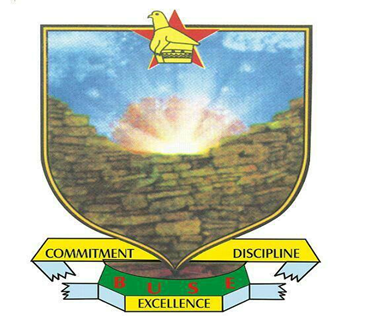
**BINDURA UNIVERSITY OF SCIENCE EDUCATION**

**FACULTY OF COMMERCE**

**DEPARTMENT OF ECONOMICS**

****

**THE IMPACT OF PUBLIC HEALTH EXPENDITURE ON ECONOMIC GROWTH IN ZIMBABWE.**

**PREPARED BY: RUTH RUTENDO CHISANGOWEROTA**

**REGISTRATION NUMBER: B1850364**

**RESEARCH SUPERVISOR: DR S MUKOKA**

**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE BACHELOR OF SCIENCE HONOURS DEGREE IN ECONOMICS OF BINDURA UNIVERSITY OF SCIENCE EDUCATION.**

**YEAR: NOVEMBER 2021**

# **RELEASE FORM**

**BINDURA UNIVERSITY OF SCIENCE EDUCATION**

NAME OF AUTHOR RUTH RUTENDO CHISANGOWEROTA

STUDENT NUMBER B1850364

TITTLE OF THE PROJECT **THE IMPACT OF PUBLIC HEALTH EXENDITURE ON ECONOMIC GROWTH IN ZIMBABWE.**

DEGREE TITTLE BACHELOR OF SCIENCE HONOURS DEGREE

IN ECONOMICS

YEAR GRANTED 2021

Permission is hereby granted to Bindura University of Science Education to produce a

single copy of this project and to sell the copies for private, scholarly or scientific

research purposes only. The author neither reserves the right of other publications and

neither the project nor extracts from it may be printed or otherwise reproduced without

the author’s approval.

SIGNED …………………………………………………

PERMANENT ADDRESS 3920 SIMBI PARK

REDCLIFF, KWEKWE

# **APPROVAL FORM**

The undersigned certify that they have read and recommended to the Bindura University of Science Education for acceptance, a project entitled, **the impact of public health expenditure on economic growth in Zimbabwe,** submitted by **Ruth Rutendo** **Chisangowerota** in partial fulfilment of the requirements of the **Bachelor of Science (Honours) Degree in Economics.**

………………………………………. ……………………………………

STUDENT DATE

…………………………………….. ……………………………………..

SUPERVISOR DATE

…………………………………… …………………………………….

CHAIRPERSON DATE

# **DECLARATION**

I, Ruth Rutendo Chisangowerota declare that this research project represents my own work, and this research project has not been previously submitted to any other universities. It also represents my own sentiments.

**Date………\………\..........\**

**Signed……………………………….**

# **ABSTRACT**

This study investigates the impact of public health expenditure on economic growth in Zimbabwe using yearly time series data from 1990 to 2020. Good health is a very important role in economic growth. It develops high worker’s effectiveness and productivity as there will be reduced sick days at work, high intellectual sense hence increased physical and mental abilities which then lead to increased production as a result improved economic growth.

The study was explained by the Vector Error Correlation Model (VECM) using time series data to show the impact of public health expenditure, inflation, foreign health aid and public education expenditure as they affect economic growth in Zimbabwe. The financial commitment to health investment and expenditure affects economic growth and development therefore, the study recommends that government should put more effort in increasing its yearly budgetary allocations to the health sector in order to have a strong improvement on health outcomes in Zimbabwe.

The Zimbabwean government should try its best to meet the WHO recommendations of increasing the allocation to 15% and guarantee policies that will produce efficient results and good cooperate governance to the health sector making sure that funds are correctly spent. In Zimbabwe the average budgetary allocation to the health sector is 2.4% which is lesser than the WHO recommendations. If the budgetary allocation in Zimbabwe increased, it will make government health expenditure to have a robust effect to the economy. For instance, if the economy can become wealthier over a rise in national income, government expenditure on health should do the same.

There is a great need to commend a model which boosts public health expenditure (PHE) in Zimbabwe. The government should consider health as a back bone of the economy. There is great need for the government to increase its budget allocations towards public health care expenditure.

Health investment has both negative and positive effects to the economy. A healthy population means a healthier economy as there will be a rise in life expectancy, a healthier population, healthy educated children, more hours at work hence more production leading to increased output which at the end is increased growth. Babatude (2012) postulates that, better health facilitates a sound ability for workers and enterprises which as a result improve the tax base of an economy thus a better fiscal base hence better economic performance leading to poverty reduction. There is a great need for more investment in health and in Zimbabwe. Sufficient investment in the sector will increase educational outcome and also economic growth.

This research also revealed a positive relationship between public health expenditure and economic growth. To achieve per capita GDP growth in Zimbabwe there is need to increase savings so as to raise sufficient capital. There is low capital formation Zimbabwe which results in shortage of capital due to the fact that there are low savings done. Thus, increasing savings could make sufficient capital available to investors.

Increasing savings could be done by increasing institute deposit insurance to safeguard depositors. This will act as an incentive for depositors to save in banks hence adequate capital can be raised which can be channeled to investors to increase their production as a result increased economic growth. Investment in agriculture and industry could be growth enhancing. When this is done it would complement with domestic investment hence accelerate economic growth. The government should increase remuneration of nurses so that they provide health care to the public. In addition, the government should subsidies for research and development in Zimbabwe.

# **ACKNOLEDGEMENTS**

Above all, I would like to thank the Lord Almighty for guiding me and giving me spiritual mind. I owe a deep sense of gratitude to my supervisor Dr S Mukoka for his patience and guidance during the completion of this research. I am really grateful to my cherished parents for their love, prayers, and financial support. May God bless you all.

# **ABREVIATIONS**

ADF Augmented Dickey Fuller

BLUE Best Linear Unbiased Estimator

E Public education expenditure

FHAID Foreign health aid

GDP Gross Domestic Product

IMF International Monetary Fund

INF Inflation

OLS Ordinary Least Squares

PHE Public Health Expenditure

VIF Variance Inflation Factor

WHO World Health Organization

ZIMSTAT Zimbabwe National Statistics Agent

**TABLE OF CONTENTS**

Contents

[**RELEASE FORM** i](#_Toc94862664)

[**APPROVAL FORM** ii](#_Toc94862665)

[**DECLARATION** iii](#_Toc94862666)

[**ABSTRACT** iv](#_Toc94862667)

[**ACKNOLEDGEMENTS** vi](#_Toc94862668)

[**ABREVIATIONS** vii](#_Toc94862669)

[**LIST OF TABLES** xi](#_Toc94862670)

[**LIST OF APPENDICES** xii](#_Toc94862671)

[**CHAPTER ONE** 1](#_Toc94862672)

[**THE PROBLEM AND ITS SETTING** 1](#_Toc94862673)

[**1.0 Introduction** 1](#_Toc94862674)

[**1 .1 Background of the study** 1](#_Toc94862675)

[**1.2.1 Trends in the Zimbabwe health expenditure** 3](#_Toc94862676)

[**1.3 Statement of the problem** 6](#_Toc94862677)

[**1.4 Purpose of the study and Objectives** 7](#_Toc94862678)

[**1.5 Statement of the Hypothesis** 7](#_Toc94862679)

[**1.6 Significance of the study** 7](#_Toc94862680)

[**1.6.1 To the Public health institutions** 8](#_Toc94862681)

[**1.6.2 To Bindura University of Science Education** 8](#_Toc94862682)

[**1.6.2 To the researcher** 8](#_Toc94862683)

[**1.6.3 To the Zimbabwean economy** 9](#_Toc94862684)

[**1.7 Assumptions of the Study** 9](#_Toc94862685)

[**1.8** **Scope of the study** 9](#_Toc94862686)

[**1.9 Delimitation of the study** 10](#_Toc94862687)

[**1.10 Limitation of the study** 10](#_Toc94862688)

[**1.11 Definition of terms** 10](#_Toc94862689)

[**1.12 Chapter Summary** 10](#_Toc94862690)

[**CHAPTER TWO** 12](#_Toc94862691)

[**LITERETURE REVIEW** 12](#_Toc94862692)

[**2.0 Introduction** 12](#_Toc94862693)

[**2.1 Theoretical literature review** 12](#_Toc94862694)

[**2.1.1 Grossman Model (1999)** 12](#_Toc94862695)

[**2.1.2 Public expenditure growth** 13](#_Toc94862696)

[**2.1.3 Human capital theory** 14](#_Toc94862697)

[**2.1.4 Wagner’s Law of Public Spending** 14](#_Toc94862698)

[**2.2 Empirical literature** 15](#_Toc94862699)

[**2.3 Gap analysis** 18](#_Toc94862700)

[**2.4 Chapter Summary** 18](#_Toc94862701)

[**CHAPTER THREE** 20](#_Toc94862702)

[**RESEARCH METHODOLOGY** 20](#_Toc94862703)

[**3.0 Introduction** 20](#_Toc94862704)

[**3.1 Model specification** 20](#_Toc94862705)

[**3.2 Description and justification of variables** 22](#_Toc94862706)

[**3.2.1 Economic growth (INPERCAPGDP)** 22](#_Toc94862707)

[**3.2.2 Public health expenditure (INPHE)** 22](#_Toc94862708)

[**3.2.3 Inflation (ININF)** 23](#_Toc94862709)

[**3.2.4 Foreign health aid (INFHAID)** 23](#_Toc94862710)

[**3.2.5 Public education expenditure (INE)** 23](#_Toc94862711)

[**3.3 Estimation methods** 24](#_Toc94862712)

[**3.3.1 Vector Error Correction Model** 24](#_Toc94862713)

[**3.3.2 Assumptions Underlying Regression Analysis** 25](#_Toc94862714)

[**3.3.3 Descriptive statistics** 26](#_Toc94862715)

[**3.3.4 Specification tests** 26](#_Toc94862716)

[**3.4 Diagnostic checking** 27](#_Toc94862717)

[**3.4.1. Stationarity Tests** 27](#_Toc94862718)

[**3.4.2 Autocorrelation** 27](#_Toc94862719)

[**3.4.3 Multicollinearity** 28](#_Toc94862720)

[**3.4.4 Heteroscedasticity** 28](#_Toc94862721)

[**3.4.5 Normality test** 28](#_Toc94862722)

[**3.4.6 Model Specification test** 29](#_Toc94862723)

[**3.4.7 Limitation of estimation technique** 29](#_Toc94862724)

[**3.5 Data type, sources and problems** 29](#_Toc94862725)

[**3.6 Summary** 30](#_Toc94862726)

[**CHAPTER FOUR** 31](#_Toc94862727)

[**DATA ANALYSIS AND RESULTS PRESENTATION** 31](#_Toc94862728)

[**4.0 Introduction** 31](#_Toc94862729)

[**4.1 Normality Test** 31](#_Toc94862730)

[**4.2. Multicollinearity** 32](#_Toc94862731)

[**4.3 Unit Root Test** 33](#_Toc94862732)

[**4.3.1 Stationary results** 33](#_Toc94862733)

[**4.4 Johansen Co-integration** 35](#_Toc94862734)

[**4.5 Vector Error Correction Model** 37](#_Toc94862735)

[**4.6 Stability Tests** 42](#_Toc94862736)

[**4.6.1 Normality Test** 42](#_Toc94862737)

[**4.6.2 Autocorrelation** 43](#_Toc94862738)

[**4.6.3 Heteroscedasticity** 44](#_Toc94862739)

[**4.7 Goodness of fit ()** 45](#_Toc94862740)

[**4.8 Chapter Summary** 45](#_Toc94862741)

[**CHAPTER 5** 46](#_Toc94862742)

[**SUMMARY, CONCLUSION, AND RECOMMENDATIONS** 46](#_Toc94862743)

[**5.0 Introduction** 46](#_Toc94862744)

[**5.1 Summary** 46](#_Toc94862745)

[**5.2 Conclusions** 47](#_Toc94862746)

[**5.3 Policy recommendations** 47](#_Toc94862747)

[**5.4 Suggestions for further studies** 48](#_Toc94862748)

[**REFERENCES** 49](#_Toc94862749)

# **LIST OF TABLES**

4.1 Descriptive Statistics…………………………………………………………………………34

4.2 Variance Inflation Factor…………………………………………………………………......35

4.3 Stationarity test at level………………………………………………………………………36

4.3.1 Stationarity test at first difference………………………………………………………….37

4.4 Cointegration test……………………………………………………………………….........38

4.5 Vector Error Correlation Model (VECM)…………………………………………………….39

4.5.1 Speed of adjustment………………………………………………………………………...43

4.6 Normality test: VEC Residual Normality tests………………………………………………45

4.6.1 Autocorrelation: VEC Residual Serial Correlation LM tests……………………………….46

4.6.2 Heteroscedasticity: VEC Residual Heteroscedasticity test…………………………………47

# **LIST OF APPENDICES**

Appendix A: Time Series Data………………………………………………………………….56

Appendix B: Normality test………………………………………………………………………57

Appendix C: Variance Inflation Factor………………………………………………………….58

Appendix D: Unit Root test……………………………………………………………………...58

Appendix E: Cointegration test………………………………………………………………….70

Appendix F: Vector Error Correlation Model…………………………………………………...76

Appendix G: Stability tests………………………………………………………………………79

# **CHAPTER ONE**

# **THE PROBLEM AND ITS SETTING**

# **1.0 Introduction**

This chapter highlights the structure of the research project on the impact of public health expenditure on economic growth in Zimbabwe. It is mainly focused on the introduction to the study, background of the study, objectives of the study, statement of hypothesis, assumptions of the study, scope of the study, delimitation of the study, limitation of the study, definition of terms and the chapter summary. This chapter reveals the outlook of the research and gives a brief picture on what the research project covers.

## **1 .1 Background of the study**

Health is an asset people possess, which has an indispensable value. Human beings mostly values being healthy, and this means a complete state of physical, mental and social well-being including the absence of illness. Thus, the most important thing is understanding factors that determine good health for its important value. The essential part of human welfare is avoiding illness by all means and maintaining our physical and mental abilities. A few decades ago, and especially quite recently due to covid-19, the contribution of health to the generation of economic growth has been emphasized.

Decisions regarding the allocation of public funds in the health sector and health related areas must consider their intrinsic and instrumental value of health. In order to explain the relationship between public health and economic growth, it is necessary to understand the concept of health in a broad sense. Health is not only the absence illness; it is also the ability of people to develop to their potential during their entire lives. Health impacts economic growth in a number of ways. For example, it reduces production losses due worker’s illness.

It is really affecting the economic growth as the proportion of public health expenditure has been far much below the WHO bench mark in Zimbabwe. For the past decades in Zimbabwe, the economic trend has been decreasing at an increasing rate this is evidenced by BOP deficit, an increase in unemployment rates and high external debts. Despite all the empirical and theoretical literature to learn from Zimbabwe is apportioning insignificant funds towards public health care expenditure. This motivated the researcher to investigates the impact of public health expenditure on economic growth.

In the first few years of independence the funds towards public health expenditure were apportioned equally and they were very significant. These increased budget allocations to the health sector were in line with the Growth and Equity Policy Statement (1981) which reinforced efficient delivery of social services to the people. Despite the increase in budget allocation, there was an unequal socio-economic structure amongst citizens due to racial inequalities.

In 1990 after independence Zimbabwe’ s health expenditure started declining rapidly because of the introduction of Economic Structural Adjustment Programme (ESAP) which was meant to usher in a new era of modernized, competitive and export led industrialisation. Social expenditures such as education and health were reduced. There was a decrease in government allocation to the health sector under ESAP from 2.6% of the GDP in 1980 to 2.2% by 1997. Ever since 1990, there has been a steady decline in real per capita spending on health.

Ever since the World Bank recommended a 15% government budget allocation to the health sector in Zimbabwe, it has not been reached. This recommendation was due to a fall in financing health sectors in developing countries. In Zimbabwe many facilities were closing down and lack of medical health care.

### **1.2.1 Trends in the Zimbabwe health expenditure**

In developing countries, the main aim is to increase government’s responsibilities in healthcare but in Zimbabwe despite the first decade of independence it is quite opposite because of the economic crisis. In the first decade of independence the government gave large sums of money to the health sector thus increased public health care expenditure percentage of total government expenditure up to year 1990.

The proportion of PHE as a percentage of GDP reduced in 1991 to 1996 due to the introduction of ESAP. This led to a decline in economic growth and was consistently negative from 2000 to 2008 with annual average rates negative 6.44%. The introduction of ESAP was meant to improve competitive and export led industrialisation hence there were huge cuts on social expenditures such as health and education.

According to the World Bank (2011), health expenditure as a percentage of government expenditure fell from 6.2% in 1990 to 4.2% in 1996 which is a drop equivalent to 32.2% and also government allocation to health sector fell from 3.0% of GDP in 1990 to 2.0% in 1996. Since 1990, there had been steady decline in per capita spending on health which was seen to have declined from US$22 in 1990 to US$11 in 1996, (World Bank 2011). The HIV /AIDS pandemic also worsened the crisis creating problems for hospitals in coping with the demand for services.

An estimation of over 3000 victims died every week. This led to the lowering of worker productivity, increasing the proportion of the dependency ratios in rural areas as well as increase in the cost of health services (World Bank, 2011). The last decade from 2000 to 2010, the economic mic environment was got worse. It was characterized by social, economic and political melt down which included decline in value of local currency, liquidity crisis, and shortage of fuel, drugs and electricity and balance of payment problems.

In year 2000 per capita health was US$8.55 compared to US$22 in 1990 which was recommended by the Commission of Review into Health Sector in 1997. It further decreased to US $0.19 in 2008 leading to the collapse of the health sector. Education sector also suffered fiscal austerity. Thus, expenditure on education declined by above 30% during ESAP, the budget allocation to education expressed as a percentage of total recurrent expenditure fell from 39% in 4 1999 to 2.1% in the 2000 budget. “The per capita allocation to education fell in real terms from Z$37.83 in 1990 to Z$30.44 in 2000 causing a fall in real wages.” postulated by the World Bank (2011).

Total expenditure on health fell from a peak in 1998 to just 7% of GDP in 2005, with falling public expenditure on health and increasing private expenditure on health. Of this the largest increase was in household out-of-pocket expenditure to 53% (in 2003) of private expenditure on health, placing significant burdens on individuals. As government spending fell, the relative contribution of donor funding of total expenditure on health grew from a low of “2.1% (2000), as postulated by the World Bank (2011).

It has been noted that there was a gradual decrease in the proportion of health expenditure allocated to the health sector from the period of 1990 when ESAP was introduced. Decrease in GDP which is a proxy for economic growth is also seen from the period where there was decrease in the public health care expenditure which enhances economic growth through labor productivity. The public health expenditure budget is not enough compared to the demand of the majority. The per capita budget has fallen since 1991 to a level where it does not manage to pay for prevention, clinic and districts hospital cost per capita (WHO, 2011). Since late 2018, the real health budget was being severely eroded by the combined effect of exchange rate depreciation and increasing inflation.

Zimbabwe’s per capita spending in health care is below the WHO recommended threshold of US$86. Overall, the percentage of children that received vaccinations increased from 69.2% in 2014 to 76% in 2019. Maternal mortality rates have dropped significantly from 614 deaths per 100,000 live births in 2014 to 462 in 2019. All Early Childhood mortality rate improved over the same period, except for neonatal, which increased from 29 deaths per 1,000 live births to 32 in 2019. The number of births attended by a skilled professional also increased from 78% in 2014 to 86% in 2019.

Although there were positive gains in 2019, the sector faced significant challenges in 2020 which were negatively impacting the achievements of the targets in the National Health Strategy. These challenges which range from inadequate funding, shortage of foreign currency to import essential drugs and equipment, power outages and intermittent fuel supply, which has significantly impacted on the operations of health care centers, depreciating local currency and increasing inflation, which has eroded the health budget, among others.

The Covid-19 pandemic also worsened the crisis creating problems for hospitals in copying with the demand for services in 2020. Many people died in 2020 and this pandemic led to the lowering of worker productivity as working hours were reduced, schools also closed. The latest economic analysis for the country says the Covid-19 pandemic and its impacts disrupted livelihoods, expanding the number of extremely poor citizens by 1.3 million, and increasing extreme poverty to 49% in 2020. The pandemic further disrupted provision of basic public services in health, education, and social protection, which were constrained prior to the pandemic.

In 2020, the supply-side challenges facing the health system following a prolonged period of doctor strikes, reduced working hours for nurses, and limited and slow access to personal protective equipment initially contributed to a decline in the coverage and quality of essential health services. The number of institutional maternal deaths increased by 29% in 2020 compared to 2018, while deliveries at home increased by 30%.

The 2020 health budget still falls short of the 15% Abuja Declaration Target. Though there was a slight improvement from 7% in 2019 to 10% in 2020, more needs to be done. Per capita spending in health care is below the WHO recommended threshold of US$86. However, Zimbabwe’s per capita allocation, which had improved to US$57 in 2017, is estimated to have sharply declined to US$21 in 2020 which puts at risk gains made over the years.

As Zimbabwe is currently facing tight public finances and limited resources to external financing, it will need to rely heavily on reallocating domestic resources to optimal public uses, mobilize humanitarian support to prevent increasing fragility and leverage private financing where possible to stimulate growth.

## **1.3 Statement of the problem**

Zimbabwe is facing poor economic growth which is associated with problems of low capacity utilization, low industrial output, low productivity, high poverty incidents, and increased external debts. It has been stated in theory and proven in a number of studies that increase in public health expenditure contributes to the expansion of an economic set up both in the short run and the long run. The health expenditure budget in Zimbabwe is not enough to meet health needs as the public health care financing is decreasing. Zimbabwe’s capita budget started decreasing since 1991.

The decrease in public health spending has resulted in delayed upgrades of deteriorating health facilities, shortages of essential drugs and prolonged periods of doctor strikes. This shortage will increase child mortality rate, morbidity rate, crude death, maternal mortality rate, reduces human capital and reduces life expectancy at birth. However, there are debates among policy makers over public health expenditure’s contribution to economic growth through consumption and investment effect as proposed by theory. Therefore, this study gives an opportunity to analyze if public health expenditure has a short run or long run impact on economic growth in Zimbabwe so as to inform the policy makers on the correct position.

## **1.4 Purpose of the study and Objectives**

This research sought to assess effects of public health expenditure on economic growth from 1990 to 2020.

Objectives will be as follows:

1. To determine the nature of the relationship between Public Health Expenditure (PHE) and economic growth in Zimbabwe.
2. To find the magnitude of the relationship between Public Health Expenditure (PHE) and economic growth in Zimbabwe.
3. To determine the implications of the relationship between Public Health Expenditure (PHE) and economic growth in Zimbabwe.
4. To recommend a model which enhances Public Health Expenditure (PHE) in Zimbabwe.

## **1.5 Statement of the Hypothesis**

**H₀**: There is no relationship between public health expenditure and economic growth in Zimbabwe.

**H₁**: There is a relationship between public health expenditure and economic growth in Zimbabwe.

## **1.6 Significance of the study**

This research study is highly significant in that public health expenditure is an important aspect of successful health systems. Good health plays a large role in economic growth. The current research study will help readers in identifying and understanding the impact of (PHE) on economic growth. The importance of this study is summarized under the following headings:

## **1.6.1 To the Public health institutions**

The study will help different institutions with an insight on the public health expenditure to demand in order to meet specific health expenditures. It helps public health institutions to know when and how to recruit and retain more health care professionals in the public system when the government is increasing public health expenditure. Also, the Ministry of health and childhood development will be able to know the amount money which they can allocate to the budget.

## **1.6.2 To Bindura University of Science Education**

The study will help the institution to pay much attention and to acknowledge the practicability of the study. Successful completion of this study should give Zimbabwean higher learning institutions, particularly BUSE, a platform for further research on the impact of public health expenditure on economic growth in Zimbabwe given the sector is critical for poverty alleviation and is of interest to both students and policy makers. The study will help as a stepping stone for other students either for reference sake or to pursue further study into the subject matter.

## **1.6.2 To the researcher**

The most important reason to do a research is to enhance your knowledge. The successful completion of this study is fulfilling part of the requirements for Bachelor of Science Honours Degree in Economics. Also academic stage helps you prepare for any research tasks you will have to accomplish in the future. The findings of this research will also provide literature, understanding the importance of public health expenditure and helps students with further and future researches.

## **1.6.3 To the Zimbabwean economy**

This study will help the economy by raising awareness to policy makers on the impact of public health expenditure on economic growth. This research will help Zimbabwe when structuring the yearly budgets on how much is needed towards the health sector after recognizing how much government expenditure contributes on economic growth and also knowing how best to allocate limited resources. Therefore, investing carefully in various public health aspects would boost income and GDP.

## **1.7 Assumptions of the Study**

• Information used is not biased

• All other factors that affect GDP are held constant.

* literature review gives a detailed understanding into the study
* This research is being carried on the assumption that the data collected provides all the necessary information required in the research.

## **Scope of the study**

* The key focus of this study is on the impact of public health expenditure on economic growth over the period 1990 to 2020.
* This study is using the time series data obtained from the World Bank, ZIMSTATS and IMF.

## **1.9 Delimitation of the study**

The study will be carried out on the case of Zimbabwe taking reference from 1990 to 2020 using time series data.

## **1.10 Limitation of the study**

Data accuracy will be distorted; they will be need for natural logarithms.

Data availability; ZIMSTATS does not provide data for some of the variables.

## **1.11 Definition of terms**

Lipsey, 1995 said that “Gross domestic product (GDP) is the monetary value of all the finished goods and services produced within a country's borders in a specific time period, usually calculated on an annual basis.”

WHO, 2014 postulated that Public health refers to all organized measures to prevent disease, promote health, and lengthen life among the population as a whole. Its activities aim to provide conditions in which people can be healthy and focus on entire populations, not on individual patients or diseases.

Lipsey, 1995 said that “Expenditure is a transaction made through the payment done via cash basis or cash-equivalent for goods or services, or a charge against available funds in settlement of an obligation as evidenced by an invoice, receipt, voucher, or other such document.”

## **1.12 Chapter Summary**

This chapter, being an introduction to the study gave an overview of the whole study. It involved the background of the study which provides the context of study, statement of the problem which shows the problem to be solved by the study. It also includes the purpose of the study, research questions and the statement of hypothesis which is the probable answer of the study. Chapter 2 will consist of theoretical and empirical literature to this study.

# **CHAPTER TWO**

# **LITERETURE REVIEW**

## **2.0 Introduction**

This chapter studies the literature relevant to the study. It follows the conceptual framework, which has the mandate to clearly outline the variables under review within this study, that is the independent and dependent variables; theoretical framework, which is guided by the research objectives mentioned earlier, it outlines the relationship that exist between the two variables under study and the implications of the relationship that exist; theory underpinning the study which is an overview of the relevant theories that the study will take into consideration; empirical framework, this is mainly the past studies carried out by other researchers related to the current study and lastly research gap analysis which outlines the gap that the study seeks to fill in to the existing body of knowledge on the subject matter.

## **2.1 Theoretical literature review**

### **2.1.1 Grossman Model (1999)**

Grossman (1999) theory highlights on the demand for health as the human capital model in much of the literature on health economics because it draws heavily on ‘human capital theory’. Grossman says that “health capital differs from other forms of human capital.” Health is seen as a strong capital stock that result in a healthy life time. He also said that a person’s stock of knowledge affects his market and non-market productivity, while his stock of health determines the total amount of time he can spend producing money earnings and commodities (Becker, 1967).

The demand for medical attention in overall results from the basic demand for health. Grossman’s model defined health to include longevity and illness free days in a given year is both demanded and produced by consumers. Increase in the illness free days’ increase productivity in the form of labour hours offered by an individual in production hence increase in economic growth. Health is a choice variable because it is a source of utility and because it determines income or wealth levels.

Being sick and constantly asking for sick days is a source of disutility, as people demand health as a consumption commodity. As an investment commodity, it determines the total amount of time available for market and activities. As health capital is one component of human capital, a person inherits an initial stock of health that depreciates with age at an increasing by investment.

The major law in economics is the law of the downward sloping demand function, the quantity of health demanded should be negatively correlated with its “shadow price”. The shadow price of health rises with age if the rate of depreciation on the stock of health rises over the lifecycle and falls with education, more educated people are proficient producers of health, under certain conditions, an increase in the shadow price may simultaneously reduce the quantity of health demanded and increase the quantities of health inputs demanded. When health stock has been increased there will be increase in life time lived which brings an incentive to save for retirement as well as increase in productivity due to more hours worked henceforth improve economic growth.

### **2.1.2 Public expenditure growth**

“Public expenditure is spending made by the government of a country on collective needs and wants such as pension, provision and infrastructure,” says (Font and Novel, 2004). Till the 19th century, public expenditure was very restricted as laissez faire philosophies believed that money left in private hands could bring better returns. In the 20th century, John Maynard Keynes argued the role of public expenditure in determining levels of income and distribution in the economy. Meanwhile the government expenditures have shown an increasing trend. There are two messages that transpire from this work; one is that a proper sense of the extent of market failure, rather than its mere presence, is relevant in all cases; the other is that ‘correcting’ for such market failure is often a difficult multidimensional business not captured by direct public provision at zero price and not necessarily involving expansion of market output.

As public expenditure theory of economic policy, this formulation leaves much to be desired, however, the pervasiveness of external effects in consumption contradicts a necessary assumption of the theory. Second, analysis of real-world situations is usually ill-suited to be couched in terms of choices among two alternatives. Third, since most policies involve a loss of welfare to someone, a formal basis for interpersonal comparisons is needed, and since the economist has no particular right to attach social weights to individual welfare in the social welfare function, this is sufficient ground to rule out rigid prescriptions (Font and Novel, 2004).

### **2.1.3 Human capital theory**

Gary S Becker’s theory focuses on the cost, skills and returns that are expected from accomplishing education which (Schultz 1999) viewed as investment in skills and competencies. This theory assumes that an educated population is a more productive one, it increases economic outputs. Human capital theory emphasizes that education raises productivity and efficiency through economically productive people employed and thus raise further incomes in the future and savings. It has been empirically evidenced that human capital in education has a positive relationship with economic. This was proved by Hong Kong, Korea, Singapore and Taiwan.

### **2.1.4 Wagner’s Law of Public Spending**

Wagner (1983) supported a positive correlation between degree of economic activity and the scope of government. This indicates that government expenditure for the provision of social good and redistribution will increase if per capita income increases. The idea was coined into the law of increasing expansion of the public and state activities. As deduced by Musgrave, Wagner’s law refers to the growth of the relative size of the public sector not the total size. The law states that as per capita income in an economy grows, the relative size of the public sector also grows (Brown and Jackson, 1990).

The argument is that, as an economic system becomes industrialized, the government’s role to correct market failures and to provide goods and services is called upon. According to Wagner the main component of growth is foreseen in education and health services and in regular areas of legal administration and protection. Wagner’s statements were empirical. Wagner had discovered the growth of the public sectors of a number of European countries and the United States and Japan during the 19th century.

## **2.2 Empirical literature**

Wang (2011) studied the relationship between total health expenditure and economic growth using the Granger causality test for a number of countries and concluded that there exists a positive relationship between the two. Also, Simon Oke (2012) in his study of human capital investment and economic growth in Nigeria using secondary data spanned through 1978 to 2008 concluded that government expenditure on education maintained a positive long run relationship with the index of national productivity while government expenditure on health and gross capital formation showed long run negative relationship with the economic growth. He went on to commend that more stock of physical capitals needed to be achieved to facilitate more investment in human capital and so enhance economic growth.

Amiri and Ventelou studied the relationship between health expenditure and economic growth with improved version of Granger causality using the Organization for Economic Co-operation and Development (OEDC) countries and concluded that a bidirectional Granger causality was leading. Rahman and Yunnah also did the same study in Bangladesh using vector autoregressive (VAR) model with Granger causality and concluded that there was unidirectional causality.

Blejer and Khan (1994) though in different countries concluded that social expenditures, when contended with the private sector reduces economic growth. It has been noted that the relationship between public expenditure and private investment expenditure is that they compete with or complement the private sector. However, it has been evidently seen that public expenditures that complement private investment promote economic growth.

Hansen and King (1996) analyzed the determinants of health care expenditure for 20 OCED countries for the period 1960-1987. They employed a country by country analysing using OLS and an error correction model to estimate the determinants of health care expenditures in these countries. Their study concluded that real GDP per capita is the most vital determinant of health care expenditures, they also observed that non income variables like literacy rate, population are additionally significant, although its impact was small.

Nurudeen and Usman, (2010) carried out their study on the relationship between health status and economic growth using autoregressive distributed lag (ARDL) approach, they claim that increase in government expenditure on health results in an increase in economic growth since it enhances productivity. Berger and Messer (2002) sight health as a form of capital, such that health care is both a consumption good that yields direct satisfaction and an investment good that yields indirect utility through increased productivity, fewer sick days and higher wages.

Aranda (2010) noted that the major reason for health expenditure is the hope of improved health status, and that health status is governed by health investment. The demand for health care is derived from the demand for health itself. Both health care expenditure and improved health status are means to an end; the end is increased productivity and economic growth.

Grossman (1991) analyses linear relationship between growth in government spending and total economic growth. The conclusion of this study was that there is a strong and significant positive relationship between government expenditure size and economic growth. Using a production function approach, Ram (1986), came out with the empirical evidence that government expenditure propels or reduces economic growth. He concluded that big governments, measured by their share in consumption expenditure to Gross National Product (GNP), reduced economic growth.

Baldacci et al (2004) analysed the role played by health expenditures to economic growth using panel data set for one hundred and twenty developing countries form the period 1975-2000. He concluded that expenditure on health within a period of time contributes to growth within that same period while lagged health expenditures seem to have no effect on growth. He concluded from his result that direct effect of health expenditure on growth is a flow and not a stock effect.

Mankiw et al (1992) find out that the growth of population is positively related to economic growth. He concluded that the growing population increases output by increasing the number of working population. However, the growth of population can only bring about economic growth if the supplies of capital and other resources are increasing adequately along with the growth of labour.

Maitra and Mukhopadhyay (2012) examined the role of public spending on the education and health sectors is examined with regard to promoting the gross domestic product (GDP) of 12 countries in Asia and the Pacific over the last three decades. In six of those countries, namely Bangladesh, Kiribati, Malaysia, Maldives, the Philippines, and the Republic of Korea, Johansen co-integration tests confirmed the existence of co-integrating relations. In the remaining countries namely Fiji, Nepal, Singapore, Sri lanka, Tonga, Vanuata, co-integrating relations were absent. The casual effect of education and health care spending on GDP was further examined in the study.

Chete and Adeoye (2002) examines the process through which human capital influences economic growth in Nigeria. Vector Auto regression analysis and ordinary least square were used in their research. Henceforward concluded that there was a positive effect of human capital on economic growth which the various Nigerian governments since the post-independence have been valued by amazing expansion of educational infrastructure across the country.

In addition, another study of human capital and economic growth was led by Lawanson (2009). Special attention was given to the key note of education and health. The study found out that there exists a positive relationship between government on education and economic growth. Nevertheless, the study suggests that there is a negative relationship between government expenditure on health. The study concluded that the contribution of human capital development to economic growth is less significant.

## **2.3 Gap analysis**

There is a great need for this study to be done in Zimbabwe because the researcher acknowledges that there is very little comprehensive research focusing specifically on the effects of public health expenditure on economic growth. It should be noted that most of the above studies were not done in Zimbabwe, so the researcher decided to fill in the gap. The major contributing factor of this research is to analyze if public health care expenditure has a short run or long run impact on economic growth in Zimbabwe so as to inform the policy makers on the correct position. Therefore, thus study will add to the existing literature and board of knowledge.

## **2.4 Chapter Summary**

This chapter focused on the literature behind the study of public health expenditure on economic growth, focusing mainly on the theoretical and empirical literature. Several studies that have been carried out in other countries have been outlined. This will enable the researcher to come up with the necessary information that will enable him to construct a model for public health care expenditure in Zimbabwe. The next chapter will look at the methodology that will be used in constructing the effects of public health expenditure on economic growth in Zimbabwe.

# **CHAPTER THREE**

# **RESEARCH METHODOLOGY**

## **3.0 Introduction**

The purpose of this chapter is to present the description of the research method to be used and statistical procedure utilised in analysing data. The main objective of this chapter is producing a well detailed account of the research methodology that is being used. The key elements to be covered in this section is research design, research approach and research strategy that was adopted. Also, on the data analysis section, stability tests that ensures the reliability and validity of results are being used, these includes normality test, autocorrelation and heteroscedasticity test. The model specification is also an important aspect of this chapter.

### **3.1 Model specification**

#### **3.1.1 Theoretical framework**

The theoretical framework of the model is the endogenous growth model between real GDP per capita as a dependent variable and independent variables, which include; public health expenditure, inflation, foreign health aid and public education expenditure. The hypothesized structural relationship for real GDP per capita in Zimbabwe can be specified as follows:

Economic growth = f (PHE, INF, FHAID, E) .................................................... (1)

Where: GDP = Per capita GDP; PHE = Public health expenditure; INF= Inflation; FHAID= Foreign health aid and E= Public education expenditure.

#### **3.1.1.2 Empirical model**

To inaugurate the relationship between public health expenditure and economic growth the equation has to be explained in the form of changes in the variables and be expressed in its linear form (Lucas, 1988).

Equation 1 is a linear equation used to measure the change in GDP by finding its derivative with respect to PHE. This means that, a percentage change in PHE will change GDP per capita by β1. Given that the study involves PHE, the research shall use Inflation (INF), Foreign health aid (FHAID) and Public education expenditure (E), as other control variables that affect GPD per capita.

lnGDP = β0 + β1 lnPHE + β2 lnINF + β3 lnFHAID + β4 lnE + εt (1)

Where:

βi = elasticity measure of changes of exogenous variables to GDP per capita

ln PERCAPGDP = natural log of GDP per Capita

ln PHE = natural log of Public health expenditure

In INF = natural log of Inflation

In FHAID= natural log of Foreign health aid

In E = natural log of Public education expenditure

ε = Error term

**β0, β1, β2, β3** = estimation parameters

Using the linear model is important because it reduces the scale of the variables from a tenford to twoford, thus minimizing the occurrence of heteroscedasticity in the model (Gujarati ,2004). Also the need to examine the percentage change in GDP growth to changes in public health expenditure, inflation, foreign health aid and public education expenditure, has also added to the reason for using the linear model.

## **3.2 Description and justification of variables**

### **3.2.1 Economic growth (INPERCAPGDP)**

Economic growth is a rise in the production of economic goods and services, compared from one period of time to another (Mankiw et al, 1992). It is the dependent variable and is measured by the (GDP) Gross Domestic Product. Also it is calculated as a percentage change in Gross Domestic Product, it is included in the model due to the fact that it reflects domestic productive capacity. When output increases demand for goods produced also increases making additional investment more profitable. According to this study increase in public health expenditure results in the increase in economic growth hence there is a positive relationship between economic growth and public health care expenditure (WHO, 2011).

### **3.2.2 Public health expenditure (INPHE)**

Public health expenditure refers to expenditure on health incurred by public funds which includes government budgetary on allocation (Lipsey, 1995). Public funds are also state, regional and local government bodies and social security. Public expenditure includes measures such as medical facilities, family planning activities and nutrition regulation which contributed to the decline in child mortality, increase in life expectancy, improving the complete mental, physical and social well-being of the community WHO (2011).

Therefore, PHE is a good measure for the level of investment in health of the economy, which then determines the level of economic growth. There is a positive relationship between public health and economic growth. So its coefficient should be positive.

### **3.2.3 Inflation (ININF)**

Inflation is the general increase in prices of goods and services in an economy. As the general price rises each unit of currency buys fewer goods and services, so it simply means a reduction in the purchasing power of money. It is measured by the Consumer Price Index (CPI). On the contrary, observations of high inflation tend to be associated with low or negative growth in GDP per capita. Spending decisions on health are not solely affected by the income level alone but also by the size of the recipients (WHO, 2011).

### **3.2.4 Foreign health aid (INFHAID)**

Foreign health aid is a source of external financing of the health care systems. The purpose is to show how foreign health aid effects public health care expenditure in developing countries. In African countries foreign aid has been used as an explanatory variable and came up to be a positive and significant variable. Gbesemete and Gerdtham (1992) incorporated per capita foreign health aid in their study of determinants of health care expenditure based on 30 African countries inclusive of Zimbabwe and found it to be positive and statically significant in determining health care expenditure.

### **3.2.5 Public education expenditure (INE)**

“Public education expenditure is observed as the nucleus for human capital investment” said (Capolupo, 2000) also the more the government expenditure is apportioned to education, the faster the economy develops. These skills and knowledge learnt through education are responsible for the increase in the labour productive through a higher cognitive capacity which then increase economic growth. Increase in public health care is seen by building more academic institutions, providing scholarships and subsidizing manpower development funds among others. In this study public education expenditure is seen as an important explanatory variable due to its credit of the long observed fact that less attention on education and training have revealed to be one of the most serious constraints to economic growth and development in Zimbabwe (Naiman and Watkins ,1999).

## **3.3 Estimation methods**

## **3.3.1 Vector Error Correction Model**

First is important to start by analyzing the properties of the time series data. The VECM specification can only be applied to cointegration series, thus the Johansen cointegration test should be performed first. Cointegration requires that a set of variables should be integrated of the same order and their linear combination must be stationary, that is 1(0). If series do not follow the same order of integration there is no meaningful relationship among them. We therefore proceed to test for cointegration if series have the same order of integration. Cointegration simply means looking for a long run equilibrium relationship among non-stationary variables. Therefore, to perfume cointegration we first check for stationarity of data. The cointegration method being used is the Johansen cointegration method.

Vector Error Correction Model (VECM) is used mainly for reconciling short run behavior of a variable with its long run behavior (Gujarati,2004). The choice of this estimation technique is due to the fact that the variables are integrated at the same order. Vector Error Correction Model (VECM) help to estimate the short run relationship of variables after determining the presence of cointegration once the optimal lag is identified. The main objective of the VECM is to indicate the speed of adjustment from the short-run equilibrium to the long-run equilibrium state.

The estimation technique used in this model are:

1. Firstly, we determine if the time series data is stationary as estimating a model with non-stationary results will cause false regression analysis (Granger and Newbold, 1974).
2. We then test the presence of cointegration between the series of the same order and thus form a cointegration equation. “Variables should be integrated in the same order” says Aremu (2009). A set of variable is said to be cointergrated if a linear combination of the variable results in the stationary process that is I(0). For a regression relation to be meaningful various series must be cointegrated however if the equation holds its unit’s roots properties misleading regression will be obtained.
3. The test deals with the null hypothesis that there is co-intergration against an alternative that there exist no co-intergration. If co-intergration exist hence construct the ECM to model short run dynamic relationship with long run equilibrium.

The error correction term should be statistically significant and should have a negative coefficient. A highly significant error correction term is a further confirmation of the existence of a long run relationship among the series under concern.

.

### **3.3.2 Assumptions Underlying Regression Analysis**

i) The model is linear in parameters.

ii) The independent variables are non-stochastic that is they are fixed in repeated samplings.

iii) The error terms are normally distributed with zero mean and constant variance

µi ̴N (0, δ2)

iv) The error terms are uncorrelated that is E (ei, ej)=0

### **3.3.3 Descriptive statistics**

In descriptive statistics we use the mean, mode, range and standard of deviation as our summary statistics, this will make quick and simple information. The minimum and maximum values help to check if there are outliers or not in the data used.

### **3.3.4 Specification tests**

#### **3.3.4.1 F Value and Prob (F)**

F-statistic is a measure of the general significance of the estimated regression model. Its value will range from zero to an arbitrarily large number when F-statistic provides a test of the null hypothesis that the true slope coefficients are simultaneously zero. Therefore, if Prob (F) calculated is 0.02 it means that there are 2 chances in 100 that all regression parameters are zero. This had been considered to test whether economic growth (GDP) is linearly related to all of its explanatory variables which are public expenditure on health, inflation, foreign health aid and public expenditure on education. If the F –value calculated surpasses the critical F-value from the F –table at the percent level of significance, we reject Hₒ.

#### **3.3.4.2 Goodness of fit (R2 test)**

R2 test shows the proportion in the dependence variable which is explained by the explanatory variables. It clearly explains exactly how well the data outfits a statistical model. It is a straight measure of how fit the observed outcomes are simulated by the model as the percentage of total variations of the conclusion explained by the model. It is indicated as

R2= ESS/TSS

Where ESS are the Explained Sum of Squares

TSS is the Total Sum of Squares

## **3.4 Diagnostic checking**

### **3.4.1. Stationarity Tests**

Stationarity is when the mean and the variances do not vary over time and when the value of covariance between the two time periods depends only on the gap between the two time periods and not the actual time at which the covariance was calculated. It is important to check for stationarity as it helps in understanding the future behavior and it is necessary for predictions.

Augmented Dickey-Fuller Test is used to test for stationarity. Unit root test on all variables is done to define their time series properties. It is done to avoid the problem of false regression when non-stationary series are estimated in their levels in stochastic models (Badawi, 2003). The Augmented Dickey Fuller (ADF) tests that take into account the possibility of structural breaks in the time series are used to analyse the time series properties of these series. The study will perform stationarity tests to determine if the variables are on the same wave length.

### **3.4.2 Autocorrelation**

Autocorrelation is tested under the null hypothesis that there is no autocorrelation and alternative hypothesis of autocorrelation. “Autocorrelation is a situation where error terms from different time periods are correlated which is the correlation of a series with its own past and future values” says (Gujarati, 2004). It happens when the errors associated with observations in a given time period carry over into the future time periods. Sometimes it is called ‘lagged correlation’ or ‘serial correlation’. To test for auto-correlation one can use the VEC Residual Serial Correlation LM test. We therefore, reject the null hypothesis when the p-values are above 5% level of significance.

### **3.4.3 Multicollinearity**

Multicollinearity is tested under the null hypothesis that there is no multicollinearity against an alternative that there is multicollinearity. It is the presence of linear relationship among the explanatory variables. It happens when all explanatory variables in a model are highly correlated. It is tested using the Variance Inflation Factor (VIF). It provides a measure of multicollinearity among the independent variables in a multiple regression model. A high VIF indicates that the associated independent variable is highly collinear with the other variables in the model. VIF ˃10 is an indicatior of multicollinearity.

### **3.4.4 Heteroscedasticity**

Heteroscedasticity is tested under the null hypothesis that there is no heteroscedasticity against an alternative of heteroscedasticity. “Heteroscedasticity is when the variance of error term is not equal”, says Gujarati (2004). The consequences of heteroscedasticity are that it affects confidence intervals, t-test, F-test because variance of error term is exaggerated. This can be caused by outliers in the sample data, omission of an important variable (model specification error) and skewness in the distribution of regressors included in the model. The VEC Residual Heteroscedasticity test is used to test for heteroscedasticity. Heteroscedasticity destroys the efficiency component of the OLS estimator since it will no longer have minimum variance. Symbolically it can be shown as Е (ui) = δi2.

## **3.4.5 Normality test**

Normality test is tested under the null hypothesis that the variables are normally distributed against an alternative hypothesis that variables are not normally distributed. The Jarque-Bera statistic is used to test for normality. The Jarque-Bera statistic follows a null hypothesis of normally distributed errors. If variables are normally distributed a histogram which is bell- shaped should be identified and the Jarque-Bera statistic should.

## **3.4.6 Model Specification test**

Under the VECM assumptions, the regression model is performed in order to test for the presence of a long run relationship between variables. The purpose is to indicate the speed of adjustment from the short-run equilibrium to the long run equilibrium. The co-integration method being used is the Johansen co-integration method. Cointegration requires that a set of variables be integrated of the same order and their linear combination must be stationary, thus I (0). If the series do not follow the same order of integration, then there can be no meaningful relationship among them.

## **3.4.7 Limitation of estimation technique**

We can only use VECM for the series which are stations in their differences (I)1. There is much debate on how the lag lengths should be determined. Also, it is possible to end up with a model including numerous explanatory variables, with different signs, which has implications for degrees of freedom.

## **3.5 Data type, sources and problems**

The data used was obtained from ZIMSTATS, World Bank, and the IMF. The study used annual time series data from the period of 1990 to 2020 using secondary data. Due to inadequate monitoring of the economy, inaccurate reporting and also the removal of zeros by the reserve bank the data has got problems in terms of quality, consistency, accuracy and reliability. Hence it makes it difficult for the researcher to use the real values and hence opt to use data expressed in US dollars.

## **3.6 Summary**

The methodology of the research is highlighted in this chapter, this includes the research approach that the study used, the research strategy adopted during the course of the research and the research design used throughout the research. The model is formulated based on the theoretical literature and empirical literature that was reviewed in chapter two. The results will be outlined in the following chapter where E-views Version 7 was used in the regression analysis.

# **CHAPTER FOUR**

# **DATA ANALYSIS AND RESULTS PRESENTATION**

## **4.0 Introduction**

The frameworks of the outcomes of the research is observed in chapter four. Due to the outcomes observed, conclusions will be drawn on the impact of public health expenditure on economic growth. To estimate this impact, e-views 7 was used and also statistical and economic interpretations of the results will be discussed. The chapter presents the model estimation and interpretation of the significance of the model as well as the results of the diagnostic test and that of the regression. The results of the Vector Error Correction Model (VECM) were presented and analysed. These results answer all research questions of the relationship between public health expenditure and economic growth.

## **4.1 Normality Test**

Table 4.1 Descriptive Statistics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | INPERCAPGDP | INPHE | ININF | INFHAID | INE |
| Mean | 867.9180 | 3.658646 | 22.81321 | 12.13796 | 26.64462 |
| Median | 671.5990 | 2.723180 | 1.634950 | 5.365500 | 44.21345 |
| Maximum | 1954.653 | 10.47584 | 222.7500 | 51.46860 | 44.45638 |
| Minimum | 356.6932 | 0.005670 | -37.20000 | 1.072800 | 1.544060 |
| Std. Dev. | 427.7286 | 3.305350 | 57.68123 | 13.35099 | 19.10396 |
| Skewness | 0.831609 | 0.604846 | 2.076037 | 1.261638 | -0.204915 |
| Kurtosis | 2.501302 | 2.035571 | 6.699051 | 3.655765 | 1.156528 |
|  |  |  |  |  |  |
| Jarque-Bera | 3.894368 | 3.091573 | 39.94181 | 8.779397 | 4.606536 |
| Probability | 0.142675 | 0.213144 | 0.000000 | 0.012404 | 0.099932 |
|  |  |  |  |  |  |
| Sum | 26905.46 | 113.4180 | 707.2095 | 376.2768 | 825.9833 |
| Sum Sq. Dev. | 5488551. | 327.7601 | 99813.74 | 5347.466 | 10948.84 |
|  |  |  |  |  |  |
| Observations | 31 | 31 | 31 | 31 | 31 |

The summary statistics that includes mean, maximum and standard of deviation are illustrated in table 4.1. To check for the outliers in the data we use the maximum and the minimum. This data has 31 observations and all variables have no outliers as shown by the difference between the maximum and the minimum values. PHE is positively skewed, however inflation is negatively skewed.

The highest standard deviation is of 427.7286 which is GDP per capita, this means that the data is spread out over a large range of values. PHE has the lowest standard deviation of 3.305350 which indicates variability on the economic growth. The measure of skewness shows that all other variables are positively skewed except for inflation. However, probability ranges from 0 to 1, it deals with the likelihood of occurrence, also the Jarque-Bera test is used to test for the hold of the normality under the null hypothesis of normality.

## **4.2. Multicollinearity**

Table 4.2 Variance Inflation Factor

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  | Coefficient | Uncentered | Centered |
| Variable | Variance | VIF | VIF |
|  |  |  |  |
|  |  |  |  |
| C | 54452.40 | 36.77009 | NA |
| INPHE | 809.7032 | 13.09981 | 5.780932 |
| ININF | 0.482556 | 1.218779 | 1.049190 |
| INFHAID | 8.765301 | 1.893051 | 1.021012 |
| INE | 23.96081 | 17.20137 | 5.714596 |
|  |  |  |  |
|  |  |  |  |

Multicollinearity is tested under the null hypothesis of no multicollinearity and against an alternative hypothesis that there is multicollinearity. It is a situation where the explanatory variables are highly inter-correlated. Therefore, it is tested using VIF. In the 4.4 table above, all the variables have values below 10 meaning that no strong relationship exists between variables and that there is no multicollinearity. This means that there is no linear relationship among the explanatory variables and it is easy to establish the influence of each one variable on other. We then fail to reject Hₒ and conclude that there is no multicollinearity between the variables and reject H₁ that there is multicollinearity.

## **4.3 Unit Root Test**

## **4.3.1 Stationary results**

“The major problems associated with time series data analysis is obtaining false results due to the non-stationarity of data” said Granger et al (1974). First of all, it is very important to find out if the data is stationary before estimating the econometric model involving time series data. Significant estimates would be obtained if the data is stationary, henceforth all convectional techniques of estimation becomes valid. Statistical tests done on such estimates will be correct as noted by Gujarati (2004).

The Augmented Dicker-Fuller test was used to check the time series data. It then showed that the results are stationary at first difference, that is the unit root tests imply that all variables are integrated of order 1. At level, no variable was stationary. However, the variables become stationery after first differencing.

Table 4.3 Stationarity test at level

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | ADF Statistics | 1% Critical Value | 5% Critical value | Conclusion |
| PERCAPGDP | -1.428933 | -3.670170 | -2.963972 | Non Stationary |
| PHE | -1.283998 | -3.670170 | -2.963972 | Non Stationary |
| INF | -2.364028 | -3.670170 | -2.963972 | Non Stationary |
| FHAID | -2.526479 | -3.711457 | -2.981038 | Non Stationary |
| E | -1.104009 | -3.670170 | -2.963972 | Non Stationary |

Table 4.3.1 Stationarity test at first difference

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | ADF Statistics | 1% Critical Value | 5 % Critical Value | Conclusion |
| PERCAPGDP | -5.912551 | -3.679322 | -2.967767 | Stationary |
| PHE | -5.769025 | -3.679322 | -2.967767 | Stationary |
| INF | -3.801607 | -3.699871 | -2.976263 | Stationary |
| FHAID | -5.621291 | -3.699871 | -2.976263 | Stationary |
| E | -5.367976 | -3.679322 | -2.967767 | Stationary |

## **4.4 Johansen Co-integration**

Estimating the parameters using OLS may result in false regression coefficient and misleading decisions as the variables are non-stationary. However, these results shows that the variables are stationary at first difference (Granger and Newbold,1997). A long run relationship can only be obtained when there is cointegration and this can only be obtained if the variables are stationary. Therefore, the presence of cointegration relationships amongst variables implies the estimation of VECM to determine the dynamic behavior of the growth equation. Johansen test for cointegration is used to determine if there exists any relationship among variables.

Table 4.4 Cointegration Test

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| Unrestricted Cointegration Rank Test (Trace) | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Hypothesized |  | Trace | 0.05 |  |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.\*\* |
|  |  |  |  |  |
|  |  |  |  |  |
| None \* | 0.760229 | 88.12134 | 69.81889 | 0.0009 |
| At most 1 | 0.620014 | 46.70733 | 47.85613 | 0.0638 |
| At most 2 | 0.345265 | 18.64631 | 29.79707 | 0.5185 |
| At most 3 | 0.188291 | 6.364093 | 15.49471 | 0.6525 |
| At most 4 | 0.010779 | 0.314299 | 3.841466 | 0.5751 |
|  |  |  |  |  |
|  |  |  |  |  |
| Trace test indicates 1 cointegrating eqn(s) at the 0.05 level | | | | |
| \* denotes rejection of the hypothesis at the 0.05 level | | | | |
| \*\*MacKinnon-Haug-Michelis (1999) p-values | | | |  |
|  |  |  |  |  |
| Unrestricted Cointegration Rank Test (Maximum Eigenvalue) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
| Hypothesized |  | Max-Eigen | 0.05 |  |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.\*\* |
|  |  |  |  |  |
|  |  |  |  |  |
| None \* | 0.760229 | 41.41401 | 33.87687 | 0.0052 |
| At most 1 \* | 0.620014 | 28.06102 | 27.58434 | 0.0434 |
| At most 2 | 0.345265 | 12.28222 | 21.13162 | 0.5201 |
| At most 3 | 0.188291 | 6.049795 | 14.26460 | 0.6068 |
| At most 4 | 0.010779 | 0.314299 | 3.841466 | 0.5751 |
|  |  |  |  |  |
|  |  |  |  |  |
| Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level | | | | |
| \* denotes rejection of the hypothesis at the 0.05 level | | | | |
| \*\*MacKinnon-Haug-Michelis (1999) p-values | | | |  |

The Johansen cointegration test under the Trace statistic shows 1 cointegration equation at 5% level of significance. The Trace static is 88.12134 and the critical value is 69.81889 therefore in our decision criteria once the Trace static is greater than the 5% critical value we reject the null hypothesis. Also the p-value is significant thus it is lower than 1%. We reject the null hypothesis that there is no cointegration in this model. If series are cointegrated, it means they exhibit a long-run relationship therefore the appropriate estimation technique is the VECM. Under the Max-Eigen statistic the Long run test indicates 2 cointegrating equations at 5% significance level.

## **4.5 Vector Error Correction Model**

Table 4.5 Vector Error Correlation Model (VECM)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Cointegrating Eq: | CointEq1 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| INPERCAPGDP(-1) | 1.000000 |  |  |  |  |
|  |  |  |  |  |  |
| INPHE(-1) | -127.5198 |  |  |  |  |
|  | (36.9193) |  |  |  |  |
|  | [-3.45402] |  |  |  |  |
|  |  |  |  |  |  |
| ININF(-1) | -9.383350 |  |  |  |  |
|  | (1.44934) |  |  |  |  |
|  | [-6.47424] |  |  |  |  |
|  |  |  |  |  |  |
| INFHAID(-1) | 20.63062 |  |  |  |  |
|  | (5.20549) |  |  |  |  |
|  | [ 3.96324] |  |  |  |  |
|  |  |  |  |  |  |
| INE(-1) | 1.963940 |  |  |  |  |
|  | (5.47952) |  |  |  |  |
|  | [ 0.35841] |  |  |  |  |
|  |  |  |  |  |  |
| C | -573.2209 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Error Correction: | D(INPERCAPGDP) | D(INPHE) | D(ININF) | D(INFHAID) | D(INE) |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| CointEq1 | -0.370500 | -0.005035 | 0.136713 | 0.020275 | 0.016870 |
|  | (0.09578) | (0.00192) | (0.04939) | (0.01340) | (0.00917) |
|  | [-3.86834] | [-2.62413] | [ 2.76778] | [ 1.51360] | [ 1.83981] |
|  |  |  |  |  |  |
| D(INPERCAPGDP(-1)) | -0.198333 | 0.009332 | -0.024519 | -0.035762 | -0.026503 |
|  | (0.20253) | (0.00406) | (0.10445) | (0.02832) | (0.01939) |
|  | [-0.97929] | [ 2.29990] | [-0.23475] | [-1.26255] | [-1.36689] |
|  |  |  |  |  |  |
| D(INPERCAPGDP(-2)) | -0.003674 | 0.000161 | 0.013294 | -0.006441 | -0.003150 |
|  | (0.10298) | (0.00206) | (0.05311) | (0.01440) | (0.00986) |
|  | [-0.03568] | [ 0.07784] | [ 0.25033] | [-0.44725] | [-0.31954] |
|  |  |  |  |  |  |
| D(INPHE(-1)) | -2.851651 | -1.012092 | 29.88479 | 3.888174 | 3.277041 |
|  | (24.3904) | (0.48865) | (12.5787) | (3.41115) | (2.33502) |
|  | [-0.11692] | [-2.07119] | [ 2.37582] | [ 1.13984] | [ 1.40343] |
|  |  |  |  |  |  |
| D(INPHE(-2)) | -4.439514 | -1.628662 | 3.097465 | 5.393126 | 4.717484 |
|  | (24.5920) | (0.49269) | (12.6827) | (3.43935) | (2.35432) |
|  | [-0.18053] | [-3.30566] | [ 0.24423] | [ 1.56807] | [ 2.00376] |
|  |  |  |  |  |  |
| D(ININF(-1)) | -3.386259 | -0.032368 | 0.644424 | -0.016408 | 0.153025 |
|  | (0.73642) | (0.01475) | (0.37979) | (0.10299) | (0.07050) |
|  | [-4.59826] | [-2.19386] | [ 1.69679] | [-0.15931] | [ 2.17052] |
|  |  |  |  |  |  |
| D(ININF(-2)) | -2.361171 | -0.009595 | 0.764997 | 0.138432 | 0.057270 |
|  | (0.67241) | (0.01347) | (0.34678) | (0.09404) | (0.06437) |
|  | [-3.51151] | [-0.71228] | [ 2.20602] | [ 1.47204] | [ 0.88966] |
|  |  |  |  |  |  |
| D(INFHAID(-1)) | 2.506043 | 0.075184 | -1.809180 | -0.662831 | -0.257757 |
|  | (1.84706) | (0.03701) | (0.95257) | (0.25832) | (0.17683) |
|  | [ 1.35677] | [ 2.03173] | [-1.89926] | [-2.56590] | [-1.45766] |
|  |  |  |  |  |  |
| D(INFHAID(-2)) | 1.637631 | 0.058772 | 0.246603 | -0.912673 | -0.181814 |
|  | (1.83845) | (0.03683) | (0.94813) | (0.25712) | (0.17600) |
|  | [ 0.89077] | [ 1.59564] | [ 0.26009] | [-3.54961] | [-1.03301] |
|  |  |  |  |  |  |
| D(INE(-1)) | -7.404338 | 0.006931 | 1.335205 | -0.178305 | 0.001777 |
|  | (3.88382) | (0.07781) | (2.00298) | (0.54318) | (0.37182) |
|  | [-1.90646] | [ 0.08907] | [ 0.66661] | [-0.32826] | [ 0.00478] |
|  |  |  |  |  |  |
| D(INE(-2)) | 2.742370 | -0.124174 | 0.205838 | 0.282811 | 0.450293 |
|  | (4.19090) | (0.08396) | (2.16134) | (0.58612) | (0.40122) |
|  | [ 0.65436] | [-1.47892] | [ 0.09524] | [ 0.48251] | [ 1.12232] |
|  |  |  |  |  |  |
| C | 33.60863 | 0.381016 | 3.012998 | 1.554897 | -1.258160 |
|  | (19.1726) | (0.38412) | (9.88777) | (2.68141) | (1.83549) |
|  | [ 1.75295] | [ 0.99193] | [ 0.30472] | [ 0.57988] | [-0.68546] |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| R-squared | 0.906609 | 0.568021 | 0.626795 | 0.638141 | 0.425025 |
| Adj. R-squared | 0.842402 | 0.271036 | 0.370217 | 0.389363 | 0.029729 |
| Sum sq. resids | 146175.3 | 58.67237 | 38878.30 | 2859.160 | 1339.728 |
| S.E. equation | 95.58219 | 1.914947 | 49.29395 | 13.36778 | 9.150574 |
| F-statistic | 14.12018 | 1.912624 | 2.442901 | 2.565105 | 1.075208 |
| Log likelihood | -159.5753 | -50.08698 | -141.0341 | -104.4954 | -93.88252 |
| Akaike AIC | 12.25538 | 4.434784 | 10.93101 | 8.321098 | 7.563037 |
| Schwarz SC | 12.82632 | 5.005729 | 11.50195 | 8.892043 | 8.133982 |
| Mean dependent | 18.17281 | 0.266257 | 8.062500 | 0.473704 | -0.701672 |
| S.D. dependent | 240.7696 | 2.242868 | 62.11524 | 17.10676 | 9.289704 |

**Table 4.5.1 Speed of Adjustment**

Preferably, every speed of adjustment is -0.05 or less, thus more negative. This means that you can say it is significant at the 5% level. Therefore, if the speed of adjustment products is positive (above 0) this means that your VECM continues to move away from long-run equilibrium after experiencing a shock, instead of converging back to it. Most important is the dependent variable.

Speed of adjustment = coefficient of the variable in the cointegrating equation x coefficient of the ECT

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Coefficient in ECT | Coefficient of ECT where variable is Dependent variable | Product = speed of adjustment |
| InPerCapGDP | 1.000 | -0.370500 | -0.3705 |
| InPHE | -127.5198 | 0.005035 | -0.6421 |
| InINF | -9.383350 | 0.136713 | -1.2828 |
| InFHAID | 20.63062 | 0.020275 | 0.4183 |
| InE | 1.963940 | 0.016870 | 0.0331 |

InPerCapitaGDP has negative speed of adjustment product of -0.3705 thus it is statistically significant at 5% it is less than -0.05, therefore it is statistically significant at 37%. InPHE has a negative speed of adjustment product of -0.6421 it is statistically significant at 5% it is less than -0.05, therefore it is statistically significant at 64%. Also, InINF has a negative speed of adjustment product of -1.2828 it is statistically significant at 5% it is less than -0.05, therefore it is statistically significant at 128%. This means that these variables have a long run relationship. However, inFHAID and InE have positive values and are not statistically significant thus continues to move away from long-run equilibrium after experiencing a shock, instead of converging back to it.

R-squared = 0.906609

This means the independent variables explain 90.66% of the variations in the per capita GDP. The remaining 9.34 is therefore, explained outside of the model.

## **4.6 Stability Tests**

## **4.6.1 Normality Test**

To test for normality, it is tested under the null hypothesis that the residuals are normally distributed against an alternative hypothesis that residuals are not normally distributed. For normal distribution the residuals are supposed to be greater than 10% (0.1) thus significance level hence we then fail to reject the null hypothesis and conclude that the model is normally distributed.

Table 4.6 Normality Test: VEC Residual Normality Tests

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Component | Jarque-Bera | Df | Prob. |  |
|  |  |  |  |  |
|  |  |  |  |  |
| 1 | 0.521475 | 2 | 0.7705 |  |
| 2 | 3.805692 | 2 | 0.1491 |  |
| 3 | 0.270967 | 2 | 0.8733 |  |
| 4 | 1.800531 | 2 | 0.4065 |  |
| 5 | 53.75063 | 2 | 0.0000 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Joint | 60.14929 | 10 | 0.0000 |  |
|  |  |  |  |  |
|  |  |  |  |  |

The first variable which is PercapGDP, the residuals are normally distributed at 77% it is greater than 10%. PHE which is the second variable is also normally distributed at 14% it is greater than 10%. INF which is the fouth variable is also normally distributed at 87% it is greater than 10%. The fourth variable which is FHAID is also normally distributed at 40% however, the firth variable which is E is not normally distributed thus it is less than 10%. Therefore, the overall model is not normally distributed is less than 10%

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

## **4.6.2 Autocorrelation**

Table 4.6.1 Autocorrelation: VEC Residual Serial Correlation LM Tests

|  |  |  |
| --- | --- | --- |
|  |  |  |
| Lags | LM-Stat | Prob |
|  |  |  |
|  |  |  |
| 1 | 22.34022 | 0.6160 |
| 2 | 15.99338 | 0.9150 |
| 3 | 23.68395 | 0.5377 |
| 4 | 24.81781 | 0.4726 |
| 5 | 21.59444 | 0.6590 |
| 6 | 29.77036 | 0.2330 |
| 7 | 17.81657 | 0.8501 |
| 8 | 27.08810 | 0.3515 |
| 9 | 31.71663 | 0.1664 |
| 10 | 16.17219 | 0.9096 |
| 11 | 15.34287 | 0.9330 |
| 12 | 33.27081 | 0.1244 |
|  |  |  |
|  |  |  |
| Probs from chi-square with 25 df. | | |

Autocorrelation is tested under the null hypothesis that there is no autocorrelation against an alternative hypothesis that there is autocorrelation. The results from table 4.8 shows that, there is no problem of autocorrelation according to VEC Serial Correlation LM tests. The P-Values are above 5% (0.05) level of significance meaning that we fail to reject the Hₒ of autocorrelation and conclude that there is no autocorrelation.

## **4.6.3 Heteroscedasticity**

Table 4.6.2 Heteroscedasticity: VEC Residual Heteroscedasticity Tests

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Joint test: | |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Chi-sq | Df | Prob. |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 319.6466 | 330 | 0.6485 |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

Heteroskedasticity is tested under the null hypothesis that there is no heteroskedasticity against an alternative hypothesis that there is heteroscedasticity. Therefore, the results from table 4.6.2 shows that, there is no problem of heteroskedasticity according to VEC Residual Heteroscedasticity tests. The P-Values are above 5% (0.05) level of significance meaning that we fail to reject the Hₒ of no heteroscedasticity and conclude that there is homoscedasticity.

## **4.7 Goodness of fit ()**

The coefficient of determination () shows the proportion of total variation explained by changes in any of the factors affecting public health care expenditure on economic growth included in the model. The ( ) value of 0.906609 shows that 90.66% of the variation in economic growth is explained by the outlined factors. The remaining 9.34% is explained by other factors not included in the model, which may be captured by the error term.

## **4.8 Chapter Summary**

The results of the model illustrated that serial correlation problem was tested using the VEC Residual Serial Correlation LM tests and concluded that there was no serial correlation in the residuals and the descriptive statistics specifies that the residuals are normally distributed. Heteroscedasticity results showed that there is no problem of heteroscedasticity according to VEC Residual Heteroscedasticity tests. The variance inflation factor results show consistence with the short run and long run relationship of variables. From the estimation, it can be said that there exists a long run relationship between economic growth and its factors which include public health expenditure and inflation in explaining economic growth while, foreign health aid and public education expenditure can move away from long run equilibrium after experiencing a shock, instead of converging back to it.

Due to the results that we have found there is need to create policy formulations that will improve child mortalities, morbidities and life expectancies given an unstable economy Zimbabwe. Therefore, chapter 5 will recommend on these policies

# **CHAPTER 5**

# **SUMMARY, CONCLUSION, AND RECOMMENDATIONS**

## **5.0 Introduction**

This chapter focuses on the major findings drawn from the study and provides a precise summary of the study. It also, avails conclusions which reckon the research objectives drawn as well as suggestions for further study. It also includes some recommendations to help increase public health expenditure in Zimbabwe. This chapter also states possible policies which should be implemented to improve public health expenditure in Zimbabwe. This research is carried out for the period of 1990 up to 2020.

## **5.1 Summary**

This research is being done to find the impact of public health expenditure on economic growth and to also assess this impact using other specified explanatory variables for the period 1990 up to 2020 using Vector Error Correlation Model (VECM) to estimate the relationship. The first chapter is about the background of PHE and its impact on economic growth. The null hypothesis that public health expenditure and inflation are statistically significant variables, while foreign health aid and public health expenditure are not statistically significant variables in explaining per capita GDP in the long run.

Once founding the objectives of the research, the researcher went on in chapter two to look at related theoretical and empirical literature on the focus of public health care expenditure theories. In chapter two, some empirical researches done by other researchers in other countries were also reviewed, this formed the basis of the methodology used in chapter three of this research.

Chapter three went on to look at the methodology used in determining the impact of PHE model in Zimbabwe. The VECM model and secondary methods were used in this research to collect data. Also the VECM regression model to test for the relationship between economic growth and its explanatory variables was shown.

After carrying out the research the results obtained were presented in chapter four showing data presentation and analysis using e-views printouts. The results obtained showed that public health expenditure and inflation are statistically significant variables in explaining economic growth. After realizing these relationships, policy recommendations based on these results will be presented in this chapter.

## **5.2 Conclusions**

The main objective of this study is todetermine the effect of public health expenditure on economic growth in Zimbabwe. The results of this study suggest that public health expenditure enhances per capita GDP in Zimbabwe both in the long run and short run. The model used in this study is the VECM, the coefficients of public health expenditure and inflation were found to be growth enhancing in Zimbabwe both in the long run and short run. Foreign health aid and public education expenditure were found to be positive which means that VECM continues to move away from long run equilibrium after experiencing a shock, instead of converging back to it. Endogenous growth model reinforced these results as it said that increased government expenditure boosts economic growth.

## **5.3 Policy recommendations**

Looking at the results in chapter four, there is a great need for recommendations to be made so that a higher and sustained per capita GDP growth can be achieved in Zimbabwe. PHE has a positive impact on per capita GDP, both in the long run and short run. Due to these results:

* a model which enhances public health expenditure (PHE) should be implemented in Zimbabwe.
* it is recommended that the government should consider health as a back bone of the economy. There is great need for the government to increase its budget allocations towards public health care expenditure. This will increase health care in Zimbabwe, we have seen in 2020 we had no enough facilities and depended on donations, production slowed down due to covid-19. Babatude (2012) postulates that “better health facilitates a sound ability for workers and enterprises which as a result improve the tax base of an economy thus a better fiscal base hence better economic performance leading to poverty reduction.”
* Zimbabwe should try its best to meet the 15% recommended by the WHO to finance the health sector. This will increase health care facilities in Zimbabwe.
* Per capita GDP growth could be achieved by increasing savings so as to raise adequate capital however, in Zimbabwe there is low capital formation which results in shortage of capital due to the fact that there are low savings done. Thus, increasing savings could make adequate capital available to investors.
* The government should also consider increasing remuneration of nurses so that they provide health care to the public and this will reduce strikes.
* In addition, the government should subsidies for research and development in Zimbabwe.

## **5.4 Suggestions for further studies**

There is always room for future research as these results are not the final results but they will inspire other researchers to do a further research on the impact of public health expenditure on economic growth. The government can also take part in providing subsidies for research development. Also further researchers can consider the impact of private health expenditure on economic growth.

# **REFERENCES**

Amiri, A. and Ventelou, B: Granger Causality between Total Expenditure on Health and GDP in OECD: Evidence from the Toda-Yamamoto. Econ. Ltrs., 116, 541--544 (2012).

Aranda P. 2010. The Determinants of Health and the Differences in Healthcare Expenditure among Countries J. Health Econ.15.103-118.

Aremu G. 2009. Effect of Public Health Expenditure on Economic Growth in Nigeria (1990-2004). Journal of Economic Thought, 3 (1): 65-83.

Babatude, M. A. (2012). An analysis of the Growth – Health Relationship in Nigeria – A paper presented at the center for the study of Africa economic development, Dakar, Senegal. Retrieved from http://www.google.com.ng/url?q=https://editorialexpress.com/cgi

Badawi A. 2003. “Testing stationarity in selected macroeconomic series from Sudan”; Institute for development Policy and Management, University of Manchester, UK.

Baldacci, E. et al. 2004, “Social Spending, Human Capital, and Growth in Developing Countries: Implications for Achieving the MDGs”, IMF Working Paper, no. wp/04/217, Washington DC

Becker, G. S. 1967, Human Capital and the Personal Distribution of Income; An Analytical Approach (University of Michigan, Ann Arbor, Michigan). Also available in G.S Becker (1993, Human Capital, Third Edition (University of Chicago Press) p102-158.

Bentham J. 1931. Principles of Legislation, (Harcourt, Brace and Co., New York).

Blejer MI. and MS. Khan. 1984. “Government policy and private investment in developing countries”. IMF Staff Papers, vol. 3 1, no. 2: 379403.

Brown and Jackson 1990, “Health- Care Costs when the Population Changes”, Canadian Journal of Economics, 8, 34.

Capolupo R. 2000. “Output Taxation, Human Capital and Growth” The Manchester School 68, 166-183 Central Statistical Office (1976-2006). (Various Issues); Monthly, Quarterly and Annual.

Font and Novell. 2004. Public Health Expenditure and Spatial Interactions in a Decentralized National Health System, Health Economics, 16, pp, 291-306

Gbesemete, K.P. and Gerdtham, U.G. 1992, “Determinants of Health Care Expenditure in Africa: A Cross-Sectional Study”, World Development Journal, 20, pp, 303-308

Chete and Adeoye 2002: “Human Resources Development in Africa”. The Nigerian Economic Society Selected Papers for the 2002 Annual Conference. pp 79-102.

Granger, C. W.J. and Newbold, P. 1977, “Spurious Regressions in Econometrics”, Journal of Econometrics, 35, 143-159.

Grossman. M. 1991. “The Human Capital Model of the Demand for Health.” National Bereau of Economic research. Working Paper 7078

Gujarati D. 2004. Basic Econometrics, New Delhi: (4th ed.). Tata McGraw-Hill.

Hansen, P. and King, A. 1996, “The Determinants of Health Care Expenditure: A Cointegrating Approach”, Journal of Health Economics, 15: 127-137.

Lawanson, D. I. 2009. Human Capital Investment and Economic Development in Nigeria. The Role of Education and Health, Oxford Business and Economic conference programme pp 65-70.

Lipsey, R. G. 1995. “Introduction to Positive Economics”, Oxford University Press. USA

Lucas.R. 1988. “On the Mechanism of Economic Development”. Journal of Monetary Economics, 22(1) p.3-42.

Mankiw N, Romer P, and Weil D. 1992. “A Contribution to the Empirics of Economic Growth.” Quarterly Journal of Economics, 108(2) Mark. M. (2002) “Journal Pricing and Mergers: A Portfolio Approach,” American Economic Review 92: 259–269.

Naiman R. and Watkins N. 1999. “A Survey of the Impacts of IMF Structural Adjustment in Africa: Growth, Social Spending and Debt Relief;” Centre for Economic and Policy Research

Nurudeen A, Usman A 2010. Government Expenditure and Economic Growth in Nigeria, 1970-2008; A Disaggregated Analysis. Bus. Econ. J. 4(1)

Ram R. 1986. “Government Size and Economic Growth: Framework and some Evidence from Cross-sectional and Time-series Data”. American Economic Review, Vol. 76, No. 1, March 1986.

Simon-Oke O. Olayemi, Human Capital and Industrial Productivity in Nigeria 2012 International Journal of Humanities and Social Science Vol 216 (august 2012)

Schulz, T.P. 1999. Health and Schooling Investment in Africa. Journal of Economic Perspective: 13: 335-337.

Solow, R. M. 1956. A Contribution to the Theory of Economic Growth. Quarterly Journal of Economics.

Wang, K. M. 2011. Health Care Expenditure and Economic Growth: Quantile Panel-Type Analysis. Econ. Modelling, 28, 1536--15

World Health Organization 2011. World Health Development Indicator Statistical Bulletin.

**Appendices**

**Appendix A: Time Series Data**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| YEARS | INPERCAPGDP | INPHE | ININF | INFHAID | INE |
| 1990 | 841.974 | 3.14364 | 1.35 | 1.3498 | 12.45426 |
| 1991 | 809.0511 | 3.93432 | -13.14 | 1.419 | 12.45457 |
| 1992 | 619.3721 | 2.81234 | -3 | 8.1661 | 22.32221 |
| 1993 | 591.7197 | 2.82342 | 0.38 | 2.24004 | 22.14536 |
| 1994 | 611.8653 | 2.72318 | -2.76 | 5.20698 | 44.33398 |
| 1995 | 623.2096 | 2.62321 | -15.23 | 5.6406 | 44.32415 |
| 1996 | 741.0959 | 2.12565 | 6.01 | 3.2872 | 44.21345 |
| 1997 | 731.9476 | 2.22345 | -0.97 | 9.3933 | 44.23414 |
| 1998 | 544.9838 | 2.14567 | 28.02 | 27.5706 | 44.23421 |
| 1999 | 580.0706 | 1.06753 | -13.43 | 27.9398 | 44.34215 |
| 2000 | 563.0575 | 1.00647 | 4.48 | 5.3655 | 44.45638 |
| 2001 | 568.3863 | 0.58796 | -37.2 | 2.6116 | 44.34265 |
| 2002 | 530.5304 | 0.57876 | 34.45 | 36.6863 | 44.23436 |
| 2003 | 478.0076 | 0.48789 | -8.57 | 4.8066 | 44.34521 |
| 2004 | 482.9985 | 0.45763 | 113.57 | 3.8574 | 44.35467 |
| 2005 | 476.5554 | 0.43643 | -31.52 | 22.6468 | 44.34562 |
| 2006 | 447.8547 | 0.06754 | 32.97 | 51.4686 | 44.23456 |
| 2007 | 431.7873 | 0.04679 | 77.73 | 1.5086 | 44.32564 |
| 2008 | 356.6932 | 0.00567 | 156.96 | 1.0728 | 44.34526 |
| 2009 | 671.599 | 0.10675 | 7.22 | 1.1618 | 44.34562 |
| 2010 | 948.3315 | 10.47584 | 3.02267 | 5.9894 | 1.54406 |
| 2011 | 1954.653 | 8.081738 | 3.46613 | 2.0754 | 3.34276 |
| 2012 | 1452.968 | 6.918353 | 3.725327 | 3.6698 | 6.07021 |
| 2013 | 1529.998 | 7.110148 | 1.63495 | 3.2219 | 5.99598 |
| 2014 | 1434.896 | 8.133524 | -0.19778 | 3.6327 | 6.13835 |
| 2015 | 1445.07 | 7.452066 | -2.43097 | 5.7546 | 5.81279 |
| 2016 | 1464.589 | 7.64762 | -1.54367 | 34.1296 | 5.47262 |
| 2017 | 1335.665 | 5.849775 | 0.893962 | 24.5325 | 5.38106 |
| 2018 | 1352.163 | 4.734331 | 10.61887 | 19.4919 | 3.58728 |
| 2019 | 1156.155 | 7.342787 | 127.95 | 28.9498 | 1.5743 |
| 2020 | 1128.211 | 10.26755 | 222.75 | 21.4298 | 2.6754 |

**Appendix B: Normality Test**

**Descriptive Statistics**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | INPERCAPGDP | INPHE | ININF | INFHAID | INE |
| Mean | 867.9180 | 3.658646 | 22.81321 | 12.13796 | 26.64462 |
| Median | 671.5990 | 2.723180 | 1.634950 | 5.365500 | 44.21345 |
| Maximum | 1954.653 | 10.47584 | 222.7500 | 51.46860 | 44.45638 |
| Minimum | 356.6932 | 0.005670 | -37.20000 | 1.072800 | 1.544060 |
| Std. Dev. | 427.7286 | 3.305350 | 57.68123 | 13.35099 | 19.10396 |
| Skewness | 0.831609 | 0.604846 | 2.076037 | 1.261638 | -0.204915 |
| Kurtosis | 2.501302 | 2.035571 | 6.699051 | 3.655765 | 1.156528 |
|  |  |  |  |  |  |
| Jarque-Bera | 3.894368 | 3.091573 | 39.94181 | 8.779397 | 4.606536 |
| Probability | 0.142675 | 0.213144 | 0.000000 | 0.012404 | 0.099932 |
|  |  |  |  |  |  |
| Sum | 26905.46 | 113.4180 | 707.2095 | 376.2768 | 825.9833 |
| Sum Sq. Dev. | 5488551. | 327.7601 | 99813.74 | 5347.466 | 10948.84 |
|  |  |  |  |  |  |
| Observations | 31 | 31 | 31 | 31 | 31 |

**Appendix: C Variance Inflation Factors**

|  |  |  |  |
| --- | --- | --- | --- |
| Variance Inflation Factors | | |  |
| Date: 12/11/21 Time: 07:36 | | |  |
| Sample: 1990 2020 | | |  |
| Included observations: 31 | | |  |
|  |  |  |  |
|  |  |  |  |
|  | Coefficient | Uncentered | Centered |
| Variable | Variance | VIF | VIF |
|  |  |  |  |
|  |  |  |  |
| C | 54452.40 | 36.77009 | NA |
| INPHE | 809.7032 | 13.09981 | 5.780932 |
| ININF | 0.482556 | 1.218779 | 1.049190 |
| INFHAID | 8.765301 | 1.893051 | 1.021012 |
| INE | 23.96081 | 17.20137 | 5.714596 |
|  |  |  |  |
|  |  |  |  |

**Appendix D: Unit Root Test**

**Stationarity at level**

**PERCAPGDP**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: INPERCAPGDP has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on AIC, maxlag=7) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -1.428933 | 0.5549 |
| Test critical values: | 1% level |  | -3.670170 |  |
|  | 5% level |  | -2.963972 |  |
|  | 10% level |  | -2.621007 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(INPERCAPGDP) | | | |  |
| Method: Least Squares | | |  |  |
| Date: 12/06/21 Time: 01:13 | | |  |  |
| Sample (adjusted): 1991 2020 | | |  |  |
| Included observations: 30 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| INPERCAPGDP(-1) | -0.142054 | 0.099413 | -1.428933 | 0.1641 |
| C | 131.6001 | 95.29709 | 1.380945 | 0.1782 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.067967 | Mean dependent var | | 9.541225 |
| Adjusted R-squared | 0.034680 | S.D. dependent var | | 235.5308 |
| S.E. of regression | 231.4107 | Akaike info criterion | | 13.79061 |
| Sum squared resid | 1499425. | Schwarz criterion | | 13.88402 |
| Log likelihood | -204.8591 | Hannan-Quinn criter. | | 13.82049 |
| F-statistic | 2.041849 | Durbin-Watson stat | | 2.096791 |
| Prob(F-statistic) | 0.164086 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Public health expenditure**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: INPHE has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on AIC, maxlag=7) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -1.283998 | 0.6237 |
| Test critical values: | 1% level |  | -3.670170 |  |
|  | 5% level |  | -2.963972 |  |
|  | 10% level |  | -2.621007 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(INPHE) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 12/06/21 Time: 01:15 | | |  |  |
| Sample (adjusted): 1991 2020 | | |  |  |
| Included observations: 30 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| INPHE(-1) | -0.164776 | 0.128331 | -1.283998 | 0.2097 |
| C | 0.804022 | 0.591479 | 1.359341 | 0.1849 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.055606 | Mean dependent var | | 0.237464 |
| Adjusted R-squared | 0.021878 | S.D. dependent var | | 2.181424 |
| S.E. of regression | 2.157430 | Akaike info criterion | | 4.440053 |
| Sum squared resid | 130.3261 | Schwarz criterion | | 4.533466 |
| Log likelihood | -64.60079 | Hannan-Quinn criter. | | 4.469936 |
| F-statistic | 1.648651 | Durbin-Watson stat | | 1.976353 |
| Prob(F-statistic) | 0.209666 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

**Inflation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: ININF has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on AIC, maxlag=7) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -2.364028 | 0.1600 |
| Test critical values: | 1% level |  | -3.670170 |  |
|  | 5% level |  | -2.963972 |  |
|  | 10% level |  | -2.621007 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(ININF) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 12/06/21 Time: 01:16 | | |  |  |
| Sample (adjusted): 1991 2020 | | |  |  |
| Included observations: 30 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| ININF(-1) | -0.545597 | 0.230791 | -2.364028 | 0.0252 |
| C | 16.19065 | 10.85209 | 1.491939 | 0.1469 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.166384 | Mean dependent var | | 7.380000 |
| Adjusted R-squared | 0.136613 | S.D. dependent var | | 60.07844 |
| S.E. of regression | 55.82407 | Akaike info criterion | | 10.94663 |
| Sum squared resid | 87257.16 | Schwarz criterion | | 11.04004 |
| Log likelihood | -162.1994 | Hannan-Quinn criter. | | 10.97651 |
| F-statistic | 5.588626 | Durbin-Watson stat | | 1.803455 |
| Prob(F-statistic) | 0.025249 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
|  | |  |
|  |  |  |

**Foreign health aid**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: INFHAID has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 4 (Automatic - based on AIC, maxlag=7) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -2.526479 | 0.1210 |
| Test critical values: | 1% level |  | -3.711457 |  |
|  | 5% level |  | -2.981038 |  |
|  | 10% level |  | -2.629906 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(INFHAID) | | | |  |
| Method: Least Squares | | |  |  |
| Date: 12/06/21 Time: 01:17 | | |  |  |
| Sample (adjusted): 1995 2020 | | |  |  |
| Included observations: 26 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| INFHAID(-1) | -1.036737 | 0.410349 | -2.526479 | 0.0201 |
| D(INFHAID(-1)) | 0.353455 | 0.399031 | 0.885783 | 0.3863 |
| D(INFHAID(-2)) | 0.175474 | 0.348995 | 0.502798 | 0.6206 |
| D(INFHAID(-3)) | 0.204212 | 0.277734 | 0.735279 | 0.4707 |
| D(INFHAID(-4)) | 0.452666 | 0.220359 | 2.054223 | 0.0533 |
| C | 13.05617 | 5.334542 | 2.447478 | 0.0237 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.557034 | Mean dependent var | | 0.623955 |
| Adjusted R-squared | 0.446293 | S.D. dependent var | | 17.72406 |
| S.E. of regression | 13.18874 | Akaike info criterion | | 8.195778 |
| Sum squared resid | 3478.857 | Schwarz criterion | | 8.486108 |
| Log likelihood | -100.5451 | Hannan-Quinn criter. | | 8.279383 |
| F-statistic | 5.030041 | Durbin-Watson stat | | 1.955896 |
| Prob(F-statistic) | 0.003814 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Public education expenditure**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: INE has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on AIC, maxlag=7) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -1.104009 | 0.7010 |
| Test critical values: | 1% level |  | -3.670170 |  |
|  | 5% level |  | -2.963972 |  |
|  | 10% level |  | -2.621007 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(INE) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 12/06/21 Time: 01:18 | | |  |  |
| Sample (adjusted): 1991 2020 | | |  |  |
| Included observations: 30 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| INE(-1) | -0.099102 | 0.089766 | -1.104009 | 0.2790 |
| C | 2.393752 | 2.974915 | 0.804645 | 0.4278 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.041714 | Mean dependent var | | -0.325962 |
| Adjusted R-squared | 0.007490 | S.D. dependent var | | 9.168970 |
| S.E. of regression | 9.134570 | Akaike info criterion | | 7.326350 |
| Sum squared resid | 2336.330 | Schwarz criterion | | 7.419763 |
| Log likelihood | -107.8952 | Hannan-Quinn criter. | | 7.356233 |
| F-statistic | 1.218836 | Durbin-Watson stat | | 1.951561 |
| Prob(F-statistic) | 0.278987 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Stationarity at fist difference**

**PERCAPGDP**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: D(INPERCAPGDP) has a unit root | | | | |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on AIC, maxlag=7) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -5.912551 | 0.0000 |
| Test critical values: | 1% level |  | -3.679322 |  |
|  | 5% level |  | -2.967767 |  |
|  | 10% level |  | -2.622989 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(INPERCAPGDP,2) | | | |  |
| Method: Least Squares | | |  |  |
| Date: 12/06/21 Time: 01:19 | | |  |  |
| Sample (adjusted): 1992 2020 | | |  |  |
| Included observations: 29 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| D(INPERCAPGDP(-1)) | -1.128317 | 0.190834 | -5.912551 | 0.0000 |
| C | 12.39567 | 44.97458 | 0.275615 | 0.7849 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.564223 | Mean dependent var | | 0.171678 |
| Adjusted R-squared | 0.548083 | S.D. dependent var | | 359.8963 |
| S.E. of regression | 241.9395 | Akaike info criterion | | 13.88172 |
| Sum squared resid | 1580437. | Schwarz criterion | | 13.97602 |
| Log likelihood | -199.2850 | Hannan-Quinn criter. | | 13.91126 |
| F-statistic | 34.95826 | Durbin-Watson stat | | 1.941620 |
| Prob(F-statistic) | 0.000003 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Public health expenditure**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | Null Hypothesis: D(INPHE) has a unit root | | | |  | | Exogenous: Constant | | |  |  | | Lag Length: 0 (Automatic - based on AIC, maxlag=7) | | | | | |  |  |  |  |  | |  |  |  |  |  | |  |  |  | t-Statistic | Prob.\* | |  |  |  |  |  | |  |  |  |  |  | | Augmented Dickey-Fuller test statistic | | | -5.769025 | 0.0000 | | Test critical values: | 1% level |  | -3.679322 |  | |  | 5% level |  | -2.967767 |  | |  | 10% level |  | -2.622989 |  | |  |  |  |  |  | |  |  |  |  |  | | \*MacKinnon (1996) one-sided p-values. | | | |  | |  |  |  |  |  | |  |  |  |  |  | | Augmented Dickey-Fuller Test Equation | | | |  | | Dependent Variable: D(INPHE,2) | | | |  | | Method: Least Squares | | |  |  | | Date: 12/06/21 Time: 01:20 | | |  |  | | Sample (adjusted): 1992 2020 | | |  |  | | Included observations: 29 after adjustments | | | |  | |  |  |  |  |  | |  |  |  |  |  | | Variable | Coefficient | Std. Error | t-Statistic | Prob. | |  |  |  |  |  | |  |  |  |  |  | | D(INPHE(-1)) | -1.130960 | 0.196040 | -5.769025 | 0.0000 | | C | 0.237350 | 0.416878 | 0.569351 | 0.5738 | |  |  |  |  |  | |  |  |  |  |  | | R-squared | 0.552102 | Mean dependent var | | 0.073589 | | Adjusted R-squared | 0.535514 | S.D. dependent var | | 3.286338 | | S.E. of regression | 2.239746 | Akaike info criterion | | 4.517074 | | Sum squared resid | 135.4445 | Schwarz criterion | | 4.611370 | | Log likelihood | -63.49757 | Hannan-Quinn criter. | | 4.546606 | | F-statistic | 33.28165 | Durbin-Watson stat | | 1.957033 | | Prob(F-statistic) | 0.000004 |  |  |  | |  |  |  |  |  | |  |  |  |  |  | | | | |  |
|  | | |  |  |
|  |  |  | |  |
|  |  |  | |  |
|  |  |  | |  |
|  |  |  | |  |
|  |  |  | |  |

**Inflation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: D(ININF) has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 2 (Automatic - based on AIC, maxlag=7) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -3.801607 | 0.0079 |
| Test critical values: | 1% level |  | -3.699871 |  |
|  | 5% level |  | -2.976263 |  |
|  | 10% level |  | -2.627420 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(ININF,2) | | | |  |
| Method: Least Squares | | |  |  |
| Date: 12/06/21 Time: 01:21 | | |  |  |
| Sample (adjusted): 1994 2020 | | |  |  |
| Included observations: 27 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| D(ININF(-1)) | -2.105422 | 0.553824 | -3.801607 | 0.0009 |
| D(ININF(-1),2) | 0.744264 | 0.446101 | 1.668376 | 0.1088 |
| D(ININF(-2),2) | 0.517336 | 0.239757 | 2.157750 | 0.0416 |
| C | 10.17849 | 11.09216 | 0.917629 | 0.3683 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.721260 | Mean dependent var | | 3.385926 |
| Adjusted R-squared | 0.684903 | S.D. dependent var | | 102.1040 |
| S.E. of regression | 57.31455 | Akaike info criterion | | 11.07094 |
| Sum squared resid | 75554.03 | Schwarz criterion | | 11.26292 |
| Log likelihood | -145.4577 | Hannan-Quinn criter. | | 11.12802 |
| F-statistic | 19.83811 | Durbin-Watson stat | | 1.588013 |
| Prob(F-statistic) | 0.000001 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Foreign health aid**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: D(INFHAID) has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 2 (Automatic - based on AIC, maxlag=7) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -5.621291 | 0.0001 |
| Test critical values: | 1% level |  | -3.699871 |  |
|  | 5% level |  | -2.976263 |  |
|  | 10% level |  | -2.627420 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(INFHAID,2) | | | |  |
| Method: Least Squares | | |  |  |
| Date: 12/06/21 Time: 01:23 | | |  |  |
| Sample (adjusted): 1994 2020 | | |  |  |
| Included observations: 27 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| D(INFHAID(-1)) | -2.604601 | 0.463346 | -5.621291 | 0.0000 |
| D(INFHAID(-1),2) | 1.003198 | 0.325592 | 3.081150 | 0.0053 |
| D(INFHAID(-2),2) | 0.357515 | 0.196208 | 1.822123 | 0.0815 |
| C | 1.912840 | 2.792728 | 0.684936 | 0.5002 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.763519 | Mean dependent var | | -0.059035 |
| Adjusted R-squared | 0.732674 | S.D. dependent var | | 27.83674 |
| S.E. of regression | 14.39260 | Akaike info criterion | | 8.307259 |
| Sum squared resid | 4764.378 | Schwarz criterion | | 8.499235 |
| Log likelihood | -108.1480 | Hannan-Quinn criter. | | 8.364343 |
| F-statistic | 24.75314 | Durbin-Watson stat | | 1.840669 |
| Prob(F-statistic) | 0.000000 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Public education expenditure**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: D(INE) has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on AIC, maxlag=7) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -5.367976 | 0.0001 |
| Test critical values: | 1% level |  | -3.679322 |  |
|  | 5% level |  | -2.967767 |  |
|  | 10% level |  | -2.622989 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(INE,2) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 12/06/21 Time: 01:24 | | |  |  |
| Sample (adjusted): 1992 2020 | | |  |  |
| Included observations: 29 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| D(INE(-1)) | -1.032931 | 0.192425 | -5.367976 | 0.0000 |
| C | -0.349567 | 1.765050 | -0.198050 | 0.8445 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.516261 | Mean dependent var | | 0.037958 |
| Adjusted R-squared | 0.498344 | S.D. dependent var | | 13.40879 |
| S.E. of regression | 9.497132 | Akaike info criterion | | 7.406329 |
| Sum squared resid | 2435.279 | Schwarz criterion | | 7.500625 |
| Log likelihood | -105.3918 | Hannan-Quinn criter. | | 7.435861 |
| F-statistic | 28.81517 | Durbin-Watson stat | | 1.956783 |
| Prob(F-statistic) | 0.000011 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**Appendix E: Co-integration Test**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Date: 12/11/21 Time: 08:33 | | |  |  |  |
| Sample (adjusted): 1992 2020 | | |  |  |  |
| Included observations: 29 after adjustments | | | |  |  |
| Trend assumption: Linear deterministic trend | | | |  |  |
| Series: INPERCAPGDP INPHE ININF INFHAID INE | | | |  |  |
| Lags interval (in first differences): 1 to 1 | | | |  |  |
|  |  |  |  |  |  |
| Unrestricted Cointegration Rank Test (Trace) | | | |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Hypothesized |  | Trace | 0.05 |  |  |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.\*\* |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| None \* | 0.760229 | 88.12134 | 69.81889 | 0.0009 |  |
| At most 1 | 0.620014 | 46.70733 | 47.85613 | 0.0638 |  |
| At most 2 | 0.345265 | 18.64631 | 29.79707 | 0.5185 |  |
| At most 3 | 0.188291 | 6.364093 | 15.49471 | 0.6525 |  |
| At most 4 | 0.010779 | 0.314299 | 3.841466 | 0.5751 |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Trace test indicates 1 cointegrating eqn(s) at the 0.05 level | | | | |  |
| \* denotes rejection of the hypothesis at the 0.05 level | | | | |  |
| \*\*MacKinnon-Haug-Michelis (1999) p-values | | | |  |  |
|  |  |  |  |  |  |
| Unrestricted Cointegration Rank Test (Maximum Eigenvalue) | | | | |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Hypothesized |  | Max-Eigen | 0.05 |  |  |
| No. of CE(s) | Eigenvalue | Statistic | Critical Value | Prob.\*\* |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| None \* | 0.760229 | 41.41401 | 33.87687 | 0.0052 |  |
| At most 1 \* | 0.620014 | 28.06102 | 27.58434 | 0.0434 |  |
| At most 2 | 0.345265 | 12.28222 | 21.13162 | 0.5201 |  |
| At most 3 | 0.188291 | 6.049795 | 14.26460 | 0.6068 |  |
| At most 4 | 0.010779 | 0.314299 | 3.841466 | 0.5751 |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level | | | | |  |
| \* denotes rejection of the hypothesis at the 0.05 level | | | | |  |
| \*\*MacKinnon-Haug-Michelis (1999) p-values | | | |  |  |
|  |  |  |  |  |  |
| Unrestricted Cointegrating Coefficients (normalized by b'\*S11\*b=I): | | | | |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| INPERCAPGDP | INPHE | ININF | INFHAID | INE |  |
| -0.000643 | 0.045125 | 0.015245 | -0.092929 | 0.001664 |  |
| -0.009256 | 1.393066 | -0.007389 | -0.014853 | 0.018662 |  |
| -0.001871 | -0.723623 | -0.010542 | -0.019287 | -0.164016 |  |
| -0.005574 | 0.544720 | 0.021024 | 0.045422 | -0.016401 |  |
| 0.004499 | -1.029556 | -0.026385 | -0.030061 | -0.005461 |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Unrestricted Adjustment Coefficients (alpha): | | | |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| D(INPERCAPGDP) | 52.25692 | 18.84903 | -31.86536 | 42.57798 | -1.101068 |
| D(INPHE) | 0.510419 | -1.328749 | 0.179266 | 0.372438 | -0.032487 |
| D(ININF) | -36.59394 | -9.728039 | 9.655743 | -3.699722 | -2.707964 |
| D(INFHAID) | 8.094931 | 0.590823 | 0.159244 | -4.197870 | -0.656839 |
| D(INE) | -1.442258 | 4.996482 | 2.372879 | -1.260642 | 0.032835 |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 1 Cointegrating Equation(s): | | Log likelihood | -574.9458 |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Normalized cointegrating coefficients (standard error in parentheses) | | | | |  |
| INPERCAPGDP | INPHE | ININF | INFHAID | INE |  |
| 1.000000 | -70.15646 | -23.70071 | 144.4771 | -2.586830 |  |
|  | (203.612) | (6.86502) | (20.4125) | (30.7387) |  |
|  |  |  |  |  |  |
| Adjustment coefficients (standard error in parentheses) | | | |  |  |
| D(INPERCAPGDP) | -0.033612 |  |  |  |  |
|  | (0.01629) |  |  |  |  |
| D(INPHE) | -0.000328 |  |  |  |  |
|  | (0.00027) |  |  |  |  |
| D(ININF) | 0.023538 |  |  |  |  |
|  | (0.00548) |  |  |  |  |
| D(INFHAID) | -0.005207 |  |  |  |  |
|  | (0.00171) |  |  |  |  |
| D(INE) | 0.000928 |  |  |  |  |
|  | (0.00111) |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 2 Cointegrating Equation(s): | | Log likelihood | -560.9153 |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Normalized cointegrating coefficients (standard error in parentheses) | | | | |  |
| INPERCAPGDP | INPHE | ININF | INFHAID | INE |  |
| 1.000000 | 0.000000 | -45.09343 | 269.2346 | -3.085121 |  |
|  |  | (11.9335) | (37.5284) | (20.5570) |  |
| 0.000000 | 1.000000 | -0.304929 | 1.778275 | -0.007103 |  |
|  |  | (0.07958) | (0.25027) | (0.13709) |  |
|  |  |  |  |  |  |
| Adjustment coefficients (standard error in parentheses) | | | |  |  |
| D(INPERCAPGDP) | -0.208084 | 28.61605 |  |  |  |
|  | (0.23205) | (34.8582) |  |  |  |
| D(INPHE) | 0.011971 | -1.828002 |  |  |  |
|  | (0.00286) | (0.42979) |  |  |  |
| D(ININF) | 0.113583 | -15.20311 |  |  |  |
|  | (0.07670) | (11.5218) |  |  |  |
| D(INFHAID) | -0.010676 | 1.188341 |  |  |  |
|  | (0.02459) | (3.69444) |  |  |  |
| D(INE) | -0.045321 | 6.895346 |  |  |  |
|  | (0.01264) | (1.89820) |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 3 Cointegrating Equation(s): | | Log likelihood | -554.7741 |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Normalized cointegrating coefficients (standard error in parentheses) | | | | |  |
| INPERCAPGDP | INPHE | ININF | INFHAID | INE |  |
| 1.000000 | 0.000000 | 0.000000 | 16.12801 | 21.91175 |  |
|  |  |  | (4.97843) | (2.64669) |  |
| 0.000000 | 1.000000 | 0.000000 | 0.066729 | 0.161930 |  |
|  |  |  | (0.03157) | (0.01678) |  |
| 0.000000 | 0.000000 | 1.000000 | -5.612937 | 0.554335 |  |
|  |  |  | (0.80156) | (0.42613) |  |
|  |  |  |  |  |  |
| Adjustment coefficients (standard error in parentheses) | | | |  |  |
| D(INPERCAPGDP) | -0.148466 | 51.67456 | 0.993296 |  |  |
|  | (0.22782) | (37.7993) | (0.48026) |  |  |
| D(INPHE) | 0.011636 | -1.957723 | 0.015709 |  |  |
|  | (0.00290) | (0.48053) | (0.00611) |  |  |
| D(ININF) | 0.095518 | -22.19023 | -0.587772 |  |  |
|  | (0.07578) | (12.5731) | (0.15975) |  |  |
| D(INFHAID) | -0.010973 | 1.073109 | 0.117359 |  |  |
|  | (0.02509) | (4.16233) | (0.05288) |  |  |
| D(INE) | -0.049761 | 5.178276 | -0.083921 |  |  |
|  | (0.01197) | (1.98573) | (0.02523) |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 4 Cointegrating Equation(s): | | Log likelihood | -551.7492 |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Normalized cointegrating coefficients (standard error in parentheses) | | | | |  |
| INPERCAPGDP | INPHE | ININF | INFHAID | INE |  |
| 1.000000 | 0.000000 | 0.000000 | 0.000000 | 21.47460 |  |
|  |  |  |  | (2.84101) |  |
| 0.000000 | 1.000000 | 0.000000 | 0.000000 | 0.160121 |  |
|  |  |  |  | (0.01721) |  |
| 0.000000 | 0.000000 | 1.000000 | 0.000000 | 0.706476 |  |
|  |  |  |  | (0.68643) |  |
| 0.000000 | 0.000000 | 0.000000 | 1.000000 | 0.027105 |  |
|  |  |  |  | (0.12968) |  |
|  |  |  |  |  |  |
| Adjustment coefficients (standard error in parentheses) | | | |  |  |
| D(INPERCAPGDP) | -0.385808 | 74.86763 | 1.888445 | -2.587583 |  |
|  | (0.24487) | (37.0540) | (0.64613) | (2.36875) |  |
| D(INPHE) | 0.009559 | -1.754848 | 0.023539 | -0.014237 |  |
|  | (0.00325) | (0.49119) | (0.00857) | (0.03140) |  |
| D(ININF) | 0.116141 | -24.20554 | -0.665554 | 3.190849 |  |
|  | (0.08752) | (13.2432) | (0.23093) | (0.84660) |  |
| D(INFHAID) | 0.012427 | -1.213555 | 0.029104 | -0.954776 |  |
|  | (0.02740) | (4.14682) | (0.07231) | (0.26509) |  |
| D(INE) | -0.042733 | 4.491580 | -0.110425 | -0.043212 |  |
|  | (0.01357) | (2.05376) | (0.03581) | (0.13129) |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

**Appendix F: Vector Error Correction Model (VECM)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Vector Error Correction Estimates | | |  |  |  |
| Date: 12/06/21 Time: 01:05 | | |  |  |  |
| Sample (adjusted): 1993 2020 | | |  |  |  |
| Included observations: 28 after adjustments | | | |  |  |
| Standard errors in ( ) & t-statistics in [ ] | | | |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Cointegrating Eq: | CointEq1 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| INPERCAPGDP(-1) | 1.000000 |  |  |  |  |
|  |  |  |  |  |  |
| INPHE(-1) | -127.5198 |  |  |  |  |
|  | (36.9193) |  |  |  |  |
|  | [-3.45402] |  |  |  |  |
|  |  |  |  |  |  |
| ININF(-1) | -9.383350 |  |  |  |  |
|  | (1.44934) |  |  |  |  |
|  | [-6.47424] |  |  |  |  |
|  |  |  |  |  |  |
| INFHAID(-1) | 20.63062 |  |  |  |  |
|  | (5.20549) |  |  |  |  |
|  | [ 3.96324] |  |  |  |  |
|  |  |  |  |  |  |
| INE(-1) | 1.963940 |  |  |  |  |
|  | (5.47952) |  |  |  |  |
|  | [ 0.35841] |  |  |  |  |
|  |  |  |  |  |  |
| C | -573.2209 |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Error Correction: | D(INPERCAPGDP) | D(INPHE) | D(ININF) | D(INFHAID) | D(INE) |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| CointEq1 | -0.370500 | -0.005035 | 0.136713 | 0.020275 | 0.016870 |
|  | (0.09578) | (0.00192) | (0.04939) | (0.01340) | (0.00917) |
|  | [-3.86834] | [-2.62413] | [ 2.76778] | [ 1.51360] | [ 1.83981] |
|  |  |  |  |  |  |
| D(INPERCAPGDP(-1)) | -0.198333 | 0.009332 | -0.024519 | -0.035762 | -0.026503 |
|  | (0.20253) | (0.00406) | (0.10445) | (0.02832) | (0.01939) |
|  | [-0.97929] | [ 2.29990] | [-0.23475] | [-1.26255] | [-1.36689] |
|  |  |  |  |  |  |
| D(INPERCAPGDP(-2)) | -0.003674 | 0.000161 | 0.013294 | -0.006441 | -0.003150 |
|  | (0.10298) | (0.00206) | (0.05311) | (0.01440) | (0.00986) |
|  | [-0.03568] | [ 0.07784] | [ 0.25033] | [-0.44725] | [-0.31954] |
|  |  |  |  |  |  |
| D(INPHE(-1)) | -2.851651 | -1.012092 | 29.88479 | 3.888174 | 3.277041 |
|  | (24.3904) | (0.48865) | (12.5787) | (3.41115) | (2.33502) |
|  | [-0.11692] | [-2.07119] | [ 2.37582] | [ 1.13984] | [ 1.40343] |
|  |  |  |  |  |  |
| D(INPHE(-2)) | -4.439514 | -1.628662 | 3.097465 | 5.393126 | 4.717484 |
|  | (24.5920) | (0.49269) | (12.6827) | (3.43935) | (2.35432) |
|  | [-0.18053] | [-3.30566] | [ 0.24423] | [ 1.56807] | [ 2.00376] |
|  |  |  |  |  |  |
| D(ININF(-1)) | -3.386259 | -0.032368 | 0.644424 | -0.016408 | 0.153025 |
|  | (0.73642) | (0.01475) | (0.37979) | (0.10299) | (0.07050) |
|  | [-4.59826] | [-2.19386] | [ 1.69679] | [-0.15931] | [ 2.17052] |
|  |  |  |  |  |  |
| D(ININF(-2)) | -2.361171 | -0.009595 | 0.764997 | 0.138432 | 0.057270 |
|  | (0.67241) | (0.01347) | (0.34678) | (0.09404) | (0.06437) |
|  | [-3.51151] | [-0.71228] | [ 2.20602] | [ 1.47204] | [ 0.88966] |
|  |  |  |  |  |  |
| D(INFHAID(-1)) | 2.506043 | 0.075184 | -1.809180 | -0.662831 | -0.257757 |
|  | (1.84706) | (0.03701) | (0.95257) | (0.25832) | (0.17683) |
|  | [ 1.35677] | [ 2.03173] | [-1.89926] | [-2.56590] | [-1.45766] |
|  |  |  |  |  |  |
| D(INFHAID(-2)) | 1.637631 | 0.058772 | 0.246603 | -0.912673 | -0.181814 |
|  | (1.83845) | (0.03683) | (0.94813) | (0.25712) | (0.17600) |
|  | [ 0.89077] | [ 1.59564] | [ 0.26009] | [-3.54961] | [-1.03301] |
|  |  |  |  |  |  |
| D(INE(-1)) | -7.404338 | 0.006931 | 1.335205 | -0.178305 | 0.001777 |
|  | (3.88382) | (0.07781) | (2.00298) | (0.54318) | (0.37182) |
|  | [-1.90646] | [ 0.08907] | [ 0.66661] | [-0.32826] | [ 0.00478] |
|  |  |  |  |  |  |
| D(INE(-2)) | 2.742370 | -0.124174 | 0.205838 | 0.282811 | 0.450293 |
|  | (4.19090) | (0.08396) | (2.16134) | (0.58612) | (0.40122) |
|  | [ 0.65436] | [-1.47892] | [ 0.09524] | [ 0.48251] | [ 1.12232] |
|  |  |  |  |  |  |
| C | 33.60863 | 0.381016 | 3.012998 | 1.554897 | -1.258160 |
|  | (19.1726) | (0.38412) | (9.88777) | (2.68141) | (1.83549) |
|  | [ 1.75295] | [ 0.99193] | [ 0.30472] | [ 0.57988] | [-0.68546] |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| R-squared | 0.906609 | 0.568021 | 0.626795 | 0.638141 | 0.425025 |
| Adj. R-squared | 0.842402 | 0.271036 | 0.370217 | 0.389363 | 0.029729 |
| Sum sq. resids | 146175.3 | 58.67237 | 38878.30 | 2859.160 | 1339.728 |
| S.E. equation | 95.58219 | 1.914947 | 49.29395 | 13.36778 | 9.150574 |
| F-statistic | 14.12018 | 1.912624 | 2.442901 | 2.565105 | 1.075208 |
| Log likelihood | -159.5753 | -50.08698 | -141.0341 | -104.4954 | -93.88252 |
| Akaike AIC | 12.25538 | 4.434784 | 10.93101 | 8.321098 | 7.563037 |
| Schwarz SC | 12.82632 | 5.005729 | 11.50195 | 8.892043 | 8.133982 |
| Mean dependent | 18.17281 | 0.266257 | 8.062500 | 0.473704 | -0.701672 |
| S.D. dependent | 240.7696 | 2.242868 | 62.11524 | 17.10676 | 9.289704 |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Determinant resid covariance (dof adj.) | | 1.86E+11 |  |  |  |
| Determinant resid covariance | | 1.13E+10 |  |  |  |
| Log likelihood | | -522.7526 |  |  |  |
| Akaike information criterion | | 41.98233 |  |  |  |
| Schwarz criterion | | 45.07495 |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

**Appendix G: Stability Tests**

1. **Normality Test**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VEC Residual Normality Tests | | |  |  |
| Orthogonalization: Cholesky (Lutkepohl) | | | |  |
| Null Hypothesis: residuals are multivariate normal | | | |  |
| Date: 12/06/21 Time: 01:06 | | |  |  |
| Sample: 1990 2020 | |  |  |  |
| Included observations: 28 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Component | Skewness | Chi-sq | df | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| 1 | 0.233887 | 0.255282 | 1 | 0.6134 |
| 2 | 0.833706 | 3.243642 | 1 | 0.0717 |
| 3 | -0.113894 | 0.060536 | 1 | 0.8057 |
| 4 | 0.602858 | 1.696041 | 1 | 0.1928 |
| 5 | 1.808255 | 15.25901 | 1 | 0.0001 |
|  |  |  |  |  |
|  |  |  |  |  |
| Joint |  | 20.51451 | 5 | 0.0010 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Component | Kurtosis | Chi-sq | df | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| 1 | 2.522333 | 0.266193 | 1 | 0.6059 |
| 2 | 3.694087 | 0.562049 | 1 | 0.4534 |
| 3 | 2.575301 | 0.210431 | 1 | 0.6464 |
| 4 | 3.299270 | 0.104490 | 1 | 0.7465 |
| 5 | 8.743938 | 38.49162 | 1 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| Joint |  | 39.63479 | 5 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Component | Jarque-Bera | df | Prob. |  |
|  |  |  |  |  |
|  |  |  |  |  |
| 1 | 0.521475 | 2 | 0.7705 |  |
| 2 | 3.805692 | 2 | 0.1491 |  |
| 3 | 0.270967 | 2 | 0.8733 |  |
| 4 | 1.800531 | 2 | 0.4065 |  |
| 5 | 53.75063 | 2 | 0.0000 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Joint | 60.14929 | 10 | 0.0000 |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**(ii) Autocorrelation**

|  |  |  |
| --- | --- | --- |
| VEC Residual Serial Correlation LM Tests | | |
| Null Hypothesis: no serial correlation at lag order h | | |
| Date: 12/06/21 Time: 01:09 | | |
| Sample: 1990 2020 | |  |
| Included observations: 28 | | |
|  |  |  |
|  |  |  |
| Lags | LM-Stat | Prob |
|  |  |  |
|  |  |  |
| 1 | 22.34022 | 0.6160 |
| 2 | 15.99338 | 0.9150 |
| 3 | 23.68395 | 0.5377 |
| 4 | 24.81781 | 0.4726 |
| 5 | 21.59444 | 0.6590 |
| 6 | 29.77036 | 0.2330 |
| 7 | 17.81657 | 0.8501 |
| 8 | 27.08810 | 0.3515 |
| 9 | 31.71663 | 0.1664 |
| 10 | 16.17219 | 0.9096 |
| 11 | 15.34287 | 0.9330 |
| 12 | 33.27081 | 0.1244 |
|  |  |  |
|  |  |  |
| Probs from chi-square with 25 df. | | |

1. **Heteroscedasticity**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares) | | | | | |
| Date: 12/06/21 Time: 01:10 | | |  |  |  |
| Sample: 1990 2020 | |  |  |  |  |
| Included observations: 28 | | |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Joint test: | |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Chi-sq | df | Prob. |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 319.6466 | 330 | 0.6485 |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Individual components: | | |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Dependent | R-squared | F(22,5) | Prob. | Chi-sq(22) | Prob. |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| res1\*res1 | 0.601252 | 0.342693 | 0.9639 | 16.83505 | 0.7724 |
| res2\*res2 | 0.932518 | 3.140653 | 0.1035 | 26.11052 | 0.2470 |
| res3\*res3 | 0.934574 | 3.246469 | 0.0972 | 26.16807 | 0.2445 |
| res4\*res4 | 0.759394 | 0.717313 | 0.7350 | 21.26304 | 0.5045 |
| res5\*res5 | 0.930976 | 3.065371 | 0.1083 | 26.06732 | 0.2488 |
| res2\*res1 | 0.890830 | 1.854545 | 0.2555 | 24.94323 | 0.2998 |
| res3\*res1 | 0.751062 | 0.685697 | 0.7566 | 21.02974 | 0.5189 |
| res3\*res2 | 0.827900 | 1.093312 | 0.5103 | 23.18120 | 0.3916 |
| res4\*res1 | 0.617379 | 0.366717 | 0.9540 | 17.28661 | 0.7473 |
| res4\*res2 | 0.767190 | 0.748942 | 0.7136 | 21.48131 | 0.4912 |
| res4\*res3 | 0.429763 | 0.171286 | 0.9986 | 12.03336 | 0.9567 |
| res5\*res1 | 0.833971 | 1.141604 | 0.4868 | 23.35120 | 0.3821 |
| res5\*res2 | 0.979640 | 10.93529 | 0.0073 | 27.42991 | 0.1954 |
| res5\*res3 | 0.796322 | 0.888568 | 0.6239 | 22.29700 | 0.4423 |
| res5\*res4 | 0.865668 | 1.464602 | 0.3587 | 24.23871 | 0.3348 |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |