**BINDURA UNIVERSITY OF SCIENCE EDUCATION**

**FACULTY OF COMMERCE**

**DEPARTMENT OF ECONOMICS**



**THE EFFECTS OF THE SECONDARY SECTOR ON GROWTH OF THE ECONOMY OF ZIMBABWE**

**(1988 -2020)**

**By**

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**DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THE BACHELOR OF SCIENCE HONORS DEGREE IN ECONOMICS**

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**DEDICATION**

I dedicate this dissertation especially to my parents, JAYDEN T ZVENYIKA and DR DAMIYANO. I thank them for their prayers and support.

**ABSTRACT**

The aim of the study is to analyse the empirical relationship between the Manufacturing sector and Economic Growth in Zimbabwe for the period 1980 to 2013 using time series data based on Kaldor's laws. The research analyses the impact of manufacturing output growth, export growth, capacity utilisation growth and mining output growth on economic growth .In order to get robust results, the research employed OLS regression technique to testify the relationship between Manufacturing sector and economic growth, using GDP as a proxy of measuring economic growth. Stationarity of variables was tested using the ADF unit root test to remove spurious relations .The results show that the output of the manufacturing sector contributes positively to economic growth. Looking at other variables, export growth and capacity utilisation growth have are significant in explaining GDP growth in Zimbabwe while mining output growth proved to be insignificant in explaining growth of the economy. The study tirades that manufacturing sector should be encouraged through tax holiday and tax reliefs to boost the output from this sector.

**Key words**: Manufacturing output growth, Mining output growth, Export growth, Capacity utilisation growth, Kaldor's lawand GDP.

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**CHAPTER ONE: Introduction**

## **1.0 Introduction**

The secondary sector is currently viewed as the greatest push factor of economic growth since the 19th century Chelsea Levinson (2018). Zimbabwe is one of the developing countries that solely depends on the manufacturing sector for its boost economically. Economic Theories like Kaldor’s Law pushes forward and supports the presents of a strong link between output caused by the secondary sector and leading to GDP boom. World bank’s statistics of 2014 clearly points that input of the secondary sector to GDP was persistantly rising and falling from 1980 and started declining in 2004 from 18% to 16% in 2009 and 11% in 2014.

Zimbabwean manufacturing sector is not performing at its best, that is, there are some areas within the sector that the government has to address so that output increases. This issue has attracted the researcher’s interests on how best can we improve the performance of the manufacturing sector. Gregory (2010) suggested that the upcoming merging economies usually base on the performance of the secondary sector. Economies like United States of America and China mainly make use of the manufacturing sector for their boom and this was postulated by economists Chelsea Levinson (2010).

This chapter serves to give the exact factors that pushed the researcher into digging deeper and this is known as the background to study-trends. The chapter is also going to give an overview of the objectives of the research that is it clearly shows what the researcher seeks to archive when the study ends. Chapter one is there to give the limitations and the delimitations faced during the research process. Definitions of the major terms are going to be given in this chapter.

## 1.**1Background to study-trends**

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Scholars like Adofu et al (2015) gives a definition of manufacturing as the making of consumption goods and exchange through the use of man power, machinery and technologically advanced assets. Goods for consumption and goods for body protection or wearing, fertilizers and liquids used in laboratories, iron and zinc, the manufacturing apparatus that uses electricity that makes work easier all constitutes to the manufacturing sector. It is has been studied by UNIDO (2011) that most African economies provide job opportunities, fight poverty and also foster for a sustainable growth in Zimbabwe through the manufacturing sector. There are three principal subjects to the manufacturing sector which are as follows: to begin with, manufacturing is becoming solutions-based and high innovation model. Secondly he mentioned that innovation and productivity is brought about by the manufacturing sector within a developing country like Zimbabwe. Lastly, the scholar mentioned that in order for any developing country to have a sustaining competitiveness and productivity to growth commitment to technology must be fostered for. So basing with the above principal subjects it is believed that through increasing returns in the manufacturing sector there is economic growth.

There has been a fall in the secondary stage of production and this seriously impacted development and growth of the economy of Zimbabwe. There is also a decline in growth of Zimbabwe because of depending more on the importation of raw materials or goods that can be used for manufacturing processes to take place and an unprecedented fall in capacity utilization rate, Ku et al (2010). From 2004 to the year 2009, the Gross Domestic Product (GDP) has been rising and falling persistently, and then it began to decline. Gross Domestic Product will be used to measure growth of the economy. Zimbabwe’ secondary production stage has been contributing, giving an increase to the output per year by 15% that is the real (GDP) increased by a 15% in 2009.It has been constant on 14% from 2010 up to 2012 and began to decline again in 2014 to 12% and thus giving us economists a clear picture that the (GDP) has been declining gradually from 2008. This decline also causes a deficit in Balance Of Payments (BOP) because of the gradual increase in importation rate. A scholar who was known in 2010 by the name Opaluwa et al came to realize that the manufacturing sector has a crucial role that gives out many advantages to developing countries that can be good enough for boom of any economy. The secondary stage of production is not actually the problem solver but it is only there to improve an economy through increasing output. The manufacturing sector improves GDP of any developing economy in the sense that job opportunities would have been created due to more industries being formed within an economy, Ku et al (2010).

## **1.2 Problem Statement**

The behaviour of the secondary stage of production contribution to Gross Domestic Product despite the dollarization issue has continued to decline and this has bitten up the Zimbabwean economy causing a decline in the country’s growth as has been clearly shown by the above statistics. So, this issue of a gradual decrease in the activities of the manufacturing sector and its productions has attracted the researchers focus and attention and became pushed in wanting to know the exact cause and then to come up with many possible ways that can be put into act to boost the activities of that sector.

## **1.3 Aim of the study**

The possible effect on growth of an economy by the secondary stage of production is the aim of this study.

## **1.4 Objectives of the study**

1. Bringing effects of the secondary stage of production on economic growth to light.
2. To clearly show the link between boom of the mining commodities and the Zimbabwean boom economically .
3. To detect the effects of a boom in exportation on growth of the Zimbabwean economy.

## **1.5 Hypothesis**

Ho**:** there is a plus link between an increase in performance of the secondary stage of production and the effectiveness of the whole economy.

## **1.6 Assumptions of the study**

-The secondary stage of production's image is clearly shown by the manufacturing output

-The data is accurate.

## **1.7 Significance of the research**

Through this research, the government of Zimbabwe will be in a position to bring about the best strategies on how to raise the effectiveness of the secondary sector. If there were any stones that were left un turned by the previous studies, well, this study is there to leave every stone turned and this will help the Zimbabwean policy makers to bring about the appropriate policing strategies to improve the secondary stage of production's performance.

The Zimbabwean government after this research will be in a position to know that the secondary sector holds much significance to the growth of the economy and will be able to identify the possible available ways and strategies that it can implement so as to make sure that the secondary sector has been supported to bring the best and sustainable growth of the Zimbabwean economy.

At the end of this piece of writing, the government of Zimbabwe should be able to know other sectors that are not being given attention whilst they are the most contributing factors to the boost of the economy more so, they would implement the recommended ways of giving attention to those sectors for the benefit of the local people.

After this piece of study, foreign investors should then come to have interests in the manufacturing industries of the Zimbabwean economy because the Zimbabwean government would have followed the recommended strategies that can best boost the performance of the manufacturing industries.

## **1.8 Delimitations of the study**

The studies aim is to detect the effects of the secondary stage of production on the Zimbabwean economy for the period 1988 to 2020.

## **1.9 Limitations of the study**

* Data inconsistency

The Zimbabwean economy used Zimbabwean dollars but there after it was using different currencies from foreign countries which then makes the data to become inconsistent. International Monetary Fundwas then used to try and correct the data inconsistent limitation.

* Unavailability of data

ZIMSTATS, sometimes do not provide statistics for the present year and the past few years, so it will be difficult to access the exact data on the present day.

## **1.10 Definition**

**Manufacturing –** it is the process of changing materials or components into finished goods that can be sold in the market place and this was postulated by Chelsea Levinson (2018). Every tangible product that you buy in a store or online is manufactured somewhere. She went on to say that, a healthy manufacturing industry is one of the hallmark indicators of a healthy, thriving economy.

**Gross domestic product –** it is defined as the total monetary or market value of all the finished goods and services produced within a country’s borders in a specific time period, by Ason Fernando (2022). He postulated that, as a broad measure of overall domestic production, it functions as a comprehensive scorecard of a given country’s economic health. Though GDP is calculated on an annual basis, it is sometimes calculated on a quarterly basis as well.

## **1.11 Summary**

Basically, chapter one was all about showing clearly the motives behind this study and exactly what pushed the researcher to undertake the study.

## **CHAPTER TWO: LITERATURE REVIEW**

## **2.0 Introduction**

This chapter is there to show how some other scholars reacted to this view of the importance of the manufacturing sector.

## **2.1 Theoretical framework**

## **2.1.1 Kaldor’s first growth law**

Kaldor (1966) after giving more flesh to the lattest theory of growth by Romer (1986) came up with the growth law. He clearly pointed out and insisted that there is a plus link between the secondary stage of production and growth of the economy. Most countries that are still developing have a sustainable rise in gross domestic product are likely to be having a productive secondary stage of production.

More of output from the secondary stage of production and employment causes a shift of man power from low productive sectors to industrial sectors. A rise in the productivity of an economy will not affect the low productive sectors given that the economy have more of man power. The movement of labor from the low productive sectors to the manufacturing sector creates employment to those that will be currently searching for jobs.`

Renelt David (2010) supported that there is a positive link between output of the secondary stage of production and economic growth.

## **2.1.2 Kaldor’s second law – Verdoon’s law**

This theory was brought forward by Verdoon so as to clearly show that there is a direct or a plus link between the rate of growth of labor productivity and the growth of the secondary stage ofproduction. This simply means that as the productivity of labor increases, the manufacturing sector also increases proportionally. He then postulated that an increase in the productivity and output is mainly due to more use of technologically advanced machinery and also the increase in economies of scale that is more benefits as the production grows.

## **2.1.3 Kaldor’s Third Law**

Kaldor’s law was there to postulate that labor can be shifted from various sectors to the manufacturing sector thus increasing the productivity of the manufacturing sector which then becomes a plus in the overall economy. Kaldor believed in the existstance of a minus link between growth of the economy and growth of the non-secondary stageofproduction, however, growth in the secondary output will cause a direct increase in the growth of the whole economy Kaldor (1966).

P = Q₁ + β₁ᴍ₁ + µ₁ whereβ₁>0

Ρ₁ = Productivity growth for all production sectors

Taking a two sector model into consideration, the law can be best explained. If the two sector model economy consists of wage differentials between the high productive sectors and low productive sectors then the law becomes effective. Usually the higher productive sectors are the manufacturing sectors since an increase in output causes labor to be more concentrated in that sector in that particular economy. The equation below best shows that an increase in the productivity of the manufacturing sector causes a rise in the productivity of other sectors.

Gₙₘ ₌ α ₊ ꞵGₘ ₋ Geₙₘ

Where Gₙₘ is productivity's growth rate

eₙₘ employment's growth rate in non-secondary stage production

(Cripps and Tarling (2016) postulated that the movement of labor from the low productive sector to the high productive sector will not cause a decrease in output in low productive sectors but will push up the output produced in high productive sectors.

## **2.2 Empirical Literature**

A survey was carried out by Adofu et al (2015) with the intention to find out the relationship between the manufacturing sector and economic growth in Nigeria between the period of 1990 and 2013 in which he used the Ordinary Least Square method. Adofu then postulated that the manufacturing sector within the Nigerian economy contributed negatively to the growth of that particular economy.

Chakerwati and Miltra (2010) came up with a research we showed theconomy.Scholars test of the manufacturing sector contribute much to the growth of the economy though it is supported by other factors like construction and the agriculture sectors in which they create employment.

Furthermore, a scholars like Viladecans-Marsal and Pons-Novell (2019) researched on the relationship between growth of an economy and the manufacturing sector and they postulated that surely there is a positive relationship between the two. The manufacturing sector incurs increasing returns to scale thus enjoying the benefits of operating at a large scale which will then lead to an increase in output thus an increase in GDP within an economy.

## **2.2.1 The effects of exports on economic growth**

Exportation also plays a vital row in improving the country’s output. An increase in exports simply means that more of Zimbabwean products are being bought by foreigners and thus bringing more of foreign currency within the economy. Growth will then be uplifted in the sense that, foreign currency will then be used to purchase more productively efficient machinery from other developed economies. This will boost performance in the manufacturing sector hence more output leading to an increase in GDP.

Mishra (2014) postulated that trade on international basis is the sum of exports and imports normalized by Gross Domestic Product, therefore when determining the contribution of trade to GDP it is necessary to take note of the import trends.

Argawal (2020) postulated that using the concept of the absolute advantage, Zimbabwe’s economic growth would boost since it will be producing goods that it is very much capable of producing at low cost and using less time than any other country. This concept increases output produced within Zimbabwe and the good part is that more will be exported which will then benefit the economy even more, because more of foreign currency will be flowing in the economy, which will then be used to purchase foreign machineries for the manufacturing sector to become more advanced and more efficient. This will lead to more of Zimbabwean firms being competitive in the outside markets, so exports also have an impact that is positive on growth of the economy.

## **2.2.2 The effects of mining sector on growth of the economy**

In support of the view which was postulated by Mahonye. N and Mandishara. L on the positive effects of the mining Industry to growth of the economy, the researcher agrees that if more minerals are extracted, they lead to more trade with other countries and thus bringing foreign currency home safely. This relationship build up with other countries brings new ways and ideas of production and thus leading to an economic boom.

Mining has been a long-standing key player in economic development, employment, infrastructure and supply of raw materials for society. It has served as a viable route to economic transformation in resource rich countries like Australia, Canada, the United States and parts of Africa. In this review, the impact of mining has been conceptualized into economic, environmental and social impacts. While it is clear that mining has transformed many economies, it has also impacted negatively on the environment and to some extent, society. Some of the negative impacts of mining are loss of vegetation cover, mass destruction of water bodies, and loss of biodiversity, land use changes and food insecurity.

However, reclamation has been a viable way of reducing the negative impacts of abandoned mine lands and ensure productive and efficient utilization of mine wastelands.

## **2.2.3 The effects of agriculture sector on the growth of an economy**

Agriculture plays a very important role on the economic boom. It is the primary stage in which many are employed and more inputs to the manufacturing sector are produced. This will then push economic output higher, so the agriculture sector economy has a plus effect on the GDP of any economy.

Awan (2014) says that contribution of agriculture in economic development can be in many ways as a livelihood, as an economic activity, and as a provider of environmental services, making the agriculture sector as a unique sector for the economic growth of a country.

Awan (2014) investigated key determinant of agriculture productivity growth, growth experience and their impact on economy growth in the selected seven economies and compare their experience with seven advanced countries and hence he found out that agriculture has significance in economic growth.

## **2.3 Summary**

Chapter two is all about showing the views of other scholars on the relationship between the manufacturing sector and the GDP of an economy.

## **CHAPTER THREE: Methodology**

## **3.0 Introduction**

The purpose of this chapter is to clearly mention all the data sources and also exoeriments and tests diagnostically are to be carried out in this chapter. The methodology will be useful to test for the link between Gross Domestic Product and the secondary stage of production is also going to be stressed out.

## **3.1 Theoretical model**

A scholar who was known as Kaldor (1966) came up with an idea that there is a positive link between Gross Domestic Product growth and the secondary stage of production growth and export growth. He postulated that growth of the secondary stage of production is a function to the growth of an economy where Gᵍᵈᵖ is the growth rate of GDP and gₘ is the growth rate of the secondary stage of production

Gᵍᵈᵖ = f (gₘ)

Gᵍᵈᵖ = αₒ + α₁gₘ

Kaldor (1966) also regress the Gross Domestic Product growth on the excess of the growth of secondary output over the growth of the non- secondary output (gₙₘ) and then regress the growth of the non-secondary output.

Gᵍᵈᵖ = α + β (gₘ ₋ gₙₘ)

gₙₘ = Xₒ + X₁ǵₘ

## **3.2 Model Specification**

This research is there to find out the extent to which the secondary sector affect growth of the economy. Other variables which do affect economic growth are included in the model. The independent variables are as follows; exports growth, mining output growth and the manufacturing output growth. To study the relationship between economic growth and the secondary sector, the following equation is obtained;

Gᵍᵈᵖ = f (ǵₘ, gₘᵢₙ, gᵃᵍʳᶜ, ǵₑₓₚ)

The mathematical model above gives us an econometric model below;

Gᵍᵈᵖ = α + β₀Gₘ + β₁Gₘᵢₙ + β₂Gₑₓₚ + β₄Gᵃᵍͬ + µ

That is

Gᵍͩᵖ – GDP growth rate

Gₘ – secondary sector growth rate

Gₘᵢₙ – mining industry growth rate

Gₑₓₚ – exportation growth rate

Gᵃᵍͬͨ *–* agriculture sector rate of growth

µ - term of disturbance

The error term is represented by µ which trapped all other variables that are not part of the model and βs are representing the estimation parameters.

## **3.3 Definition and of variables's Justification**

## **3.3.1 Economic Growth**

Growth of the economy is clearly defined the sum increase of all Commodities and services that are produced within an economy. Scholars like Adofu et al (2015) came up with a meaning that says, growth of an economy is the ability of an economy to expand its output more quicker than the population expansion. So, for any economy to find out either there has been a growth or not, it has to sum up all the variable that directly push GDP upwards or downwards, so this research going to use Gross Domestic Product as a way of measuring growth of an economy.

## **3.3.2 Manufacturing output growth**

The manufacturing sector is the secondary stage of the production life cycle of any economy. This is where goods has to be produced by labor or by using machineries, tools, chemicals and biological dispensation and in most cases the goods are for local use and for foreign trade Adofu l (2015). Srzmai crushed the idea that was brought by scholars who were known as Adofu et al (2015) and Fagerberg which stated that the manufacturing sector has a negative impact on GDP through postulating that the manufacturing sector is the CPU or the main brains to growth.

## **3.3.3 Exports Growth**

Export goods are goods that has been produced by a country’s resources within its boundaries and then the products will then be sold to other countries Chien-Hui and Bwo-Nung (2011). Export growth rate is the percentage at which the good that are being sold to other countries are increasing at a given period of time usually per year. It has been researched that export growth has a positive relationship with the growth of GDP thus an increase in exports leads to a proportionate increase in GDP and thus bringing foreign currency within an economy.

## **3.3.4 Mining Output Growth**

It is believed that the mining sector creates more job opportunities and this improves productivity of an economy. If more people get employed, that means more output is generated hence leading to an increase in the GDP of a country (Kaldor 1966). In the case of Zimbabwe, mining output pushes GDP upwards because it was privileged to have high valued minerals which is an advantage at the foreign market.

## **3.3.5 Agriculture Output Growth**

Agriculture output growth creates employment and also its output can be input to the manufacturing sector. Agriculture output pushes GDP upwards thereby helping the Zimbabwean development.

## **3.4 Estimation Procedure**

In this study, E-views an economic software is going to be used to analyze the data so as to come up with the relationship between the variables with GDP and the OLS methodology is going to be used to carry out the analysis. The augmented Dickey fuller test is going to be used so that the data will not be biased. So, GDP will be regressed with respect to the following variables; mining industry growth, secondary output growth and as well exports growth. Conditions like Best, Linear, Unbiased and Efficiency (BLUE) are best found using OLS which is also best in giving out the highest possible variables.

## **3.4.1 Test Statistics**

For any economist to test the significance of any variable correctly, t-tests can be effectively be used since it shows whether the variable being used by the researcher is significant or not in a particular analysis. The t-test has the hypothesis which is β = 0 and the null hypothesis which is β ≠ 0, so if the t-test calculated is greater than two that means the independent variable is significant in explaining the dependent variable.

## **3.4.2 F – Test**

For an economist to measure the significance of the model as a whole, an F Statistics has to be used. Coefficients of the regression are equal to zero, that becomes the null hypothesis. This tests the model with variables that are being used in this study and these are export growth, manufacturing output growth and mining output growth with the model with no variables and with the estimate of the dependent variable. The probability value of F is the probability that the null hypothesis for the full model is true.

## **3.5 Diagnostic Tests**

Maddala (2010) postulated that normality, multi-collinearity and heteroscedasticity can be seen how they are structured through the use of diagnostic tests. The tests of the data for the variables are run to see if the expectations of the data Can be useful in the long run model of the effects of the secondary sector on growth of Zimbabwe.

## **3.5.1 Heteroscedasticity**

If the variance of the error term is not constant, it simply means that there is heteroscedasticity. The presents of heteroscedasticity causes the OLS not to meet the BLUE conditions meaning that the effects of the secondary sector on growth of an eF-Statisticaccurate but just not efficient. It may not affect the results but, using OLS in the study or the analysis of the effects of the variable on economic growth, minimum variance will not be shown that is needed. Instead, Homoscedasticity meaning that all the error terms in manufacturing output are constant is required. All the variables should have a constant error term. The OLS meets the BLUE conditions if the data is homoscedastic.

## **3.5.2 Autocorrelation**

There may be an implemented policy on the manufacturing sector that may not be useful in that same very year but then be used effectively the upcoming year leading to autocorrelation. The data in use should not be auto correlated in any way. Autocorrelation given its meaning as, when the disturbance term of say last year is affecting the current year disturbance term. To test for autocorrelation, the Durban-Watson test was used which is very capable of finding out errors that follow the first order autogressive process.

## **3.5.3 Normality**

Testing on either the data is normally distributed or not the process is known as normality testing. Jacque Berra statistic is used for normality testing of which the result has to be closer to 2.

## **3.5.4 Multicollinearity**

If the data is insufficient or the study has many variables whose data is minimal, it is said that there is multicollinearity in the data. If the mining sector output is growing in proportionate way as the export output is growing the impact on GDP will hardly be notified. Multicollinearity basically means near to the expected result. One may detect the r-squared and the t-statistic, hence if the r-squared is more higher whilst the t statistics are very low there is a link between some variables.

## **3.5.5 Stationarity**

Stationarity in data comes in play if the data do not depend on time. So, if the variables in this study do depend on certain periods, the variables are said to be stationary meaning that they will be unuseful to create a durable model. It is always recommended to check for stationarity because if non stationary data is part of the analysis the results will not be accurate and inappropriate Granger (1986).

## **3.6 Data Sources and Problems**

A set of digits that was taken into consideration for the following variables in this study, which are, mining output growth, manufacturing output growth and the trade output growth was taken from ZIMSTATS.

## **3.7 Summary**

Chapter three basically was there only just to show the methodology used and the diagnostic tests that gives room to produce unbiased best linear data. Chapter four will be there to give the calculation details to see if the data is suitable for research.

## **CHAPTER FOUR: DATA ANALYSIS AND PRESENTATION**

## **4.0 Introduction**

As has been clearly been shown in the chapters above, the vital objective of the research is to give the effects of the secon sector on economic growth. So this chapter through the methodology specified in chapter three is there to analyze the data and clearly present the data starting with the descriptive statistics of the data followed by the multicollinearity, with the stationarity too. This will be made possible using E-views.

## **4.1 Descriptive Results**

**Table 4.1: Descriptive Statistics**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | AGRIC | GDP | MF | MNG | TRD |
| Mean | 1.89E+09 | 1.06E+10 | 15.36013 | 2.493649 | 68.88340 |
| Median | 1.80E+09 | 8.29E+09 | 14.41609 | 1.961655 | 70.45199 |
| Maximum | 3.18E+09 | 2.05E+10 | 26.89870 | 7.009879 | 109.5216 |
| Minimum | 9.62E+08 | 4.42E+09 | 7.721094 | 0.498667 | 44.10035 |
| Std. Dev. | 5.06E+08 | 5.48E+09 | 4.463056 | 1.856326 | 14.69602 |
| Skewness | 0.544000 | 0.758260 | 0.661458 | 1.092809 | 0.317032 |
| Kurtosis | 2.944598 | 1.886343 | 3.020796 | 3.063807 | 3.202084 |
|  |  |  |  |  |  |
| Jarque-Bera | 1.631869 | 4.867588 | 2.406990 | 6.573874 | 0.608953 |
| Probability | 0.442226 | 0.087703 | 0.300143 | 0.037368 | 0.737509 |
|  |  |  |  |  |  |
| Sum | 6.24E+10 | 3.48E+11 | 506.8844 | 82.29040 | 2273.152 |
| Sum Sq. Dev. | 8.21E+18 | 9.60E+20 | 637.4038 | 110.2703 | 6911.132 |
|  |  |  |  |  |  |
| Observations | 33 | 33 | 33 | 33 | 33 |

Data is of period 1988 to 2020

Descriptive statistics analysis examines measures of dispersion of data. The calculations of the data known as the descriptive data has been clearly shown by the table above. Standard deviation is the one that measures the variability of the variables. As has been shown on the above table, Export output growth (TRD) has the highest deviation of 14. 69602 as compared to the one with the lowest deviation of 1.856326 which is the mining output growth. The range that all the data of all variables lie is shown exactly by the maximum and minimum values. Skewness is one thing that we can use to find out where exactly the data is concentrated. The observations may be concentrated towards the lowest value or they may be near the maximum value. In this case, all the observations are positively skewed and hence they are more concentrated to one.

## **4.2 Diagnostic Tests**

## **4.2.1 Heteroskedasticity**

If the variance of the error term is not constant, it simply means that there is heteroskedasticity. The presents of heteroskedasticity causes the OLS not to meet the BLUE conditions meaning that the impact of the manufacturing sector on economic growth is not biased but just not efficient. It may not affect the results but, using OLS in the study or the analysis of the impact of the variable on economic growth, minimum variance will not be shown that is needed. Instead, Homoskedasticity meaning that all the error terms in manufacturing output are constant is required. All the variables should have a constant error term. The OLS meets the BLUE conditions if the data is homoskedastic.

**Table 4.2: Breusch-Pagan-Godfrey Test**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Heteroskedasticity Test: Breusch-Pagan-Godfrey | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
| F-statistic | 2.233337 | Prob. F(4,28) | | 0.0909 |
| Obs\*R-squared | 7.981960 | Prob. Chi-Square(4) | | 0.0922 |
| Scaled explained SS | 7.542245 | Prob. Chi-Square(4) | | 0.1099 |

In this, the most needed values are of the observed R-squared and of the corresponding probability Chi-Square. The probability Chi-Square is the value that is used to accept or reject the set hypothesis. The null hypothesis is rejected if the probability Chi-square is less than 5% 0r 0.05 and conclude that there is homoskedasticity in the model whereas if the probability Chi-square is above 5% or o.05 we accept the null hypothesis and conclude that there is no homoskedasticity in the model. So, using the Breusch-Pagan-Godfrey test it is clear that the probability Chi-square is above 5% or 0.05 hence we accept the null hypothesis and conclude that there is no homoskedasticity in the model.

## **4.2.2 Autocorrelation**

There may be an implemented policy on the manufacturing sector that may not be useful in that same very year but then be used effectively the upcoming year leading to autocorrelation. The data in use should not be auto correlated in any way. Autocorrelation is defined as, when the disturbance term of say last year is affecting the current year disturbance term. Autocorrelation test, the Durban Watson-test was used which is very capable of finding out errors that follow the first order autogressive process.

## **4.2.3 Normality**

Testing on either the data is normally distributed or not the process is known as normality testing. Jacque Berra statistic is used for normality testing of which the result has to be closer to 2.

## **4.2.4 Multicollinearity**

If the data is insufficient or the study has many variables whose data is minimal, it is said that there is multicollinearity in the data. If the mining sector output is growing in proportionate way as the export output is growing the impact on GDP will hardly be notified. Multicollinearity basically means near to the expected result. One may analyze the r-squared and the t-statistic, hence if the r-squared becomes too high whilst the t statistics are very low there is link between some variables.

**Table 4.3: Correlation Matrix**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **AGRIC** | **MF** | **MNG** | **TRD** |
| **AGRIC** | **1.000000** | **0.128567** | **-0.107884** | **0.102779** |
| **MF** | **0.128567** | **1.000000** | **0.627971** | **-0.234354** |
| **MNG** | **-0.107884** | **0.627971** | **1.000000** | **0.111953** |
| **TRD** | **0.102779** | **-0.234354** | **0.111953** | **1.000000** |

Results of the study

## **4.2.5 Stationarity**

Stationarity in data comes in play if the data do not depend on time. So, if the variables in this study do depend on time then the variables are said to be stationary meaning that they cannot be used to create a long term model. It is always recommended to check for stationarity because if non stationary data is included in the analysis the results will not be accurate and inappropriate Granger (1986).

**Table 4.4: Stationarity test in levels**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | ADF | Critical Value  1% | Critical Value  5% | Decision |
| **G***GDP* | -0.239301 | -3.653730 | -2.957110 | Not Stationary |
| **G***M* | -1.826887 | -3.653730 | -2.957110 | Not Stationary |
| **G***EXP* | -3.106168 | -3.653730 | -2.957110 | Not Stationary |
| **G***MIN* | -2.437582 | -3.653730 | -2.957110 | Not Stationary |
| **G***AGRIC* | -1.518435 | -3.653730 | -2.957110 | Not Stationary |

The table above clearly proves that the test at level gives out results that are not stationary since the Augmented Dickey- Fuller value is greater than the test values hence a test at first order difference is needed so that the values become stationary.

**Table 4.5: Stationarity Testing at First Order Difference**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variables** | **ADF** | **Critical Value** | **Critical Value** | **Decision** |
| **G*GDP*** | **-4.006225** | **-3.661661** | **-2.960411** | **Stationary** |
| **G*M*** | **-5.560790** | **-3.661661** | **-2.960411** | **Stationary** |
| **G*EXP*** | **-8.245049** | **-3.661661** | **-2.960411** | **Stationary** |
| **G*MIN*** | **-4.915541** | **-3.670170** | **-2.963972** | **Stationary** |
| **G*AGRIC*** | **-5.531012** | **-3.661661** | **-2.960411** | **Stationary** |
|  |  |  |  |  |

## **4.3 Model Specification**

Since, it has been observed that the data is all stationary at first difference, The OLS will then come into play for estimation and the results are said to be unbiased. The variables above were then used to regress GDP and looking at the adjusted R squared and looking at the independent variables explains the variation in the dependent variable. It clearly demonstrates that GDP growth is mainly triggered up by the independent variables. This will only mean that there are about a few variables that affect GDP but yet not have been included in the model but were included in the error term. The results clearly show that the manufacturing sector has a positive impact on economic growth.

**Table 4.6 Ordinary Least Squares (OLS) Results**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GDP | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 06/15/22 Time: 04:34 | | |  |  |
| Sample: 1988 2020 | |  |  |  |
| Included observations: 33 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | 3.72E+10 | 4.62E+09 | 8.055856 | 0.0000 |
| AGRIC | -6.186993 | 1.289914 | -4.796436 | 0.0000 |
| MF | -3.18E+08 | 2.02E+08 | -1.574868 | 0.1265 |
| MNG | -6.75E+08 | 4.73E+08 | -1.426927 | 0.1647 |
| TRD | -1.22E+08 | 46796503 | -2.609288 | 0.0144 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.653641 | Mean dependent var | | 1.06E+10 |
| Adjusted R-squared | 0.604161 | S.D. dependent var | | 5.48E+09 |
| S.E. of regression | 3.45E+09 | Akaike info criterion | | 46.89790 |
| Sum squared resid | 3.33E+20 | Schwarz criterion | | 47.12464 |
| Log likelihood | -768.8154 | Hannan-Quinn criter. | | 46.97419 |
| F-statistic | 13.21022 | Durbin-Watson stat | | 0.513303 |
| Prob(F-statistic) | 0.000004 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

r-squared: 0.653641

Adjusted r-squared: 0.604161

Probability (F-Statistic): 0.000004

Durbin Watson Statistic: 0.513303

Secondary output growth, mining industry boom and the export growth are the independent variables that were regressed against the dependent variable Gross Domestic Product (GDP). The probability of F statistic shows us that the model is sufficient and effective. The Durbin- Watson Statistic value should be greater than one and less than two so it can be corrected by serial correlation statistic value.

From the test above, it is easily noted that the R-Squared result of 0.6 proves that the model is under specified, but it can be ignored because the variables can reach up to twenty and hence the variables becomes difficult to work with the OLS would require some variables to be dropped since the model would have been over specified. Some of the tests like stationarity tests will prove the variables to be worth it if the data proves to be stationary.

## **4.4 Summary**

In short, this chapter serves the purpose of specifying the model used to prove that the manufacturing sector positively affect economic growth.

## 

## **CHAPTER FIVE: SUMMARY. CONCLUSIONS AND RECOMMENDATIONS**

## **5.0 Introduction**

Chapter five is there to give a clear picture and an overall view on whether the main aims of the research that had been mentioned in chapter one can be clarified or justified. This chapter will go on to serve the purpose of giving out the best policies or policies that can best solve the economic problems that have been stated in this study.

## **5.1 Summary**

Pochecoz Lopez and Thirwall (2013) brought forward the fact that a strong relationship is there between the growth of the manufacturing output and the economic growth, so the fact is supporting the main aim of this research which was to determine the effects of the secondary sector on the economic growth of Zimbabwe using series data based on time from. Using GDP as the proxy for growth of the economy a plus link between growth of the economy and exports was identified and the results were clearly shown in chapter four. Basing on the results presented in chapter four, the mining sector has a weak positive relationship with economic growth. The adjusted R-Squared of 0.60 given by the Ordinary Least Squares in chapter four clearly proves that the methodology of this study is significant. It has been shown by the study that the most significant variations against GDP are trade, manufacturing output growth and agriculture output growth but however the mining sector has no much significance. So the results of the study shows that there is a positive relationship between economic growth and the manufacturing sector so we then fail to reject the null hypothesis that there is a positive relationship between the manufacturing sector and economic growth.

## **5.2 Conclusion**

To carry out the investigation for the set objectives on whether the manufacturing sector has significance on growth of the economy the OLS was made use of, as a regression technique and the objectives became successful through the use of CLRM. The results of the regression tells and informs us that the manufacturing sector holds much significance on economic growth of Zimbabwe. These results are there to help the researcher to come up with the best recommendation strategies that can be used by the Zimbabwean government.

Due to costly and more attention requirements of the mining sector, the sector has contributed less to the growth of the economy of Zimbabwe, so the study has just proven that the mining industry has no much significance to the growth of Zimbabwe of which it was one of the objectives of this study to find out either the mining industry is positively or negatively related to the growth of the Zimbabwean economy. So as to attract foreign investors in Zimbabwe, the government has to put more of its attention and efforts into the manufacturing sector for the economy to grow since the sector produce more yield than any other sector within the economy and this has to be done through the imposition of more advanced technology to the manufacturing sector.

## **5.3 Recommendations**

**ₒ S**ince, the secondary sector has the highest significance on the Zimbabwean economy, the government is advised to bring more advanced technology that is more efficient in terms of time of production reduction and also the more the machines are advanced hence the reduction in costs. This will enable the Zimbabwean manufactured products to be more competitive outside the Zimbabwean borders since the products would be of high quality.

ₒ The Zimbabwean government has to put measures that are effective on controlling the quantities of imports so as to ensure competitiveness of local products. If imports have been reduced through barriers like embargo, duty payments and tariffs, Zimbabwean firms will become protected from external competition which will reduce structural unemployment caused by shut down of local firms due to inadequate demand, so local people will be depending on locally produced products.

ₒ The government of Zimbabwe has to play this part of attracting foreign investors into the economy that focuses on the manufacturing companies and this can be done through offering promotions to the local manufacturing firms and this will cause the manufacturing sector to be more fruitful and become more significant in boosting the Zimbabwean economy.

ₒ Mining sector can also be significant on the Zimbabwean economic growth if measures to promote its operations are taken. The measures do include the funding of this sector through introducing more extracting machinery and employment of more educated persons who can introduce even more advanced ways and methods of mineral extraction, This will boost the extraction of more minerals that are just laying idol, this will bring more foreign currency since more minerals will be exported to other countries.

ₒ Agriculture is also another sector that the government of Zimbabwe has to take note of. It is a potential sector which can be fruitful and boost the economic growth that is needed by any country. More methods of farming has to be invented. Farmers has to be supplied and be supported through being supplied by tractors and other farming equipment and advanced machinery for mass production. This sector is the key to the manufacturing sector.

## **5.4 Areas for further study**

More studies on technology has to be done in the future, so as the local people to put more attention on it to boost the operations of the manufacturing sector, the mining sector and the agricultural sector leading to an economic boom.

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**LIST OF APPPENDICES**

**APPENDIX A: RAW DATA**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| obs | AGRIC | GDP | MF | MNG | TRD | YEAR |
| 1 | 1.80E+09 | 7.81E+09 | 19.46708 | 2.390138 | 44.10035 | 1988 |
| 2 | 1.72E+09 | 8.29E+09 | 22.97104 | 2.059322 | 45.06254 | 1989 |
| 3 | 1.78E+09 | 8.78E+09 | 20.48479 | 1.229287 | 45.65925 | 1990 |
| 4 | 1.84E+09 | 8.64E+09 | 24.09614 | 6.556822 | 51.05155 | 1991 |
| 5 | 2.06E+09 | 6.75E+09 | 26.89870 | 7.009879 | 63.71249 | 1992 |
| 6 | 2.08E+09 | 6.56E+09 | 21.02116 | 5.660610 | 63.16706 | 1993 |
| 7 | 1.60E+09 | 6.89E+09 | 19.05483 | 5.961453 | 71.11950 | 1994 |
| 8 | 2.03E+09 | 7.11E+09 | 19.26422 | 3.694206 | 79.15679 | 1995 |
| 9 | 2.18E+09 | 8.55E+09 | 16.68576 | 3.990079 | 72.06962 | 1996 |
| 10 | 2.01E+09 | 8.53E+09 | 15.87868 | 3.100290 | 82.20506 | 1997 |
| 11 | 2.41E+09 | 6.40E+09 | 14.41609 | 0.804858 | 88.51404 | 1998 |
| 12 | 2.49E+09 | 6.86E+09 | 13.20136 | 0.703600 | 70.92266 | 1999 |
| 13 | 2.62E+09 | 6.69E+09 | 13.38798 | 0.801847 | 74.06741 | 2000 |
| 14 | 2.73E+09 | 6.78E+09 | 13.14537 | 0.564823 | 67.89787 | 2001 |
| 15 | 2.79E+09 | 6.34E+09 | 11.87174 | 1.320306 | 66.80735 | 2002 |
| 16 | 3.18E+09 | 5.73E+09 | 12.16674 | 1.215036 | 70.45199 | 2003 |
| 17 | 2.42E+09 | 5.81E+09 | 13.94949 | 2.064641 | 76.03961 | 2004 |
| 18 | 2.05E+09 | 5.76E+09 | 15.12285 | 1.945654 | 76.04371 | 2005 |
| 19 | 1.87E+09 | 5.44E+09 | 16.01319 | 4.450150 | 82.82065 | 2006 |
| 20 | 1.78E+09 | 5.29E+09 | 16.09742 | 5.529277 | 84.17290 | 2007 |
| 21 | 1.70E+09 | 4.42E+09 | 16.33452 | 2.405775 | 109.5216 | 2008 |
| 22 | 1.59E+09 | 9.67E+09 | 11.03051 | 0.912793 | 61.77844 | 2009 |
| 23 | 9.62E+08 | 1.20E+10 | 9.208113 | 2.284566 | 83.12419 | 2010 |
| 24 | 1.17E+09 | 1.41E+10 | 9.172401 | 3.025829 | 89.46653 | 2011 |
| 25 | 1.26E+09 | 1.71E+10 | 14.04340 | 1.961655 | 74.16253 | 2012 |
| 26 | 1.28E+09 | 1.91E+10 | 12.91906 | 1.511742 | 58.65649 | 2013 |
| 27 | 1.38E+09 | 1.95E+10 | 12.59076 | 1.484881 | 54.67162 | 2014 |
| 28 | 1.34E+09 | 2.00E+10 | 11.88860 | 0.804563 | 56.74881 | 2015 |
| 29 | 1.65E+09 | 2.05E+10 | 11.59602 | 0.903846 | 51.21902 | 2016 |
| 30 | 1.56E+09 | 1.76E+10 | 11.01701 | 1.366163 | 50.02971 | 2017 |
| 31 | 1.50E+09 | 1.81E+10 | 7.721094 | 2.304343 | 69.44702 | 2018 |
| 32 | 1.65E+09 | 1.93E+10 | 15.73823 | 0.498667 | 63.28192 | NA |
| 33 | 1.96E+09 | 1.81E+10 | 18.43000 | 1.773303 | 76.00194 | NA |

**APPENDIX B: DESCRIPTIVE STATISTICS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | AGRIC | GDP | MF | MNG | TRD |
| Mean | 1.89E+09 | 1.06E+10 | 15.36013 | 2.493649 | 68.88340 |
| Median | 1.80E+09 | 8.29E+09 | 14.41609 | 1.961655 | 70.45199 |
| Maximum | 3.18E+09 | 2.05E+10 | 26.89870 | 7.009879 | 109.5216 |
| Minimum | 9.62E+08 | 4.42E+09 | 7.721094 | 0.498667 | 44.10035 |
| Std. Dev. | 5.06E+08 | 5.48E+09 | 4.463056 | 1.856326 | 14.69602 |
| Skewness | 0.544000 | 0.758260 | 0.661458 | 1.092809 | 0.317032 |
| Kurtosis | 2.944598 | 1.886343 | 3.020796 | 3.063807 | 3.202084 |
|  |  |  |  |  |  |
| Jarque-Bera | 1.631869 | 4.867588 | 2.406990 | 6.573874 | 0.608953 |
| Probability | 0.442226 | 0.087703 | 0.300143 | 0.037368 | 0.737509 |
|  |  |  |  |  |  |
| Sum | 6.24E+10 | 3.48E+11 | 506.8844 | 82.29040 | 2273.152 |
| Sum Sq. Dev. | 8.21E+18 | 9.60E+20 | 637.4038 | 110.2703 | 6911.132 |
|  |  |  |  |  |  |
| Observations | 33 | 33 | 33 | 33 | 33 |

**APPENDIX C: UNIT ROOT TESTS**

**STATIONARY VARIABLES: TRADE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: TRD has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on SIC, maxlag=8) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -3.106168 | 0.0361 |
| Test critical values: | 1% level |  | -3.653730 |  |
|  | 5% level |  | -2.957110 |  |
|  | 10% level |  | -2.617434 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(TRD) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 06/15/22 Time: 04:19 | | |  |  |
| Sample (adjusted): 2 33 | | |  |  |
| Included observations: 32 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| TRD(-1) | -0.439814 | 0.141594 | -3.106168 | 0.0041 |
| C | 31.19497 | 9.940515 | 3.138165 | 0.0038 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.243347 | Mean dependent var | | 0.996925 |
| Adjusted R-squared | 0.218125 | S.D. dependent var | | 13.26178 |
| S.E. of regression | 11.72656 | Akaike info criterion | | 7.822051 |
| Sum squared resid | 4125.367 | Schwarz criterion | | 7.913660 |
| Log likelihood | -123.1528 | Hannan-Quinn criter. | | 7.852417 |
| F-statistic | 9.648277 | Durbin-Watson stat | | 2.327492 |
| Prob(F-statistic) | 0.004119 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**MINING**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: MNG has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on SIC, maxlag=8) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -2.437582 | 0.1400 |
| Test critical values: | 1% level |  | -3.653730 |  |
|  | 5% level |  | -2.957110 |  |
|  | 10% level |  | -2.617434 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(MNG) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 06/15/22 Time: 04:23 | | |  |  |
| Sample (adjusted): 2 33 | | |  |  |
| Included observations: 32 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| MNG(-1) | -0.333006 | 0.136613 | -2.437582 | 0.0209 |
| C | 0.818619 | 0.426799 | 1.918043 | 0.0647 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.165317 | Mean dependent var | | -0.019276 |
| Adjusted R-squared | 0.137495 | S.D. dependent var | | 1.540935 |
| S.E. of regression | 1.431084 | Akaike info criterion | | 3.615204 |
| Sum squared resid | 61.44008 | Schwarz criterion | | 3.706812 |
| Log likelihood | -55.84326 | Hannan-Quinn criter. | | 3.645569 |
| F-statistic | 5.941804 | Durbin-Watson stat | | 1.799680 |
| Prob(F-statistic) | 0.020927 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**MANUFACTURING**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: MF has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on SIC, maxlag=8) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -1.826887 | 0.3613 |
| Test critical values: | 1% level |  | -3.653730 |  |
|  | 5% level |  | -2.957110 |  |
|  | 10% level |  | -2.617434 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(MF) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 06/15/22 Time: 04:26 | | |  |  |
| Sample (adjusted): 2 33 | | |  |  |
| Included observations: 32 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| MF(-1) | -0.193913 | 0.106144 | -1.826887 | 0.0777 |
| C | 2.927511 | 1.687021 | 1.735314 | 0.0929 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.100113 | Mean dependent var | | -0.032409 |
| Adjusted R-squared | 0.070117 | S.D. dependent var | | 2.757726 |
| S.E. of regression | 2.659287 | Akaike info criterion | | 4.854455 |
| Sum squared resid | 212.1543 | Schwarz criterion | | 4.946063 |
| Log likelihood | -75.67128 | Hannan-Quinn criter. | | 4.884821 |
| F-statistic | 3.337515 | Durbin-Watson stat | | 1.784799 |
| Prob(F-statistic) | 0.077682 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**GROSS DOMESTIC PRODUCT**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: GDP has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on SIC, maxlag=8) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -0.239301 | 0.9232 |
| Test critical values: | 1% level |  | -3.653730 |  |
|  | 5% level |  | -2.957110 |  |
|  | 10% level |  | -2.617434 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(GDP) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 06/15/22 Time: 04:28 | | |  |  |
| Sample (adjusted): 2 33 | | |  |  |
| Included observations: 32 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| GDP(-1) | -0.012364 | 0.051666 | -0.239301 | 0.8125 |
| C | 4.48E+08 | 6.00E+08 | 0.746014 | 0.4615 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.001905 | Mean dependent var | | 3.20E+08 |
| Adjusted R-squared | -0.031365 | S.D. dependent var | | 1.53E+09 |
| S.E. of regression | 1.55E+09 | Akaike info criterion | | 45.22405 |
| Sum squared resid | 7.23E+19 | Schwarz criterion | | 45.31565 |
| Log likelihood | -721.5847 | Hannan-Quinn criter. | | 45.25441 |
| F-statistic | 0.057265 | Durbin-Watson stat | | 1.429919 |
| Prob(F-statistic) | 0.812500 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**AGRICULTURE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Null Hypothesis: AGRIC has a unit root | | | |  |
| Exogenous: Constant | | |  |  |
| Lag Length: 0 (Automatic - based on SIC, maxlag=8) | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  | t-Statistic | Prob.\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller test statistic | | | -1.518435 | 0.5116 |
| Test critical values: | 1% level |  | -3.653730 |  |
|  | 5% level |  | -2.957110 |  |
|  | 10% level |  | -2.617434 |  |
|  |  |  |  |  |
|  |  |  |  |  |
| \*MacKinnon (1996) one-sided p-values. | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Augmented Dickey-Fuller Test Equation | | | |  |
| Dependent Variable: D(AGRIC) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 06/15/22 Time: 04:30 | | |  |  |
| Sample (adjusted): 2 33 | | |  |  |
| Included observations: 32 after adjustments | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| AGRIC(-1) | -0.142426 | 0.093798 | -1.518435 | 0.1394 |
| C | 2.74E+08 | 1.84E+08 | 1.493862 | 0.1457 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.071370 | Mean dependent var | | 4978058. |
| Adjusted R-squared | 0.040415 | S.D. dependent var | | 2.74E+08 |
| S.E. of regression | 2.69E+08 | Akaike info criterion | | 41.71596 |
| Sum squared resid | 2.16E+18 | Schwarz criterion | | 41.80757 |
| Log likelihood | -665.4554 | Hannan-Quinn criter. | | 41.74633 |
| F-statistic | 2.305646 | Durbin-Watson stat | | 1.916773 |
| Prob(F-statistic) | 0.139374 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**THE ORDINARY LEAST SQUARES RESULTS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: GDP | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 06/15/22 Time: 04:34 | | |  |  |
| Sample: 1 33 | |  |  |  |
| Included observations: 33 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | 3.72E+10 | 4.62E+09 | 8.055856 | 0.0000 |
| AGRIC | -6.186993 | 1.289914 | -4.796436 | 0.0000 |
| MF | -3.18E+08 | 2.02E+08 | -1.574868 | 0.1265 |
| MNG | -6.75E+08 | 4.73E+08 | -1.426927 | 0.1647 |
| TRD | -1.22E+08 | 46796503 | -2.609288 | 0.0144 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.653641 | Mean dependent var | | 1.06E+10 |
| Adjusted R-squared | 0.604161 | S.D. dependent var | | 5.48E+09 |
| S.E. of regression | 3.45E+09 | Akaike info criterion | | 46.89790 |
| Sum squared resid | 3.33E+20 | Schwarz criterion | | 47.12464 |
| Log likelihood | -768.8154 | Hannan-Quinn criter. | | 46.97419 |
| F-statistic | 13.21022 | Durbin-Watson stat | | 0.513303 |
| Prob(F-statistic) | 0.000004 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**APPENDIX E: HETEROSKEDASTICITY**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Heteroskedasticity Test: White | | | |  |
|  |  |  |  |  |
|  |  |  |  |  |
| F-statistic | 1.303127 | Prob. F(14,18) | | 0.2944 |
| Obs\*R-squared | 16.61098 | Prob. Chi-Square(14) | | 0.2775 |
| Scaled explained SS | 15.69590 | Prob. Chi-Square(14) | | 0.3323 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Test Equation: | |  |  |  |
| Dependent Variable: RESID^2 | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 06/15/22 Time: 04:52 | | |  |  |
| Sample: 1 33 | |  |  |  |
| Included observations: 33 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | -6.47E+19 | 2.33E+20 | -0.277019 | 0.7849 |
| AGRIC | 1.09E+11 | 1.22E+11 | 0.894955 | 0.3826 |
| AGRIC^2 | -1.992408 | 14.38422 | -0.138513 | 0.8914 |
| AGRIC\*MF | 1.36E+09 | 4.45E+09 | 0.305248 | 0.7637 |
| AGRIC\*MNG | 1.05E+09 | 1.03E+10 | 0.101686 | 0.9201 |
| AGRIC\*TRD | -1.88E+09 | 9.77E+08 | -1.921955 | 0.0706 |
| MF | -2.29E+19 | 1.40E+19 | -1.636923 | 0.1190 |
| MF^2 | 4.44E+17 | 2.89E+17 | 1.538043 | 0.1414 |
| MF\*MNG | -2.42E+18 | 1.49E+18 | -1.630145 | 0.1204 |
| MF\*TRD | 2.41E+17 | 1.20E+17 | 2.009991 | 0.0597 |
| MNG | 4.47E+19 | 3.34E+19 | 1.338322 | 0.1975 |
| MNG^2 | 2.28E+18 | 2.38E+18 | 0.955157 | 0.3522 |
| MNG\*TRD | -4.01E+17 | 2.72E+17 | -1.476817 | 0.1570 |
| TRD | 2.65E+18 | 2.92E+18 | 0.905310 | 0.3773 |
| TRD^2 | -1.52E+16 | 1.21E+16 | -1.259860 | 0.2238 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.503363 | Mean dependent var | | 1.01E+19 |
| Adjusted R-squared | 0.117090 | S.D. dependent var | | 1.66E+19 |
| S.E. of regression | 1.56E+19 | Akaike info criterion | | 91.52615 |
| Sum squared resid | 4.37E+39 | Schwarz criterion | | 92.20638 |
| Log likelihood | -1495.181 | Hannan-Quinn criter. | | 91.75502 |
| F-statistic | 1.303127 | Durbin-Watson stat | | 1.532899 |
| Prob(F-statistic) | 0.294436 |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

**APPENDIX F: MULTICOLLINEARITY**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **AGRIC** | **MF** | **MNG** | **TRD** |
| **AGRIC** | **1.000000** | **0.128567** | **-0.107884** | **0.102779** |
| **MF** | **0.128567** | **1.000000** | **0.627971** | **-0.234354** |
| **MNG** | **-0.107884** | **0.627971** | **1.000000** | **0.111953** |
| **TRD** | **0.102779** | **-0.234354** | **0.111953** | **1.000000** |