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**An Investigation into the Relationship between Trade Openness and Economic Growth:
A study of selected economies in the Sub-Saharan Region (1990 – 2013).**

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**A dissertation submitted in partial fulfilment of the requirements of the Master of
Science Degree in Economics (MSc Econ)**

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DEDICATION

I dedicate this dissertation to my father, Zachias and late mom, Petronella (May her deal soul rest in peace),my loving sister, Michelle and my relatives and friends.

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My sincere acknowledgements go to my Creator, Jehovah who gives me strength to do everything without whom I would not have achieved this.

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ABSTRACT

The debate of trade openness and economic growth has been studied by many researchers and various conclusions have been made. This study attempted to add a voice to the debate by coming up with proxy measures for trade openness. Average tariffs, tariff revenues, imports volumes, foreign direct investment and total trade volumes were variables used to explain economic growth.

The study employed the Random Effects Model ahead of the pooled ordinary least squares and Fixed Effects Model owing to the results of the Poolability test, Breusch-Pagan test as well as the Hausman test. Average tariffs, tariff revenues, foreign direct investment and total trade volumes were found to be significant in explaining economic growth and therefore the thrust (as suggested in the policy recommendations) was to liberalise trade in line with the mentioned variables.

The study found that trade liberalisation spurs economic growth although it is just one piece of the puzzle of government policies that requires other pieces (policies) to complete the maze.

LIST OF ACRONYMS

GDP	Gross Domestic Product
U.S.	United States of America
SADC	Southern Africa Development Community
EU	European Union
FTA	Free Trade Area
ESAP	Economic Structural Adjustment Programme
UNCTAD	United Nations Conference on Trade and Development
IMF	International Monetary Fund
WB	World Bank
SSA	Sub-Saharan Africa

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CHAPTER ONE

INTRODUCTION AND BACKGROUND OF STUDY

1.0.0 Introduction

“The ordinary means therefore to increase our wealth and treasure is by foreign trade, wherein we must ever observe this rule; to sell more to strangers yearly.” – Thomas Munn (1664).

International trade is based on one country/ economy exporting one good for another with another economy. International trade has been practised from as early as the 1500s with different schools of thought being introduced to explain the causes, benefits and costs of trade among nations.

The Mercantilist economic system which came into existence in the 1500s, viewed international trade as a ‘zero-sum game’ which meant that no economy could make itself better off without making another worse off. This notion emanated from the simple fact that world resources were taken as static and therefore no one economy could increase its wealth (a function of the country’s holdings of the precious metals) without making another economy’s wealth decrease.

During this period of Mercantilism, economies were viewed as being productive if exports exceeded imports. This according to the Mercantilists, “led to export subsidisation and imposition of quotas and tariffs on imports.”

Roughly two centuries after it came into existence, the Mercantilist economic system faced heavy criticism mainly for their static view of world resources. The belief that strong countries would continue accumulating wealth was also criticised. In his 1752 publication titled, “Political Discourses”, David Hume argued that as an economy increased its stock of precious metals, a corresponding increase in nominal money supply was required to support the rising stock of precious metals. This, according to Hume, would fuel inflation. Hume’s argument is easily understandable taking from Friedman (1963)’s famous quote, “inflation is always and everywhere a monetary phenomenon.”

The challenges of Mercantilism also arose from the fact that economies had to impose retaliatory tariffs thereby stalling international trade. By 1776, Adam Smith publicly criticised the Mercantilist school of thought by noting that countries could not continue 'selling' without 'buying.' He introduced the 'invisible hand' theory into the economics field whereby government had to follow free-market principles by eliminating tariff and non-tariff barriers. In his view, these barriers actually stifled international trade. The basic criticism lay in the view that Mercantilism was of unfair trade among economies, with liberalised trade, economies (consumers included) are believed to benefit more through enhanced economic growth and variety of goods to choose from.

This study aims to investigate the relationship between trade openness and economic growth. The view that trade liberalisation spurs economic growth is to be investigated. Trade liberalisation consists of a number of policy measures that aim to reduce misalignment between domestic and international prices. These include reductions in tariffs, the conversion of non-tariff barriers into tariffs and a reduction in the overvaluation of currency (UNCTAD, 2008). Most governments in Sub-Saharan Africa however view tariffs as a vital source of revenue to meet their budgetary requirements. A quick analysis of such measures shows that these measures address the challenge of budgetary constraints in the short run only. In the case of Zimbabwe, the scarce currency is progressively siphoned out of the consumers through high tariffs.

Andersen and Babula (2008) argue that trade openness affects economic growth in three ways which are reallocation of resources, enhanced variety for consumers to choose from and increased competition among producers. Reallocation of resources generates efficiency gains that will increase the level of aggregate national income. This is in line with the comparative advantage theory which states that countries will specialise in the production of goods in which and they have lower opportunity costs prior to trade than the other country. The translation from specialisation to greater economic growth can only be realised if the country decides to open up to trade and import goods in which they do not have a comparative advantage 'cheaply.'

The opening up to trade also implies that there are more varieties available for consumption (higher consumption leads to higher levels of aggregate income). Trade openness also creates an opportunity for competition among producers. Equilibrium prices are bound to fall as firms' economies of scale increase since there is a larger market to supply. Economic growth

can also be spurred by higher real wages (due to lower equilibrium prices). Warner (2003) found out that the average tariff rate on capital and intermediate goods displayed a negative correlation with economic growth. He showed a number of regression results displaying a negative significant effect on the unweighted tariff rate on capital and intermediate goods.

Warner’s findings are however in contrast to Ulasan (2008)’s conclusions that there was no evidence to support the proposition that trade openness has a direct robust relationship with long run economic growth. The study concluded that economic institutions and macroeconomic uncertainties relating to inflation and government consumption are key factors in explaining economic growth in the long run.

1.0.1 Importance of Study

According to the views of Anderson and Babular (2008) mentioned above, trade openness can help enhance economic growth. However this ought to be put to test in order for us to come up with a concrete conclusion of whether trade openness can enhance economic growth or not hence revealing the importance of study

A view of selected economies’ tariff revenues over a period of five years shows that tariff revenue has been on the decline or in some instances, constant as shown in the table 1 below.

Table 1: Tariff Revenue Percentage Contribution to Total Revenue

Year	Zimbabwe	Zambia	South Africa
2009	26.00	11.90	24
2010	16.00	14.00	24
2011	12.00	11.27	24,5
2012	14.00	9.53	25
2013	10.00	9.12	23

Source: Zimbabwe National Budget Statements, South African Revenue Services (SARS)

The table shows declining tariff revenues contribution to total revenue for Zimbabwe and Zambia with Zimbabwe’s tariff revenue dropping from 26% in 2009 to 10% in 2013. That of Zambia also dropped from 11.90% to 9.12 in 2013 while that of South Africa remained fairly stable over the same period. These trends provide justification to reduce dependency on tariff revenues and focus on other revenue streams that can enhance e revenue base, economic growth and global competitiveness.

1.0.2 Background of Study

In spite of the wave of liberalizations undertaken during the last 30 years, the debate on the link and causality between trade openness, growth and income distribution is still open (Rodriguez and Rodrik, 2000). Basing on this notion by Rodriguez and Rodrik, we feel the need to study this relationship as a region.

In 1980 Zimbabwe and Zambia were among the founding members of the Southern Africa Development Community (SADC) then known as the Southern Africa Development Co-ordination Conference, South Africa later joined in 1994. The economic bloc aimed to foster economic, social as well as security cooperation in the southern region of the continent. The bloc set its sight on creating a free trade area in 2000 with South Africa, Botswana, Lesotho, Namibia, Swaziland, Mauritius, Madagascar and Zimbabwe being the initial participants in the free trade area. The free trade area came into full swing in 2008 and by 2009 intra-SADC trade had grown to about US\$34 billion from US\$13,2 billion in 2000 (SADC, 2012).

1.0.3 Statement of Problem

For many African countries, the argument for the imposition of tariffs and other non-tariff barriers has been to protect local industries and to raise revenue for the government. We have a case of economies that are lagging behind in terms of economic ideas, technology and economic growth. The thrust therefore is to try and address this problem by investigating the relationship between trade openness and growth.

Should we continue ‘protecting’ an under-performing or non-performing industry or we should open up to trade and compete against other countries on an open market. The latter certainly deserves more merit thereby giving this paper an opportunity to investigate the relationship between trade openness and economic growth before the policy can be advanced.

1.0.4 Objectives

The main objective is to investigate on the relationship between trade openness and economic growth. This will be done for selected economies, South Africa, Zimbabwe, Nigeria and Zambia for the period 1990 to 2013. The sample of these countries was influenced by the need to have three of the four countries being SADC countries. South Africa provides a

representative of a better developed economy in the region whilst Nigeria compliments South Africa to complete our requirement to have two of Africa's leading economies as part of the study.

The early 1990s saw most developing countries liberalising their institutions in the economic structural programmes. The study will thus look at the period starting 1990 up to 2013. The specific objectives are:

- a) to investigate the relationship between total trade volume to GDP and economic growth
- b) to investigate the relationship between average tariff and economic growth

1.0.5 Hypothesis

The study seeks to test the following hypothesis:

- a) There is a positive relationship between total trade volume to GDP and economic growth
- b) There is a negative relationship between average tariff and economic growth

1.0.6 Research Questions

- a) What is the relationship between total trade volume to GDP and economic growth?
- b) What is the relationship between average tariff and economic growth?

1.0.7 Significance of Study

Most sub-Saharan economies view tariff revenues as a vital pillar of government revenues. Together with non-tariff barriers, governments view these as means of protecting local industries. This study gains significance in the sense that it seeks to allow sub-Saharan economies the opportunity to strengthen their recognition in international trade. In short, we investigate how opening up to trade can enhance economic performance and profile on the world economic stage.

1.0.8. Organisation of the study

This chapter gave the background and overview of the study. The remaining part of the study is organised as follows; Chapter 2 covers the literature and empirical review whilst Chapter 3

outlines the research methodology. Chapter 4 covers the estimation and results of the study and Chapter 5 gives the conclusions and policy recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.0.0 Introduction

Numerous researches have been done on this subject of trade liberalisation and economic growth. This section will look at some of the studies done on the subject as well as giving a background of earlier theories of trade which explain international trade. From the 1500s, international trade had begun among countries with every country striving to increase its stock of wealth. Wealthier countries cumulatively reduced their imports and exported more than they imported annually.

2.0.1 Background of Study

In spite of the wave of liberalizations undertaken during the last 30 years, the debate on the link and causality between trade openness, growth and income distribution is still open (Rodriguez and Rodrik, 2001). Basing on this notion by Rodriguez and Rodrik, we feel the need to study this relationship as a region.

As we study the subject of trade liberalisation and its impact on economic growth we have to take into cognisance the fact that the world has become more integrated but at the same time it has polarised the poor and rich economies. According to Sen, (2010), the strong-arm tactics of the advanced nations within and outside the WTO has continued to prevail with market imperfections evident in the agricultural, textile and clothing industries. Organisations such as the IMF and WB are biased towards the developed world in terms of offering credit which has very strong effects on trade and economic growth.

Zimbabwe liberalised the economy during the early 1990s under the Economic Structural Adjustment Programme (ESAP). The programme aimed to liberalise the economy by reducing government expenditure as well as reducing government intervention in the economy. However parts of the private sector displayed worrying signs of deindustrialisation, public debt spiralled upwards and the standard of living of most Zimbabweans was also plummeting to levels not seen in twenty-five years (Saunders, 1996). This led to the programme being aborted before it had come to its finality as the economy worsened.

Although the free trade area aims to create a more liberalised trade system among member countries, the free trade covers goods of SADC origin only. The thrust then is to extend trade liberalisation outside the boundaries of SADC. This direction of study is driven by an understanding of how the region is trading amongst itself and the rest of the world.

From the 1960s going backwards, South Africa promoted its local industries via import-substitution trade policies (Edwards, 2009). However predominantly depending on gold exports for foreign exchange meant taking a risk of being vulnerable to changes in metal prices on the international market. Starting from the 1970s, South Africa employed export promotion policies in other sectors of the economy and these policies managed to liberalise trade regimes. The Reynchers Commission of Inquiry of 1972 inquired on the need to promote export diversification and it led to tariffs being replaced by quantitative restrictions and according to Bell, (1997), there was a resultant net decline in local industry protection.

By 1989, South Africa had reduced tariffs for imports of goods used in the motor vehicle, textiles and clothing manufacturing lines to zero. It is early though, to conclude that trade liberalisation of this kind contributed to increasing level of economic growth in that country.

Behar and Edwards (2011) study showed that the SADC traded mainly in primary products in the agricultural sector. This then means that trade involving secondary products is mainly done outside the region or with the rest of the world. The extent of trade liberalisation with the rest of the world by SADC countries (in particular South Africa, Zambia and Zimbabwe which are part of this study) is not as great as the liberalisation among SADC member states. This then leaves us with an area for possible study; can trade liberalisation with the rest of the world spur economic growth in the region?

2.0.2 Theoretical Review

‘The causes which determine the economic progress of nations belong to the study of international trade’ (Marshall 1890). From the earliest of times, the subject of international trade has received great attention due to the reason that trade is at the core of the progress of any economy. Whilst earlier trade theories focused on static gains and trade creation gains as the gains from international trade, the new theories are biased towards dynamic gains of trade. Thirwall (2000) argues that dynamic gains from trade are dependent on the demand as

well as production characteristics of the goods produced in that economy. More importantly is the trade regime adopted.

The Mercantilist economic system which came into existence in the 1500s, viewed international trade as a 'zero-sum game' which meant that no economy could make itself better off without making another worse off. This notion emanated from the simple fact that world resources were taken as static and therefore no one economy could increase its wealth (a function of the country's holdings of the precious metals) without making another economy's wealth decrease. During such periods countries were more egocentric than today. This undoubtedly fuelled colonisation of 'weaker' states as the 'stronger' states made themselves better off seemingly at the expense of the weaker ones.

Roughly two centuries after it came into existence, the Mercantilist economic system faced heavy criticism mainly for their static view of world resources. The belief that strong countries would continue accumulating wealth was also criticised. In his 1752 publication titled, "Political Discourses", David Hume argued that as an economy increased its stock of precious metals, a corresponding increase in nominal money supply was required to support the rising stock of precious metals. This, according to Hume, would fuel inflation. Hume's argument is easily understandable taking from Friedman (1963)'s famous quote, "inflation is always and everywhere a monetary phenomenon."

The challenges of Mercantilism also arose from the fact that economies had to impose retaliatory tariffs thereby stalling international trade. By 1776, Adam Smith publicly criticised the Mercantilist school of thought by noting that countries could not continue 'selling' without 'buying.' He introduced the 'invisible hand' theory into the economics field whereby government had to follow free-market principles by eliminating tariff and non-tariff barriers. In his view, these barriers actually stifled international trade. The basic criticism lay in the view that Mercantilism was of unfair trade among economies, with liberalised trade, economies (consumers included) are believed to benefit more through enhanced economic growth and variety of goods to choose from.

This paper aims to investigate on the relationship between trade openness and economic growth. The view that trade liberalisation spurs economic growth is to be investigated.

Trade liberalisation consists of a number of policy measures that aim to reduce misalignment between domestic and international prices. These include reductions in tariffs, the conversion

of non-tariff barriers into tariffs and a reduction in the overvaluation of currency (UNCTAD, 2008). A quick analysis of such measures shows that these measures address the challenge of budgetary constraints in the short run only. In the case of Zimbabwe, the scarce currency is progressively siphoned out of the consumers through high tariffs.

Krueger (1978) gave an interesting view of trade openness by suggesting that a country can open up to international trade by employing a combination of trade policies that are biased towards the export sector and employing policies that protect the importing sector.

Anderson and Babula (2008) argue that trade openness affects economic growth in three ways which are reallocation of resources, enhanced variety for consumers to choose from and increased competition among producers. Reallocation of resources generates efficiency gains that will increase the level of aggregate national income. This is in line with the comparative advantage theory which states that countries will specialise in the production of goods in which they have lower opportunity costs prior to trade than the other country. The translation from specialisation to greater economic growth can only be realised if the country decides to open up to trade and import goods in which they do not have a comparative advantage.

The opening up to trade also implies that there are more varieties available for consumption (higher consumption leads to higher levels of aggregate income). A reduction in tariff and non-tariff barriers renders the domestic price of imports to the final consumer to fall. Demand of such imports will be expected to increase (provided the good is price elastic) and through the aggregate consumption branch (C) of the Keynesian output-expenditure model of; $Y = C + I + G + (X - M)$, economic growth can be enhanced. This is achieved through the multiplier effect of the change in consumption on the national income. This change in consumption patterns can also spur investment which in turn boosts the national income. The equation below will help illustrate;

$$I_t = I_0 + I(r) + b(C_t - C_{t-1})$$

Where I_t is the aggregate investment at time t

I_0 is autonomous investment

$I(r)$ is interest rate determined by the interest rate

C_t is the consumption at time t and C_{t-1} is that of the previous period.

Trade openness also creates an opportunity for competition among producers to increase. Equilibrium prices are bound to fall as firms' economies of scale increase since there is a larger market to supply. Economic growth can also be spurred by higher real wages (due to lower equilibrium prices). It is therefore vital to remember that trade policy is one of the vital economic policy that can bring changes to the aggregate national income which puts us in a position to avoid trivialising the study between trade openness and economic growth.

Ulasan (2008) points out to three different effects of openness to trade that help in enhancing economic growth. These are communication effect, duplication effect and integration effect. The communication effect emanates from the notion that international trade provides channels for communication with foreign counterparts that facilitate the transmission of technology. The duplication effect argues that in the absence of international trade, some ideas and technologies may be duplicated across economies. However, openness to trade encourages new and distinct ideas to emerge. As economies reduce the extent of duplication of ideas and technologies, economies will tend to concentrate on production of goods and services in which they possess comparative advantage.

The duplication effect can be linked to the new trade theories for example the Linder theory which give attention to the role played by technology in economic growth. Linder (1961), argued that trade across international borders is more pronounced between countries with similar or almost similar per-capita incomes. Going back to the duplication effect mentioned above, it is more probable for countries with similar per-capita incomes to duplicate production lines. Therefore in the presence of trade this duplication is reduced as economies concentrate on production of goods and services in which they possess comparative advantage and trade these for goods and services in which they possess little or no comparative advantage.

The allocation effect states that opening up to trade will allow specialisation. Relative domestic factor prices will change after opening up to international trade. The price of the abundant factor will increase proportionally more than the increase in the price of the good that uses the abundant factor intensively; that results in an increase in the real wages in the labor-abundant country. On the other hand, the price of the scarce resource will decrease proportionally more than the decline the relative price of the good that uses the scarce resource intensively.

David (2007) came up with his own three channels through which trade openness might affect economic growth, exchange rate gains, specialization gains as well as economies of scale gains. Gains from exchange result from consumers benefitting from resultant lower priced imports due to reduced trade barriers. Primary and intermediate imports' prices also fall due to these reduced trade barriers.

Gains from specialization result from producers directing resources away from previously protected sectors of the economy towards those that have the greatest value added. Gains from economies of scale, according to David (2007) result from the pro-competitive effect of reducing trade barriers. This competition will allow for the more competitive firms to remain in business and achieve lower average total costs and higher efficiency levels elbowing out the less competitive ones in the process.

2.0.3 Empirical Review

Yanikkaya, (2003) did a study to examine the growth effects of trade openness measures. Their study covered the period 1970 – 1990 and included a number of countries from various regions Pakistan, Sri-Lanka, Lesotho. South Africa, Poland, Sweden, Spain, Italy, Jamaica, Philippines etc. The study enabled a comparison of regression results across various measures individually. They came up with two broad categories of measures, with one group being made up of trade volume measures and the other, trade restriction measures.

The results showed contrasting results for the two groups mentioned. Trade volumes' estimation results showed a positive and significant relationship between trade openness and economic growth. The study made use of various measures of openness which included;

- The U.S trade openness which is the ratio of each country's total bilateral trade with the U.S. to its gross domestic product.
- Population density which is the ratio of total population to total land area

These two and other measures made up the trade volumes' measures group. The second group was made up of total import duties (as a measure of the severity of trade restrictions), total export duties, bilateral payment arrangements (defined as restrictions on payments on trade restrictions).

The results generally showed expected relationships with economic growth. Trade barriers, according to the study, "...have negative repercussions on growth through reducing the size of the external sector of a country." For instance, bilateral payment arrangements measure showed a negative but insignificant relationship with economic growth across the spectrum of countries. Population density also showed a positive relationship with growth. This is in line with Sachs and Warner (1995)'s argument that countries with higher population densities tend to be more open and have more international trade channels.

According to this study, trade volumes support the hypothesis that trade positively affects economic growth through numerous channels such as technological transfers, scale economies and comparative advantage. However, trade restriction measures did not reveal a positive relationship between trade openness and growth. One important lesson from this study was that under certain conditions, trade restrictions can benefit developing countries.

Sachs and Warner (1995) did a study on the relationship between trade openness and economic growth. The study was done for 118 countries for the period 1970 – 1989. The study made use of various measures with the researchers constructing various dummies for trade openness that included;

- unweighted average tariffs (TAR) dummy; where dummy = 1 if $TAR > 40\%$
- Exports marketing board (XMB) dummy; where dummy = 1 if country has maintained an export marketing board or similar monopoly on exports.
- Socialist economic system (based on the Kornai, 1992 definition of a socialist system).

The study found out that on average, economies that had liberalised their trade regulations experienced annual growth rates of 1.5% more compared to pre-liberalisation years. The study also revealed a 1.5% - 2% increase in investment rate post-liberalisation.

Rodriguez and Rodrik (2001) did a study on the same subject of trade openness and growth. They sought to challenge the results of various studies which had revealed a positive relationship between trade openness and growth which had been widely agreed to in economic literature. The study used data for 49 countries for the period 1990 – 2003 that had been used by other researchers such as Wacziarg and Welch (2003), Sachs and Warner (1995), Frankel and Romer (1999), Dollar (1992) as well as Martin, Miller and Doppelhofer (2004). Rodriguez and Rodrik's study was more of a critique of these previous researchers.

They argued that previous studies had either constructed inappropriate measures of trade restrictions or used questionable econometric methodologies.

Rodriguez and Rodrik also argued that trade can have positive relationship with growth, but the question emanates from the causation side. They argued that economic growth can also be affected by geography, demographic structures as well as political institutions. An instance for the effect of demographic structures is that of China which accounts for close to a third of the world population as of 2012, (Li Yang, 2013). Such an abundant labour resource may assist spur growth since labour costs are expected to be lower. Political institutions play a significant role in the shaping of economic growth trends and patterns. Rodriguez and Rodrik's study also revealed some interesting insights into the 1990 – 2003 period which had been termed the 'liberalisation' period by various researchers mentioned above. The 1990 - 2003 period had a 1.09% average growth rate, 0.35% lower than the 1975 – 1990 period, which had been termed the 'closed economies' era.

Rodriguez and Rodrik countered Dollar (1992) measures of changes in trade volumes. In fact, countries that saw greater increases in trade shares seemed to have outperformed those that did not. However they quickly pointed out that the difference was not significant at conventional levels. Some of the revelations that helped support Rodriguez and Rodrik argument that openness to trade spurs no economic growth are that of Lesotho and Lebanon growth trends. According to previous studies being criticised by Rodriguez and Rodrik, Lebanon and Lesotho were classified as 'closed economies' during the period of study. Ironically Lebanon's economic growth rate was ranked as the third highest in the world whilst Lesotho had the sixth highest growth rate of per capita income in the world. This is a clear contrast of previous other researchers such as Dollar (1992) and Frankel and Romer (1999) arguments that 'open economies' experienced higher growth rates than closed ones.

Rodriguez and Rodrik further did a test on the correlation between changes in the trade to GDP ratio and changes in openness to trade. They found no relationship between the two and concluded that, "trade openness is not important for growth."

Teweldemedhin and Van Schalkwyk (2010) did a study on South Africa to examine the relationship between trade and total factor productivity (TFP) in the agricultural sector. They constructed a model which had TFP as the dependent variable. The model was as follows;

$$TFP = f(\text{export share}; \text{import share}; CFC; PP; RER; SADC; EU)$$

Where;

TFP – ratio of total production to land area planted

Export share – volume of total exports to production

Import share – volume of total imports to domestic consumption

CFC – ratio of total capital formation to GDP in the agricultural sector

PP – producer price index

RER- real exchange rate

SADC and EU – dummies for the respective trade agreements

Of more importance to this study though was the time series analysis they also did on the dynamic relationship between TFP and trade openness covering the period 1970 to 2005.

They constructed the following model;

$$TFP = f(OPEN; CFC; DEBT)$$

Where;

OPEN - taken as a proxy for the degree of trade openness in South Africa.

DEBT – total financial debt in the agricultural sector relative to its GDP.

The data for the analysis of the relationship between TFP and trade openness was that of time series and hence various tests were duly carried out to make it stationary. The study was evenly balanced, producing an adjusted coefficient of determination of 71% and the results of the study also revealed the following;

- OPEN with a coefficient of (0.034) was significant at the 5% level of significance
- CFC with a coefficient of (0.092) was significant at the 10% level of significance
- DEBT with a coefficient of (-0.328) was significant at the 1% level of significance.

Goldar and Kumari (2003) had also found out that trade liberalisation increases the capital stock (as measured by CFC in the model).

2.0.4 Conclusion

The chapter has looked at the theoretical and empirical evidence on the subject of trade openness and economic growth. Early theories argued that economies could only get

wealthier by selling more than they bought. This was however unsustainable in the long run as it stalked international trade. This opened the up debate as to the role of opening up to trade in economic growth. Numerous studies mentioned in the previous section looked into the issue and basically two broad outcomes, either trade openness spurred economic growth or it did not. For developing economies, the opening up to trade can help stir economic growth to higher levels.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0.0 Introduction

The chapter will dwell on the estimation techniques for the subject at hand, the various ways in which trade openness' effect on economic growth has been measured. We will also explain in detail the variables used in this research and subsequently the econometric framework.

3.0.1 Sachs-Warner Index

The Sachs-Warner measure was developed by Sachs and Warner in 1995 as a dummy variable for measuring trade openness. Though the measure has gradually lost its applicability, it is still a vital guide to measuring trade openness. It was combined into tariff and non-tariff barriers to trade. An economy was deemed to be closed if it exhibited any one of the following;

- i. Average tariff rate of 40% or more
- ii. Non-tariff barriers covering 40% or more of trade
- iii. Black market exchange rate that is depreciated by 20% or more relative to the official exchange rate
- iv. Monopoly on exports by government
- v. Socialist economic system.

The above measure helped this research in giving a guideline as to how trade openness can be measured and subsequently linking it to economic growth.

3.0.2 Model Specification

The variables chosen in this research were found to be directly or indirectly affected by the degree of trade openness. Therefore as we explore the effect of trade liberalisation on economic growth during the period 1990 to 2013, we make use of variables that are a reflection of the extent of trade liberalisation in a country.

The general model in which GDP per capita is taken as the dependent variable is as follows;

$$Y_i = f(B_0 + B_1 TTV_i + B_2 Exp_i + B_3 Imp_i + B_4 TaxRev_i + B_5 AveTar_i + B_6 Fdgi_i + \varepsilon) \quad (\text{Equation 1.0})$$

The empirical model of this research with natural logarithms to be used for the purposes of regression is given below;

$$\ln Y_i = B_0 + B_1 \ln TTV_i + B_2 \ln Exp_i + B_3 \ln Imp_i + B_4 \ln TaxRev_i + B_5 \ln AveTar_i + B_6 \ln Fdgi_i + \varepsilon \quad (\text{Equation 1.1})$$

B_0 is the slope coefficient and ε is the error term

The period of study ranges from 1990 to 2013.

3.0.3 Definition of Variables

i. Gross domestic product per capita (Y_i)

This is the dependent variable of the model and was used as the proxy for economic growth and is measured as a ratio of the real GDP to the total population. The measure has been historically used as a measure of economic growth as it links the total real income generated in a period (usually as calendar year) to the total number of people that stand to benefit from this income.

ii. Total Trade Volume to GDP (TTV_i)

Expected sign of variable - positive

This variable is an aggregate of trade in services and trade in goods. In other words it is the sum of exports and imports as a percentage of real GDP for the i^{th} country. The justification lies in the need to observe the combined effect of exports and imports (which are affected by the degree of trade openness) on economic growth.

iii. Exports of goods and services to GDP (Exp_i)

Expected sign of variable - positive

This is an aggregate value of goods and services which have been sold or rendered beyond the i^{th} country's borders. The unit of measurement is the US dollar. The justification for this measure lies in the output-expenditure Keynesian model; $Y=C+I+G+(X-M)$. The volume of exports in a country is a function of the trade policies in place and therefore changes in exports have an effect on economic growth.

iv. Imports of goods and services to GDP (Imp_i)

Expected sign of variable - positive

This is an aggregate value of all i^{th} country's imports (goods and services) taken as a ratio of GDP.

v. Total Tax Revenue to GDP ($TaxRev_i$)

Expected sign of variable - positive

This variable measures the compulsory remittances to government as stipulated by the statutes of the individual countries whenever goods are imported or exported. The measure however excludes fines and penalties as they tend to distort the actual revenue generated from export and import taxes when measured against target revenues. ($TaxRev_i$ variable is measured as the total tax revenue generated per calendar as a ratio of the GDP of that particular calendar year for each country.

vi. Average tariff ($AveTar_i$)

Expected sign of variable – negative

The average tariff variable is a measure of the simple mean of tariffs employed by individual countries over the period of twenty-four years from 1990 to 2013. This is a more direct measure of direct measure of trade openness.

vii. Foreign Direct Investment to GDP ($Fdgi_i$)

Expected sign of variable – positive

This is a measure of the ratio of the foreign direct investment to GDP. The justification of adding this variable to the model emanates from Sen, (2010) who argued that FDI along with technology remains a conditioning factor for trade flows. Wacziarg (2001) also argued that investment (foreign) is the main channel linking trade and growth. It would then be expected of a more open economy in terms of trade, *ceteris paribus*, to attract more FDI than closed ones. The expected behaviour of this variable would be to positively affect economic growth.

3.0.4 Sources of Data

The data used in this research was derived from the World Bank official website, www.data.worldbank.org/indicator/GC. We made use of panel data for the four countries, Nigeria, South Africa, Zambia and Zimbabwe for the measures of 1990 to 2013.

3.0.5 Diagnostic Tests

We will run several tests on the data to test the applicability of the whole model, relevance of individual variables, as well as the suitability of inclusion of individual variables in the same model. Some of the to be run include multicollinearity, poolability (F-test), Breusch-Pagan Lagrange test as well as the Hausman test. The Hausman test enables us to test between the fixed effects model (FEM) and the random effects model (REM).

Multicollinearity Test

Multicollinearity is the existence of a perfect or exact linear relationship among some or all explanatory variables of a regression model, Gujarati (2004). The test will assist in revealing explanatory variables that might exhibit linear correlation between them. The presence of multicollinearity among explanatory variables will present a challenge of explaining the effects on the dependent variable. The test was econometrically done with the Pearson correlation matrix where a value of at least 0.80 for any two variables will lead to the conclusion that the two variables in question are correlated.

Pooled Ordinary Least Squares

We will run the pooled ordinary least squares (OLS) regression under the assumption that the behaviour of individual variables across the different countries is similar.

Poolability Test

The poolability test will be done to test the most suitable regression model to use between the pooled OLS mentioned above and the Fixed Effects Model (FEM). The test makes use of the F-test and will run under the following hypothesis;

H_0 = there is no heterogeneity across countries

H_1 = there is heterogeneity across countries

Result: We reject H_0 if we conclude that countries differ and hence the behaviour of variables should be taken to be different across countries.

Breusch-Pagan Test

Having compared the pooled OLS model and the FEM we go ahead and compare the pooled OLS model and the Random Effects Model (FEM). The thrust is still to come up with the most suitable model to employ.

Hausman Test

This test tests the most suitable model between the FEM and the REM.

3.0.6 Conclusion

The chapter has given a justification for the inclusion of the mentioned variables as well as an explanation of the methodology to be employed in the research. The World Bank worldwide website provided a bulk of the data for this research.

CHAPTER FOUR

ESTIMATION AND RESULTS

4.0.0 Introduction

The chapter will look at the results of the estimation techniques as well as the econometric findings of the study. The data was subjected to various tests in order to increase the level of confidence in it. The higher the level of confidence in the data the more confident we will be able to derive interpretations and subsequently draw conclusions from the regression results.

4.1.0 Econometric Tests

Multicollinearity Test

We ran the test in order to ascertain the relationship between each pair of explanatory variables of the model. The Pearson correlation matrix which was made use of revealed that TTV_i and Exp_i were correlated as evidenced by a correlation coefficient of 0.862 which is more than the employed limit of 0.80 (*see appendix 1 for the correlation matrix*). The evident multicollinearity between the two variables was corrected for by dropping Exp_i from the model.

Breusch-Pagan Lagrangian Multiplier Test for Random effects

The test results revealed a $chibar(02) = 0$ and a $p\text{-value} = 1.000$ thereby enabling us to conclude that the REM is a more appropriate model than the pooled OLS model. (*See Appendix 2 for the Breusch-Pagan test results*).

Hausman Test

The test pitted the Fixed Effects Model against the Random Effects Model and the results revealed a chi-square measure of $Chi2(5) = 5.25$ and a $p\text{-value} = 0.3856$. We concluded that the random effects model is more preferable to the fixed effects model. (*See appendix 3 for Hausman Test results*).

4.2.0 Estimation of the model

4.2.1 Unrestricted Pooled Ordinary Least Squares Model

The model revealed three significant variables at all three levels of significance, 1%, 5% and 10%. These variables were $TaxRev_i$, $AveTar_i$, $Fdgi_i$.

TTV_i , Exp_i and Imp_i were found to be insignificant at all three levels as well. (See appendix 4). However we have to hasten to point that after dropping the Exp_i variable (owing to its high correlation with TTV_i , the number of significant variables increased from three to four with TTV_i becoming significant at all the three levels of significance. (See appendix 5). This showed how multicollinearity can distort interpretations of variables' behaviour if not corrected for.

4.2.2. Random Effects Model

Having chosen the REM ahead of both the FEM and the pooled OLS models, the study employed the REM and found four out of five variables to be significant in explaining economic growth at all three levels of significance. Only Imp_i was found to be insignificant. An extract of the results is given in Box 1 below;

Table 2: Random Effects Model Regression Results

Random Effects GLS Regression	No. of Observations = 32
Group Variable: Country	Number of Groups = 4
R-sq - within = 0.5741	Observation per group: min = 4
Between = 0.9863	avg = 8.6
Overall = 0.8874	max = 14
corr (u _i , X) = 0 (assumed)	wald chi2 (5) = 204,98
	Prob>Chi2 = 0.0000

Gdpcap	coefficient	Std Error	z	P > z	95% Conf. interval	
Ttv	1.554531	0.551481	2.82	0.005	0.473648	2.635414
Imp	-0.633292	0.5992151	-1.06	0.291	-1.807732	0.541148
Taxrev	0.5734876	0.1834816	3.13	0.002	0.2138703	0.9331049
Avatar	-1.484838	0.1949757	-7.62	0.000	-1.866984	-1.102693
Fdgi	-0.3676916	0.902547	-4.07	0.000	-0.5445876	-0.1907956
constant	5.832891	1.8402091	3.1	0.002	2.226148	9.439634

4.3.0 Discussion of Results

The overall suitability of the model was confirmed by a coefficient of determination of 88.74% thereby giving us an assurance that over 88% of variations in GDP per capita were due to changes in the explanatory variables used in the model. A total of four out of five explanatory variables were found to be significant at all three levels of significance. A detailed discussion of the results for every variable is given in this section and reference can be made to Appendix 6.

Total Trade Volume to GDP (TTV_i)

This variable measuring the total exports and imports value to the gross domestic product was expected to be positively related to the dependent variable and indeed it came out with a positive coefficient of 1.55. A unit change in the TTV to GDP ratio results in a 1.55 unit change in the GDP per capita. Teweldemedhin and Van Schalkwyk (2010) argued that growth in export and import shares stimulates economic production. Goldar and Kumari (2003) gave three channels through which exports (which are part of the TTV variable) can enhance economic performance. They argued that opening up to trade would create externalities through;

- Exposure to the international which in-turn provides incentives for product and process innovation. As the local producers are challenged by the forces of the international market, to ensure survival and maintained relevance, they increase their production scales and efficiencies thereby driving the economy forward.
- Allowing for economies of scale through increased efficiency
- Increased stock of knowledge and human capital accumulation through increased exports.

Imports of goods and services to GDP (Imp_i)

The variable of imports to GDP ratio was found to be insignificant at all levels of significance. The explanation for the insignificance of the variable can be that even after trade liberalisation has been implemented, the purchasing power behind the rise of imports' supply is the most relevant. We might experience an opening up of trade and a greater access to the market for foreign producers but at the core of the expected influx of imports is the actual demand rather than potential demand. The period under study, 1990 to 2013 was characterised by economic structural adjustments for Zambia and Zimbabwe (early to mid 1990s) as well as political independence for South Africa in 1994. These events, if put together will show that economies were not fully geared to demand as much imports as would be expected after trade liberalisation.

Although the structural adjustments had liberalised trade to a greater extent, the South African and Zimbabwean governments implemented differing tariff policies during the period of our study. Since the attaining of their independence in 1994, the South African government had implemented policies to open up their trade but by 2007, according to Edwards et al (2009), the government had imposed quotas on imports of clothing and textiles from China and other Asian countries. As for Zimbabwe, according to Mudzonga (2009), the strides made during the ESAP period were seen to be eroded by the setting up of a tariff commission in 1998 charged with overseeing the imposition of tariffs as a replacement to the non-tariff barriers abolished during 1991 – 1995.

These antagonistic policies with regards to trade openness (tariff policy to be precise) implemented within the 1990 – 2013 period could have rendered imports insignificant in explaining economic growth.

Tax Revenue to GDP ($TaxRev_i$)

The expected sign of this variable was positive and the regression results revealed that a 0.57 unit increase in tax revenue led to a unit increase in economic growth. The variable was significant all three levels of significance. (The justification of this variable in such a model was to give a 'developing country' perspective of tax revenues. It is against a background that

liberalising trade for many African countries can actually lead to balance of trade problems as increases in imports tend to exceed exports.

According to Santos-Paulino and Thirwall (2004), liberalisation of trade tends to enhance imports to a greater extent than exports thereby ushering in balance of trade problems. This finding was also supported by the World Bank (2008) when they found that developing countries had experienced negative trade balances after trade liberalisation. Taking this notion into consideration, developing countries ought to derive some kind of consolation from their skewed trade patterns by generating revenues from the imports. This also directly or indirectly protects the local industry from foreign competition.

Average tariff (*AveTar_i*)

The REM revealed that a unit decline in the average tariff across the board would result in a 1.48 unit increase in economic growth and was significant at all three levels of significance (1%, 5% and 10%). The positive coefficient was in line with the expected negative relationship between tariffs and economic growth. Reduction of tariffs (both import and export) is a vital policy towards liberalisation of trade. A reduction in import tariffs results in a reduction the consumer prices of such imported goods downstream as the tariff component of the consumer price is reduced. This will tend to boost aggregate consumption and ultimately economic growth provided the goods are price-elastic.

Lungu (1997) found out that liberalisation of the textile sector in Zambia had enhanced demand of foreign textiles and clothing owing to the notion that foreign products were of better quality than local ones coupled with the reduction in the consumer prices. Producers who are able to withstand foreign competition increase their efficiency and quality of production which will have the effect of enabling them to access foreign markets thereby boosting exports and ultimately boosting economic growth.

Foreign Direct Investment to GDP (*Fdgi_i*)

The variable was found to be significant at all three levels of significance but the coefficient of 0.368 was negative contrary to the priori expected sign. Although this is against established theory, the negative relationship could be attributed to Gorg and Greenway, (2004) who argued that the spill over of foreign direct investment to domestic firms being theoretical and not practical.

Moyo, D (2009) argued aid and investment sent to Africa had been both an economic and political disaster and had led to rising poverty levels, slower economic growth and incompetent governments in the continent. It is therefore worth noting that foreign direct investment cannot spur economic growth without the recipient government and private sector playing their part. According to Schumpeter, (1954), foreign direct investment spurs growth when combined with transfer of entrepreneurship and efficient human capital thereby enhancing the absorptive capacity. Kofi and Kwabena, (2014) found no relationship between foreign direct investment and economic growth.

4.4.0. Conclusion

The random effects model was chosen ahead of the pooled OLS model and the fixed effects model as shown by the various tests conducted. The results confirmed the hypothesis tested, Total Trade Volume variable was found to be positively related to economic growth whilst average tariff variable exhibited a negative relationship with economic growth. Therefore we accepted the null hypothesis for both Total Trade volume and average tariff. These findings were in line with the literature, economic growth is positively related to total trade volume and total revenue to GDP and is negatively related to imports ratio to GDP and average tariffs.

CHAPTER FIVE

CONCLUSION AND POLICY RECOMMENDATIONS

5.0.0 Introduction

This chapter will dwell on the overall conclusions of the study as well as suggest policy recommendations in the area of trade liberalisation. We will also present the study limitations. Previous studies had different conclusions on the relationship between trade liberalisation and economic growth. This study has attempted to add a voice to the subject and the results of that attempt were outlined in the previous chapter.

5.0.1 Conclusions

The study added a voice to the trade liberalisation and economic growth debate and found that trade liberalisation indeed spurred economic growth. We found that export-biased economies stood better chances of growing their economies as shown by the coefficients of TTV and Imp. It is not surprising that negative terms of trade are theoretically not related to good economic performance.

5.0.2 Policy Recommendations

The study results imply that there is still room for improvement in the pursuance of fully liberalising trade. Tariffs can further be reduced in order to enhance economic growth as our results showed that reducing tariffs by one unit could spur economic growth by 1.48 units. The results for our imports to GDP ratio also reinforced the fact that as much as imports are necessary for any economy to function, there has to be a balance between imports and exports. Export incentives can be introduced in the form of tax holidays for exporting entities, for instance, oil producers in Nigeria, mining and manufacturing players in South Africa as well as agricultural and mining players in Zimbabwe.

We recommend that governments of the SSA region should continue shying away from viewing imports as a source of revenue and start seeing it as an enemy to favourable trade balance. Regarding foreign direct investment, Moyo, (2009) argues that for foreign direct investment to enhance economic growth, it should be combined with international and regional trade, bond markets, increased domestic savings and reduction of remittance costs.

Sub-Saharan governments have to push themselves towards self-sustenance and economic prowess and this can only happen through positive trade balances and creating socio-economic environments that attract productive foreign direct investments. The separation of the economy and socio-politics is difficult and hence we recommend that Sub-Saharan economies should improve their political fields to ensure continuity irrespective of the government of the day. Nigerian religious and ethnic conflicts which are present today (2015) work towards destabilising the country and the continent as well given that it has the second largest economy after South Africa.

It is worth noting that trade policies cannot be stand alone conditions for enhanced economic performance. The growth process is very complex and as such requires all arms of the economy to pull in one direction with one policy augmenting the other. It would be unfortunate to reduce trade tariffs in an economy with very low capacity (with no hope of improvement) utilisation as this poses the danger of becoming a ‘supermarket’ economy.

We further recommend government policies that are biased towards technological improvements as technology is one of the reasons why there is an ever widening gap between the developed and developing countries, employment of obsolete technologies by developing countries in production lines poses a threat to the very survival of those industries in this twenty-first century and beyond.

5.0.3 Study Limitations

The study revealed how trade openness affects economic growth four of Sub-Saharan economies. Data limitations did not enable us to add to the study as many other economies in the region as possible. The conclusions we made about the region basing on the data we regressed may not apply for many other economies in the region.

The complexity of the economic growth process itself poses a limitation in terms of causality (i.e.) economic growth is affected by many other economic and non-economic variables that may not necessarily be linked to the subject under investigation (trade openness).

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APPENDICES

Appendix 1. Correlation matrix

```
. xtset country year
      panel variable:  country (strongly balanced)
      time variable:  year, 1990 to 2013
                delta: 1 unit

. correlate ttv exp imp taxrev avetar fdig
(obs=32)
```

	ttv	exp	imp	taxrev	avetar	fdigsniping
ttv	1.0000					
exp	0.8620	1.0000				
imp	0.3966	0.3251	1.0000			
taxrev	-0.4071	-0.5126	0.2728	1.0000		
avetar	0.1525	0.3566	0.4364	-0.1964	1.0000	
fdig	0.2858	0.3067	0.2586	-0.4203	0.1169	1.0000

Appendix 2. Breusch-Pagan Test results

```
. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

gdpcap[country,t] = Xb + u[country] + e[country,t]

Estimated results:
      |          Var          sd = sqrt(Var)
-----+-----
gdpcap | 1.056287          1.027758
e      | .0754308          .2746467
u      | 0                  0

Test:  Var(u) = 0
              chibar2(01) = 0.00
              Prob > chibar2 = 1.0000
```


Appendix 3. Hausman Test results

```
. hausman fel rel
```

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fel	rel	Difference	S.E.
ttv	2.005571	1.554531	.4510397	.
imp	-.3213402	-.633292	.3119519	.
taxrev	.1515458	.5734876	-.4219418	.2129469
avetar	-.5324344	-1.484838	.9524039	.2045975
fdig	-.2122771	-.3676916	.1554145	.

b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)' [(V_b-V_B)^(-1)] (b-B)
 = 5.25
 Prob>chi2 = 0.3856
 (V_b-V_B is not positive definite)

Appendix 4. Unrestricted Pooled Ordinary Least Squares Model results

```
. xi:xtreg gdpcap ttv exp imp taxrev avetar fdig
```

Random-effects GLS regression Number of obs = 32
 Group variable: country Number of groups = 4

R-sq: within = 0.5751 Obs per group: min = 4
 between = 0.9878 avg = 8.0
 overall = 0.8887 max = 14

Wald chi2(6) = 199.72
 Prob > chi2 = 0.0000

corr(u_i, X) = 0 (assumed)

gdpcap	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
ttv	1.160268	.9165802	1.27	0.206	-.6361966	2.956732
exp	.5007285	.9224233	0.54	0.587	-1.307188	2.308645
imp	-.5993649	.6107185	-0.98	0.326	-1.796351	.5976212
taxrev	.5873892	.1877766	3.13	0.002	.2193539	.9554246
avetar	-1.531558	.2155983	-7.10	0.000	-1.954122	-1.108993
fdig	-.3698914	.0915941	-4.04	0.000	-.5494126	-.1903703
_cons	5.648817	1.896254	2.98	0.003	1.932227	9.365407

sigma_u | 0
 sigma_e | .2797768
 rho | 0 (fraction of variance due to u_i)

Appendix 5. Restricted Pooled Ordinary Least Squares Model results

```

. xtreg gdpcap ttv imp taxrev avetar fdig

Random-effects GLS regression           Number of obs   =       32
Group variable: country                 Number of groups =        4

R-sq:  within = 0.5741                   Obs per group:  min =        4
        between = 0.9863                                     avg =       8.0
        overall = 0.8874                                     max =       14

Wald chi2(5) = 204.98
corr(u_i, X) = 0 (assumed)              Prob > chi2     = 0.0000

-----+-----
      gdpcap |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      ttv |    1.554531   .551481     2.82   0.005     .473648   2.635414
      imp |   -.633292   .5992151    -1.06   0.291    -1.807732   .541148
  taxrev |    .5734876   .1834816     3.13   0.002     .2138703   .9331049
  avetar |   -1.484838   .1949757    -7.62   0.000    -1.866984  -1.102693
      fdig |   -.3676916   .0902547    -4.07   0.000    -1.5445876  -.1907956
      _cons |    5.832891   1.840209     3.17   0.002     2.226148   9.439634
-----+-----
      sigma_u |           0
      sigma_e |    .27464671
      rho |           0   (fraction of variance due to u_i)
-----+-----

. estimates store pool1

```

Appendix 6. Random Effects Model results

```

. xtreg gdpcap ttv imp taxrev avetar fdig, re

Random-effects GLS regression           Number of obs   =       32
Group variable: country                 Number of groups =        4

R-sq:  within = 0.5741                   Obs per group:  min =        4
        between = 0.9863                                     avg =       8.0
        overall = 0.8874                                     max =       14

Wald chi2(5) = 204.98
corr(u_i, X) = 0 (assumed)              Prob > chi2     = 0.0000

-----+-----
      gdpcap |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
      ttv |    1.554531   .551481     2.82   0.005     .473648   2.635414
      imp |   -.633292   .5992151    -1.06   0.291    -1.807732   .541148
  taxrev |    .5734876   .1834816     3.13   0.002     .2138703   .9331049
  avetar |   -1.484838   .1949757    -7.62   0.000    -1.866984  -1.102693
      fdig |   -.3676916   .0902547    -4.07   0.000    -1.5445876  -.1907956
      _cons |    5.832891   1.840209     3.17   0.002     2.226148   9.439634
-----+-----
      sigma_u |           0
      sigma_e |    .27464671
      rho |           0   (fraction of variance due to u_i)
-----+-----

```