ADDIS ABABA UNIVERSITY
SCHOOL OF ECONOMICS

TRADE POLICY AND ECONOMIC GROWTH IN SUB SAHARAN AFRICA: A PANEL DATA APPROACH

By
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Approved by: **Signature**

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Table of Contents

List of Annex

Page

List of Tables Page

ACRONYMS

EC2SLS	Error Component Two-Stage least squares
GATS	General Agreement on Trade in Services
GDP	Gross Domestic Product
GLS	Generalized Least Squares
IMF	International Monetary Fund
LDC	Least Developed Countries
OLS	Ordinary Least Squares
R&D	Research and Development
SSA	Sub-Saharan Africa
UN	United Nations
USD	United States Dollar
WDI	World Development Indicators
WTO	World Trade Organization
PTW	Pen World Table
UNCTAD	United Nation Conference on Trade and Development

Abstract

Despite a number of multi-country case studies utilizing comparable analytical frameworks, numerous econometric studies using large cross-country data sets, and important theoretical advances in growth theory, there is still disagreement among economists concerning how a country's international economic policies and its rate of economic growth interact. The central objective of this paper is to empirically assess the link between trade policy and economic growth in Sub Saharan Africa countries. Apart from reviewing different literatures, this study also provides empirical evidence on the relationship between economic growth and trade policies. In doing so, the study uses a panel data covering 47 Sub Saharan Africa countries over the periods 2000 – 2008. The estimation support claims that openness to international trade stimulates both economic growth and investment. Besides, trade policies such as average weighted tariff rate and real effective exchange rate have both direct and indirect impacts on economic growth.

Chapter One

1. Introduction

1.1 Statement of the problem

Do trade policies inhibit or promote economic growth? The idea that open trade policies help the poor countries is often disputed. Traditionally economists have been argued that more open economies grew quickly. However, according to Lopez (2005), neither the existing theoretical models nor the previous empirical analysis seem to have produced a definite and positive answer to this inquiry.

Multilateral institutions such as IMF and World Bank have provided a pessimistic answer to the question, as cited in Rodrik and Rodriguez (2000). The reason for the strong bias in favour of trade openness is partly based on the conclusion of wide range of empirical studies, which claimed that outward oriented economies consistently have higher growth rate than economies with high level of restrictions.

For instance, as cited in Rodrik and Rodriguez (2000), Kruger (1998) and Stiglitz (1998) judges that countries that follow more open and "outward oriented" trade strategies exhibit empirically superior growth performance than countries with more closed and "inward oriented" policies. Oskam et al (2004) have identified three open trade policies argument: (i) open international trade transfers international prices to domestic markets of LDCs by _getting the prices right_ and promoting market competition, which leads to efficient resource allocation; (ii) trade serves as a vehicle for transfer of knowledge, technology, capital and other physical inputs, which facilitate convergence of poor and developed economies; and (iii) Open international trade disciplines governments of LDCs to pay attention to international market prices, which may have an

indirect positive effect for good governance of LDCs. Kruger and Berg (2003) suggested that if poor countries opened more, poverty would fall.

Popularizing this view, Wacziarg and Welch (2003) argued that over the period 1950-1998, countries that have liberalized their trade regimes have experienced, on average, increase on annual growth rates by 1.5% compared to pre-liberalized times. In the neo-classical analysis of openness and growth, trade can increase the rate of technological progress, hence productivity growth, either through expansion for market for output or the market for input (Dowrick and Golley, 2004). They further explained output expansion drives growth by allowing domestic producers to exploit economies of scale and economies of specialization. While, expansion for input market drives growth by allowing domestic producers to get access for wide variety of capital goods, which effectively enlarge the base of productive knowledge. Ann Harrison (1994) finds that greater openness is associated with higher growth.

As cited in Dowrick and Golley (2004), the study of World Bank (2002) showed that the more globalized developing countries have increased their per capita growth rate from 1% in the 1960s to 3% in the 1970s, and 4% in the 1980s to 5% in the 1990s. The World Bank qualifies the benefit of trade openness, noting that the more globalized group has been able to break into global markets for manufactured and services, rather than relying on primary commodities. In line with this view, Kruger (1986) argued that as a consequence of trade liberalization and other economic policy reforms, economic growth has accelerated in most of the developing world, with the most rapid growth in the countries whose reforms have gone furthest. The world economy as a whole has experienced very high growth rates over the past five years, and that has certainly

enabled developing countries to grow more rapidly. But the most rapid growth has generally been in countries whose reforms have been most pronounced, or which were already outer-oriented.

According to David and Loewy (1998) the more open an economy, the greater the competitive pressures on it, and the greater the need for it to incorporate foreign knowledge into its production processes to be able to compete with foreign firms. This provides the basis for the assumption that outward oriented policies facilitate the diffusion of knowledge and spur the growth process.

However, studies by Yanikayya (2003) showed that even though there is a positive and strong association between trade openness and growth, estimation result from trade barriers contradict the conventional view on the growth effect of trade restrictions, which suggests an adverse association between trade barriers and growth. For him, there is a positive and significant relationship between trade barriers and economic growth.

Oskam et al (2004) have identified four unfavourable arguments of open trade policies: (i) inadequate institutions, governance and infrastructure hamper (or even reverse) the positive effects of outward oriented policies; (ii) infant industry argument - the development of non-agricultural sectors in the growth process of poor countries or LFAs is crucial, not only to increase national or local income but also to absorb the migrating rural labour force, whereby it contributes in poverty alleviation; (iii) Trade driven development paths increase relative income differences and make LDCs even less competitive- countries with relative open trade policies make clear that a trade driven development path is insufficient to develop LDCs, even in situations where

infrastructure and institutions are functioning rather well; and (iv) trade exposes LDCs to external (price) shocks and growth path instability. Lopez and Thirlwall (2008) have found that in the aftermath of trade liberalisation, growth performance did improve in the majority of countries under study, but at the expense of trade balance deterioration.

Studies of Moore (1990) on Central America revealed that in the absence of redistribution of the return from land and capital, the impact of trade liberalization is to increase the inequality of distribution of income, and thereby an increase in the incidence of poverty. Chang (2009) in his article, *Economic History of the Developed World: Lessons for Africa*, pointed out that in terms of trade policy, with few exceptions such as Switzerland and the Netherlands, all of today's rich countries used protectionism. He believed that the success of developed countries is partly because of the adoption of infant industry protection argument. He further explained that DCs advocacy of free trade policy is an act equivalent to "kicking away the ladder", with which it climbed up to the top.

For Birdsall and Hamoudi (2002) "openness" or "closedness" is orthogonal to the problem of poor, slowing growth, commodity producing countries. Rather, they emphasised that commodity trap, which may also become poverty trap, is a significant explanatory variable for the slow economic growth of poor nations. Rodrik (2006) stated that not only the "Washington Consensus", which aimed at trade liberalization, among other things, registered very few successes in Sub Saharan, but the reform proved ill-suited to deal with the growing public health emergency in which the continent become embroiled.

According to the study of Rodrik and Rodriguez (2000) the nature of the relationship between trade policy and economic growth remains very much an open question. The issue is far from having been settled on empirical grounds. In fact they are skeptical that there is a general, unambiguous relationship between trade openness and growth. They suspect that the relationship is a contingent one, dependent on a host of country and external characteristics. In line with this view, Rodrik (1997) has argued that there are clear limitations to what trade policy, or outward orientation, can accomplish. For him growth depends primarily on investment on human resources, infrastructure, and institutions of macroeconomic management, which it takes time to achieve. Opening an economy to international trade is not a quick fix that can substitute these harder tasks. Rather, excessive emphasis on trade liberalization can backfire if it diverts the scarce energies and political resource of government leaders from the growth fundamentals.

Albeit, the issue of trade policy for developing countries is an old one, each period demands new answer to fit new circumstances and reflect new experience (Bliss, 1989). Different scholars have different views on the relationship between trade policy and growth. Some of them are sceptical (such as Rodrik and Rodriguez, 2000) about openness promote economic growth. While others (such as Frankel and Romer, 1999) argued that outward policies are the means for achieving faster economic growth. Hence, the purpose of this study is to empirically assess how trade policies influence economic growth within the context of Sub-Saharan Africa countries.

1.2 Objective of the Study

1.2.1 General Objective

The general objective of this study is to empirically assess the link between trade policy and economic growth in Sub Saharan Africa countries.

1.2.1 Specific Objectives

In accordance with this general objective, the study will have the following specific objectives:

- To present a review of theoretical and empirical literature with the aim of understanding what the existing literature says about the relationship between trade policies and economic growth;
- To examine the link between institution, trade and economic growth.
- To empirically study whether restrictive trade policies have slow down economic growth in Sub-Saharan Africa; and
- To suggest policy directions based on the finding of the study.

1.3 Research Questions, Hypothesis, Methods of Analysis and Data

1.3.1 Research Questions

To accomplish the stated objectives, this study attempted to answer the following research questions:

- What the existing literature says about the relationship between trade policies and economic growth?
- How are trade policies and economic growth related in the context of Sub Saharan Countries?

1.3.2 Hypothesis of the Study

The working hypothesis of this study is that trade policies have direct impact on productivity growth and it has indirect impacts that operate through investment. In the neo classical analysis of welfare gains through exploitation of comparative advantage, a reduction on trade barriers increase trade and the level of productivity. GDP rises through the reallocation of resources and capital accumulation. In the models of endogenous technological change, open trade policies can increase the rate of technological progress, hence productivity growth, either through expansion of the market for output or through expansion of the market for input.

1.3.3 Method of Analysis

As methods of analyses, the paper attempts to explain theoretically and assess empirically the impact of trade policy on economic growth. Theoretically, the entire chapter two is used to review the existing empirical and theoretical literature about the relationship between trade policies and economic growth to meet some of the objectives stated in 1.2. Empirically, the entire chapter three used econometric techniques to meet the remainder objectives. As an econometric technique, the paper employed generalised least square (GLS) estimation technique on a balanced panel data gathered for the period 2000 – 2008 to see how trade policies affect economic growth of the region.

1.3.4 Data

First of all, the data on trade policy in SSA is a sorry state. According to Yeats (1997) data on trade in Africa is patchy and trade policy is in general is tremendously difficult to measure. However, this study attempted to capture the effect of trade policy by using weighted mean average tariff rate and real effective exchange rate, where relatively consistent information is obtained. This study utilized a balanced panel data gathered

from trustworthy web sites that collect information on trade related issues such UN, World Bank, WDI, PWT, etc.

1.4 Delimitation of the Study

Basically, this study examines the relationship between trade policies and economic growth. The study makes use of the two prominent trade restriction indices, simple trade-weighted average tariff and real effective exchange rate. Hence, inferences about the relationship between growth and other forms of trade policies are not to be implied from the conclusions of this study. Moreover, the empirical part of this study focuses solely on Sub-Saharan Africa region during the period 2000-2008. Hence, any definitive conclusion about other trade policies or time periods may not be made based on the results of this study.

1.5 Significance of the study

The number of studies that analysed the effect of trade policy on economic growth in Sub Saharan Africa is limited. For instance, studies by Wacziarg (1998) used a panel made up of five-year averages for 57 countries during 1970-89. However, according to Rodrik and Rodriguez (2000) it would be interesting to see if the results hold up with constructed over a decade or more. Hence, this study used a time period of 9 years, which helps to obtain a robust result. Besides, this study will provide current and updated information on the relationship between trade policy and economic growth. Since the major objective of the study is to analyse how trade policies affect economic growth, it provides veritable tools for trade policy analysis. Moreover, this study will serve as a benchmark for further studies.

1.6 Organization of the Study

The rest of the paper is organized as follows. Chapter two discuses both theoretical and empirical review of literature on the relationship between trade policies and economic growth. Chapter three analyse the data collected from different sources using econometric techniques. Finally, chapter four will provide conclusion and state the policy recommendations of the study.

Chapter Two

2. Review of related literature

What is the relationship between trade restrictions and economic growth in a small economy such as Sub Saharan Africa that takes world price as given? Empirical evidence in this field often produces conflicting results. Some studies showed that countries that have open trade policies have registered an improvement in real GDP. While, other studies have found little evidence on the relationship between open trade policies and economic growth. This section tries to address both the theoretical and empirical literature on the linkage between trade policies and economic growth.

2.1 Theoretical Literature

2.1.1 The link between trade policies and economic growth

Rodrik and Rodriguez (2000) have summarized the modern theory of trade policy as it applies to small country in three prepositions:

> *"First, in static models with no market imperfections and other pre-existing distortions, the effect of a trade restriction is to reduce the level of real GDP at world prices. In the presence of market failures such as externalities, trade restrictions may increase real GDP (although they are hardly ever the first-best means of doing so). Second, in standard models with exogenous technological change and diminishing returns to reproducible factors of production (e.g., the neo-classical model of growth), a trade restriction has no effect on the long-run (steady-state) rate of growth of output. This is true regardless of the existence of market imperfections. However, there may be growth effects during the transition to the steady state. (These transitional effects could be positive or negative*

depending on how the long-run level of output is affected by the trade restriction). Third, in models of endogenous growth generated by non-diminishing returns to reproducible factors of production or by learning-by-doing and other forms of endogenous technological change, the presumption is that lower trade restrictions boost output growth in the world economy as a whole. But a subset of countries may experience diminished growth depending on their initial factor endowments and levels of technological development." (Rodrik and Rodriguez, 2000; 8)

In line with the above statement Baldwin (2003) stated that under the traditional comparative-statics framework, either in the absence or presence of economic distortions, changes in trade policy lead only to one-time changes in levels of production, although in the real world of economic frictions one might expect to observe the shift to new equilibria take place only over a number of years. Similarly, trade-policy changes in the standard neo-classical model of exogenous growth bring about changes in the pattern of product specialization but not in the steady-state rate of growth. Matteis (2004) argued that open trade policies support competition and, therefore, enhance resource optimization, with consequent reduction of production costs. It also helps to raise productivity, with further reductions of costs and increase access to foreign capital. As a result, it accelerates growth.

Whether trade policies promote innovation in a small economy or not depends upon whether the force of comparative advantage push the economy's resources in the direction of activities that generate long-run growth via externalities in R&D, expanding product variety, upgrading product quality, and so on or divert them from such activities (Rodrik and Rodriguez, 2000).

According to Krueger (1980) countries adopting an export-oriented trade strategy have generally experienced rapid growth of traditional exports, but even more rapid growth of non traditional exports. Experience has been that growth performance has been more satisfactory under export promotion strategies (meant as a general bias toward exports and not as a package of specific measures to encourage selective exports of particular items themselves induced by a bias toward import substitution) than under import-substitution strategies. He further explains why outward oriented policies enhance economic growth as compared to inward trade policies by raising the issue market size. Domestic markets are extremely small in most developing countries, and attempts to replace imports result in the construction of plants of less-than-efficient minimum size, while simultaneously generating an oligopolistic or monopolistic market structure. As import substitution proceeds, new activities are increasingly capital intensive and inefficiencies from below minimum- efficient size increase. While export promotion permits entrepreneurs to base their plans on whatever size plant seems appropriate: size of domestic market is no longer a virtually binding constraint. Moreover, given the vast disparity in capital-labour ratios of the industrial sectors of the developed and developing countries, the opportunity for trade represents a means for shifting the demand for labour outward more rapidly than the import-substitution strategy permits.

Grossman and Helpman (1990) argued that knowledge is a public good. It is both non-rival and non-excludable. This is because, the same idea can be used in different applications and in different locations at the same time and the origination of an idea may have difficulty extracting compensation from all agents that make use of it. Hence, spillover benefit can be created in the process of innovations, where country can exploit

this benefit by opening up their economies to international trade. This statement may lead to a hypothesis that international trade in tangible commodities facilitate the exchange of intangible ideas. Popularizing this view Harrison (1994) pointed out that openness to trade provides access to imported inputs, which embody new technology; increase the effective size of the market facing producers, which raise the returns to innovation; and affect a country's specialization in research intensive production. However, in the presence of intellectual property right, the hypothesis does not hold water. For instance, at the global level, one of the most important international public law governing intellectual property rights is the 1995 Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) administered by the World Trade Organization (WTO). TRIPS reflect the interest of the intellectual property owners. TRIPS extends patent rights for 20 years, requires developing countries to offer patent protection for pharmaceuticals, sharply circumscribes the conditions under which states may issue compulsory licenses, and reduces states_ autonomy in crafting domestic intellectual property policies that suit their diverse levels of innovation and economic development (Sell, 2007).

When foreign inputs are important for production, any trade policy that restricts their availability hurts the economy. However, even a small government distortion in international transactions is shown in the neo classical model to substantially lower the productivity of capital and thus the growth rate over a long period. Also, the open-economy model, which permits foreign inputs in the neoclassical production function, gives some interesting results not found in a closed-economy model. Trade distortions caused by tariffs and exchange controls lower the long-run growth rates more significantly in a country that needs to import more under a free trade regime. This

implies that trade distortions have more serious repercussions for growth in small, resource-scarce countries than in large, resource-abundant ones (Lee, 1993).

As far as externalities are concerned, the existence of positive spillovers in the production process, driving a wedge between private and social marginal costs, can also be welfare-improving. Externalities of relevance are those linked to 1) the accumulation of physical capital, 2) the accumulation of human capital, i.e. the improvement of skills (education of workers, engineers; on the job training; learning by doing) and 3) 'knowledge production' (to learn how to imitate (use a blueprint); to adapt technology to one's own needs; to innovate (create new technology). (Nowak-Lehmann (2000)) If there are positive externalities between firms or sectors of the economy, other firms or other sectors will profit from their existence. However, the incentive to produce knowledge will be too low, since market prices do not (fully) reflect the input of the innovators' physical and human capital and their knowledge. The issue in trade policy is in how far it might be justified to subsidize innovative sectors or supposedly innovative sectors (pick winners) and therefore enhance spillovers in the economy. The existence of spillovers in production is able to lead to an increase in the long-run rate of growth. One will notice that all these factors also impact positively on technical progress.

According to dynamic trade theory the static gains from trade - due to specialization and reallocation of *existing* resources - are small compared to the dynamic gains due to an increase in the growth rate and the volume of additional resources made available to, or employed by, the trading country (Kreinin, 1998; cited in Nowak-Lehmann (2000). Dynamic gains are caused by an accelerated accumulation of physical capital and human

capital (perhaps due to a higher rate of domestic and/or foreign saving), enhanced technological transmissions and improvements in the quality of macroeconomic policy.

However, according to Lall (2000) technology cannot simply be transferred to a developing country like a physical product: its effective implantation has to include important elements of capability building: simply providing equipment and operating instructions, patents, designs or blueprints does not ensure that the technology will be effectively utilised. There are strong tacit elements in the technology that require effort and entail uncertainty.

Many opponents of trade openness argued that open trade policies could be detrimental to countries which are lagged in technological development and have an initial comparative advantage in non-dynamic sectors. According to Rodrik and Rodriguez (2000) there is determinate theoretical link between trade protection policies and growth once real world phenomena such as learning, technological change, and market imperfection are taken into account.

As more and more countries acquired their independence from their colonial powers after the end of WWII, the wide spread view to develop was industrialization by pursuing import-substitution policies. There seemed to have a number of sound reasons for such strategy at that time. The leaders of the independent nations were aware that their colonizers had higher per capita income and are more industrialized. Besides, their rulers were taking anti-industrialization actions to keep the colonized nations underdeveloped (Baldwin, 2003). Hence, to these new leaders the issue of industrialization seems to be top agenda. An economically sensible way of achieving industrialization seemed to be to restrict imports of manufactured goods for which

there already was a domestic demand in order both to shift this demand toward domestic producers and permit the use of the country's primary-product export earnings to import the capital goods needed for industrialization.

In addition, the impressive degree of industrialization achieved by the Soviet Union in the 1920s and 1930s and by China after 1949 by pursuing inward-looking policies was additional historical examples that impressed the leaders of the newly independent nations. (ibid)

The infant industry argument maintains that during the temporary period when domestic unit costs in an industry are above import commodity price, domestic firms cannot be competitive internationally. This may due to a host of reasons including the lack of both internal and external economies of scale, inexperienced workers or limited finance. Therefore, protection policies are socially desirable methods until local firms withstand foreign competition. When domestic firms get "matured", the protection is no longer needed and can be removed.

Alemayehu (2009) has identified three arguments that are usually provided to justify the infant industry argument and its alleged short-term loses but long-term potential. First, with imports the domestic industry may be unable to exploit economies of scale and industries are characterized by learning by doing. Second, the existence of externalities which take the form of externalities in the labour training, externalities related to exploitation of economies of scale and externalities related to reputation and similar business good will can be considered as another argument in favour of protection. Finally, no one knows which industry will maintain its comparative

advantage, say after twenty from now. Hence, societies needs to protect those invested in the wrong skill or location by guaranteeing that their industries will not be allowed to fail.

However, protection can be a dangerous tool. Apart from the cost it imposes on consumers, it dilutes the incentive to invest in capability development, the very process it is meant to foster. Firms are very sensitive to competitive pressures in deciding to invest in capabilities, and the protection offered in typical import-substituting regimes tended to detract from costly and lengthy investments in competitive skills and knowledge (Lall, 2000). There may be many solutions: offer limited protection; impose performance requirements; or enforce early entry into export markets while maintaining domestic protection. The last has the added advantage that it taps the information externalities of export activity, and was the one used by the larger Asian NIEs.

One can understand from the theoretical framework that the theoretical prediction about the link between trade policy and growth are ambiguous. A potential source for the presence of an unambiguous relationship between trade barriers and growth is highlighted by a variety of theoretical models that suggest that the relationship between trade barriers and growth may be contingent on the level of development. For example, Lucas's (1988), as cited in De Jong and Ripoll (2006), skill-acquisition model of endogenous growth suggests that by allowing countries to establish a comparative advantage in the production of high-learning goods, the erection of trade barriers during early stages of development may enhance their long-term growth prospects. Young's (1991) learning-by-doing model carries similar implications. He shows that the growth

rate of a less-developed country may decrease in going from autarky to free trade, because comparative advantage induces these countries to specialize in goods in which the learning externality has already ceased.

In addition to the above ambiguity, there are debates on the benefit of trade to a small economy. Afonso (2001), as cited in (Addis, 2010), reviewed as follows:

> *Myrdal (1956 and 1957) stated that the international trade had some positive effect on the LDCs, but in the long run the negative effect remained because it encouraged a production of primary good subject to irregular prices and demand. Emmnauel (1969) decided on the existence of unequal trade bias against on the LDCs. Lewis (1954 and 1969) decided on the deterioration of trade terms of the LDCs. In the short run, the opening of international trade was remained with the demand of DCs markets and their technologies. Whereas, the LDCs due to their market size and sophistication, the weak capacity for technological innovation and the commercial intervention the LDCs would be in a disadvantage situations.*

Considering the ambiguities in the theoretical literature, a number of empirical studies were undertaken to examine the relationship between trade policy and economic growth. The empirical findings of many authors suggest that it is impossible to sign the effect of trade policy on growth unambiguously based on the theoretical consideration alone. Hence, the impact of either open or closed trade policy on economic growth remains to be a matter of empirical testing. The forthcoming section reviews the empirical evidence on the relationship between trade policy and economic growth.

2.2 Empirical Evidence

The manner in which the international economic policies of governments affect the rates of growth of their economies has long been a subject of controversy. This situation still continues today. Despite a number of multi-country case studies utilizing comparable analytical frameworks, numerous econometric studies using large cross-country data sets, and important theoretical advances concerning how a country's international economic policies and its rate of economic growth interact were used, there is still disagreement among economists concerning the nature of the relationship.

According Rodrik and Rodriguez (2000) there are several reasons for this. A key one is the difference among investigators in the manner they define the issue being studied. Some authors focus on whether there is a causal relationship between such index of real exchange rate distortion and index of real exchange rate variability with growth (Dollar, 1992). Differences in the quality and detail of the data being analyzed are another source of disagreement among economists on the subject. Those who study trade and growth relationships among developing countries are greatly hampered by the lack of good data even on such matters as levels of import protection, and they often are forced to undertake case studies (Edward, 1998). While many insights have been revealed from such studies about the nature of the development process and its relationship with trade, some are reluctant to draw broad generalizations from them because of their specificity and the bias that the personal viewpoints of the authors may introduce into the analyses. In contrast, while econometric analyses based on quantitative data concerning trade and growth for a cross section of countries do permit broad generalizations; these studies are limited by the scope and comparability of available

quantitative data. Differences in what investigators regard as appropriate econometric models and tests for sensitivity of the results to alternative specifications that may be based in part on the personal policy predilections of the authors can also result in significant differences in the conclusions reached under such quantitative approaches.

Frankel and Romer (1999) attempted to identify whether trade cause growth or not by using a cross-sectional analysis. One of the difficulties to link the issue of trade with growth is the problem of endogeneity. They seem to solve the problem by taking geographic factors as an instrument variable for trade and income. This is because some countries trade because they are near well-populated countries and others trade less because they are isolated. Geographic factors are not a consequence of income or government policy, and there is no likely channel through which they affect income. In their finding, trade raises income. The relation between the geographic component of trade and income suggest that a rise in one percent point in the ratio of trade to GDP increases income per person by at least one half-percent.

However according to Rodrik and Rodriguez (2000) the work of Frankel and Romer (1999) is concerned with the relationship between incomes and the volumes of trade, and does not have immediate implication for trade policy. The reason is that the implications of geography-induced differences in trade, on the one hand, and policy-induced variations in trade, on the other, can be in principle quite different. Selective trade policies work as much by altering the structure of trade as they do by reducing the volume of trade. To the extent that policy is targeted on market failures, trade restrictions can augment incomes (or growth rates) even when indiscriminate barriers in the form of geographical constraints would be harmful. Of course, to the extent that

selective trade policies are subject to rent-seeking, it is also possible that geography-induced variations in trade underestimate the real costs of trade restrictions. Ultimately, whether on balance trade policies are used towards benign ends or malign ends is an empirical question, on which the Frankel-Romer paper is silent.

Another most influential paper on the relationship between trade policy and economic growth is the work of Sachs and Warner (1995). These authors construct a binary index of openness that combines information about several aspects of trade policy. The Sachs-Warner openness indicator is a zero-one dummy. According to them define an economy as 'closed' if any one of the following five criterion are satisfied: (i) an average tariff rate higher than 40 percent, (ii) nontariff barriers covered on average more than 40 percent, (iii) it had socialist economic system, (iv) it had a state monopoly of major export, and (v) its black market premium exceeded 20 percent. The Sachs-Warner dummy has a high and robust coefficient when inserted in growth regressions. The point estimate of its effect on growth (in the original benchmark specification) is 2.44 percentage points indicating economies that pass all five requirements experience on average economic growth two and a half percentage points higher than those that do not. However, Rodrik and Rodriguez (2000) believes that the robust statistical power of Sachs-Warner indicator derives from state monopoly and black market premium, not from the direct indicator of trade policy such as tariff and non-tariff trade barriers.

Edward (1997) used a new comparative data set for 93 countries to analyze the robustness of the relationship between openness and Total Factor Productivity (TFP). He used nine indexes of trade policy to investigate whether the evidence supports the view that, other things remained constant, TFP growth is faster in more open economies

than closed ones. The nine indicators of openness he uses are: (i) the Sachs-Warner openness index; (ii) the World Bank's subjective classification of trade strategies in *World Development Report 1987*; (iii) Edward Leamer's openness index, built on the basis of the average residuals from regressions of trade flows; (iv) the average black market premium; (v) the average import tariffs from UNCTAD; (vi) the average coverage of non-tariff barriers; (vii) the subjective Heritage Foundation index of Distortions in International Trade; (viii) the ratio of total revenues on trade taxes (exports + imports) to total trade; and (ix) Holger Wolf's regression-based index of import distortions for 1985. However, Rodrik and Rodriguez (2000) criticized Edward's work on the basis of the ground that the robustness of the regression results is largely an artificial weighting and identification assumptions that seem to be inappropriate. Of the 19 different specifications reported in Edwards (1998), only 3 produce results that are statistically significant at conventional levels once they qualify these assumptions. Furthermore, the specifications that pass econometric scrutiny are based on data that suffer from serious anomalies and subjectivity bias.

Another impressive work on the existing literature with regard to trade policy and economic growth is the work of Ben-David (1996). He attempted to investigate the effect of trade policy on income by asking whether trade liberalization leads to income convergence among the liberalizing countries. The expectation that trade liberalization might lead to income convergence is based on the theory of factor price equalization (FPE). According to this theory, under certain conditions[1], allowing free trade in goods result in equalization of factor prices. Hence, the policy implication of Ben-David is that removing trade barriers will enhance convergence among trading partners. However,

[1] This condition includes equal number of goods and factors, identical technology and absence of transport cost, among other things. (Rodrik and Rodriguez, 2000)

studies of Rodrik and Rodriguez (2000) showed that there is no systematic link between trade liberalization and convergence. In fact, they reports that much of the evidence suggests trade liberalization diverges incomes among liberalizers.

The paper by Lee (1993) attempts to answer how international trade and trade policy are linked to long run growth rate and to what extent can differences in trade policy explain cross country variations in the long run in the framework of a neoclassical model of an open economy. He used two indicators of trade policy: an imported-weighted tariff average and the black market premium. The result of his finding shows that trade policy generates cross-country divergences in growth rates of per capita income. In a neoclassical model of an open economy in which domestic production requires domestic and imported inputs, trade distortions caused by government policies of tariffs and exchange controls lower growth rates significantly over a long transitional period because they impede the supplies of imported inputs, thereby decreasing the productivity of capital accumulation. However, the Rodrik and Rodriguez (2000) checked the existence of reverse causality[2] and they found out that reverse causality indeed occur over the subsequent period 1980-94.

On the one hand, studies by Wacziarg and Welch (2008) by using a new data set of on openness indicators and economic growth shows that openness promotes economic growth. Analysis based on the new data set suggests that over the 1950–98 period, countries that liberalized their trade regimes experienced average annual growth rates that were about 1.5 percentage points higher than before liberalization. Post liberalization investment rates rose 1.5–2.0 percentage points, confirming past findings

[2] Countries that perform well tend to liberalize their trade regime eventually.

that liberalization foster growth in part through its effect on physical capital accumulation. Liberalization raised the average trade to GDP ratio by roughly 5 percentage points, suggesting that trade policy liberalization did indeed raise the actual level of openness of liberalizers.

On the other hand, the paper by Ackah and Morrissey (2006) investigates the relationship between trade policy and growth using a dynamic panel regression model with GMM estimates for data on 44 developing countries over 1980-1999. Trade policy is captured by measures of tariffs, import and export taxes. Hence, the average effects of changes in such policy variables have been investigated. Their preferred specification for growth includes as an explanatory variable an interaction term between trade barriers and initial income levels to capture the non-linearity in the relationship. This specification reveals a significant interaction effect under which the marginal impact of tariffs on growth is declining in initial income. In particular, for low-income countries tariffs appear to be associated with *higher* growth, whereas only for middle income and richer countries is there a negative impact of tariffs on growth. The impact of a marginal change in protection on growth changes from positive to negative as income increases beyond a threshold level of GDP per capita (below which, in rough terms, a country would be classed as low-income). Put differently, trade liberalisation seems to offer the possibility of achieving faster growth only in relatively richer countries.

In line with the above finding the paper by Yanikkaya (2003) demonstrates that trade liberalization does not have a simple and straightforward relationship with growth using a large number of openness measures for a cross section of countries over 1980-2000. He used two groups of trade openness measures: measures of trade volumes and

measures of trade restrictions. On the one hand, his estimation results for various measures of trade volumes indicate that there is a positive and significant association between trade openness and growth. They are also consistent with the conclusions of empirical and theoretical growth studies. On the other hand, his estimation results for trade barriers contradict the conventional view on the growth effects of trade restrictions, which suggests an adverse association between trade barriers and growth. Using various new measures of trade restrictions along with commonly used average tariff rates; his estimation results from the most specifications show a positive and significant relationship between trade barriers and growth.

2.2.1 The link between institutions, trade and economic growth

Interest in understanding institutions and their role in economic development has been constantly increasing over the past half a century. Followed by extensive empirical research, this growing interest in institutions basically propagated the renowned claim that institutions are the fundamental reasons behind differences in productivities among countries (Hall and Jones, 1999; Acemoglu and Robinson, 2005; as cited in Tilahun, 2010).

North (1990) offers the following definition of institutions: "Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction". Economic institutions matter for economic growth because they shape the incentives of key economic actors in society; in particular, they influence investments in physical and human capital and technology, and the organization of production (Acemoglu et al, 2004).

According to Roe et al (2003) institutions granting enforceable rights to physical and intellectual property, legal structures to adjudicate commercial disputes, development of codes of conduct to assure transparent financial institutions, to govern competition among firms, and the provision of public goods for transport and education that can be sustained by what the polity considers to be within the realm of the social good, increase transition and long-run growth substantially.

There is a wide range of consensus among both scholars and practitioners that a country's overall performance is affected by its institutional framework. As cited in Meon and Sekkat (2006) it has been observed that ailing institutions are associated with slower growth (Mauro, 1995), lower total factor productivity (Hall and Jones, 1999), lower TFP growth (Olson et al, 2000) or lower per capita income and (Acemoglu et al, 2001) argued that the causality runs from institutions to economic performance.

Recent studies revealed that in order to fully reap the benefit of openness trade strategies, the existence of good institutions are indispensable. As cited in Meon and Sekkat (2006) the risk of predation and imperfect enforcement of contracts impairs foreign trade since it increases both the cost and risk of trading abroad (Anderson, 2001). Anderson and Marcouiller (1999) also found that bad opaque public policies and ineffective legal systems reduce the volume of trade. In similar fashion Dollar and Kraay (2002) also report a positive correlation between openness and rule of law.

Meon and Sekkat (2006) have identified the direct and the indirect impact of institutions on the volume of trade. The direct impact of institutions on the propensity to trade runs through the reduction of expected return of trading abroad. Hence, faulty institutions

may serve as a tax on trade flows. As a result, a deterioration of the quality of a country's institutions would result in a reduction of its export. The indirect impacts of institutions affect trade through investment and other productivity. Empirical finding by Brunetti and Weder (1998), as cited in Meon and Sekkat (2006, showed that nearly all facets of governance, ranging from political stability to the control of graft, tend to be positively associated with investment. Hall and Jones (1999) observed that bad institutions reduce aggregate productivity, while Olson et all (2000) found that they are also associated with slower productivity growth.

According to Dollar and Kraay (2002) countries that trade more are also countries with better institutions. This to a large extent reflects the common origins of both that have been stressed in the literature. Countries in which colonial powers invested in developing strong institutions are also countries that tended to trade more. Countries with geographical characteristics that were conducive to more trade are also countries in which better institutions developed.

When Dollar and Kraay (2002) apply the identification strategy of the existing literature to try to isolate the partial effects of trade and institutions, they were notably unsuccessful. They find that ordinary least squares regressions of current log-levels of per capita income on trade shares and measures of institutional quality deliver economically large and statistically significant coefficients on both variables. However, when they instrument for both trade and institutions using the instruments suggested by the literature discussed above, they find that both sets of instruments have very strong explanatory power for both endogenous variables. As a result, they encounter overwhelming problems of multicollinearity in the second-stage regressions which

preclude the estimation of meaningful partial effects of either variable. From this it can be concluded that the cross-sectional evidence is not very informative about the relative importance of trade and institutions in the long run, although existing evidence on their individual effects suggests that both are important.

Next they turn to the acceleration of growth in poor countries in recent decades, and examine the extent to which it can be attributed to improved institutional quality and greater participation in international trade. They did so by estimating dynamic regressions of decadal changes in real per capita GDP growth on lagged growth, and changes in decadal averages of trade shares and measures of institutional quality, using lagged levels of institutional quality and trade as instruments to control for possible reverse causation from changes in growth to changes in trade and changes in institutional quality.

Here they do not encounter the same severe identification problems they saw in the cross-section of countries. In the cross-section of countries, they found that trade and institutions are both strongly linked to a common set of historical and geographical determinants. However, when they consider decadal changes in trade and institutions, they find that lagged levels of trade are good instruments for changes in trade but not changes in institutional quality, and similarly, lagged levels of institutional quality predict changes in institutions but not changes in trade. As a result, instrumented decadal regressions are not plagued by the same multicollinearity problems as they occur in cross-sectional regressions. Using these regressions, they find a strongly significant and economically relevant effect of changes in trade on changes in growth, but only modest evidence of the partial effects of improvements in institutional quality.

Economies opened to trade will experiment higher growth and faster institutional change and economies specializing in manufacturing products tend to grow more and raise the institutional change (Navas-Ruiz, 2007).

To sum up, as it is clear from the above theoretical and empirical literatures, there is no clear-cut conclusion on the relationship between trade policy and economic growth. Therefore, this calls for further investigation on the area of the study. In this paper, the relationship between trade policy and economic growth will be examined by using a panel data approach.

Chapter Three

3. Data, Model Specification, Estimation and Result Discussions

3.1 Data

This study uses secondary data for the year 2000 - 2008. The data for the main dependent variables, such as real GDP per capita income, investment to GDP ratio and openness, is collected from Pen World Table (PWT). Data for other macroeconomic and policy variables and social indicators is collected from World Bank Development Indicators (WDI), Africa Development Indicators (ADI) and United Nation Conference on Trade and Development (UNCTAD), which are rich in such kinds of data for developing countries like SSA.

3.1.1 Growth equation

3.1.1.1 Dependent Variable (Real GDP Per Capita Growth rate)

Equation (1) is fairly standard growth specification. The dependent variable real GDP per capita growth rate is a better measure of economic well-being since the economy's output of goods and services would not be influenced by changes in prices. It is an annual percentage growth rate of GDP per capita at constant set of prices per person. The data for this variable is collected from Pen World Table (2010).

3.1.1.2 Independent variables

i. Labour Force (LB_{it})

This variable measures the ratio of working age to total population. This variable is expected to have a positive sign. According to the neo-classical economic growth model

an increase in human capital is positively correlated with economic growth. The data for this variable is collected from ADI.

ii. Ratio of Investment to GDP $(I/Y)_{it}$

In the neo-classical growth model, investment is a key determinant of economic growth. If there is high investment rate, the economy will have a large capital stock and high level of output, and if the saving rate is low, the economy will have small capital stock and low level of output. As a result, this variable is expected to have positive sign. The data for this variable is obtained from WDI.

iii. Openness $(OPEN_{it})$

Openness is measured by the share of exports and imports in total GDP, measured at current price. This variable affects economic growth positively through an increase in technological progress. Hence, the variable is expected to have a positive sign. The data for this variable is collected from Pen World Table (2010)

3.1.2 Investment Equation

3.1.2.1 Dependent Variable (Investment output ratio $(I/Y)_{it}$)

This variable measures the share of investment in total GDP. Firms invest in order to add units of capital to the stock they already have and to replace the worn out capital stock. They do this because they want to conduct their operations in the most profitable way. The data for this variable is collected from World Development Indicators from World Bank (WDI).

3.1.2.2 Independent Variables

I. Openness ($OPEN_{it}$)

Openness is measured by the share of exports and imports in total GDP, measured at current price. This variable affects investment positively through an increase in technological progress. Hence, the variable is expected to have a positive sign. The data for this variable is collected from Pen World Table (2010)

II. Institutional Quality ($INST_i$)

The institutional environment encompasses macroeconomic stability and openness to trade, as well as the enabling environment for markets consisting notably of the legal and judiciary system, the financial system, taxation, labour relations, investment procedures and customs administration (UNCTAD, 2008). The World Bank estimates the institutional quality of a particular country in terms of rule of law, government effectiveness, regulatory quality and control of corruption. The rank (out of 100) is given for each component. So, we take the aggregate value of the four components as a proxy for SSA's institutional quality. A higher aggregate value is associated with better institutional quality. Hence, the sign of this variable is expected to be positive. The data for this variable will be collected from World Development Indicators from World Bank (2010).

III. Ratio of Price of Investment Goods to price of GDP (PIPit)

This variable measures the opportunity cost of investment. Hence, it is expected to have a negative sign. The data for this variable is collected from Pen World Table.

3.1.3 An Openness Equation

3.1.3.1 Dependent Variable (Openness)

This variable measures the share of export and import in total GDP, measured at current price. The data for this variable is obtained from Pen World Table (2010)

3.1.3.2 Independent variables

I. Geographic Factor (Geo_i)

This variable is entered in the equation in order to measures whether a country is landlocked or not. This is because countries that have access to sea outlets are expected to trade more. This variable is measured using a dummy variable. A country will take a value of 1 if it has access to sea outlet and 0 otherwise. This variable is expected to have a positive sign. The data for this variable is collected from World Development Indicators from World Bank (WID).

II. Tariff Barriers (TAR_{it})

Obviously tariff rate decreases the volume of imports significantly as it increases the price of imported goods in the domestic market. Therefore, this variable is expected to have a negative sign.

III. Real Effective Exchange Rate ($REER_{it}$)

It is a trade –weighted geometric average of the level of consumer prices in home country relative to that in its trading partners. The real effective exchange rate is used to capture appropriate incentives for exports, which may trigger supply response. The CPI-based REER index, for country $_i$, is defined by the IMF as:

$$REERit = \prod_{i \neq j}((\frac{eit}{pit})/(\frac{ejt}{pjt}))\, wij$$

Where e_i= index of nominal exchange rate of country i in US dollar at time t

ej= index of nominal exchange rate of country j in US dollar at time t

p_i=index of consumer prices of country i at time t

p_j=index of consumer prices of country j at time t

w_{ij}= trade weight assigned to partner j by country i

Trade weights reflect relative importance of bilateral trade as well as competition in the third market. The evolution of the real exchange rate determines the competitiveness of a country's commodities in the international market, thus profitability. By nature of its construction, an increase in the REER index represents real depreciation which would make exports more competitive in the world market and hence boosts out volume of export and improves the trade balance while a decrease in the REER index represents real appreciation which would make exports less competitive in the world market and hence, volume of export decreases.

The expected sign for this variable is indeterminate. This is because when a country devalues its currency, two things happen. One is it boosts out the country's export as its product is relatively cheap in the foreign market. The other, it reduces import as the imported goods are relatively expensive in the domestic market. The first effect promotes openness while the second effect reduces the degree of openness. If the first effect is stronger than the second effect, the expected sign of REER will be positive while if the second effect is stronger than the first effect the expected sign will be negative.

IV. Population (POPit)

Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. The values shown are midyear estimates. Larger population is assumed to increase international trade. Hence, the variable is expected to have a positive sign. The data for this variable is collected from WDI.

V. Population Density (POPDNSTit)

Population density is midyear population divided by land area in square kilo meters. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes. Also a larger population density is assumed to increase foreign trade. Therefore, this variable is expected have a positive sign. The data for this variable is collected from WDI.

3.2 Model Specification and Explanation of variables

3.2.1 Model Specification

This study uses a time series cross country analysis. Roderick and Rodriguez (2000) argued robust result would be obtained on the relationship between trade policy and economic growth if one makes use of over a decade or more. Panel data analysis allows

the study of dynamic as well as cross sectional aspects of the problem. Because of this, we found that using panel data is a better way of estimation.

It is argued that there is little of policy relevance to be gained from analysing the relationship between current levels of development and current variable (Dowrick and Golley, 2004). Much more informative about the process of development is to examine the impact of current and lagged variables on the rate of economic growth. This enables to capture the determinant of medium run economic performance and may provide some guidance to countries seeking to raise living standard via higher rate of income growth, irrespective of their current level of development. Some of the methodology and data sources that have been used in the previous studies may prove to be useful additions to the analysis of growth rates. In particular this study includes institutional as a potentially important determinant of economic growth (Acemoglu et al, 2004).

Dowrick and Golley (2004) have distinguished openness in two types, 'revealed openness' and 'policy openness'. The first measures the ratio of total foreign trade (export plus import) to country's GDP. This measure of openness is most often used in many empirical studies. The latter measure of openness is policy openness. Rodrik and Rodriguez (2000) argued that measurement of policy openness is fraught with difficult. This is because it is difficult to find a reliable measure of policy openness that are uncorrelated to each other.

Sachs and Warner (1995) have produced what is probably the most influential attempt of define policy openness and to estimate its effect on economic growth. The Sachs-Warner openness indicator (OPEN) is a zero-one dummy, which takes the value 0 if the economy was closed according to any one of the following criteria:

1. It had average tariff rates higher than 40% (TAR);

2. Its nontariff barriers covered on average more than 40% of imports (NTB);

3. It had a socialist economic system (SOC);

4. It had a state monopoly of major exports (MON);

5. Its black market premium exceeded 20% during either the decade of the 1970s or the decade of the 1980s (BMP).

Since the study focuses on the analysing the impact of trade policy on economic growth, it makes use of average tariff rate and real effective exchange rate as the major explanatory variable. Besides, using the two prominent trade policy instruments (i.e. average tariff rate and real effective exchange rate) helps to avoid the problem of multicollinearity if one uses both 'revealed openness' and 'policy openness' together as an explanatory variable in a single equation, which may lead to unreliable estimates with high standard errors and of unexpected sign or magnitude (Verbeek, 2004). The paper also wants to distinguish the direct impact of trade policy on growth and the indirect impact that operates through investment.

Hence, the study attempts to estimate a structural model consisting of a growth equation, an investment equation and an equation explaining openness. The growth equation allows to estimate the direct impact of policy measures on per capita income and investment equation and an equation explaining openness helps to measure the indirect effect of trade policy that operating through investment.

The estimating equation in standard form based on Dowrick and Golley (2004) is given as follows:

(1) Growth real GDP per capita

$$\ln Y_{it} = \eta_0 + \eta_1 \ln OPENit + \eta_2 \ln LB_{it} + \eta_3 \ln(I/Y)_{it} + u_{it} \text{ .....eq(1)}$$

(2) Investment ratio

$$\ln(I/Y)_{it} = \delta_0 + \delta_1 \ln Y_{it} + \delta_2 \ln OPEN_{it} + \delta_3 INST_{it} + \delta 4 \ln PI/P_{it} + v_{it} \text{ .....eq(2)}$$

(3) Trade Ratio

$$\ln OPEN_{it} = \theta_0 + \theta_1 GEO_i + \theta_2 \ln TARit + \theta_3 \ln REER_{it} + \theta_4 \ln POP_{it} + \theta_5 POPDNST_{it} + \varepsilon_{it} \text{...eq(3)}$$

Where Y is Real GDP per Capita

LB is Active Labour Force

I/Y is Investment GDP ratio

TAR is Average Tariff Rate

REER is Real Effective Exchange Rate

OPEN is Openness (Ratio of Trade to GDP)

PI/P is Ratio of Price of Investment Goods to Price of GDP

GEO is Geographic Factor

INST is Institutional Quality

POP is Total Population

POPDNST is Population Density

The subscript i indexes countries, the subscript t indicate the time period, and the absence of a time subscript shows that the variables are averaged over the whole period. The system of equation is recursive, allowing us to use single equation estimation if there is no correlation between the error terms – a condition in which we test. The point

estimate of the direct impact of openness on economic growth is 'η_1'. The indirect impact of openness that operates through investment channel is 'δ_2'. The impact of trade policy variables on economic growth is captured by $(\theta_2 + \theta_3)(\eta_1 + \delta_2)$.

3.3 Model Estimation and Interpretation of the result

Since the data for this research run both across countries and time, panel data techniques are applied to estimate the regression equations. These techniques make it possible to take into account country-specific factors which show very little or no variation over time. However, before estimating econometric model, it is essential to explore the data. This is because, according to Alemayehu and et al (2009), data exploration is a pre-requisite for a good model formulation. Data exploration helps us to identify the pattern of the data in order to give it a good mathematical form.

I. Distributional Tests

As normality is the underlying assumption in statistical method, this section tries to address whether the variables specified in the model are drawn from a normally distributed population.

There are three ways of testing normality: Skewness and kurtosis, Shapiro-Wilk, and Shapiro-Francia. As normality assumption is critical in many statistical methods, violation of this assumption may lead to invalid and unreliable interpretation and inferences. According to the reported summary statistics in ANNEX 1, most of the variables happen to have positively skewed and leptokurtic distribution, which lacks kurtosis. In addition, an attempt has been made to see the graph box of each variable

(see ANNEX 2). Hence, we can say that most of the variables show that they are not normally distributed.

In order to overcome, the problems regarding the distributional properties, it is better to use transformation. As recommended by Alemayehu et al (2009), transformation of variables is among the three major techniques of data exploration and inferences. According to these authors, transformation of a variable, particularly into logarithmic form, helps to show influential points in a very sharp manner and also corrects skewed variables into the right distribution towards normality which is relevant in the context of regression analysis. Hence, in this paper, it is identified that there is a need to transform into logarithmic forms.

II. Multicollinearity Test

In the presence of multicollinearity, the regression coefficients possess large standard errors (in relation to the coefficient themselves), which means the coefficients cannot be estimated with great precision or accuracy (Gujarati, 2004: pp. 344).

To check for the presence of Multicollinearity in the model we have used the variance covariance matrix presented in the ANNEX 4. The table implies that there is no problem of Multicollinearity in the model.

III. Diagnostic Tests

A. Hausman Test for Endogeneity

We suspect that investment rate and the level of openness may be endogenous in the growth regression, in the sense that these variables may be correlated with the structural error term.

The null hypothesis for which states that an ordinary least squares (OLS) estimator of the same equation would yield consistent estimates; that is, any endogeneity among the regressors would not have deleterious effects on OLS estimates. A rejection of the null indicates that endogenous regressors' effects on the estimates are meaningful, and IV techniques are required. The test was first proposed by Durbin (1954) and separately by Wu (1973; a T4 statistic) and Hausman (1978). This Durbin-Wu-Hausman (DWH) test is numerically equivalent to the standard Hausman test obtained by using hausman with the sigma more option, in which both forms of the model must be fitted. Under the null, it is distributed chi-squared with m degrees of freedom, where m is the number of regressors specified as endogenous in the original IV regression.

Based on this the test statistics p-value makes us to fail to reject the null hypothesis indicating that there is no endogeneity. Accordingly, we performed OLS estimation technique. (See ANNEX 5).

B. Hausman Specification Test

Under this section we carry out some diagnostic tests to examine which estimation technique fits the model and the data well.

Panel data models examine fixed and/ or random effects of group of time. Hence, our data should have individual effects or time effects. In order to examine the presence of individual effects and/or time effects, it is required to perform either fixed effects or random effects test.

The following figure shows the Hausman Specification test used to choose between the fixed effect and random effects model. The test result suggests that random effect is the appropriate model for growth model and for investment and openness model fixed effect is more appropriate.

The null and alternative hypothesis for this test is:

Ho: difference in coefficients not systematic

and

H_1: Ho is not true.

If we fail to reject the null hypothesis, the random effect regression model is favoured and vice versa. (see ANNEX 6 for detail)

C. Test for Hetroskedasticity

The homoskedasticity assumption states that the variance of the unobservable error, *u*, conditional on the explanatory variables, is constant. Homoskedasticity fails whenever the variance of the unobservables changes across different segments of the population, which are determined by the different values of the explanatory variables (Wooldridge, 2004).

In short, if we persist in using the usual estimation procedures despite hetroskedasticity, whatever conclusions we draw or inferences we make may be very misleading. (Gujarati, 2004)

In this study we have applied the Breusch – Pagan test for hetroskedasticity discussed in Verbeek (2000). This study estimates the square of residual of the random effects model. The test statistics multiplies the R2 of auxiliary regression of this residual with explanatory variables used in the model by N (T-1). The test statistics has a Chi-square distribution with J degrees of freedom, where J is the number of explanatory variables used in the auxiliary regression.

As the test statistic is greater than the tabulated value for all the three models we reject the null hypothesis of homoskedasticity (see ANNEX 7 for detail). Hence, our data is not free from hetroskedasticity.

D. Testing for Serial Correlation AR (1)

In a model where the regressors are not strictly exogenous, at least one of the regressors is correlated with one period lagged error term. Since the presence of this serial correlation biases the standard errors and causes the results to be less efficient, we should be concerned about testing for it.

To test for autocorrelation, in this study we used the modified Durbin-Watson test designed by Bhagrave, Franzini and Narendranathan (1983). The test statistic is

$$DW = \frac{\sum\sum [\hat{\varepsilon}it - \hat{\varepsilon}i, t-1]}{\sum\sum \hat{\varepsilon}it2}$$

The Durbin Watson statistic found to be 0.0036521 suggesting that there is a positive autocorrelation in the estimated model. (See ANNEX 8 for detail)

Based on all these tests, it is observed that serial autocorrelation and hetroskedasticity prevail.

IV. Model Estimation Results and Interpretation of Results

The above diagnosis tests result indicates that there is high autocorrelation and hetroskedasticity problem in the model. Therefore, using fixed effects or random effect model may result in inefficient estimates. With the presence of autocorrelation and hetroskedasticity problems' using the Feasible Generalized Least Square (FGLS) estimation technique is appropriate to come up with efficient estimates. Hence, the model specified in this paper is estimated with FGLS estimation method using annual data for the period 2000-2008.

Regarding the growth equation all the variables are found to be statistically significant. The sign of the labour force, investment output ratio and openness is positive as expected. Openness is significant at 10% significance level but both labour force and investment are significant at 1% level of significance. The overall trade share is an important explanatory variable of growth in addition to human and physical capital.

The significance of openness variable implies that country's economic growth is positively correlated with the more open the economy to the global market. A one percent increase in openness will result in 1.81 percent increase in economic growth. Moreover, a higher human and physical capital is positively correlated with economic

growth. However, the marginal contribution of an increase in physical capital for economic growth is larger as compared to the marginal contribution to human capital.

We have seen that share of real investment in GDP contributes significantly to growth. We have also seen that openness positively and significantly affect economic growth. However, it is possible that openness may have additional, indirect effect on economic growth, operating through the investment channel.

TABLE 3.1: GROWTH REGRESSION ESTIMATES

Dependent Variable: Log of Growth Rate of Real GDP per capita

Independent Variable	***Coefficient***	***z-ratio***	***p-value***
ln of (openness)	*0.2254684*	*3.21*	*0.063**
ln of (investment output ratio)	*0.4363692*	*6.12*	*0.000****
ln of (labour force)	*0.3751579*	*2.21*	*0.001****
Number of observations = 289			
Number of groups = 41			
Wald $chi^2(10)$ = 40.22			
Prob > chi^2 = 0.0000			

* Significant at 10%, ** Significant at 5% and *** Significant at 1%

Table 3.2 summarizes the result of our investment regression, following the specification of equation (2). With the exception of institutional quality all the remaining variables are significant at 1% and 5% level of significance. We confirm the finding of Dowrick and Golley (2004) that the price of investment goods relative to GDP has a significant negative impact on investment. Both GDP growth rate and openness have positive sign as it is expected. By looking at the effect of openness on investment it can

be argued that more open economies are conducive for the growth of investment. The positive effect of openness on investment could be attributed through the transfer of technology as the neo-classical economists argued. A 10 percent increase in trade share is predicted to increase the investment rate by 5.37 percent. The overall impact of openness on economic growth is the sum of the direct and indirect effect. The magnitude of the indirect effect is the product of two regression coefficients $\eta_3 * \delta_2$ (0.25), which is positive and considerable in magnitude. Moreover, the insignificance coefficient of institutional quality deviates from both our expectation and what the other studies, such as Dowrick and Golley (2004), on the issue states.

We have seen that variations in trade intensity do have a significant effect on economic growth. This raises the question of what factors influence a country's trade share and what the role of policy instruments might be.

TABLE 3.2: INVESTMENT REGRESSION ESTIMATES

Dependent Variable: Log of Investment Output Ratio

Independent Variable	***Coefficient***	***z-ratio***	***p-value***
ln of(real GDP per capita)	*0.0246599*	*2.27*	*0.023***
ln of (price of investment to price of GDP ratio)	*-1.90e-0.07*	*2.68*	*0.007****
Institutional quality	*0.0015671*	*0.73*	*0.466*
ln of (openness)	*0.5370963*	*8.47*	*0.000****
Number of observations = 289			
Number of groups = 41			
Wald $chi^2(10)$ = 58.17			
Prob > chi^2 = 0.0008			

* Significant at 10%, ** Significant at 5% and *** Significant at 1%

The regression estimates of table 3.3 presents the determinants of an openness. We find that, with the exception of population density, all the remaining variables are found to be significant. This means that higher density does seem to allow more opportunity for internal trade, hence reducing the need for foreign trade. However, a larger population seems to increase foreign trade. As it is expected, the sign of mean weighted average tariff rate and real effective exchange rate is negative. This implies that these trade policies seem to lower the degree of openness. This is because, as in the case of tariff, it restrains both the volume of import and export. Devaluation, so as to promote export, seems to negatively affect openness. Hence, this suggests that trade policies that restricts openness negatively affect economic growth.

TABLE 3.3: OPENNESS REGRESSION ESTIMATES

Dependent Variable: Log of Openness

Independent Variable	***Coefficient***	***z-ratio***	***p-value***
Geographic factor	*0.2055576*	*5.34*	*0.000****
ln of (population)	*-0.1691782*	*-11.48*	*0.000****
Population density	*-0.0003325*	*-1.55*	*0.120*
ln of (tariff)	*-0.0242287*	*-1.84*	*0.065**
ln of (real effective exchange rate)	*-0.0181822*	*-2.06*	*0.039***
Number of observations = 386			
Number of groups = 43			
Wald $chi^2(10)$ = 244.86			
Prob > chi^2 = 0.0000			

* Significant at 10%, ** Significant at 5% and *** Significant at 1%

Both of the above findings echo the finding of Wacziarg and Welch (2003) and David and Loewy (1998).

Finally, we also find that the sign of the coefficient landlocked is positive and statistically significant at % level of significance, which is in line with our prior expectation. Being a country with sea outlets encourages openness. To put it differently, countries that have access to sea outlets trade more in the global market.

Chapter Four

4. Conclusion and Implication

The macroeconomic impact trade policy on growth and development has entertained a hot debate in the literature. Empirical studies on the matter have employed diverse methodologies and ideologies. Much like the diversity of their approaches, so have been the results obtained. For the most part, these studies have arrived at conflicting pieces of evidence and the dispute seems to have continued without showing any tendency of begetting a common understanding.

This paper attempted to examine the impact of trade policy on economic growth in Sub Saharan African countries. The study utilized a panel data approach employed Generalised Least Square Estimator (GLS), consisting of 47 countries between the periods 2000 to 2008.

The main findings of the analysis are openness to international trade stimulates economic growth and investment. Both the direct and indirect effect of openness in promoting economic growth is found to statistically significant. This implies that an increase in trade does, on average, benefits on economic growth of SSA countries. This also entails that outward-oriented economies exhibit faster economic growth. Tariff barriers do affect the level of trade, hence economic growth.

Looking into the relationship between revealed openness and investment, it shows that there is positive and significant relationship between these variables. This suggests that opportunities for international trade raise the marginal product of investment.

Moreover, access to sea outlets raises the marginal product of openness. However, in the investment share regression institutional quality remains to be statistically insignificant.

Finally, even though, our results do appear to be robust, a note of caution must be made since the results that are presented in the finding part are potentially sensitive to econometric approaches. From our findings, it could be argued that SSA should liberalize their trade to attain a faster economic growth, as in the case of IMF and WB advocators. However, doing so without introducing appropriate complementary policies, trade reform alone cannot serve as magic solution. Hence, further research is clearly required to disentangle these hypotheses in order to provide clear policy guidance for the future.

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ANNEXES

ANNEX 1: LIST OF COUNTRIES IN THE SAMPLE

Angola	Gambia	Swaziland
Benin	Ghana	Tanzania
Botswana	Guinea	Togo
Burkina Faso	Guinea Bissau	Uganda
Burundi	Kenya	Zambia
Cameron	Lesotho	Zimbabwe
Cape Verde	Madagascar	
Central Africa Republic	Malawi	
Chad	Mali	
Comoros	Mauritania	
Congo	Mauritius	
Cote d'Ivoire	Mozambique	
Democratic Republic of Congo	Nambia	
Djibouti	Niger	
Equatorial Guinea	Nigeria	
Eritrea	Rwanda	
Ethiopia	Sao Tome and Principe	
Gabon	Senegal	
	Seychelles	
	Sudan	

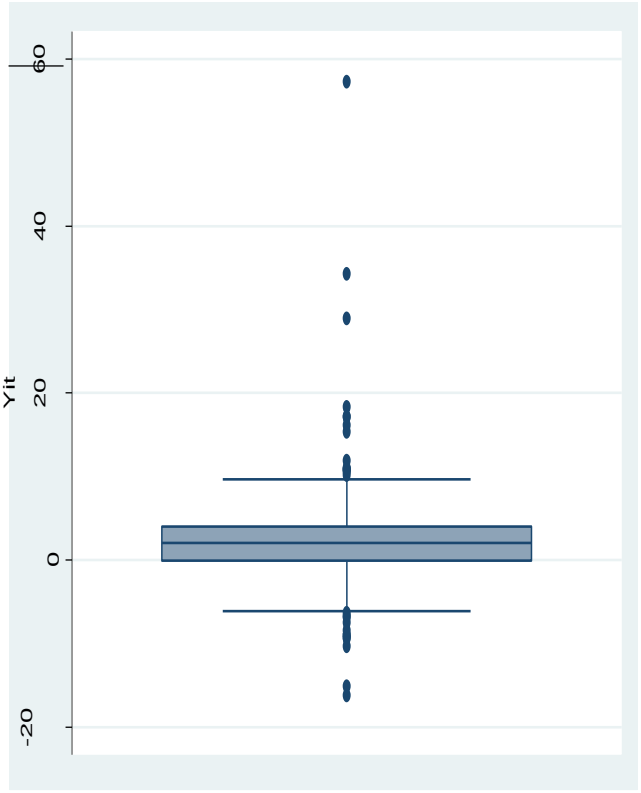
ANNEX 2: NORMALITY TEST FOR EXPLANATORY VARIABLES

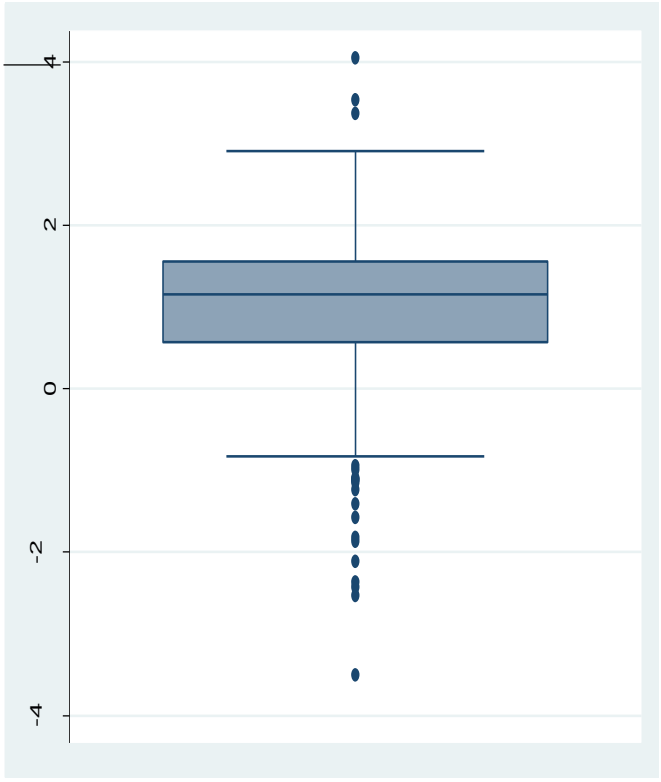
```
. sktest yit  lbit openit iyit instit tarit reerit geoi pop popdnst pip

                    Skewness/Kurtosis tests for Normality
                                                              ------- joint ------
    Variable |   Obs   Pr(Skewness)   Pr(Kurtosis)  adj chi2(2)     Prob>chi2
-------------+-----------------------------------------------------------------
         yit |   396        0.0000         0.0000          .          0.0000
        lbit |   396        0.0000         0.0000          .          0.0000
      openit |   396        0.0000         0.0000          .          0.0000
        iyit |   396        0.0000         0.0000          .          0.0000
      instit |   396        0.1385         0.0559       5.86          0.0534
       tarit |   386        0.0000         0.0000      49.34          0.0000
      reerit |   396        0.0000         0.0000          .          0.0000
        geoi |   396        0.0000              .          .               .
         pop |   396        0.0000         0.0000          .          0.0000
     popdnst |   396        0.0000         0.0000          .          0.0000
         pip |   396        0.0000         0.0000          .          0.0000
```

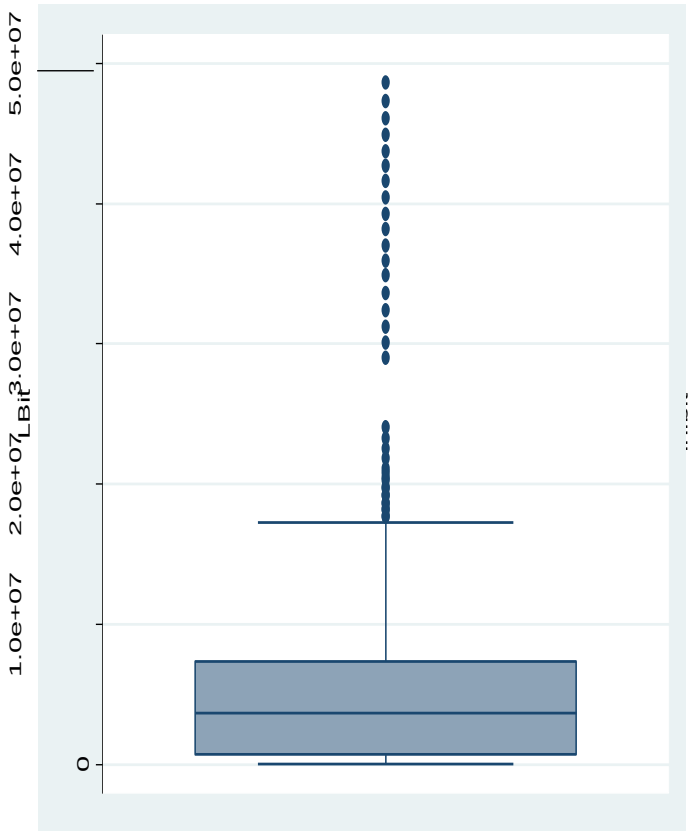
```
. swilk yit  lbit openit iyit instit tarit reerit geoi pop popdnst pip

                    Shapiro-Wilk W test for normal data

    Variable |   Obs        W           V           z       Prob>z
-------------+-------------------------------------------------------
         yit |   396    0.76317     64.615       9.914     0.00000
        lbit |   396    0.66563     91.227      10.734     0.00000
      openit |   396    0.90708     25.352       7.689     0.00000
        iyit |   396    0.85750     38.879       8.706     0.00000
      instit |   396    0.98502      4.088       3.349     0.00041
       tarit |   386    0.94331     15.116       6.451     0.00000
      reerit |   396    0.02557    265.854      13.278     0.00000
        geoi |   396    0.99769      0.631      -1.096     0.86341
         pop |   396    0.59609    110.198      11.184     0.00000
     popdnst |   396    0.67214     89.450      10.688     0.00000
         pip |   396    0.80423     53.411       9.461     0.00000
```

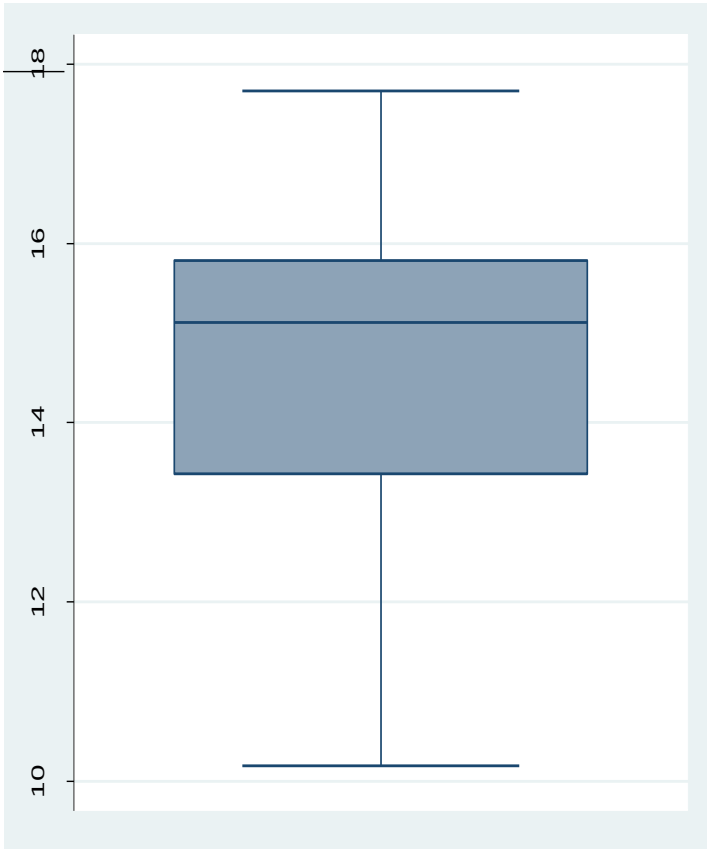
```
. sfrancia yit  lbit openit iyit instit tarit reerit geoi pop popdnst pip

                  Shapiro-Francia W' test for normal data

    Variable |   Obs       W'          V'          z       Prob>z
-------------+-------------------------------------------------------
         yit |   396    0.75442     71.515       8.719     0.00001
        lbit |   396    0.66682     97.023       9.287     0.00001
      openit |   396    0.90521     27.605       6.902     0.00001
        iyit |   396    0.85518     42.172       7.720     0.00001
      instit |   396    0.98534      4.270       3.133     0.00087
       tarit |   386    0.94353     16.074       5.833     0.00001
      reerit |   396    0.02232    284.708      11.237     0.00001
        geoi |   396    1.00000     -0.000           .     0.00001
         pop |   396    0.59452    118.080       9.649     0.00001
     popdnst |   396    0.67161     95.629       9.260     0.00001
         pip |   396    0.80438     56.967       8.291     0.00001
```

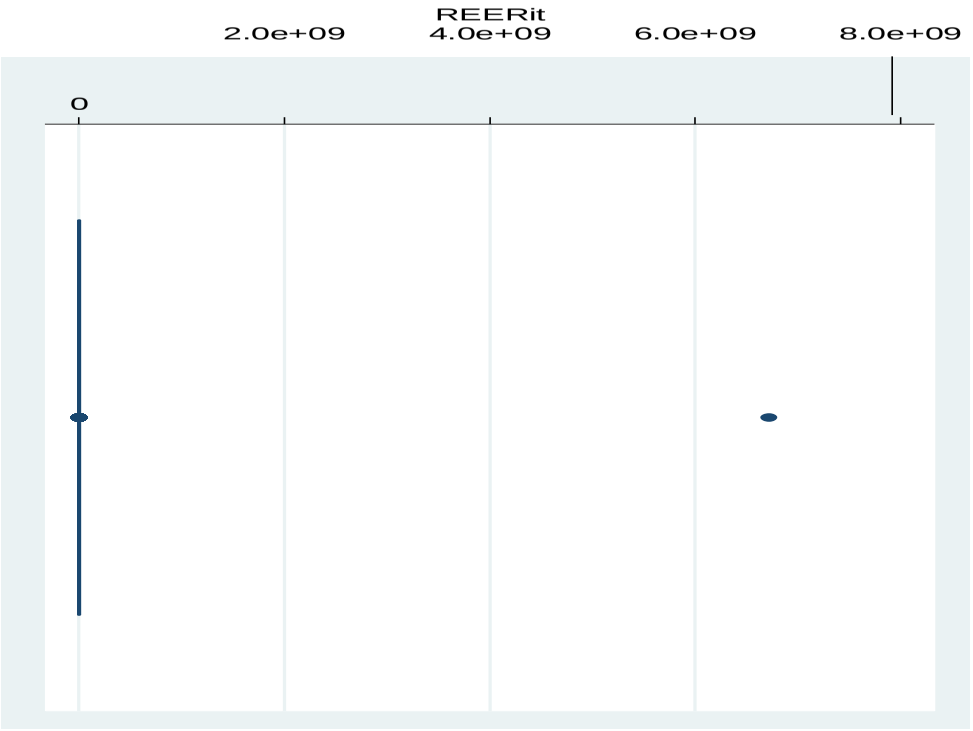
ANNEX 3: GRAPH BOX VARIABLES

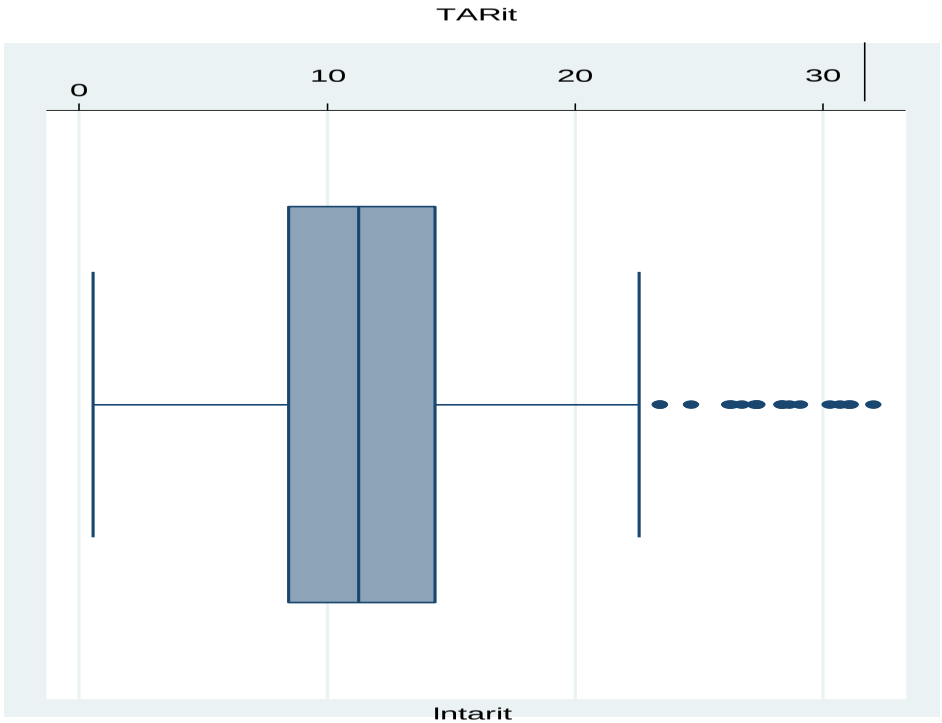


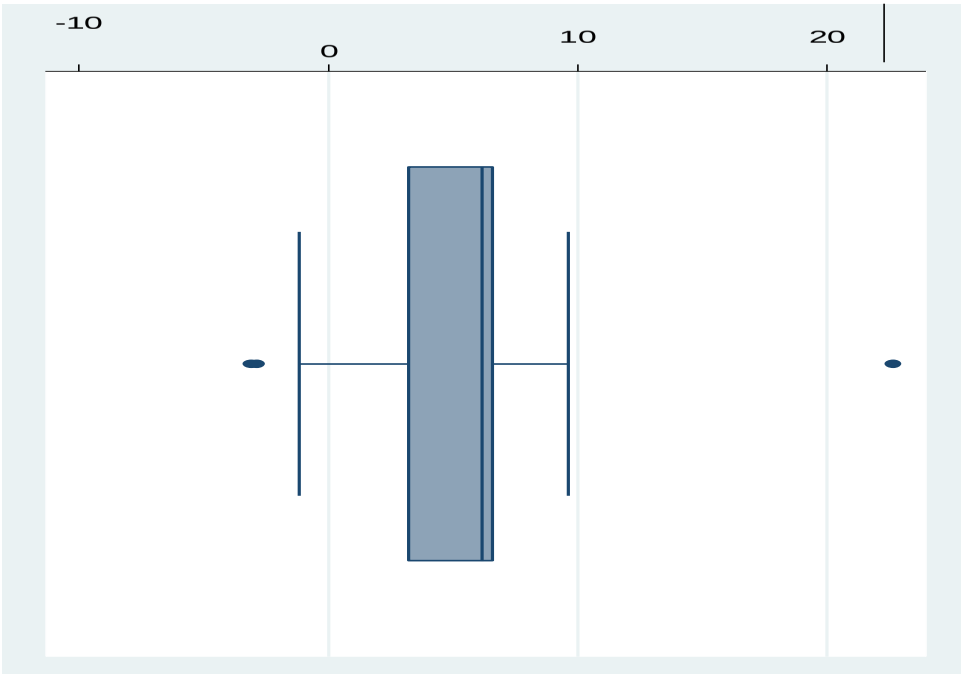


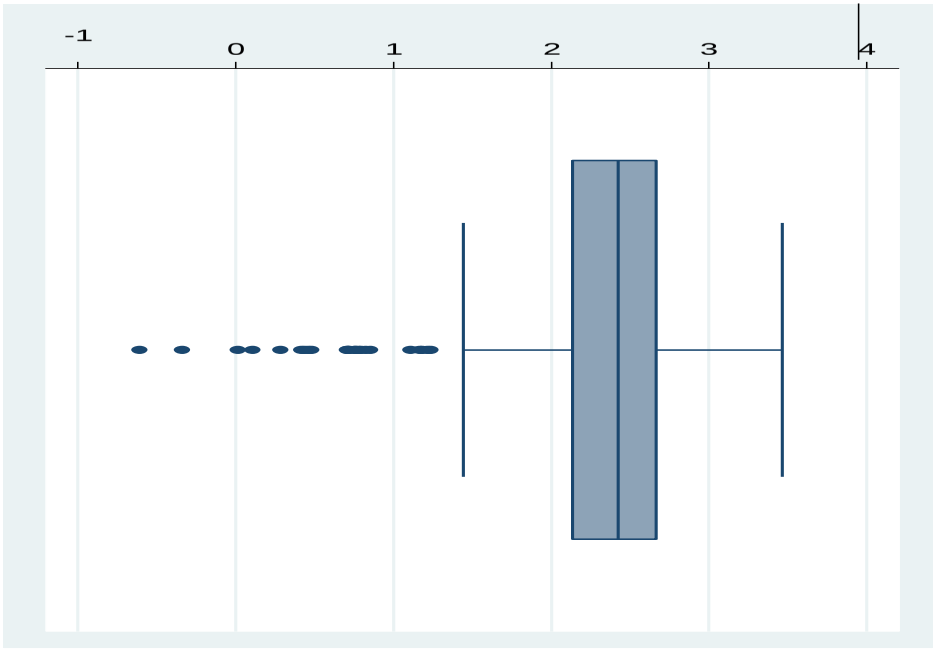




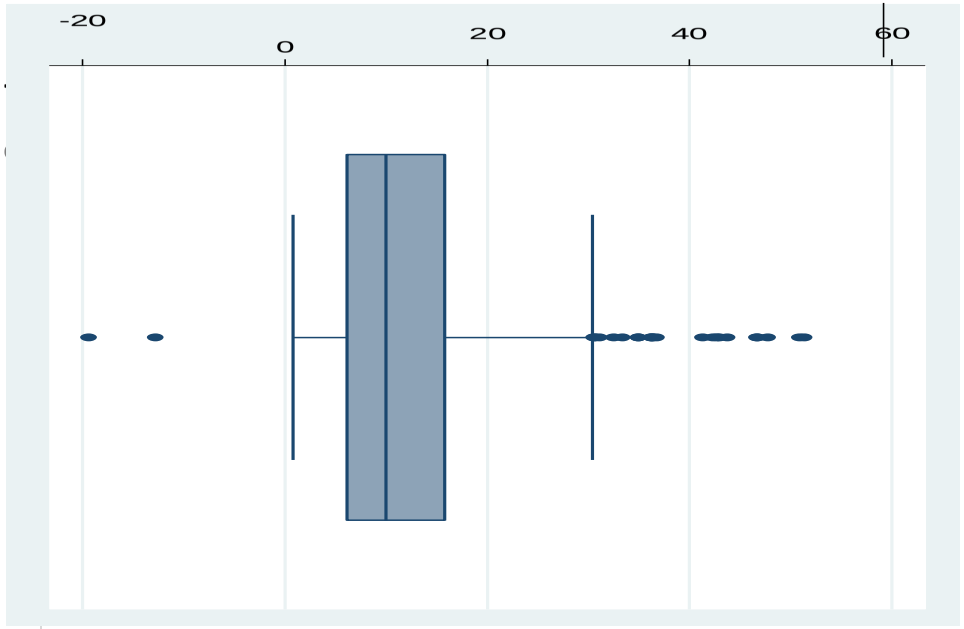

REERit
2.0e+09
4.0e+09
6.0e+09
8.0e+09
0


TARit
0
10
20
30
Intarit

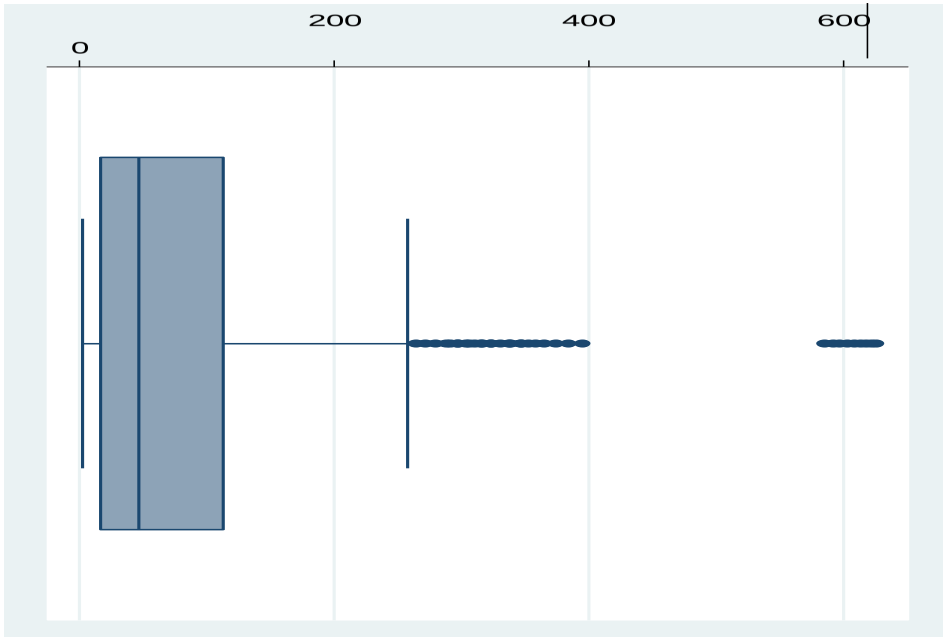

lnreerit
-10
0
10
20


-1
0
1
2
3
4

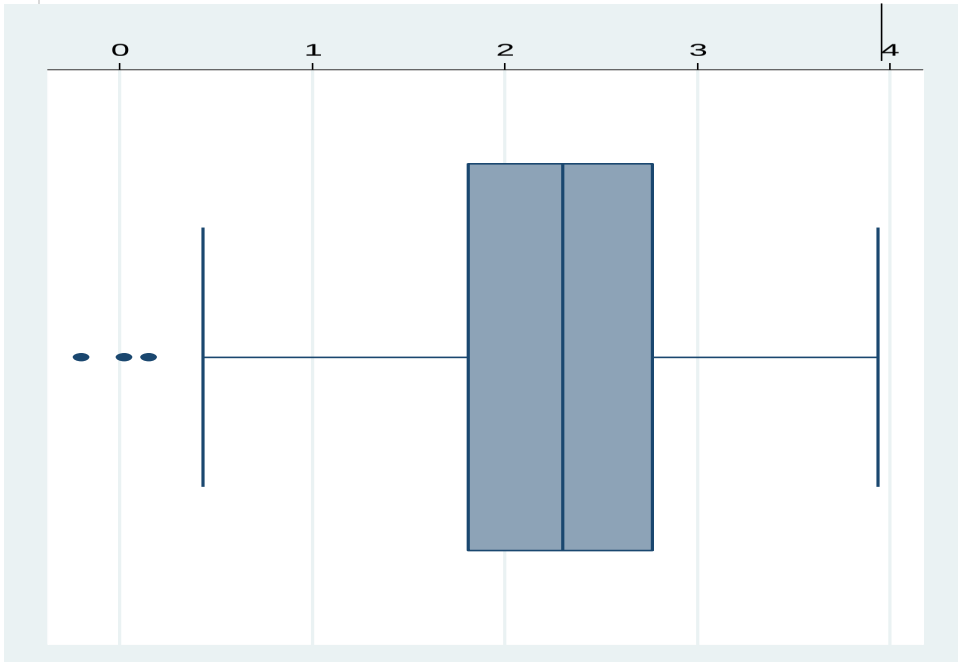
(I/Y)it

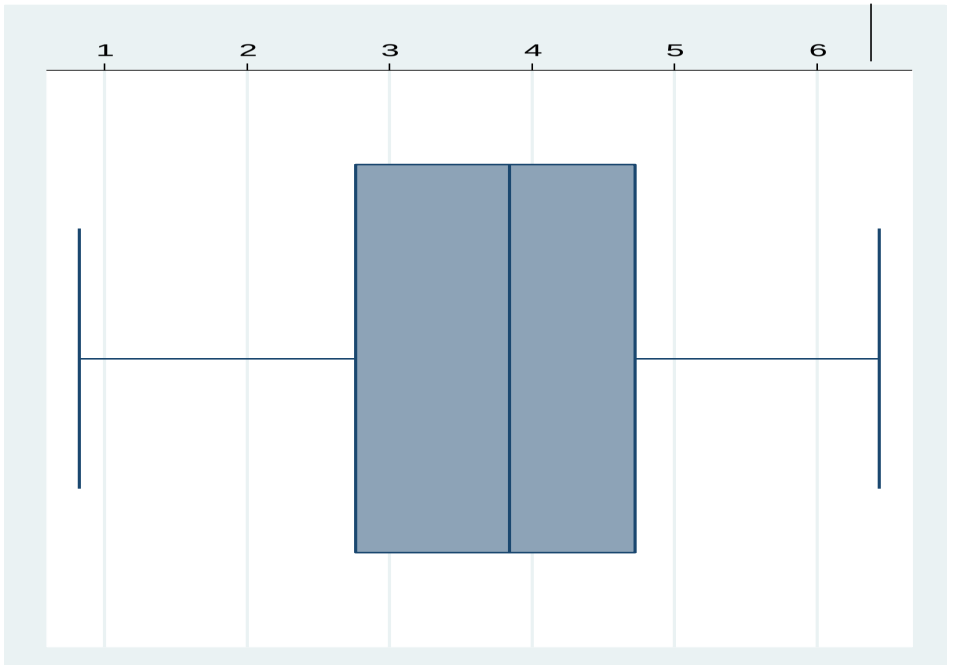


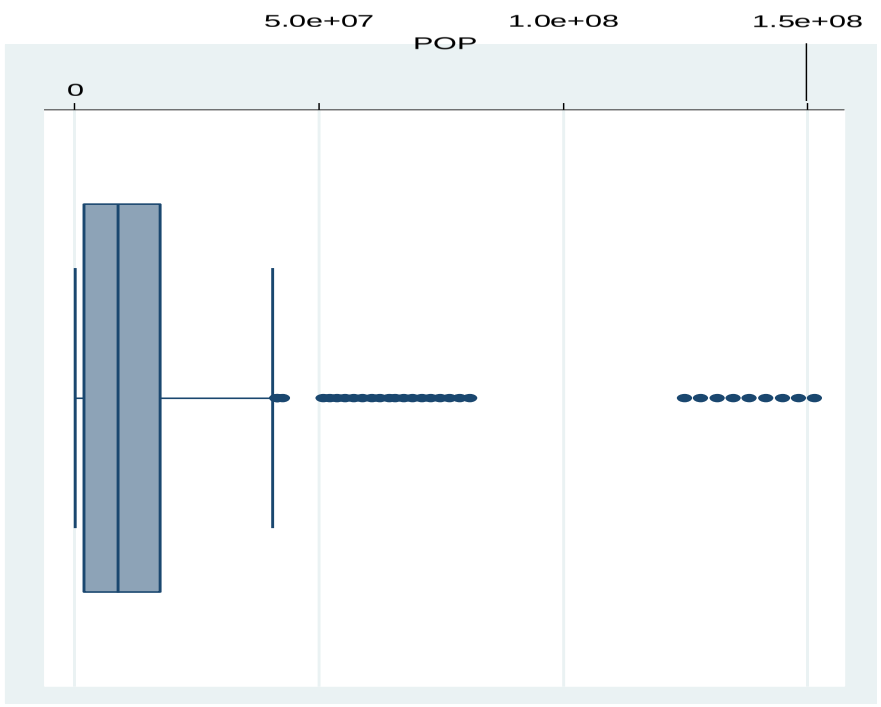
POPDNST



lniyit






POP
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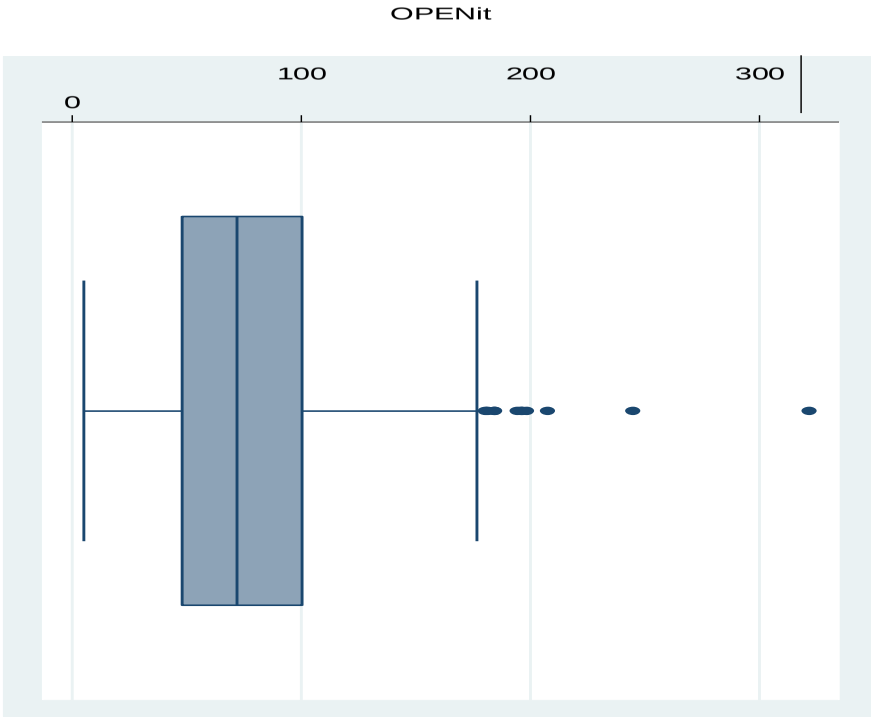
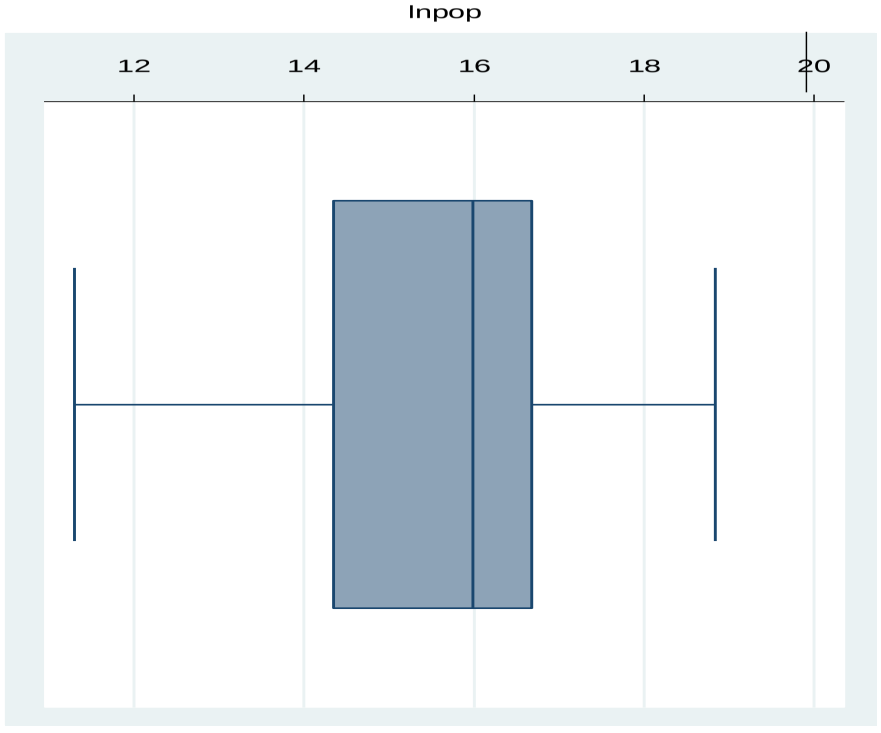
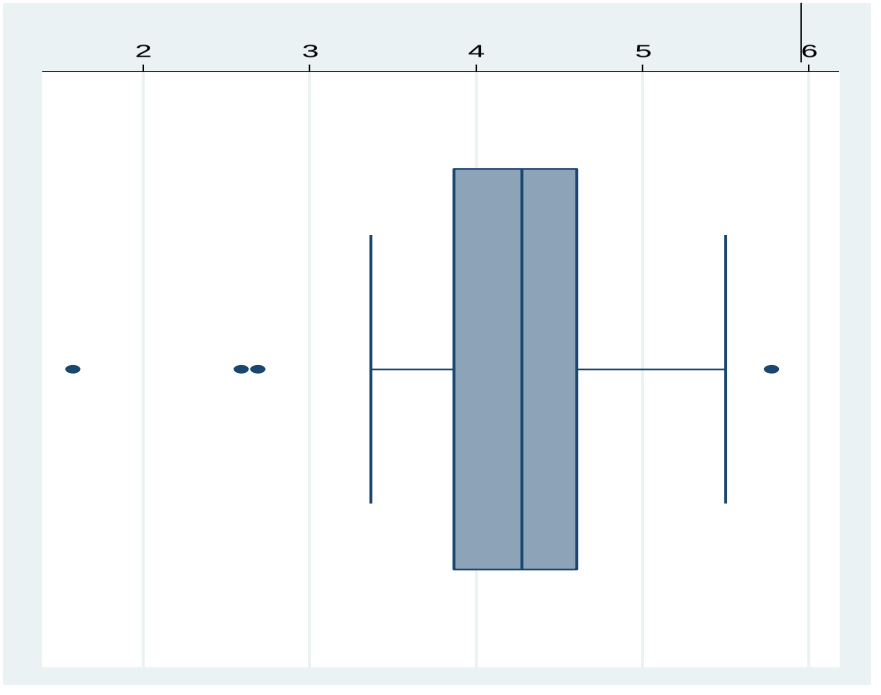
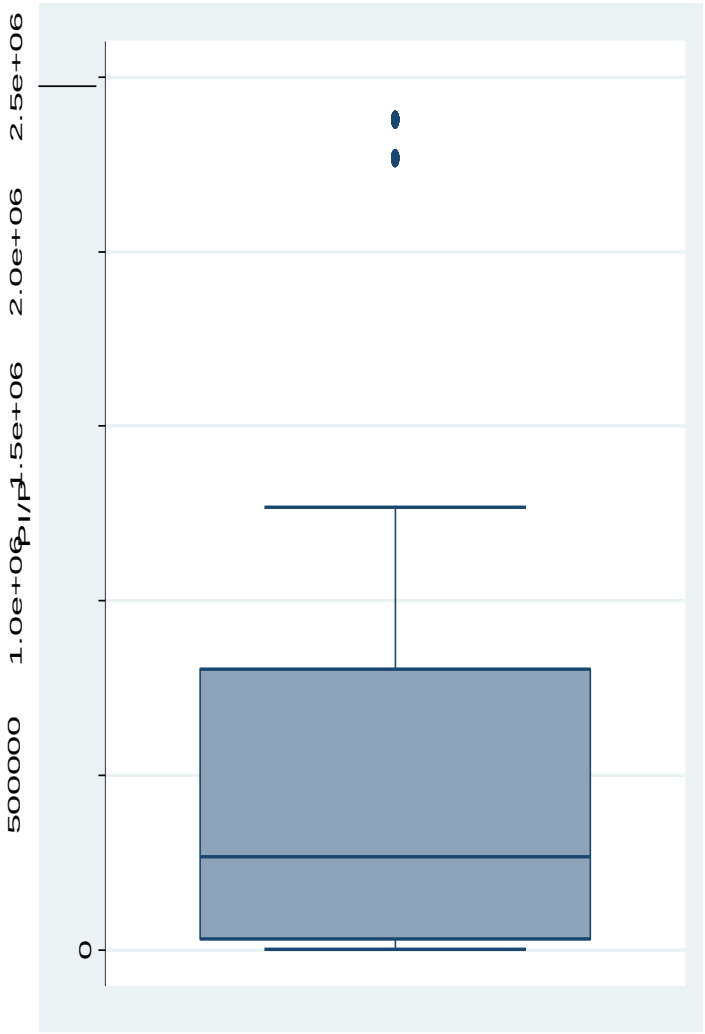
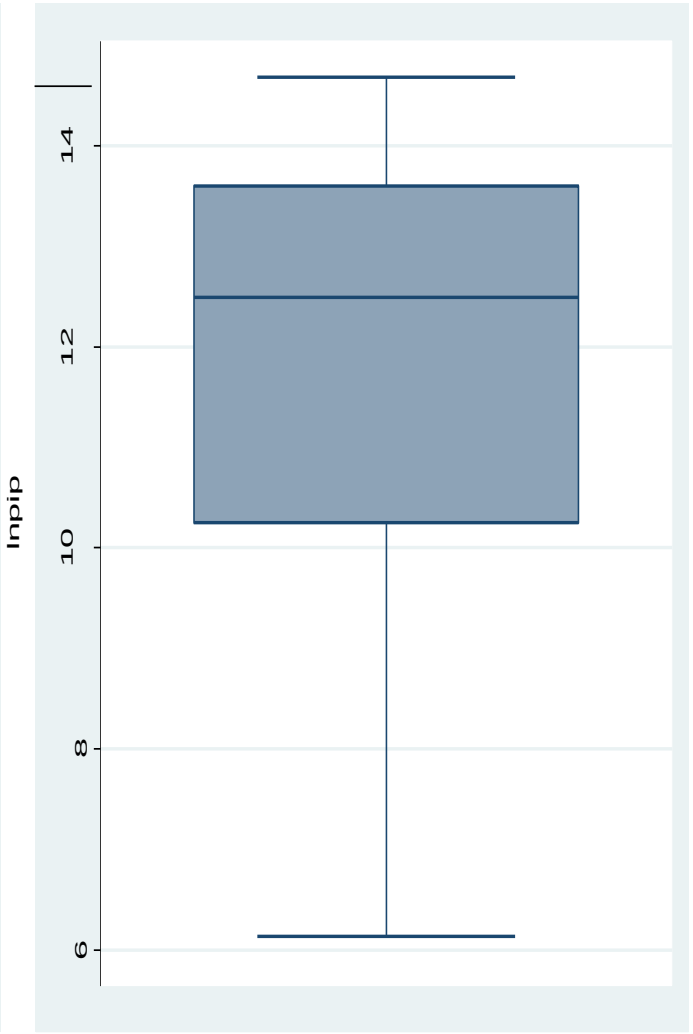
1.0e+08
1.5e+08


OPENit
0
100
200
300


lnpop
12
14
16
18
20


2
3
4
5
6


500000
1.0e+06
1.5e+06
2.0e+06
2.5e+06
PI/P


6
8
10
12
14
lnpip

ANNEX 4: MULTICOLLINEARITY TEST

```
. correlate yit  lbit openit iyit instit tarit reerit geoi pop popdnst pip
(obs=386)
```

	yit	lbit	openit	iyit	instit	tarit	reerit	geoi	pop	popdnst	
yit	1.0000										
lbit	0.0934	1.0000									
openit	0.2266	-0.3158	1.0000								
iyit	0.3169	-0.2136	0.3861	1.0000							
instit	0.0670	-0.1869	0.0670	0.0074	1.0000						
tarit	-0.0374	-0.0763	0.2400	0.0709	-0.2415	1.0000					
reerit	-0.0177	-0.0082	0.0676	0.0084	-0.0765	0.0314	1.0000				
geoi	0.0266	0.0321	0.2158	0.0564	-0.1704	0.0784	-0.0695	1.0000			
pop	0.0820	0.9784	-0.2853	-0.1685	-0.2053	-0.0414	-0.0071	0.0556	1.0000		
popdnst	-0.0074	-0.0402	0.0298	-0.1451	0.1334	-0.0365	-0.0230	0.0038	-0.0307	1.0000	
pip	0.1031	0.4498	-0.2807	0.1569	-0.2119	-0.1278	-0.0104	-0.0150	0.4631	-0.4036	1

ANNEX 5: HUASMAN ENDOGENEITY TEST

```
. ivregress 2sls lnyit lnlbit  instit (lnopenitt =  lntarit lnreerit lnpop popdnst geoi)

Instrumental variables (2SLS) regression            Number of obs =     281
                                                    Wald chi2(3)  =    6.57
                                                    Prob > chi2   =  0.0871
                                                    R-squared     =  0.0146
                                                    Root MSE      =  1.0076

------------------------------------------------------------------------------
       lnyit |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lnopenitt |   .8479661   .3449181     2.46   0.014      .171939    1.523993
     lnlbit |   .1644097   .0751207     2.19   0.029     .0171758    .3116436
     instit |   .0060961   .0060756     1.00   0.316    -.0058118     .018004
      _cons |  -5.345422    2.54677    -2.10   0.036      -10.337   -.3538438
------------------------------------------------------------------------------
Instrumented:  lnopenitt
Instruments:   lnlbit instit lntarit lnreerit lnpop popdnst geoi

.
. estat endogenous

  Tests of endogeneity
  Ho: variables are exogenous

  Durbin (score) chi2(1)          =  1.49833  (p = 0.2209)
  Wu-Hausman F(1,276)             =  1.47956  (p = 0.2249)

.
```

ANNEX 6: HUASMAN SPECIFICATION TEST

```
. xtreg  lnyit lnlbit lnopenitt lniyit, fe

Fixed-effects (within) regression               Number of obs      =       291
Group variable: id                              Number of groups   =        43

R-sq:  within  = 0.0559                         Obs per group: min =         1
       between = 0.0010                                        avg =       6.8
       overall = 0.0006                                        max =         9

                                                F(3,245)           =      4.83
corr(u_i, Xb)  = -0.9699                        Prob > F           =    0.0028

------------------------------------------------------------------------------
       lnyit |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lnlbit |    1.672826    .761166     2.20   0.029     .1735615    3.17209
  lnopenitt |    .1546294   .3908072     0.40   0.693    -.6151412     .9244
     lniyit |    .2611019    .197849     1.32   0.188    -.1286001    .650804
      _cons |     -24.938    10.7835    -2.31   0.022     -46.1782   -3.697809
-------------+----------------------------------------------------------------
     sigma_u |  2.7891705
     sigma_e |  .80641984
         rho |  .92285533   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(42, 245) =     3.93                 Prob > F = 0.0000

. estimates store fe

. xtreg  lnyit lnlbit lnopenitt lniyit, re

Random-effects GLS regression                   Number of obs      =       291
Group variable: id                              Number of groups   =        43

R-sq:  within  = 0.0398                         Obs per group: min =         1
       between = 0.1205                                        avg =       6.8
       overall = 0.1008                                        max =         9

Random effects u_i ~ Gaussian                   Wald chi2(3)       =     17.13
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0007

------------------------------------------------------------------------------
       lnyit |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lnlbit |    .1190934   .0767985     1.55   0.121    -.0314289    .2696157
  lnopenitt |     .303045   .2350849     1.29   0.197     -.157713    .7638029
     lniyit |    .4580253   .1311637     3.49   0.000     .2009492    .7151014
      _cons |   -3.196708   1.825898    -1.75   0.080    -6.775401    .3819858
-------------+----------------------------------------------------------------
     sigma_u |  .64817924
     sigma_e |  .80641984
         rho |  .39248597   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. estimates store re

. hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re          Difference          S.E.
-------------+----------------------------------------------------------------
     lnlbit  |    1.672826     .1190934       1.553732        .7572818
  lnopenitt  |    .1546294      .303045      -.1484155        .3121944
     lniyit  |    .2611019     .4580253      -.1969234        .1481227
------------------------------------------------------------------------------
                           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(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =         4.22
                Prob>chi2 =       0.2384
```

```
. xtreg  lniyit lnyit lnpip  lnopenit instit, fe
note: lnpip omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =        29
Group variable: id                              Number of groups   =         4

R-sq:  within  = 0.0901                         Obs per group: min =
       between = 0.2154                                        avg =       6
       overall = 0.1530                                        max =

                                                F(3,245)           =      8.0
corr(u_i, Xb)  = -0.0120                        Prob > F           =    0.000

------------------------------------------------------------------------------
      lniyit |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval
-------------+----------------------------------------------------------------
       lnyit |   .0631208   .0226732     2.78   0.006     .0184615      .107
       lnpip |  (omitted)
    lnopenit |   .5040551   .1351037     3.73   0.000     .2379422    .77016
      instit |  -.0046392   .0041365    -1.12   0.263    -.0127869    .00350
       _cons |   .3185758   .5970078     0.53   0.594    -.8573468    1.4944
-------------+----------------------------------------------------------------
     sigma_u |  .55392482
     sigma_e |  .29155191
         rho |  .78306566   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(42, 245) =    24.75                 Prob > F = 0.000

. estimates store fe

. xtreg  lniyit lnyit lnpip  lnopenit instit, re

Random-effects GLS regression                   Number of obs      =        29
Group variable: id                              Number of groups   =         4

R-sq:  within  = 0.0897                         Obs per group: min =
       between = 0.2223                                        avg =       6
       overall = 0.1587                                        max =

Random effects u_i ~ Gaussian                   Wald chi2(4)       =     35.2
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.000

------------------------------------------------------------------------------
      lniyit |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval
-------------+----------------------------------------------------------------
       lnyit |    .068486   .0222275     3.08   0.002      .024921    .11205
       lnpip |   .0052072   .0400561     0.13   0.897    -.0733014    .08371
    lnopenit |   .5183595   .1119594     4.63   0.000     .2989231    .73779
      instit |  -.0035727   .0037305    -0.96   0.338    -.0108843    .00373
       _cons |   .1472693   .7668677     0.19   0.848    -1.355764    1.6503
-------------+----------------------------------------------------------------
     sigma_u |  .54885131
     sigma_e |  .29155191
         rho |  .77992322   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. estimates store re

. hausman fe re

                 ---- Coefficients ----
                |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
                |       fe           re       Difference          S.E.
----------------+----------------------------------------------------------------
       lnyit    |   .0631208     .068486      -.0053653        .0044737
    lnopenit    |   .5040551    .5183595      -.0143044         .075618
      instit    |  -.0046392   -.0035727      -.0010665        .0017873
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtre
            B = inconsistent under Ha, efficient under Ho; obtained from xtre

    Test:  Ho:  difference in coefficients not systematic

                  chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =          2.43
                Prob>chi2 =        0.4872
```

```
. xtreg  lnopenit geoi pop lnpopdnst  lntarit lnreerit, fe
note: geoi omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       386
Group variable: id                              Number of groups   =        43

R-sq:  within  = 0.1552                         Obs per group: min =         8
       between = 0.0807                                        avg =       9.0
       overall = 0.0526                                        max =         9

                                                F(4,339)           =     15.57
corr(u_i, Xb)  = -0.8822                        Prob > F           =    0.0000

------------------------------------------------------------------------------
    lnopenit |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        geoi |  (omitted)
         pop |   1.41e-08   7.64e-09     1.85   0.065    -8.92e-10    2.92e-08
   lnpopdnst |    .4427638   .2289834     1.93   0.054    -.0076435    .8931711
     lntarit |   -.0230039   .0326504    -0.70   0.482    -.0872268     .041219
    lnreerit |    .0625912   .0097633     6.41   0.000     .0433869    .0817955
       _cons |    2.137656    .777031     2.75   0.006     .6092469    3.666066
-------------+----------------------------------------------------------------
     sigma_u |   .97237129
     sigma_e |   .22722677
         rho |    .9482198   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(42, 339) =    28.33                 Prob > F = 0.0000

. estimates store fe

. xtreg  lnopenit geoi pop lnpopdnst  lntarit lnreerit, re

Random-effects GLS regression                   Number of obs      =       386
Group variable: id                              Number of groups   =        43

R-sq:  within  = 0.1052                         Obs per group: min =         8
       between = 0.0207                                        avg =       9.0
       overall = 0.0275                                        max =         9

Random effects u_i ~ Gaussian                   Wald chi2(5)       =     32.93
corr(u_i, X)       = 0 (assumed)                Prob > chi2        =    0.0000

------------------------------------------------------------------------------
    lnopenit |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        geoi |    .3569625    .131649     2.71   0.007     .0989352    .6149897
         pop |   -1.96e-09   2.44e-09    -0.80   0.421    -6.74e-09    2.82e-09
   lnpopdnst |    .0170871   .0468535     0.36   0.715    -.0747441    .1089182
     lntarit |   -.0359652   .0331671    -1.08   0.278    -.1009715    .0290412
    lnreerit |    .0486702   .0097392     5.00   0.000     .0295818    .0677587
       _cons |    3.823118   .2148559    17.79   0.000     3.402008    4.244228
-------------+----------------------------------------------------------------
     sigma_u |   .38071705
     sigma_e |   .22722677
         rho |   .73734527   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. estimates store re

. hausman fe re

Note: the rank of the differenced variance matrix (3) does not equal the number of co
        what you expect, or there may be problems computing the test.  Examine the ou
        and possibly consider scaling your variables so that the coefficients are on

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re       Difference          S.E.
-------------+----------------------------------------------------------------
         pop |    1.41e-08    -1.96e-09      1.61e-08        7.24e-09
   lnpopdnst |     .4427638     .0170871     .4256767        .2241387
     lntarit |    -.0230039    -.0359652     .0129613               .
    lnreerit |     .0625912     .0486702      .013921        .000686
------------------------------------------------------------------------------
                           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(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      412.59
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)

.
```

ANNEX 7: HETROSKEDASTICITY TEST

```
. reg  ei2 lnyit instit lnlbit  lnpip lnopenit
```

Source	SS	df	MS	Number of obs =	281
Model	98.4268263	5	19.6853653	F(5, 275) =	8.06
Residual	671.860016	275	2.44312733	Prob > F =	0.0000
				R-squared =	0.1278
				Adj R-squared =	0.1119
Total	770.286842	280	2.75102444	Root MSE =	1.5631

ei2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyit	-.2649941	.093616	-2.83	0.005	-.4492892	-.080699
instit	-.0431595	.0093935	-4.59	0.000	-.0616518	-.0246672
lnlbit	-.0831949	.103435	-0.80	0.422	-.2868199	.12043
lnpip	-.0930094	.0678124	-1.37	0.171	-.2265067	.0404879
lnopenit	.2098193	.2363893	0.89	0.376	-.2555432	.6751818
_cons	21.56876	2.003737	10.76	0.000	17.62415	25.51337

H_0: Homoskedastic residuals

H_1: Hetroskedasticity

Test statistic: $R^2(N(T-1)) = 0.1278(281(9-1)) = 287.2944$

Tabulated value

$\chi^2_{5,0.950} = 11.07$

As the test statistic is greater than the tabulated value we reject the null hypothesis of homoskedasticity.

```
. reg ei lnyit lnpip lnopenit instit
```

Source	SS	df	MS	Number of obs =	281
Model	1.35988889	4	.339972221	F(4, 276) =	9.83
Residual	9.54642072	276	.034588481	Prob > F =	0.0000
				R-squared =	0.1247
				Adj R-squared =	0.1120
Total	10.9063096	280	.038951106	Root MSE =	.18598

ei	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnyit	-.0316621	.0111078	-2.85	0.005	-.0535288	-.0097954
lnpip	-.0156358	.0058535	-2.67	0.008	-.0271591	-.0041126
lnopenit	.0337838	.0246872	1.37	0.172	-.0148153	.0823828
instit	-.0050028	.0011005	-4.55	0.000	-.0071691	-.0028364
_cons	4.527518	.1552943	29.15	0.000	4.221806	4.83323

H_0: Homoskedastic residuals

H_1: Hetroskedasticity

Test statistic: $R^2(N(T-1)) = 0.1247(281(9-1)) = 280.3256$

Tabulated value

$\chi^2_{4,0.950} = 12.81$

As the test statistic is greater than the tabulated value we reject the null hypothesis of homoskedasticity.

```
. reg ei2 geoi lnpop popdnst lntarit lnreerit
```

Source	SS	df	MS	Number of obs = 386
Model	1088.55151	5	217.710301	F(5, 380) = 2782.56
Residual	29.7315367	380	.078240886	Prob > F = 0.0000
				R-squared = 0.9734
Total	1118.28304	385	2.90463128	Adj R-squared = 0.9731
				Root MSE = .27972

ei2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
geoi	2.885037	.03028	95.28	0.000	2.8255	2.944574
lnpop	-.1885703	.0097595	-19.32	0.000	-.2077598	-.1693809
popdnst	.0008212	.0001269	6.47	0.000	.0005717	.0010707
lntarit	-.3348094	.0246968	-13.56	0.000	-.3833689	-.2862498
lnreerit	.4329049	.0059596	72.64	0.000	.421187	.4446229
_cons	17.69261	.1763408	100.33	0.000	17.34589	18.03934

H_0: Homoskedastic residuals

H_1: Hetroskedasticity

Test statistic: $R^2(N(T-1)) = 0.9734(386(9-1)) = 3005.8592$

Tabulated value

$\chi^2_{5,0.950} = 16.23$

As the test statistic is greater than the tabulated value we reject the null hypothesis of homoskedasticity.

ANNEX 8: TSET FOR SERIAL CORRELATION

```
. generate eidif = ( ei - ei_1)*( ei - ei_1)
(13 missing values generated)

. sum eidif

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
       eidif |        384    .0103115    .0498345   3.27e-11   .4422697

. sum ei2

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
         ei2 |        386    18.09184    1.704298   13.12444   23.63312

.
```

DW=0.00057

```
. xtgls  lnyit lnlbit  lnopenitt lniyit, panel(hetero) corr(ar1) force
(note: 2 observations dropped because only 1 obs in group)

Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   common AR(1) coefficient for all panels  (0.2755)

Estimated covariances      =        41          Number of obs      =       289
Estimated autocorrelations =         1          Number of groups   =        41
Estimated coefficients     =         4          Obs per group: min =         3
                                                                 avg =   7.04878
                                                                 max =         9
                                                Wald chi2(3)       =     40.22
                                                Prob > chi2        =    0.0000
```

lnyit	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnlbit	.1055905	.032908	3.21	0.001	.041092	.1700889
lnopenitt	.2254684	.1210787	1.86	0.063	-.0118414	.4627782
lniyit	.4363692	.0712688	6.12	0.000	.296685	.5760534
_cons	-2.478473	.9703016	-2.55	0.011	-4.380229	-.5767167

```
. xtgls lniyit lnyit pip lnopenitt instit, panel(hetero) corr(ar1) force
(note: 2 observations dropped because only 1 obs in group)

Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   common AR(1) coefficient for all panels  (0.8062)

Estimated covariances      =        41          Number of obs      =       289
Estimated autocorrelations =         1          Number of groups   =        41
Estimated coefficients     =         5          Obs per group: min =         3
                                                                 avg =   7.04878
                                                                 max =         9
                                                Wald chi2(4)       =     83.82
                                                Prob > chi2        =    0.0000
```

lniyit	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnyit	.0246599	.0108478	2.27	0.023	.0033986	.0459213
pip	1.90e-07	7.08e-08	2.68	0.007	5.10e-08	3.29e-07
lnopenitt	.5370963	.063449	8.47	0.000	.4127385	.6614541
instit	.0015671	.0021501	0.73	0.466	-.0026471	.0057812
_cons	-.1561029	.2753636	-0.57	0.571	-.6958056	.3835999

```
. xtgls  lnopenitt geoi lnpop popdnst lntarit lnreerit, panel(hetero) corr(ar

Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   common AR(1) coefficient for all panels  (0.7998)

Estimated covariances      =        43          Number of obs      =        38
Estimated autocorrelations =         1          Number of groups   =         4
Estimated coefficients     =         6          Obs per group: min =
                                                               avg =  8.97674
                                                               max =
                                                Wald chi2(5)       =    244.8
                                                Prob > chi2        =    0.000
```

lnopenitt	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval
geoi	.2055576	.0384684	5.34	0.000	.130161	.280954
lnpop	-.1691782	.0147411	-11.48	0.000	-.1980703	-.140286
popdnst	-.0003325	.0002141	-1.55	0.120	-.0007521	.000087
lntarit	-.0242287	.0131499	-1.84	0.065	-.050002	.001544
lnreerit	-.0181822	.0088204	-2.06	0.039	-.0354698	-.000894
_cons	6.933854	.2381249	29.12	0.000	6.467138	7.4005

Declaration

I, the undersigned, declare that this project is original work and has not been presented for a degree in any other university, and that all sorts of materials used for the project have been duly acknowledged.

Declared by:

Name _____

Signature _____

Date _____

Confirmed by:

Name _____

Signature _____

Date _____

Place and date of submission _____