CAUSALITY BETWEEN FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH: EVIDENCE FROM SUB-SAHARAN AFRICA

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF JIMMA UNIVERSITY IN PARTIAL FULFILLMENT OF THE AWARD OF DEGREE OF MASTER OF SCIENCE IN ECONOMIC POLICY ANALYSIS

BY

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UNDER THE GUIDANCE OF

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AND

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DECLARATION

I hereby declare that this thesis entitled "Causality between financial development and economic growth: evidence from sub-Saharan Africa", has been carried out by me under the guidance and supervision of Dr. Badassa Wolteji and Asst. Prof. Jibril Haji Ketebo.

The thesis is original and has not been submitted for the award of degree of diploma in any university or any other institution.

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ABSTRACT

The relationship between economic growth and financial development has been one of the most researched topics. Theoretically, there are three basic causal relationships between these two economic variables. These are finance-led growth, demand following and feedback relationship. Consensus is not also reached among researchers as far as empirical studies are concerned. The objective of this study is to examine the direction and significance of causality between these two variables. Economic growth is measured by annual growth rate of GDP while financial development is measured by broad money ratio to GDP. It uses panel data analysis for 24 sub-Saharan African countries for the period 2005-2014. GLS AR (1) regression model is used to correct for autocorrelation problem. After conducting for unobserved effects, we found that the causality between these two variables is bidirectional and the relationships are found to be negative.

Key terms: Causality, Economic Growth, Financial Development, Fixed effects, Random Effect, Sub-Saharan Africa

ACKNOWLEDGEMENT

Above all, my dearest gratefulness and adoration goes to the Almighty God for giving me the chance and all those exertions to complete this research work. Next, I am indebted to my advisor Dr. Badassa Wolteji for his valuable devotion in sharing his indispensable expertise and help for my every inquiries. I wish I had much more time to grasp more knowledge from you. Thirdly, my special gratitude goes to my co-advisor and economics department head at Jimma University, Jibril Haji Ketebo (Asst. Prof.). This study would not be completed without your key support and guidance.

My bigheartedly love goes to my father Hailu Ketema (Kes), my mother Mulu Weldegebriel and all the remaining family. It is because of you that I am here. Finally, I want to thank my friends Habtamu Legese, Endalkachew Bubamo, Terefe Admaw and Assefa Tafese who supported me to complete of this work.

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CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Financial development is said to occur when financial instruments and intermediaries are well established to mitigate the effects of information asymmetry, limited enforcement and transaction costs. This definition is basic but it is also narrow. At a broader level, financial development can be defined as improvement in the quality of five key functions: producing and possessing information about possible investments and allocating capital based on these assessments; monitoring individuals and firms and exerting corporate governance after allocating; facilitating trading, diversification and management of risks; mobilizing and pooling savings; and easing the exchanges of goods, services and financial instruments (Martin Cihak). When countries are compared with respect to this definition they are at different stages of development.

Even though the debates about the channels through which financial development helps economic growth continue, its importance is one of the issues which are under consensus. Financial development stimulates investment by mobilizing savings, by facilitating capital inflows and remittances. Technological progress can also be promoted by reducing transaction costs and making capital available for innovational activities (DFID, 2004). Financial development not only increases capital accumulation but also makes use funds more efficient (Jen-Te Hwang, 2010). Commercial banks and other financial institutions, for example, pool, distribute and reduce risks. Liquidity and information can also be increased due to the improvement in banking sector (Armenta). With weak financial regulation and supervision, however, credit to private sector and bank deposit, which are among the indicators of financial development in many literatures, can be negatively related to economic growth (Rym Avadi, 2013).

There are different theoretical frameworks related to financial development and economic growth. Two of them are interest group theory and legal theory of financial development. Interest group theory tries to explain that the role of financial liberalization and trade openness in reducing the influence of the interest group that oppose financial development. It says that foreign entry in the domestic goods and money markets reduces rents and creates more investment needs for

incumbents to counter competition and the advantage of new opportunities (Cagatay Bircan, 2013).

Legal theory of financial development, on the other hand, describes the reason why cross-country financial development differences occur. Legal traditions differ from one another in terms of degree of emphasis on the right of private property owners. Laws might also have differences on their ability to adapt to changing commercial and financial conditions. Therefore, the theory claims that historically determined legal traditions shape the today's financial development of countries (Levine, 2001).

As far as the empirical foundations are concerned, studies are intensively done on the relationship between financial sector development and economic growth with different objectives. One area of research was the impact of financial development on economic growth. In many studies that made impact analysis, it is found that financial sector efficiency has significant and positive impact on economic growth [see for example, (Chee Keong Choong)**;** (SAQIB, 2013)**;** (Petra Valickova, 2013)**]** while some others show that particular forms of financial development can result in lower growth rates [(Varuna Ramlala)**;** (Rissa, 2015)**]**.

The other focus area of the previous studies was the direction of causality between these two variables. With regards to this, many researches established unidirectional causality that runs from financial development to economic growth [(Dimitris K. Christopoulosa, 2003)**,** (Eggoh, 2009)**]**. On the other hand very few studies indicate a causality running from economic growth to financial development (Gonul Yuce Akinci, 2014). There are also studies that found bidirectional causality [for example, (Varuna Ramlal)**;** (Chrysost Bangake, 2009)**;** (Nicholas Apergis, 2007)]. Therefore, the causality between these two variables is still inconclusive. Causality that runs from financial development to economic growth is called *finance-led growth* while the reverse is called *demand following*. The bidirectional causality on the other hand is known as *feedback* relationship.

As far as sub-Saharan region is concerned, the issue is not well documented as it is often done in worldwide context especially that focus on cross country studies. Country specific studies are relatively abundant in this region. For example, (Kitenge, 2013) analyzed causality for South Africa data for the period 1966 to 2008. The result indicated that economic growth Granger causes financial development. It also found that there exists a long run and short run causal relationship from economic growth to bank assets. A study that (Bekana, 2016) has conducted, on the other

hand, concluded that financial sector has growth stimulating effect on Ethiopia Economy. Other studies also have covered the cases of individual countries but our focus is on cross country issues. Among the few studies on cross country, (Anthony Enisan Akinlo, 2010) examined the long run relationship between these two variables for ten sub-Saharan African countries by using the Vector Error Correction Model. The result shows that in four countries, financial development Granger causes economic growth while in one country demand following causal relationship is found. For other five countries bidirectional causality is established. The other few studies also show contrasting results.

The inconclusiveness of the issue demands even more studies. This research analyzes the causality between financial development and economic growth for sub-Saharan African region. Using panel data and panel diagnosis tests, the study examines the direction and sign of causality as it may have a significant policy implications. For example, if the causality runs from financial development to economic growth that obviously led us to the conclusion that finance must be given priority in economic growth strategy. The study supplements the shortage of cross-country studies in sub-Saharan African region by including many more countries.

1.2. Statement of the Problem

Despite the existence of many researches done on causality between economic growth and financial development, the results are mixed. Worldwide review conducted by (Juzhong Zhuang, 2009) shows that 50 percent of the literatures have found unidirectional causality while the rest show bidirectional relationship. These contrasting results themselves call for more of other researches. These differences may come even from slight methodological differences and even the types of data used.

From sub-Saharan African data many studies have been also done but most of them focused on single economy using mainly time series data analysis. To the best of my knowledge studies that focus on cross-country analysis are very few. (Anthony Enisan Akinlo, 2010) studied ten sub-Saharan African (SSA) countries using time series data for the period 1980-2005. It is found that the existence of bidirectional causality for Chad, South Africa, Kenya, Sierra Leone and Swaziland. For other countries, Central African Republic, Gabon, Nigeria, and Zambia, the result indicates unidirectional causality. (Ngongang, 2015) also analyzed the same issue in 21 SSA

countries using dynamic panel GMM technique. They found that there is a positive link between these two variables.

Our study, unlike many other studies on SSA data, uses panel data analysis and conducts tests that are more appropriate for this type of data which are discussed in detail in chapter three. Secondly, this research includes sufficiently as many countries as possible so that we can have better sample for sub-Saharan African region. Twenty four individual countries are included and the selection of these countries merely depends on availability of data.

Moreover, this research tries to address the possible model specification problems in previous studies. One thing, unobserved effects model has not been included in most of these studies. A given sample country can have its own unique characteristics because of history, culture, institutions and any other unique features which do not vary over time. Time by itself may also affect the variables through global business cycle. Therefore, these country and time specific cases must be controlled which many studies are lacking. Even those studies that have tried to address this problem used the method of differencing rather than including the unobserved effects model (Ngongang, 2015). Therefore, to address effects of these unique characteristics we include unobserved entity and time effects model.

Depending on the above values added on the existing literature, this research addresses the following questions. The first question to be addressed is whether the causal relationship exists between these two economic variables or not. If they have causal relationship, the sign and the direction of that causality will be the second question.

1.3. Hypothesis

With regard to causality between financial development and economic growth there are three likely theoretically supported results given that the causality exists. They are *finance-led growth*, *growth-driven finance* and *feedback* relationships. These theoretical explanations depend on the expectation that the causality exists and it would be positive. However, it may not work for all financial development indicators. Those researches that are in line with finance-led growth hypothesis reason out that the finance is leading factor the economy to revive. Growth-driven finance, on the other hand, suggests that when an economy grows it creates demand for finance and financial service arrangements. According to proponents of this theory, it is this demand that creates financial development. The feedback relationship is bidirectional causality by which

economic growth creates demand for financial development and this in turn drives economic growth.

This study expects positive unidirectional causality that runs from financial development to economic growth. Accordingly, it is hypothesized that as the ratio of broad money increases, the economy of sub-Saharan African region also grows.

1.4. Objective of the Study

The general objective of this study is to investigate the causality between financial development and economic growth in sub-Saharan African region. Accordingly, the specific objectives are the following.

(1) To study the direction of causality between these economic variables;
(2) To examine the significance of the causality given that causality exists.

1.5. Significance of the Study

These days financial development is attracting the policy makers' attention to stimulate growth. Specially, farmers and other smaller income owners are being included in small and medium financial services. Therefore, this research will indicate the research areas that the sub Saharan African practitioners and academicians can focus on. It is also supposed to become, as many other researches, to serve as policy reference for governmental and non-governmental institutions that work at sub-Saharan Africa level. Best policy must be based on both theoretical and empirical foundations. Thus, for those who want to make academic research on the issue, it also helps as a reference and encouraging tool to go deeper than this research covers.

1.6. Organization of the Study

The study is organized in five chapters including the current chapter of introduction. In Chapter Two literatures are reviewed where we systematically examine the previous studies done on the relationship between economic growth and financial development. Under this part, both empirical and theoretical frameworks are discussed. Chapter Three presents the methodology we followed which explains the model, the procedure, the data and method of analysis. In Chapter Four empirical data analysis is made based on diagnosis test results. Finally, in Chapter Five concludes the whole discussion and policy recommendations are also made.

CHAPTER TWO

REVIEW OF LITERATURE

2.1. Theoretical Literature Review

2.1.1. Theories Related to Economic Growth

In this part of the review, the existing theories about economic growth, especially classical and endogenous growth models, are shortly presented. For many endogenous models Solow growth model is a bench mark which is based on simplified classical assumptions. Therefore, here is to review what has been said about this model and how other endogenous growth models are explained in literatures.

Exogenous growth models do not explain technological progress from where it comes. The theory modeling starts from the fact that production depends on labor and capital like $Y = F(K, L)$ where Y stands for income, K for capital and L for labor (Solow, 1956). When we analyze the labor part of the model, what matters in the process is not simply labor but effective labor or effective number of workers. Efficiency of labor reflects knowledge of the society about production methods. In history, for example, the efficiency of labor rose when *assembly-line* transformed manufacturing in the early nineteenth century; and it arose again when computerization was introduced in the late twentieth century.

So the above equation becomes like $Y = F(K, L \times E)$ where $L \times E$ is effective labor. By assumption technological progress causes the efficiency of labor E to grow at some constant rate g. And this technology is free; it is publicly available as non-excludable and non-rival good (Rossi, 2011). This kind of technological progress is called labor augmenting, and g is called the rate of labor augmenting technological progress. Because the labor force L is growing at a rate of n and the efficiency of each unit of labor E is growing at a rate of g, the effective number of workers $L \times E$ is growing at rate $n + g$.

When technological progress is there and that progress is augmented into labor then the equilibrium (break-even) capital must be in such a way that must replace depreciating capital (δk), that must provide capital for new workers (nk), and that must provide capital for new effective workers created by technological progress (gk). This is denoted by the equation

$\Delta k = sf(k) - (\delta + n + g)k$ (Lewis, 1957). According to these theories total output grows at a rate of population growth plus effective labor of technology that is $n + g$ at steady state of an economy.

Endogenous growth models, however, try to endogenize technology which is unexplained in neoclassical growth models (or Solow model). Therefore, endogenous growth theory provides a theoretical framework for analyzing endogenous growth. It says growth is determined by the system governing the production process rather than by forces outside that system. This theory explains both growth rate and differentials across countries and a general proportion of the growth observed (Romer, 1990).

Despite their structural resemblance exogenous and endogenous growth models differ in their underlying assumptions and the conclusions drawn. Endogenous growth models do not accept the neoclassical assumption of diminishing marginal return to capital investments. They seek to explain the existence of increasing returns to scale and the divergent long term growth pattern among countries. Moreover, for them, exogenous changes in technology no more explains the long run growth rather technological policy based on monopolistically competitive system explains it.

2.1.2. Joseph Schumpeter's Theory on Economic Growth and Role of Finance

Joseph Schumpeter's Theory on Economic Growth and Development (1911), as reviewed by (Croitoru, 2012)**,** brought out the fact that the role of financial intermediation is at center for economic growth. In his explanation how financial transactions take central stage in economic growth, he did not use the modern definitions of financial transactions. Rather he used the bankers as an example. Bankers through their selection and funding of entrepreneurs, promote innovative activities and spur economic growth. For Schumpeter the importance of credit cannot be separated from entrepreneurial actions that is innovation (Croitoru, 2012). Banks are intermediary between those who demand capital and owners of capital. Therefore, as a bank issues a loan, it authorizes the implementation of the new combinations that make the whole society better off. In this regard banking activity stimulate economic growth (Mandiefe, 2015).

Schumpeter regards credit creation by banks as the main source of finance. They move capital from idle hands into the hands of an entrepreneur. Therefore, according to this theory, development of a country's financial sector development has positive influence on the level and rate of its per capita income (Raghuram G. Rajan, 1998).

Schumpeter's understanding on financial sector is that there is positive causality that runs from financial development to economic growth. Our research is also going to see whether this is valid for sub-Saharan African economy.

2.1.3. Theories of Legal Differences for Financial Development

These theories start from the fact that legal traditions differ in terms of the priority they give to private property rights. Since private property rights form the basis of financial development, historically determined differences in legal traditions explain financial development differences. For example, inflexible legal traditions produce gaps between legal capabilities and financial needs in an economy. The criticism of this theory is that it does not clearly show the channel by which legal effects of financial developments. Despite these criticisms, empirical results by (Levine, 2001) show consistency with these theories. Legal traditions differ in terms of the priority they attach to private property rights and this condition influences financial development of countries.

For example, the English Common Law used to protect private property owners against the crown which facilitated private contracting and financial development. In contrast the codification of the French and German civil codes in the 19th century under Napoleon and Bismarck solidified government dominance of the judiciary. Their civil law systems focused comparatively less on private property rights and more on the rights of the government. These legal traditions then spread through conquest and colonization all over the world (Weingast, 1989). According to this theory, therefore, differences in legal origin can importantly explain cross-country differences in financial development today.

Legal traditions also differ in terms of their abilities to adapt to changing commercial and financial conditions which is called legal adaptability channel (Levine, 2001). There is also political channel. Political channel focuses on the differences between Common and Civil Law countries. Legal-adaptability channel emphasizes the advantages of both the Common Law and the German Civil Law over the French Civil Law system. Furthermore, the political channel focuses on the power of the government relative to the judiciary. In this channel the Civil law has been an indication of a powerful State. For legal adaptability channel, however, the ability of the legal system to adapt to changing conditions is analyzed. It says that the crucial issue is not the power of the state rather it is how effectively legal traditions respond to growing commercial and financial conditions (Levine, 2001).

These theories actually focus on the historical laws by going centuries ago. Even recent time commercial laws can significantly affect the way the financial sector grows and contribute to economic growth. Moreover, whatever the channel through which these laws and conducts affect financial development, they determine economic growth among other things.

2.1.4. Interest Group Theory

Interest group theory is another theory related to financial development. Of course the theory is general but it can also be adapted to explain the financial development conditions of a country. Its central idea is that trade liberalization is a significant leading indicator of domestic financial liberalization. The theory starts by saying that there are interest groups that oppose financial development. Then it analyzes the role of trade and financial openness in reducing the influence of these groups. In a closed economy, it says, some groups benefit from financial repression and the resulting low financial development. Increasing both trade and capital account openness undermines this political and economic group. Foreign entry in the domestic goods markets reduces rents and creates competition. Opening up capital flows also renders financial repression increasingly impossible to implement. By analyzing empirically (Bircan, 2012) found a result against the theory that capital account liberalization or its interaction with trade is a leading indicator of domestic financial liberalization. They only found that product market liberalization is a leading indicator of domestic financial reform.

Generally speaking, the theory is pro free market economic system. Many African countries in general and sub-Saharan African countries in particular have liberalized their financial systems after Structural Adjustment Program (SAP). What can be different might be an Ethiopian case where the country opted not to liberalize the financial system. Ethiopian economy is much closed to the international business interactions. For instance, no foreign bank has been allowed; exchange rate is not flexible; some businesses are reserved for Ethiopians only i.e., non-citizens are not allowed to engage in these jobs. Moreover, the lion share of the banking sector in the country is owned by the public. However, the objective of this review is not to evaluate the effectiveness of any policy related to this theory rather it is to see the theory itself.

2.2. Empirical Literature Review

2.2.1. Financial Sector Development and Poverty Reduction

Poverty is one of the most serious problems of the whole world. The problem not only affects developing countries but also the developed world (Hafiz Ghufran Ali Khan, 2011). In contrast to the relationship of financial developments with economic growth its relation to poverty reduction is not that much studied (Sylviane G. Jeanneney, 2008). (Dhrifi, 2013) used simultaneous equation model on 89 countries over the period 1990-2011 to assess the effect of financial development on poverty reduction. The study decomposed the effect into direct effect and growth (indirect) effect. It finds that the indirect effect of financial development through economic growth is not robust. However, the direct effect of financial development through the channel of insurance, access to credit and saving services, is robust to reducing poverty. From developing countries data (Sylviane G. Jeanneney, 2008) also found similar result that the direct effect is stronger than the indirect effect. Moreover, they found that *McKinnon conduit effect* is most likely the main channel through which the poor benefits from financial development which is very similar result with (Kayode, 2014) that used the Nigerian data.

Contrary to these results the review made by (Juzhong Zhuang, 2009) indicates that many literatures reached a consensus that financial sector development contributes to poverty reduction; and a major channel is through economic growth. Higher growth benefits the poor by creating more jobs, enabling the government to allocate more fiscal resources on social spending. It can also directly supports poverty reduction by broadening the access to finance of the poor and vulnerable groups. Finance facilitates transactions; reduces the costs of remitting funds; provides the opportunity to accumulate assets and to smoothen consumption; and enables poor households to better cope with shocks, thus mitigating the risk of falling into poverty.

Researches like (Hafiz Ghufran Ali Khan, 2011) found results that support the hypothesis that economic growth depends on financial sector development and this growth then plays a positive role in poverty reduction. They suggested four mechanisms to improve financial development namely improving efficiency, increasing range, improving regulations and increasing accessibility of financial sector. They also consider Microfinance and Small and Medium Enterprise credit programs as effective instruments to improve poor households' economic and social welfare and reduce poverty.

(Sin Yu Hu, 2011) analyzed the causal relationship between financial development and poverty reduction in China using ARDL-Bounding testing procedure. In the short run the direction of causality is different for different proxy of financial development. In the long run, however, unidirectional causality from poverty reduction to financial development is found to be predominant. This means the ongoing processes of poverty reductions in China are likely to lead to further development of financial sector in the long run.

(Rewilak, 2013), in his PhD thesis, finds contrasting result with the evidence that economic growth is universally important for poverty reduction. His results also show that financial development helps incomes of the poor to increase in certain regions, whilst it may be detrimental to the poor's income in others.

2.2.2. African Financial Sector Development Overview

2.2.2.1. Banking Systems

Banking system in Africa consists of central banks and deposit taking institutions. According to (Franklin Allen, 2010) the Central Banks are technically independent of government control but in practice they work closely with the Ministries of Finance of their States and help formulate and implement macroeconomic policies. The deposit taking institutions are made up of local banks and branches or subsidiaries of foreign banks. Foreign banks have played an important role in banking development in Africa.

(Eugene Bempong Nyantakyi, 2015) review the banking system in Africa. They focus on depth, penetration of banks, efficiency and competitiveness in the banking industry. For financial deepening they used domestic credit to private sector as a percentage of GDP. Their review shows that the banking sector is much shallower and less penetrated than those major regions of the world. In comparison to other African regions sub-Saharan Africa has the shallowest financial depth.

2.2.2.2. Insurance Sector

The insurance industry in Africa is still in its infancy stage and is relatively undeveloped compared to other developing countries. (Scanz, 2016) make in-depth and structured telephone interviews with 28 senior executive of insurance companies in Africa. According to him a shortage of skilled and experienced professional is a key weakness limiting growth. According to (Franklin Allen, 2010) the auto insurance sector holds the largest portion of the market share in the continent. Non-

life insurance constitutes 85% of the industry premium. Even though it is in infant stage the insurance sector in Africa varies from a monopoly to a very competitive market. For instance, in Nigeria there are about 48 insurance companies. According to (PWC, 2014) South Africa is the number one insurance market on the continent. They actually made a review on insurance markets of South Africa, Nigeria and Kenya. They find out that the growing middle income class and improving literacy levels were mentioned as the top social changes impacting insurance growth.

2.2.2.3. Stock Markets

The stock market in Africa faces a serious challenge in terms of depth when it is measured by market capitalization and listing. The continent's market capitalization is covered by South Africa and Egypt. To make things worse the 2008 economic crisis highly affected the stock market (Franklin Allen, 2010)**.** (Franklin Allen, 2010) used two standards to measure liquidity of African stock markets. First, they measure the markets trading activity, relative to the size of the economy, by the total value of shares traded scaled by the total market capitalization. By both measures with the exception of South Africa and Egypt, stock markets in Africa are thin and illiquid. (Mahama, 2013), in his bachelor's degree thesis, found result in line with the above mentioned study by focusing on the performance of 15 African stock exchanges. Moreover, his results show that African stock markets have received little attention from foreign investors as there is the perception that the region is characterized by high volatility and lower investment returns.

In contrast to the above results (Massa, 2009) found that the African equity market had developed and expanded in a very short time before the 2008 financial crisis. She supported her idea by showing that there had been at least one African stock markets in the world every year since 1995. Moreover, according to her 2004 six African countries were among the world's 10 best performing stock markets. She also shows that the waves of global financial crisis have hit some of the key drivers of stock market development.

2.2.2.4. Microfinance

Microfinance has a long history in Africa in general and in sub-Saharan Africa in particular, initially organized in an informal setting; and it is recognized as a tool for poverty reduction in th continent. The industry has experienced high growth in recent years and is becoming an important driver in the development of the economies in Africa and continues to play a key role as a grassroots financial tool (Franklin Allen, 2010). Reports also indicate that microfinance grew in

Africa at a remarkable pace even at the highest of the crisis in 2008 (UNOSA, 2013). It, on the other hand, tried to show the existing challenges of the sector at micro, meso and macro level.

2.2.3. Effect of Financial Development on Economic Growth

The relationship between financial development and economic growth has been one of the most heavily researched topics in economics. Hundreds of studies have been written to conceptualize how the development and structure of an economy's financial sector affects domestic savings, capital accumulation, technology and income. The premise that financial sector development plays a vital role in facilitating economic growth is under consensus. And actually this consensus is supported by a large body of empirical evidences generated from cross country and country-specific studies. Moreover, the effects of financial development on growth in developing countries are more persistent and larger than those in developed countries (Juzhong Zhuang, 2009).

Generally speaking, the importance of finance in the economy can be summarized in to three functions. They are credit functions, liquidity provision functions and risk management functions (Martin Neil Baily, 2013). They also provide payment services, match savers and investors and generate and distribute information. This is of course elementary description and only tells theoretically why financial sectors exist. This part of the empirical review is going to assess the empirical foundations on the contribution of financial sector development to economic growth from real world data.

Many studies found positive and significant contribution of financial development to economic growth. However, their rationales by which this happens are also different. For instance, (Raghuram G. Rajan, 1989) show the importance of financial development for growth by reducing the cost of external finance to firms. It can also be a factor in determining the composition of an industry as well as its concentration. They also provide an evidence that financial market imperfections have an impact on investment and growth. They argue that financial market development is determined by historical accident or government regulation. It is because the costs imposed by a lack of financial development will favor incumbent firms over new entrants.

(Levine, 2004) reviewed theoretical and empirical works on the relationship between financial development and economic growth. The result of the review indicates that empirical analysis show a strong positive link between these two variables in the long run. Furthermore the evidences suggest that both financial intermediaries and markets matter for growth. From his review, the

reviewer recommends that further studies should be done on the determinants of financial development independently. (Juzhong Zhuang, 2009) also made a review for Asian Development Bank and drew similar conclusions. One broad conclusion they made from the review is that there are convincing arguments that financial sector plays vital role in facilitating economic growth and poverty reduction. The most important role is to reduce information, enforcement, and transaction costs. This can be achieved through a number of specific functions that the financial sector performs. These results, as to them, are supported from both cross-country and country specific studies.

(Malik, 2009) made analysis on the issue using a panel data set for 35 developing countries over the period 1970-2003. The basic methodological tool they used is a Vector Error Correction Model (VECM), which was used to examine the relationship between variables of financial sector and economic growth. They tested whether financial sector development affects economic growth through domestic capital accumulation. The result, however, finds that financial sector development affects per capita GDP mainly through its role in efficient resource allocation, rather than its effect on capital accumulation. This contradicts with the conclusion of (SAQIB, 2013) which says financial development should have a significant positive effect on economic growth as it fosters capital accumulation and leads to a productive gains.

(SAQIB, 2013) offers a broad analysis of the effect of development and efficiency of financial sector on economic growth for a group of selected developing countries using a cross-country data averaged over the period 2005-2009. It provides strong and robust support to the view that financial development is crucial for economic growth and the efficiency of the sector is potentially important for the long term growth performance of developing countries. The author recommendation is that importance of financial sector development should not be underestimated and it has to be one of the main strategies to achieve sustainable economic growth in the long term. Liberalization of the financial system, adoption of the internationally acceptable standards, strengthening of prudential regulation and supervision and training of the staff to manage and regulate these institutions are also recommended by the study as a tool for financial development.

One part of the world that pays higher attentions of the researchers is China since it has been experiencing faster economic growth and putting greater influence in the world economy and politics. (Jin Zuhuang, 2012) use data from 286 Chinese cities over the period 2001–2006 to

investigate the relationship between financial development and economic growth. Both traditional cross-sectional regressions and first-differenced and system GMM estimators for dynamic panel data suggest that most traditional indicators of financial development are positively associated with economic growth. Their result is in contrast to the existing conclusion that a state ruled banking sector hinders economic growth. Actually, this kind of conclusion emanates from the argument that government by itself is distorting body. They focus on the years after China's accession to the World Trade Organization (WTO) in 2001 and their finding suggests that the financial reforms that have taken place after China's accession to the WTO are in the right direction.

Therefore, what this section of the review indicates is that the importance of financial sector for economic growth is under consensus. However, the channels through which it helps better is still controversial. The two side arguments whether financial reforms can help economic growth or not is not also settled.

2.2.4. Causality between Financial Development and Economic Growth

This issue is the central objective of this study. Literatures suggest significant disagreements on the finance-growth relationship. Many economists argue that the financial markets highly contribute to economic growth. For example, finance has a prominent role in the endogenous growth theory through its positive impact on the levels of capital accumulation and savings or of technological innovation. This is *finance-led growth* hypothesis or *supply-leading* relationship. Others argue in other way as *enterprise leads then finance follows* in which finance does not cause growth; rather it responds to demands from the real sector. This is termed as *growth-led* or *demand following* relationship which says high economic growth creates demand for financial instruments and arrangements. Then financial markets respond to these changes (Juzhong Zhuang, 2009). The final view on the causality between finance and growth is *feedback* hypothesis. It says that a country with well-developed financial system can promote economic growth which in turn creates demand for extra improvement in financial arrangements.

Now let us have some empirical literatures to review on the above hypothesis and results that are concerned on cross-country and country-specific. (Chee Keong Choong) tried to analyze the causal relationship between these two variables in Malaysia. They used per capital nominal GDP for measuring economic growth and size and liquidity level of stock market for financial development. Their result supported finance-led growth hypothesis. Using the autoregressive distributed lag

approach they found that stock market development has significant and positive impact on economic growth. And this result does not support demand following hypothesis while it is in line with finance-led hypothesis.

(Varuna Ramlala) also analyzed this issue with similar objective but reached to different conclusion. They studied the causality of these two variables for Barbados, Jamaica and Trinidad and Tobago over the period 1970-2002. They measured financial development by the ratio of broad money to GDP, and the ratio of domestic credit to the private sector and GDP. Economic growth on the other hand is measured by per capita growth in real GDP. Their evidence supports the bi-directional causality but they also found a result that says particular forms of financial development might result in lower growth rates.

(Gonul Yuce Akinci, 2014) investigated the link between financial development and economic growth on the member countries of Organization for Economic Cooperation and Development (OECD) by using unbalanced panel data analysis. The financial sector development is measured by ratio of domestic credit (DC) to GDP, the banking sector as a percentage of GDP, the ratio of broad money (M_2) to GDP, the ratio of total bank deposits to GDP, and the ratio of financial system deposits to GDP. For economic growth percentage change of GDP in constant prices is used as proxy. They found that there is long run relationship between financial development and economic growth and there will be mutually reinforcing factors for each other. They recommend OECD member countries to take more measures to help increase financial development which results in more efficient allocation of funds and connections between savers and investors.

(Dimitris K. Christopoulosa, 2003) combined cross-sectional and time series data to examine the relationship between financial development and growth in ten developing countries among which Kenya is included from African continent. Most of these countries are from the Latin America. They used panel root tests and panel co-integration analysis; and they fail to find an evidence towards bidirectional causality. Another result is that there is no short run causality between financial deepening and output. Their result only supports the long run unidirectional causality from financial depth to economic growth.

(Chrysost Bangake, 2009) also has investigated the issue by taking 71 countries as a sample from both developed and developing countries over the period 1960-2004. They use panel unit root tests, and panel co-integration analysis and find strong evidence that there is long run relationship

between financial development and economic growth for all groups of countries. This relationship is also found to be strong bidirectional. Furthermore, their results show that the magnitude of causal relationships depends upon the income level of countries. The causal relationship running from finance to growth seems to be stronger in low income countries than in middle and high income countries. This suggests that financial reforms can have favorable impact on economic growth in low income countries. These results have important policy implications. Policies aiming at improving economic growth might promote financial development and financial markets policies have to take the financial aspects of economic growth in to consideration.

2.2.5. Evidences from Sub-Saharan Africa

Sub-Saharan African region constitutes the larger part of African continent and its socioeconomic characteristics are not significantly different from other African regions. Since we made a review on African financial sector status in general we here shall focus on only few studies.

(Anthony Enisan Akinlo, 2010) examined the long run causal relationship between financial development and economic growth for ten sub-Saharan African countries. They used multivariate Granger causality test within the context of VECM framework. They used the ratio of broad money to GDP as a proxy of financial development. As many literatures do they also measure economic growth by per capita real output. They detected long run co-integration among the variables for all ten countries. For some countries (Chad, South Africa, Kenya, Sierra Leone and Swaziland) bidirectional causality is found. In Central African Republic, Congo Republic, Gabon, and Nigeria the VECM shows unidirectional causality running from financial development to economic growth. In Zambia, on the other hand, the causality runs from economic growth to financial development.

As to (Kisu Simwaka, 2012) Granger causality test results, economic growth drives financial development with no feedback effects in Malawi. They also found that finance-growth nexus is long run phenomenon. Apart from the econometric analysis, they descriptively explain the existing financial development stage of the country. Like in many African countries the financial sector in Malawi is among the world least developed. Using annual time series data and autoregressive distributed lag (ARDL) technique (Mercy J. Kiprop, 2015) examine this issue for Kenyan economy. Their results revealed that financial development exerts a positive and significant effect

on economic growth in Kenya hence confirming supply leading hypothesis. This was confirmed both in the short-run as well as in the long-run regression results.

The Ethiopian case is also addressed by many studies that have focused on country-specific analysis. Among them (Bekana, 2016) analyzed whether financial sector development drives economic growth in the post-communist economy of the country. His study concludes that financial sector development has a growth stimulating effect in Ethiopian economy. However, as to the study result, the financial sector development did not reach the minimum level to support the long run economic growth. He suggested that the regulatory and supervisory framework for financial sector should be strengthen to ensure public confidence and improve the contribution of the financial sector to the economy growth.

The results of the above reviews can be summarized in to three major parts. Firstly, financial development, by whatever means, is an important factor for economic growth processes. This premise is under consensus. Secondly, the causality between these two variables is still controversial both worldwide and for sub-Saharan African particular case. The results might be demand-following, growth-led or feedback (two way) relationship. This condition demands new studies to be done that can more explain the changing conditions of the financial system. Thirdly, apart from conflicting results, researches on these issues are very few in sub-Saharan Africa especially that are based on cross-country analysis. This study addresses the causality between financial development and economic growth using Generalized Least Square (GLS) estimation technique for twenty four countries from sub-Saharan African region. The study also addresses country specific and time effects.

CHAPTER THREE

METHODOLOGY

3.1. Data Type, Source and Description

As the success of any econometric analysis depends on accuracy of data, it is essential to discuss about the source and nature of data. For this study, all of the data are taken from World Bank (WB) open data source. We use panel type of data that contains 24 sample of individual countries from sub-Saharan Africa over 10 year period which covers from 2005 to 2014. Sample countries which are included in this study are Benin, Botswana, Burundi, Cameroon, Central Africa Republic, Chad, Democratic Republic of Congo, Cote d'Ivoire, Djibouti, Ethiopia, Ghana, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Seychelles, Sudan, Swaziland, Tanzania and Uganda. The inclusion of these countries is purely dictated by availability of data.

Panel data represent a nexus of time series and cross-section data. Because of several major advantages over conventional cross-sectional or time series data sets, panel data analysis is widely used in economic studies. Panel data usually gives a researcher a large number of data points, therefore improves the efficiency of econometric estimates. More importantly, it allows a researcher to analyze a number of important economic questions that cannot be addressed using cross-sectional or time series data sets. Besides, panel data is advantageous to construct and test more complicated behavioral models than purely cross-sectional or time series data (Hsiao, 2003).

3.2. Estimation Technique

With the existence of serial correlation Ordinary Least Squares (OLS) estimators can be statistically inefficient or give misleading inferences. Therefore, we use Generalized Least Squares (GLS) estimation technique so that the coefficients become efficient.

The GLS technique works by transforming the original model then using the OLS technique (Gujarati, 2004). Let us take the simple model $Y_{it} = \beta_0 + \beta_1 X_{it} + \varepsilon_{it}$ with the existence of serial correlation which is the case of our model. The lagged value of the above model becomes:

$$Y_{t-1} = \beta_0 + X_{i,t-1} + \varepsilon_{i,t-1}$$

The lagged model is multiplied by the correlation coefficient between residuals in $AR(1)$ process denoted by ρ.

$$\rho Y_{t-1} = \rho\beta_0 + \rho X_{i,t-1} + \rho\varepsilon_{i,t-1}$$

Then the lagged model that is multiplied by ρ is subtracted from the original model which gives:

$$Y_{it} - \rho Y_{t-1} = \beta_0 - \rho\beta_0 + \beta_1 X_{it} - \rho X_{i,t-1} + \varepsilon_{it} - \rho\varepsilon_{i,t-1}$$

Let us generalize the above model as follows

$$Y_{it}^* = \beta_0^* + \beta_{it}^* X_{it}^* + \varepsilon_{it}^*$$

Then the Ordinary Least Square (OLS) estimation technique is applied so that we get Best Linear Unbiased estimators. This is how the GLS model works.

3.3. Model Specification

The model that this study uses is adopted from (Dimitris K. Christopoulosa, 2003) with some adjustments and inclusion of more variables. Firstly, we include the effects of country and time specific effects. Secondly, we also include the scenario that whether the nations have secondary markets or not. We also use different data source and different sample countries. The general model is specified as follows.

$$y_{it} = \beta_0 + \beta_1 F_{it} + \beta_2 S_{it} + \beta_3 P_{it} + \beta_4 H_{it} + \beta_5 A_{it} + a_i + a_t + u_{it}$$

where y_{it} is gross domestic product in country i and year t; F_{it} is a measure of financial development (broad money ratio to GDP); S_{it} is the share of gross domestic capital formation to nominal GDP; P_{it} is inflation measured by consumer price index; H_{it} is human capital; A_{it} is dummy for existence of secondary market 1=for those who have stock market and 0=for those who do not have stocks markets; a_i is country specific effects; a_t is time fixed effects; and u_{it} is an error term. Since the direction of causality is not yet clear until the test is conducted, we shall also specify the model.

$$F_{it} = \beta_0 + \beta_1 y_{it} + \beta_2 S_{it} + \beta_3 P_{it} + \beta_4 H_{it} + \beta_5 A_{it} + a_i + a_t + u_{it}$$

Therefore, we do not have unique dependent variable. Rather percentage of GDP growth and broad money ratio variables are endogenous to the model while other variables are exogenous. By using

the same kind of symbol for coefficients we do not mean that they are technically similar for both models rather it is simply to reduce characters.

3.4. Diagnosis Tests

3.4.1. Tests for Fixed and Random Effect

One of the adjustments of this research from the original model is that it uses unobserved effects. There may be country specific and time invariant factors that cannot be observed. These unobservable factors like historical or institutional set ups may affect the outcome variable. Moreover, the time may also be a factor. In this case, the estimators become biased and inconsistence as consequence of an omitted variable. If these factors are correlated with one of the independent variables then the model becomes fixed effects model. Fixed effects remove the effect of those time invariant characteristics so we can assess the net effect of the explanatory variables on the dependent variables.

If these factors are uncorrelated with each of the explanatory variables but still affect the dependent variable then the model becomes random effects model (Wooldridge J. M., 2013). The crucial distinction between fixed and random effects is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not (Greene, 2008).

To decide between fixed or random affects we will run a (Hausman, 1978) test where the null hypothesis is that the preferred model is random effects and the alternative hypothesis is that of fixed effects. It basically tests whether the unique errors are correlated with the regressors where the null hypothesis say they are not correlated. Therefore, the study will conduct this test to decide whether to use fixed or random effects model.

3.4.2. Testing for Unit Roots

One of the issues in the regression analysis is stationarity. This is the concept that tells how the covariance between a variable and its lagged values is. In AR (1), theoretically, we have two kinds of non stationarity namely homogenous non-stationarity (unit root) and explosive non-stationarity (explosive root). In explosive root a shock to a system becomes more and more as time goes and this is not seen in real life (Gujarati, 2004). Unit root, on the other hand, is said to exist if a shock has exact effect in the coming period. We need stationarity process where the effect of a previous

value of a variable dies out as time goes. This is because when there is unit root there would be spurious relationship between variables. In this case the ordinary t and F tests loses their values.

We use IPS test (Kyungo Ima, 2003) to check whether each variables have unit root or not. The model considers a sample of N cross section (24 countries for this case) observed over T time period (10 years in this case). Suppose that the stochastic process, Z_{it} is generated by the first order autoregressive process:

$$Z_{it} = (1-\theta_i)\mu_i + \theta_i Z_{i,t-1} + \varepsilon_{it}, \text{ i=1,…, N; t = 1,…, T}$$

Where initial values, Z_{i0}, are given. The interest of the model is to test the null hypothesis of unit roots $\theta_i = 1$ for all i. Let us express it as different form:

$$Z_{it} - Z_{i,t-1} = (1-\theta_i)\mu_i + \theta_i Z_{i,t-1} - Z_{i,t-1} + \varepsilon_{it}$$

$$\Delta Z_{it} = (1-\theta_i)\mu_i + (\theta_i - 1)Z_{i,t-1} + \varepsilon_{it}$$

$$\Delta Z_{it} = (1-\theta_i)\mu_i - (1-\theta_i)Z_{i,t-1} + \varepsilon_{it}$$

$$\Delta Z_{it} = \alpha_i \mu_i + \beta_i Z_{i,t-1} + \varepsilon_{it}$$

Where $\alpha_i = (1-\theta_i)$ $\beta_i = -(1-\theta_i)$ and ΔZ_{it} $Z_{it} - Z_{i,t-1}$. The null hypothesis of unit roots then becomes $H_0 : \beta_i = 0$ for all i against the alternatives $H_A : \beta_i = 0$; where i = 1, 2, …, N_1, $N_1 + 2$, …, N with alternative hypothesis β_i to differ across groups. This test also allows for some (but not all) of the individual series to have unit roots under the alternative hypothesis.

3.5. Description of Variables

Living standards of current generation is very different from that of the predecessors. This is because as people have more income they consume greater amount of goods and services which makes them better off. National income which is measured by Gross Domestic Product (GDP) has been used as a popular measure of standards of an economy. The growth of national output has been indicating how this standard of the economy is changing i.e. how the economy is growing. In this study, economic growth is measured by annual percentage growth rate of GDP.

Financial development, on the other hand, can be measured by different variables. The most popular measures in the literature are ratio of private credit to GDP, ratio of bank deposit to GDP and ratio of broad money to GDP. For this research, broad money ratio to GDP is used to measure the financial development. Existence of secondary markets is also included as a dummy variable

as additional indicator of financial sector development. Because we are using simultaneous equation model, both GDP growth and broad money ratio appear as dependent and independent variable in turn in the specification.

At any moment, the capital stock is a key determinant of economic output (Mankiw, 2010). Consequently, changes in determinants of capital stock can affect economic growth. Therefore, this model includes gross capital formation per GDP. The two main determinants of capital accumulation are investment and depreciation. Investment causes the capital stock to rise while depreciation causes the capital stock to fall since it is the wearing out of old capital. Investment per worker (let it be i) equals sy where s is saving rate and y national income per worker. Then $i = sf(k)$ where $f(k)$ is production function which depends on the existing capital. If we assume that a certain fraction δ of the capital stock wears out each year then the amount of capital that depreciates each year is δk where k is capital stock per worker. Therefore, the change in the capital accumulation would be as follows.

$$\Delta k = i - \delta k$$

$$\Delta k = sf(k) - \delta k$$

Another very important variable included in this model is overall price changes, inflation. In macroeconomics, price level is defined as weighted average of several prices (Jochumzen, 2010). When prices rise it might indicate higher demand which may stimulate production or it may also have negative impact on growth. It can be measured by different indices; some of them are consumer price index (CPI), producer price index (PPI), core index and GDP deflator. The two main popular indices are CPI and GDP deflator. GDP deflator is the ratio of nominal GDP to real GDP.

$$GDP\ deflator = \frac{Nominal\ GDP}{Real\ GDP}$$

CPI, on the other hand, is the price of goods and services relative to the price of the same basket in some base year, i.e.

$$CPI = \frac{\sum_{i=1}^{n}[Number\ of\ X_i \times Pc_i]}{\sum_{i=1}^{n}[Number\ of\ X_i \times P_{bi}]}$$

where X_i is i^{th} type of consumer good, P_{ci} is the current price of X_i and P_{bi} is the base year price of X_i. To take the advantage that consumer price index includes the prices of imported goods in to consideration, this study is going to use CPI to capture rate of inflation.

Human capital development is another variable. It may affect the process of economic growth and even the financial sector development. It will be measured by total enrollment in tertiary education expressed as a percentage of the total population of the five-year age group following on from secondary school leaving.

CHAPTER FOUR

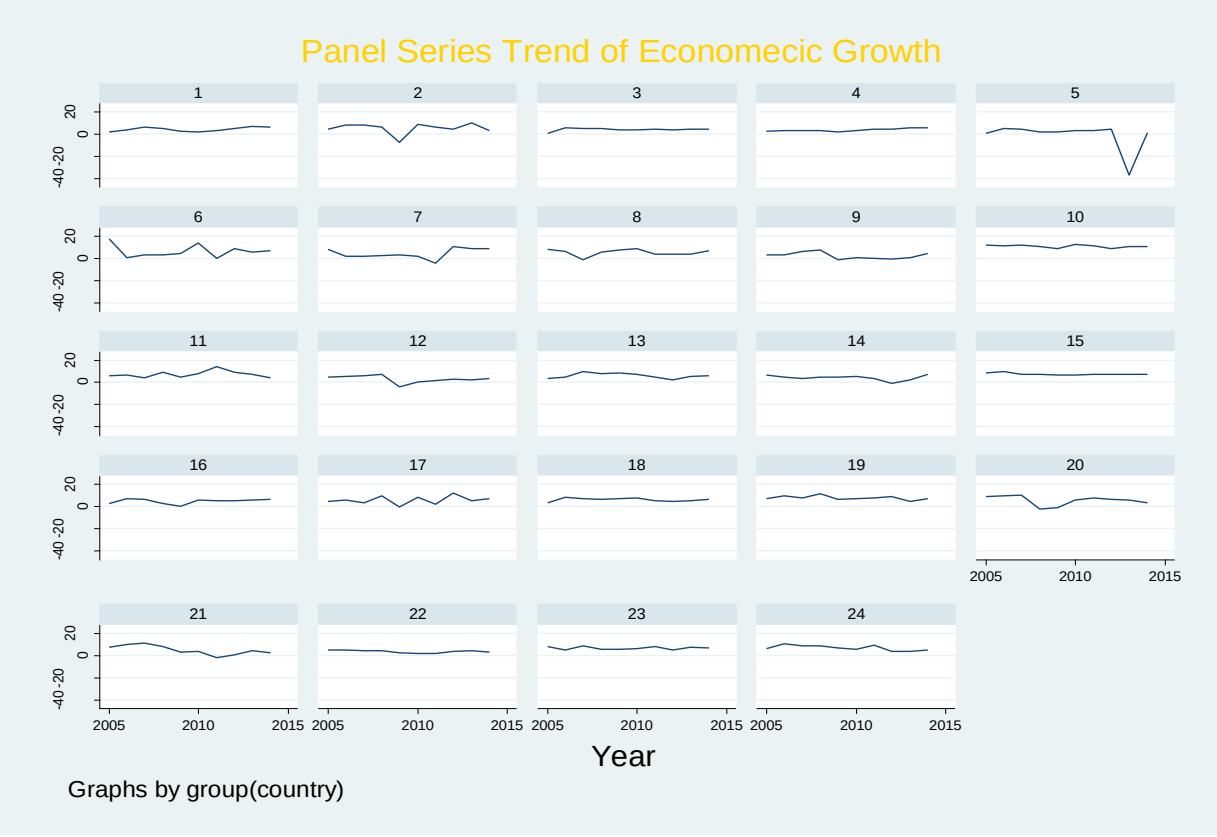
EMPIRICAL ANALYSIS

Under this chapter we present empirical results. In the first part, descriptive analysis is discussed briefly followed by results of diagnosis test results. Final discussion under this chapter is econometrics estimation results which are actually conditional on diagnosis test results.

4.1. Descriptive Analysis

Economies of sub-Saharan African countries are growing at rate of around 5% annually. There are some countries that experienced negative economic growth like Djibouti and double digit economic growth such as Ethiopia and Sudan which means that the general trend follows fluctuating pattern. This trend is depicted in **Figure 1** below for the period between 2005 and 2014 and sample countries are coded in numbers (**Appendix I**).

Figure 1: Panel Trend of Economic Growth



Generally, the sub-Saharan African economy for this specified period has grown on average by 5.17 annually with standard deviation of 4.3. This indicates that although the average growth of economies of these countries seems satisfactory, there is considerable variation among countries. The worst growth rate was that of central Africa which was registered in 2013 while the best growth rate was that of Chad in 2005. The variation of the ratio of broad money to GDP is also high with the standard deviation of 17.66 while the mean is 29.71. This means that broad money ratio varies from one country to another on average by 17.66. Regarding inflation rate the average rate is around 8 percent but still some countries have registered higher inflation rates as presented in **Table 1**.

Table 1: Summary Statistics

Variables	Mean	Std. Dev.	Min	Max
$\mathbf{Y_{it}}$	5.174448	4.303574	-36.69995	17.33253
Fit	29.71225	17.66501	4.530351	96.76787
Sit	23.13325	8.984397	0	55.36268
Pit	7.896653	7.286483	-8.97474	44.39128
Hit	6.272439	4.614907	0.46957	27.51322

It is also important to discuss summary of variables included in the model for each of the sample countries. As **Table 2** below shows there is significant variation of economic growth and financial development both among countries and through time. The mean shows the average values of each variable while standard deviation indicates how much values deviate from the mean within that period for particular sample country.

Particular to Ethiopian case the average economic growth in the given period is the highest and far better rate in the region which is about 10.69. The variation of this rate is also the second lowest next to Mozambique which shows the country is in a good position as far as volatility of the growth process is concerned. The country is also among the highest ratio of broad money to GDP holders. However, average inflation is also the second highest rate in the region under consideration next to Sudan. This might significantly negatively affect the growth process and compromise the positive impact of financial development on economic growth.

Table 2: Summary Statistics for Each Country

Country Name		Y_{it}	F_{it}	S_{it}	P_{it}	H_{it}
Benin	**Mean**	4.229823	32.46219	22.93386	3.220829	10.6957
	Std. Dev.	1.923924	5.874913	3.467317	2.773951	3.511939
Botswana	**Mean**	5.192347	45.65144	33.9778	8.121028	17.21355
	Std. Dev.	4.993858	4.730179	5.277608	2.46673	6.387454
Burundi	**Mean**	4.08389	24.51584	26.08859	10.62431	2.958571
	Std. Dev.	1.261754	1.882361	3.029232	6.463323	0.6762409
Cameroon	**Mean**	3.707905	19.64322	18.91795	2.748463	10.34921
	Std. Dev.	1.32412	2.057541	1.263876	1.483731	3.58181
CAR	**Mean**	-1.114958	19.16726	11.92617	5.865043	2.330277
	Std. Dev.	12.58123	5.290794	2.266852	7.356805	0.5171034
Chad	**Mean**	6.363821	11.35614	27.43862	3.726364	2.255082
	Std. Dev.	5.540531	2.27789	5.218719	7.386189	0.6422104
DRC	**Mean**	5.164359	9.487707	24.84879	4.118281	6.184736
	Std. Dev.	3.02231	2.818422	6.811567	2.337077	1.454038
Cote d'Ivoire	**Mean**	4.254359	29.54757	13.08971	2.605066	7.972644
	Std. Dev.	4.601874	6.042879	4.649796	1.884004	1.632602
Djibouti	**Mean**	2.270062	83.42938	28.17508	4.324634	4.040169
	Std. Dev.	2.960869	5.160218	6.891775	2.87981	1.573414
Ethiopia	**Mean**	10.69388	37.87569	14.12805	17.49544	5.748097
	Std. Dev.	1.224973	4.036171	18.30662	12.49934	2.33896
Ghana	**Mean**	7.317894	28.96824	25.19608	12.82356	9.918325
	Std. Dev.	3.013954	2.939822	3.991028	3.520523	3.62782
Madagascar	**Mean**	2.929681	23.05423	23.81682	9.476087	3.655648
	Std. Dev.	3.229821	1.493076	8.637129	3.635803	0.6107651
Malawi	**Mean**	5.805049	19.93381	17.99251	14.24942	0.681792
	Std. Dev.	2.346924	5.599147	5.303358	7.595825	0.1729973
Mali	**Mean**	4.130748	24.01012	20.96537	3.066879	5.777427
	Std. Dev.	2.263522	2.964636	2.587387	3.008094	1.152513

Mozambique	**Mean**	7.48145	35.6364	28.52608	7.470281	3.525219
	Std. Dev.	1.041175	8.708021	16.86864	4.120656	1.424648
Namibia	**Mean**	4.747076	52.20675	25.20184	5.989097	9.575826
	Std. Dev.	2.202969	10.07484	3.654288	2.109523	1.929989
Niger	**Mean**	5.713405	18.26966	32.46364	2.535549	1.529203
	Std. Dev.	3.684761	4.568573	6.792436	3.948418	0.4912235
Nigeria	**Mean**	6.039925	25.03029	12.25386	10.79121	10.19769
	Std. Dev.	1.530456	8.690772	4.13666	3.502551	0.7461074
Rwanda	**Mean**	7.683717	17.60097	22.44606	7.308637	5.393455
	Std. Dev.	1.762268	1.566143	3.907648	4.12271	1.895506
Seychelles	**Mean**	5.540048	66.15372	33.09987	8.75833	3.61379
	Std. Dev.	4.295521	15.52758	4.626406	13.8265	1.614671
Sudan	**Mean**	4.921705	21.61089	23.34486	18.88618	14.49358
	Std. Dev.	4.242146	2.407259	4.18978	11.90063	1.528235
Swaziland	**Mean**	3.577718	23.08276	17.07037	6.911933	5.553972
	Std. Dev.	1.266301	2.524743	2.485487	2.483684	0.8169218
Tanzania	**Mean**	6.587983	23.34128	27.51537	9.062624	2.5468
	Std. Dev.	1.363139	0.9769255	5.113254	3.56108	0.8405832
Uganda	**Mean**	6.864851	21.05836	24.7773	9.340415	4.327759
	Std. Dev.	2.408478	1.48753	2.44734	4.884019	0.8309165

* CAR = Central African Republic * DRC = Democratic Republic of Congo

4.2. Specification Test Results

4.2.1. Unit Root Test

Unit root test is one of the mechanisms of testing non-stationarity. Among other many alternative panel unit root tests, this research uses IPS test from Ima-Pesaran-Shin (Kyungo Ima, 2003). The null hypothesis under this test is that all panel contain unit root while the alternative hypothesis says that some panes are stationary. The result indicates that Y_{it} and P_{it} are stationary at integration of order one while gross capital formation is integrated of order two. Broad money ratio and human capital are integrated of order three.

Table 3: Unit Root Test Results

Variable	W-t bar		
	Statistic	P-value	Level of Integration
Fit ***	-4.2423	0.0000	I(3)
Yit *	-6.1329	0.0000	I(1)
Sit **	-3.7075	0.0001	I(2)
Pit *	-7.9567	0.0000	I(1)
Hit ***	-8.3956	0.0000	I(3)

4.2.2. Hausman Test

As has been described in the methodology part, the study used two models. The first model takes annual GDP growth as dependent variable while the second model takes broad money ratio to GDP as dependent variable. Therefore, we made Hausman test for these models independent to check whether to use fixed effects or random effects model. For both models random effects model is found to be appropriate as presented as follows.

Table 4: Hausman Test Results

Y_{it} as Dependent Variable				
Variable	Coefficients		Difference	SE
	FE	RE		
Fit	-0.1465484	-0.1465517	3.23e-06	0.017187
Sit	0.108312	0.1108063	-0.0024944	0.0250623
Pit	0.0398813	0.034607	0.0052743	0.0240565
Hit	0.1125853	0.1131067	-0.0005215	0.0638207
Chi^2 (4) = 0.06				
Prob. > Chi-Squared = 0.9996				

F_{it} as Dependent Variable				
Variable	**FE**	**RE**	**Difference**	**SE**
Yit	-.4466798	-.446243	-.0004368	.0527208
Sit	-.1270336	-.1230127	-.0040209	.0439212
Pit	-.1772413	-.1776342	.0003929	.0419068
Hit	-.1591144	-.1634438	.0043294	.1118602
Chi^2 (4) = 0.01				
Prob. > Chi-Squared = 1.0000				

4.2.3. Heteroscedasticity Test

The assumption of homoscedasticity says that the conditional variance of the residual term is the same for all the explanatory variables. To test the existence of heteroscedasticity problem we conduct Breusch-Pagan test where we regress the squared residual[1] on independent variable and we compare the chi-squared statistics with the tabulated value (Pagan, 1979).

From the auxiliary regression of the residual squared on the explanatory variables (**Appendix VI**) it is found that the probability of overall significance of chi-squares to be 0.6614 for model I and 0.7893 for model II which means that both of these auxilliary regression models are insignificant. Therefore, we fail to reject the null hypothesis that says conditional variance of the residual is constant for both models. Thus, the assumption of homoscedasticity is fulfilled.

4.2.4. Serial Correlation

Existence of serial correlation in linear panel data model biases the standard errors that causes the results to be less efficient. Accordingly, identifying serial correlation is one of the basic specification tests in panel data analysis. Even though there are many other tests available, this study conducted Wooldridge test for autocorrealtion in panel data (Wooldridge J. M., 2002). The null hypothesis in this test says that there is no first order autocorelation. The test results show that

[1] $Var(e_i) = E[e_{it} - E(e_{it})]^2$ but from classical linear regression assumption $E(e_{it}) = 0$. Therefore, $Var(e_{it}) = E[e_{it}]^2$.

there is serious serial correlation problem among the error terms in model I as the hypothesis is strongly rejected while there is no autocorrelation in model II (**see Appendix VII**).

4.3. Empirical Results

As we are working on causality between financial development and economic growth we use two regression models. **Model** I takes economic growth variable, annual growth of gross domestic product, as dependent variable while **model II** uses financial development indicator, broad money ratio to GDP, as dependent variable. Both models consider the above diagnosis test results before the estimation technique is chosen.

The first diagnosis test was unit root test that helps to know in what order each of the variable is stationary. The result shows that $\mathbf{Y_{it}}$ and $\mathbf{P_{it}}$ are stationary at order one so we use their first differenced values for the estimation. $\mathbf{S_{it}}$ is stationary at order two so we use second differenced values and $\mathbf{F_{it}}$ and $\mathbf{H_{it}}$ are stationary of order three so we use their third differenced values for both regression analysis.

The Hausman test shows that random effects model is appropriate for both regression models. However, with serious autocorrelation problem the traditional random effects GLS models may result in biased standard errors and hence inefficient estimators. The first model suffers from serial correlation problem while there is no such a problem in the second model. Therefore, it is expected to use appropriate regression model that produces robust standard error estimators in **model I**. To do so, there are alternative techniques depending on the type of the problem. Since our problem is only serial correlation we use random effect GLS with AR (1) disturbances regression for the first model.

According to the result, in model I, broad money ratio and gross capital formation ratio have statistically significance effect on economic growth while inflation, human capital and existence of stock market are insignificant. When the ratio of gross capital formation to GDP increases by one, then economic growth increases by around 0.112.

On the other hand, an increase in broad money ratio to GDP, financial development indicator, has decreasing effect on economic growth. This is consistent with (Rym Avadi, 2013) that have found

that financial development, measured by credit to private sector and bank deposit ratio, can be negatively related to economic growth with under poor financial management. As ratio of broad money to GDP increases by one, economic growth decreases by around 0.13.

One reason for this result might be that many economic growths of sub-Saharan African countries come from rural agriculture production. Basically, these agricultural activities are not based on highly developed financial requirements rather they are functions of household labor decision processes. The increase in money base that could have inflationary effect could negatively affect the household decisions of agricultural production. In that way economic growth might have been compromised. Other contributors for economic growth in developing countries are small and medium business enterprises. These business organizations in many sub-Saharan African countries are not easily getting credit and other financial services. Therefore, the increase in monetary base is actually played by foreign financial organizations and businesses. Therefore, the result might not be because monetization of an economy is bad for growth of the economy but because these financial benefits are not gained by economic agents that are engine to the economic growth in the region.

Table 5: Random Effects GLS AR (1) Estimation Result (Model I)

$Y_{it}(1)$	Coefficient	Std. Err.	z	P>|z|	[95% Conf. Interval]	
$F_{it}(3)$	-0.130793	0.0421488	-3.10	0.002	-0.2134032	-0.0481829
$S_{it}(2)$	0.1117848	0.062232	1.80	0.072	-0.0101876	0.2337572
$P_{it}(1)$	0.0741582	0.0605341	1.23	0.221	-0.0444864	0.1928028
$H_{it}(3)$	0.0945044	0.1616791	0.58	0.559	-0.2223808	0.4113895
A_{it}	-0.9515975	1.498249	-0.64	0.525	-3.888111	1.984916
Cons	0.4973197	1.103566	0.45	0.652	-1.66563	2.66027
Wald Chi^2 (6) = 19.32						
Prob. > Chi-Squared = 0.0037						

The second regression model takes financial development as dependent variable. Since this model does not have serial correlation problem, we do not use autoregressive disturbance process unlike we did for the first model. It is also found to be overall significant. The result shows that economic growth and inflation rate have negative and significant effect on financial development. GDP growth is significant at 1% level of significant while inflation is significant at 10% level of significance. When inflation rate increases by one broad money ratio to GDP decrease by 0.18.

As economic growth increases by one then broad money ratio to GDP decreases by around 0.45. This result is also unexpected by the researcher. The possible reason is that as the economy grows which, as has been said, is the effect of agricultural production increases demand for money. This demand for money is accompanied by new small household investments which decreases the proportion of money which has termed as monetary base.

Table 6: Random Effects GLS Estimation Result (Model II)

Fit(3)	**Coefficient**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf. Interval]**	
Y_{it}(1)	-0.446243	0.1325398	-3.37	0.001	-0.7060162	-0.1864698
S_{it}(2)	-0.1230127	0.1091689	-1.13	0.260	-0.3369798	0.0909544
P_{it}(1)	-0.1776342	0.0977865	-1.82	0.069	-0.3692922	0.0140238
H_{it}(3)	-0.1634438	0.2799265	-0.58	0.559	-0.7120897	0.3852021
A_{it}	-0.2284197	1.53261	-0.15	0.882	-3.232281	2.775441
Cons	0.0494862	1.127219	0.04	0.965	-2.159822	2.258795
Wald Chi^2 (5) = 19.78						
Prob. > Chi-Squared = 0.0014						

From these two regression results it is found that the causality between economic growth and financial development is bidirectional but negative which shows that financial development negatively contributes to economic growth in sub-Saharan African countries and vice versa.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. Summary and Conclusion

The objective of this study was to investigate the direction and sign of causality between economic growth and financial development. Economic growth is measured by broad money ratio to GDP and economic growth by percentage change of annual gross domestic product. The model was simultaneous model that takes economic growth and financial development as dependent variable in two equations and it was adopted from (Dimitris K. Christopoulosa, 2003) with some modifications. We used panel type of secondary data from World Bank.

Given that the estimations have serial correlation problem we used autoregressive order one disturbances model to get robust standard errors in Model I. After Hausman test random effects model was opted for both models. The first model estimation result shows that financial development has negative impact on economic growth. From model II it is found that economic growth has also negative impact on financial development. This implies that the causality between financial development and economic growth is bidirectional and negative.

Our conclusion is that broad money ratio as measure of financial development and economic growth in sub-Saharan Africa failed to positively contribute to each other. The descriptive analysis also shows that the variation of both variables through time and among countries is significantly high. For Ethiopian case though it has achieved the highest rate of economic growth and relatively high broad money ratio it had also one of the highest rate inflation.

5.2. Recommendation

It is important financial services to be inclusive so that they can positively contribute to economic growth. Therefore, from the results we have gotten, we recommend that policy makers must concern on agricultural sector and other small and micro enterprises which are the major engines of growth in sub-Saharan Africa region. Many financial institutions in the region are private (and foreign based) where they are accessed only by the rich and the middle income households while these groups are minority in least developing countries particularly sub-Saharan Africa. This condition is increasing the income gap which might also compromise economic growth. For this

reason policy makers in the respective countries of the region can work to make financial services more accessible for the poor.

Moreover, inflation was found to have negative relationship with financial development which might also have negative indirect impact on economic growth. Therefore, economic authorities in the region and policy makers of the respective countries should focus on price stability. It is also suggested policy makers to work on regulating interest rate which might compromise role of supply of money to economic growth by discouraging investment.

With regard to Ethiopian case we have seen that the country was doing well in registering higher and continuous economic growth. The average broad money ratio to GDP was also high compared to other countries in the region. However, it has suffered from higher inflation. The major recommendation we can give here is that the country has to have stable prices especially that of consumer prices so that the increase in broad money ratio positively contribute to economic growth.

5.3. Future Research Direction

The results of this study highly deviate from what other studies have found. Therefore, other researchers are welcomed to the same issue but with different data set and diversified financial development indicators. Although broad money ratio to GDP is one of the indicators of financial development, it is better to use other indicators like bank asset ratio, domestic credit to private sector. Moreover, the importance of finance (especially microfinance) for economies to grow in the region can be a good research area. The analysis of stage (or level) and challenges of financial development of sub-Saharan African region can also be one of the future research direction.

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APPENDIXES

Appendix I

Codes for Sample Countries

Country	Code
Benin	1
Botswana	2
Burundi	3
Cameroon	4
Central Africa Republic	5
Chad	6
Democratic Republic of Congo	7
Cote d'Ivoire	8
Djibouti	9
Ethiopia	10
Ghana	11
Madagascar	12
Malawi	13
Mali	14
Mozambique	15
Namibia	16
Niger	17
Nigeria	18
Rwanda	19
Seychelles	20
Sudan	21
Swaziland	22
Tanzania	23
Uganda	24

Appendix II

Summary Statistics

```
. xtsum yit fit sit pit hit countryname
```

Variable		Mean	Std. Dev.	Min	Max	Observations	
yit	overall	5.174448	4.303574	-36.69995	17.33253	N =	240
	between		2.250739	-1.114958	10.69388	n =	24
	within		3.694006	-30.41055	16.14316	T =	10
fit	overall	29.71225	17.66501	4.530351	96.76787	N =	240
	between		17.15159	9.487707	83.42938	n =	24
	within		5.380807	11.30569	60.32639	T =	10
sit	overall	23.13325	8.984397	0	55.36268	N =	239
	between		6.364689	11.92617	33.9778	n =	24
	within		6.479769	9.005202	49.96985	T-bar =	9.95833
pit	overall	7.896653	7.286483	-8.97474	44.39128	N =	240
	between		4.57885	2.535549	18.88618	n =	24
	within		5.737289	-4.804452	36.10308	T =	10
hit	overall	6.272439	4.614907	.46957	27.51322	N =	240
	between		4.213455	.681792	17.21355	n =	24
	within		2.052486	-1.775034	16.57211	T =	10
countr~e	overall	12.5	6.936653	1	24	N =	240
	between		7.071068	1	24	n =	24
	within		0	12.5	12.5	T =	10

```
. sum yit fit sit pit hit
```

Variable	Obs	Mean	Std. Dev.	Min	Max
yit	240	5.174448	4.303574	-36.69995	17.33253
fit	240	29.71225	17.66501	4.530351	96.76787
sit	239	23.13325	8.984397	0	55.36268
pit	240	7.896653	7.286483	-8.97474	44.39128
hit	240	6.272439	4.614907	.46957	27.51322

Appendix III

Unit Root Test Results

```
. xtunitroot ips  yit, lags(aic 1) demean

Im-Pesaran-Shin unit-root test for yit
------------------------------------------

Ho: All panels contain unit roots          Number of panels  =     24
Ha: Some panels are stationary             Number of periods =     10

AR parameter: Panel-specific               Asymptotics: T,N -> Infinity
Panel means:  Included                                  sequentially
Time trend:   Not included                 Cross-sectional means removed

ADF regressions: 0.17 lags average (chosen by AIC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 W-t-bar              -6.1329        0.0000
------------------------------------------------------------------------------
```

```
. xtunitroot ips  fit, lags(aic 3) demean

Im-Pesaran-Shin unit-root test for fit
------------------------------------------

Ho: All panels contain unit roots          Number of panels  =     24
Ha: Some panels are stationary             Number of periods =     10

AR parameter: Panel-specific               Asymptotics: T,N -> Infinity
Panel means:  Included                                  sequentially
Time trend:   Not included                 Cross-sectional means removed

ADF regressions: 1.92 lags average (chosen by AIC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 W-t-bar              -4.2423        0.0000
------------------------------------------------------------------------------
```

```
. xtunitroot ips  sit, lags(aic 2) demean

Im-Pesaran-Shin unit-root test for sit
-----------------------------------------

Ho: All panels contain unit roots          Number of panels       =     24
Ha: Some panels are stationary             Avg. number of periods =   9.96

AR parameter: Panel-specific               Asymptotics: T,N -> Infinity
Panel means:  Included                                  sequentially
Time trend:   Not included                 Cross-sectional means removed

ADF regressions: 0.67 lags average (chosen by AIC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 W-t-bar              -3.7075        0.0001
------------------------------------------------------------------------------

. xtunitroot ips  pit, lags(aic 1) demean

Im-Pesaran-Shin unit-root test for pit
-----------------------------------------

Ho: All panels contain unit roots          Number of panels  =     24
Ha: Some panels are stationary             Number of periods =     10

AR parameter: Panel-specific               Asymptotics: T,N -> Infinity
Panel means:  Included                                  sequentially
Time trend:   Not included                 Cross-sectional means removed

ADF regressions: 0.54 lags average (chosen by AIC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 W-t-bar              -7.9567        0.0000
------------------------------------------------------------------------------
```

```
. xtunitroot ips  hit, lags(aic 3) demean

Im-Pesaran-Shin unit-root test for hit
------------------------------------------

Ho: All panels contain unit roots          Number of panels  =     24
Ha: Some panels are stationary             Number of periods =     10

AR parameter: Panel-specific               Asymptotics: T,N -> Infinity
Panel means:  Included                                  sequentially
Time trend:   Not included                 Cross-sectional means removed

ADF regressions: 2.25 lags average (chosen by AIC)
```

	Statistic	p-value
W-t-bar	-8.3956	0.0000

Appendix V

Hausman Test for Model I: $Y_{it}(1)$ as Dependent Variable

```
. xtreg yit1 fit3 sit2 pit1 hit3 ait, fe
note: ait omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       168
Group variable: countryname                     Number of groups   =        24

R-sq:  within  = 0.1043                         Obs per group: min =         7
       between = 0.0436                                        avg =       7.0
       overall = 0.1036                                        max =         7

                                                F(4,140)           =      4.07
corr(u_i, Xb)  = -0.0098                        Prob > F           =    0.0037
```

yit1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
fit3	-.1465484	.046798	-3.13	0.002	-.2390706	-.0540263
sit2	.108312	.0670595	1.62	0.109	-.0242682	.2408921
pit1	.0398813	.0614462	0.65	0.517	-.0816011	.1613637
hit3	.1125853	.1725754	0.65	0.515	-.2286056	.4537762
ait	0	(omitted)				
_cons	-.073045	.4687642	-0.16	0.876	-.9998171	.853727
sigma_u	.56201293					
sigma_e	6.0696552					
rho	.00850074	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(23, 140) =     0.06                 Prob > F = 1.0000

. estimate store fe
```

```
. xtreg yit1 fit3 sit2 pit1 hit3 ait, re

Random-effects GLS regression                   Number of obs      =       168
Group variable: countryname                     Number of groups   =        24

R-sq:  within  = 0.1042                         Obs per group: min =         7
       between = 0.1798                                        avg =       7.0
       overall = 0.1049                                        max =         7

                                                Wald chi2(5)       =     18.99
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0019
```

yit1	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
fit3	-.1465517	.0435277	-3.37	0.001	-.2318644	-.061239
sit2	.1108063	.0622001	1.78	0.075	-.0111036	.2327163
pit1	.034607	.0565413	0.61	0.540	-.0762119	.1454258
hit3	.1131067	.1603409	0.71	0.481	-.2011556	.4273691
ait	-.4097041	.8777671	-0.47	0.641	-2.130096	1.310688
_cons	.1502642	.6458743	0.23	0.816	-1.115626	1.416155
sigma_u	0					
sigma_e	6.0696552					
rho	0	(fraction of variance due to u_i)				

```
. estimate store re

. hausman fe re
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
fit3	-.1465484	-.1465517	3.23e-06	.017187
sit2	.108312	.1108063	-.0024944	.0250623
pit1	.0398813	.034607	.0052743	.0240565
hit3	.1125853	.1131067	-.0005215	.0638207

```
                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(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =        0.06
            Prob>chi2 =      0.9996
```

Hausman Test for Model II: Fit (3) as Dependent Variable

```
. xtreg fit3 yit1 sit2 pit1 hit3 ait, fe
note: ait omitted because of collinearity

Fixed-effects (within) regression               Number of obs      =       168
Group variable: countryname                     Number of groups   =        24

R-sq:  within  = 0.1092                         Obs per group: min =         7
       between = 0.0569                                        avg =       7.0
       overall = 0.1087                                        max =         7

                                                F(4,140)           =      4.29
corr(u_i, Xb)  = -0.0158                        Prob > F           =    0.0026
```

fit3	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
yit1	-.4466798	.1426404	-3.13	0.002	-.7286875	-.1646722
sit2	-.1270336	.1176729	-1.08	0.282	-.3596793	.1056121
pit1	-.1772413	.1063878	-1.67	0.098	-.3875758	.0330932
hit3	-.1591144	.3014491	-0.53	0.598	-.7550954	.4368667
ait	0	(omitted)				
_cons	-.0743008	.8184401	-0.09	0.928	-1.692401	1.543799
sigma_u	.85963409					
sigma_e	10.596724					
rho	.00653786	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(23, 140) =     0.05                 Prob > F = 1.0000

. estimate store fe
```

```
. xtreg fit3 yit1 sit2 pit1 hit3 ait, re

Random-effects GLS regression                   Number of obs      =       168
Group variable: countryname                     Number of groups   =        24

R-sq:  within  = 0.1092                         Obs per group: min =         7
       between = 0.0702                                        avg =       7.0
       overall = 0.1088                                        max =         7

                                                Wald chi2(5)       =     19.78
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0014
```

fit3	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
yit1	-.446243	.1325398	-3.37	0.001	-.7060162	-.1864698
sit2	-.1230127	.1091689	-1.13	0.260	-.3369798	.0909544
pit1	-.1776342	.0977865	-1.82	0.069	-.3692922	.0140238
hit3	-.1634438	.2799265	-0.58	0.559	-.7120897	.3852021
ait	-.2284197	1.53261	-0.15	0.882	-3.232281	2.775441
_cons	.0494862	1.127219	0.04	0.965	-2.159822	2.258795
sigma_u	0					
sigma_e	10.596724					
rho	0	(fraction of variance due to u_i)				

```
. estimate store re

. hausman fe re
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
yit1	-.4466798	-.446243	-.0004368	.0527208
sit2	-.1270336	-.1230127	-.0040209	.0439212
pit1	-.1772413	-.1776342	.0003929	.0419068
hit3	-.1591144	-.1634438	.0043294	.1118602

```
                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(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                       =         0.01
             Prob>chi2 =       1.0000
```

Appendix VI

Heteroscedasticity Test

Model I

```
. xtreg eit2 fit3 sit2 pit1 hit3 ait

Random-effects GLS regression                   Number of obs      =       168
Group variable: countryname                     Number of groups   =        24

R-sq:  within  = 0.0028                         Obs per group: min =         7
       between = 0.0839                                        avg =       7.0
       overall = 0.0220                                        max =         7

                                                Wald chi2(5)       =      3.25
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.6614
```

eit2	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
fit3	.2990189	1.085887	0.28	0.783	-1.829281	2.427319
sit2	.446834	1.552325	0.29	0.773	-2.595668	3.489336
pit1	1.25767	1.41269	0.89	0.373	-1.511152	4.026492
hit3	-.8501076	4.000652	-0.21	0.832	-8.691241	6.991025
ait	-35.73234	23.65459	-1.51	0.131	-82.09448	10.6298
_cons	50.02314	17.40596	2.87	0.004	15.90809	84.13819
sigma_u	20.89778					
sigma_e	134.78301					
rho	.02347541	(fraction of variance due to u_i)				

Model II

```
. xtreg Rit2 yit1 sit2 pit1 hit3 ait

Random-effects GLS regression                   Number of obs      =       168
Group variable: countryname                     Number of groups   =        24

R-sq:  within  = 0.0053                         Obs per group: min =         7
       between = 0.0748                                        avg =       7.0
       overall = 0.0293                                        max =         7

                                                Wald chi2(5)       =      2.41
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.7893
```

Rit2	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
yit1	-1.297528	3.195993	-0.41	0.685	-7.561561	4.966504
sit2	-.8457429	2.635355	-0.32	0.748	-6.010944	4.319458
pit1	1.555747	2.375973	0.65	0.513	-3.101074	6.212568
hit3	1.356827	6.753014	0.20	0.841	-11.87884	14.59249
ait	88.57928	67.67493	1.31	0.191	-44.06114	221.2197
_cons	45.91893	49.79742	0.92	0.356	-51.68221	143.5201
sigma_u	139.22762					
sigma_e	238.87618					
rho	.25356839	(fraction of variance due to u_i)				

Appendix VII

Serial Correlation Test

Model I

```
. xtserial fit3 sit2 pit1 hit3 ait, output

Linear regression                               Number of obs =       144
                                                F(  3,    23) =      5.56
                                                Prob > F      =    0.0051
                                                R-squared     =    0.0692
                                                Root MSE      =    18.807

                        (Std. Err. adjusted for 24 clusters in countryname)
------------------------------------------------------------------------------
             |               Robust
      D.fit3 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sit2 |
         D1. |  -.1490006   .1422544    -1.05   0.306    -.4432762    .1452751
             |
        pit1 |
         D1. |  -.3613818   .1017573    -3.55   0.002    -.5718828   -.1508808
             |
        hit3 |
         D1. |  -.2717354    .270781    -1.00   0.326    -.8318885    .2884177
             |
         ait |
         D1. |           0  (omitted)
------------------------------------------------------------------------------

Wooldridge test for autocorrelation in panel data
H0: no first order autocorrelation
    F(  1,      23) =     24.605
           Prob > F =      0.0001
```

Model II

```
. xtserial yit1 sit2 pit1 hit3 ait, output

Linear regression                               Number of obs =       144
                                                F(  3,    23) =      0.66
                                                Prob > F      =    0.5878
                                                R-squared     =    0.0554
                                                Root MSE      =    10.087

                                (Std. Err. adjusted for 24 clusters in countryname)
------------------------------------------------------------------------------
             |               Robust
      D.yit1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        sit2 |
         D1. |   .1302722   .1030918     1.26   0.219    -.0829893    .3435337
             |
        pit1 |
         D1. |   .1300611   .1301578     1.00   0.328    -.1391908     .399313
             |
        hit3 |
         D1. |   .0902882     .29284     0.31   0.761    -.5154974    .6960738
             |
         ait |
         D1. |           0  (omitted)
------------------------------------------------------------------------------

Wooldridge test for autocorrelation in panel data
H0: no first order autocorrelation
    F(  1,      23) =      2.721
           Prob > F =      0.1126
```

Appendix VIII

Estimation Results

Model I

```
. xtregar yit1 fit3 sit2 pit1 hit3 ait, re

RE GLS regression with AR(1) disturbances       Number of obs      =       168
Group variable: countryname                     Number of groups   =        24

R-sq:  within  = 0.1016                         Obs per group: min =         7
       between = 0.1292                                        avg =       7.0
       overall = 0.0997                                        max =         7

                                                Wald chi2(6)       =     19.32
corr(u_i, Xb)      = 0 (assumed)                Prob > chi2        =    0.0037
```

yit1	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
fit3	-.130793	.0421488	-3.10	0.002	-.2134032	-.0481829
sit2	.1117848	.062232	1.80	0.072	-.0101876	.2337572
pit1	.0741582	.0605341	1.23	0.221	-.0444864	.1928028
hit3	.0945044	.1616791	0.58	0.559	-.2223808	.4113895
ait	-.9515975	1.498249	-0.64	0.525	-3.888111	1.984916
_cons	.4973197	1.103566	0.45	0.652	-1.66563	2.66027
rho_ar	-.35240548	(estimated autocorrelation coefficient)				
sigma_u	0					
sigma_e	7.1300793					
rho_fov	0	(fraction of variance due to u_i)				
theta	0					

Model II

```
. xtreg fit3 yit1 sit2 pit1 hit3 ait, re

Random-effects GLS regression                   Number of obs      =       168
Group variable: countryname                     Number of groups   =        24

R-sq:  within  = 0.1092                         Obs per group: min =         7
       between = 0.0702                                        avg =       7.0
       overall = 0.1088                                        max =         7

                                                Wald chi2(5)       =     19.78
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0014
```

fit3	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
yit1	-.446243	.1325398	-3.37	0.001	-.7060162	-.1864698
sit2	-.1230127	.1091689	-1.13	0.260	-.3369798	.0909544
pit1	-.1776342	.0977865	-1.82	0.069	-.3692922	.0140238
hit3	-.1634438	.2799265	-0.58	0.559	-.7120897	.3852021
ait	-.2284197	1.53261	-0.15	0.882	-3.232281	2.775441
_cons	.0494862	1.127219	0.04	0.965	-2.159822	2.258795
sigma_u	0					
sigma_e	10.596724					
rho	0	(fraction of variance due to u_i)				