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HUMAN CAPITAL, FINANCE AND ECONOMIC GROWTH IN SUB-SAHARAN AFRICA

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Human Capital, Finance and Economic Development in Sub-Saharan Africa

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ABSTRACT

Several researches has investigated separately the impact of human capital and financial sector development economic growth in sub Saharan African countries. Therefore, it is important to investigate their interactive effect in the Sub Saharan African countries using recent panel data set. This research examines the impact of human capital and financial development on economic growth in a cross-country analysis. The empirical research used a dynamic panel data model to analyze annual data of 26 countries from several Sub-Saharan African countries between the period 2010 - 2020. The result show that GDP per capita growth rate is positively correlated with gross fixed capital formation, total trade, and labor force, pupil to teacher ration primary and pupil to teacher ratio secondary. On the other hand, GDP per capita growth rate is negatively correlated with domestic credit to private sector, domestic credit to private sector by bank, general government final consumption expenditure, inflation, and secondary school enrollment. Regarding the interaction effect of Human capital and financial development, the interaction effect has significant and positive effect on GDP per capita growth. The researcher concluded that skilled human power with the support of finance will boost productivity and this resulted in increasing the level of economic growth. Human capital with the support of financial development in the form of domestic credit to private sector enhanced economic development. Finally, the government should facilitate credit for education to improve the GDP per capita growth in each country. If there is available credit to schools, students and private sectors, there will be advanced education with full equipment and human resource, and this in return generate skilled work force. Generally, the government should develop a strategy that interlinks educational and financial institutions.

Keywords: Human Capital, Financial Development, Economic Growth, Interaction Effect, Sub-Saharan Africa, Dynamic Panel Data

Declaration

This is to certify that the thesis prepared by Tesfamariam Desie entitled " **Human Capital, Finance and Economic Development in Sub-Saharan Africa** "submitted in partial fulfillment of the requirement for the degree of Master of Science in economic policy analysis for the graduate program complies with the regulations of the university meets the accepted standards with respect of originality and equity.

Signed by the examining committee:

Examiner:_____; Signature: _____; Date: _____

Examiner: **Sisay Debebe (PhD)** ; Signature:  ; Date: 13/07/2023

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CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Achieving rapid and sustainable economic growth is the objective of Sub-Saharan African countries. Various economic factors, such as inflation, money supply, exchange rate, industrial production index, foreign direct investment, interest rate, human resources (active population, investing in human capital), financial sector development, etc., have an impact on the nation's ability to grow economically. Political and social frameworks, economic freedom, human capital and institutions all affect productivity and efficiency (Faith and Semmanda, 2020).

Economic development is a broader concept than gross domestic product (GDP) economic growth. It is a multifaceted concept that includes social and economic development as well as other welfare indicators such as education attainment rate, infant mortality rate and life expectancy. Human resource investments and human capital are expected to raise individuals productivity, and hence increased higher economic growth (Montiel, 2011). Economic growth in emerging countries is positively affected by the development of human capital and the financial sector development (Aaqibet al., 2020).

Human capital may affect economic growth through the channel of innovation and along with financial development could be complementary or substitute in their relationship to economic growth (Ahmad et al 2021; Botev, 2019). People with higher levels of education are less risk-averse, have many information, and high savers (Ibrahim, 2018; Zhang et al., 2021).When people's educational level improves, especially higher education level, they are empowered and have more options. Education gives people to have access for financial services and helps them to transfer from the informal to the formal sector. High levels of literacy will also help people to understand and demand financial products; hence favorably affect savings and investment. (Muhamad et al., 2018).

Human capital, which includes both knowledge and skills, is influenced by factors including education, health, and nutrition (Ogundari & Awokuse, 2018). In the literature, education, health, training, and other investments in people are used to define human capital. The role of human capital in the process of economic growth has been extensively investigated since the mid- to late

1980s, when the new growth theory (endogenous growth theory) emerged (Christensen et al., 2020). Endogenous growth theory, popularized by Romer (1986) and Lucas (1988), argues that endogenous factors in the economy, such as human capital and knowledge base, helps production per capita to rise over time. According to this theory, human capital creates new kinds of technology and efficient manufacturing, both of which contribute to economic development.

A well-developed and efficient financial system, in addition to human capital, favorably affect economic development. The financial system may help the economic development by increasing human and physical capital, allocating money to the most productive activities, and minimizing the cost of saving and investing resources (Khan et al., 2020). Financial sector development is crucial for the economic development of a country because it helps to reduce risk through well-organized risk management process , monitor transactions through proper regulatory institutions to enhance efficient market, effective utilization of savings by minimizing cost of transactions and access to financial institutions and ease trade by exchanging goods and services (Levine 1997). Financial sector development has a major impact on economic growth, as can be seen by the recent continuous growth rates of global development indicators (WDIs) utilized in various areas (Ibrahim, 2018).

Recent research has examined the existence of a strong financial system in a country, and the majority of findings show that it enhances economic development. Many studies have been conducted on the relationship between financial development and economic growth (Batuo et al. 2018, Bist; 2018, Asteriou & Spanos, 2019, Appiah et al. 2020). Financial institutions acquire and assess data, distribute investable funds to the most lucrative investment opportunities, and promote capital formation.

The impact of human capital and financial sector development on the economic growth of Sub Saharan African countries have been studied by different scholars. However, most of the researches has investigated separately the impact of human capital and financial sector development economic growth in the region. Therefore, it is important to investigate their interactive effect in the Sub Saharan African countries using recent panel data set.

1.2 Statements of the Problem

Development of an economy requires educated and skilled manpower as well as well-developed financial sector. Various studies have shown the impact of human capital and financial sector development on economic growth. Human capital is favorably associated with economic development (Li & Liang,2010 ; Neeliah & Seetanah,2016; Munir &Arshad, 2018; Rosenda Silva et.al 2018). Contrary to certain findings, education does not necessarily promote economic progress.

Many empirical data on economic growth in Sub Saharan African countries concentrate on technological development and human capital, with education serving as a proxy for human capital. According to Mincer (1981), human capital contributes to the growth of a nation like personal human capital contributes to an individual's growth. Mincer expanded his argument with the statement that increasing human capital was both a prerequisite for and a result of economic progress. In addition to being complementary to or substituting for financial development in their relationship to economic growth, human capital may have an impact on economic growth through the channel of innovation (Ahmad et al. 2021; Botev, 2019).

In addition to being complementary to human capital development in their relationship to economic growth, financial intermediaries may have an impact on economic growth. The establishment and development of financial institutions, markets and instruments creates favorable condition for investments as well as economic progress and hence, for poverty reduction. In order to bring structural change and welfare gain to the overall economy, the development of financial sector instills efficiency in the system (Biplab & Inder,2018) . Optimal capital allocation is supported by financial development, which provides good information regarding possible lucrative businesses.

The existence of a robust financial system in different countries has been investigated by different researchers, and the majority of results reveal that it has a positive effect on economic growth. There are also many studies that have found the favorable association between financial development and economic growth (Levin , 2005; Mausud & Hardaker 2012; Serhawit & Giri ,2015; Jalles, 2016; Batuo et al. 2018, Bist; 2018, Asteriou & Spanos, 2019, Appiah et al. 2020).

Early studies have looked into the effects of human capital and financial development on growth independently. However, in cross-country studies, the literature appears to have largely neglected the combined interactive impact of human capital and financial sector development on growth. As a result, research into the combined effects of financial development and human capital on growth is required.

The study used panel data models to analyze this problem for a collection of cross-countries based on the lack of research addressing the finance-human capital nexus. This study adds to the current literature in a variety of ways. To begin with, the current researches are insufficient to fully address the combined interaction effect of human capital and financial development on the growth of a country especially on the sun Saharan African countries. Thus, it create and apply a financial development and human capital indexes based on two bank-based variables and two education based variables, to analyze their interaction effect on the economic development. This paper look at this issue from a Sub-Saharan countries perspective using a panel data approach. Hence, this paper has used this approach to provide valid empirical evidence on the effects of human capital development and financial development on economic growth in the region.

1.3 Objectives of the Study

1.3.1 General Objectives of the Study

The main goal of the study is to assess the interplay effects of human capital and financial development on economic growth in Sub-Saharan Africa over the period of 2010-2020.

1.3.2 Specific Objectives of the Study

The specific objectives of this study are:

i. To investigate the effect of human capital on economic growth of Sub-Saharan Africa.
ii. To investigate the effect of finance on economic growth of Sub-Saharan Africa.
iii. To evaluate the interactive effect of human capital and finance on economic growth in sub Saharan African countries

1.4 Research Hypothesis

With the abovementioned background and statement of the problem in mind, the following research hypothesis are expected:

- Human capital may have a positive and significant effect on the economic growth of Sub-

Saharan African countries

- Finance may have a positive and significant effect on the economic growth of Sub-Saharan African countries.
- The interactive effect of financial development and human capital may have a positive and significant effect on the economic growth in sub Saharan African countries

1.5 Significance of the Study

Investigating the interaction effect of human capital and finance on economic development is important for any country because the policy makers will have better understanding on formulating their economic policies. Thus, this study would have a modest contribution by implicating some basic insights in the area for policy makers to have the factual evidence on the interaction of human capital and financial sector development on economic growth in sub Saharan African countries. It will also serve as a springboard for further studies on human capital development, financial sector development and economic growth. It will also improve the practical knowledge and skill of the researcher of this study by making familiar with factual evidence on the economic problems.

1.6 Scope and limitation of the Study

The research examined yearly data spanning 11 years, from 2010 to 2020. The availability of data for Sub-Saharan country analysis especially for secondary and primary school enrollment as well as data on financial sector development have limited our analysis to some of Sub-Saharan African countries.

1.7Organization of the Thesis

The first chapter describes the introduction part of the study like background of the study, statement of the problem, research objectives, and research questions. The remaining parts of this thesis are organized as followed. Chapter two presents concept and definitions, theoretical review, empirical review and conceptual framework of the study. In chapter three, the methodological framework of model, the research approach, method of data collection, and research design issues are presented. The empirical results with descriptive and inferential statistics of the model are presented and analyzed in the fourth chapter. Lastly, in chapter five, the main findings of the study are summarized and some recommendations are mentioned

CHAPTER TWO

2. REVIEW OF LITERATURE

This section deals with the review of the existing literatures on the effect of human capital, financial development and their interactive effect on economic growth of some sub Saharan African countries.

2.1 Theoretical Literature Review

It was commonly assumed that an economy relied only on raw labor and physical capital (land, technology, and equipment) before the emergence of modern human capital ideas. Investment in capital equipment was thought to be the main factor of output. For instance, according to classical theorists, capital utilization of labor has given more emphasis (Zhang et al., 2021; Hassan, 2019; Ogundari & Awokuse, 2018). However, since the 1950s, contemporary economists have identify that health and education are crucial factors in enhancing human capital and, consequently, accelerating economic growth (Akhmetshin, 2018).

2.1.1 Human capital and neoclassical growth theories

Among the early human capital theorists were Schultz (1961) and Becker (1962). They state that education increases a person's talent and consequently his or her human capital. It improves the labor force's skill and their production capacity. According to Schultz (1975), as noted by Xiao (2001), education helps individuals to respond changing economic conditions by recognizing shocks, interpreting information, and reallocating resources. Education was taken into account by Spence (1973) as a market indicator for workers' capacity for productivity. It may be used as a screening method to identify potential employees who can perform specific tasks more quickly and affordably than their competitors. However, until Mankiw, Romer, and Weil modified the fundamental neoclassical growth model in 1992, their argument was not fully incorporated into economic development theories. These investigators used a Cobb-Douglas production function to examine the Solow growth model (Fashina et al., 2018; Yao et al., 2021).

According to the neoclassical growth theory, the accumulation of material inputs like physical capital and labor are the main driver of long-term economic development. In many researches, it has proved that technical advancement, which has considered as an exogenous factor, has a significant impact on growth. Solow (1957) and Cass (1965) among the first to demonstrate this.

They provide the convergence growth theory, which holds that technology is the only long-term driver of growth. They bring the convergence theory of growth, which takes technology as the sole long-term engine of growth. They generally stated that new technological knowledge must be applied to new goods, markets, or processes in order to increase production per capita in the long run. The laws of diminishing returns will lead the economic growth to halt if there is no technical innovation. The extra capital goods become outmoded and the marginal product of capital will not be significant if we keep giving people more of the same capital goods without coming up with new uses for them.

This theory is formulated by assumption that the marginal product of capital in the stock of capital is strictly diminishing (Lim et al., 2018; Fraumeni et al.,2019). To put it another way, they believed that as capital per worker increased, the growth of the economy would decrease until it reached a stable state, and that the lower the initial level of per capita income, the higher the expected growth rate (Khan & Chaudhry2019; 2019 Zhang et al., 2019). However, the model is inadequate to explain the continuing economic improvement in East Asian emerging countries (Hosainpour, 2011 & Zarra-Nazhad).

The value of human capital and its effect on economic growth have been the subject of various studies (Psacharopoulos, 1984; Mankiw et al., 1992). Shultz (1961), who was the first to identify it as a source of economic growth, defines human capital as direct investments on education, training, health, and internal migration. Becker described human capital as education, on-the-job training, medical care, and migration to improve the country's economy in his book, "Human Capital." Benhabib and Spiegel (2000) assert that an educated workforce promotes creativity, technological adoption, and economic advancement. According to Schultz (1993), human capital is crucial and significantly contributes to economic growth.

2.1.2 Human capital and endogenous growth theories

In order to address the long-term causes of economic development and fill the gap of neoclassical theory, endogenous growth models were developed in the middle of the 1980s. Lucas (1988) and Romer (1990), two famous proponents of this theory, intentionally include technological advancements as an explanatory variable in the development of their model. According to the endogenous growth theorists, human capital and other factors (not included in the neoclassical growth model) also contribute to a the country development in addition to technology.

Lucas (1988) argues that human capital is a unique input in the production function that is mostly created by employees through education or on-the-job training. The Lucas model considered the rate of human capital accumulation to be a key determinant of productivity improvement.

Instead of taking human capital as a direct input to the production of products, Romer (1990) considers it as a factor influencing innovation that has a positive effect on productivity in the long-run. In other words, endogenous growth is created by the accumulation of technology and knowledge according to Romer, whereas for Lucas, it is driven by the non-decreasing marginal returns of human capital.

In general, they reach to the conclusion that large population is inadequate to foster economic expansion; rather, human capital, research, and development are also the basis for growth. These models suggest that the concept of decreasing returns to scale may not be appropriate since the returns on physical and human capital do not always decline over time. The productivity of the capital and the technology will increase if the owner capital employs a healthy and talented worker. The two other explanations for increasing returns to scale are the knowledge transfer between producers and the external advantage from improvements in human capital (Thisse, 2018; Arjun et al., 2020; Guo et al., 2021; Apostol et al, 2022).

Similarly, Mankiw et al (1992) created an improved Solow model to re-examine the Solow growth model and explain cross-country per capita income variation. Similar to this, Mankiw et al. (1992) created an improved version of the Solow model to re-evaluate the Solow growth model and explain the variation in per capita income between nations. Human capital is considered as a component of production alongside physical capital and raw labor in the labor. They conclude that differences in human capital, saving, and population growth determine the variation in income per capita for cross-country. Physical capital accumulation and population growth have greater impacts on income per capita when human capital incorporated into the equation. According to the researchers, taking it out of the model can lead to distorted conclusions.

2.1.3 Investment in education and rate of returns to education

Finance and time spent on formal education, on-the-job training, and off-the-job training are the three major investments in education. These investments, which are made with the expectation of a future return on investment, include small earning during training, direct tuition costs and

postponed income while in school. In his book "Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education," Becker (1993) states that there are different ways to invest in human capital, such as through education, training, expenditures on health care and other services. In other words, acts that effect future real income through the embedding of resources in people are referred to as human capital investment. In other terms, human capital investment refers to activities that have an impact on future earning via investing in people. He thus thinks that spending money on education and training is the most important aspect of creating human capital. He argued, with a stronger emphasis on education, that training and education boost workers productivity by providing them skill and appropriate information (Kucharková et al., 2018; Kryscynski et al., 2021).

In general, the costs of education and the employment opportunities after graduation determine the private returns to education (Fleischhauer, 2007; Bloome, 2018; Patrinos, 2020; Shaturaev, 2021). Similar to investments in physical capital, decisions to invest in human capital are only made when the expected return (the net internal rate of return) is higher than the market rate of interest. In other words, investing in education is done with the anticipation of future returns for those who complete it. Increased productivity for firms, high income for employees, and more job prospects are the returns on investment in education.

According to Jackson and Collings (2018) and Donald et al. (2018), a worker's pay/return is based on the size of his or her human capital stock. As a result, compensation disparity amongst employees is mostly attributed to variations in the stock of human capital, rather than to variations in the cost of labor.. Education has a public as well as a private advantage. There could be educational spillovers that benefit other people, in which case the social gains would outweigh the sum of educated people's individual gains. McMahon (1998, 2010) distinguished four types of returns to education: financial, non-financial, private and social. Wages represent the financial and private returns from schooling investment. The impact of education on GDP growth and others' earnings (by making them more productive) are additional monetary advantages or returns to society. Along with financial benefits, education may also provide non-financial benefits to individuals and society as a whole.

Health effects, more effective household management, lifelong learning and adapting at home (using new technologies such as the Internet, radio, and television, and so on), and non-financial work satisfaction are a few examples of non-financial private returns. The advantages of living in

an educated society (better citizenship, democracy stability, poverty reduction, and lower crime rates) and the community services offered by education (dissemination of knowledge through articles, books, media, and also informally) are a few examples of non-financial social benefits (Gambo & Fasanmi, 2019; Lusardi, 2019; Eaton et al., 2020).

2.1.4 Measuring human capital

There are different views on how to analyze human capital. According to Le et al (2003), Devkota et al (2021), there are three techniques of assessing human capital: income-based, outcome-based, and cost-based.

Some scholars just use educational indicators (outcome-based method) to measure a nation's human capital, such as educational attainment, the rate of school enrollment, or literacy. For instance, Mankiw et al. (1992), Barro and Lee (2000), and Angjeli & Pano (2019) have all used educational attainment (or average educational attainment) as a proxy for human capital. However, employing these indicators as a proxy for human capital has limitations. First, it does not include educational quality, which is affected by educational facilities and access to educational services. Second, according to Mulligan and Sala-IMartin (2000), worker productivity varies with their education level and is proportional to the number of years spent in school. According to Jones and Fender (2011), a worker with 10 years of education is expected to have ten times as much human capital as a worker with just one year of education. However, an individual's effectiveness may be determined following participation in production activities (Dae-Bong, 2009). Similar to this, Levine and Renelt (1992) calculated human capital using school enrolment rates.

The argument behind utilizing such a statistic is that enrollment rates represent current investments in human capital that will ultimately be reflected in the stock of human capital. The present enrollment rates, however, may not accurately show the educational level of the current labor force but rather that of the future labor force because there is a significant time lag between educational investment and additions to the human capital pool (Lee et al., 2003; Collin & Weil, 2020). In addition, because graduates might not find employment, current students' educational attainment might not fully contribute to the future human capital pool of productive workers. Despite their shortcomings, enrollment rates in some countries can serve as a good proxy for human capital (Jones & Fender; 2010; Egert et al., 2020.

Another alternative is an income-based method, which measures human capital stock based on an individual's earnings from the labor market. In accordance with Mulligan & Sala-i-Martin (2000), the overall stock of human capital is equivalent to the sum of individual wages. In recent applications, the income-based technique has been the most popular. It has recently been employed to evaluate human capital in China, the US, the UK, Australia, New Zealand, Sweden, and Norway (Christian, 2011). However, for a number of reasons wage discrepancies may not truly represent productivity differences. Additionally, there is a lack of information on incomes, particularly in underdeveloped countries where the wage rate is sometimes invisible (Le et al., 2003).

The cost-based (traditional) technique is another way for measuring human capital stock. It is a measure of human capital that is not directly measured and is derived by summing the costs associated with the creation of human capital (Dae-Bong, 2009). Eisner (1988), Oluwatobi & Ogunrinola (2011), Umaru (2011), and Faggian et al (2019) show how to measure the stock of human capital using the cost of educating and training people in a systematic way. Several OECD countries have embraced this cost-based approach to evaluating education offerings. El-Saharty et al. (2020) argues that the cost-based approach is the second-best alternative technique for valuing output, with final demand prices being the best option. However, it does have some limitation.

For instance, Appleton and Teal (1998) and Dae-Bong (2009) have criticized its identification of human capital inputs rather than outputs. In terms of the expenses associated with human capital, it is hard to precisely define the line between investment and consumption. Moreover, present investment might not accurately reflect current levels of human capital since there is a significant time lag between education investment and additions to the human capital levels. Investments made in education might not be used effectively to build a viable human capital stock because of corruption, grade repetition, and dropouts.

2.1.5 Financial Development and Growth

Classical economists, like Ricardo, give much attention for real estate and capital shortages as the restraints on development of the economic, disregarding the importance of financial markets. Lately, a substantial body of literature focused on the impact of the development of the financial sector on the growth of the economy. These studies contend that there is a positive and significant relationship between the growth of the financial industry and the development of the

economy. One of the pioneers of the modern development theory, Joseph Schumpeter, argued that the efficiency of financial intermediaries is essential for economic development. Other economists have also underlined that a nation's economic growth is significantly predicted by the effectiveness or ineffectiveness of its banking sector.

The new endogenous economic growth theories has strengthened the case for the relationship between economic growth and financial intermediaries because these theories contend that saving behaviour directly affect growth of the economy. Financial intermediaries may therefore have a big impact on what happens in the real world. A flourishing and effective financial sector helps entrepreneurs by combining personal and business savings.

The growth of financial sector directly affects the level of technological advancement and productivity growth, which in turn causes an increase in total production (Bloch and Tang, 2003). According to Bencivenga and Smith (1991), the expansion of banks spurs economic development by directing savings toward useful endeavours, which is in line with Schumpeter's theory. Furthermore, they demonstrated that even if aggregate saving is decreased, economic growth is still possible because financial sector development improves the effectiveness of investment. On the contrary, Robinson (1952) and Lucas (1988) came with a different conclusion about the relationship between the economic growth and financial sector development. For them financial sector primarily follows economic development.

Shaw and Mackinnon (1973) placed a strong emphasis on the part capital accumulation plays in economic development. They also suggested that abolishing reserve tax and institutional interest rate restrictions, as well as ensuring that the financial sector runs in a competitive environment with no entry barriers, can boost economic growth. Mackinnon and Shaw’s results provide important theoretical understandings of the role played by the financial intermediaries in emerging nations. They emphasized the obstacles to economic growth posed by inefficient financial intermediaries as well as the advantages of financial liberalization in developing or low-income countries, despite the fact that these economies' underlying problems are caused by the whole economy, not only the financial sector. The Mckinnon-Shaw model generally demonstrates that financial restraint lowers the quantity and quality of investment in the economy. In contrast to Mckinnon and Shaw's argument, structural economists like Taylor (1983), Van Wijnbergen (1983), and Buffie (1984) stated that financial development reduces the total available real credit, impeding economic expansion.

Hallwood and McDonald (2000) stated that the difficulties a nation faces in its internal financial system affects its foreign finance. A domestic financial crisis, which prompts investors to remove their money from a particular country, might quickly trigger a capital account balance of payment problem. A stable financial system is therefore necessary to maintain a nation's place in the global financial system as well as the sustainability of its external sector.

Kelly and Marvotas (2003) believed that the finance industry in emerging countries is insufficient. They note that to attain such financial industry , many developing nations should carry out extensive financial reforms, such as allowing market-based credit allocation systems, eliminating restraints on bank lending, decreasing reserve requirements, and loosening entry restrictions into the banking sector.

Patrick (1966) created the supply-leading and demand-following theory, on the other hand, to answer the question of whether financial development and economic expansion are causally related. According to the supply-leading theory, there is a direct causal link between financial intermediaries and economic growth, meaning that the establishment of new financial institutions and markets rises the supply of financial services, which in turn increases economic growth. Greenwood and Jovanovic (1990), King and Levine (1993), Calderon and Liu (2003) Tsionas (2004) and Demirguc Kunt and Levine (2008) are among the scholars who concur with this theory.

The demand-following theory, on the other hand, proposes a causal relationship between economic growth and financial development, i.e., that rising demand for financial services could result in a growth in the financial sector as the economy expands (Patrick, 1966). This view is shared by Robinson (1952) and Lucas (1988).

According to the model created by Greenwood and Jovanovich in 1990, financial expansion caused by economic growth, and higher economic growth rates then driven by finance industry through investment. Endogenous factors affects both the economic growth and financial sector. This statement was supported by Blackburn and Hung (1998), who also emphasized the positive finance-growth development relationships with dual causality. In certain models, the importance of banks in the growth of the financial sector is underlined, whereas in other models, the advantages of the security markets are emphasized. Arestiset al. (2005) proposed three theories:,

the bank-based theory, the market-based theory and the financial services theory to investigate the relationship between financial sector and economic progress.

According to the bank-based theory, by effectively allocating resources, banks can stimulate economic growth (Arestis et al., 2005). The research of Gerschenkron (1962), quoted by Levine (2004), showed that bank-based financial systems are preferable to market-based systems since the second one decreases incentives for investors to search and obtain information by making information available the general public.

However, by privatizing the information they collect, banks can establish long-term relations with the businesses entities (Levine, 2004). On the other side, the market-based model emphasizes the benefit of good markets. According to Levine (2004), these marketplaces offer a more comprehensive set of risk management tools that allow for better adaptation of risk-reduction methods. According to Levine (1997), the economy obtains financial services from both markets and banks. The establishment of an environment in which financial services may be efficiently provided, rather than the absence of one, is the issue, according to the third hypothesis, financial services.

Theoretically, every argument in favor of linking financial intermediaries to growth stems from the fact that a strong financial system serves a variety of essential functions. A modern financial system that works effectively mobilizes capital, encourages investment by identifying and fostering attractive business opportunities, monitors the performance of firm managers, and permits risk diversification and reduction. These activities promote economic growth by accelerating the accumulation of both human and physical capital as well as the improvement of technology.

2.2 Empirical Literature Review

2.2.1 Human Capital and Economic Growth

The quantitative relationship between expenditure on education and training and changes in per capita GDP has explored in the literature of economic growth models. Numerous research have been conducted, spanning from the 1950s publication of classical growth models to the so-called endogenous growth models that are still widely used in many contemporary empirical research.

Both data sets and econometric modeling methods have considerably improved over the past few years, and numerous novel model assumptions have been published and empirically tested.

Usually, these models use data from a wide range of countries, sometimes just industrialized nations but occasionally a wider group. It might be challenging to generate consistent series of educational variables over sufficiently long periods to make econometric time series analysis. To make a more in-depth analysis of the relationship between human resources and economic growth in recent years, cross-sectional and time series data from industrialized nations are included in panel sets.

Physical and human capital, according to Oketch (2006), can both be endogenously determined in a growth model, but they may still interact even if growth is not taken into consideration. Thus, having a lot of physical capital may lead people to a higher educational level, which can help them to create more knowledge and innovate to increase the physical capital (Ferreira-Lopes & Sequeira, 2011). By raising the demand for financial services, education may accelerate the economic growth. According to Evans et al. (2002), higher education promotes the fastest expansion of physical capital.

Kendall (2012) investigated the relationship between human capital, the expansion of the banking industry and economic growth in India at national level. The study found that raising human capital might support economic expansion despite limited financial development. According to this finding a higher level of human capital might reduce dependency on finance and enable growth to occur through activities that need a lot of human capital investments.

In contrast, Hakeem (2010) used an improved Solow model in a panel data framework to examine how financial development and human capital determine economic growth in Sub-Saharan Africa countries. The study revealed that there is a positive correlation between financial development and human capital and economic growth in Sub-Saharan African countries. However, it was found that financial development had a less significant effect on growth, which may be attributed to financial repression, inadequate infrastructure and lack of institutional development.

Knowles et al. (2002) employed a neoclassical growth model approach, with female and male human capital education being considered separately. The results show that female human capital is more important than male human capital in boosting labor productivity. Similarly, Giri and Sehrawat (2017) examine the effects of male and female human capital on India's economic development separately. According to the statistical data, female human capital is statistically significant, has positive effect on development, and increases labor productivity in the short and long runs. Contrarily, male human capital has positive but lower effect on growth. The investigators found that physical capital, as well as male and female human capital, had a long-term causal relationship with economic growth.

Maskay (2012) examined if the effects of financial development on growth is reliant on a country's human capital and if this effect varies with differences in human capital in a cross-country. Two financial development indicators—M3/GDP (liquid liabilities) and the size of the stock market as a share of GDP—as well as a measure of human capital—the percentage of people over 25 with a secondary education—were employed in the study. The results reveal that there is a high correlation between the two, suggesting that countries with weak financial development may have good economic development by increasing their human capital.

Using the World Bank Enterprise Surveys database on labor force growth in 89 countries, Cull and Xu (2013) observed that firms, particularly those who relied on external capital, grow more quickly in low-income countries with a well-developed banking system. A well-developed banking system is also associated with higher investment rates and staff training in low-income countries, telling that banks play a significant role in the creation of human capital.

The trans-log production function was used by Evans et al. (2002) to analyze the relative importance of financial sector development and human capital in the process of economic expansion in a panel dataset of 82 countries from 1972 to 1992. Three measurements of human capital (primary and secondary school enrolment rates, as well as real public education spending) and two indicators of financial development (M2/GDP and domestic credit/GDP) were employed in the study. The authors found that finance, as measured by M2/GDP or credit, makes a great contribution to economic development.

Li and Liang (2010) investigate human capital in East Asia, and their results show that growth is favorably associated with both education and health capital stocks. However, compared to the stock of education, the stock of health has a significantly larger effect on growth of the economy.

Neeliah and Seetanah (2016) look at the long- and short-term effects of the favorable relationship between human capital and economic growth. The outcome showed that economies in developing nations are expanding. Arshad and Munir (2018) analyze the short- and long-term effects of the human capital stock and real physical capital on the Pakistan's economic growth using the endogenous growth model. The findings are consistent with the endogenous growth model, which holds that GDP per worker grows as real physical capital and human capital build up, raising per capita income, labor productivity, employment rates, and the sources of economic development. Silva et al. (2018) investigated how human capital affects economic growth. The findings imply that improving health has a very significant and advantageous effect on the economic progress since a healthy worker increases the labor productivity.

(Taiwo et.al, 2020) examined the impact of human capital on economic growth in sub Saharan African countries. The study also took into account the various income levels in the area. According to the study, human capital has significant and positive impact on the economic development of those countries. The study also discovered that the degree of economic development affects the relationship between human capital and economic growth. In general, they found the significance of both education and health indicators of human capital on the economic growth.

(M. Matashu, 2021) used an ARDL and ECM cointegration analytic technique to look at the long-term link between human capital formation and economic growth in SSA nations. The results showed that there is a cointegration link between economic growth and human capital. In the short run, physical capital had a big and favourable impact on economic growth, but in the long run, that impact was insignificant.

2.2.2 Financial Sector Development and Economic Growth

Various empirical studies have looked into the effects of financial system as a factor that influences a country's savings, investment, and growth rates. The research findings are consistent with the argument that development of the financial industry promotes economic expansion. Numerous studies have shown that the strength of financial sector is a good predictor of economic growth, physical accumulation, and productivity growth even after controlling income, education, political stability, and measures of monetary and trade.

Goldsmith's (1969) pioneering work, which emphasized the relation between a country's financial system and its major economic infrastructure, served as the foundation for empirical research on the relationship between financial development and economic growth. Al-Mashat conducted an empirical study to examine the impact of financial sector expansion on non-government savings and economic growth in Egypt using the data from 1960 to 1999. The findings of the statistical study show that non-government savings react favorably to most financial system indexes. Higher savings were achieved in Egypt when market-based financial systems were built due to rising real returns on savings, improved the effectiveness of financial sector, and a significant portion of resources being intermediated through financial institutions.

There is clear evidence of a cross-country link between financial sector development and the amount of income per capita, regardless of how financial development is defined. Finance contributes to long-term growth mostly via increasing total factor productivity, according to a variety of econometric studies. In thirty-five nations, Goldsmith found a clear link between financial development and economic activity, using data from before 1964. Financial repression is a term used to describe when a country's financial system is undeveloped. This is one of the main reasons why many emerging or transition nations have poor growth rates. Financial development contributes to poverty reduction and can serve as a solid foundation for more targeted, micro empirical research into how specific financial sector policies and programs can be employed as successful tools for reducing poverty in low-income nations.

Levine et al. (2000) employ the consistency the panel data model using cross-section estimation method. The researchers brings a different dataset which concentrates on the size of the financial services, whether finance organizations or the central bank handle financial services, and the amount of credit that is channeled through the financial sector to the private sector. According to the researchers the financial industry and economic growth are positively linked under all conditioning parameters; full conditioning information, fundamental and policy conditioning sets.

Benhabib and Spiegel (2000) look at the relationship between different financial sector parameters and growth in investment, total factor productivity, and overall economy. Investment and total factor productivity are closely related with financial sector development. Benhabib and Spiegal (2000) used endogenous growth model as well as neoclassical growth model, where total

output is a function of labor, physical capital, and human capital, respectively, for calculating growth equations.

Based on savings data in Sri Lanka from 1970 to 1997, Kelly and Mavortas (2003) created a measure of financial industry development indices. The statistical findings show that, during the study period, Sri Lanka's private savings were significantly and positively affected by the growth of the banking industry. Another study found a strong correlation between GDP per capita growth and measures of the size and liquidity of the stock market, banking sector, and financial system. In addition, recent studies show that the expansion of the finance industry has a direct impact on economic progress.

A review research by Nyasha and Odhiambo (2015) examined the empirical and theoretical relationships between market- and bank-based financial development and growth in the economy in countries with developed as well as developing economies. They reached to the conclusion that various unique characteristics, approach, sets of data, and other elements examined in each nation had a significant impact on the direction of casualty linkage. Jalles (2016) states that there is a growing interest in the importance and contribution of financial intermediaries to economic development. The main barrier to economic progress is corruption; institutions with lower levels of corruption or greater standards of operation promote the development of finance and, consequently, economic growth. Phiri (2015) argues the relationship between finance progress and economic growth is not balanced.

In their 2016 study, Sehrawat and Giri looked at the effects of financial development and growth in SAARC nations . They found long-term relations between India's financial sector and economic development. Masoud and Hardaker (2012) use the endogenous growth model to examine the effect of financial industry in emerging economies. It is found that the development of the financial sector is essential for growth and that there is a consistent correlation between stock market expansion and financial expansion across time.

Four aspects of financial institutions and markets are examined by Zia et al. (2021): (i) the financial depth; (ii) the extent to which people can access and use these institutions and markets; (iii) their effectiveness in providing financial services; and (iv) their stability. Financial institutions and financial markets, which have the stock and bond markets, are examined based on these four characteristics. However, Sethi et al. (2019) recognize that each of these four

features might not fully reflect all of the features of financial systems. Instead of being a feature of the financial system itself, financial depth serves as a proxy for all of the types of services offered by the financial system.

To measure the size of financial institution credit to private-sector to GDP ratio is chosen and to analyze the size of financial market the share of outstanding domestic private debt to GDP and stock market capitalization are taken by Ukamaka (2021). Access is determined by the number of bank accounts per 1,000 adults. To measure stability the researcher employed the z-score and stock price index volatility, while net interest margin and turnover ratio are employed to measure efficacy.

The domestic credit-to-GDP ratio, the credit-to-GDP ratio of commercial banks, and the ratio of liquid liabilities in the financial sector to GDP are additional frequently used indicators (Muyambiri & Odhiambo, 2018; Mohieldin et al., 2019; Azizi, 2020; Bernard Azolibe, 2021). On the other hand, Erdal (2018), Donou-Adonsou (2020), and Samuel-Hope (2020) use the deposit component of M2 as a percentage of nominal GDP with a one-period lag as opposed to the currency component. As opposed to M3 to GDP this may be more reliable measurement of finance sector development in the emerging economies (Mansoor et al , 2020).

2.2.3 Measurement of financial Development

Traditional quantitative indicators based on monetary and credit aggregates are used to measure financial development and deepening. They may not be sufficient for evaluating a nation's financial development (Lynch, 1996), but they are the only indicators that are available in the IMF's monetary survey, especially for developing countries.

The most fundamental indicator is the money/GDP ratio, which shows how much the economy is monetized. Financial deepening, also known as financial sector development, is frequently linked to an increase in the real size of the financial sector and its relationship to GDP (Nain & Kamaiah, 2014; Muyambiri & Muyambiri, 2018; Chen et al., 2020).

The M2/GDP ratio measures the entire size of the financial intermediary sector and is closely linked to both the level and rate of change of real GDP per capita. M1/GDP, on the other hand, is not highly related to economic progress (Tennant & Abdulkadri, 2010; Díaz-Bonilla, 2015). Because of the scarcity of data on other financial assets, broad money M2 is frequently used as an appropriate indicator of the financial sector's size. It should be noted, however, that this metric

does not take into account the whole scope of financial intermediation (Besong, 2016). In nations where inflation is a problem, this statistic may be a good indicator of monetization. Outreville (1999) examine the empirical link between inflation rates and financial market performance in a new work. They use "fine-tuned" financial development indicators that aren't available in many underdeveloped nations.

The ratio of long-term to short-term financial asset worth is suggested by Liu and Woo (1994) as a proxy for financial expertise. The money supply (M1) is used to calculate the value of short-term financial assets. A country's degree of financial development should be positively connected to the ratio of wide money to narrow money (M2/M1). As the financial system grows, savings deposits grow faster than transaction balances. The difference between the wide and narrow money ratios to GDP, as defined by King and Levine (1993), is an alternative measure of "quasi-liquid liabilities."

Akinboade (1998) studied the link between financial intermediaries and the growth Botswana economy. Granger causation between real per capita income and financial sector was investigated using two measurements. The tests for unit roots and co-integration were followed by the adoption of an error-correction approach. He found that there is a causal relationship between finance sector progress and economic growth in Botswana.

Ghirmay (2004) investigated the relationship between economic growth and the financial intermediaries in 13 sub-Saharan African nations. The findings of the co-integration study demonstrate that nearly all (12 of the 13) nations financial sector have a long-term association with the growth of the economy. Regarding the direction of long-term causality, the findings reveal that, in eight of the nations, financial sector has a causal impact on economic development. In six nations, there is evidence of reciprocal causal linkages at the same time. The results show that by strengthening their financial institutions, the Sub- Saharan African nations can speed up economic growth.

Odhiambo (2005) conducted an empirical examination of the effect of financial strength on Tanzania's economic growth. Three financial development proxies were taken compared to real GDP per capita (a proxy for economic growth) in the research. The empirical findings of this study, along with the Johansen-Juselius co-integration approach and a vector ECM, show a bi-directional causality between financial sector development and economic growth in Tanzania.

Using causality tests, Atindehou, Gueyie, and Amenounve (2005) empirically investigated the link between financial development and economic progress in the Economic Communities of West African countries. The findings show a weak causal linkage between economic growth and financial sector and , on the one hand, and between economic growth and finance on the other hand in almost all nations. Ceteris paribus, these findings indicate that West African country leaders should concentrate their economic and monetary policies on strengthening of their financial sector, which will in turn support the growth of their economy.

Using dynamic panel data modeling, Adjasi and Biekpe (2006) investigated the impact of stock market on economic growth in 14 African nations. The findings primarily indicate that a favourable association between expansion of stock market and growth of their economy. The findings show that, for nations categorized as upper middle income countries, the stock market development has a positive effect on their economic growth. Only modestly capitalized markets, based on market capitalization categories, get significant growth from stock market expansions. The overall trend in the results demonstrates that for low income African countries and less developed stock markets to generate economic benefits from stock markets, they must expand and develop their stock markets.

Quartey and Prah (2008) studied the financial sector development in order to know if the demand following or supply leading or Patrick's Stages of development theories applied to Ghana. When broad money to GDP ratio is used as a proxy for financial service, there is some evidence in favour of the demand following theory; however, when the growth of private credit to GDP ratio, private credit to domestic credit ratio and domestic credit to GDP ratio are taken as proxies for financial sector development, there is no strong evidence in favour of either the demand following or supply leading assumption.

Odhiambo's (2008) analysed the dynamic causal linkage between financial development and output growth in Kenya. Savings were also included as an intermittent variable to develop tri-variate causality model. The empirical findings of this study show that there is a clear unidirectional causal flow from economic growth to financial sector when using co-integration and error correction approaches. The findings also show that savings fuel the expansion of Kenya's financial services while economic growth creates savings.

For seven Sub-Saharan African countries, Enisan and Olufisayo (2008) looked at the long-term and causal linkage between stock markets and economic growth. The study found that the growth of Egypt's and South Africa's stock markets is co-integrated with economic progress using the autoregressive distributed lag bounds test. This test also reveals that the expansion of the stock market has a significant long-term positive effect on the growth of the economy. Further evidence that stock market expansion drives economic growth in Egypt and South Africa comes from the Granger causality test using a vector ECM. For Cote d'Ivoire, Kenya, Morocco, and Zimbabwe, the Granger causality based on VAR reveals a bi-directional relationship between stock market expansion and economic growth.

2.2.4 Interactive effect of human capital and finance on economic Growth

In the interacting term of human capital and financial development, there is rising worry about the link with economic growth. Ibrahim (2018) explored the expansion of human capital and financial development in Sub-Saharan Africa in his most recent research. According to him, both short and long-term economic growth are boosted by human capital and financial development. The combined influence of human capital and financial development has led to the conclusion that good human capital quality encourages growth more than financial development. In order to support global economic growth, better human capital accumulation leads to innovation and adoption of new technology. According to Hakeem (2010), the stock of physical and human capital is required for growth. The study found no substantial influence of economic development on growth due to financial underdevelopment. The combined influence of human capital and financial development, on the other hand, is critical to increasing growth and preventing the rise of anybody who can slow down progress in Sub-Saharan Africa. Evans et al. (2002) also say that human capital and financial development have a positive and substantial impact on economic growth, and that ignorance may be deceiving because both are equally important to progress.

2.3 Research Gap

Early studies have looked into the effects of human capital and financial development on growth independently. However, in cross-country studies, the literature appears to have largely neglected the combined interactive impact of human capital and financial sector development on growth, despite the fact that financial development can influence growth through its interaction with human capital. Even if financial development accelerates, a lack of human capital can stifle

innovation. As a result, research into the combined effects of financial development and human capital on growth is required.

Few researchers explores the impact of the interaction between financial development and human capital on growth in sub-national economies, while studies on the interaction between human capital and financial development on growth in cross-country contexts are scarce. Although some have acknowledged human capital as a component in growth but neglected the relationship between human capital and financial development in their study on financial development and growth. Similarly, the studies that have tried to investigate the impact of financial sector development on economic growth has neglected its interaction effect with human capital on growth.

Thus, this research has attempted to fill in some of the gaps. It examines the impact of financial development, human capital, and their interactions effect on economic growth. The research is based on data from sub Saharan countries spanning ten years, from 2010 to 2020.

CHAPTER THREE

3. RESEARCH METHODOLOGY

This first section of this chapter discusses the theoretical framework that supports my model and is influenced by related and appropriate literature. The discussion focuses on how accumulation of human capital and development of finance sector influence economic growth. The data and variables employed are then described, allowing for a discussion of the study's particular empirical model. Finally, the basic characteristics of the data that are used to generate model estimates are reviewed.

3.1 Research Design

A research design is a framework that specifies the methods and steps to be taken in collecting and analyzing data. The study's design is determined by the researchers' objectives. The objective of this study was to analyze the relationships between human capital, financial development and economic growth. Quantitative research methods were employed to test these relationships. Explanatory study design, as defined by Browne et al (2019), explores the cause and effect links between dependent and independent variables. As a result, this study looked at the cause and effect links between cross country economic growth, human capital and financial development.

3.2 Data type and sources

This analysis relied on secondary data from the World Bank's Development Research Group databases (International Bank for Reconstruction and Development and International Development Association) and the World Bank's World Development Indicators and International Financial Statistics. The study spans eleven-year period from 2010 to 2020. However, due to the lack of data for several countries and years, the study was limited to 26 nations and 11-years' time frame for the empirical analysis. The countries that are used for this study are Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Congo, Dem. Rep., Cote d'Ivoire, Ethiopia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Mali, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Tanzania, Togo, Uganda and Zimbabwe.

3.2.1 Selection of Countries

The sample of this study consists of some selected Sub Saharan African countries. The World Bank's Database was used to make this categorization. Due to a lack of data for many of them, the study's sample reduced to a panel of 26 nations.

3.2.2 Theoretical Framework

In this study, the standard Solow (1956) neoclassical growth model is applied, with the addition of human capital as a production input. A country's per capita income in a given time period t, Y_{it}, will be a function of labor, L_{it}, and physical capital, K_{it}. $y_{it} = A_{it}L_{it}^{\alpha}K_{it}^{\beta}\varepsilon_{it}$, is the Cobb-Douglas production function, where ε_{it} is the error term. Now, if we add human capital to the log differences of the previous equation, we get an estimable form of the equation.

$$y_{it} = \alpha_{it} + al_{it+}\beta K_{it} + \gamma HC_{it} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

The neoclassical model also uses the initial level of income as a predictor of growth rate because it determines how far a country is from its steady state. The predicted per capita income growth from the increasing capital formation will increase as this distance increases (Lim et al., 2018). The following model is revealed when the initial level of revenue is included into the equation:

$$y_{it} = \alpha_{it} + al_{it+}\beta K_{it} + \gamma HC_{it} + Y_{it-1}\varepsilon_{t.} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

where y_{it} is the growth rate

3.3 Definition of Variable, measurement and hypothesis

3.3.1 Dependent Variable

The growth rate of real per capita GDP is the model's dependent variable. The World Bank's World Development Indicator (WDI) database reports overall GDP growth rates at market prices. The difference between the logarithms of real per capita GDP multiplied by 100 is the standard measure of per capita growth.

3.3.2 Financial Development

Despite the fact that there is a lot of evidence often contradicting evidence pointing to the significance of financial sector for economic growth, there is no single financial development measurement that can be taken as the best in the literature. Many researchers have used the banking sector as a proxy. Several metrics that have been used in the literature are considered in this study.

3.3.3 Conditioning Information

Different conditioning data set, or control variables, are used in growth research. Levine, Loyaza, and Beck (2000) used three different sets of conditioning information: the simple conditioning information set, the policy conditioning information set, and the complete conditioning information set. The simple set consists of the constant, initial per capita GDP logarithm, and initial educational attainment. The simple set is supplemented by measurement of government size, inflation, and international trade openness. The policy set, as well as indices of political stability and ethnic diversity, make up the whole conditioning information set. The policy conditioning information set is used in this thesis.

Government size is calculated by taking the share of total government consumption as a percentage of GDP, inflation is calculated using the annual growth of the GDP implicit price deflator, and openness is calculated using the sum of exports and imports of goods and services as a percentage of GDP (World Bank WDI).

3.3.4 Interaction Effect

Developments in both human capital and finance may have an impact on economic growth. However, by considering these factors, it is also possible to make predictions on their interaction effect. As the growth of human capital accelerates, so might the ability of individuals to take risk, which would raise the demand for credit and investment. The probability of allowing investment through bank borrowing increases with financial development. Because of this, the combined effects of finance and human capital on growth can be greater than their respective individual contributions imply.

The term "interaction" is used in this paper to describe the relationship between human capital and financial development. The product of the total values of the two variables can be used to produce interaction terms. Another option is to center the variables by deducting the differences from the respective means before multiplying them by their product. When the product of level

variables was employed, the interaction term with financial development and human capital became multicollinear. The mean deviation strategy avoids the challenge, making it my preferred approach in this investigation. The difficulty is avoided with the mean deviation strategy in this study.

3.4 Empirical Model

The discussion thus far in this chapter can be summarized by the following empirical model:

$$y_{it} = \alpha_{it} + \beta_1 \ln(FinDev)_{+} \beta_2 \ln(\beta HuCap)_{it} + \beta_3 (HuCap_{it*} FinDev)_{it} + \beta_4 \ln(Infli)_{it} + \beta_6 \ln(Gov)_{it} + \beta_7 \ln(TD)_{it} + \varepsilon_{t.} \quad \text{.....(3)}$$

Where, y is growth of real per capita GDP, FinDev is one of the measures of financial development, HuCap is the measure of human capital, Infis inflation, Gov is government consumption that represents the size of the government, Popgrth is annual population growth, TD is the sum of export and imports of goods and services as a percentage of GDP.

As explained earlier, the study model considers two measures of financial development (bank credit to the private sector (PvtCred), and total domestic credit (DomCred)) and two measure of human capital (pupil to teacher ratio at primary school(PTTRP) and secondary school enrollment(SSE)). These results in the following estimable equation:

$$y_{it} = \alpha_{it} + \beta_1 \ln(GFCF)_{+} \beta_2 \ln(GGFCE)_{it} + \beta_3 (DCTPS)_{it} + \beta_4 \ln(DCTPSBB)_{it} + \beta_5 \ln(TD)_{it} + \beta_6 \ln(LFPR)_{it} + \beta_7 \ln(GDPPC)_{it} + \beta_8 \ln(SSE)_{it} + \beta_9 (PTTRP)_{it+} \beta_{10} (PTTRS)_{it} + \beta_{10} (INF)_{it} + \varepsilon_{t.} \quad \text{.....(4)}$$

Where, GFCF is gross fixed capital formation (% of GDP) , GGFCE is general government final consumption expenditure (% of GDP), DCTPS is domestic credit to private sector (%GDP), DCTPSBB is domestic credit to private sector by banks (% of GDP), TD is trade (% of GDP), LFPR is labor force participation rate, total (% of total population ages 15-64), GDPPC is GDP per capital in real terms, SSE-School enrollment, secondary (% gross), PTRP- Pupil-teacher ratio, primary and PTRS-Pupil-teacher ratio, secondary.

From the above general equation four models are run;

$$y_{it} = \alpha_{it} + \beta_1 \ln(GFCF)_{+} \beta_2 \ln(GGFCE)_{it} + \beta_3 (INF)_{it} + \beta_4 (DCTBB)_{it} + \beta_5 \ln(TD)_{it} + \beta_6 \ln(LFPR)_{it} + \beta_7 \ln(GDPPC)_{it} + \beta_8 \ln(SSE)_{it} + \beta_{10} (SSE * DCTBB)_{it} + \varepsilon_{t.} \quad \text{.....(5)}$$

$$y_{it} = \alpha_{it} + \beta_1 \ln(GFCF)_+ \beta_2 \ln(GGFCE)_{it} + \beta_3(INF)_{it} + \beta_4(DCTPS)_{it} + \beta_5 \ln(TD)_{it} + \beta_6 \ln(LFPR)_{it} + \beta_7 \ln(GDPPC)_{it} + \beta_8 \ln(SSE)_{it} + \beta_9 (SSE * DCTPS)_{it} + \varepsilon_{t.} \quad (6)$$

$$y_{it} = \alpha_{it} + \beta_1 \ln(GFCF)_+ \beta_2 \ln(GGFCE)_{it} + \beta_3(INF)_{it} + \beta_4(DCTPS)_{it} + \beta_5 \ln(TD)_{it} + \beta_6 \ln(LFPR)_{it} + \beta_7 \ln(PTTRP)_{it} + \beta_8 (PTTRP * DCTPS)_{it} + \varepsilon_{t.} \quad (7)$$

$$y_{it} = \alpha_{it} + \beta_1 \ln(GFCF)_+ \beta_2 \ln(GGFCE)_{it} + \beta_3(INF)_{it} + \beta_4(DCTPS)_{it} + \beta_5 \ln(TD)_{it} + \beta_6 \ln(LFPR)_{it} + \beta_7 \ln(PTTRP)_{it} + \beta_8 (PTTRP * DCTPS)_{it} + \varepsilon_{t.} \quad (8)$$

Each model has different human capital and financial development proxies' interaction. The first model (Equation 5) is the interaction of secondary school enrollment with domestic credit to private sector. In the second model (equation 6) the secondary school enrollment, interact with domestic credit by banks. In the third model (equation 7) pupil to teacher ratio at primary school, interact with domestic credit to private sector. In the fourth model (equation 8) pupil to teacher ratio interact with domestic credit by banks.

3.5 Model Specification

Panel data models were employed in a lot of contemporary macroeconomics research. Panel regression models are based on panel data, which consists of multiple observations on the same cross-sectional or individual units throughout time.

A panel dataset gives different advantages compared to a single time series and/or cross-section data set. Panel data, in this case countries, can first take into account variability among individual units. Second, panel data gives more useful data, more variability, less co-linearity across variables, more degrees of freedom, and greater efficiency since they combine time series of cross-section observations. Third, panel data helps economists to investigate adjustment dynamics and to describe and estimate more intricate and realistic models than a single cross-section or a single time series would allow (Verbeek, 2000; Gujarati, 2004; Baltagi, 1995).

3.5.1 Specification and Estimation Procedure

The nature of many econometric relationships is dynamic. Panel data are used in this study because they let the researcher better understand the dynamics of adjustment. The existence of a lagged dependent variable among the regressors is what distinguishes these dynamic interactions (Baltagi, 2021). The overall framework of an autoregressive model of order of ***p*** with additional regressor x_{it} could be defined as follows for a dynamic panel data approach (Baltagi, 2005):

$$Y_{it} = \theta_1 Y_{it-1} + \cdots + \theta_p Y_{it-p} + X'_{it}\beta + \alpha_i + \varepsilon_{it}; t = 1, \ldots, T, i = 1, \ldots, N \quad \ldots\ldots\ldots(9)$$

Where $\boldsymbol{\alpha_i}$ is a time-invariant individual effect whose treatment may be fixed or random, $\boldsymbol{\varepsilon_{it}}$ represents a disturbance term supposed to be uncorrelated with $\boldsymbol{X_{it}}$. However, in this situation, the typical formulation of equation (2) reduces to a first-order model. In a static panel data model choosing between fixed or random effects produces a consistent and efficient estimator, whereas in a dynamic model the opposite occurs because it will depend upon $\boldsymbol{\alpha_i}$ irrespective of the way we treat the latter (Verbeek, 2004).

Only when T is a very large number of time periods would a within estimator used to a first-order autoregressive model produce consistent estimates, according to Green (2003). A two-step method based on differencing and instrumenting that is a reliable and effective estimator (Arellano and Bond, 1991). To eliminate the individual effects (αi), the dynamic equation must first be differentiated. Cameron & Trivedi (2005) put the first step of the procedure as;

$$\Delta Y_{it} = \theta_1 \Delta Y_{it-1} + \cdots + \theta_p \Delta Y_{it-p} + \Delta X'_{it}\beta + \Delta\varepsilon_{it} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (10)$$

In this regard, it is assumed that $\boldsymbol{\varepsilon_{it}}$ are serially uncorrelated, otherwise, estimators are inconsistent. The second step deals with instrumental variable (IV) estimation of the first differenced (FD) model that uses appropriate lags of the dependent variable as instruments. According to Drukker (2008), these couple of steps does lead to consistent parameter estimates. The fixed or random effects panel data estimators are not appropriate even for the FD equation. In contrast to a static model, ordinary least squares on the FD data produce inconsistent estimates because the regressor $\Delta \boldsymbol{Y_{it-1}}$ is correlated with the error $\Delta\boldsymbol{\varepsilon_{it}}$, even if the $\boldsymbol{\varepsilon_{it}}$ are serially uncorrelated. For serially uncorrelated $\boldsymbol{\varepsilon_{it}}$, the FD model error term $\Delta\boldsymbol{\varepsilon_{it}} = \boldsymbol{\varepsilon_{it}} - \boldsymbol{\varepsilon_{it-1}}$ has correlation with $\Delta\boldsymbol{Y_{it-1}} = \boldsymbol{Y_{it-1}} - \boldsymbol{Y_{it-2}}$ because $\boldsymbol{Y_{it-1}}$ depends on $\boldsymbol{\varepsilon_{it-1}}$. However, $\Delta\boldsymbol{\varepsilon_{it}}$ is uncorrelated with $\Delta\boldsymbol{Y_{it-k}}$ for $\boldsymbol{k \geq 2}$, opening up the possibility of IV estimation using lagged variables as instruments (Cameron & Trivedi, 2005).

The Arellano-Bond estimator uses an IV estimation strategy based on the assumption that $\mathbf{E}(\boldsymbol{Y_{ik}}, \Delta\boldsymbol{\varepsilon_{it}}) = 0$ for all $\boldsymbol{k \leq t-2}$ in the level equation, so that the lags $\boldsymbol{Y_{it-2}}, \boldsymbol{Y_{it-3}}, \boldsymbol{Y_{it-4}}$, and so forth can be applied as instruments in the first differenced equation. In the case of the system GMM estimator, we consider the additional condition that $\boldsymbol{E(\Delta Y_{it-1}, \varepsilon_{it}) = 0}$ and incorporate the levels equation utilizing $\Delta\boldsymbol{Y_{it-1}}$ as an instrument (Cameron & Trivedi, 2005). Similar additional moment

conditions can be added for endogenous and predetermined variables, whose first differences can be used as instruments.

Depending on the previous justifications, our equation to be estimated can be specified in the first differenced forms as:

$$\Delta y_{it} = \beta_1 \Delta y_{it-1} + \beta_2 \Delta \ln(GFCF)_+ \beta_3 \Delta \ln(GGFCE)_{it} + \beta_4 \Delta(INF)_{it} + \beta_5 \Delta(DCTBB)_{it} + \beta_6 \Delta \ln(TD)_{it} + \beta_7 \Delta \ln(LFPR)_{it} + \beta_8 \Delta \ln(GDPPC)_{it} + \beta_9 \Delta \ln(SSE)_{it} + \beta_{10} \Delta (SSE * DCTBB)_{it} + \Delta \varepsilon_{t.} \quad (11)$$

$$\Delta y_{it} = \beta_1 \Delta y_{it-1} + \beta_2 \Delta \ln(GFCF)_+ \beta_3 \Delta \ln(GGFCE)_{it} + \beta_4 \Delta(INF)_{it} + \beta_5 \Delta DCTPS_{it} + \beta_6 \Delta \ln(TD)_{it} + \beta_7 \Delta \ln(LFPR)_{it} + \beta_8 \Delta \ln(GDPPC)_{it} + \beta_9 \Delta \ln(SSE)_{it} + \beta_{10} \Delta (SSE * DCTPS)_{it} + \Delta \varepsilon_{t.} \quad (12)$$

$$\Delta y_{it} = \beta_1 \Delta y_{it-1} + \beta_2 \Delta \ln(GFCF)_+ \beta_3 \Delta \ln(GGFCE)_{it} + \beta_4 \Delta(INF)_{it} + \beta_5 \Delta(DCTPS)_{it} + \beta_6 \Delta \ln(TD)_{it} + \beta_7 \Delta \ln(LFPR)_{it} + \beta_8 \Delta \ln(GDPPC)_{it} + \beta_9 \Delta \ln(PTTRP)_{it} + \beta_{10} \Delta (PTTRP * DCTPS)_{it} + \Delta \varepsilon_{t.} \quad (13)$$

$$\Delta y_{it} = \beta_1 \Delta y_{it-1} + \beta_2 \Delta \ln(GFCF)_+ \beta_3 \Delta \ln(GGFCE)_{it} + \beta_4 \Delta(INF)_{it} + \beta_5 \Delta(DCTPS)_{it} + \beta_6 \Delta \ln(TD)_{it} + \beta_7 \Delta \ln(LFPR)_{it} + \beta_8 \Delta \ln(GDPPC)_{it} + \beta_9 \Delta \ln(PTTRP)_{it} + \beta_{10} \Delta (PTTRP * DCTPS)_{it} + \Delta \varepsilon_{t.} \quad (14)$$

Using the latest version of Arellano-Bond GMM estimation, equations (11), (12), (13) and (14) are first estimated to the human capital, financial development and their impact on economic growth from Sub-Saharan African country analysis. Since the Arellano-Bond method generates several instruments (for large T) leading to potentially poor performance of asymptotic results (when the number of groups is small), we have employed the least possible number of instruments. The Stata/SE 13.0 computer software was used for estimation.

CHAPTER FOUR

4.RESULT AND DISCUSSIONS

This chapter examines the impact of human capital and financial development on economic growth in a cross-country analysis. The empirical research uses annual data of 26 different Sub-Saharan African countries for 11-years period, from (2010–2020). The research offer descriptive statistics of variables utilized in the model in the first half of this chapter. The second portion is a report on the findings of the diagnostic testing. The third section presents and discusses the results of the estimated model, and the fourth portion will wrap up the chapter.

4.1 Descriptive Statistics

The summary statistics in Table 1 show the mean GDP per capita growth rate of 1.77 percent per year with a standard deviation of 4.55 percent. The minimum growth rate is -36.55% and the maximum are 18.06 for the period of 2010-2020. The maximum growth rate was Sierra Leone's in 2013 while the minimum growth rate was that of Central African Republic in 2013. The mean per capita GDP (in 2015 constant USD) is $ 1106.177 with a standard deviation of $1,045.68. The minimum per capita GDP is $270.69 for Burundi during 2020 and the maximum per capita GDP is $5754.48 for South Africa during 2014.

The mean rate of domestic credit to private sector (%GDP) during the study period was 20.43 with standard deviation of 21.68%. The minimum domestic credit to the private sector as a percentage of GDP is 3.72 while the maximum domestic credit to the private sector was 128.44%. The minimum domestic credit as a percentage of GDP was Democratic Republic of Congo in 2010 while the maximum domestic credit to private sector was that of South Africa in 2014. The maximum domestic credit to private sector (128.42%) of GDP in Republic of Congo was to recover the private sector from covid19 economy slowdown. While the minimum

domestic credit in Congo democratic republic was the indication low economy base in the country.

Table 4.1: Descriptive Statistics

Variable		Mean	Standard deviation	Minimum	Maximum	Observation
GDPPCG	overall	1.767258	4.553582	-36.55692	18.06588	N=286
	between		1.774451	-1.129344	6.502218	n=26
	within		4.206769	-33.68596	17.66886	T=11
GDPPC	overall	1106.177	1045.678	270.6914	5754.485	N=286
	between		1059.792	301.6876	5620.14	n=26
	within		98.45239	607.0822	1479.609	T=11
DCTPS	overall	20.4321	21.68433	3.723919	128.8498	N=286
	between		21.87034	5.649185	121.899	n=26
	within		2.946391	6.411396	30.12389	T=11
DCTPSBB	overall	17.92786	11.5097	3.697574	63.26957	N=286
	between		11.38642	5.617759	61.53019	n=26
	within		2.715105	8.786569	27.62369	T=11
GFCF	overall	22.10825	7.483141	5.885067	52.41832	N=286
	between		6.223771	10.59763	35.50553	n=26
	within		4.31523	11.08994	50.16528	T=11
GGFCE	overall	14.15651	7.063163	3.587513	40.55352	N=286
	between		6.223771	5.436709	39.06753	n=26
	within		4.31523	4.695453	20.73335	T=11
Inf	overall	5.305579	5.204964	-3.233389	32.01479	N=286
	between		3.943432	0.6743849	13.66852	n=26
	within		3.476583	-4.560423	23.65185	T=11
LFPR	overall	71.01732	10.26036	47.11	90.34	N=286
	between		10.38254	47.97506	88.35507	n=26
	within		1.12261	68.14343	76.29941	T=11
TD	overall	60.80235	25.11255	20.72252	152.5146	N=286
	between		23.64023	33.08176	141.569	n=26
	within		9.559748	29.08184	92.05128	T=11
SSE	overall	44.86732	17.60996	13.04247	109.4441	N=286
	between		16.89242	19.76423	102.1207	n=26
	within		5.896547	16.38331	85.22429	T=11
PTRP	overall	44.47785	11.69576	26.99486	85.09274	N=286
	between		11.30604	31.28413	82.70514	n=26

	within		3.667363	35.03893	70.16576	T=11
PTRS	overall	27.2991	8.80635	14.20295	69.15858	N=286
	between		7.572257	14.71219	47.56985	n=26
	within		4.714299	-0.5274232	50.61596	T=11

The mean of domestic credit to private sector by banks (% of GDP) during study period was 17.93% with standard deviation of 11.51. The minimum of domestic credit to private sector by banks (% of GDP) is 3.7% while the maximum domestic credit to private sector by banks (% of GDP) is 63.27%. The maximum Domestic credit to private sector by banks (% of GDP) during study period was in South Africa in 2010 while the minimum was that of Congo democratic republic in 2011. From the result we can understand that South Africa in 2010 has injected loans to private sector to recover the private sector from loss caused by the pandemic. On the other hand, Congo democratic republic in 2011 has lowest financial proportion out of the country economy. The reason for that is the country financial system is not developed during that time as a result of conflict.

Gross fixed capital formation (% of GDP) has a mean of 22.11% with standard deviation of 7.48%. The term "gross fixed capital formation," abbreviated as "GFCF," refers to resident producers' investments in fixed assets within a particular period, after subtracting disposals. Certain increases to the value of non-produced assets realized by producers or institutional entities are also included. The minimum percentage of Gross fixed capital formation (% of GDP) was 5.88% while the maximum Gross fixed capital formation (% of GDP) was 52.41%. The minimum Gross fixed capital formation (% of GDP) was Guinea-Bissau in 2012 while the maximum Gross fixed capital formation (% of GDP) Guinea in 2016.

General government final consumption expenditure (% of GDP) has a mean of 14.16 with standard deviation of 7.06. General government final consumption expenditure (% of GDP) has a maximum value of 40.55% and with a minimum value of 3.59. From these Chad has the lowest General government final consumption expenditure in 2019. On the other hand, Lesotho has maximum portion of General government final consumption expenditure from its GDP in 2013.

The mean rate of inflation is 5.31% with a standard deviation of 5.2%. The maximum inflation rate was 32.01% while the minimum inflation rate was -3.23%. The maximum inflation rate during study period was in Ethiopia in 2011 while the minimum inflation was happened in

Burkina Faso in 2019. This means that the general price level is declining and consumer prices get cheaper.

Labor force participation rate, total (% of total population ages 15-64) has a mean of 71.01 with standard deviation of 10.26%. Labor force participation rate, total (% of total population ages 15-64) has a maximum rate of 90.34% and a minimum value of 47.11. The highest Labor force participation rate, total (% of total population ages 15-64) was in Uganda in 2020 while Senegal has the lowest Labor force participation rate, total (% of total population ages 15-64) in 2015.

Trade (% of GDP) has a mean of 60.8% with standard deviation of 25.11%. Trade (% of GDP) has a minimum value of 20.72% and a maximum value of 152.51%. Nigeria during study period has the lowest trade (% of GDP) in 2016 where as Lesotho in 2020 has the highest Trade (% of GDP).

The gross enrollment ratio (GER) is the proportion of all enrolment, regardless of age, to the population in the age category that is considered to formally correspond to the education level displayed. The goal of secondary education is to provide the groundwork for lifetime learning and human development by giving more subject- or skill-oriented training with more specialized teachers. Secondary education completes the basic education program that began at the elementary level. School enrollment, secondary (% gross) has a mean of 44.89 percent with standard deviation of 17.61 %. School enrollment, secondary (% gross) has a minimum value of 13.04% and a maximum value of 109.44%. During the study period Niger in 2010 has the lowest School enrollment, secondary (% gross) whereas South Africa in 2015 has the highest School enrollment, secondary (% gross).

The typical Pupil-teacher ratio in primary schools is the number of students per teacher. Pupil-teacher ratio, primary has a mean value of 44.48 pupils with standard deviation of 11.7. Pupil-teacher ratio, primary has a maximum value of 85.09 pupils and with a minimum value of 26.99 pupils. Central African Republic has maximum Primary school pupil-teacher ratio in 2020 while Ghana has the lowest Primary school pupil-teacher ratio in 2019.

Secondary school pupil-teacher ratio is the average number of pupils per teacher in secondary school. Pupil-teacher ratio, secondary has a mean value of 27.2991 with standard deviation of 8.81. Secondary school pupil-teacher ratio has a maximum value of 69.16 where as it has a minimum value of 14.2. Under the study period Congo Democratic republic in 2010 has the

lowest Secondary school pupil-teacher ratio whereas Central African Republic in 2015 has the highest Secondary school pupil-teacher ratio.

4.2 Correlation Analysis

From table 4.2, GDP per capita growth rate is positively correlated with gross fixed capital formation, total trade, and labor force, pupil to teacher ratio primary and pupil to teacher ratio secondary. On the other hand, GDP per capita growth rate is negatively correlated with GDP per capita, domestic credit to private sector, domestic credit to private sector by bank, general government final consumption expenditure, inflation, and Secondary school enrollment.

From the table below, GDP per capital is positively correlated with domestic credit to private sector (DCTPS), domestic credit to private sector by banks (DCTPBB), General government final consumption expenditure (% of GDP), inflation, secondary school enrolment while it is negatively correlate with gross fixed capital formation labor force, total deposit, and pupil to teacher ration primary.

Table 4.2: Correlation among Variables

Variables	GDPPCG	GDPPC	DCTPS	DCTPSBB	GFCF	GGFCF	Inf	LFPR	TD	SSE	PTRP	PTRS
GDPPCG	1											
GDPPC	-0.0777	1										
DCTPS	-0.0815	0.7867	1									
DCTPSBB	-0.0785	0.7273	0.9177	1								
GFCF	0.2338	-0.1426	0.0293	0.0804	1							
GGFCF	-0.0653	0.0521	0.2865	0.3137	0.0885	1						
Inf	-0.1291	0.0686	-0.1028	-0.1083	-0.0046	-0.1165	1					
LFPR	0.0952	-0.4813	-0.3432	-0.3442	0.0584	0.0166	0.0051	1				
TD	0.0952	-0.0046	0.1186	0.1533	0.2195	0.5372	-0.0521	-0.1936	1			

SSE	-0.0353	0.4854	0.4197	0.3572	-0.0401	0.1374	0.1357	-0.1575	0.0770	1		
PTRP	0.1114	-0.3703	-0.3045	-0.3482	-0.0077	-0.0881	0.0093	0.2374	-0.1220	-0.3972	1	
PTRS	0.0971	-0.1850	-0.0755	-0.1146	-0.0040	0.0373	0.0183	0.0430	-0.0103	-0.4126	0.5229	1

The other variable domestic credit to private sector is positively correlated with domestic credit to private sector by banks (DCTPSBB), gross fixed capital formation, General government final consumption expenditure (% of GDP), secondary school enrolment, and total trade.

The other variable domestic credit to private sector by banks is positively correlated with), gross fixed capital formation, General government final consumption expenditure (% of GDP), secondary school enrolment, and total trade. The fifth variable gross fixed capital formation is positively correlated with General government final consumption expenditure (% of GDP), labor force participation rate and total trade. The sixth variable General government final consumption expenditure (% of GDP) is positively correlated with labor force participation rate, inflation and secondary school enrolment. The seventh variable inflation is positively correlated with labor force participation rate, Secondary school enrolment, pupil to teacher ration primary and pupil to teacher ration secondary. Labor force participation ration is positively correlated with pupil to teacher ration primary and pupil to teacher ration secondary. Total trade is positively correlated with secondary school enrolment.

4.4 Regression Analysis

4.1.1 Regression Result of Human Capital, Finance and Economic Development

Looking at the results displayed below in Table 4.3 the dynamic model estimation with predetermined variables has been implemented by applying a one-step system GMM. The researcher chooses the one-step system GMM because it has a lower bias and higher efficiency than all the other estimators, including the standard first-differences GMM estimator (Blundell et al., 2001; Hayakawa, 2007; Kukenova & Monteiro, 2008; Hayakawa & Qi, 2020). Within this strategy, the first step to be considered is to identify the appropriate instruments for period t in the equations. Generally, a crucial assumption for the validity of GMM is that the instruments are exogenous. From the result below, the Hansen J test shows a case of no over-identifying

restrictions for all four models in the table below. This suggests that the entire model seems to be valid in the present context. The AR (1) term is found to be significant with a p-value of 0.018 for model one and 0.020 for model 2, 0.014 for model 3 and 0.012 model 4 each. Whereas AR (2) term is found to be insignificant with a p-value of 0.950 for model one, 0.977 for model 2, 0.521 for model 3 and 0.700 respectively. This implies the presence of a negative first-order autocorrelation though does not imply inconsistency in the results.

Table 4.3: Econometrics Result using one Step dynamic System GMM

Variables	*Model (1)*	*Model (2)*	*Model(3)*	*Model (4)*
lnGDPPCG				
L1.	0.1393	0.1438	0.1731*	0.1920**
	(0. 1003)	(0.1001)	(0.0926)	(0.0974)
lnGFCF	0.3327***	0.3295**	0.3341**	0.2960**
	(0.1292)	(0.1296)	(0.1407)	(0.1277)
lnGGCFE	-0.4374**	-0.3946**	-0.2690**	-0.0411**
	(0.0290)	(0.0235)	(0.0779)	(0.0033)
lnGDPPC	0.1817	0.2230*	0.2216	0.5215***
	(0. 1103)	(0.1169)	(0.1032)	(0.1112)
lnDCTPSBB	4.1208**		0.7146**	
	(1.6818)		(1.3416)	
lnDCTPS		3.2154***		4.9208***
		(1.2185)		(1.0026)
Inf	0 .0141	0.0159	0.0267	0.0058
	(0.0177)	(0.0179)	(0.0213)	(0.0153)
lnTD	-0.0104	-0.0516	0.19036	0.0106
	(0.3324)	(0.3237)	(0.3240)	(0.3132)
lnLFPR	-1.7125**	-1.6498**	-2.3202**	-2.0773***
	(0.8258)	(0.8055)	(0.9150)	(0.7521)
lnSSE	2.7564**	2.2145**		
	(1.2203)	(0.9178)		
lnPTRP			0 .0354***	0.0242*
			(0.0097)	(0 .0134)
*lnSSE**	1.1513**			
lnDCTPSBB	(0.4458)			
*lnSSE**		0.91219**		
lnDCTPS		(0.3180)		
*lnPTRP**			0.0164***	
lnDCTPSBB			(0.0052)	
*lnPTRP**				1.1979**
lnDCTPS				(0.271)
Constant	-2.8872	-1.3171	5.3731	7.3573
	(3.0190)	(2.7457)	(4.0954)	(3.7195)
Hansen Test of Overid. Restrictions	chi2(157) = 201.35 Prob > chi2 = 0.559	chi2(157) = 201.40 Prob > chi2 = 0.090	chi2(162) =185.14 Prob > chi2 = 0.103	chi2(163) =183.70 Prob > chi2 = 0.128
Arellano-Bond Test for Autocorrelation	AR(1)z = -2.36 Pr > z = 0.018	AR(1) z = -2.33 Pr > z = 0.020	AR(1): z = -2.46 Pr > z = 0.014	AR(1)= z = -2.50 Pr > z = 0.012

	AR(2): -0.06 Pr > z = 0.950	AR(2): z = 0.03 Pr > z = 0.977	AR(2): z = 0.64 Pr > z = 0.521	AR(2)= z = 0.39 Pr > z = 0.700
N	286	286	286	286

t statistics in parentheses ***p < 0.01, **p < 0.05, *p<0.1

From the above table, the lag of growth of GDP per capital is not statistically significant. The result indicated that even if the lag of GDP per capital growth favorably associated with the current GDP per capita it has no significant effect on growth. The reason for the insignificant effect of lag of GDP per capita growth is previous year GDP per capita growth is temporary and nominal which is not a long-term growth.

When we come to natural logarithm of gross fixed capital formation, it is significantly and positively affects the growth rate of GDP per capita growth. Other things being remain constant increasing the level of gross fixed capital formation by 1 percent resulted in 0.33 percent, 0.329 percent, 0.334 percent and 0.296 percent in model 1, mode 2, model 3, and mode 4 respectively as displayed in the table below. This indicated that gross fixed capital formation is one of major determining factors in increasing the level of GDP per capita growth. We can Cleary understand that an increasing gross fixed capital formation the faster the economy growth and then the faster GDP per capita growth. Firms produce more goods and services and resulted in increasing the GDP per capita of the country. The GDP per capita growth of the country is determined by the gross fixed capital formation the result is aligned with more specifically in poor and developing countries (Ali et al., 2015; Mitić et al., 2020; Purba et al., 2019).

The third variable, general government final consumption expenditure has negatively related with the growth of real GDP per capital and significantly affects the GDP per capita growth of the country. This is due to the fact that increasing the level of government expenditure resulted in increasing the level of aggregated demand which can lead to raise short term economic growth and potential leads to higher inflation in developing countries especially in Sub-Saharan African countries. According to the classist view government expenditure harms economic growth. Devarajan et al. (1996), Zhang et al. (2022) and Le et al. (2020) argued that government expenditure negatively affected economic growth of the country. The study result indicated that other factors being remain constant increasing the level of government expenditure by 1 percent resulted in decreasing the level of GDP per capital growth by 0.43 percent in model 1, by 0.39 percent in model 2, by 0.26 in model 3, by 0.04 percent in model 4 respectively.

GDP per capita has insignificantly affected the growth of GDP per capita in model 1, model 2 and mode 3; however it has a significant effect on model 4. The reason is that only the interaction of human capita measured and explained in the form of pupil to teacher ratio in primary school and financial development explained in the form of domestic credit to private sector allows the GDP per capita to have a significant effect on GDP per capita growth. We also understand that the country without primary education and not access with domestic credit to private sector has resulted in insignificant effect of GDP per capital on GDP per capita growth.

The other variable, the natural logarithm of domestic credit to private sector by banks (lnDCTPSBB) has positive and significant effect on GDP per capita growth of the country in model 1 and model 4 as shown in the table below. Financial development measured by domestic credit to private sector by banks enhanced investment allocation, promotes the level of investment in the country, improved the economic growth of the country, improved the economic development of the country and the final consequence is improve the level of GDP per capita growth. The result is aligned with Gozgor et al.(2019), Campa (2020) and Iheonu et al.(2020).

Like that of Domestic credit to private sector by banks, domestic credit to private sector has positively and statically affected the GDP per capita growth in Sub Saharan African countries. Other things being remain constant increasing the level of domestic credit to private sector by 1 percent resulted in increasing the level of GDP per capital growth by 3.21 percent and 4.92 percent in model two and model four respectively. Improving the level of financial development in the form of domestic credit to private sector enhanced GDP per capita growth by resource mobilization and strong directional relationship between domestic credits. The resource mobilization from depositor's particularly households to borrower facilitates economic development through easing the credit constraint of the private sector. The result is also in line with Ganda (2019), Matei (2020), Nwani & Omoke (2020).

The other two variables namely inflation and trade openness are not statistically significant determinants of GDP per capita growth. The natural logarithm of labor force participation negatively affected the GDP per capita growth of the Sub Saharan African countries. Other things being remain constant; increasing the level of labor force participation rate by 1 percent resulted in decreasing the level of GDP per capita growth of Sub Saharan African country by 1.71 percent in model one, 1.65 percent in model 2, 2.3 percent in model 3 and 2.1 percent in

model 4. From the result we can clearly understand that global economic slowdown is likely to force more labor forces to accept lower quality, poorly paid jobs which lack social protection and job security. Furthermore as inflation and nominal income rises faster than real income, the cost of living crisis tends to pushing more people in to poverty in African countries which resulted in decreasing the level of GDP per capita growth in Sub Saharan African countries. The other reason is that even if the labor force participation rate is increasing in Sub Saharan countries. However skilled and trained labor force participation is not increasingly in adequate level. As a result of this the unemployment rate in the continent increases from time to time and this indirectly affected the GDP per capita growth of the countries.

Regarding the secondary school enrollment as proxy variable for human capital, it has significant and positive effect on GDP per capital growth in model 1 and model 2 respectively as shown in the table below. Other things being remain constant increasing the level of Secondary school enrolment by 1 percent resulted in increasing the level of GDP per capita growth by 2.75 percent and 2.21 percent in model 1 and 2 respectively as displayed in the table below. This is due to the fact that higher the education level the higher the productivity and higher GDP per capita growth in the country.

Like Secondary school enrolment, pupil to teacher ratio has positive and significant effect on GDP per capita growth. Increasing the level of pupil to teacher ratio by one percent resulted in increasing the level of GDP per capita growth by 0.03 percent in model three. However it has not significant effect in model 4 as shown in the table below.

- **The interaction effect of Secondary School enrolment and Domestic Credit to Private Sector by banks (Model 1)**

Regarding the interaction effect of Human capital and Financial development in model 1 displayed in the below table, the interaction effect has significant and positive effect on GDP per capita growth. This is due to the fact that skilled human power with the support of finance will automatically increase productivity and this resulted in increasing the level of economic growth. Human capital with the support of financial development in the form of domestic credit to private sector enhanced economic development. Other things being remain constant increasing the interaction effect by 1 percent resulted in increasing the level of GDP per capita growth by 1.15 percent. The result is aligned with previous researchers like Ibrahim & Sare (2018) who

studied in Africa, Ibrahim, M., & Alagidede, P. (2018) in Sub Saharan African country, Sarwar et al. (2018) in Emerging Countries.

- **The interaction effect of Secondary School enrolment and Domestic Credit to Private Sector (Model 2)**

From the result below in model 2, Secondary school enrollment as proxy for Human capital and Domestic credit to private sector for financial development has significant and positive effect on GDP per capita growth in sub Saharan African countries. Other things being remain constant increasing the level of interaction by one percent resulted in increasing the level of GDP per capita growth by 0.912 percent. From the result we can clearly understand that advanced level of education with the support of finance in the form of credit to private sector increases the level of educated human capital and this intern generated productivity and finally the level of GDP per capita growth across each sub Saharan African country.

- **The interaction effect of Pupil to Teacher ratio and Domestic Credit to Private Sector by banks (Model3)**

Likewise model 1 and model 2, the interaction of human capital (pupil to teacher ratio as proxy variable) and domestic credit to private sector by banks as a proxy variable for financial development has significant and positive effect on GDP per capita growth of sub Saharan African countries. Other things being remain constant, increasing the level of the interaction by one percent resulted in increasing the level of GDP per capita growth by 0.0164 percent. This is due to the fact that access of credit by banks to private sector facilities the establishment of different primary school and this will in return increase the level of pupil to teacher ratio in primary school and resulted in improving the quality of education. Generally the indirect effect of financial development on human capital and indirect effect of human capital on financial development automatically improves the GDP per capita growth of the country.

- **The interaction effect of Pupil to Teacher ratio Primary and Domestic Credit to Private Sector (Model 4)**

Likewise model 1, model 2 and model 3, the interaction of human capital (pupil to teacher ratio as proxy variable) and domestic credit to private sector as a proxy variable for financial development has significant and positive effect on GDP per capita growth of sub Saharan

African countries. Other things being remain constant, increasing the level of the interaction by one percent resulted in increasing the level of GDP per capita growth by 1.2 percent. This is due to the fact that access of credit to private sector facilities the establishment of different primary school and this will in return increase the level of pupil to teacher ratio in primary school and resulted in improving the quality of education. Generally the indirect effect of financial development on human capital and indirect effect of human capital on financial development automatically improves the GDP per capita growth of the country. The result is aligning with the finding of Hakeem & Oluitan (2012), Cojocaru et al. (2016), Caporale et al. (2015).

CHAPTER FIVE

5. SUMMARY, CONCLUSION AND POLICY RECCOMENDATION

5.1 Conclusion

The research examines the impact of human capital and financial development on economic growth in a cross-country analysis. The empirical research incorporates annual data of 26 different Sub-Saharan African nations over 11-years period, from (2010–2020).

The mean GDP per capita growth rate of 1.767 percent per year with a standard deviation of 4.553 percent. The minimum growth rate is -36.55% and the maximum are 18.06 for the period of 2010-2020. The maximum growth rate was Sierra Leone's in 2013 while the minimum growth rate was that of Central African Republic in 2013. The mean per capita GDP (in 2015 constant dollars) is $ 1,106.18 with a standard deviation of $1,045.69. The minimum per capita GDP is $270.69 for Burundi during 2020 and the maximum per capita GDP is $5,754.48 for South Africa during 2014.

GDP per capita growth rate is positively correlated with gross fixed capital formation, total trade, and labor force, pupil to teacher ration primary and pupil to teacher ratio secondary. On the other hand, GDP per capita growth rate is negatively correlated with GDP per capita, domestic credit to private sector, domestic credit to private sector by bank, general government final consumption expenditure, inflation, and secondary school enrollment.

From the regression result, the lag of growth of GDP per capital is not statistically significant. The result indicated that even if the lag of GDP per capital growth positively related with the current GDP per capita it has not significantly affect the growth. When we come to natural logarithm of gross fixed capital formation, it is significantly and positively affects the growth

rate of GDP per capita growth. Other things being remain constant increasing the level of gross fixed capital formation by 1 percent resulted in 0.33 percent, 0.329 percent, 0.3341 percent and 0.296 percent in model 1, mode 2, model 3, and mode 4 respectively.

The other two variables namely inflation and trade openness are not statistically significant determinants of GDP per capita growth. The natural logarithm of labor force participation negatively affected the GDP per capita growth of the Sub-Saharan African countries. Other things being remain constant; increasing the level of labor force participation rate by 1 percent resulted in decreasing the level of GDP per capita growth of Sub Saharan African country by 1.71 percent in model one, 1.65 percent in model 2, 2.3 percent in model 3 and 2.1 percent in model 4.

Regarding the interaction effect of human capital and financial development, the interaction effect has significant and positive effect on GDP per capita growth. The researcher concluded that it is because skilled labor will naturally boost productivity with the help of finance, which led to an increase in the rate of economic growth. Economic growth was accelerated by human capital with the support of financial development in the form of domestic credit to the private sector.

Secondary school enrollment as proxy for human capital and domestic credit to private sector for financial development has significant and positive effect on GDP per capita growth in Sub-Saharan African countries. The interaction of human capital (pupil to teacher ratio as proxy variable) and domestic credit to private sector by banks as a proxy variable for financial development has significant and positive effect on GDP per capita growth of Sub-Saharan African countries.

Likewise model 1, model 2 and model 3, the interaction of human capital (pupil to teacher ratio as proxy variable) and domestic credit to private sector as a proxy variable for financial development has significant and positive effect on GDP per capita growth of Sub-Saharan African countries.

Other things being remain constant, increasing the level of the interaction by one percent resulted in increasing the level of GDP per capita growth by 1.2 percent. This is due to the fact that access of credit to private sector facilities the establishment of different primary school and this will in return increase the level of pupil to teacher ratio in primary school and resulted in

improving the quality of education. This is because private sector access to credit enables the opening of various primary schools, which will raise the pupil-to-teacher ratio in primary schools and improve the quality of education. Generally, the indirect effect of financial development on human capital and indirect effect of human capital on financial development automatically improves the GDP per capita growth of the country.

5.2 Policy Recommendation

From the result and conclusion part, the researcher has drawn the following major recommendations:

1. The researcher concluded that the GDP per capital growth of Sub-Saharan African countries is significantly and favorably impacted by gross fixed capital formation. Therefore, the researcher recommended those government officials to draw a policy that enhances the accumulated capital in their country, such as encouraging households to save implementing incentive policies for foreign investors, ,and creating awareness about the significance of banks to the rural areas.
2. Government spending on final consumption has had a detrimental impact on the sub-Saharan counties GDP per capita growth. The researcher recommend that in order to generate and boost investment in the nations, government should cut down on its spending and shift back to capital investments.
3. Domestic credit to private sector by banks has significant effect on GDP per capita. Therefore, in order to accomplish inclusive financial service and subsequently enhance the economic growth of the country, central banks and policymakers in each nation should assist the financial development by implementing clear and straightforward credit procedure policies and directives to private banks. In addition, the government should

develop a policy that makes it simple for the private sector to get loans from financial institutions using merely patent rights without the need for collators.

4. The government or policy makers should have to develop a strategy that equipped the human capital with adequate knowledge, skills and experiences. The government should also adopt a university industry linkage for students to transform their theoretical knowledge in practice.
5. The government should also focus on facilitating credit for education to improve the GDP per capita growth in each country. If there is available credit to schools, students and private sectors there will be advanced education with full equipment and human resource, and this in return generate skilled work force. Generally, the government should develop a strategy that interlinks educational institutions and financial institutions.

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APPENDIXES

Descriptive Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations	
GDPPCG	overall	1.767258	4.553582	-36.55692	18.06588	N =	286
	between		1.774451	-1.129344	6.502218	n =	26
	within		4.206769	-33.68596	17.66886	T =	11
GDPPC	overall	1106.177	1045.678	270.6914	5754.485	N =	286
	between		1059.792	301.6876	5620.14	n =	26
	within		98.45239	607.0822	1479.609	T =	11
DCTPS	overall	20.4321	21.68433	3.723919	128.8498	N =	286
	between		21.87034	5.649185	121.899	n =	26
	within		2.946391	6.411396	30.12389	T =	11
DCTPSBB	overall	17.92786	11.5097	3.697574	63.26957	N =	286
	between		11.38642	5.617759	61.53019	n =	26
	within		2.715105	8.786569	27.62369	T =	11
GFCF	overall	22.10825	7.483141	5.885067	52.41832	N =	286
	between		6.223771	10.59763	35.50553	n =	26
	within		4.31523	11.08994	50.16528	T =	11
GGFCE	overall	14.15651	7.063163	3.587513	40.55352	N =	286
	between		6.91097	5.436709	39.06753	n =	26
	within		1.950029	4.695453	20.73335	T =	11
inf	overall	5.305579	5.204964	-3.233389	32.01479	N =	286
	between		3.943432	.6743849	13.66852	n =	26
	within		3.476583	-4.560423	23.65185	T =	11
LPR	overall	71.01732	10.26036	47.11	90.34	N =	286
	between		10.38254	47.97506	88.35507	n =	26
	within		1.12261	68.14343	76.29941	T =	11
TD	overall	60.80235	25.11255	20.72252	152.5146	N =	286
	between		23.64023	33.08176	141.569	n =	26
	within		9.559748	29.08184	92.05128	T =	11
SSE	overall	44.86732	17.60996	13.04247	109.4441	N =	286
	between		16.89242	19.76423	102.1207	n =	26
	within		5.896547	16.38331	85.22429	T =	11
PTRP	overall	44.47785	11.69576	26.99486	85.09274	N =	286
	between		11.30604	31.28413	82.70514	n =	26
	within		3.667363	35.03893	70.16576	T =	11
PTRS	overall	27.2991	8.80635	14.20295	69.15858	N =	286
	between		7.572257	14.71219	47.56985	n =	26
	within		4.714299	-.5274232	50.61596	T =	11

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Model 1

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: year                            Number of obs      =       167
Time variable : countryID                       Number of groups   =        10
Number of instruments = 168                     Obs per group: min =        13
Wald chi2(10) =  1.45e+11                                      avg =     16.70
Prob > chi2   =     0.000                                      max =        23
------------------------------------------------------------------------------
             |               Robust
    lnGDPPCG |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnGDPPCG |
         L1. |   .1392946   .1000257     1.39   0.164    -.0567521    .3353413
             |
      lnGFCF |   .3326525   .1292269     2.57   0.010     .0793723    .5859326
     lnGGFCE |  -.4374295   .3290389    -1.33   0.184    -1.082334     .207475
   lnDCTPSBB |   4.120812   1.681864     2.45   0.014     .8244198    7.417204
         inf |   .0140862   .0177538     0.79   0.428    -.0207105    .0488829
          lnTD |  -.0104536   .3324235    -0.03   0.975    -.6619917    .6410845
       lnLFPR |   -1.71246    .825872    -2.07   0.038     -3.33114    -.093781
      lnGDPPC |   .1812601   .1102698     1.64   0.100    -.0348646    .3973849
        lnSSE |   2.756365   1.220268     2.26   0.024     .3646841    5.148046
lnSSEDCTPSBB |  -1.151285   .4458412    -2.58   0.010    -2.025118   -.2774526
       _cons |  -2.887223   3.019017    -0.96   0.339    -8.804388    3.029942
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnGFCF lnGGFCE lnDCTPSBB)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/25).L.lnGDPPCG
Instruments for levels equation
  Standard
    lnGFCF lnGGFCE lnDCTPSBB
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnGDPPCG
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.36  Pr > z =  0.018
Arellano-Bond test for AR(2) in first differences: z =  -0.06  Pr > z =  0.950
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(157)  = 201.35  Prob > chi2 =  0.010
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(157)  =   0.00  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)


.
```

Model 2

```
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: year                            Number of obs      =       167
Time variable : countryID                       Number of groups   =        10
Number of instruments = 168                     Obs per group: min =        13
Wald chi2(10) =   1370.30                                      avg =     16.70
Prob > chi2   =     0.000                                      max =        23
------------------------------------------------------------------------------
             |               Robust
    lnGDPPCG |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lnGDPPCG |
         L1. |   .1438259    .100106     1.44   0.151    -.0523782    .3400299
             |
      lnGFCF |   .3294606   .1296154     2.54   0.011     .0754191    .5835022
     lnGGFCE |  -.3946461   .3235379    -1.22   0.223    -1.028769    .2394766
     lnDCTPS |   3.215455    1.21857     2.64   0.008     .8271008    5.603808
         inf |   .0158928   .0178868     0.89   0.374    -.0191647    .0509502
        lnTD |  -.0516192   .3237223    -0.16   0.873    -.6861032    .5828649
      lnLFPR |  -1.649838   .8055238    -2.05   0.041    -3.228636   -.0710405
     lnGDPPC |   .2229872   .1169147     1.91   0.056    -.0061615    .4521359
       lnSSE |   2.214546   .9178234     2.41   0.016      .415645    4.013447
  lnSSEDCTPS |  -.9121978   .3180805    -2.87   0.004    -1.535624   -.2887716
       _cons |  -1.317111   2.745704    -0.48   0.631    -6.698592    4.064371
------------------------------------------------------------------------------
Instruments for orthogonal deviations equation
  Standard
    FOD.(lnGFCF lnGGFCE lnDCTPS)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/25).L.lnGDPPCG
Instruments for levels equation
  Standard
    lnGFCF lnGGFCE lnDCTPS
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnGDPPCG
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.33  Pr > z =  0.020
Arellano-Bond test for AR(2) in first differences: z =   0.03  Pr > z =  0.977
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(157)  = 201.40  Prob > chi2 =  0.010
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(157)  =   0.00  Prob > chi2 =  1.000
  (Robust, but weakened by many instruments.)


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```

Model 3

Dynamic panel-data estimation, one-step system GMM

Group variable: year			Number of obs	=	167
Time variable : countryID			Number of groups	=	10
Number of instruments = 173			Obs per group: min	=	13
Wald chi2(10) = 207.69			avg	=	16.70
Prob > chi2 = 0.000			max	=	23

lnGDPPCG	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnGDPPCG						
L1.	.173136	.0926577	1.87	0.062	-.0084697	.3547416
lnGFCF	.3341058	.1407951	2.37	0.018	.0581526	.610059
lnGGFCE	-.2690837	.2779152	-0.97	0.333	-.8137876	.2756202
lnDCTPSBB	.7146476	.3416957	2.09	0.036	.0449364	1.384359
inf	.0267996	.0212688	1.26	0.208	-.0148865	.0684857
lnTD	.1903676	.3239984	0.59	0.557	-.4446575	.8253927
lnLFPR	-2.320213	.9150121	-2.54	0.011	-4.113604	-.5268219
lnGDPPC	.2216899	.1032377	2.15	0.032	.0193478	.4240321
PTRP	.035422	.0097637	3.63	0.000	.0162854	.0545585
lnPTRPDCTPSBB	-.0164502	.0052247	-3.15	0.002	-.0266903	-.0062101
_cons	5.37312	4.09548	1.31	0.190	-2.653874	13.40011

Instruments for orthogonal deviations equation
  Standard
    FOD.(lnGFCF lnGGFCE lnDCTPSBB lnTD lnLFPR lnSSE lnGDPPC PTRP)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/25).L.lnGDPPCG
Instruments for levels equation
  Standard
    lnGFCF lnGGFCE lnDCTPSBB lnTD lnLFPR lnSSE lnGDPPC PTRP
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnGDPPCG

Arellano-Bond test for AR(1) in first differences: z = -2.46 Pr > z = 0.014
Arellano-Bond test for AR(2) in first differences: z = 0.64 Pr > z = 0.521

Sargan test of overid. restrictions: chi2(162) = 185.14 Prob > chi2 = 0.103
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(162) = 0.00 Prob > chi2 = 1.000
  (Robust, but weakened by many instruments.)

Model 4

Dynamic panel-data estimation, one-step system GMM

Group variable: year		Number of obs	= 167
Time variable : countryID		Number of groups	= 10
Number of instruments = 174		Obs per group: min	= 13
Wald chi2(10) = 1733.51		avg	= 16.70
Prob > chi2 = 0.000		max	= 23

lnGDPPCG	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnGDPPCG						
L1.	.1919941	.097424	1.97	0.049	.0010465	.3829417
lnGFCF	.2960887	.1277295	2.32	0.020	.0457435	.5464339
lnGGFCE	-.0411481	.233281	-0.18	0.860	-.4983705	.4160742
lnDCTPS	-4.920827	1.002661	-4.91	0.000	-6.886006	-2.955648
inf	.0058292	.0153039	0.38	0.703	-.0241657	.0358242
lnTD	.0106252	.313205	0.03	0.973	-.6032453	.6244957
lnLFPR	-2.077335	.7520836	-2.76	0.006	-3.551392	-.6032787
lnGDPPC	.5214636	.1112294	4.69	0.000	.303458	.7394692
PTRP	-.0242515	.0133904	-1.81	0.070	-.0504962	.0019933
lnPTRPDCTPS	1.197898	.2709204	4.42	0.000	.6669037	1.728892
_cons	7.357371	3.719587	1.98	0.048	.0671155	14.64763

Instruments for orthogonal deviations equation
  Standard
    FOD.(lnGFCF lnGGFCE lnDCTPS inf lnTD lnLFPR lnGDPPC PTRP lnPTRPDCTPS)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/25).L.lnGDPPCG
Instruments for levels equation
  Standard
    lnGFCF lnGGFCE lnDCTPS inf lnTD lnLFPR lnGDPPC PTRP lnPTRPDCTPS
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.L.lnGDPPCG

Arellano-Bond test for AR(1) in first differences: z = -2.50 Pr > z = 0.012
Arellano-Bond test for AR(2) in first differences: z = 0.39 Pr > z = 0.700

Sargan test of overid. restrictions: chi2(163) = 183.70 Prob > chi2 = 0.128
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(163) = 0.00 Prob > chi2 = 1.000
  (Robust, but weakened by many instruments.)