The Nexus Between Human Capital Investment, Labor Market and Economic Growth in Developing Countries: (In case of Ethiopia)

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A Thesis Submitted To

The Department of Economics

Presented in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Economics

(Development Economics)

Addis Ababa University

Addis Ababa, Ethiopia

May, 2020

Addis Ababa University

School of Graduate Studies

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This is to certify that the thesis prepared by Addis Teshome, entitled: *The nexus between* Human *Capital Investment, Labor Market and Economic Growth in Developing Countries: (In Case of Ethiopia)* submitted in partial fulfillment of the requirements for the degree of Master of Science in Economics (Development Economics) fulfills with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Acknowledgment

I would like to express my very great appreciation to my adviser Dr. Mesele Araya for his valuable and constructive suggestions during the planning and development of this research work. His willingness to his time so generously has been very much appreciated.

I would also like to thank the staff of NBE specifically Research Department for their support to get the important data which I can used in the methodology part and provided me additional constrictive idea. I also acknowledge the staff of Lion International Bank Risk and Compliance Department for providing me with conductive environment to pursue my education and work this paper.

Finally, I would like to acknowledge financial and emotional support of my Sister, Menbere Teshome. She kept me going on and this work would not have been possible without her input.

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Abstract

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This study examined the relationship between Human Capital Investment, Labor market and Economic Growth in Ethiopia. Annual Secondary time series data sourced from CSA, NBE, MOFED and WB covering the period 1981-2018 were used. The study conducted the Johansen Co-integration analysis and Granger causality test. The analysis was based on the impulse response and variance decomposition in VAR and VEC model. The Johansen co-integration result confirmed the existence of long run relationship between human capital investment labor market and economic growth. According to VECM result the increase of human capital investment increase unemployment rate in short run. In the other hand the positive change of unemployment result decline of real GDP in the short run signaling the positive effect of human capital investment on real GDP has decrease by negative effect on labor market. In the long run, population growth positively affects real GDP however real effective interest rate and inflation have a negative effect on real GDP. Based on the variance decomposition result in the long run the variance of real GDP due to the change in unemployment rate is the largest cause of variation in real GDP next to the variation of total investment. The researcher recommended that increasing human capital investment targeted to increase the Economic Growth should be supported by increasing job opportunity and creating supportive well-structured labor market to self-employed and entrepreneur in order to get the targeted effect on real GDP. The supply side of the labor market producing more skill full labor should be supported by the demand side of the labor market by increasing the job creation and develop more comfortable and structural organized environment for the people who went to create their own job (entrepreneur).

Key words: Labor market, Co-integration, Human capital investment and Economic growth

List of Acronyms

CSA –Central Statistical Agency

$HSDP_S$- Health Sector Development plan

ILO -International labor organization

MOFED- Ministry of finance and Economic Development

NBE- National bank of Ethiopia

OECD-Organization for Economic Co-operation and Development

PHC – Private Health Care

RGDP – Real Gross Domestic Product

UNICEF–United Nations International Children's Emergency Fund

VAR - vector auto regression

VECM - vector error correlation model

WB- World Bank

CHAPTER ONE

INTRODUCTION

1.1.Background of the study

Human capital is productive investment embodied in human persons including skills, ability, ideas, health and condition often resulting from expenditure on education on the job training program and medical care. When the person's skill enters into labor market, it will provide benefit to the labor in the form of salary or wage and at the same time contribute to the economy through production and service process. (Todaro & Smith, 2015)

In the first half of the twenty century neoclassical economics idenfifed three factors of economic growth namely land ,capital and labor. The neo classicalists explianed those factors as enough to determine economic growth in capitalist countires however through time some other different ideas came in to existence. (OECD, 2006)

In 1957,Robert M.Solow demonestrated his article with the idea that the contribution of land, labor and capital to economic growth is insignificant in capitalist economy like United States. On the other hand by opposing the Solow's theory Arrow,1992 argued that the three elements responsible for economic growth are accumulation of physical capital ,human capital and education which he called learing by investment.

Another economics T.W Shultz agreed with the idea of Arrow and he critized those economists that reject the idea of investment in human capital as one of the topic of economic anlysis. Moreover, according to Shultz the cost for education ,health and professional development are investment in human capital. Cited by (Sweetland, 2016) Similary, Romer argued that economic growth is dependent on the level of human capital. The country rich in human capital can develop very quikly ,while the shortage of human capital can lead to economic stagnation.

Since the human skill enter in to labor market to contribute to economic growth, there is a need to investigate the contribution of human capital to economic growth by including the labor market in the analysis. however, most of the economic analysis and theories explained the relatioship between human capital and economic growth without considering the labor market.

moreover, the main focus of those analysis and theories were developed countries. Thus applying those theories for developing countries having different economic structure and labor market response won't be logical.

Labor markets in developing countries are quite different from those in high income countries in that labor market in low income countries is characterized by large proportion of labor force in agriculture sector. Moreover, in low income countries there are low proportion of workers who earn income fully in the wage labor market as compared to the labor force in developing country. Thus, referring those theories of labor market written in the context of developed countries to that of low income countries could not be reasonable. (Rosenzqelg, 1998)

1.2. Statement of the problem

According to ILO (2016), the effect of human capital investment on Labor market has two opposing results on higher income country and lower income country. Human capital development in higher income country (developed country) has a significant and positive effect on labor market by increasing employment opportunity. However, in developing country the result is somehow different which is higher investment on education can increase the unemployment level in general and educated unemployment in particular. It indicates that there is a bottleneck with skilled person far outnumbering the availability jobs matching which is compatible with their competencies and expectation which will further affect the overall economic growth of the country.

Mohammed (2016) investigates the relationship between unemployment and economic growth in sub-Saharan Africa using panel data from the period of 1991-2014. The PMG (Pooled mean regression) result showed that there is a negative long run relationship between unemployment and economic growth. However, the short run relationship of the two variables is weak. The variance decomposition result showed that the effect of economic growth to reduce unemployment is minimal.

On the other hand, many researchers try to investigate the direct relationship and the impact of human capital development on economic growth of developing countries specifically in Ethiopia. Among those Tewodros, (2014) titled human capital and economic growth causality and co-integration analysis, investigated the relationship between human capital (education and health)

and economic growth using time series date from1971-2011 in Ethiopia and he found that in the long run investment on education and health would positively affect economic growth.

Wubet (2016) investigates the impact of human capital on economic growth in Ethiopia over the period 1971-2005 using an error correlation methodology. The result of the study showed that contrary to micro economic studies the macroeconomic evidence showed that the human capital variable in the form of schooling has insignificant impact on the level of output. It was mentioned in her study that the decline in the quality of education was responsible to the negative relationship between human capital development and economic growth.

As far as the researcher's knowledge is concerned, previous studies try to investigate the effect of human capital in economic growth of Ethiopia without considering the labor market. Yet, this paper tried to investigate the same issue but including mediating factor which is labor market. The researcher's rational behind considering the labor market while examining the relationship between human capital investment and economic growth is that to examine the response of labor market in general and unemployment rate in specific following the more the country increases its investment in human capital and its overall effect in economic growth of the countries.

The main difference of this research from the previous research is including the labor market issue to examine relationship between human capital investment and economic growth. The researcher asked how can estimate the effect of human capital investment on economic growth of the countries without considering the labor market as the skill labor are enter to labor market in order to contribute for economic growth. Therefore, contrary to the previous study this research tries to study the relationship between human capital investment, labor market and economic growth in Ethiopia.

Ethiopia unemployment registered 4.98 percent in 2013 from 8.7 percent in 1999. Recently in 2018, the unemployment rate register 5.2 present moreover, Unemployment in urban area registered 19 percent in 2018 from 16.9 percent in 2016. The urban and the rural unemployment rates on average were 19.88 present from 1999 unite 2018 (CSA, 2018)

In the other hand, Ethiopia average share of aggregate education expenditure from total expenditure took 23 percent for the last decade. In 2014 the education expenditure was 22.5 percent from total government expenditure. This figure rose to 24.6 percent in 2015, 32.9 present

in 2016, 39.8 present in 2017 and 43.3 in 2018. Moreover, as part of human capital investment the government 5.1 percent of total expenditure went to health sector in 2014, 6.4 percent in 2015, 8.2 percent in 2017 and 9.6 percent in 2018 (UNICEF, 2010).

Hence, the above data showed that considerable amount of government expenditure went to human capital at the same time unemployment rate had also continued the problem in the countries. Therefore, this paper tried to investigate the relationship between human capital investment, labor market and economic growth of Ethiopia.

The researcher motivated to answer three major question firstly what is the effect of the human capital on labor market as general and unemployment rate as specific. Secondly, does the human capital investment can increase the economic growth in developing country specifically in Ethiopia? Finally does the link exist between human capital investment, Labor market and economic growth?

1.3. Objective of the study

The general objective of the study is to investigate the relationship between human capital investment, Labor market and economic growth and the specific objective are:

- To assess the trend of human capital investment, labor market performance and economic growth of Ethiopia
- To examine the effect of human capital investment on labor market.
- To estimate the impact of labor market on economic growth.

1.4. Hypothesis of the study

In order to meet the specific objective of the study the researcher develop the following hypothesis:

- Human capital investment has a positive effect in economic growth through decreasing the unemployment level in labor market.
- Human capital have a negative dynamic effect on the economic growth through increasing unemployment level in labor market.

1.5.Significant of the study

The main focus of developing country is to increase the economic growth as much as possible and able to increase the living standard of the people. In order to achieve those aim's, the government try to take different measure and make policy change in developing country. Increasing spending in education and health is one of the fiscal policy that the government used targeted increasing economic growth. It is very important how and in what extent the government can increase economic growth because considerable resource is spending on human capital investment. This research is helpful in order to know if the government can achieve the targeted economic growth by increasing human capital investment with consideration of labor market in the investigation and show how and in what extent human capital investment, labor market and economic growth link each other. Secondly, it can be reference for other research in related study.

1.6.Scope of the study

The scope of the study is to answer two questions firstly, does human capital investment affect labor market by affecting unemployment level which has its own effect on economic growth in Ethiopia and secondly, is there any relationship between human capital investment, labor market and economic growth. In order to answer the two main questions, the researcher examined the theoretical and empirical investigation using time series data from 1981 up to 2018 on education and health spending (human capital investment), unemployment rate and RGDP of Ethiopia.

1.7.Limitations of the study

The research have two limitations first, it focus only on government spending on health and education related to human capital investment due to the fact that other indictor of human capital such as the ability of innovation and creativity are difficult to measure in addition to this only unemployment is consider as the proxy variable to measure response of labor market due to the problem of the availability of time series data for other indictor of labor market such as educated unemployment .Secondly, for unemployment the time series data available only since 1991 therefore, in order to use the variable, the data from 1981-1990 was found by back casting trend analysis which can affect the overall forecasting capacity of the research

1.8. Organization of the study

The rest of the paper organized as follows: chapter two presents the theoretical and empirical related literature to the study, while chapter three provides research methodology. Chapter four sub-sectioned into two section the first part contains the overview Ethiopia economy with special attention on human capital investment, labor market and economic growth the other section presented econometric result and decision finally, chapter five conclude the study by putting some recommendation and issue for further study.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Theoretical Literature Review

This theoretical part of the research is elaborate about the basic issue of the research with giving special attention on human capital investment, labor market and economic growth in that order. Firstly, historical trend of the issue of human capital and when the issue become concern in different growth theories will discussed with giving attention on endogens growth theory because the endogens growth theory give much recognition to human capital investment. Here, human capital investment indicates the government expenditure in education and health as a country level not individual expenditure in education and health. Secondly, basic indictor of labor market listed and discussed with focusing on the major indicator of labor market which is unemployment. Theoretically structure of labor market specifically in developing countries is discussed.

Human Capital

According to Keeley (2007) human capital defines as knowledge skill competence and attributes embodied in individual that facilitate the creation of personal social and economic wellbeing. In the global knowledge economy people skills, learning, talents and attribute-their human capital have become key to both their ability to earn living and to wider economic growth.

Traditionally, many economists believed four things which can relate to economic growth land, labor or workers, capital or assets and enterprise or what the economist says animal spirits. (Keynes, 1936) As the traditional view state as labor it mentions or indicate worker as a mass who are willing and able to do physical work without considering what they knew or what their abilities were. (Keeley, 2007)

An exception view of the traditional economists was Adam smith as he introduces economic activity was creating not by workers as collective mass but by the acquired and useful abilities of all the inhabitants or members of the society. He believed that worker individual capabilities were a kind of capital –an asset just like a spinning wheel or a flour mill that could yield returns. (smith, 2007) Although it showed up from time to time in the earlier years of the 20th century it

wasn't really until the 1960s that economists began systematically to incorporate the issue of human capital into their work.

Robert Solow in the 1950s came up with more redefined solutions to the growth question. He explained the relationship between various factors of growth labor and physical capital through economic models. Initially these didn't take much account of the impact of differing levels of education or the quality of labor on economic growth however, since the early 1960s there's been increasing agreement on one key part of the growth issue namely the importance of people –their abilities their knowledge and their competences which is called human capital.

In 1960 other economist Becker studied differentials in personal income that had accrued to courage graduated in the United States. His opening remark appealed to the environment of cold war panic brought on by soviet advisement in areas of economic growth and military technology. Becker attempted to determine if national expenditure on higher education was adequate and if American college student's quality could be improved. Becker theorized that many exceptional students did not attend because of personal finical circumstances backer study give important methodology for analyzing human capital investment. Cited by (Sweetland, 2016)

Human capital in Economic growth theory

The study of economic growth begins with neo classical growth theory by Solow and swan in 1956 which state that capital accumulation drive to economic growth in short run however, in the long run growth rate will revert to the rate of the technology progress. Due to the drawback of the neo classical theory which is diminishing return to scale of accumulated capital in the long run. Other collection of economists develops endogens growth theory. (Onylmadu, 2015)

After the neo classical economists, the first formal mathematical and economic models was developed by American economists Romer and Lucas hypothesized about the endogenous character of the most important technological innovations based on investment in technological development and human capital. The idea of Endogenous growth model and neo-classical economists look like the same but they differ in their assumption and final conclusion about the source of economic growth according to the Solow model which is part of neo classical economist the state intervention with policy instrument is insignificant to provide economic growth rate. (Heijdara & Der Ploeg, 2002)

According to Romer the state can affect the economic growth only through affecting the saving rate in terms of advice to politicians the growth theory overcomes this shortcoming of neoclassical theory moreover, they didn't accept the neoclassical assumption of diminishing marginal productivity of capital by assume the possibility of production scale effect throughout the economy often focus on the influence of external effects on the profitability of investments. Positive externalities can have important influence.

In endogenous growth theory, in addition to the technological progress there are other factor which can affect economic growth in the long run. Firstly, the quality of human capital investment which is highly depend on the investment in human development (education, health) secondly, in the case of imperfect completion market the creation of the necessary condition in order to protection of intellectual property right affect the economic growth in the long run third, state support to development of new idea and technology and the contribution of government in creating a favorable environment to attracting new technologies.

Generally, endogenous growth theory supports the intervention of government in economic growth process compare to with the neoclassical economic growth theory moreover, the endogenous growth model takes the human capital as an important determinant of economic growth.

Endogens growth theory states that economic growth is primarily the result of endogenous and not external forces. Investment in human capital, innovation and knowledge has a significant contribution to economic growth. Moreover, the theory also focuses on positive externalities and spillover effects of a knowledge based economy. There are three model in endogens growth model which are AK model, product variety model and the Schumpeterian growth model. (Heijdara & Der Ploeg, 2002)

The AK model developed by Arrow in 1962 emphasizes production depend on output per worker according to the model through learning by doing work as worker continue to specializes in the production process the productivity of their input will be higher because of specialization. (Arrow, 1992)

$$Y(t) = AK(t)$$

$r(t) + \sigma = \frac{A}{1-S1(t)} - \frac{s1(t)}{1-st(t)}$

$$\max \Delta(0) = \int_0^{\infty} \left[\frac{C(t)^{1-\frac{1}{\sigma}-1}}{1-1/\sigma} \right] e^{-pt}\, dt$$

$$A(t) = r(t)A(t) - (1 + tc(t)C(t) + Z(t)$$

Where σ is the constant inter temporal substitution elasticity tcIs a consumption tax Z (t) is a lump –sum transfer from the government or tax if it is negative $A(t)$ represents financial assets and $r(t)$ is the rate of interest using the analytical methods

$\frac{C(t)}{C(t)} = \sigma(r(t) - p - \frac{tc(t)}{1+tc(t)}$

Since the model deals with a closed economy and there is no government debt the only financial asset which can be accumulated consists of company shares.

The basic AK growth model

$c(t) = \sigma \left[r(t) - p - \frac{t(c)t}{1+tc(t)} \right]$C (t)

$$k(t) = (A - \sigma)K(t) - C(t)$$

$r(t) = \frac{A}{1-Sr(t)} - \frac{st(t)}{1-st(t)} - \sigma$

The level of the consumption tax does not influence the growth rate as the tax does not distort the inter-temporal consumption. Since there is no labor in the model human wealth is the most important part which can affect the growth rate.

The drawback of AK model to explain the long run economic growth was initiated other endogens growth model which is called product variety model. According to the model

economic growth is the result of expansion of specialized intermediate variety of products. Based on the model there are three interactions in growth process the research sector, produces research outputs and intermediate goods sector moreover economic growth can be increased through productivity of research and labor supply.

From the part of endogens growth model the theory developed by Schumpeterian state that the innovation and creativity of the entrepreneur determined economic development based on the assumption of private property, competitive market and efficiency of financial market which means this theory is compatible with developed country which those assumption are fulfill .those condition may cannot be maintain in the cause of economic growth of developing countries (Pletak, 2014)

(Barro, 1990) has proposed a model in which productive government spending has an effect on the economic growth rate. The production function is replaced in to

$$Y(t) = AK(t)^{\propto}G(t)^{1-\propto} = AK(t)\left(\frac{G(t)}{K(t)}\right)^{1-\propto}$$

Where G (t) is the flow of public spending. The idea is that productive public spending affects all producers equally these services are provided free of charge and there is no congestion effect reinstates diminishing returns to private capital k (t) because $\propto$ is less than unity if somehow the government succeeds in maintain a constant ratio between its productive spending and the private capital stock however, his model ends up looking very much like the basic AK model and thus will display endogenous growth. (Heijdara & Der Ploeg, 2002)

Labor market

According to ILO (2016) report some of labor market indicators are labor force participation rate, Employment to population ratio, Status in employment and unemployment. Labor force participation rate is a measure of the proportion of a country working age population that engages actively in the labor market it provides an indication of the relative size of the supply of labor available to engage in the production of goods and services.

The other indicator of labor market Employment to population ratio is defined as the proportion of a countries working age population that is employed. The youth employment to population

ratio is the proportion of the youth population –typically defined as persons aged 15-24 that is employed. A high ratio means that a large proportion of a countries population is employed while a low ratio means that a large share of the population is not involved directly in labor market related activities either because they are unemployed or more likely because they are out of labor force.

Indictors of status in employment distinguish between the two main categories of the employed – employees a/so known as wage and salaried workers and the self-employed are further disaggregated into employers own –account worker's members of producer's cooperatives and contributing family workers each of these categories expressed as a proportion of the total number of employed persons. Categorization by employment status can help in understanding both the dynamics of the labor market and the level of development in any particular country. Over the years and with economic growth, one would typically expect to see a shift in employment from agriculture to the industrial and services sectors with a corresponding increase in wage and salaried workers and concomitant decreases in self-employed and contributing family workers many of whom will have previously been employed in the agricultural sector. (ILO, 2016)

The unemployment rate is probably the best known labor market measure and certainly one of the most widely used in many countries. With the combination of the labor force participation rate and employment to population ratio it provides the broadest available indicator of economic activity and status in terms of labor markets for counties that regularly collect information on the labor force. According to ILO the unemployment rate shows the proportion of the labor force that does not have a job but actively looking for available.

Stylized facts of unemployment

According to Ben Heijdara & Der Ploeg, (2002) The stylized facts about the labor market in advanced capitalist countries can be subdivided into two categories of time series evidence and cross section information. The main indictor of labor market performance is the unemployment rate ever since the great depression of the 1930s this has been at the forefront of macroeconomic research and the stylized facts of unemployment are

- Unemployment rate fluctuates overtime, it is more fluctuates between business cycles than within business cycles, the rise in European unemployment coincides with an enormous increase in long –term unemployment.
- In the very long run unemployment shows no trend.
- Unemployment differs a lot between countries
- Few unemployed have themselves chosen to become unemployed
- Unemployment differs a lot **b**etween age groups, occupations regions races and sexes.

Types of unemployment

The labor market by its nature is in continues change. Some workers quit their jobs, other workers are laid off, some firms cut employment, other firms expand employment, new workers enter the market after completing their education and many other workers reenter after spending some time in the non-market sector at different time. Therefore, many workers are in between jobs. If workers looking for jobs and firms looking for workers could find each other immediately there would be no unemployment however, Frictional unemployment arises because both workers and firms need time to locate each other and to abridgment the information about the value of the job match. Frictional unemployment does not indicate the existence of structural problem in the economy (Borjas, 1999)

The other type of unemployment which is seasonal unemployment came from people can loss their job only for short period of time due to different case such as technological change when the firms stop their production for certain time. Both frictional and seasonal unemployment have no a real effect on economy. Economists give much more attention for other type of unemployment called structural unemployment. (Borjas, 1999)

Structural unemployment rise due to two major reasons first, even in the condition where number worker looking for work equal the number of job available structural unemployment can occur if the kinds of person looking for work do not fit the job available second, even skill are perfectly available structural unemployment can exist if there is an imbalance between the number of worker looking for jobs and the number of jobs available. There is an excess supply of workers and the market does not clear because the wage is sticky and cannot adjust download (Borjas, 1999)

Other supplementary measure of unemployment

Nowadays, it is common that the unemployment rate by itself has limits its relevance in fully measuring labor market however there are other additional issue which sometimes used related to unemployment to explain the labor market. (Heijdara & Ploeg,2002)

Underemployment

Underemployment exist when a person's employment is inadequate in relation to specified norms of alternative employment account being taken of his or her work-related skill and academic achievement there are two types of underemployment they are visible and invisible underemployment.

Visible underemployment includes individuals who are involuntarily working less than the normal duration of work determined for the activity who were seeking or available for additional work during the reference period this can usually be measured in labor force surveys and comparably it is easy to identify. Invisible underemployment is much more difficult to measure and refers to individual who are working in jobs where their skills are not adequately utilized

Discouraged workers

The 1987 employment outlook concluded that the concept was highly subjective and vague and in some countries discouraged workers were neither close to the unemployed in the sense that they were quite likely to enter the labor market and look for work nor close in the sense that their lack of job finding success had determined them out of the labor market. However, these conclusions were based on analysis of just a few countries.

The high and persistent unemployment constitutes a major problem in many developing countries. Unemployment rate are high in many countries have only slowly declined in this recovery and are often well above those recorded in the late 1970s policy makers carefully track changes in the unemployment rate is regarded as the key indicator of labor market performance.

Dispute the researcher focus is in the type of the structural unemployment which indicate imbalance between the number of worker looking for jobs and the number of jobs available it is difficult to get abundances information and data about only structural unemployment due to the

unemployment rate measure unemployment is person who is actively searching for employment however unable to find works.

Labor market in developing countries

One glacial view of labor markets in developing countries was that such markets are operated with imperfections which directly mean that it operates quite definitely from those in high income countries. In low income countries labor was not a scarce resource in some sectors like agriculture sector. The alternative view was that labor markets in low income countries characterized with relatively homogeneous and direct governmental interventions in the labor market are rare, relatively little of the labor force is unionized and contractual arrangements are relatively un complex. There now appears to be important elements of truth in both views. Although the influence of problems in other markets principally inter-temporal market, on labor arrangements is understated in both perspectives. (Rosenzqelg, 1998)

There are some features of low –income countries that require special attention in modeling the operation of labor markets. Certainly one important and persistent characteristic of low income countries is the large proportion of the labor force is in agriculture sector. To the extent that agricultural production requires different organization that confronts problems different from those in industrialized sectors. Labor market analysis in low income countries shows differ from those in developed one.

A second characteristic of labor market in low income countries is the low proportion of workers who earn income wholly or chiefly in the wage labor market compared to the labor force in high income countries is low. Workers in family enterprises or unpaid family laborers (the alternative employment models) not only dominate the labor force in agriculture but make up a significantly larger proportion of the work force in the non- agriculture sector in developing countries when we compared to that sector in high income countries. The behavior of the family enterprise and its members particularly in the context of agricultural production thus forms the core of many labor market models depicting low income labor market. (Rosenzqelg, 1998)

According to Rosen (1998) even in developing countries the labor market can distinct as rural labor market and urban labor market because the two have different feature. In rural sector since the majority of the population of low-income countries reside in the rural areas and agriculture

constitutes the largest part in terms of employment, it is not surprising that most of the literature concerned with low income country labor markets is concerned with rural labor markets. The central question addressed is the determination of the opportunity cost of removing a labor from the agricultural sector which is called Lewis model.

The macro development model of (Lewis, 1954)assumed that in the early stages of development agricultural laborers would be shifted to the industrial sector without any reduction in total agricultural output such economies are characterized as surplus labor economics moreover the shadow wage of an agricultural laborer is nil. These models also assumed that the private costs of moving out of agriculture for an agricultural agent was his/her consumption, approximated by the average product in agriculture

Employment and wage determination in rural labor markets

The household has multiple members that some members (dependents) do not provide resources to the family (do not work) that household size and its composition are exogenous that there is a single family welfare function in which the consumption and leisure time of each member is given equal weight and that the household size and its composition are exogenous that there is a single family welfare function in which the consumption and leisure time of each member is given equal weight and that the household obtains returns from the land its members work with the land area being fixed in size specifically with the assumption that a household with n members and N workers owns or has assigned to it a piece of land on which it produces output X which it also consumers or sells . The technology of production is given by

$X = F(L, A) F_{L,\ F_A} \geq 0 \quad F_{LL} < 0$

Where L= NH h= hours of work and X is total output

The family welfare function is

U= U (c, l)

Where $c = \frac{X}{n}\, l$ =Ω-h

Absent labor markets the autarkic household

The simplest route to surplus labor is to assume that there's no labor market and that contrary to the leisure of household members is not valued in that case the only choice variable for the household is the number of hours each member will work and the first order condition for that choice is

$$U_C F_L = 0$$

Where U_C and F_L are the marginal utility of consumption and the marginal product of family labor respectively if U_C is positive that is low income households have not reached satiety with respect to consumption expression indicates that work time is allocated such that the marginal product of an additional time unit of work by any family member is zero since this is optimal expression shows that the total output of families with the same amount of land A is invariant to the number of family laborers as long as the work time of family workers never reaches the full extent of Ω hours moreover if a family workers leaves and is not provided any resources by the family (does not become a new dependent) the loss to him/her of moving out is average family consumption at F_L=0 the discrepancy between the social and private costs of moving are due here both to the absence of a labor market and the family sharing rule for if the migrant family members still received c when working outside the household then c would not enter into the decision to leave

Sen (1966) considered an autarkic model in which the family welfare function included leisure as in that case the first order condition is

$$(N/n)U_C \;\; U_{l=}F_L$$

The marginal product of an extra hour of work by the family worker is no longer zero here, labor is in surplus only if the removal of a family member leaves the marginal rate of substitution between consumption and leisure unchanged since in that case $F_L$and total output is unaltered thus the existence of labor surplus depends importantly on the characteristics of the family welfare function specifically on family members fully compensating for the lost hours of work associated with the loss of a family worker by increasing their labor supply Sen characterizes this situation as one in which there is disguised unemployment since hours of work have a non-zero marginal product but laborers can be removed from the household (agriculture) without any loss in output.

Unemployment, underemployment and rigid wages the nutrition based efficiency model

There are agricultural agents willing to or seeking work but unable to find employment unable to contributes to production if wages do not decline in the face of this excess supply of laborers the removal of workers from agriculture presumably leaves the number of employed people and thus agricultural output unchanged the question of theoretical interest in this approach

The most important explanation for the downward rigidity of rural wage is the nutrition based efficiency wage model. In this framework labor effort is distinguished from labor time worked while time worked is a family decision variable as above individual labor effort per unit of time is hypothesized to be a technological and particular function of individual nutritional intake or consumption at low consumption level. The appeal of the nutrition efficiency wage model is that it provides a reason why low income labor markets might be different from high income labor markets in the model low income per is the cause of labor market problem (unemployment) not the revers like the labor surplus hypothesis however as will be discussed below it is unclear if the model has any relevance to any known population on this planet.

The effect of human capital investment on labor market

Boateng (2002) develop a logical framework which exist between human capital specification higher education and labor market to explain the source of the low rate of return to higher education and increase educated unemployment in Africa and to guide the formation of a comprehensive human recourse development policy on the continent link to this a critical question is what skills are produced and how they are utilized in comprehensive economic. The labor market facilitates the supply side decision by individual to invest in particular skills with the objective of maximizing their lifetime earrings on the other hand demand side of labor market facilitate the decision by firms and employed to utilized particular skill mix in combination with existing stock of machinery and other production factors with the aim of maximizing profit thus the labor market provide the vital link between the education sector and the other sector.

In the path-breaking early contribution to the literature, Uzawa 1965 argued that labor augmenting technological progress should not be seen as some kind of manna from heaven but instead should be consider as the outcome of the intentional actions by economic agents

employing scarce resources in order to advance the state of technological knowledge Uzawa 1965 formalized his notions by assuming that all technological knowledge is embodied in labor terms of the aggregate production function. (Cited by Boateng, 2002)

Generally, it is the fact that most of economic theory are formulated based on the developed country economic situation. The same is true for the theory of human capital investment which state the human capital investment is directly favorable for economic growth however the economic structure of developed and developing countries are somehow different. The theory that can explain in developed countries cannot be explain the developing counties.

The structure of labor market in developing countries and developed countries are different. According theories the human capital investment may directly affect the economic growth the researcher asked what about in developing counties? Really those theories can be the right reflection of developing counties which have different labor market situation. Can it be possible to link human capital investment and economic growth without considering the labor market structure of specific countries?

2.2.Empirical literature review

There is different empirical study which study on human capital investment especially with the connection of economic growth. Therefore, this section presents the different study which done in other developing countries and in Ethiopia respectively.

Kenny (2019) try to investigate effect of human capital investment on unemployment volatility in Nigeria from the period of (1981-2015) with the primary objective of the composition of human capital investment in Nigeria and the result show that investment in specified in human capital reduce the outside option of workers implying less in entire to separate and thus longer job spells. The theoretical model generates unemployment dynamics that are constant with the observed patterns for unemployment separation and job finding rate across education groups and the error correlation model result revealed that government current investment in human capital in terms of spending on education needs to increase in quantum for its significant to be meaningful.

Bhorat, Cassim, & Tseng (2016)investigate the interrelation between higher education employment and economic growth in south Africa the south Africa economy characterized by a

skill biased trajectory enduring jobs for the better educated by difference between tertiary and vocational training and the result show that further education and training graduates are almost as likely to be employed as school leaves without higher education moreover the estimation result of Olley and Pakes two stages regression on modified cobb-Douglas production of function result indirect that the degree cohort contributes to economic growth whilst other higher education instruction including further education and training do not productively contribute to economic growth,

Eigbiremola & Anaduaka (2014) investigated human capital development and economic growth using time series from 1999-2012 empirical results show that human capital development in line with theory exhibits significant positive impact on output level. The result further reveals a relatively inelastic relationship between human capital development and output level.

Faridi, Ahmad, & Shahnawaz (2016) study the impact of education and health on employment in Pakistan by focusing health and education by using primary source of data and logistic regression technique has been used to estimate the coefficient of the variable the study has concluded that education at all level is positive and significantly repealed with employment.

Kazmi, Ali, & Ali, (2017) try to investigate the impact of human capital on economic growth in evidence from Pakistan by taking formal education as an indicator to assess the impact of human capital on real GDP. The result of Jhohansen co-integration show that human capital and economic growth are co-integrated as there is a long run relationship.

Girsberger & Meango (2017) try to investigate the puzzle of educated unemployment in West Africa by develop a search and mulling model with let endogenous agents who make an education choice and participate in labor market with three sectors (public, private formal and self-employment)low arrival rate and low productivity in self-employment explain why education created workers do not downgrade increasing public sector vacancy creation crowd out the formal sector and pushes worker into self-employment and unemployment.

Boztosun, Aksoylu, & Ulucak (2016) examine the role of human capital in economic growth by using co-integration and causality tests by using the data of turkey for period (1961-2011) and the finding revealed a dual causality relationship between human capital and economic growth variable.

Kuloglu (2016) study the relationship between human capital and economic growth in turkey the causal relationship between the dynamic of human capital and economic growth were investigated in the turkey economy over the period 1990-2013 using ARDL approach and the main findings of this analysis are that there is co-integration between the variable in the short run and long-term in addition to that education spending affects positively economic growth.

Samiullah (2014) investigate the relationship between unemployment, labor market and human capital in the case of Pakistan between the year between the period 1981-2010 having the objective of examine the relationship between human capital and unemployment by using Johnsen co-integration approach to determine the long run relationship and VECM for short run adjustment according to the result human capital has a strong and significant effect on unemployment level.

Haifa Mabrouka and Fakher (2016) investigate the relationship between higher education (human capital development), educated unemployment, labor market poverty and economic growth in Tunisia using secondary data from 1990-2013 using OLS estimation. His result show that there is a bidirectional causal relationship between per capital gross domestic product (GDP) and poverty (POV) and also between number of graduate student and school enrolment territory education besides unidirectional causal relationship which running from number of graduate students to unemployment with tender educated unemployment, from higher education expenditure to poverty rate and from unemployment with extra education to poverty rate the empirical result also verify the existence of positive effect of enrollment tertiary education , number of graduate students on economic growth.

Related empirical study in Ethiopia

Kidanemariam (2015) investigate the impact of human capital development on economic growth of Ethiopia by using the time series data from 1975-2011 in ARDL approach and the result show that estimated long run model indicate that human capital in the form of health have a big positive impact on real GDP per capital followed by education or human capital which lead to the conclusion of an economic performance significantly improve when the ratio of public expenditure on real to GDP increase and when secondary school enrolment get better.

Wubet (2016) investigate the impact of human capital on economic growth in Ethiopia over the period 1971-2005 using an error correlation methodology and found that contrary to micro economic studies the macroeconomic evidence shows that the human capital variable in the form of schooling has insignificant impact on the level of output and mention that the decrease of the quality of education in the wake of expansion in the sector is responsible element.

Daniel (2016) try to investigate the cause of educated youth unemployment and its socio economic effect. The study was primary based on descriptive and quantities data the primly data were collected from 389 educated unemployment youth that are selected by purpose snowball and convenience. Snow ball and convenience sampling technique through questioners and interview. The result show that lack of enter ship skill quality of education rural urban migration mismatch of skill with the labor market lack of good governance job selection altitude by unemployed educated youth and lack of work explain were identified as the cause of educated youth unemployment

Broussar & Tsegay investigate about youth unemployment in Ethiopia by using comprehensive descriptive and found that while unemployment in urban areas remain wide spread it declined markedly since 1990 for the economy as a whole and for youth however while the economies has demonstrated impressive reduction in unemployment there has been significant increase education attainment however there has not been as much job creation to provide employment opportunities to the newly educated job seekers.

Most of the previous study conducted on human capital investment and economic growth some other researchers tried to see the relationship of unemployment and economic growth separately. Some of the result confirm the negative relationship between human capital investment and economic growth while other find the positive result in addition to the inconstancy all researches examine the issue of human capital investment and economic growth without considering the labor market.

Contrary to the previous empirical study this research tries to examine the relationship between human capital investment and economic growth with consideration of structure of the labor market which can affect the effectiveness as well as efficiency of using skill labor. This can be easily presented on the following diagram:

Figure 2.2 1: The relationship between human capital investment labor market and economic growth

As it clearly sees in the above figure after the government massively increase the human capital the skill labor inters into the labor market and the skill labor can affect or contribute for economic growth. As most of the theory state as the human capital investment can affect the labor market by decreasing unemployment rate in developed countries this paper aim to study the relationship between the three variable in developing counties.

CHAPTER THREE

3. DATA AND METHODOLOGY

3.1. Type and source of data

The study investigates the relationship between human capital investment labor market and economic growth by using secondary time series data from 1981-2018on government spending on education and health, unemployment rate and real growth domestic product, population growth, total investment, real effective exchange rate and inflation rate in Ethiopia. The data sources are CSA (Central Statistical Ageny) National bank of Ethiopia (NBE) Minister of finance and economic development (MOFED)and World Bank official website.

3.2. Methodology

To investigate the relationship between the human investment, labor market and economic growth and in order to meet the objective VAR and **VECM** was used moreover co-integration, Granger causality test and variance decomposition is employed.

3.2.1 Theoretical framework and Model specification

As part of the model specification part it is important to decide the independent variable which can affect the dependent variable based on what theory say about it with reference of different empirical evidence link to this we can rely depend on early economic growth model.

3.2.1.1 Human capital approach (investing in education and health)

According to Romer (2012) we can start with simple production function

$$Y = AK$$

Where Y is output, K is the capital stock, and A is a constant measuring the amount of output produced for each unit of capital. In this case the above production function does not exhibit the property of diminishing returns to capital. The absence of the diminishing returns to capital is a key difference between endogenous growth model and Solow model.

$$\nabla K = Sy - \delta k \ldots\ldots\ldots\ldots\ldots (3.2)$$

Equation 3.2 states that the change in the capital stock (ΔK) equals investment δkminus depreciation $\delta k$and after combining equation 3.2 into production function we can get

$$\frac{\nabla Y}{Y} = \frac{\Delta K}{K} = S_a - \delta$$

In this case the rationality to assumption of constant return to scale is the interpretation of K which means K is not only representing the stock of capital rather it represents knowledge as a type of capital. Clearly, knowledge is an important input into the economy production-both its production of goods and services and its production of new knowledge.

$$K(t) = s[1 - ak]\alpha(1 - aL)1 - \alpha K(t)A_a\ (t)1 - A_{1\,(t)}1 - \alpha$$

Dividing both sides by $K(t)$ and defining $C_k = s(1 - ak)\alpha(1 - aL)\ 1 - \alpha$ gives us $gk(t) = K_t/k_t = C_K\ A_t\, L_t\, /k_t^{\,1-\alpha}$

According to Romer (2012) based on the above equation the growth rate can affect by the accumulation of knowledge which is described as human capital because it increases the productivity of the labor here, the researcher rationality to include the labor market in the analyses is due to the people who have a knowledge must get a job or should have the opportunity to create there on job to contribute in the productivity in the first place. Based on this fact the model can specified as flow

Economic growth which measure by real gross domestic product (RGDP) is the dependent variable which affect by different independent variable including the human capital investment (measure by government spending on education and health), labor market which can indicate by the unemployment rate. Other factors that affect economic growth and unemployment include inflation rate (IF), population growth (PG), total investment(I) and Real effective interest rate (REER) are incorporated into the model.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2\ + \beta_3 X_3 + \beta_4 X_4 + \beta_5\, X_5\ + \beta_6 X_6$$

$$rgdp = \alpha + \beta_1 hci + \beta_2 UN + \beta_3 IF + \beta_4 I + \beta_5\, PG + \beta_6\, REER$$

Where RGDP Real gross domestic product

HCI human capital measured by (government spending on education and health)

UN unemployment rate

IF inflation rate

PG population growth

I total investment

REER real effective exchange rate

Definition and measurement of the variable

Economic growth: economic growth is an increase in the capacity of an economy to produces good and services compared from one period to another. The RGDP of a country is inflation – adjusted measure that reflect the total value of all final goods and services produced within a country over a period of time.

Labor market: -is the place where workers and employees interact with each other in the labor market employers compete to hire the best and the workers compete for the best satisfying job and labor demand is the firms demand for labor and supply is the workers supply of labor and the researcher use unemployment rate as a proxy variable to indicate the labor market and it is person who is actively searching for employment however unable to find works. Unemployment rate expected to have a negative effect on economic growth.

Human capital investment: Human capital is productive investment embodied in human persons including skills, ability, ideas, health and condition often resulting from expenditure on education on the job training program and medical care. The researcher use government expenditure in education and health as a proxy variable to measure human capital investment and it expected that it has negative effect on labor market specifically in developing countries by increasing unemployment rate.

Inflation: -is a quantitative measure of the rate at which the average price level of a basket of selected goods and services in an economy increases over a period of time often expressed as a percentage, inflation indicator a decrease in the purchasing power of a nation's currency and it expected to have a negative sign in the economic growth.

Total investment: -is the amount of goods purchased or accumulated per unit time and specifically in Ethiopia it represents the capital formation variable because there is no any stock market in the country. It expected a positive effect on economic growth of the country.

Population growth: -is the increase in the number of individuals in a population. The researcher expected to population growth affect economic growth positively.

Real effective exchange rate: -measures the value of a currency against a basket of other currencies it takes into account changes in relative prices and shows what can actually be bought. It expects to a negative effect on economic growth and unemployment rate.

3.3. Econometric model and analysis

In this research two type of model will be conducted vector (autoregressive) VAR and vector error correlation (VECM) besides granger casually test and different diagnostic test was conducted moreover the impose response test and variance decomposition result is discussed.

3.3.1. **VAR model**

The vector auto regression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of the variable. The reduced form VAR approach side steps the need for structural modeling by treating every endogenous variable where there is p-lagged values and k dimensional the VAR model can express as

$$Y_t = A_1 Y_{t-1} + \cdots + A_P\, Y_t - P + QX_t + \varepsilon_t$$

Where $Y_t = (Y_{1t,}\ \ Y_{2t} \ldots\ldots\ldots\ldots Y_{kt})$ is a $k * 1$ vector of endogens variable

$x_{t=}\ \ (x_{1t} x_{21} \ldots\ldots\ldots\ldots x_{dt})$ is a d*1 vector of exogenous variable

$A_1 \ldots\ldots\ldots\ldots\ldots\ldots A_P$ are $k * k$ matrices of lag coefficients to be estimated.

Q is a $k * d$ matrix of exogenous variable coefficients to be estimated.

$\varepsilon t = (\varepsilon t_1\ \varepsilon t_{2t} \ldots\ldots\ldots\ldots\ldots\ \varepsilon t_t)$ is a $k * 1$ white noise innovation process with $E\varepsilon t_t = 0$, $E(\varepsilon t\ \varepsilon t_)$ = 0 for t≠0

3.3.1.1 Test of VAR model

Stationery test

To apply one of the multivariate model which is VAR it is a pre required to test the stationery of each variable since the majority of economic theory is built up on the assumption of stationary which directly mean that regressing a non-stationary variable Y_t upon a non-stationary variable X_t may lead to a spurious regression in which estimators and test statistics are Misleading with the exception when two or more I (1) variable are co integrated. If there exists a particular linear combination of these non-stationary variables that is stationary which can be a cases a long run relationship between these variables exists. The existence of long run relationship also has its implications for the short run behavior of the variables because there has to be some mechanism that derives the variables to their long run equilibrium relationship and such mechanism are modeled by an error correction mechanism.

One of the mechanisms to test stationary of a unit root test is augmented Dukey fuller test (ADF test) which proposed by (Wayine and Fuller, 1979). This test is valid only if the series is an AR (I) process. If the series is correlated at higher order lags the assumption of white noise disturbance is violated the augmented dickey fuller (ADF) test constructs a parametric correction for higher order correlation by assuming that the y series follows an AR (P) process. Moreover, Phillip Perron (PP test) is other way to test the stationary of the variable.

3.1.1.2. Choosing the optimal $_{lag}$ length

Following the stationery test the next step is choosing the optimal lag length chosen by selecting to minimize the specified information criterion amongst models with 0 to K_{max}lags. There are varies method to do that such as Akaike Schwarz, Hannan Quinn, modified Akaike, modified Schqarz and modified Hannan-Quinn. It is note that the sample used for model selection excludes data using full set of lag differences up to K_{max}.

Granger causality test

One of the most econometrician taught is that correlation does not imply causality correlation or covariance is a symmetric relationship $Cov(x, y) = Cov(y, x)$We cannot in general infer anything about the existence or direction of causality between x and y by observing non zero covariance even if our statistical analysis is successful in establishing that the covariance is highly unlikely to have occurred by chance such a relationship could occur because x causes y because y causes x, because each causes the other, or because x and y are responding to some third variable without any causal relationship between them.

Granger, (2003) defined the concept of granger causality, which under some controversial assumptions can be used to shed light on the direction of possible causality between pairs of variables. The formal definition of granger causality asks whether past values of X aid in the prediction of Y_t conditional on having already accounted for the effects on $Y_t$of past values of y

Co-integration test

The most common tests to determine the number of co integrating relationships among the sires in a VAR / VEC are due to Johansen (1995) if we have $N\ I(1)$variable that are modeled jointly in a dynamic system, there can be up targeting relationship as a common trend as synonymous. The co-integrating rank of the system is the number of such common trends or the number of co integrating relationships.

To determine the co integrating rank r, we perform a sequence of tests. First it is better to test the null hypothesis of $r = 0$ against $r \geq 1$ to determine if there is at least one co integrating relationship. If we fail to reject $r = 0$, then we conclude that there are no co-integrating relationships or common trends among the series. In this case we do not need a VEC model and can simply use a VAR in the differences of the series.

If $r = 0$ is rejected at the initial stage then at least some of the series are co-integrated and it is possible to determine the number of co integrating relationships by second steep which is by testing the null hypothesis that $r \leq 1$against $r \geq 2$ if it is not possible to reject the hypothesis of no more than one common trend, then it is possible to estimate a VECM system with one co integrating relationship.

If $r \leq 1$ is rejected the it is possible to test $r \leq 2$ against $r \geq 3$ and so on and it is better to choose r to be the smallest value at which it fail to reject the null hypothesis that there are no additional co integrating relationships.

3.3.2 Vector error correlation model specification

A vector error correction models is a restricted VAR intended for use with non-stationary series that are known to be co-integrated or have long run relationship. The VECM has co-integration relations constructed into the specification so that it limits the long run behavior of the endogenous variables in order to converge to their co-integrating relationships while allowing for short run adjustment dynamics. The co integration term is known as the error correction term since the deviation from long run equilibrium is corrected gradually through a series of partial short run adjustments.

3.3.2.1 Impulse response

The impulse-response functions are $n * n$ set of dynamic marginal effects of a onetime shock to variable j on itself or another variable i

$$\delta Y_{il} + z/\delta_{\Sigma tj} \;\; S = 0, 1, 2 \ldots..$$

There is no limit on how far into the future these dynamic impulse responses can extend if the VAR is stable then the IRF_S should converge to zero as the time from the shock s gets large – onetime shocks should not have permanent effects. IRF_S are usually presented graphically with the time $_{with}$ the time lag s running from zero up to some user set limit s on the horizontal axis and the impact at the s-order lag on the vertical. Each of n^2 IRF_S graphs tells us how a chock to one variable affects another or the same variable.

3.3.2.2 Forecast variance decomposition

Forecast error variance decomposition can measure the extent to which each shock contributes to unexplained movement (forecast errors) in each variable all variance decompositions start at zero.

CHAPTER FOUR

4. RESULT AND DISCUSSION

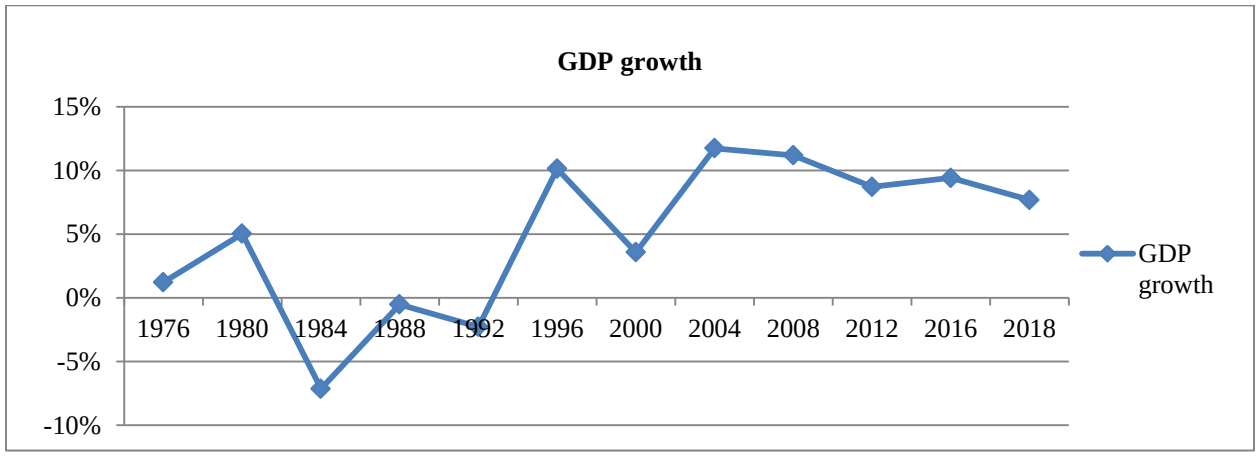
4.1 Overview of Ethiopia Economy

This section focus on the overall Ethiopia economy performance in general and the economic growth of the country, government investment on human capital (education and health) and unemployment in particular.

4.1.1. Economic growth of Ethiopia

Annual GDP growth of Ethiopia has been shown a fluctuating trend in the period under study. It registered negative figure in the 1984 and 1992 FY This reflects that the GDP growth has shown an improvement in the post 1992 periods amidst the fluctuating figure in the period under scrutiny.

Figure 4.1. 1 GDP of Ethiopia



Source: World Bank and NBE

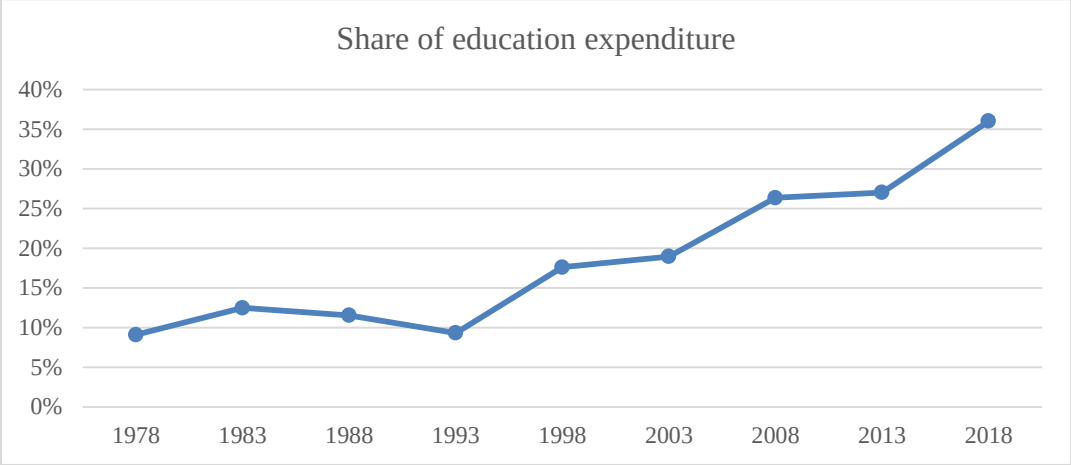
4.1.2 Government investment in Ethiopia

Education

As it is shown in the figure 4.1.2 below, the share of education from total capital expenditure registered somehow an upward trend in the period under study except in the year 1988 and 1993. Moreover, in the year 2018, the share of education from the total capital expenditure (36 present)

has almost doubled the figure in 1998 (19 present) reflecting the rise in government expenditure on education which in turn signifies the government has started to provide attention to education as its one priority area of investment.

Figure 4.1 2 Share of education expenditure



Source: MOFED and own computation

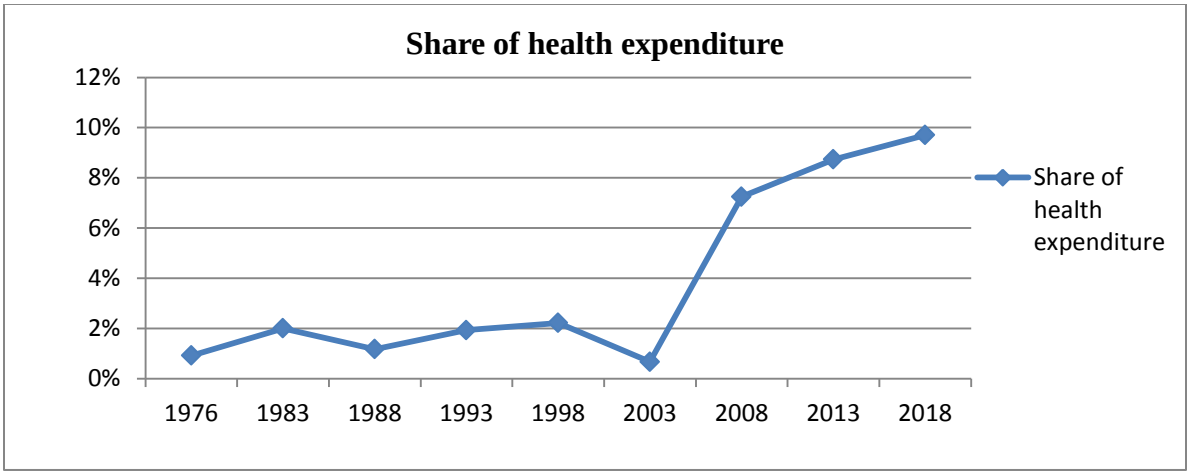
According to MOFEC (2017), Ethiopia has experienced implementation five-year education sector development program (ESDPs) since 1997/98 to insure educational program is well coordinated with national development plan also known as (the Growth and Transformation Plan II) which has the objective of becoming a middle income country by 2025.

The program is now in its final stage covering the years from 2015/16 to 2019/20 and it focuses on improving the quality of education, increasing access to education opportunities with enhanced equity, quality and relevance

Health

The share of health from capital expenditure reported to be in the rising trend particularly since 2003 which jumped over to 10 present in the year 2018 from its lowest share of 1 present in 2003. As a result, it can be concluded that the government has boosted its investment on human capital in the last two three decades.

Figure 4.1 3 Share of health expenditure



Source: MOFED and own computation

According to MOFEC (2017), Ethiopia has implemented health sector development plans (HSDPSs) between 1997/98 and 2014/15 in four phases (HSDP I-IV) which is part of transformation plan for the year 2015/16-2019/20. During this period the government has shown commitment and effort to implement pro-poor health policies and strategies which resulted in improved health outcomes compared to the country health profile in 1990's. The HSDPs help the government bring all actors including public, private and development partners in implementing the pro-poor policies and strategies in well –coordinated and effective manner.

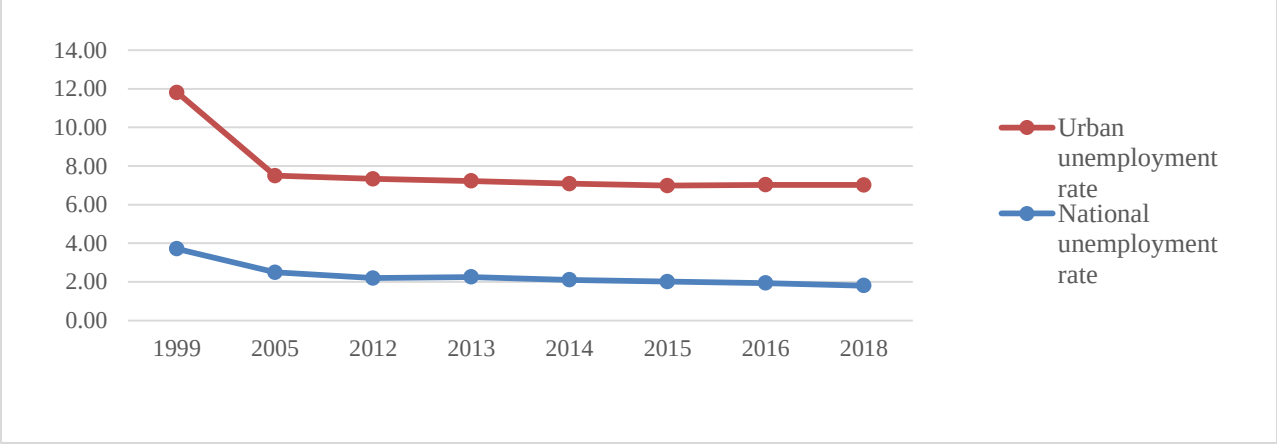
The country has made impressive progress in the expansion of primary health services coverage reaching most communities and households intensive investment that has been made by the government the development partners and community participation in (PHC) through the health extension program contribute largely for the successes achieved in the health sector.

4.1.3 Labor market in Ethiopia

Unemployment trend in national and urban level

In the figure 4.1.4, the national unemployment and the urban unemployment rate of Ethiopia remained stagnant 2 present and 5 present respectively since 2005. The implication of this figure is that around 2mln people have the ability and willing to work yet unable get a job at the national level. The same is true for the urban unemployment.

Figure 4.1 4 National and Urban unemployment level in Ethiopia

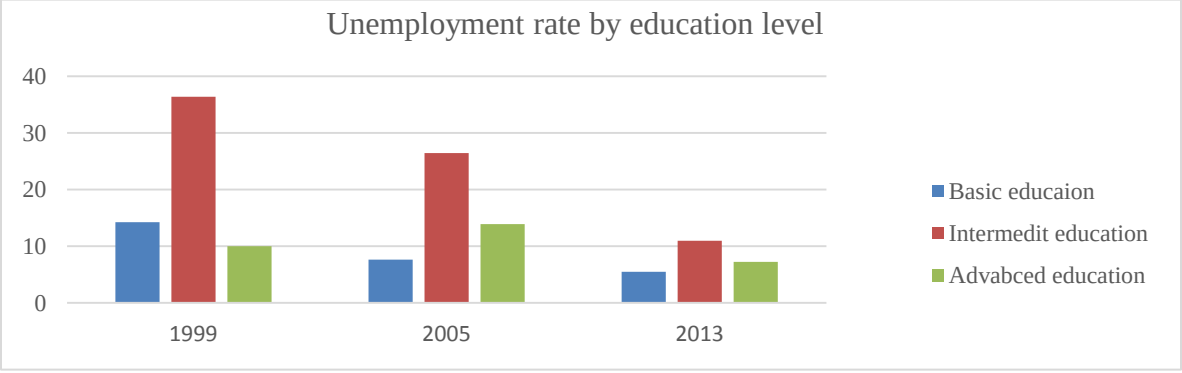


Source: WB

Unemployment by education level

According to CSA, from total of unemployed people 36 present having intermediate education while unemployed people with basic and advanced education took a share of 15 present and 10 present in that order. The rest 39 present were illiterate. This signals considerable amount of unemployed people is educated.

Figure 4.1 5 Unemployment by education level



Source: World Bank indictor and NBE

4.2 Result and discussion in econometrics model

In this part of the research the result of VAR and VECM has presented in addition to this pre estimation test of time series data individually as well as group test was presented.

4.2.1 Stationery test

As the time series analysis allowed for only stationery variable in which the mean and the variance should be constant over time it found important to test the stationary of each variable in the model. Among the methods to test the stationary of the variable augmented dickey fuller test and Phillips-Perron test is the most used. According to the result of augmented dickey fuller test with the assumption of trend and intercept except that of real gross domestic product and inflation all variable is not stationery at level however all variables are become stationery at first difference with one present significant level. The result was further indicating that all variable should be used in the model after first difference.

Table 4.2.2 1: Augmented Ducky Fuller test

ADF test					
At level			At first difference		Order of integration
Variable	t-stat	Critical value	t-stat	Critical value	
Rgdp	-5.39	-4.22	-9.24	-4.24	I(1)
LHCI	-3.38	-4.24	-5.57	-4.23	I(1)
Un	-1.18	-4.22	-5.19	-4.23	I(1)
Lpg	-0.88	-4.32	-6.83	-4.32	I(1)
Li	-1.63	-4.22	-7.54	-4.23	I(1)
Reer	-1.98	-4.22	-5.51	-4.32	I(1)
If	-5.78	-4.22	-8.29	-4.24	I(1)

Source: own computation from Eviews 9

Note: - All critical values are at 1 present significant level.

Table 4.2.2 2 Phillips Perron test (PP test)

PP test					
At level			At first difference		Order of integration
Variable	t-stat	Critical value	t-stat	Critical value	
Rgdp	-5.55	-4.22	-16	-4.23***	I(1)
LHCI	-2.33	-4.22	-5.58	-4.23***	I(1)
Un	-1.38	-4.22	-5.19	-4.23***	I(1)
Lpg	-0.14	-4.22	-3.21	-3.20*	I(1)
Li	-7.39	-4.22	-32.63	-4.23***	I(1)
Reer	-2.1	-4.22	-5.51	-4.32***	I(1)
If	-5.78	-4.22	-24.46	-4.23***	I(1)

Source: own computation on Eviews 9

Note ****, **, * represent significant level at 1%,5% and 10% respectively

Both ADF test and PP test indicate that some of the variable are not stationery at level however all variables are become stationery after first difference.

4.2.2 Determination of optimal lag length

The subsequent step after stationary test is identification of optimal lag length with Akaike information criterion and according to the process in Akaike information criterion the optimal lag length is two with 5 present level of significant.

Table 4.2.2 3 VAR lag order selection criteria

VAR Lag Order Selection Criteria
Endogenous variables: RGDP LHCI UN LI IF LPG REER
Exogenous variables: C
Date: 05/17/20 Time: 23:23
Sample: 1981 2018
Included observations: 36

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-476.9516	NA	1120.083	26.88620	27.19410	26.99367
1	-141.5173	521.7866	0.000145	10.97318	13.43644	11.83292
2	-49.67133	107.1536*	1.86e-05*	8.592852*	13.21145*	10.20487*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4.2.3 Co-integration of test

In order to compute the co-integration test Johansen co-integration tests is used and table 4.2.2.4 shows the result of Johansen co-integration tests. According to the result there are four co-integration equations which directly show the presences of long run relationship between the variable. So as to include the long run relationship which presences among the variable in addition to VAR model VEC model has estimated.

Table 4.2.2 4 Johansen co-integration test

Date: 05/02/20 Time: 11:28
Sample (adjusted): 1983 2018
Included observations: 36 after adjustments
Trend assumption: Linear deterministic trend
Series: IF LHCI LI LPG REER RGDP UN
Lags interval (in first differences): 1 to 1

Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.901382	229.1937	125.6154	0.0000
At most 1 *	0.755139	145.7997	95.75366	0.0000
At most 2 *	0.676474	95.14538	69.81889	0.0001
At most 3 *	0.508909	54.52028	47.85613	0.0104
At most 4	0.402240	28.91976	29.79707	0.0628
At most 5	0.224770	10.39540	15.49471	0.2515
At most 6	0.033589	1.229969	3.841466	0.2674

Trace test indicates 4 Co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.901382	83.39403	46.23142	0.0000
At most 1 *	0.755139	50.65432	40.07757	0.0023
At most 2 *	0.676474	40.62510	33.87687	0.0067
At most 3	0.508909	25.60053	27.58434	0.0878
At most 4	0.402240	18.52436	21.13162	0.1115
At most 5	0.224770	9.165429	14.26460	0.2726
At most 6	0.033589	1.229969	3.841466	0.2674

Max-eigenvalue test indicates 3 Co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

4.2.4. Granger Causality Test

As Annex B2 shows the result of granger causality test and according to the result human capital investment, unemployment, real effective exchange rate, total investment, population growth and inflation are jointly granger causes real GDP however none of them are individually granger cause the real GDP.

Unemployment, real exchange rate, total investment, population growth, inflation and real GDP jointly granger causes human capital investment however all of them except that of population growth does not individually and strongly granger cause human capital investment.

All variable including human capital investment, total investment, real effective exchange rate, total investment, population growth, inflation and real GDP does not granger cause unemployment rate both jointly and individually.

Human capital investment, unemployment, total investment, population growth and real exchange rate are jointly granger causes inflation rate however, all variable except that of unemployment rate does not individually and strongly granger cause inflation rate moreover, Human capital investment, unemployment rate, total investment, inflation rate and real exchange rate are jointly granger causes population growth however, all variable except that of unemployment rate does not individually and strongly granger cause population growth. Inflation, population growth, total investment, real GDP are individually and strongly granger cause real effective exchange rate and all variable including human capital investment and

unemployment rate jointly granger cause the real effective exchange rate. All variable both individually and jointly does not granger cause the total investment.

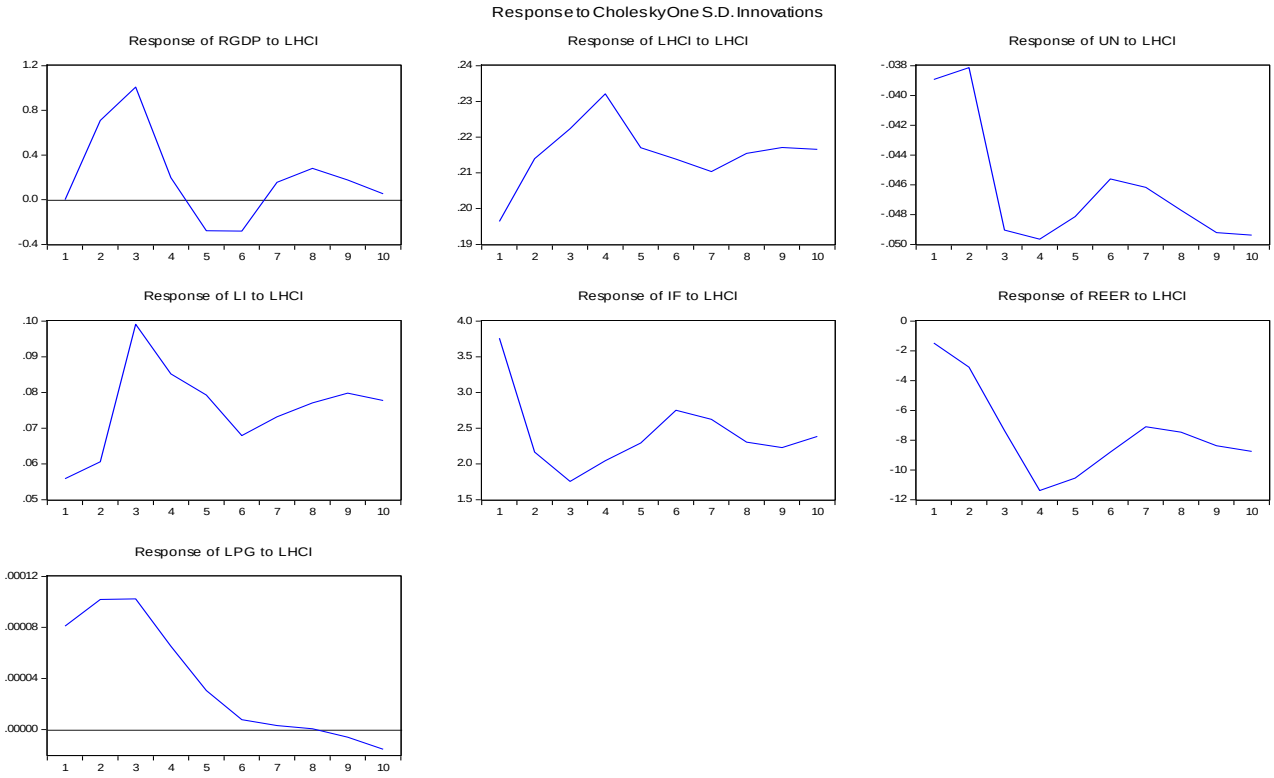
4.2.5. Test of impose response result

The response of other variable to innovation in human capital investment

As figure 4.2.6 clearly indicates the response of real GDP to positive innovation in human capital investment was initial increasing until the third year and start decline between the period third year and fourth year. After the fourth year it become negative seventh year after that it become stable and constant under the positive regime. The response of unemployment to human capital investment to positive shock is decline until the fourth year and start increasing at increasing rate until sixth year and it became decline until the ninth year after that it is somehow stable under the negative regime signaling there is a fluctuated response of unemployment for the positive change of human capital investment.

The response of inflation and population growth to positive innovation in human capital is positive and negative within forecasting year respectively. The response of total investment for the positive shock in human capital investment is positive and increasing until the fourth year and decline however stay positive within the forecasting period. however, real effective exchange rate shows a positive response in opposite way that of total investment first it sharply declines and start increasing after the fourth year.

Figure 4.2 1:The response of other variable for the change of human capital investment

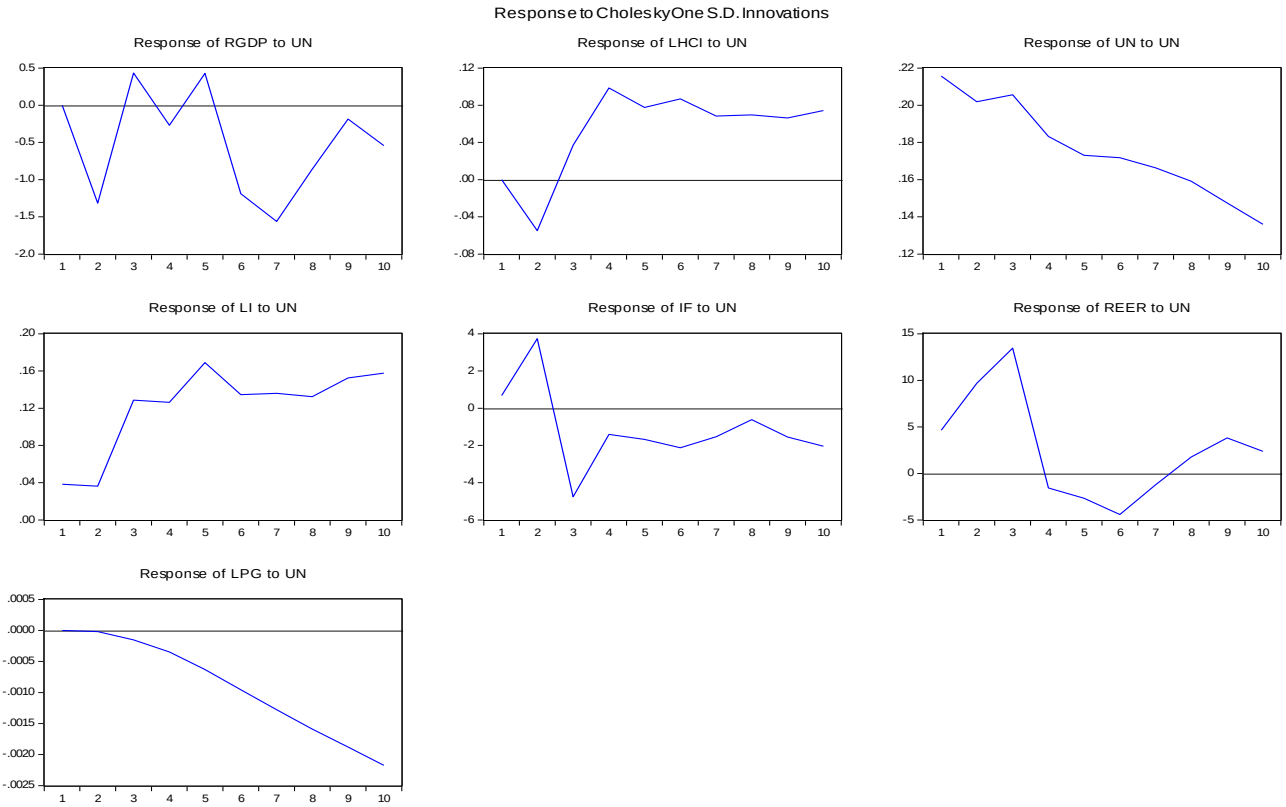


The response of other variable to innovation in unemployment rate

When unemployment shows the positive innovation real GDP is response up and down trend utile the fourth year however after fifth year it shows decreasing trend up to the ninth years within the negative regime signaling the existence of the negative relationship between unemployment and real GDP. in the other hand when the positive shock exit in unemployment rate human capital investment increase until the fourth year and start decline with the forecasting period.

Inflation and real effective exchange rate initially increase however, start decline with negative regime until eighth year indicating there is a negative response of inflation and real effective exchange rate to the positive shock of unemployment in addition to the population growth totally decline for the positive shock in unemployment rate with the negative regime under the scope of forecasting period. Total investment shows the positive response for the change in unemployment rate.

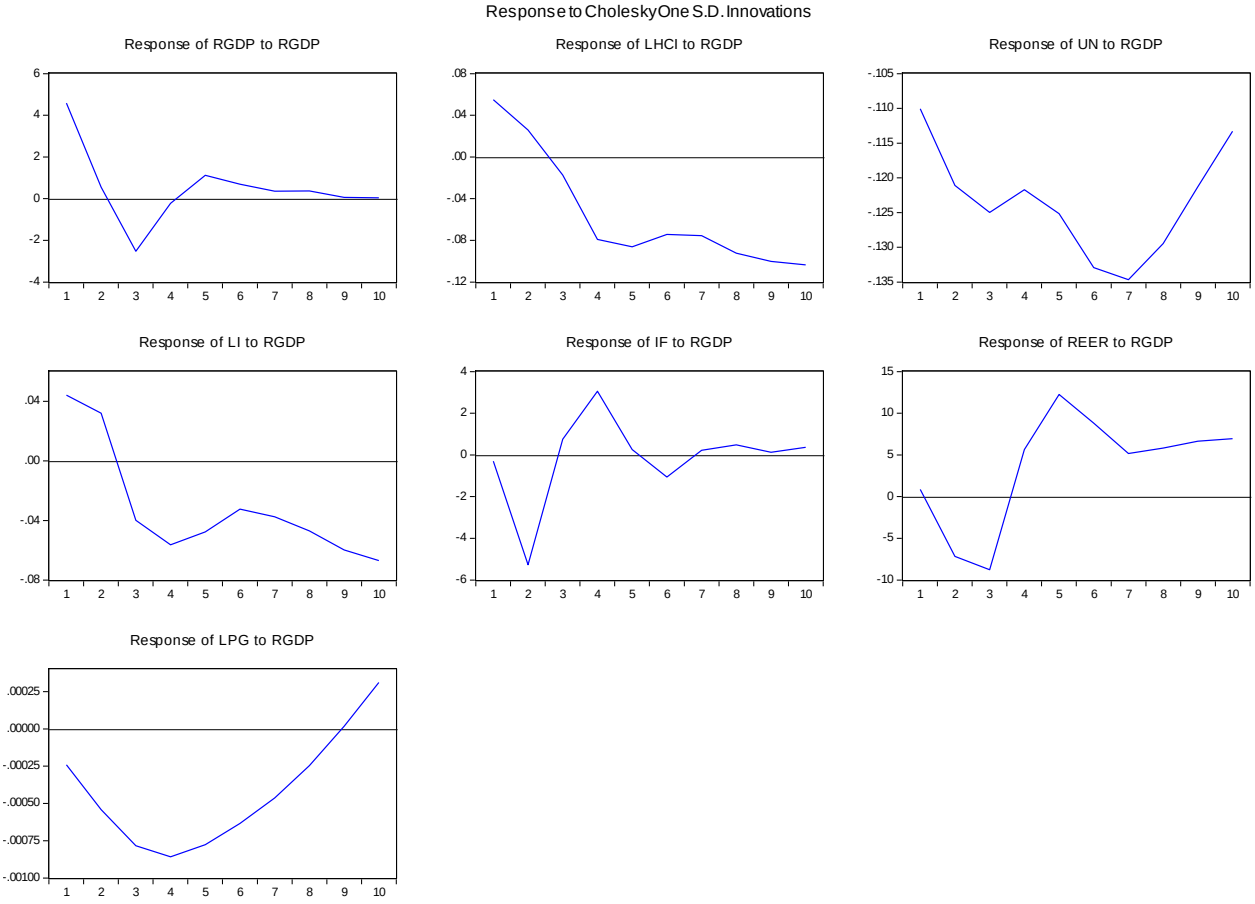
Figure 4.2 2 : The response of other variable for the change of unemployment



The response of other variable to innovation in real GDP

The response human capital investment for the innovation of real GDP is decline until the third year with positive regime moreover it continues the decrement under the negative regime after within the forecasting period. In the other hand unemployment decrease until the seven year and dramatically increase after the seventh year up to the end of the forecasting period moreover population growth shows the negative reaction with decreasing trend for real GDP innovation until the ninth year however it starts increasing after the tenth year. Real exchange rate and inflation shows somehow up and down movement with both negative and positive regimes to the innovation in real GDP. Total investment response negatively within the forecasting period.

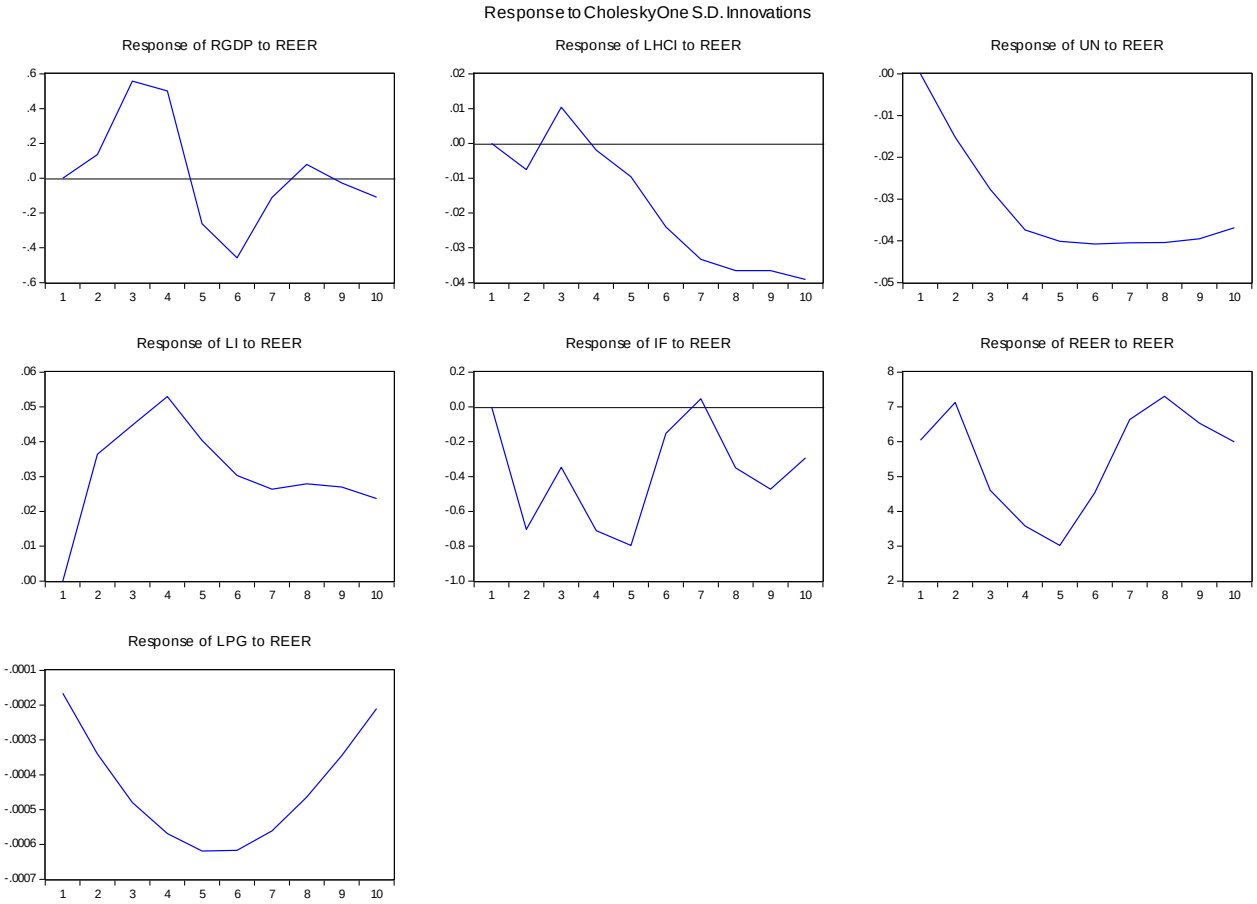
Figure 4.2 3:The response of other variable for the change real GDP



The response of other variable to innovation in real effective exchange rate

Human capital investment and unemployment rate show almost the same response for innovation in real effective exchange rate increasing which is decline with the negative regime and population growth decline until the fifth year and then increasing also inflation and real GDP shows somehow the same response for innovation in real effective exchange rate however the inflation is under the negative regime for all forecasting period

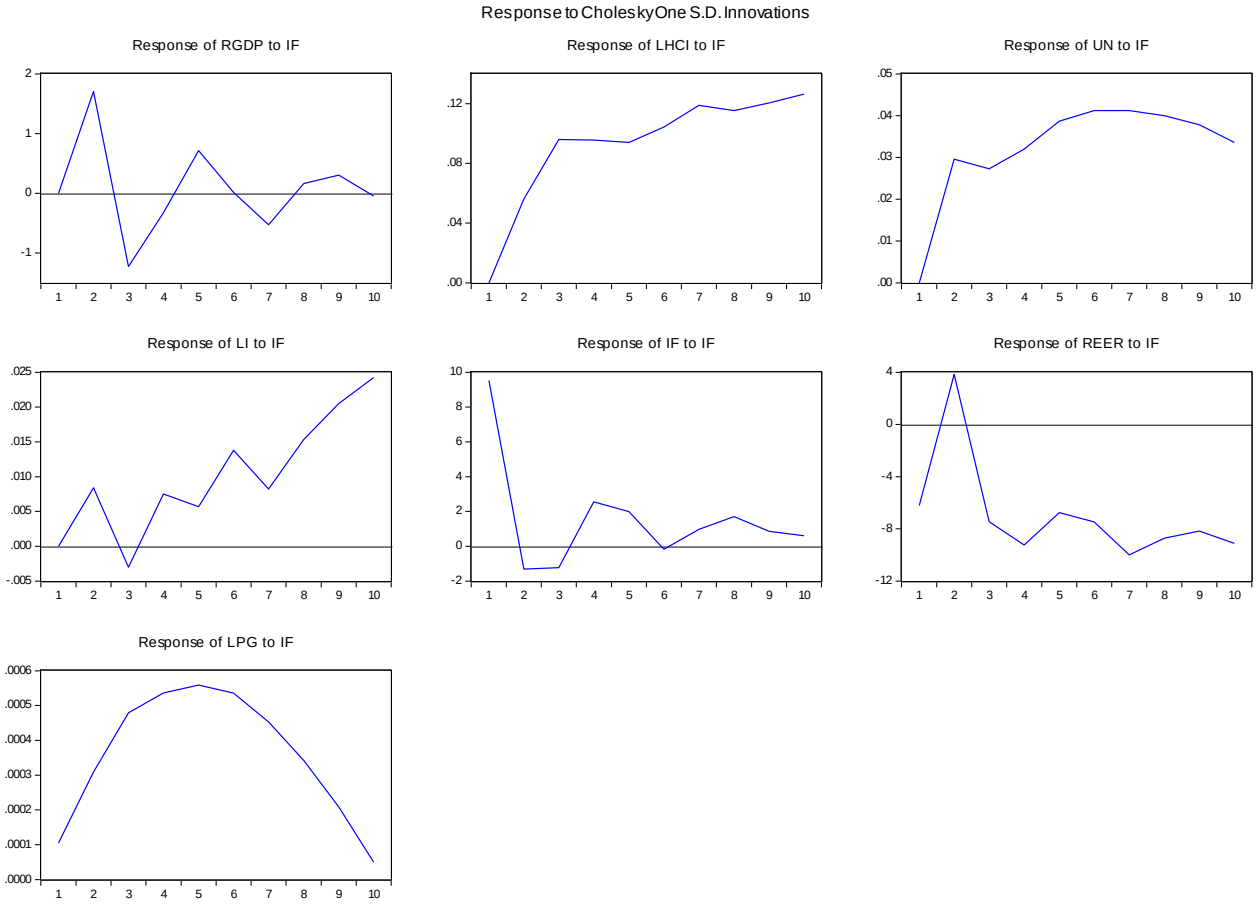
Figure 4.2 4 : The response of other variable to the change of real exchange rate



The response of other variable to innovation inflation

Unemployment and human capital investment show increasing negative response for the positive innovation of inflation rate. Real effective exchange rate and real GDP show up and down movement. Total investment increases however with positive regime.

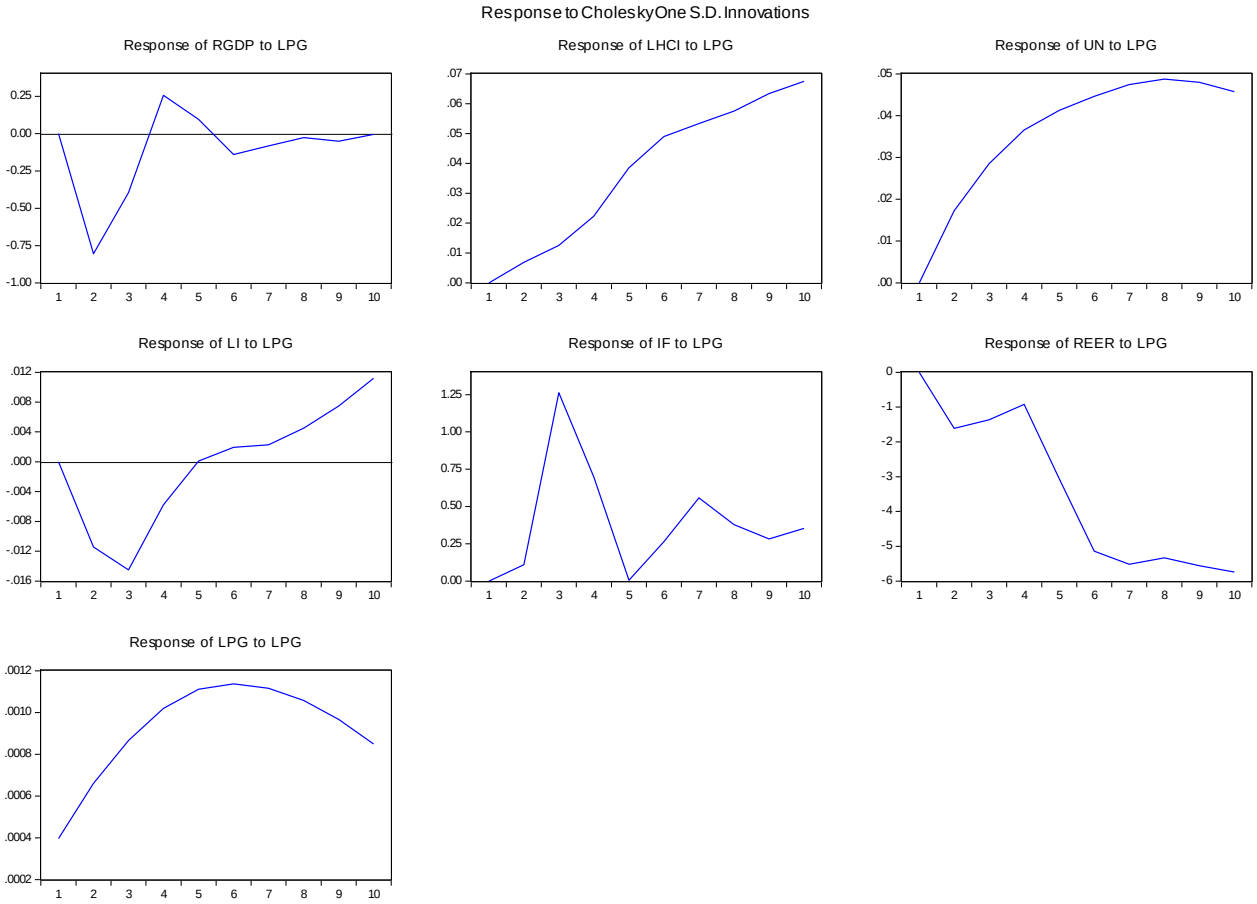
Figure 4.2 5 : The response of other variable to the change in inflation rate



The response of other variable to innovation population growth

Unemployment, inflation and human capital investment shows appositive response for the positive change of population growth whereas Real GDP and total investment shows up and down trend with both negative and positive regimes. Moreover, real effective exchange rate show decline trend with positive regime for the forecasting period.

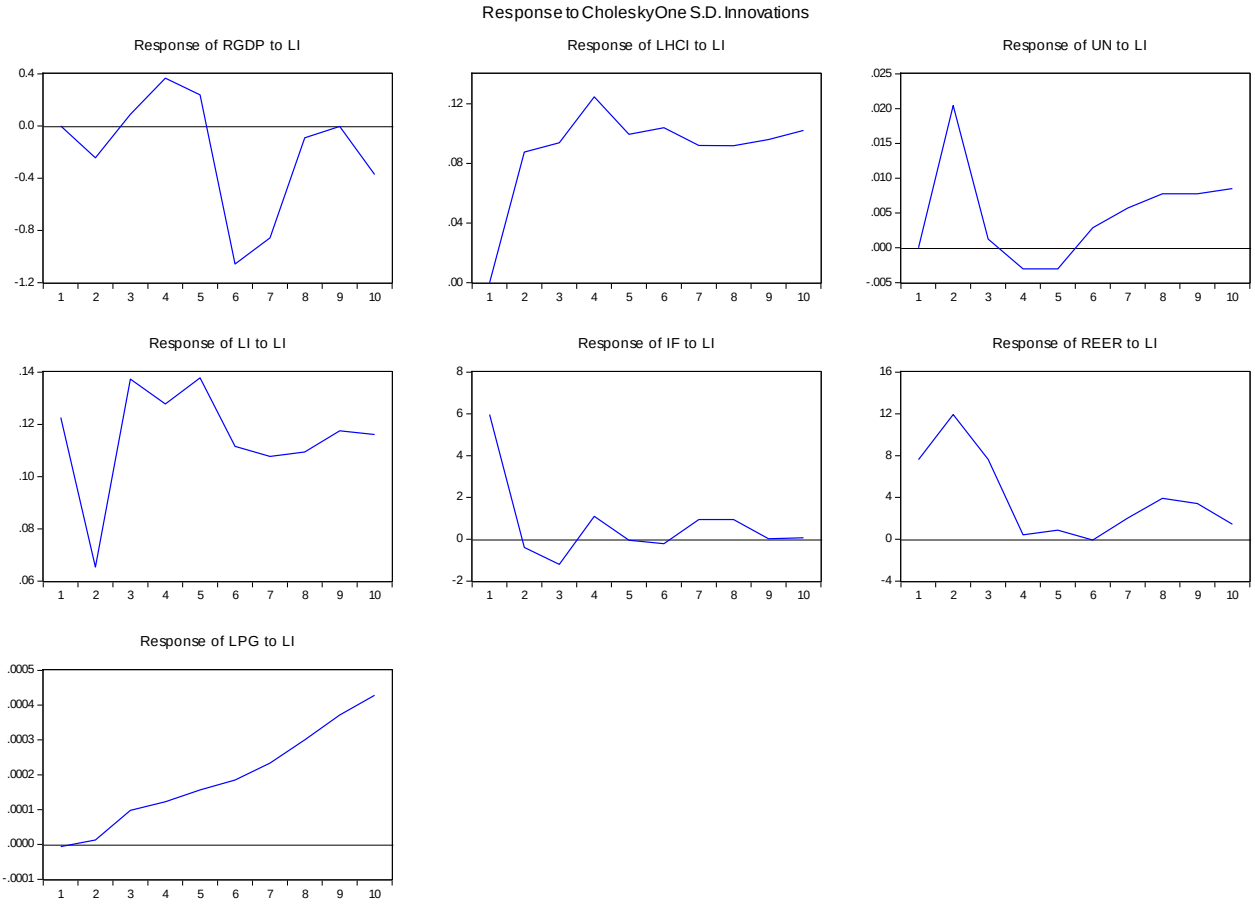
Figure 4.2 6: The response of other variable to the change of population growth



Response of other variable to the change in total investment

Inflation, real GDP and unemployment show both positive and negative response with the forecasting period for the positive shock in total investment. Human capital investment, population growth and real effective exchange rate are shows positive and negative response respectively. Real effective exchange rate shows the positive response.

Figure 4.2 7: The response of other variable to the change of total investment



4.2.6. Variance decomposition

According to variance decomposition result of real GDP (Annex C1) shows the variance in real GDP largely explained or source form its own change which is 79 present in second year and 57 present in the last forecasting year. As the result clearly shows the next great variation in real GDP came from total investment and unemployment rate with 21 percent and 7.4 present respectively. Within the forecasting period human capital investment and population growth has no significant effect on real GDP.

In the short run the higher variance of unemployment came from its own shock however in the tenth year the greater variation in unemployment came from population growth and real effective exchange rate which registered 16 present and 15 present in that order and 9.36 present variation of unemployment explained by the variation from human capital investment.

Significant and great variation of human capital investment rise from its own innovation which is 56 present in third year and 46 present in tenth year. In the other hand the change in real effective exchange rate explain by unemployment rate in the tenth year followed by real GDP which took 27 present and 19 present respectively. Inflation is not significant to explain the variation in real effective exchange rate.

Dispute to the first year the great variation in total investment soured from real GDP followed by unemployment rate which registered 19 and 11 present in that order. Moreover, in the tenth year the great variation in inflation came from the shock in real GDP and total investment with 26 and 24 present respectively. Human capital investment and population growth is insignificant contribution to explain the variation in inflation.

4.2.7 Vector Error Correlation Model Result and Analysis

The long run model

From the result of VECM it is possible to drive the long run equation which exit in the model and show the long run relationship between the variable

$$rgdp = -737 + 43.14\text{lpg} - 0.180\text{reer} - 0.583\text{if}$$

$$lhci = 48.8 - 2.78lpg + 0.039reer + 0.22if$$

$$un = 101.98 - 5.67lpg + 0.015reer + 0.032if$$

$$i = 74.03 - 4.11lpg + 0.05reer + 0.21if$$

As the above equation which derived from the result of VECM clearly shows population growth is positively affect real GDP in the long run However, real effective exchange rate and inflation rate is negatively affect real GDP also all variable are statically significant with t-value of 4.63,3.02 and 2.33. The one percentage increase in population growth can increase real GDP by 43.14 present. And the one percentage increase on real effective exchange rate and inflation decrease real GDP by 0.18 and 0.58 present.

Real effective exchange rate and inflation rate positively affect human capital investment in the long run yet population growth increase lead to decrease human capital investment among those inflation and real effective exchange rate is statically significant. One percentage change in real

effective exchange rate and inflation rate lead to 0.03 and 0.22 present increases on human capital investment in that order.

Real effective exchange rate and inflation rate positively affect unemployment rate and both variable are statically significant however Population growth positively affect unemployment rate and it is statically significant one percentage change in real effective exchange rate and population growth is lead to 0.015 and 0.032 percentage increase in unemployment. Moreover, a one percentage change population rate is decrease unemployment rate by 5.67present.

Table 4.2.2 5 Vector Error Correction Estimates

Vector Error Correction Estimates
Date: 04/07/20 Time: 08:16
Sample (adjusted): 1983 2018
Included observations: 36 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	CointEq2	CointEq3	CointEq4
RGDP(-1)	1.000000	0.000000	0.000000	0.000000
LHCI(-1)	0.000000	1.000000	0.000000	0.000000
UN(-1)	0.000000	0.000000	1.000000	0.000000
LI(-1)	0.000000	0.000000	0.000000	1.000000
IF(-1)	0.583711	-0.225818	-0.032396	-0.215158
	(0.25014)	(0.04836)	(0.02886)	(0.05380)
	[2.33352]	[-4.66981]	[-1.12240]	[-3.99886]
REER(-1)	0.180599	-0.039781	-0.015168	-0.053443
	(0.05968)	(0.01154)	(0.00689)	(0.01284)
	[3.02632]	[-3.44823]	[-2.20280]	[-4.16345]
LPG(-1)	-43.14324	2.783234	5.670911	4.119752
	(9.30171)	(1.79819)	(1.07329)	(2.00077)
	[-4.63821]	[1.54779]	[5.28366]	[2.05908]
C	737.1416	-48.80941	-101.9829	-74.02662

Source: own computation from Eviews 9

Short run dynamics for VECM

The adjustment coefficient towards long run equilibrium for real GDP, human capital investment and unemployment rate is 1.56, 0.12 and 0.01percent. In short run the percentage change in human capital investment associated to 0.02 present increase in unemployment rate where other

things remain constant in the other hand the percentage change in unemployment result 3.61 present decline of real GDP. (see annex B4)

4.2.8 Variance decomposition in VECM

According to the variance decomposition result of the VECM in the long run the variance of RGDP due to unemployment rate is 9.9 present which is the largest variation next to the variation in total investment and human capital in other hand variance of unemployment is highly affected or explain by the variation in itself which contain 75.2 present next highest change came from the variation in real GDP.

Post estimation diagnostic test

Post estimation test of LM test and heteroskedastic test indicate that the model is free from both problem (see annex A5 and A8) more over the VAR stability test confirmed the model is stable. (Annex B1)

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusions

The study is try to investigate the relationship between human capital investment, labor market and economic growth in Ethiopia by using VAR and VECM model for test the short run and long run relationship respectively. Time series data cover from 1981-2018 on real gross domestic product human capital investment (spending in education and health), unemployment rate, inflation rate, population growth real effective exchange rate and total investment is used to analysis the model.

The Johansen co-integration test indicate that there is four Co-integration equation in the model which can be a good reference to conclude there is a long run relationship between the variable. According to VECM long run result population growth is positively affect real GDP in the long run However, real effective exchange rate and inflation rate is negatively affect real GDP also all variable are statically significant with t-value of 4.63,3.02 and 2.33 respectively. The one percentage increase in population growth can increase real GDP by 43.14 present Moreover, the one percentage increase on real effective exchange rate and inflation decrease real GDP by 0.18 and 0.58 present.

Based on the result of impose response test on VECM result the response of unemployment to human capital investment to positive change is decline until the fourth year and start increasing at increasing rate until sixth year and it became decline until the ninth year after that it is somehow stable under the negative regime signaling there is a fluctuated response of unemployment for the positive change of human capital investment in the other hand, When unemployment shows the positive innovation real GDP is response up and down trend utile the fourth year however after fifth year it shows decreasing trend up to the ninth years within the negative regime indicating the existence of the negative relationship between unemployment and real GDP.

According to VECM result in short run the percentage change in human capital investment associated to 0.02 present increase in unemployment rate where other things remain constant in the other hand the percentage change in unemployment result 3.61 present decline of real GDP.

In the long run Real effective exchange rate and inflation rate positively affect human capital investment Yet, the increase on population growth lead to decrease human capital investment. among those inflation and real effective exchange rate is statically significant. One percentage change in real effective exchange rate and inflation rate lead to 0.03 and 0.22 present increases on human capital investment in that order.

According to variance decomposition result in the short run 21 present and 7.4 percent of variance in real GDP explained or source form total investment and unemployment respectively Moreover, Greater variation in unemployment came from population growth and real effective exchange rate which registered 16 present and 15 present in that order and 9.36 present variation of unemployment explained by the variation from human capital investment. Therefore, the result clearly indicates there is relationship between the real GDP, human capital investment and unemployment.

Generally, human capital investment can have negative effect on real GDP through increasing unemployment rate which means the increasing in human capital investment without considering the labor market can increase the unemployment rate and the effect of unemployment rate in RGDP is negative and statically significant

5.2 Recommendations

Based on the result of the estimation the researcher recommended that increasing one of the Fiscal policies government investments in productive sector such as education and health should be supported by the other side of increasing creating Job opportunity in labor market in order to achieve the targeted effect of increasing human capital investment in the economic growth of the countries

Even if increasing human capital investment is good measure to increase the economic growth of Ethiopia it is nonsense without considering labor market in short run. The supply side of the labor market producing more skill full labor should be supported by the demand side of the labor

market by increasing the job creation and creating more comfortable and structural organized environment for the people who went to create their own job (entrepreneur).

Job Creation Commission in Ethiopia was established as per proclamation 1097/2018 which has a responsibility to lead the job creation agenda with better structural and organized manner and have a vision to create 14 million jobs until 2030. It is a virtuous start to increase the demand side of labor market and utilize the skillful labor in more efficient ways. Therefore, this beginning must be continuing in more attention.

5.3 Issue for further study

This research takes the unemployment rate as the proxy variable to labor market due to lack of times series data of educated unemployment in Ethiopia This investigation of the relationship of human capital investment, labor market and economic growth have been a good outcome if educated unemployment taken as a proxy to labor market in order to show the clear effect of human capital investment on labor market. Therefore, as there is a hope to get organized data on labor market through job creation commission which have the additional responsibility of organized all labor market data other interested researchers can further study this issue by taking educated unemployment as a proxy variable for labor market using as a panel data.

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Appendices

Appendices. A

A1. ADF Unit root test at first difference

Null Hypothesis: D(LI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.549801	0.0000
Test critical values:	1% level	-4.234972	
	5% level	-3.540328	
	10% level	-3.202445	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LI,2)
Method: Least Squares
Date: 04/30/20 Time: 01:50
Sample (adjusted): 1983 2018
Included observations: 36 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LI(-1))	-1.283162	0.169960	-7.549801	0.0000
C	0.056646	0.066963	0.845926	0.4037
@TREND("1981")	0.007502	0.003219	2.330941	0.0260

R-squared	0.633670	Mean dependent var	2.73E-05
Adjusted R-squared	0.611468	S.D. dependent var	0.302132
S.E. of regression	0.188326	Akaike info criterion	-0.421633
Sum squared resid	1.170396	Schwarz criterion	-0.289673
Log likelihood	10.58939	Hannan-Quinn criter.	-0.375575
F-statistic	28.54133	Durbin-Watson stat	1.833777
Prob(F-statistic)	0.000000		

Null Hypothesis: D(LHCI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.574903	0.0003
Test critical values:	1% level	-4.234972	
	5% level	-3.540328	
	10% level	-3.202445	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LHCI,2)
Method: Least Squares
Date: 04/30/20 Time: 01:49
Sample (adjusted): 1983 2018
Included observations: 36 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LHCI(-1))	-0.936512	0.167987	-5.574903	0.0000
C	0.073862	0.092667	0.797076	0.4311
@TREND("1981")	0.004284	0.004146	1.033238	0.3090

R-squared	0.485352	Mean dependent var	-0.018869
Adjusted R-squared	0.454161	S.D. dependent var	0.345857
S.E. of regression	0.255522	Akaike info criterion	0.188642
Sum squared resid	2.154626	Schwarz criterion	0.320602
Log likelihood	-0.395553	Hannan-Quinn criter.	0.234699
F-statistic	15.56072	Durbin-Watson stat	1.776081
Prob(F-statistic)	0.000017		

Null Hypothesis: D(LPG) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.833106	0.0000
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPG,2)
Method: Least Squares
Date: 04/30/20 Time: 01:53
Sample (adjusted): 1991 2018
Included observations: 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPG(-1))	-0.141674	0.020733	-6.833106	0.0000
D(LPG(-1),2)	1.506916	0.161354	9.339171	0.0000
D(LPG(-2),2)	-1.034274	0.308944	-3.347776	0.0038
D(LPG(-3),2)	0.466807	0.305858	1.526222	0.1453
D(LPG(-4),2)	0.227073	0.224333	1.012215	0.3256
D(LPG(-5),2)	-0.534959	0.223541	-2.393114	0.0285
D(LPG(-6),2)	0.619631	0.221992	2.791229	0.0125
D(LPG(-7),2)	-0.413714	0.172404	-2.399675	0.0281
D(LPG(-8),2)	0.263706	0.079110	3.333398	0.0039
C	0.004857	0.000722	6.727139	0.0000
@TREND("1981")	-2.97E-05	4.76E-06	-6.249978	0.0000

R-squared	0.996982	Mean dependent var	-0.000290
Adjusted R-squared	0.995207	S.D. dependent var	0.000581

S.E. of regression	4.02E-05	Akaike info criterion	-17.11822
Sum squared resid	2.75E-08	Schwarz criterion	-16.59485
Log likelihood	250.6551	Hannan-Quinn criter.	-16.95822
F-statistic	561.6400	Durbin-Watson stat	1.850012
Prob(F-statistic)	0.000000		

Null Hypothesis: D(REER) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.515784	0.0003
Test critical values:	1% level	-4.234972	
	5% level	-3.540328	
	10% level	-3.202445	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(REER,2)
Method: Least Squares
Date: 04/30/20 Time: 01:54
Sample (adjusted): 1983 2018
Included observations: 36 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(REER(-1))	-0.957582	0.173608	-5.515784	0.0000
C	-2.154102	11.03373	-0.195229	0.8464
@TREND("1981")	0.118320	0.499353	0.236946	0.8142

R-squared	0.479723	Mean dependent var	0.618889
Adjusted R-squared	0.448191	S.D. dependent var	41.83787
S.E. of regression	31.07878	Akaike info criterion	9.790583
Sum squared resid	31874.40	Schwarz criterion	9.922543
Log likelihood	-173.2305	Hannan-Quinn criter.	9.836641
F-statistic	15.21386	Durbin-Watson stat	1.953528
Prob(F-statistic)	0.000021		

Null Hypothesis: D(RGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.245485	0.0000
Test critical values:	1% level	-4.243644	
	5% level	-3.544284	
	10% level	-3.204699	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP,2)
Method: Least Squares

Date: 04/30/20 Time: 01:55
Sample (adjusted): 1984 2018
Included observations: 35 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP(-1))	-2.016777	0.218136	-9.245485	0.0000
D(RGDP(-1),2)	0.619691	0.138284	4.481299	0.0001
C	0.060612	2.337823	0.025927	0.9795
@TREND("1981")	0.008148	0.104281	0.078134	0.9382

R-squared	0.774415	Mean dependent var	-0.286077
Adjusted R-squared	0.752584	S.D. dependent var	12.52494
S.E. of regression	6.230023	Akaike info criterion	6.603848
Sum squared resid	1203.209	Schwarz criterion	6.781602
Log likelihood	-111.5673	Hannan-Quinn criter.	6.665208
F-statistic	35.47343	Durbin-Watson stat	1.864964
Prob(F-statistic)	0.000000		

Null Hypothesis: D(UN) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.196028	0.0008
Test critical values:	1% level	-4.234972	
	5% level	-3.540328	
	10% level	-3.202445	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UN,2)
Method: Least Squares
Date: 04/30/20 Time: 01:55
Sample (adjusted): 1983 2018
Included observations: 36 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(UN(-1))	-0.900193	0.173246	-5.196028	0.0000
C	0.027371	0.081293	0.336702	0.7385
@TREND("1981")	-0.002655	0.003708	-0.715914	0.4791

R-squared	0.449988	Mean dependent var	0.001361
Adjusted R-squared	0.416654	S.D. dependent var	0.299672
S.E. of regression	0.228881	Akaike info criterion	-0.031576
Sum squared resid	1.728751	Schwarz criterion	0.100384
Log likelihood	3.568368	Hannan-Quinn criter.	0.014482
F-statistic	13.49937	Durbin-Watson stat	2.019756
Prob(F-statistic)	0.000052		

Null Hypothesis: D(IF) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.292998	0.0000
Test critical values:	1% level	-4.243644	
	5% level	-3.544284	
	10% level	-3.204699	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IF,2)
Method: Least Squares
Date: 04/30/20 Time: 01:57
Sample (adjusted): 1984 2018
Included observations: 35 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IF(-1))	-2.169666	0.261626	-8.292998	0.0000
D(IF(-1),2)	0.511193	0.154414	3.310535	0.0024
C	1.188424	5.849863	0.203154	0.8403
@TREND("1981")	-0.048128	0.261074	-0.184345	0.8549

R-squared	0.791568	Mean dependent var	0.031429
Adjusted R-squared	0.771397	S.D. dependent var	32.61790
S.E. of regression	15.59542	Akaike info criterion	8.439042
Sum squared resid	7539.732	Schwarz criterion	8.616796
Log likelihood	-143.6832	Hannan-Quinn criter.	8.500403
F-statistic	39.24312	Durbin-Watson stat	2.300438
Prob(F-statistic)	0.000000		

A2. VAR Residual Serial Correlation LM Tests

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 05/18/20 Time: 06:31
Sample: 1981 2018
Included observations: 36

Lags	LM-Stat	Prob
1	64.82356	0.0644
2	58.73658	0.1607

Probs from chi-square with 49 df.

A3. Lag exclusion Wald test

VEC Lag Exclusion Wald Tests
Date: 05/03/20 Time: 03:11
Sample: 1981 2018
Included observations: 36

Chi-squared test statistics for lag exclusion:
Numbers in [ ] are p-values

	D(RGDP)	D(LHCI)	D(UN)	D(LI)	D(LPG)	D(REER)	D(IF)	Joint
DLag 1	22.91426 [0.001764]	9.566289 [0.214512]	4.920176 [0.669704]	4.468048 [0.724561]	384.8587 [0.000000]	114.1368 [0.000000]	18.30837 [0.010654]	605.0874 [0.000000]
df	7	7	7	7	7	7	7	49

A4. VAR Lag Exclusion Wald Tests

Date: 05/18/20 Time: 07:07

Sample: 1981 2018

Included observations: 36

Chi-squared test statistics for lag exclusion:

Numbers in [ ] are p-values

	RGDP	LHCI	UN	LI	IF	REER	LPG	Joint
Lag 1	12.32268 [0.090434]	34.23878 [1.55e-05]	41.97961 [5.25e-07]	5.746935 [0.569590]	12.12689 [0.096463]	143.5466 [0.000000]	660.0325 [0.000000]	1325.382 [0.000000]
Lag 2	18.24980 [0.010892]	8.515662 [0.289323]	10.08078 [0.184042]	2.662656 [0.914359]	13.73537 [0.056093]	33.31297 [2.31e-05]	148.2471 [0.000000]	298.1151 [0.000000]
df	7	7	7	7	7	7	7	49

A5 VEC residual Heteroscedasticity test

VEC Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)
Date: 06/02/20 Time: 23:57
Sample: 1981 2018
Included observations: 36

Joint test:

Chi-sq	df	Prob.
622.3033	616	0.4215

Appendices. B

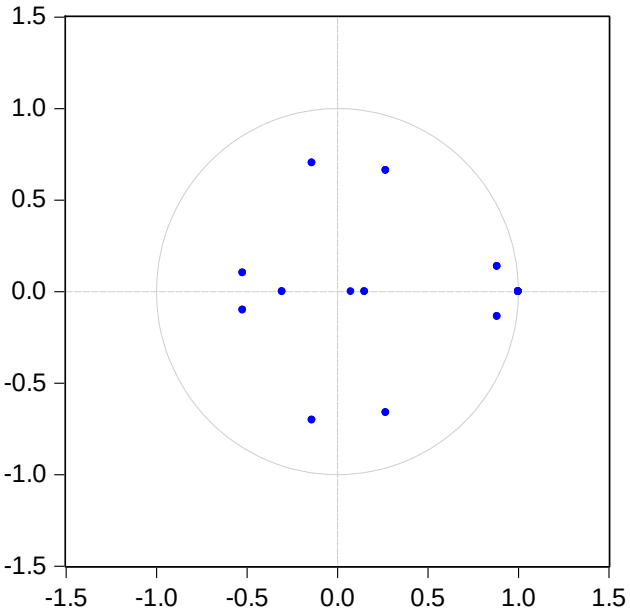
B1. VAR Stability Test

Roots of Characteristic Polynomial
Endogenous variables: RGDP LHCI UN LI IF REER LPG
Exogenous variables: C
Lag specification: 1 2
Date: 05/18/20 Time: 05:41

Root	Modulus
0.996338	0.996338
0.792168 - 0.255355i	0.832308
0.792168 + 0.255355i	0.832308
0.755464 - 0.124539i	0.765660
0.755464 + 0.124539i	0.765660
0.394747 - 0.651079i	0.761399
0.394747 + 0.651079i	0.761399
-0.103733 - 0.732953i	0.740257
-0.103733 + 0.732953i	0.740257
-0.469835 - 0.239440i	0.527330
-0.469835 + 0.239440i	0.527330
-0.368133	0.368133
-0.097696 - 0.234843i	0.254354
-0.097696 + 0.234843i	0.254354

No root lies outside the unit circle.
VAR satisfies the stability condition.

Inverse Roots of AR Characteristic Polynomial



B2. Granger causality test

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 05/03/20 Time: 06:03
Sample: 1981 2018
Included observations: 36

Dependent variable: RGDP

Excluded	Chi-sq	df	Prob.
LHCI	1.028988	2	0.5978
UN	0.716165	2	0.6990
LI	2.299579	2	0.3167
IF	3.363790	2	0.1860
LPG	4.279243	2	0.1177
REER	2.199147	2	0.3330
All	38.15698	12	0.0001

Dependent variable: LHCI

Excluded	Chi-sq	df	Prob.
RGDP	2.298937	2	0.3168
UN	3.431382	2	0.1798
LI	3.855549	2	0.1455
IF	4.822074	2	0.0897
LPG	12.30148	2	0.0021
REER	0.724569	2	0.6961
All	32.86114	12	0.0010

Dependent variable: UN

Excluded	Chi-sq	df	Prob.
RGDP	0.211076	2	0.8998
LHCI	0.189983	2	0.9094
LI	2.594471	2	0.2733
IF	2.238506	2	0.3265
LPG	4.112639	2	0.1279
REER	1.950653	2	0.3771
All	13.91930	12	0.3059

Dependent variable: LI

Excluded	Chi-sq	df	Prob.
RGDP	0.163670	2	0.9214
LHCI	0.291439	2	0.8644
UN	1.379854	2	0.5016
IF	2.972216	2	0.2263
LPG	0.648027	2	0.7232
REER	1.282535	2	0.5266
All	10.75227	12	0.5503

Dependent variable: IF

Excluded	Chi-sq	df	Prob.
RGDP	3.353801	2	0.1870
LHCI	1.425870	2	0.4902
UN	15.99276	2	0.0003
LI	3.164317	2	0.2055
LPG	0.989895	2	0.6096
REER	2.611469	2	0.2710
All	26.50975	12	0.0091

Dependent variable: LPG

Excluded	Chi-sq	df	Prob.
RGDP	0.176662	2	0.9155
LHCI	4.627241	2	0.0989
UN	8.038983	2	0.0180
LI	3.781125	2	0.1510
IF	4.620888	2	0.0992
REER	4.463554	2	0.1073
All	37.21670	12	0.0002

Dependent variable: REER

Excluded	Chi-sq	df	Prob.

RGDP	6.683649	2	0.0354
LHCI	2.757709	2	0.2519
UN	4.998469	2	0.0821
LI	11.35413	2	0.0034
IF	59.83381	2	0.0000
LPG	9.827931	2	0.0073
All	216.0038	12	0.0000

B3. Johansson co-integration test

Date: 05/02/20 Time: 11:28
Sample (adjusted): 1983 2018
Included observations: 36 after adjustments
Trend assumption: Linear deterministic trend
Series: IF LHCI LI LPG REER RGDP UN
Lags interval (in first differences): 1 to 1

Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.901382	229.1937	125.6154	0.0000
At most 1 *	0.755139	145.7997	95.75366	0.0000
At most 2 *	0.676474	95.14538	69.81889	0.0001
At most 3 *	0.508909	54.52028	47.85613	0.0104
At most 4	0.402240	28.91976	29.79707	0.0628
At most 5	0.224770	10.39540	15.49471	0.2515
At most 6	0.033589	1.229969	3.841466	0.2674

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.901382	83.39403	46.23142	0.0000
At most 1 *	0.755139	50.65432	40.07757	0.0023
At most 2 *	0.676474	40.62510	33.87687	0.0067
At most 3	0.508909	25.60053	27.58434	0.0878
At most 4	0.402240	18.52436	21.13162	0.1115
At most 5	0.224770	9.165429	14.26460	0.2726
At most 6	0.033589	1.229969	3.841466	0.2674

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

B4. Short run relationship in VECM

Error Correction:	D(RGDP)	D(LHCI)	D(UN)	D(LI)	D(IF)	D(REER)	D(LPG)
CointEq1	-1.565116	-0.012525	0.000227	0.002884	-1.362975	-0.300480	-5.85E-05
	(0.31099)	(0.01383)	(0.01662)	(0.00996)	(0.80496)	(0.85131)	(3.5E-05)
	[-5.03270]	[-0.90568]	[0.01364]	[0.28962]	[-1.69323]	[-0.35296]	[-1.69089]
CointEq2	6.062027	-0.124676	-0.140889	0.489243	12.72608	-18.99855	-0.000917
	(4.45296)	(0.19802)	(0.23805)	(0.14258)	(11.5259)	(12.1896)	(0.00050)
	[1.36135]	[-0.62961]	[-0.59185]	[3.43144]	[1.10413]	[-1.55858]	[-1.85118]
CointEq3	-0.770949	0.143440	-0.012486	0.267777	-14.18227	-8.808886	-0.000852
	(1.83175)	(0.08146)	(0.09792)	(0.05865)	(4.74127)	(5.01429)	(0.00020)
	[-0.42088]	[1.76091]	[-0.12751]	[4.56569]	[-2.99124]	[-1.75676]	[-4.18286]
CointEq4	-11.58042	0.003152	0.140129	-0.555923	-9.034308	19.46263	0.000806
	(4.30611)	(0.19149)	(0.23020)	(0.13787)	(11.1458)	(11.7877)	(0.00048)
	[-2.68930]	[0.01646]	[0.60873]	[-4.03209]	[-0.81055]	[1.65110]	[1.68186]
D(RGDP(-1))	0.546529	-0.002805	-0.001823	-0.000307	0.364759	-0.621745	3.31E-05
	(0.21248)	(0.00945)	(0.01136)	(0.00680)	(0.54997)	(0.58164)	(2.4E-05)
	[2.57219]	[-0.29687]	[-0.16051]	[-0.04508]	[0.66323]	[-1.06895]	[1.39961]
D(LHCI(-1))	-3.679681	-0.112004	0.022428	-0.203884	1.015335	2.619161	0.000400
	(4.43128)	(0.19706)	(0.23689)	(0.14188)	(11.4698)	(12.1303)	(0.00049)
	[-0.83039]	[-0.56838]	[0.09468]	[-1.43699]	[0.08852]	[0.21592]	[0.81073]
D(UN(-1))	-3.618238	-0.488106	-0.058020	-0.223233	32.02523	31.54626	0.000879
	(4.39356)	(0.19538)	(0.23487)	(0.14067)	(11.3722)	(12.0270)	(0.00049)
	[-0.82353]	[-2.49823]	[-0.24703]	[-1.58688]	[2.81610]	[2.62295]	[1.79822]
D(LI(-1))	2.839782	0.506660	0.024541	-0.461775	22.90923	-44.23545	-0.000327
	(5.38108)	(0.23930)	(0.28766)	(0.17229)	(13.9283)	(14.7303)	(0.00060)
	[0.52773]	[2.11730]	[0.08531]	[-2.68016]	[1.64480]	[-3.00302]	[-0.54613]
D(IF(-1))	-0.054573	-0.010311	-0.000434	0.002467	0.054219	0.930342	-1.99E-05
	(0.11971)	(0.00532)	(0.00640)	(0.00383)	(0.30986)	(0.32770)	(1.3E-05)
	[-0.45588]	[-1.93692]	[-0.06780]	[0.64371]	[0.17498]	[2.83900]	[-1.49279]
D(REER(-1))	-0.140217	-0.001121	0.000344	-0.001482	-0.054214	0.271663	-6.11E-06
	(0.05545)	(0.00247)	(0.00296)	(0.00178)	(0.14354)	(0.15180)	(6.2E-06)
	[-2.52848]	[-0.45445]	[0.11589]	[-0.83489]	[-0.37770]	[1.78957]	[-0.99032]
D(LPG(-1))	-2065.350	16.27182	43.50975	-29.35874	300.7376	-4058.457	0.669070
	(669.202)	(29.7593)	(35.7743)	(21.4268)	(1732.15)	(1831.89)	(0.07445)
	[-3.08629]	[0.54678]	[1.21623]	[-1.37019]	[0.17362]	[-2.21545]	[8.98635]
C	62.29350	-0.392453	-1.346589	1.146405	-11.99876	129.9582	0.009916
	(20.2709)	(0.90144)	(1.08364)	(0.64904)	(52.4686)	(55.4900)	(0.00226)
	[3.07306]	[-0.43536]	[-1.24265]	[1.76631]	[-0.22868]	[2.34201]	[4.39675]

R-squared	0.766898	0.554774	0.189160	0.628335	0.731453	0.881708	0.977708
Adj. R-squared	0.660059	0.350712	-0.182475	0.457989	0.608368	0.827491	0.967490
Sum sq. resids	505.0357	0.998742	1.443280	0.517751	3383.588	3784.486	6.25E-06
S.E. equation	4.587282	0.203996	0.245228	0.146877	11.87362	12.55735	0.000510
F-statistic	7.178107	2.718653	0.508994	3.688571	5.942698	16.26250	95.69050
Log likelihood	-98.62177	13.44422	6.817029	25.27026	-132.8589	-134.8744	229.1099
Akaike AIC	6.145654	-0.080234	0.287943	-0.737237	8.047717	8.159690	-12.06166
Schwarz SC	6.673494	0.447605	0.815782	-0.209397	8.575556	8.687530	-11.53382
Mean dependent	0.163727	0.169342	-0.027250	0.158163	0.083333	0.132500	0.030073
S.D. dependent	7.867811	0.253164	0.225514	0.199503	18.97336	30.23371	0.002831
Determinant resid covariance (dof adj.)		2.95E-07					
Determinant resid covariance		1.73E-08					
Log likelihood		-35.83317					
Akaike information criterion		8.212954					
Schwarz criterion		13.13946					

Appendices. C

C1. Variance decomposition in VAR

Variance decomposition of RGDP

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.810880	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	5.444649	79.04331	0.089294	0.983218	10.93178	0.069577	4.035416	4.847409
3	6.425664	67.33182	0.375845	1.965572	19.99265	1.630144	3.477284	5.226685
4	6.639410	63.42110	0.438872	2.015399	21.91391	1.603658	5.647781	4.959287
5	6.923314	59.67943	1.103257	5.154319	22.23403	1.496311	5.194147	5.138510
6	6.965132	58.98805	1.095797	5.093819	21.98510	1.588617	5.972439	5.276179
7	7.060824	57.57802	1.194847	6.945730	21.39593	1.555819	5.829990	5.499655
8	7.086192	57.51499	1.201133	6.911848	21.44391	1.555651	5.884957	5.487507
9	7.112912	57.11781	1.194356	7.317077	21.40054	1.548883	5.840826	5.580511
10	7.126324	57.15170	1.190455	7.402252	21.32501	1.543480	5.827456	5.559646

Variance decomposition of LCHI

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.810880	13.76979	86.23021	0.000000	0.000000	0.000000	0.000000	0.000000
2	5.444649	11.88436	67.97718	1.797960	15.86532	0.009906	0.401619	2.063652
3	6.425664	10.52172	56.50336	2.261216	23.65761	0.038000	0.301306	6.716789
4	6.639410	8.485644	49.19203	4.494085	29.07424	0.030463	0.366647	8.356889
5	6.923314	8.151731	48.40192	4.557704	29.16055	0.091367	0.461303	9.175424
6	6.965132	8.099118	48.06703	4.485462	29.17270	0.195428	0.536432	9.443826
7	7.060824	8.259176	47.57758	4.871745	29.01807	0.243163	0.598451	9.431817
8	7.086192	8.263890	46.98823	5.623231	28.99375	0.240647	0.590002	9.300258
9	7.112912	8.220242	46.45545	6.325750	28.81432	0.295913	0.696191	9.192143
10	7.126324	8.206983	46.07482	6.665429	28.58693	0.408261	0.938429	9.119155

Variance decomposition of UN

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.810880	10.59094	2.451704	86.95736	0.000000	0.000000	0.000000	0.000000
2	5.444649	13.34148	1.837369	76.43738	0.606939	3.794319	2.458803	1.523711
3	6.425664	14.32923	1.942792	65.31737	2.561235	7.889460	6.236091	1.723822
4	6.639410	13.77051	1.949762	57.80973	2.132028	12.24624	10.45582	1.635917
5	6.923314	13.75211	2.311333	51.99833	1.886505	15.22221	13.15111	1.678409
6	6.965132	14.05922	3.136853	48.43233	1.920926	16.62312	14.17331	1.654241
7	7.060824	14.96839	4.547655	45.59395	1.809036	17.24730	14.25175	1.581919
8	7.086192	15.64898	6.358908	43.18960	2.029202	17.36575	13.91126	1.496302
9	7.112912	15.86151	8.053065	41.17425	2.747907	17.20203	13.46157	1.499673
10	7.126324	15.77668	9.367029	39.79929	3.536428	16.86906	13.02359	1.627920

Variance decomposition of LI

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.810880	24.23073	6.550724	1.249051	67.96949	0.000000	0.000000	0.000000
2	5.444649	24.13677	5.822556	1.784219	63.34792	0.001337	0.093770	4.813425
3	6.425664	20.71138	4.730234	9.237148	61.04248	0.158042	0.194588	3.926127
4	6.639410	19.82001	4.464400	9.442680	62.04654	0.311130	0.203847	3.711386
5	6.923314	20.00438	4.620153	9.385639	61.71315	0.356427	0.236276	3.683976
6	6.965132	19.85284	4.565240	10.24695	60.92284	0.363154	0.314334	3.734641
7	7.060824	19.64784	4.522344	10.93588	60.35255	0.409744	0.348498	3.783155
8	7.086192	19.60269	4.500157	10.93240	60.11964	0.528414	0.550815	3.765883
9	7.112912	19.56533	4.495465	10.91994	59.99783	0.609865	0.652377	3.759186
10	7.126324	19.54189	4.489974	10.90648	59.96372	0.647159	0.685207	3.765571

Variance decomposition of LPG

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.810880	16.59166	0.070427	0.309807	0.001002	83.02711	0.000000	0.000000
2	5.444649	24.12398	0.316210	0.159822	0.928496	72.36352	0.941023	1.166947
3	6.425664	28.87519	1.707292	0.950452	2.213136	63.40695	1.199036	1.647944
4	6.639410	29.65309	3.469691	3.887974	3.282337	57.25971	0.956508	1.490691
5	6.923314	27.64204	5.322187	10.26188	4.963469	50.14342	0.614222	1.052770
6	6.965132	23.93248	6.790463	19.45330	6.516848	41.96924	0.602153	0.735528
7	7.060824	19.62806	7.539087	29.56641	7.780915	33.48824	1.278364	0.718913
8	7.086192	15.61201	7.573267	38.47991	8.665999	25.98374	2.729431	0.955648
9	7.112912	12.27890	7.056654	45.29719	9.248297	20.07788	4.732139	1.308940
10	7.126324	9.724286	6.225685	50.07534	9.545114	15.81191	6.954156	1.663506

Variance decomposition of REER

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.810880	2.058228	0.007052	0.609178	9.969488	17.34424	70.01181	0.000000
2	5.444649	12.83075	0.004593	4.383080	6.866181	8.435509	34.89189	32.58800
3	6.425664	23.80363	0.017298	9.701530	7.108698	7.475120	29.47733	22.41639
4	6.639410	15.56459	0.240894	24.68968	20.36580	4.696947	19.89217	14.54991
5	6.923314	21.06573	0.759471	31.22724	16.20699	4.212213	15.40682	11.12153
6	6.965132	21.14753	2.537201	33.40839	15.20290	5.587878	12.94237	9.173734
7	7.060824	19.24943	3.763475	32.81575	14.39029	8.158096	13.66984	7.953119
8	7.086192	18.89944	4.376034	30.17591	13.59562	10.39205	15.30870	7.252246
9	7.112912	19.02458	5.019705	28.70416	12.93565	11.60173	15.79797	6.916200
10	7.126324	19.14232	6.049846	27.80708	12.50605	12.14133	15.67239	6.680986

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.810880	1.728607	2.189061	0.748072	36.11621	2.572128	5.348974	51.29695
2	5.444649	8.096458	1.740812	8.870853	31.29359	2.013172	5.374619	42.61050
3	6.425664	6.420869	1.316353	27.95944	25.83554	2.071010	4.058871	32.33792
4	6.639410	10.34611	1.716931	27.07945	24.38895	2.016389	3.859144	30.59303
5	6.923314	10.17053	1.659364	26.44595	25.91136	2.325541	3.730356	29.75690
6	6.965132	10.32431	1.620262	26.91633	25.08780	2.784678	4.305827	28.96080
7	7.060824	10.28455	1.662266	26.42946	24.79567	3.165396	5.188474	28.47418
8	7.086192	10.38637	1.656011	26.16361	25.06481	3.280707	5.267260	28.18123
9	7.112912	10.36232	1.699855	26.12547	25.01272	3.357893	5.261955	28.17978
10	7.126324	10.36722	1.851159	26.15191	24.87712	3.409210	5.284065	28.05931

C2. Variance decomposition in VECM

variance decomposition of RGDP

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.520684	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	5.260988	75.13638	0.371477	1.445348	14.70600	0.029031	3.457115	4.854649
3	6.375756	60.03058	2.385492	1.566530	28.11421	0.694766	2.531586	4.676842
4	6.492112	57.95493	3.227459	1.579257	27.59043	0.682224	3.891012	5.074690
5	6.875233	54.19583	3.094404	7.839285	24.98988	0.713837	3.504719	5.662046
6	6.935814	53.38103	3.599736	8.123268	24.82024	0.721380	3.790468	5.563872
7	6.981176	52.82986	4.008512	8.283347	24.90654	0.712810	3.742372	5.516559
8	7.043214	51.94772	4.429981	8.377896	25.05113	0.704942	3.704139	5.784186
9	7.144282	50.51681	4.840053	9.563510	24.78701	0.704049	3.604617	5.983954
10	7.190124	49.87530	5.295405	9.910366	24.66508	0.716773	3.565286	5.971788

Variance decomposition of LHCI

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.520684	14.07943	85.92057	0.000000	0.000000	0.000000	0.000000	0.000000
2	5.260988	12.74432	66.66942	0.573255	18.09033	0.031786	0.001285	1.889593
3	6.375756	10.13150	55.17424	3.295659	26.08611	0.035895	0.050343	5.226254
4	6.492112	7.092406	48.63767	8.208927	29.36153	0.023291	0.044147	6.632024
5	6.875233	5.732480	47.89665	11.17411	27.99710	0.046398	0.062615	7.090644
6	6.935814	5.404994	47.43923	12.85003	26.43876	0.114413	0.055370	7.697211
7	6.981176	5.165963	46.81546	13.85377	25.77389	0.177825	0.051193	8.161901
8	7.043214	4.768979	46.40533	14.13879	26.03862	0.221841	0.047998	8.378440
9	7.144282	4.436432	46.17858	14.20096	26.24522	0.266949	0.042647	8.629212
10	7.190124	4.235882	45.90811	14.27707	26.32383	0.318713	0.039377	8.897018

Variance decomposition of UN

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.520684	7.470540	0.006721	92.52274	0.000000	0.000000	0.000000	0.000000
2	5.260988	6.496166	0.276421	90.72789	0.539187	0.678683	0.042712	1.238944
3	6.375756	6.018233	0.170888	88.30784	2.901448	1.225863	0.227884	1.147845
4	6.492112	5.807662	0.135066	87.10243	3.274169	1.900156	0.564471	1.216044
5	6.875233	6.500523	0.182199	85.20613	3.510780	2.490024	0.864061	1.246284
6	6.935814	7.221372	0.255717	83.65337	3.366605	3.079680	1.119094	1.304166
7	6.981176	7.952623	0.444239	81.72435	3.454039	3.707905	1.381994	1.334855
8	7.043214	8.517465	0.764712	79.73601	3.580450	4.367999	1.715305	1.318054
9	7.144282	9.051609	1.277062	77.50458	3.755031	5.027712	2.107568	1.276440
10	7.190124	9.524725	1.976908	75.24540	3.851301	5.641122	2.527953	1.232587

Variance decomposition of LI

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.520684	23.02740	9.575974	0.667871	66.72875	0.000000	0.000000	0.000000
2	5.260988	22.59965	9.652879	1.125130	61.26563	0.165674	0.056663	5.134376
3	6.375756	16.17438	10.87381	10.47026	58.53201	0.120716	0.041394	3.787434
4	6.492112	15.71942	11.98132	10.16374	57.35663	0.399715	0.074407	4.304770
5	6.875233	15.94057	12.47143	11.30904	54.93827	0.555344	0.200563	4.584780
6	6.935814	15.56495	13.31045	10.97447	54.40042	0.645610	0.379042	4.725065
7	6.981176	15.00063	14.08480	10.57868	54.57529	0.663075	0.390212	4.707306
8	7.043214	14.60132	14.82065	10.29360	54.21377	0.710192	0.383217	4.977240
9	7.144282	14.30584	15.44165	10.17351	53.72013	0.765107	0.408385	5.185381
10	7.190124	14.06127	16.06619	9.936416	53.42832	0.812293	0.447252	5.248267

Variance decomposition of LPG

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.520684	15.81173	0.007721	2.249212	0.387562	81.54377	0.000000	0.000000
2	5.260988	22.30984	0.693153	3.056904	0.083465	70.92324	1.918673	1.014726
3	6.375756	24.29581	2.309036	7.594326	0.032222	60.89470	3.436282	1.437622
4	6.492112	21.51852	4.245605	16.96772	0.020139	51.82985	4.312261	1.105905
5	6.875233	16.51175	6.177644	30.74414	0.011437	41.38562	4.544660	0.624747
6	6.935814	11.64870	7.556890	44.68262	0.027050	31.42036	4.317531	0.346848

7	6.981176	7.946278	8.301878	56.25618	0.073080	23.27161	3.830215	0.320758
8	7.043214	5.405530	8.625567	64.78435	0.138785	17.29262	3.301376	0.451778
9	7.144282	3.716116	8.715249	70.82786	0.202321	13.05400	2.830925	0.653530
10	7.190124	2.599769	8.681098	75.09355	0.257401	10.04672	2.440869	0.880596

Variance decomposition of REER

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.520684	2.202414	0.791460	4.928993	4.425855	21.10019	66.55109	0.000000
2	5.260988	6.832104	1.486742	18.08461	2.297258	11.61402	34.59853	25.08673
3	6.375756	9.589180	1.095198	31.22737	5.913462	10.99979	28.27313	12.90186
4	6.492112	6.615347	0.740208	20.54840	28.43467	9.840258	25.27451	8.546599
5	6.875233	7.915335	0.960817	16.37187	33.57842	11.32328	22.94015	6.910117
6	6.935814	7.587767	0.856353	15.60883	31.17524	14.96931	23.20526	6.597243
7	6.981176	6.618561	0.740612	14.24068	28.77075	18.43038	24.95178	6.247236
8	7.043214	6.283556	0.677274	12.37092	27.72786	20.80574	26.57207	5.562587
9	7.144282	6.216521	0.664594	11.33786	27.51121	22.36080	26.95278	4.956236
10	7.190124	5.990155	0.749392	10.77005	27.12064	23.69078	27.13884	4.540146

Variance decomposition of IF

Period	S.E.	RGDP	LHCI	UN	LI	LPG	REER	IF
1	4.520684	2.121629	4.998668	0.639776	41.08522	2.592321	4.432783	44.12960
2	5.260988	5.326548	6.052446	6.653922	41.35861	2.195746	4.487562	33.92517
3	6.375756	5.157143	5.853469	24.07156	31.98175	3.049887	3.651928	26.23427
4	6.492112	8.019481	5.386497	23.74325	30.47785	3.526839	4.628998	24.21709
5	6.875233	7.003227	5.534590	22.55554	36.04188	3.316800	5.252085	20.29588
6	6.935814	6.361601	5.696010	24.43530	37.07412	3.244960	5.003508	18.18451
7	6.981176	6.277406	5.947795	24.56728	37.69341	3.441787	4.905413	17.16691
8	7.043214	6.389771	6.101048	24.25346	37.97323	3.692469	5.220086	16.36993
9	7.144282	6.125724	6.217538	24.69550	38.47166	3.785069	5.441968	15.26254
10	7.190124	5.853513	6.260745	25.66232	38.64971	3.834968	5.456419	14.28232

C3. Impulse response in VAR