An analysis of the contribution of human capital to economic growth in South Africa

LC Ntuli

orcid.org/0000-0001-6194-6738

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Supervisor: Dr GF Nubong

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ABSTRACT

The importance of human capital, as a key economic variable that promotes growth, has long been a controversial topic, hampered in part by the lack of its empirical evidence in developing countries such as South Africa. Although single country studies have been conducted on human capital and economic growth, there are a variety of proxies employed and a significant correlation is yet to be established. There is also uncertainty in the spheres of human capital and its impact on economic growth, and consequently most analysis and policy conclusions have been based on models and studies carried out in developed countries. Whereas the adoption of ineffective policies towards investing and developing the human capital of any country could have adverse effects on their economic growth and development. This should be all the more true for an emerging country like South Africa. This study contributes to this debate by conducting an analysis of the contribution of Human Capital to Economic Growth in South Africa.

Human capital refers to the abilities gained by individuals through formal and informal education, employment, work experience, as well as other types of knowledge and attained qualifications. Human capital relates to the correlation between the level of education, training and productivity. Human capital theory argues that education can contribute to the improvement of productivity and employee efficiency through the development of cognitive skills. Proponents of the human capital theory have found that basic literacy improves the productivity of low skilled workers while technical and specialised knowledge improves the productivity of highly skilled employees. This suggests that access to knowledge and skills through education in an economy can lead to an increase in the productivity of labour and therefore to economic growth in the economy. It is for this reason that the South African government devotes substantial amounts of money towards human capital development, particularly through expenditure in the education sector. This is done out of the belief that human capital is a key tool in accelerating the

economic growth of the country. This study therefore sets out to establish whether there is a long run relationship between human capital proxied by expenditure in education and economic growth in South Africa. It uses the autoregressive distributed lag (ADRL) model and the error correction model (ECM) model to examine the long-run and short-run relationships between education expenditure and economic growth alongside other explanatory variables. It uses secondary time series data, over the period 1980 to 2019. The results of the study revealed that there is a positive long-run relationship between education expenditure and GDP per capita in South Africa. However, there is no short-run relationship between education expenditure and growth in GDP per capita in South Africa, suggesting that there is a lag period before any expenditures in education can translate to meaningful economic growth as can be expected. The findings of this study reveal that a deliberate investment in education would have long term benefits for the South African economy and should consequently be considered a policy priority for the South African government. The study therefore recommends that the South African government should continue to invest in human capital development through expenditures on the educational sector but should also implement policies that are geared towards improving the quality of the education and resolving the other challenges of the educational sector, particularly improving the through put rates and improving upon the quality of education in the township and rural areas. Such a focus on improvements in the educational sector should improve the quality of human capital, and accelerate the level of economic growth in the country.

Keywords: human capital, economic growth, education, expenditure

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LIST OF ABBREVIATIONS

ADF:	Augmented Dickey-Fuller
AIC:	Akaike Information Criterion
ARDL:	Autoregressive Distributed Lag
CUSUM:	Cumulative sum of recursive residual
ECM:	Error Correction Model
FDI:	Foreign Direct Investment
GDP:	Gross Domestic Product
GEAR:	Growth Employment and Redistribution Strategy
H 0:	Null hypothesis
H 1:	Alternative hypothesis
NDP:	New Development Plan
NGP:	New Growth Path
NPC:	National Plan Commission
OECD:	Organisation for Economic Co-operation and Development
PP:	Phillips-Perron
RDP:	Reconstruction and Development Programme
SARB:	South African Reserve Bank
STATS SA:	Statistics South Africa
UNDP:	United Nations Development Programme
R&D:	Research and development
GNP:	Gross National Product

VAR:	Vector Autoregressive
VEC:	Vector Error Correction
VECM:	Vector Error Correction Model
VECT:	Vector Error Correction Term
OLS:	Ordinary least squares
GMM:	Generalised method of moments
SSA:	Sub-Saharan Africa
OECD:	Organisation for Economic Co-operation and Development
HDI:	Human development index
EEA:	European Economic Area
UNICEF:	United Nations International Children's Emergency Fund
USD:	United States Dollar
NFF:	New Funding Framework
SAPSE:	South African Post-Secondary Education
NSFAS:	National Student Financial Aid Scheme

CHAPTER 1

INTRODUCTION TO THE STUDY

1.1 Introduction

Over the past few decades, the various factors influencing the rate of economic growth have been the focus of many studies. The different perspectives on economic growth have brought a new understanding of what underlies long-term economic prosperity. There are several factors that have been analysed as determinants of economic growth; however, there has not been much emphasis on the contribution of human capital to economic growth in emerging economies like South Africa. Post-Keynesian growth theories argued that investments and savings were fundamental to economic growth, whereas neoclassical models argue that it is technical progress (alternatively called technology) that is significant in determining long term economic growth. According to Evenson and Singh (cited by Evenson, 1997:1), endogenous growth theories argue that expenditure in research and development (R&D), human capital and externalities are all also important in determining the levels of long term economic growth.

Over the years, economic theorists have made several attempts to explain how human capital contributes to economic growth. However, there is still some misconception surrounding the impact of human capital on economic growth. In earlier economic theories, human capital was not considered as a prominent factor that contributed to economic growth. However, the significance of human capital as economic variable/phenomenon emerged in Adam Smith's writings, whereby he emphasised labour as a source of wealth for an economy. Several decades later, the Solow-Swan model emerged. According to the Solow-Swan model, both human and physical capital may result in a higher level of economic growth. Romer (1990) also emphasised

the significance of human capital for endogenous growth models. As such, an economy's growth is dependent on its technological development and human capital is significant for technological development since the knowledge an individual has acquired enables new information to be generated.

Moreover, economic growth literature suggests that there are various mechanisms that illustrate a correlation between education as facet of human capital and economic growth. Mankiw, Romer and Weil (1992) found that education is the core component of human capital – it equips the workforce with tools to improve productivity. Lucas (1988) and Romer (1990) assert that education promotes innovation capacity, which promotes new knowledge production, technology and processes that enhance productivity that leads to economic growth. Moreover, Benhabib and Spiegel (1994) indicate that education enables diffusion and transmission of new knowledge, for the development of new technologies in order to boost economic growth

1.1.1 Background

South Africa is a natural resources rich country with important deposits of the world's greatest natural resources, including iron, silver, platinum, uranium, and copper. The population of South Africa is approximately 59.62 million (StatsSA, 2020), and an educated labour force could make a difference in the use and transformation of the country's natural resources and enhancing its contribution towards the country's economic growth. Post-apartheid, the economic landscape of South Africa has been characterised by seasons of meaningful growth especially attributed to the lifting of sanctions, trade openness and an increase in foreign direct investments. The democratic transition led to South Africa being one of the largest economies in Africa, by diversifying the economy beyond the bound of the mining and agricultural sectors.

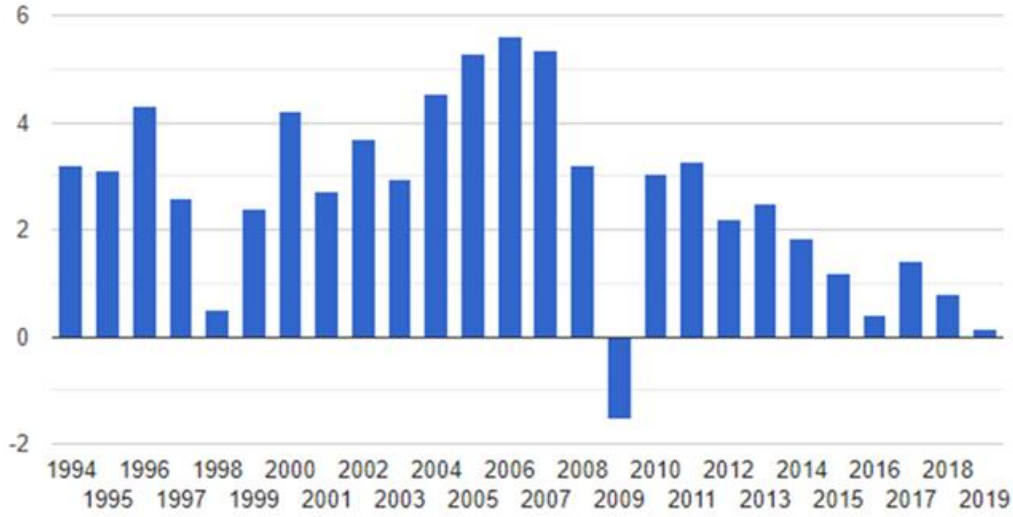


Figure 1.1: Economic growth, rate of change of real GDP

Source: The Global Economy (2021)

The Reconstruction and Development Programme (RDP) that was implemented in 1994 resulted in an increase in economic growth, and in 1996, GDP increased to more than 4%. South Africa's economic conditions began to deteriorate from around 1997 following the Asian financial crisis, and thereafter the speed in deceleration increased between 2008 and 2019. The Asian financial crisis negatively impacted South Africa's gross domestic product with the growth rate declining to 0.5% between 1997 and 1998. Following this period however, the country witnessed a commodity boom from 2004 to 2007 (Frankel, Smit & Sturzenegger, 2008:1-2). The global financial crisis in 2008 once again had a dire impact on the economic growth of South Africa. During this period, the economy went into a recession, which had a significant impact on the social sectors of the economy and led to an increase in unemployment and poverty levels. Since then, South Africa has recorded a positive growth rate; although it appears to be struggling to

raise the annual growth rate to the 5 to 6% levels mentioned in the National Development Plan's (NDP) objectives for 2030. Although a number of economists as well as the NDP have argued that attaining a growth rate of 5 to 6% is important to tackle the triple challenges of poverty, unemployment and equality, and make meaningful progress along the paths of the Sustainable Development Goals (SDGs) while combating structural unemployment in the country (Clemens *et al.*, 2007*).*

Given the importance of Economic growth, it is important to ascertain all the factors that could contribute to such growth in a country like South Africa, including the human capital variable. Wideman (2008) argues that, at the advent of the democracy era, there was a sharp increase in the education expenditure, which was caused by the change of government (cited by Mutambirwa, 2017:8). The macroeconomic policies implemented post-apartheid prioritised a significant portion of the national budget towards an investment in education. As can be seen in figure 1.2 below:

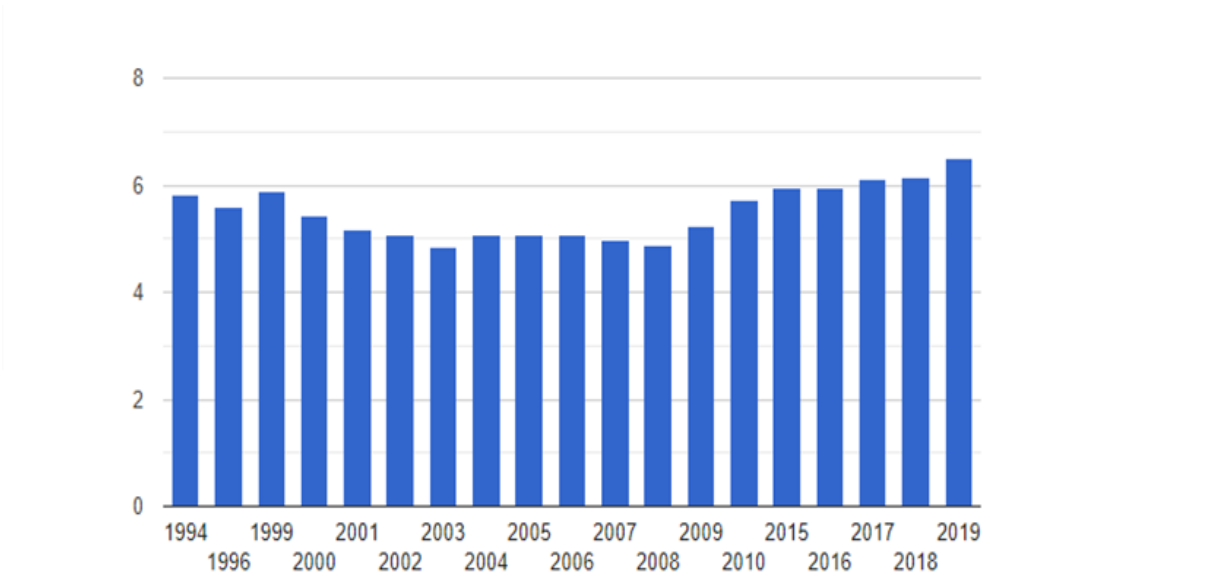


Figure 1.2: The trends in education expenditure as percentage of GDP (1994-2019)

Source: The Global Economy (2021)

Government expenditure in development activities declined by 2.2% per year in the period 1994 to 2004 (Du Plessis & Smit, 2005). This can be attributed to the legacy of apartheid, whereby a generation of marginalised people were deprived of quality education. After 1996, the government had focused on the development of new schools and improving the quality of educators through an investment in skills and training. The government implemented the New Growth Path and National Development Plan from 2009 to 2014. These macroeconomic policies were aimed at combating poverty, income disparities and high levels of unemployment by promoting education standards by 2020 and 2030. As such there is sufficient evidence that the South African government has thus far devoted substantial amounts of money towards human capital development in an attempt to address the challenges of the country's past, although the effectiveness of these efforts are still to be ascertained. It can however still be argued that the government has demonstrated its belief in the importance of human capital as a key contributor in accelerating the economic growth of the country. This study intends to contribute to this debate by conducting an analysis of the contribution of human capital to economic growth in South Africa in the last couple of decades. It seeks to establish if there is any correlation between human capital and economic growth in South Africa and if there exists a long run relationship between the two variables.

1.2 Problem statement

According to the Global Competiveness Report (2017:202), the lack of an educated labour force is among the key problematic factors affecting the competitiveness of the South African Economy. This has affected the quality of the investment climate and business environment, influencing the ease of doing business in South Africa, and has resulted in low capital and foreign direct investments. As a result, the gross domestic investment in the country declined by

11% between 1980 to 2016 (South African Reserve Bank, 2018). In 2019, education expenditure had increased to approximately 20% of the general government expenditure (Macro Trends, 2021). The high expenditure towards this facet of human capital is not reflected in the economic growth rate, as the average economic growth rate remains at a low 2.94% (World Bank, 2020). Therefore, the increase in education expenditure has not been effective in propelling the influence human capital ought to have on an economy's growth. In addition, the economic trajectory in South Africa is currently unsustainable; with low economic growth, high unemployment and inequality. The National Development Plan was implemented in order to mitigate the effect of the triple challenge of poverty, inequality and unemployment. In this regard, an investment in human capital development can be an important way of promoting equality and economic participation in the country which would ultimately contribute towards to economic growth and development. Endogenous growth theories have argued that that economic growth does not only come from increased savings and investments in physical capital but that the knowledge and skills acquired by individuals in the economy could serve as sources of long term growth in the economy through the element of technical progress also known as technology in growth models. To enhance the contribution of human capital to economic growth and development in South Africa, the South African government has recently devoted a significant portion of its budget towards education although these investments have not succeeded to overturn the country's episodes of slow growth. There is still strong evidence of poor education and skills outcomes in South Africa that require the attention of the South African government, in order to boost the contribution of human capital to the country's' growth and development. Analysing the relationship between human capital and the economic growth of South Africa is therefore fundamental in determining whether any further increases in the expenditure on education is justifiable and likely to contribute in a meaningful way to the countries efforts at promoting economic growth and addressing the triple challenge of poverty,

unemployment and inequality. Moreover, a study to examine the contribution of human capital on economic growth is also important to inform policy.

Furthermore the lack of a universal proxy for human capital poses a very challenging issue. Ngepha *et al,*. (2021) examined the human capital and economic growth in South Africa using skill levels as a proxy for human capital. Borojo and Jiyan (2016) employed school enrolment as proxy for human capital in their study while earlier literature employ various proxies for human capital such as the education expenditure, completion rate, literacy rate and the primary, secondary and tertiary attainment rate. The use of a variety proxies provides conflicting results on the impact of human capital on economic growth, however in a country where there high education expenditures it is important measure the economic returns of this investment. Very few studies have focused on how education expenditure as a proxy of human capital has an impact on economic output and economic growth in South African. This study sets forth to fill this research gap in South Africa.

1.3 Research questions

The central research question this study aims to answer is: How does human capital contribute to the economic growth of South African? This question is divided into four sub-questions.

I. What is the level of human capital in South Africa?

II. Is there a long run relationship between human capital and economic growth in South Africa?

III. Is there a short run relationship between human capital and economic growth in South Africa?

IV. How does human capital impact the economic growth of South Africa?

V. What role can the South African government play in the formation of human capital?

1.4 Research objectives

1.4.1 Primary objective

The purpose of this study is to determine the impact of human capital towards the economic growth of South Africa, in order to ascertain the implications of an increase in human capital expenditure in South Africa and its effect on economic growth. In order to achieve this aim, the study sets out the following objectives:

1.4.1.1 Theoretical objectives

I. Discuss theoretical and empirical theories pertaining to human capital and economic growth.

II. Provide background on economic growth and human capital in South Africa.

III. Review the trends in economic growth and human capital in South Africa.

IV. Discuss the importance of human capital for economic growth.

1.4.1.2 Empirical objectives

I. Determine the long-run relationship between human capital and the economic growth of South Africa.

II. Determine the short-run relationship between human capital and the economic growth of South Africa.

III. Assess the impact of human capital on the economic growth of South Africa.

IV. Contribute to human capital development strategies through empirical research to promote economic growth in South Africa.

1.5 Significance of the study

Various studies have been conducted on the relationship between human capital and economic growth of developing countries, including Van Zyl and Bonga (2009), Eigbiremolen and Anaduaka (2014) and Abel *et al.* (2019), whereas several studies have also been conducted in developed countries such as Asteriou and Agiomirgianakis (2001), Maitra (2012), and Pegkas and Tsamadais (2014). However, there is no consensus on the relationship between human capital and economic growth in the various empirical studies that have been conducted in both developed and developing countries. Theoretical literature does not put much emphasis on human capital's contribution towards an economy's growth, and therefore the following study seeks to examine human capital's contribution towards the economic growth of South Africa. Education as a sphere of human capital is at the core of this study. South Africa is among the various countries that invest a great deal of money towards education. This research study seeks to ascertain whether further increases in investment towards education is justifiable.

Moreover, the study is also important in order to inform policy on whether human capital stimulates the economic growth of South Africa. The findings of the study may also shed light on the formulation and implementation of fiscal policy that pertains to education in South Africa; policies which may improve the quality of human capital and thereby contribute to the economic

growth of South Africa. Furthermore, the study can be utilised to develop South Africa's current educational policies and promote better learning and education outcomes.

1.6 Ethical considerations

The study employs secondary data from reputable sources such as the PWT 10.0 database, the South African Reserve Bank and the World Bank. This data is freely available to the public and therefore is of low ethical risk. In executing this research, I shall adhere to the ethical guidelines as stipulated by the NWU. This study abides to the ethical principles and ethical guidelines of the North-West University (NWU, 2016:15).

1.7 Chapter classification

Chapter 1: Introduction and background to the study

The following chapter presents the introduction and background of the research study, and includes a problem statement, research questions, the objectives of the study and the ethical considerations. In addition, it provides an overview of the direction and significance of this study.

Chapter 2: Literature review

Chapter 2 of this study consists of the theoretical literature that studies the role of human capital for economic growth, and provides theoretical background on human capital as a key tool for economic output. This chapter includes the various economic growth theories, from neoclassical, growth accounting through to the exogenous theory. The chapter also presents the various empirical literature on the relationship between the human capital of both developing and developed countries. The review of empirical literature is fundamental to compare findings of empirical literature to that of the study.

Chapter 3: Background to the study

This chapter presents an overview of human capital and economic growth of South Africa. The chapter evaluates South Africa's economic trajectory, and then proceeds to examine the trends in economic growth and human capital. It also evaluates the educational sector and the challenges thereof, which provides some background to the human capital development in South Africa. Moreover, this chapter also discusses the history of higher education funding, NFSAS and the importance of fee free higher education. This chapter also provides background on the human capital education in South Africa, which is fundamental to provide policy recommendation to promote the economic growth of South Africa.

Chapter 4: Research design and methodology

The following chapter presents the model that will determine human capital's contribution towards the economic growth of South Africa, in order to achieve the empirical objectives set by the study. The chapter consists of stationary tests, cointegration tests, diagnostic tests and stability checks employed in the study along with their explanation.

Chapter 5: Results and findings

Chapter 5 of this study consists of the results from econometric model and provides an interpretation of the results. The chapter will link the findings of this study to previous theoretical and empirical literature. The results of this study are imperative for policy recommendation on the contribution of human capital to the economic growth of South Africa.

Chapter 6: Conclusions and recommendations

This chapter provides a summary of economic literature and the major findings obtained from this study. The aim of this chapter is to compare the results of the econometric methods to that of

the literature review, evaluate variances and highlight the relevance of the study. After the analysis of the results obtained in Chapter 5, the study will provide policy recommendations and the limitations of this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to review the literature on human capital as it is presented within the endogenous growth theory framework. This shall be done through a systematic review of the theoretical and empirical literature as well as a presentation of the results of similar studies that have examined the human capital growth relationship. Given the fact that this study aims to analyse the contribution of human capital towards the economic growth of South Africa, it is vital to review previous studies on this subject in order to situate the current study within the existing debates on the subject.

This chapter shall therefore provide the necessary theoretical and empirical background upon which the rest of the study is built to accomplish its set objectives. As such the rest of the chapter is divided into 5 sub-sections. Section 2.2 presents an overview of economic growth theories, briefly focusing on the neoclassical growth theories, like the Solow-Swan model, the augmented Solow model by Mankiw, Romer and Weil which is the basis of the production

function used for our econometric estimations and the endogenous growth models such as the Romer-Frankel model, the Romer model and the Lucas model. Section 2.3 discusses human capital and economic growth. Section 2.4 examines the growth accounting and the sources of growth literature while section 2.5 reviews the relevant empirical literature on human capital and economic growth focusing on studies from selected developing and developed countries. Section 2.6 will conclude the chapter.

2.2 Review of theories of economic growth

Neoclassical growth theories argues that that economic growth is determined exogenously. The proponents of neoclassical growth theories also postulate that capital is a fundamental element that drives economic growth, thereby distinguishing it from an array of economic growth theories (Makaula, 2014:27). whereas endogenous growth theory asserts that internal forces are more responsible for determining long term economic growth rather than exogenous factors. They argue for example that an increase in the level of productivity in the production process could contribute to accelerated innovation and an increase in human capital investment (Mutambirwa, 2016:29). The merits and arguments of each of these growth models shall be briefly reviewed in the sections that follow:

2.2.1 Neoclassical growth theories

2.2.1.1 Solow model

The Solow model emerged from Robert Solow and Trevor Swan (1956). The Solow model of growth is generally accepted as the basic model of reference in the literature on economic growth and is often widely celebrated because of its foundational contribution to our understanding of the theory of economic growth. The Solow model explains long-term economic growth by taking into consideration inputs such as technology, labour and capital. The model also argues that the

accumulation of physical capital is significant for short-run economic growth, whereas technological advancement is vital for long-run economic growth. According to Robert Solow and Trevor Swan, the rate of technological advancement, savings rate and the rate at which the population grows are the three factors that determine the economic growth of any economy.

Robert Solow and Trevor Swan developed a model where physical capital and labour are determinants of long-run economic growth; it is based on the neoclassical aggregate production function and where technological progress is labour augmenting. The Solow-Swan model can be shown as follows:

$$Y_t = F(K_t, A_t \cdot L_t)$$

Where:

Y_t: is the total output at a given time period

A_t: is the level of productivity or technology at a given time period

K_t: is the capital input at a given time period

L_t: is the labour input at a given time period

t: is the time period

The labour input within the neoclassical framework describes the physiological characteristics of human work, whereas technology encompasses the abilities, skills and other factors that improve the labourers' ability to produce (Makaula, 2014:28). The neoclassical aggregate production function used in the Solow model is characterised by constant returns to scale and the diminishing marginal returns to capital and labour (Mutambirwa, 2016:27). When the production

function indicates that there are constant returns to scale, the total output per capital is dependent on the capital stock of the workers, and therefore a proportional increase in the production inputs leads to a proportional increase in the aggregate level of output. However, when there are returns to scale, the relationship between labour and capital stock for production is similar to the level of labour and capital stock within the economy.

In the Solow model, any addition in one the factors of production will result in decreasing returns in the total output, and therefore the aggregate production function exhibits diminishing marginal returns. The intensive form of the production function can be indicated as follows (Savvides & Stengos, 2008:33):

$$\widetilde{Yt} = f(\widetilde{Kt})$$

$$\widetilde{Yt} = \frac{Yt}{At.Lt}$$

$$\widetilde{Kt} = \frac{Kt}{At.Lt}$$

Where:

$\widetilde{Yt}$: Output per effective labour input

$\widetilde{Kt}$: Capital per effective labour input

Moreover, the neoclassical framework also indicates that savings are equivalent to investment in physical capital and can be written as follows (Savvides & Stengos, 2008:34):

$$\dot{K} = S_K Y - \delta_K K$$

$$\dot{K} = \frac{dK}{dt}$$

$$s_k = \frac{S_K}{Y}$$

Where:

s_k: Constant saving ratio

S_K: Total savings for physical capital formation

The Solow-Swan model also indicates that both the labour force and technological progress are exogenous factors and grow at a constant rate and can be written as follows (Savvides & Stengos, 2008:34):

$$g_L = \frac{\dot{L}}{L}$$

$$g_A = \frac{\dot{A}}{A}$$

After differentiating the $\widetilde{Kt}$: Capital per effective labour input and incorporating the above equations, we find that:

$$\dot{\tilde{k}} = s_k \tilde{y} - (g_A + g_L + \delta_K)\tilde{k}$$

The steady-state level of capital per effective labour input is indicated as follows:

$$k * = s_K \frac{\tilde{y}}{(g_A + g_L + \delta_K)}$$

The Solow model can also be expressed in the form of the Cobb-Douglas production function, where there are constant returns to capital and labour, as indicated below (Savvides & Stengos, 2008:34):

$$Y_t = {K_t}^{\alpha}(AtLt)^{1-\alpha}$$

$$0 < \alpha < 1$$

$$\tilde{y} = \tilde{k}^{\alpha}$$

$$k* = \left(\frac{s_K}{(g_A + g_L + \delta_K)}\right)^{1/1-\alpha}$$

$$y* = \left(\frac{s_K}{(g_A + g_L + \delta_K)}\right)^{\alpha/1-\alpha}$$

Where:

α: is the output capital share

$1 - \alpha$: is the output labour share

$AtLt$: is the labour productivity

$k*$: Steady state level of capital per effective labour

$y*$: Income per labour

The Solow model also indicates that capital accumulation plays a pivotal role in the economy's growth. The change in capital stocks results in a change in aggregate income and can illustrated by the equation below (Mutambirwa, 2016:26):

$$K = s(k) - (n + g + \delta)k$$

Where

$s(k)$: is proportion of income saved and invested

k: Capital

δ: is the depreciation rate

g: is the level of technological change

n: is the population growth rate

From the equation above, it is evident that capital is positively correlated to the rate of investment and negatively correlated to the level of technological change, population growth rate and depreciation. Because of diminishing marginal returns to capital and labour, the economy will reach the steady-state position whereby the increase in capital does not result in economic growth.

The process by which economies grow past the steady state is exogenous, and represents technological innovation. Solow asserted that positive technological change that is greater than zero results in an increase in each worker's output (Mutambirwa, 2016:27). Karabona and Koutung (2013) supported this view and stated that technological innovation enables to be greater production, and production can occur with fewer resources

2.2.1.2 Augmented Solow model

The augmented Solow model is an improvement of Solow-Swan's original model. In the previous model, Solow did not explicitly incorporate human capital. Mankiw, Romer and Weil (1992) improved the model by augmenting the original Solow to include human capital, which is

postulated to be a fundamental driver of an economy's growth. According to Chirwa (2016), the incorporation of human capital is significant, as the complementary relationship between physical capital accumulation and human capital promotes economic growth.

The augmented Solow model indicates that human capital can be employed to explain the variety in income levels. The model not only illustrates the implications of low human capital, it also highlights how education can improve human capital as it enables the labour force to gain skills, knowledge and competencies that improve productivity and enhance economic growth. Acemoglu (2008:117) asserted that human capital includes all the qualities that lead to an increase in the productivity of a worker, and these qualities can be measured based on education and health (Weil, 2013). There is variety in the levels of education and health; the non-homogeneity of workers in productivity in various economies highlights the importance of the augmented Solow model.

The augmented model assumes that three inputs should be included in the aggregated production function: human capital, physical capital and labour. According to Mankiw, Romer and Weil, human capital directly contributes to production. Physical capital, human capital and labour exhibit constant returns; however, there are diminishing returns. The augmented Solow model can be shown as follows (Savvides & Stengos, 2008:37):

$$Yt = kt^{\alpha} Ht^{\beta} (AtLt)^{1-\alpha-\beta}$$

$$\widetilde{yt} = \widetilde{kt}^{\alpha} \ \widetilde{ht}^{\beta}$$

$$\overline{ht} = {Ht}/{AtLt}$$

Where

H: is the human capital stock

β: is the proportion of output for human capital

$AtLt$: is the productivity augmented labour

$\widetilde{Y}t$: Output per effective labour input

$\widetilde{h}t$: Human capital per effective labour input

Mankiw, Romer and Weil assumed one good is produced in an economy, output(y) and all the firms are identical, and the market is perfectly competitive. The model also assumes that both human capital and physical are accumulating factors, and the economy is a representative agent that saves its output in order to accumulate more physical capital or human capital. Human capital and physical capital can be indicated as follows. (Savvides & Stengos, 2008:37):

$$Kt = SKYt - \delta Kt$$

$$Ht = SHYt - \delta Ht$$

Where

SK: is the saving rate for physical capital

SH: is the saving rate for human capital

δ: is the depreciation rate

The underlying assumption in this framework is that human capital, and physical capital all have the same production function. As a result, the depreciation rate for both human and physical capital is the same. Moreover, Mankiw, Romer and Weil also assume that individuals invest in human capital when they forgo consumption and commit a proportion of their income to

accumulate human capital relative to the proportion of income invested in physical capital. They also indicate that both human capital and physical capital depreciate at the same constant rate, and output is employed either for consumption or investment in human capital and physical capital, and gives the steady state values as follows (Savvides & Stengos, 2008:38):

$$k* = \left(\frac{{s_K}^{1-\beta}\, {s_H}^{\beta}}{(g_A+g_L+\delta_K)}\right)^{1/1-\alpha-\beta}$$

$$H* = \left(\frac{{s_H}^{1-\alpha}\, {s_K}^{\alpha}}{(g_A+g_L+\delta_K)}\right)^{1/1-\alpha-\beta}$$

The augmentation of the Solow model facilitates the suitability of a developing country such as South Africa, where government expenditure in education is relatively higher than other developing countries. This model also assumes that an increase in the quality of workers by improving education and health leads to an increase in productivity and therefore economic growth.

2.2.2 Endogenous growth theories

2.2.2.1 Lucas model

The Lucas model is based on the credence that education leads to development of human capital, which is fundamental for economic growth. Lucas distinguishes between the internal impact of human capital where workers' training increases productivity in a firm and an external impact where there are spill-overs and an improvement in the level of productivity within the economy.

According to the Lucas model, the development and investment in human capital result in spill-overs that lead to technological advancement (Oketch, 2006, cited by Johansen 2015:6). The production function for the Lucas model is illustrated in the equation below:

$$Yi = AK^{\rho}UH^{1-\rho}h_{\alpha}^{\partial}$$

Where

K is the level of physical capital

h_{α}^{∂}: represents the human capital externalities

UH: the level of human capital

In this model, the main assumption is that there are constant returns to scale and that the marginal product of human capital motivates the population to acquire higher levels of education. In addition, the model also assumes that the investment in human capital is a key driver of endogenous economic growth. Human capital accumulation is a significant part of the Lucas model. Lucas (1988) asserted that there are resources, effort and time that should be invested to accumulate human capital. Therefore, there are costs to human capital accumulation, which suggests that there should be an adequate rate of growth in the level of human capital. Lucas (1988) found that too much investment in human capital will lead to a decrease in the current level of productivity within an economy, which will also reduce the returns on the time and resources invested towards human capital accumulation.

The underlying view in this model is that workers allocate time for their work and education. Therefore, there is a trade-off that transpires between work and education; when people take time to improve their skills through education and training they lose income; however, it will eventually increase their productivity and future income (Makaula, 2014:36). This theory postulates that there are various kinds of education to lead to a higher level of human capital. Lucas argued that knowledge can be acquired in the following ways:

I. Knowledge gained from formal schooling. The amount of time people spend acquiring theoretical knowledge will result in the accumulation of human capital.

II. On-the-job training. The experience one acquires on the job, and the knowledge absorbed from co-workers lead to the accumulation of human capital.

2.2.2.2 Frankel-Romer model

Solow indicated that technological advancement drives economic growth; however, the model illustrated that technological change is exogenous, and therefore technological change is determined exogenously. Romer postulated that technological progress is an endogenous factor, and he modified the Frankel model based on the credence that all firms have the same level of technology and input cost. The Frankel model is indicated below:

$$Y = AK^{\rho}L^{1-\rho}$$

Where

A: is the level of technology

Y: is the aggregate output in the economy

K: is the capital

L: is the labour

The Frankel model does not distinguish between technological advancement and capital accumulation. The model varies from the neoclassical model as it indicates that there are returns to capital as opposed to the view of diminishing returns to capital in the neoclassical theory. According to this model, there is proportional growth in output and capital as a result of an increase in acquired knowledge by individuals. The improvement in the knowledge of people

results in innovation that leads to the proportional growth in output and capital as opposed to the view of decreasing marginal returns in the Solow model.

Romer, in effect, extended the Frankel model by introducing a lifetime utility function:

$$W = \int_0^{\infty} E^{-pt}(Uct)dt$$

Where:

ct: Consumption per person for period t

U: Instantaneous utility function

P: positive rate of time preference

Moreover, Romer also asserted that an increase in the number of firms in an economy will lead to the development of new knowledge and technological progress, which will promote economic growth. In this model, knowledge is regarded as a capital good and there is correlation between the accumulation of capital and economic growth. This correlation will lead to an increase in aggregate output.

2.2.2.3 Romer model

According to Romer, when people utilise resources in order to make them valuable, it results in economic growth. The initial Romer model (1986) did not consider knowledge as a fundamental tool that is required in productivity. The second model (1990) took a different approach and accounted for the impact of technological progress in the economy. In this model, Romer emphasised the significance of the production knowledge, and he further asserted that innovation leads to increased returns through the production of new products. Romer also postulates that the accumulation of knowledge correlates with the level of investment. The model is based on the

assumption that technological labour is influenced by labour and promotes productivity and therefore increases output. The production function of the Romer model can be shown as follows:

$$Y = K^{\partial} AL^{1-\partial}$$

Where:

A: The level of knowledge

L: Labour force

K: Stock of capital

The Romer model takes note of the impact of human capital on the economy's growth. It further states that an economy with high levels of human capital stock will experience accelerated economic growth (Romer, 1990). Romer distinguishes between two ways in which knowledge leads to economic growth. He firstly finds that knowledge in the form of new ideas results in the production of a variety of goods. Secondly, he finds that knowledge that is influenced by research leads to an increase in the level of knowledge in the company and thereby increases human capital productivity. Romer also recognises knowledge accumulation through experience, which is linked to productivity and other factors that lead to economic growth. The model emphasises that economic growth is determined by technological change, which is mainly influenced by human capital efficiency.

2.3 Human capital in Economic growth theories.

There are various points of view that have contributed both directly and indirectly to the formation of human capital theories. Economists such as Becker (1962), Goode (1959), and Mincer (1958) have had a significant impact on the evolution of the concept of human capital.

These economists discussed the various factors that influence the overall economy. The endogenous growth theory for example, arose as a result of the growing interest in the concept of human capital. Mankiw, Romer, and Weil (1992) developed various models that attempted to explain human capital at various output levels.

Mincer (1958), Schultz (1961), and Becker (1962) were the first to independently apply the concept of human capital to economic growth and labour economics (1961). Becker, Mincer and Schultz (1970) asserted that investing in education and skills contributes to the accumulation of human capital within the economy, which leads to an increase in overall economic growth. Harbison (1964) supported this view, and suggested that human resources are critical to a nation's wealth (cited by Gamede, 2017:16). Other economists, however, argue that investing in human capital is only beneficial to economic growth in the long run. They contend that in order for an economy to succeed, it requires all factors of production.

At the centre of the human capital theory is the notion that there should be investment in human resources to promote higher income and productivity. Proponents of the human capital theory postulate that human capital is a factor of production that is related to physical capital; they contend that financial capital and natural resources are passive factors, whereas human beings are the active factors that use the passive factors to drive economic development. As such the sources of economic growth in any country can be analysed by the theory of human capital without doubt. This is because in a company for example , workplace technical equipment,(i.e. machinery and fixed capital,) may not be the only determinants of output produced by a worker, but the output of the company is also dependent on human capital, which includes the health condition of their individual workers which has a direct effect on their productivity.

According to human capital theory, human capital measures the economic value of an employee or individual, and also measures the variety in income received by employees. In productivity, it

is evident that the level of labour varies; however, the quality and level of labour can be increased through investments in human capital, and these investments yield economic value for the employees and enhance overall growth. The human capital theory recognises employees as capitalists, as employees acquire expertise, knowledge and skills that are utilised to promote economic growth. The human capital theory also proposes that the individuals in the economy earn economic advantages through the investment made in people (Sweetland, 1996:341). Schultz, Bucker and Mincer also emphasise the importance of investment in education, and they asserted that the investment in education improves human capabilities, which are a combination of innate abilities and human capital investment (Babalola, 2000, cited by Adelakun, 2011:32). The human capital theory also acknowledges the effect of healthcare expenditure, education expenditure and the training of the labour force as investments in human capital (Mutambirwa, 2016:33). On the other hand, the stock of human capital increases under the condition that gross investments are greater than depreciation as time passes.

Human capital refers to the abilities gained by individuals through formal and informal education, employment, work experience, as well as other types of knowledge and attained qualifications. Human capital relates to the correlation between the level of education, training and productivity. The human capital theory illustrates how education results in the improvement of productivity and employee efficiency through the development of cognitive skills. Proponents of the human capital theory have found that basic literacy improves the productivity of low skilled occupants; whereas technical and specialised knowledge improves the productivity of highly skilled employees. This indicates that access to schooling in an economy should lead to an increase in productivity and therefore growth of the economy.

According to Mankiw, Romer and Weil, continuous improvement in educational quality will result in long-term economic growth. Economist Becker (1962) supported this view, and stressed

the importance of education and training for human capital, emphasising that the consistent advancement of technology and civilisation necessitates the acquisition of a wide range of knowledge and skills. Mincer recognised the economic value of human capital; however, Becker emphasised the link between human capital and education. Becker and Mincer both acknowledged the existence of different types of knowledge and the sources from which different types of knowledge are obtained, i.e. skills can be learned in a formal school setting or in the workplace. Becker examined the relationship between investment education and income, and found that individuals with higher income levels invested more in their education. Jacob Mincer (1958) attempted to define human capital by examining the relationship between a person's abilities and their income. Mincer's human capital model emerged as a means of explaining an individual's various levels of human capital and income as a function. Mincer affirmed that an individual's human capital is based on prior levels of ability. An individual's basic skills and knowledge enable him or her to acquire additional skills and knowledge. According to Mincer (1981), an increase in an individual's human capital generates income and, as a result, an increase in standard of living, resulting in economic growth.

It is evident, based on numerous studies, that people with higher levels of education earn higher income. Weiss (1998) asserted that various individuals believe that having a higher level of education and many years of experience will yield higher levels of income. Various studies have also indicated that individuals with higher levels of education have high income levels and are able to increase their standard of living relative to those with lower levels of education; however, the returns on spending on higher education are lower than spending on primary education in developing countries. This may be because highly educated people are expected to be more efficient and productive than less educated workers. Mincer found that microeconomic studies indicate a link between education levels and income. Mincer (1958) found that the number of years spent in training is compensated with more income in the future; moreover., it also has a

positive impact on economic growth. These studies demonstrate that differences in wage rates and productivity levels are caused by differences in a country's labour force's knowledge and skills. Mincer goes on to say that there is a positive relationship between human and physical capital, and that combining complementary human capital and physical capital leads to higher profits from human capital.

Mincer (1958) also demonstrated that differences in individual human capital stocks and growth can explain much of the observed variation in wage structure and personal income distribution at a macroeconomic level. Moreover, Mincer introduced a framework for investigating the nature and causes of income inequality. The model incorporated education and years of work experience to measure two major types of human capital formation. Individuals can gain more skills and knowledge through a variety of means, including schooling, on-the-job training, and experience. Mincer indicated that work experience has a direct impact on an individual's level of human capital. As a result, an individual's human capital is influenced by the various levels of education attained. However, it is also influenced by the age, experience, and training of an individual. According to Mincer, this is because human capital is accumulated through a variety of knowledge and skills that result from formal education, training, and a significant amount of experience. As a result, an economy will benefit greatly from investing in these skills and knowledge.

Both Schultz (1971) and Becker (1962) developed and examined growth models supplemented with human capital and discovered a significant positive relationship between economic growth and human capital formation. Romer (1990) studied the impacts of human capital on the rate of economic growth. According to Romer, the level of investment in human capital will determine the rate of economic growth. As a result, an economy that invests more in human capital will witness accelerated growth rates. Romer argues that the rate of economic growth can be

explained by the return on education, as evidenced by several country regressions. Hanid and Arshed (2016:299) argue that investing in human capital improves individual skill development, resulting in higher levels of economic growth. Hanid and Arshed also describe human capital as an important component of long-term economic growth, particularly in terms of productivity.

Human capital theory stresses the importance of education in both individual living standards as well as the development of the economy. According to Lucas (1988), human capital is the number or level of skills possessed by an individual; disparities in skills possessed by individuals is shown in productivity. As a result, having a higher level of education and a higher quality of education will result in higher productivity and therefore economic growth. Goode (1959) conceptualised human capital as an individual's skills, knowledge and attitudes, as well as other qualities required in the production of goods and services (cited by Fleischhauer, 2007:4). This definition, however, does not only refer to education attainment; it is broader in that it includes skills acquired in an informal setting. Therefore, human capital also refers to various investments that will improve human skills, including informal education. The continuous accumulation of knowledge and the generation of ideas will improve the quality and productivity of goods and services. According to Dakhli and Clercq (2004), increasing human capital fosters innovation, which leads to higher economic growth rates. It can be concluded that an individual's skills and abilities play an important role in the evolution and shaping of an economy

Smith (1776) noted that a significant and valuable proportion of the population was unable to work with the efficiency that they would be capable of demonstrating if they had been trained. Adam Smith formed the foundation of all productive human capital frameworks, and suggested that labour inputs are more than just numbers and labour qualitatively includes all inhabitants or members' acquired and useful abilities, including the state of skill, precision and judgement with which labour is applied. He further emphasised the importance of a well-educated economy. He

claimed that a lack of education prevents people from working effectively and to their full potential. The value of human knowledge was first recognised in Sam Smith's Wealth of Nations (1776), in which he highlighted the impact of human knowledge on the production of both goods and services. As a result, investing in people through education can be considered capital. Alfred Marshall (1890) took up Smith's theory and went so far as to say that the most valuable of all capital is that invested in human beings. Acknowledging Smith's views, Marshall (1890) based his economic discussions of human capabilities on the premise that they are agents of productive wealth. Marshall, on the other hand, empirically rejected the inclusion of human capital in the market mechanism, because it lacked a market exchange for determining value (cited by Zerihun 2014:11).

There are various literature on the human capital theory that categorises the various types of education. In 1981, Schultz differentiated the various forms and means of education as: primary education, secondary education, tertiary education, at-home and at-work learning, whereas Mincer (1971) focused on apprenticeships and on-the-job learning. Rauch (1993) investigated the positive externalities in the economy as a result of formal education. According to Rauch, economic literature associates human capital with quantifiable components. Education and experience are two of these components. According to Rauch's research, education has a greater impact on productivity than average work experience. His study, on the other hand, used the average experience of the labour force and individual experience as a measurement.

There are numerous advantages to obtaining an education. Sweetland (1996:341) asserted that education leads to improved health. According to Becker (1993), education also contributes to an increase in the population's standard, while slowing the rate at which the population is growing. Schultz (1961) emphasised that education has a positive externality, which benefits production and the economy. Moreover, higher education levels have been linked to lower crime rates and

better living conditions and increased social cohesion, as well as greater political and economic participation, which yields higher economic growth rates. Education also provides the general population with the means to participate in democratic and legal due process and to pursue values such as equality, fraternity and liberty on both private and social levels (Sweetland, 1996:34).

2.4 Growth accounting and sources of growth

The concept 'growth accounting' emerged from Robert Solow (1997); however, growth accounting became prominent in 1987 in the work of Denison in his investigation of the sources of growth in United States of America during the period of 1909 to 1958 (De Jager, 2004:50). The aim of growth accounting is to assign the growth rate of aggregate output or output per capita employed to the causes of output, to determine the sources of growth in an economy. Growth accounting attempts to resolve the variety in international output levels and the causes of differences in growth rates in various countries. Growth accounting is a quantitative method employed to measure various factors that contribute to an economy's growth.

The importance of growth accounting in economic history accrues in various ways. Firstly, growth accounting is employed to measure future growth prospects by assigning expected contributions to the sources of growth. Crafts and Woltjer (2020:6) supported this view, as they state that by assigning proximate sources of growth, the growth accounting method enables an in-depth analysis of the growth processes of various economies, Secondly, growth accounting is a method of standardisation and, consequently, represents an important evaluation of growth performance strengths and limitations, as it provides insight into how growth is influenced by the various sources of growth. Thirdly, modifications to the basic growth accounting methodology allow for the quantification of specific sectors or new technologies' contributions to growth.

According to Denison, the following are the sources of growth (De Jager, 2004:50):

- High employment levels;
- Labour;
- Well-educated labour force;
- Increased capital stock;
- Greater market sizes;
- Enhanced resource allocation; and
- Availability and distribution of knowledge required for production.

Schultz (1961) criticised the quantity of labour as a source of economic output. According to Shultz, employing the number of employed persons as an economic contributor is inadequate, it is no more meaningful than employing the number of machines as a proxy for stock of capital as an economic factor.

Robert Solow's work led to development of the growth accounting framework and the emergence of the 'residual'. According to Gamede (2017:28), the Solow model indicates that any increase in the GNP can be attributed to the short-term adjustment of input, either labour or capital, and is influenced by an unknown factor 'the Solow residual'. Solow accredited the increase in economic growth to the external process of technological advancement. Solow's (1957) study employed the growth accounting method on America for the period 1909 to 1949; the study revealed that population growth and capital account for approximately 12.5% of variation in the production. However, the source of the 87% growth in aggregate output was unaccounted for in the Solow model. According to Liu (2006:6), the source of growth that Solow model failed to explain 'the residual' is human capital, and is an important source of economic growth.

Shultz (1960) and Becker (1964) investigated the 'residual', and examined the importance of human capital and the various factors that influence human capital, and this led to the abundant literature on human capital and its emphasis on training. This new literature provided a theoretical basis for analysing the persistent GNP growth that was influenced by a structure that regulated the internal production process rather than external forces. As a result, an explanation of the residual uncovered in Solow's growth model was provided. Human capital was the residual that contributed a significant proportion of growth. The discovery of the residual was revolutionary. Human capital accumulation was used in the empirical analysis of endogenous growth accounting theories to explain increases in economic growth. Although human capital is fundamental in growth accounting methodology, the theoretical exposition has yet to elaborate on how education investment contributes to economic growth. According to Bailey and Eicher (1994), although education is fundamental in an economy, human capital and education's integration in growth models only became prominent in the early 1980s (Gamede, 2017:28). With these developments in the literature, there has consequently been a clear theoretical link established between human capital (proxied in thus study by expenditure in education) and economic growth, often proxied by a growth in GDP per capita. This theoretical relationship has also been tested by a number of empirical studies as shall be briefly explored in section 2.5 that follows:

2.5 Empirical literature on human capital and economic growth

Eigbiremolen and Anaduaka (2014) examined the impact of human capital on economic growth in Sudan from 1989 to 2009. The study employed the three-stage least squares technique and a simultaneous equation was used to incorporate human capital. The study concluded that there is a positive relationship between the quality of education, health and Sudan's economic growth. The findings of the study coincide with theoretical and empirical literature that suggests that

investments in education and healthcare promote economic growth. Odonko *et al.* (2017) investigated the impact of human capital on Ghana's economic growth over a span of 40 years. The study employed the ordinary least squares technique to analyse human capital development and economic growth. Their study concluded that human capital development has an enormous positive impact on the economic growth in Ghana.

Asghar *et al.* (2012) found that human capital has a positive impact on the economic growth of Pakistan. The study was conducted from1974 to 2009, and employed Vector Error Correction Model (VECM) to check for causality and the Johannsen cointegration technique to establish if there was a long run relationship between the variables. Both cumulative sum techniques and cumulative sum square techniques confirmed the stability of the model. The study concluded that health is a significant factor in human capital formation; it is fundamental for people to be healthy to promote economic growth. Therefore, both education and health are core elements of human capital.

Oloo *et al*. (2013) examined the relationship between human capital and economic growth in Kenya over a period of 30 years (1981-2011). The study utilised capital expenditure on healthcare and education as proxies of human capital. In this study, an ordinary least squares technique was employed to analyse the correlation between the human capital and economic growth of Kenya. The results indicate a positive correlation between healthcare expenditure and the economy's growth; however, there is a negative correlation evident between education expenditure and the economic growth of Kenya.

Johnson (2011) analysed economic development and human development in Nigeria from 1985 until 2009. The study analysed the relationship between human capital proxied by expenditure on healthcare and education, and school enrolment (primary, secondary and tertiary) and gross domestic product as proxy of economic growth. The study employed the ordinary least squares

technique. Johnson examined the impact of human capital on economic growth utilising the multiple regression model, and the results indicated that the variables account for 99% of variation in the gross domestic product. The study found that there is a significant positive relationship between human capital development and Nigeria's economic growth.

Van Zyl and Bonga (2009) conducted a study on the human capital development and the economic growth of South Africa from 1979 to 2006. In order to analyse the relationship between human capital expenditure and the economic growth of South Africa, the study employed econometric techniques such as the granger causality test, auto-regressive distributed lag and constant elasticity of substation model. The variables of this study include the gross domestic product, human capital (which consists of the level education and training), government expenditure on education, the level of capital, and employment. The results of the study concluded that the increase in human capital expenditures in South Africa does not result in an increase economic growth. Van Zyl and Bonga suggest that the low returns on the investments in education can be attributed to the inefficient use of resources required in education and training. Fiscal stimulation of human capital does not propel economic growth.

Abel *et al.* (2019) investigated the correlation between human capital development and the economic growth of Zimbabwe from1980 until 2015. The study employed techniques such as cointegration tests, error correction model and the Granger causality test. The purpose of the study was to evaluate human capital expenditure post-independence. The study illustrated that there is a long-run and short-run correlation between human capital development and Zimbabwe's economic growth. Education expenditure and health expenditure were employed as proxies for human capital development. The study found that expenditure on health is positively correlated to long-run economic growth; however, expenditure on education is negatively correlated to long-run economic growth. Although the study indicated that human capital

development and economic growth are positively correlated, the relationship among the variables is weak.

Ramirez *et al.* (1997) examined the link between human capital development and the economic growth of various countries. The study identified two channels; the impact of human capital development on economic growth and the impact of economic growth on human capital development. The study employed cross-country data from 1972 to 1990. The study proposes that human capital development leads to economic growth; however, economic growth also leads to human capital development. This bidirectional correlation promotes continuous economic growth. Furthermore, the study revealed that countries that focus on economic growth attain the viscous category, whereas countries that focus on human capital development attain virtuous economic growth.

Benhibib and Spiegel (1994) found that the increase in the level of human capital is insignificant and has a negative impact on the growth of per capita income. The study employed various countries to develop a model using gross domestic product, and number of years in schooling as inputs of a production function. The study also measured the level of physical and human capital stock to analyse cross-country literature on economic development. The Cobb Douglas production function, whereby labour and physical capital are factors of production, is employed in this study. The study concludes that human capital is significant and positively correlated to physical capital. Therefore, human capital is fundamental for physical capital accumulation as opposed to economic growth. Another study by Benhabib and Spiegel (1994) also discovered similar results, indicating a positive relationship between human capital and economic growth. The granger causality test was used in a study of the Swedish economy to examine the relationship between human capital and economic growth. The findings of this study indicated that the Swedish economy is heavily reliant on human capital and there was an increase in their

education level in 1970, which had a less than expected impact on human capital. In 2002, Benhabib and Spiegel found that there is a significant positive relationship between human capital and technology diffusion. Their findings indicate that economies with greater human capital stock tend to have accelerated technological innovation. The Nelson Pepps model was employed over the period of 1960 through 1995, and cross-sectional data of 27 countries. The model indicated that there is slow factor productivity, and 81% of the countries lack the human capital stock that is required to accelerate factor productivity.

Siraj (2012) investigated the effect of human capital on Ethiopia's economic growth for the period 1974 to 2015, with the use of the augmented Solow growth model. Siraj employed public health and education expenditure as proxies for human capital, while the gross domestic product measured economic growth. The augmented Dickey-Fuller test tested for stationarity, while the Johansen cointegration technique examined the cointegration of variables. The study concluded that the short-run causality test indicates that public education expenditure and gross capital formation have a significant impact, whereas the increase in the labour force, public healthcare expenditure and the inflation rate have an insignificant impact.

Dinkineh (2015) also found that human capital proxied by public health expenditure, public education expenditure and primary, secondary school enrolment have a significant impact on Ethiopia's economic growth in both the long run and short run. However, tertiary enrolment has an insignificant impact. The study also included physical capital, which positively impacts the economic growth, but the study found that inflation has a negative impact.

Altiner and Toktas (2017) investigated the impact of human capital on economic growth of 32 developing countries. The study employed secondary data of 2000 to 2014 and the panel data analysis method. The study assessed the impact of an increase in the level of education on the economy's growth. Altiner and Toktas' study found that labour has a negative impact on the

economic growth; however, physical capital has a positive impact. Moreover, the impact of human capital on the economy's growth is less than that of physical capital.

Bassanini and Scarpetta (2001) examined the correlation of human capital accumulation and the economic growth of OECD countries based on time series data of the period 1971 to 1998. The study indicated that an additional year of school leads to a 6% increase in the long-run per capita output. The study also confirmed that the promotion of research and development, the efficiency of financial markets, trade openness and the macroeconomic climate are fundamental and have an impact on physical and human capital accumulation. Ogunniyi (2017) also studied the impact of human capital accumulation on Nigeria's economic growth. The study used secondary data over a time span of 34 years (1981-2014). The study adopted the ADRL method to determine both the long-run and short-run correlation between human capital accumulation and economic growth. The results of the study indicated that there is a long-run relationship among the two variables. Oggunyi further asserted that an increase in expenditure in education is required in order to attain economic growth.

Mutabazi (2017) analysed the relationship between human capital development and economic growth in Rwanda from 1988 to 2017. The study consisted of the Cobb Douglas production function, various econometric techniques such the Johannsen co-integration test and the vector error correction model that indicated the existence of a long-run relation between the variables. The study employed gross domestic product as a proxy for economic growth, whereas aggregate government expenditure, the life expectancy rate and the school enrolment rate are employed proxies for human capital development. The study coincides with the various literature that proposes that human capital development results in long-run economic growth.

According to Maitra (2016), who utilised the Cobb Douglass production function and the vector error correction mechanism, the investment in human capital does not have a significant impact

on short-run economic growth; however, it leads to economic growth in the long run. The study consisted of time series over a span of 29 years (1981-2010), where gross domestic product is a proxy for economic growth, and expenditures in education and health are proxies for human capital investment. Maitra also conducted research study in 2012 on Asia-Pacific countries, which indicated that health and education spending increases the gross domestic product. Milanzi (2018) examined human capital investment and its impact on Malawi's economic growth. The study employed time series data over a span of 22 years (1995-2017). The autoregressive distributed lag was employed to determine the relationship among the variables. The study concluded that government expenditure on education has a positive impact, whereas government expenditure on education has a positive impact on the economic growth in Malawi.

Jaiyeoba (2015) investigated the correlation between human capital investment and Nigeria's economic growth over the years 1982 to 2011. The study employed a trend analysis, the Johansen co-integration technique and ordinary least squares method. The study found that there is a long-run correlation between public spending on education and health and Nigeria's economic growth. Furthermore, health and education spending, and secondary and tertiary school enrolment are positively significant, whereas primary school enrolment is not significant. Isola and Alani (2012) also studied Nigeria and human capital's impact on economic growth. Their study employed the growth account model, whereby gross domestic product is a function of human capital and physical capital. The study suggested that the government of Nigeria should give more attention to education expenditure as opposed to health expenditure.

Mehrara and Musai (2013) focused on the relationship between economic growth and human capital in developing countries. Mehrara and Musai's (2013) study gave particular attention on education investment, which not only focused on students, as the investment on education can also be used in training and development of educators. Their study used the panel co-integration

and panel root test for various developing nations over the period of 1970 to 2010, to analyse the causal link between education and GDP. Their results conclude that education is statistically insignificant to GDP. However, it is GDP that is statistically significant to education, meaning that higher GDP leads to higher education in these countries. Their study also proved that the quality of education declines when there is an increase in the number of enrolments. Mehrara and Musai (2013) stated that investing more in education will not yield higher economic growth, because the education systems in developing nations are not market oriented. Therefore, the study suggests that the educational systems of developing countries do not match what is required in the labour market.

Using a vector autoregression (VAR) modelling process, Zivengwa (2013) investigated the cointegration relationship between education and economic growth in Zimbabwe from 1980 to 2008. The results indicated a positive relationship between education and economic growth, with physical investment serving as a conduit to transmit these positive effects. Mariana (2015) investigated the relationship between education and economic development in the Romanian economy between 1980 and 2013 using VECM modelling techniques. The empirical findings suggest that education has a positive impact on economic growth in the long run. Anyanwu *et al.* (2015) also found that human capital development has a positive impact of Nigeria's economic growth. Their research study is based on the time period 1981 to 2010. The study utilised the ADRL method, which indicated that there is cointegration evident among the proxies of human capital development and economic growth. However, the study indicates that the impact of the human capital development proxies on economic growth is statistically insignificant.

Olayemi (2012) examined the correlation between human capital investment and productivity in Nigeria. The study employed secondary data over the period of 1978 to 2008. The nexus among the variables human capital investment and productivity was examined using the cointegration

technique and the error correction mechanism. The study also employed granger causality to investigate the causality among the variables of the model. According to this study, government spending on education is positively correlated with industrial productivity in the long run, whereas government spending on health and capital formation is negatively correlated to industrial productivity in the long run. The study indicated that there is a need for more physical capital to complement human capital investment that will lead to an increase in productivity.

Beskaya *et al. (*2010) examined the effect of education on economic growth in Turkey using the ARDL model applied to data ranging from 1923 to 2007, and the findings indicated a significant long-run relationship between school enrolment and economic growth in Turkey. Hanushek's study focused on school resources and the various factors that have an effect on learning outcomes. Hanushek (2013) examined the correlation between economic growth and education in various developing countries to determine the impact of human capital. The study employed cross-sectional data and a cross-sectional regression model to determine the relationship among the variables. The study highlighted that there are various other factors that impact human capital, and is not limited to the proxies such education, health and income. However, the study concluded that human capital positively impacts long-run economic growth. Nowak and Dahal (2016) used OLS and VECM estimation techniques to examine the long-run relationship between education and economic growth in Nepal between 1995 and 2013. Their findings indicate that secondary and higher education substantially contribute to real per capita GDP.

The relationship between human capital and economic growth is investigated using panel data by Umut (2011). The study examined both developing and developed countries and includes the following countries: The United States of America, Italy, New Zealand, the United Kingdom, Spain, Brazil, China, Japan, France, Israel, Turkey, South Korea and Iran. Umut (2011) employed gross domestic product as a proxy for economy growth, and school enrolment, public

expenditure on health and education as proxies for human capital. The study covered the period of 1999 to 2008. Umut's study found that public expenditure on education and health positively impacts the economy's growth. Therefore, an increase in these expenditures leads to economic growth. However, the study found that secondary school enrolment has a negative impact on the economy's growth.

Afzal *et al.* (2010) used annual data from 1971 to 2009 to examine the short-run and long-run relationship between school education and economic growth in Pakistan. The study found evidence of cointegration between school education and economic development using the autoregressive distributed lag (ARDL) bounds testing approach. The study's findings revealed a clear link between school education and economic growth in Pakistan, with a positive relationship between education and growth in both the short- and long run. Shazhad (2015) examined the role of human capital formation in Pakistan's economic growth. The study employed secondary data of the period 1990 to 2013. Shazhad found that education enrolment, health and physical stock are important for the economic growth in Pakistan. The study employed the ordinary least squares technique. This study indicated that education as a proxy for human capital has a positive significant impact on gross domestic product. Gross capital formation and the investment growth are both significant and positively impact economic growth. Moreover, Shazhad's study revealed that there is a negative significant correlation between the life expectancy rate and consumer price index and economic growth, respectively. According to this study, the facets of human capital are fundamental for Pakistan's economic growth.

Iwegbunam (2017) examined the impact of government expenditure in various sectors on South Africa's economic growth. The study employed quarterly data for the period 1970 to 2016. Iwegbunam utilised the vector error correction model to analyse the correlation, which revealed

that there is a long-run correlation among the variables in the study. The model indicated that private consumption expenditure and the employment to population ratio is significant and negatively correlated to the economy's growth. Moreover, the level of foreign direct investment and the gross fixed capital formation are negatively correlated to economic growth, respectively. Iwegbunam states that an increase in public capital expenditure decreases the positive impact of the two variables on the economy's growth. He further states that the South African government needs to increase expenditure on sectors that promote human and capital development in order to increase economic growth.

Altiner and Toktas (2017) conducted a study on the role of human capital on the economic growth of 32 developing countries. The study investigates the relationship between human capital and economic growth using a panel data analysis method over the period of 2000 to 2014. The study focused on the impact of an increase in the level of education on an economy's growth. The study found that physical capital has a positive impact on an economy's growth and labour negatively impacts economic growth. Moreover, the study also indicated that the impact of human capital on an economy's growth is less than that of physical capital. Shaihani *et al.* (2011) used the ARDL to analyse the effect of education level on economic growth in Malaysia from 1978 to 2007. The study's findings revealed that primary and tertiary education had a negative significant relationship with economic growth, while secondary education had a positive significant relationship with economic growth. Nonetheless, tertiary education had a long-term positive and substantial effect on economic development.

Gyimah-Brempong *et al.* (2006) employed panel data for the period 1960 to 2000, the augmented Solow growth model and the GMM method to examine the impact of higher education of economic in growth within African countries. The study found that primary, secondary and tertiary education is statistically significant and positively impacts the income per

capita growth rate in African countries. Moreover, the study also indicates that growth elasticity of higher education levels is approximately 0.09%, which is double the impact of an increase in physical capita investment. The study emphasised the need for higher education and human capital for the economic growth of African countries. Karambakuwa *et al*. (2020) examined the effect of human capital on the economic growth of various SSA countries over the period of 1980 to 2016. The study employed the fully modified ordinary least squares approach and the dynamic ordinary least square method. The analysis indicated that human capital has a significant impact on economic growth. Moreover, the addition of interactive variables to human capital (government expenditure and foreign direct investment) leads to similar results. However, their study indicated that the interactive variable, urbanisation, is significant and positively impacts economic growth.

The study by Owusu-Nantwi (2015) analysed the relationship between education expenditures and economic growth in Ghana over the period 1970 to 2012. The vector error correction and cointegration analysis are used to test for a causal relationship between the variables. The empirical findings indicate a long-run positive and significant relationship between education spending and real GDP, gross capital formation, and labour force participation. The findings of the study suggest that education contributes significantly to Ghana's long-term economic growth. Furthermore, in the short run, granger causality exists between economic growth and education expenditures in both directions. Riihelaninen (2013) investigated the impact of government spending on education on economic growth in the European Union. The study's findings indicated that education had a temporary positive impact on economic growth during the economic crisis. Kiran (2014) also investigated the link between educational spending and economic growth. This study was conducted using data from 18 countries and found a positive correlation between economic growth and education spending.

Mukhopadhyayn and BiswajitMaitra conducted research on education expenditure, healthcare spending, and economic growth levels in a few Asia-Pacific countries (2011). A normalised cointegration equation and a vector error correction model were used in the study. According to this study, expenditure on healthcare and education contributes to the economic growth of Asia-Pacific countries. Almajdob and Marikan (2019) investigated the impact of education spending of various countries to economic growth. According to the study, educational investment has a greater impact in Latin America, Africa, and Asia, but it has a lower impact in OECD countries. Osiobe investigated the relationship between the European Union's educational expenditure during the years of the economic crisis (2019). According to the findings of the study, there is a positive relationship between educational spending and economic growth. Kiran (2014) investigated the influence of spending on economic growth in Latin American countries; in this study, a co-integrating relationship between educational expenditure and economic growth is evident.

According to Dahal (2016), higher education stimulates economic development and results in higher employment levels. As a result, the quantity and quality of education available to a population in an economy have an impact on the workforce, working environment, and leadership. Higher education, as per Dahal (2016), promotes economic growth and results in higher employment levels. The study by Dahal (2016) suggests that the level of education, and quality of education in an economy have an effect the workforce, working environment and leadership. Wolf investigated the relationship between high levels of education and labour productivity in 1993. According to the study, there is a positive relationship between university enrolment (especially in science and technology) and productivity. The study concluded that higher levels of science and technology graduates promote a country's economic growth. On the other hand, Adawo investigated the impact of primary, secondary and tertiary education on

economic growth in 2011. According to Adawo's research study, primary education promotes economic growth, while secondary and tertiary education reduces economic growth.

Anyanwu (2014) acknowledged that there are factors influencing African countries' economic growth. This conclusion was reached after studying China and African countries. The study was carried out using the GDP of various African countries from 1996 to 2010. Mehrara examined the relationship between education and GDP in oil-exporting economies in 2013. Mehrara discovered that there is causality in oil revenue, economic growth and education; however, education has a minor impact on GDP. As a result, the revenue generated by oil is significant in terms of human capital and aggregate growth; however, the increase in educational enrolment leads to a decline in quality of education.

Rehman examined the relationship between education investment, healthcare spending, and GDP in 2011. The study revealed that there is a bidirectional relationship between healthcare spending and educational spending. However, there is a unidirectional relationship between healthcare spending and GDP. Rehman also investigated the relationship between education and economic growth in 2015. According to the findings of this study, no economic growth is possible without an investment in education. The study also suggested that there is a significant positive relationship between education and economic growth. Furthermore, Rehman (2015) asserted that the decrease in poverty rates is due to education increasing production per capita.

Edrees investigated the relationship between infrastructure, economic growth and human capital (2016). According to the study, in wealthy countries there is a unidirectional correlation between economic growth and human capital, whereas in poor countries there is a unidirectional correlation between economic growth and infrastructure. Therefore, the various countries' income levels result in different casual relationships. Sahni investigated the granger casual correlation between human capital investment and economic growth (2015). The research was

based on India's human capital and economic growth. It was discovered that investing in human capital has a significant impact on economic growth.

According to Kim (2010), education is the foundation of economic development. She contended that education has a significant impact on a country's level and quality of human capital, as well as on economic growth. Kim (2010) found that emerging economies face issues such as low HDI, low GDP growth, and high levels of unemployment. Kim (2010) also highlighted the importance of maintaining an educated labour force for technological innovation and productivity gains. Pegkas and Tsamadias (2014) explored the correlation between educational attainment and economic growth. The study looked at the potential impact of various educational levels on economic growth in Greece from 1960 to 2009. Models of co-integration and error correction were used. According to the empirical analysis of this study, secondary education and higher education have a statistically significant positive impact on growth, whereas primary education has a negative impact on economic growth. Sinnathurai (2013) found that economies with lower labour productivity have lower levels of economic growth, higher rates of poverty, and lower levels of employment. In Africa, approximately 1 billion people live on less than one dollar per day.

Ogunrinola and Oluwatobi examined the relationship between Nigeria's economic growth and human capital development (2011). Ogunrinola and Oluwatobi studied the impact of government spending on education and healthcare on aggregate output. According to the study, there is a positive relationship between human capital investment and economic growth. However, there is a negative relationship between capital stock investment and aggregate output. Johnson (2011) investigated the relationship between human capital development and economic growth using ordinary least squares (OLS) techniques; GDP was used to track economic growth, as well as health and education spending. Enrolment in primary, secondary and tertiary education

was used to measure the level of human capital. The study found a link between human capital development and economic growth.

Dauda examined the role of human capital in economic development in 2010. The research was carried out using a variety of analytical tools, including unit root tests, error correction mechanisms (ECM), and co-integration tests. The study confirmed that there is a positive relationship between labour force participation and human capital formation. Sankay and Shaari (2010) examined the impact of human capital development on economic growth from 1970 to 2008. The Johansen co-integration technique and vector error correction analysis were used in the study. Human capital was discovered to be critical for Nigeria's economic growth. Hussin, Muhammad and Razak (2012) investigated the relationship between government spending on education and economic growth in Malaysia using time series data from 1970 to 2010 and the vector autoregression (VAR) technique. They discovered that economic growth was linked to fixed capital formation, labour force participation, and government spending on education. In terms of education causing growth, the study found that human capital, such as education, has a significant impact on growth. The study also found that government spending on education, labour force participation, and capital have a greater impact on long-run economic growth.

Kiran (2014) investigated the impact of educational expenditures on economic growth, and his findings revealed a co-integration relationship between educational expenditure and aggregate output. Fiszbein and Psacharopoulos investigated the impact of educational investment on the Venezuelan economy. This study found that educational expenditure at the primary level is more important for economic growth than education expenditure at the secondary level. However, Mohan (2013) found that education investment is unimportant in promoting economic growth. There are numerous factors that are critical to economic growth.

Sacerdoti, Brunschwig and Tang (1998) investigated the role of human capital in the rate of economic growth in Western Africa. According to the study, physical capital contributes more to economic growth than human capital. As shown by this study, the ineffectiveness of human capital was caused by a shortage of qualified and trained workers who are unable to adapt to changing technology in human capital. Evans, Green and Murinde (2002) investigated the impact of human capital and financial development using data from 82 countries over a 21-year period. The researchers discovered that both financial development and human capital were equally effective in terms of economic growth. Sarkar (2007) studied 92 countries from 1970 to 1987 and discovered that human capital is important in the fight against income inequality and promoting higher levels of economic growth.

Over the period 1969 to 2001, an investigation on the impact of human capital in the endogenous model was conducted in Turkey using the causality test; the study found a positive correlation between human capital and economic growth. Taban and Kar (2006) used the causality and cointegration tests to investigate the relationship between the two variables. According to the study, there is a link between human capital and economic growth. Abbas and Foreman-Peck (2008) investigated the relationship between human capital and economic growth. The OLS technique was used in the study, which revealed that human capital contributed 40% of the increase in economic growth. According to the study, a lack of investment in education will result in low or no economic growth. The study also found that if a country has more educated people, it is less likely to have people living in poverty or on less than $1 per day.

Ali (2012) and Gebrehiwot (2014) examined the relationship between human capital and economic development and concluded that there is a positive long-run cointegration link. The studies were conducted in various countries and the autoregressive distributed technique (ARDL) was used for model estimation. Ali (2012) performed the granger causality test, and the results

demonstrated the existence of a causal relationship between human capital and economic growth. Ali (2012) employed real GDP, human capital formation, physical capital investment, and labour force as variables in the study, which spanned the years 1972 to 2009. Gebrehiowot (2014), on the other hand, used variables such as real GDP, human capital proxied by education and health investment, labour force, and gross fixed capital formation, and annual data from the Ethiopian Economic Association (EEA) and the National Bank of Ethiopia was used from 1975 to 2011. Similarly, Sulaimain, Bala, Tijani, Waziri and Maji (2015) included technology in their study and concluded that there is a positive relationship between human capital, technology and economic growth in Nigeria. The authors advocated for their governments to invest more in human capital development, which is consistent with SA government policies.

Bakare (2006) identified the consequences of low human capital investment, including high levels of illiteracy and a low rate of economic growth. This study suggested that education has a positive impact on the economy, and therefore investing in education and training is critical if the goal is to propel the economy to higher levels of productivity and income, thereby accelerating growth. Oleyami (2012) discovered that a percentage change in total expenditure on education increased industrial production by 6.892% in the long run, in a study of human capital and growth in Nigeria using industrial production as the dependent variable and total expenditure on education and total expenditure on health as the independent variables. The long-run test revealed that government education spending has a long-run positive relationship with industrial production. It satisfied the *a priori* expectation by being positive, implying that positive changes (increases) in education expenditure generate increases in industrial productivity, which, in turn, spur economic growth.

Appleton and Teal (2009) investigated the impact of human capital on economic growth, with the goal of drawing comparisons between Africa and South Asia. Human capital, physical

capital, GDP, and the indirect effects of human capital investment are all variables used to estimate the link between economic growth and human capital development. Apart from highlighting health as one of the significant contributors to human capital development, the study demonstrated that expenditure on education may affect health, such that ill-health may have indirect effects on labour productivity by negatively affecting schooling, by making efficient use of data heavily extracted from the United Nations development programme's HDR for the period that runs from 1980 to 2009. The study challenged the dominant narrative that education yields high returns in terms of economic growth, concluding that physical and human capital are complementary, and that human capital growth in Africa remains slow in comparison to South Asia. Appleton and Teal (2009) suggest that poor health combined with a lack of education could justify such outcomes.

Ranis (2004) investigated the relationship between human development and economic growth within the context of India. The study examined the relationship and the two-way links involved. According to the findings of the empirical analysis, there is a high potential for positive causality at the micro-level. The study also suggests that individual and household consumptions can be an important component in increasing human development and responding to the real needs of the population more effectively than government assistance. Moreover, the study indicates that at a macro-level, the distribution of increased income from economic growth will have a significant impact on human development. Wilson and Briscoe (2004) used a Cobb Douglas production function with variables to examine the impact of human capital on economic growth in the European economy. The study added useful variables to improve the estimation's econometric value. Gross output, physical capital, labour stock, materials, and intermediate inputs are among the variables examined in the study. The model also contains an explanatory variable, the efficiency variable, which measures how input values correspond to output values. The findings

demonstrated that higher levels of education and training are associated with higher levels of European economic growth.

Lee (2010) examines the impact of education on economic growth in 75 countries from 1960 to 2000, employing a 'conditional dummy' and education attainment for the population aged 15 and up in 1960. After controlling for continental dummies, the findings show that education helps to accelerate growth in a variety of economies. Zhang and Zhuang (2011) examined the effect of human capital composition on economic growth in China using the generalised methods of moments (GMM). The results revealed that tertiary education played a more important role on economic growth than primary and secondary education. Furthermore, Zhang and Zhuang's (2011) study found that the impact of human capital composition on regional economic growth is related to the level of development. It further suggests that tertiary education is more important in more developed provinces, while primary and secondary education is more important in underdeveloped provinces.

Barro (1991) discovered that while primary and secondary enrolment rates have a positive growth effect, adult literacy rates do not always. According to Barro and Sala-i-Martin (1995), the average number of school years has a significant positive impact on economic output. Using input-output analysis, Bloom *et al.* (2004) investigated the impact of human capital on economic growth and discovered that education and life expectancy both contribute positively to economic growth. Jorgenson *et al.* (2003) investigated the sources of growth for the US economy from 1977 to 2000 and discovered that investments in information and higher education dominated economic growth in the US. Jorgenson *et al.* (2003) employed the two-stage least squares method in their study. Some of the empirical studies that are most relevant to this study are summarised in table 2.1 below, highlighting their choice of variables and chosen methodology.

2.6 Conclusion

The theoretical and empirical literature review presented in this chapter has directed attention to the portion of economic growth theories that consider human capital as an important determinant of economic growth. It has been argued that neoclassical growth theory mostly attributes economic growth to exogenous factors. The development of the endogenous growth theories however incorporated human capital as an internal factor that contributes towards economic growth. This chapter has thus briefly reviewed the neoclassical growth theories of Robert Solow as well as the endogenous growth theory of Romer and Lucas. It also briefly reviewed the growth accounting literature and the sources of growth, human capital and economic growth were also discussed as it is significant for this study. Furthermore, the study will adopt the augmented Solow model as it accounts for the knowledge acquired.

The empirical literature discussed in this study accounts for both country-specific and cross-country analysis. In support of the relationship between human capital and economic growth, the empirical literature of various economies indicates that there could be either a positive or negative impact of human capital on the economic growth of various countries. These different studies have investigated human capital utilising various econometric techniques and come up with different conclusions. The findings in these studies have however established that there is a theoretical link between human capital and economic growth. These studies coincide with objectives of this study of analysing the contribution of human capital to economic growth in South Africa. . Haven presented an overview of human capital and economic growth theories, the chapter that follows will examine the situation of human capital and the recent economic performance of South Africa.

CHAPTER 3

THE RECENT PERFOMANCE OF THE SOUTH AFRICAN ECONOMY

3.1 Introduction

The aim of this chapter is to provide a background to the performance of the South African Economy focusing on the behaviour of the economic growth and human capital variables in South Africa. The chapter is significant in addressing the objectives of this study as it provides an overview of the performance of the South African economy, thereby creating the background and context around which this study seeks to conduct an analysis of the impact of human capital development on South Africa's economic growth. As such, the chapter is subdivided in to eight sections. Section 3.2 shall present an overview of the economic performance and challenges of the South African economy while section 3.3 shall analyse trends in economic growth and

human capital in South Africa. Section 3.4 shall examine education expenditure and the challenges of the education sector in South Africa. Section 3.5 shall present an overview of the history of higher education funding in South Africa as a key determinant to providing a context to the discussion on education expenditure as a proxy for human capital development in South Africa. Section 3.6 looks at the challenges with the National Student Financial Aid Scheme while section 3.7 concludes the chapter.

3.2 South Africa's recent economic performance.

The South African economy has been facing various challenges over the past few years. South Africa's GDP was 351.4 billion USD in 2019 (World Bank, 2020), which was only a 0.15% growth from the previous year. In the year following 2019, the decline in construction, the mining industry and transport led to the further drop in real GDP in 2020 by 7% from the previous year (StatsSA, 2021). This sharp decline was reported to be the greatest decline in economic activity since 1946. The Covid-19 pandemic had a dire impact on the economic trajectory. The SARB reduced the repo rate by 300 bases to shield business and individuals from the adverse effects of the pandemic. However, the inflation rate has remained within the Reserve Bank's inflation rate target of 3 to 6% since 2017 (Statista, 2021). During the fiscal year 2018/2019, the budget deficit was 4.2% of the GDP; the budget deficit widened further in the fiscal year 2019/2020 to 12.3% of GDP, which can be attributed to the economic pressures as a result of the pandemic.

On the other hand, the increase in gold and agricultural exports, together with a decline in the cost of fuel imports in 2020 led to a current account surplus, at 2.23% of the GDP (World Bank, 2021). Due to persistent economic weaknesses throughout the years, South Africa's local and foreign currency credit ratings were downgraded in 2019; the currency was further downgraded to sub-investment grade by the three major credit rating agencies, S&P, Moody's and Flitch.

According to Banking Association South Africa, the country has a well-developed and proactively regulated banking system, which is equal to or greater than those of industrialised countries (Africa Business Information, 2021). Despite the poor economic outcomes, South Africa's banking sector remains intact maintaining a capital ratio of 16% (Ceicdata, 2020), which is higher than the regulatory requirement of 10%.

However, South Africa's social indicators are weak and the country faces enormous challenges with its human development indicators. For example, in 1994, only 8.9 million of the nearly 50 million population were employed and the country's unemployment rate stood at 20%. By the end of the 2018, only 28% of the population was employed (BusinessTech, 2019). These high levels of unemployment has been a permanent reality in post-apartheid South Africa, with more recent statistics in the third quarter of 2019 placing the unemployment rate at a high of 29.1%. At the dawn of the Covid-19 pandemic and by March 2020, 2.6% million people had lost their jobs, resulting in a high unemployment rate of 30.8% by the end of that year.. Moreover, the distribution of employment is racially skewed – the unemployment rate of African people is four times more than that of white people and two times that of Indians (BusinessTech, 2019). Furthermore, unemployment disproportionately affects young people and women. Youth unemployment has dramatically in the last ten years (between 2010 and 2020), with the unemployment rate for young people rising from 44.9% to 54.7%.

3.3 Trends in economic growth and human capital in South Africa

Economic growth is fundamental for South Africa, as it is imperative in the reduction of the unemployment rate and promotes the economic participation of the previously marginalised, thereby decreasing the level of income inequality (Patel, 2010; Jones, 2012, cited by Iwegbunam, 2017:23). South Africa is among the many us developing countries that have identified the importance of human capital in the promotion of economic growth. South Africa is endowed

with an immense number of natural resources, and therefore human capital that increases knowledge, skills and innovation has the potential of promoting the efficient use of these natural resources in order to attain more economic growth. Various economists have argued that human capital is a significant driver of economic growth and development (Gyimah-Brempong & Wilson, 2005). In this view, South Africa has invested in the various spheres of human capital development, particularly in education, in an attempt to increase labour productivity within the economy and promote economic growth in the country. See figure 3.1 below.

3.3.1 South Africa's economic growth

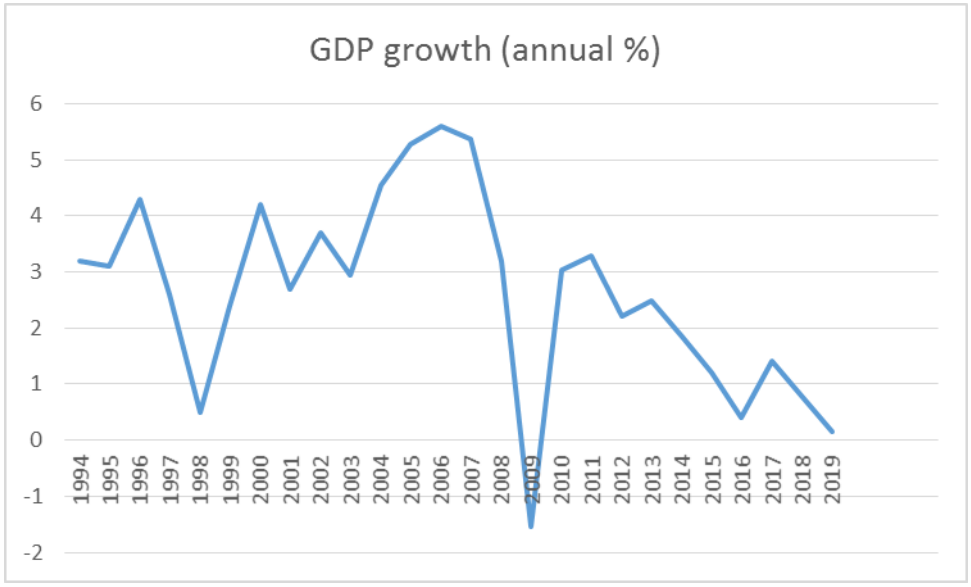


Figure 3.1: Economic growth: The rate of change in the real GDP of South Africa, 1994-2019

Source: The Global Economy (2021)

Figure 3.1 depicts the trends in the economic growth of South Africa. At the dawn of democracy in South Africa in 1994, the economy was surrounded by a lot of uncertainty, which resulted in o the aggregate output of the economy falling below the country's potential output. The earlier years of the democratic government were characterised by episodes of slow growth mostly attributed to a negative output gap, and the country's low capacity utilisation. Subsequent years

of low growth could be attributed to the lack of investor confidence due to the political uncertainty surrounding the transition from Apartheid to a democratically elected government. The general levels of the growth in the economy picked up in the Mandela government era as international confidence in his government had increased, and investments into South Africa were boosted further after the uplifting of the various sanctions that had been placed on the country and its re-integration into the global economy.

The first democratic government of South Africa implemented various macroeconomic policies that were aimed at increasing the economic participation of individuals in the economy, and at increasing their level of productivity. Macroeconomic programs policies such as the Reconstruction and Development Plan (RDP) had a significant impact on economic growth, and led to more than 4% growth in 1996 (Mutambirwa, 2016:8). However, around 1997-1998, the Asian financial crisis had a dire impact on the aggregate output in the economy (Hussain, Mlambo & Oshikoya, 1999); this caused economic growth to further decline further to 0.5% between 1997 and 1998. This was around when the country was introducing the Growth, Employment and Redistribution (GEAR) program, which started off within the stormy years of the Asian financial crisis and consequently produced mitigated results with the phenomenon of jobless growth, accompanied by increased poverty and inequality.

The dotcom crisis that greatly affected the global economy did not leave the South African economy indifferent. During this period between 2000 to 2001, South Africa's economic growth declined from 4.2% to 2.7%. During this period, South Africa's inflation targeting monetary policy had been implemented to control the level of inflation and provide macroeconomic stability. The inflation targeting policy also brought about exchange rate stability, reducing exchange rate risk, which led to an increase in investor confidence (Muradzikwa, 2002:8). In the

same period, the rand also appreciated as a result of the inflation rate targeting of 3 to 6%; however, the economic growth rate was less than 4%. Investor confidence continued to grow within the economy, which is evident from 2004 to 2007 with the economic growth rate stabilising to about 5.5% during this period.

Barclays Bank's acquisition of shares in the Amalgamated Banks of South Africa (ABSA) had occurred (Wilson & Vencatachellum, 2016:26). In addition, the anticipation of the FIFA World Cup resulted in a sharp increase in the economy's growth; various investments were allocated for the improvement of various infrastructure such as roads, stadiums, airports, which temporarily increased the level of employment and also promoted growth. The 2008 global financial crisis had a negative impact on the global economy, increasing the global unemployment rate. Moreover, during this period, the rand depreciated and South Africa witnessed an increase in oil prices, which had a significant impact on the cost of production. The dire impact of the global financial crisis continued past 2010; however, the South African economy realised economic growth of 3% despite the various structural issues, including political instability.

There are various issues apparent in the economy of South Africa, including weak consumer demand, low business and consumer confidence, high inflation, high unemployment, poverty, increasing government debt and the dependence on public revenue, which contribute to the low economic growth rates (SARB Quarterly Bulletin, 2017). These issues have had a dire impact on the investment rate. Moreover, throughout the period of 2010 to 2013, South Africa realised an average of approximately 2.8% economic growth. In the same period, the global economy witnessed positive economic growth and low interest rates; however, the rand had depreciated reducing the cost of exports. During this period, bond yields were constant, which indicated improved investor confidence. The depreciation of the rand persisted until 2014, which led to a low economic growth of 1.8% (SARB, 2016).

In 2016, South Africa realised low economic growth of 0.4%. In this period, the country had been downgraded to sub-investment level, which reduced investor confidence in the country. The low investor confidence was evident as consumer demand was supressed, which led to a decrease in aggregate economic output. Another one of the Reserve Bank's objectives is to attain financial stability in the country, in order to foster an environment conducive to long-term economic growth. In 2017, the Reserve Bank reduced the interest rate by 25 basis points with the aim of avoiding a recession (Businesstech, 2018), which is another measure South Africa employs to promote economic growth. In 2019, the country had achieved low economic growth of 0.7, which is a decline from 0.8% in 2018. This low economic growth can be attributed to the decline in both the agricultural and manufacturing sector.

South Africa has transitioned from an agriculture, mining and manufacturing-driven economy to an economy that is mainly driven by the finance sector. Both the mining and agricultural sectors consist of low skilled employees, who account for the majority of the South African labour force. This transition has resulted in a large portion of the population losing employment as the two sectors continue declining. The high unemployment rate can be attributed to low education levels and biasness in capital and intensive sectors that cannot employ the low skilled labour force.

3.3.2 Human capital

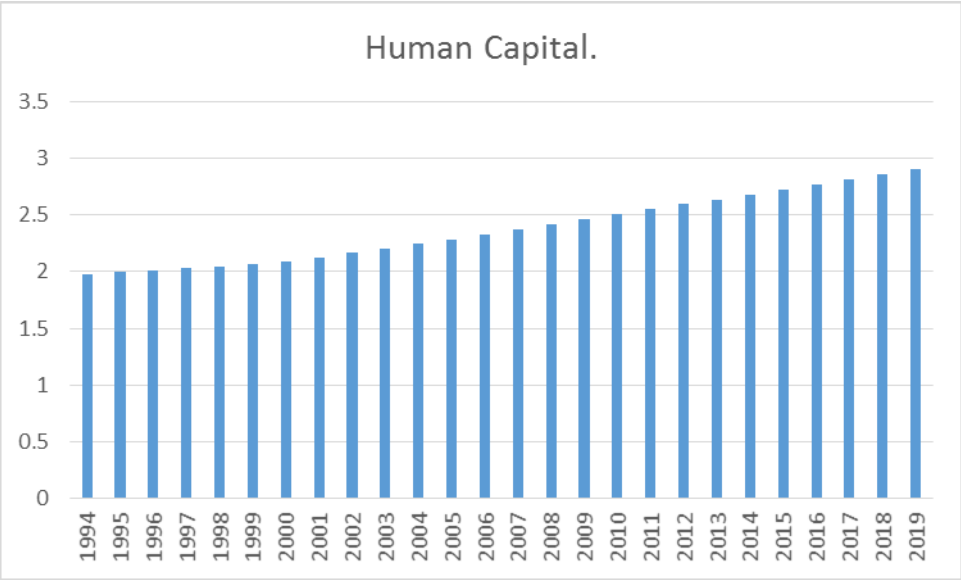


Figure 3.2: Human capital index, based on years of schooling and returns to education

Source: Author's figure, generated using data Penn World Tables 10.0

Figure 3.2 depicts the human capital index between 1994 and 2019, which illustrates an upward trend from as low as 1.98% in 1994 to 2.91% in 2019; however, human capital growth remained below 2% until 1998. The World Bank Report (2012) indicates that education in the early 1990s was redefined in preparation for the 'future'. Education is focused on building the future. Along with various other policies and initiatives and an improvement in the level of education access rates, support structures in marginalised areas and trained teachers resulted in improvement in performance. The upward trend of the human capital index can be attributed to the above initiatives.

3.3.3 Economic growth relative to human capital

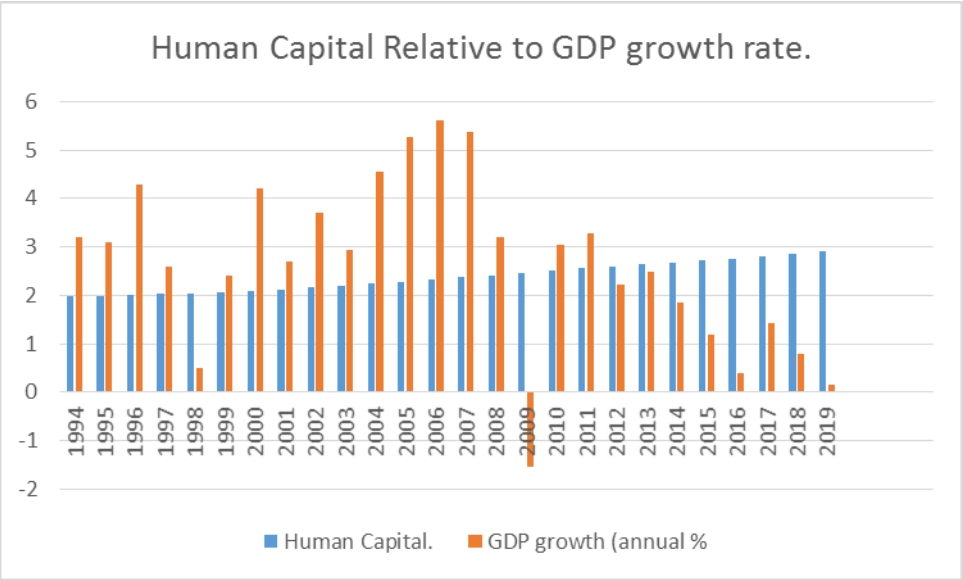


Figure 3.3: Human capital relative to GDP growth rate, 1994-2019

Source: Author's figure, generated using data Penn World Tables 10.0 & World Development Indicators (2021)

Figure 3.3 depicts the trends in human capital relative to the economic growth in South Africa for the period 1994 to 2019. The diagram above provides a collective comparison of the human capital index and gross domestic product growth in percentage, both the human capital index and gross domestic product performed well throughout the period of 1994 to 1997. Human capital slightly increased after 1997; however, the gross domestic product's growth rate significantly declined in 1998 achieving a low growth of 0.5%. International references to South Africa are significant as the global economy has a direct impact on the country's economic performance such as the Asian financial crisis. The Asian financial crisis led to a decrease in investor confidence, which resulted in a decline in the growth of the gross domestic product and therefore a slow increase in the level of human capital.

The human capital index continued to slowly increase between 1999 and 2008. During this period, the gross domestic product also realised significant positive growth; however, the global financial crisis led to a plunge in the economy's growth. The gross domestic increased rapidly in 2010 and 2011; thereafter, the economy of South Africa realised low economic growth. The upwards trend of the human capital continued despite the low economic growth; in 2019, human capital realised 2.91% growth.

The analysis thus far indicates that there are fluctuations in the growth in the gross domestic product during the period of 1994 to 2019; however, during this period, human capital continued to growth at a slow pace. Abbas and Foreman-Peck (2008) asserted that human capital has a significant and positive impact on the economic growth of various countries. However, in 2006, the gross domestic product's growth rate was more than 5%, whereas human capital growth was approximately 2.2%. It is worth noting that the low growth rate in human capital throughout 1994 and 1999 can be attributed to the economic climate along with transition from an apartheid government to a democratic government.

3.4 Education expenditure and the challenges of the education sector

Over the past decades, there has been an increase in the expenditure of education in South Africa, and the education expenditure in the country is comparable to the level of wealthier countries, and above that of Sub-Saharan African countries. Prior to 1994, education in South Africa was classified by race, whereby white people receive quality education, whereas the marginalised majority received poor quality education (Gamede, 2017:50). Until 1993, the apartheid government allocated R4 504 for the education for each white student, R3 625 for each Indian student, R2 855 for each coloured student and a mere R1 532 for each black African student (De Wet & Wolhuter, 2009:369). After the apartheid era, the democratic government devoted much of its investments towards education in an attempt to increase access to education,

particularly for the black majority. The macroeconomic policies used after 1994 were more catered to devoting the national budget to education investment.

South Africa currently spends more than 20% of its annual budget on education (including both basic and higher education), and its total education spending exceeds 6% of GDP. According to UNICEF (2020), the South African government meets all of the major international spending benchmarks. Over the period 1994 to 1998, education expenditure increased by 69% (Mutabirwa, 2016:8). This increase can be attributed to the government's macroeconomic policy objectives within the Reconstruction and Development Programme (RDP), which emphasised increased social development spending (Mutabirwa, 2016:8). Moreover, the Reconstruction and Development Programme (RDP) also aimed at developing new schools and establishing training and development to enhance the quality of educators. Furthermore, in the period 2000 to 2008, South Africa increased educational expenditure by 123.9%. It also made education a top priority within subsequent government policy programs like The New Growth Path (NGP) and the National Development Plan (NDP) which were implemented by the government during the period of 2009 to 2014. These programs placed an emphasis on education and were particularly set up to encourage employment creating economic growth as a means of combating poverty, increasing employment and decreasing income inequality.

According to the SARB (2015), over the period of 2009 to 2014, education expenditure in the country rose by 74%. By 2015, education expenditure as percentage of GDP was 18.7%; however, it declined by 0.65% in 2016 (Macrotrends, 2021). Education expenditure as a percentage of GDP has continuously increased since 2017 and in 2019, it was 6.5%.

Notwitstanding these levels of spending on education in South Africa, many people are still concerned about the cost-effectiveness of education spending. In South Africa, education typically accounts for approximately 20% of the national budget, with the remaining 80%

distributed among 18 or more other government departments. According to the World Development Indicators (2021), government expenditure per student as a percentage of GDP rose from 14.4 % to 17.8% during the period 1999 and 2014. When one compares the apartheid school system to the structures that exists today, it is clear that things have improved. Learners in South Africa have been consistently enrolling in primary education, and the enrolment rate has remained above the 100 % margin during the period of 1999 to 2017, as illustrated in Figure 3.7. Jansen and Taylor (2003:2) also indicated that South Africa has one of the highest rates of school primary enrolment on the continent, with a particularly high number of girls enrolled in elementary schools. This can be attributed to the fact that in South Africa enrolment in education is mandatory from grade 1 up to grade 9. School enrolment and the completion rate can exceed 100% due to the addition of over aged and under aged pupils, as a result of repetition and early or late enrolment (The Global Economy, 2021). Figure 3.8 below indicates that South Africa's net enrolment rate and completion rate were well above 80% in 2014; however, the completion rate and net enrolment rate are slightly lower than the OECD, as indicated in Figure 3.5.

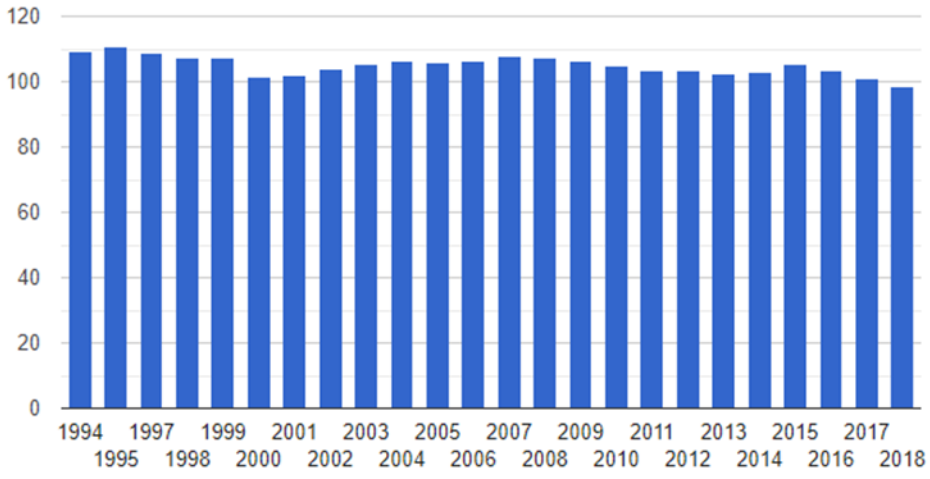


Figure 3.4: Primary education enrolment rate, 1994-2019

Source: The Global Economy (2021)

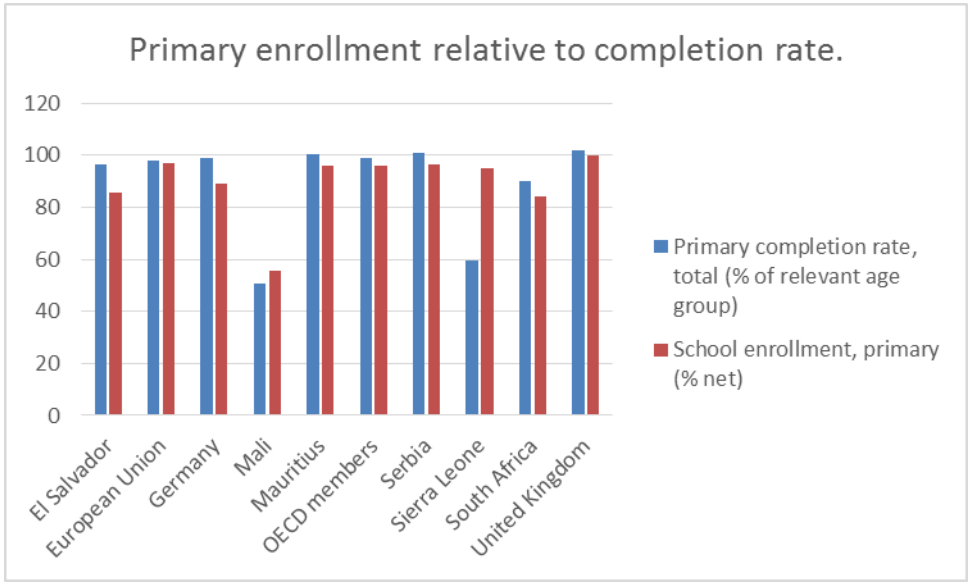


Figure 3.5: Primary enrolment rate relative to the completion rate, 2014

Source: Author's figure, generated using data from The Global Economy 10.0 & World Development Indicators (2021)

Various developing countries prioritise primary education as a means to increase literacy rates; however, secondary education, which is fundamental to attain critical skills required for economic development, remains neglected, including in South Africa. South Africa's primary enrolment rate is relatively high; however, the country's secondary education's attainment rank is very low when compared to other middle income economies (Van der Berg *et al.* 2014, cited by Mlachila & Moeletsi (2019:10). The low retention rate in South Africa persists from primary education. In 2015, South Africa had an approximately 100% secondary school enrolment rate; however, Mlachila and Moeletsi (2019:17) highlighted that only half of the population of the age 25 to 34 had attained a completed upper secondary education. The Department of Basic Education (2019) reported that secondary education's completion rate had improved throughout the period of 2005 to 2017 with only a 10% increase.

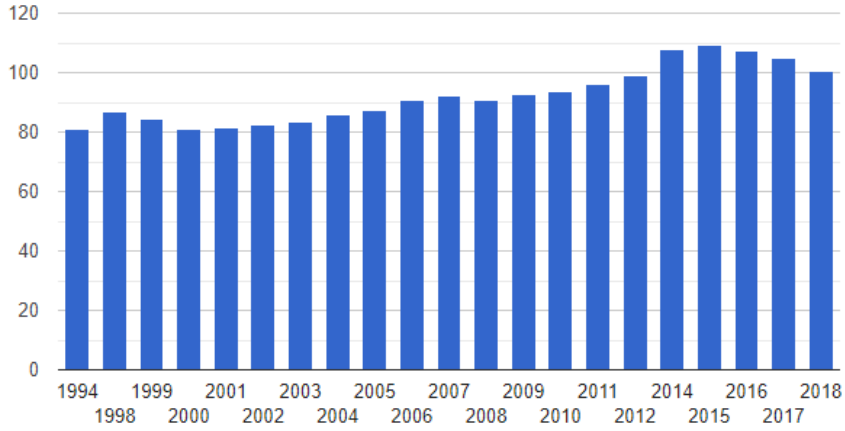


Figure 3.6: Secondary education enrolment rate, 1994-2018

Source: The Global Economy (2021)

When we examine the country's current school system in greater depth, we can conclude that South Africa is on the right track toward achieving the Millennium Development Goals, particularly in the areas of primary education. However, the drop-out rate of pupils who leave the school system early and without school-leaving qualifications is dramatic. According to Statistics South Africa, the 'survival rate' per 1 000 pupils is approximately 52%, which indicates that the effective drop-out rate is approximately 48% (BusinessTech, 2020). Moreover, when looking at the registration and attendance statistics, the results of South Africa's national school leaving examinations, the matric results reveal the startling state of the country's education system (BusinessTech, 2020). School leavers in 2010 had attained an average pass rate of 67.8% (BusinessTech, 2020). In 2019, the matric pass rate was 81.3%, which was the highest rate since the birth of democracy in 1994, which was the first time that the matric pass rate had surpassed the 80% mark, but the high pass rate does not reflect the quality of education as the pass rate does not indicate the number of students who had only achieved the minimum pass requirement of only 30%. In 2019, only 44.55% of students had met the requirements for

university entrance (South African Market insights, 2021). On the other hand, the number of individuals aged 20 and older with no education decreased from 11.4% to 4.5% in 2018 and those with at least a grade 12 qualification increased from 30.5 percent to 45.2 percent during the same time period.

Van der Berg *et al*. (2017) asserted that financial constraints led to poor enrolment rates in the tertiary education sector (Mlachila & Moeletsi, 2019:24). According to the Department of Education (2016), only 2% of the total population enrolled for tertiary education in 2016, which may also be attributed to the lack of funding in tertiary education. Moreover, the opportunity cost associated with the duration of tertiary education and the retention rates are of much concern. Murray found that a quarter of total enrolled students drop out at the end of their first year to get a job and earn an income. These challenges remain despite the fact that South African universities have been implementing extended degree programmes to help students manage the jump to tertiary education. In 2015, the Department of Higher Education indicated that 48% of university students have not completed the qualification they had enrolled for, with the highest dropout rate being African students. Their report also indicated that at least 32% of enrolled students drop out in the first year of their degree. The 2017 household survey indicated that 22% of the students drop out due to lack of funding, whereas 20% of students drop out due to poor academic performance (Reviews of National Policies for Education, 2008:147). The high dropout rate, low completion rate and extended years in tertiary education all undermine the efficiency of education expenditure in South Africa's tertiary education. One of the aims of the National Development Plan is that at least 75% of the cohort complete their tertiary education. Figure 3.10 below illustrates that South Africa's proportion of the population that has a tertiary qualification is lower than various developed countries.

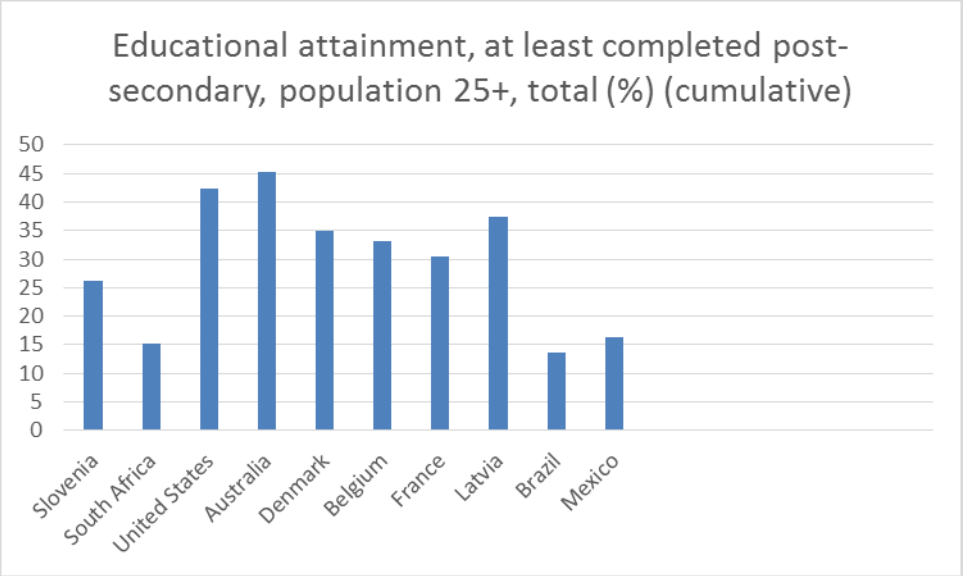


Figure 3.7: Educational attainment, at least completed post-secondary, population 25+, total (%) (cumulative) 2015

Source: Author's figure, generated using data from World Bank

Fiske and Ladd1 asserted that the repetition and high drop-out rates and low matriculation pass rates among African students are as a result of apartheid policies and legislations. There are also widespread educational failures at the primary, secondary and higher levels, resulting in the waste of scarce resources that the country requires for other types of development. Therefore, it is evident that the South African government has not been able to develop a viable education system; the government has also failed to breach the gap between previously marginalised and the favoured individuals.

The economic stagnation in South Africa can be attributed to the poor education system. According to Statistics South Africa, education plays a significant determinant in labour market outcomes. Education has an impact on employability and income, and therefore education is fundamental to attain sustainable economic growth. South Africa's poor education has had a dire impact on the economy. Not only does it fail the previously marginalised individuals, but it also leads to a poor quality labour force; it also limits the inclusion of low skilled individuals into the

workforce and their contribution to the economy's growth. The failure of the education system also leads to disparities in the returns on skills, employment rate, poor productivity and even lower income in the informal sector. This analysis is important because it highlights the reason why increases in educational expenditure in South Africa may not be translating to higher levels of economic growth in the country. This has implications for labour participation and the quality of education also has an impact on the productivity of labour in South Africa, both of which are important for long-term growth and development. The clear policy implications of this reality is that the government of South Africa needs to channel its investments to improve upon the quality and output of its educational system in order to enhance the contribution of this sector to the country's growth and development. An important piece of these improved educational outcomes would have to come from the tertiary education system from which 20-40% of those enrolled drop out because of financial reasons and due to poor academic performance. This reveals policy inadequacies with respect to the preparation for higher education as well as with the funding of higher education. Preparation adequacy refers to those who drop out in first year due to poor academic performance suggesting that their time spent during the secondary and high school years did not adequately prepare them for university studies even though the passed their matric with university exemption. This is a more difficult and systemic problem to resolve because it will have to do with making certain changes in the secondary educational and high school sector. The avenue that could benefit from immediate policy intervention would be the 20% that drop out from tertiary education for financial reasons. This second tier of dropouts can be directly assisted with policy interventions that target the Tertiary education funding model. The next section shall in this regard briefly examine the funding of higher education in South Africa.

3.5 History of university education funding frameworks

The Holloway formula was one of the earliest models of university funding in South Africa and it emerged from the Holloway Commission's report of 1951. The government had appointed the commission to examine university financing and they proposed the 'Holloway formula' which was implemented in 1953 and employed as funding instrument during the period of 1953 to 1970. The termination of the Holloway formula was subsequent to the Van Wyk de Vries Commission of Enquiry that was appointed by the government in 1968. During the period of 1968 to 1977, the government funded universities on an *ad hoc* basis, as the Van Wyk de Vries was only implement in 1997. In 1984, the South African Post-Secondary Education Information System (SAPSE) was implemented and later revised in 1993. Since the implementation of the Holloway formula, various university funding frameworks have been altered and improved leading up to the 2003 new funding framework (NFF). These different frameworks shall be briefly examined in turn in the sub-sections that follow:

3.5.1 The Holloway formula

The Holloway formula was based on the three key elements in an institution and can be illustrated as follows (Styger, 2014:262):

$$H = Sb + Ss + A$$

Where:

H: Aggregate funding

Sb: Basic instructional determination (independent to the number of students)

Ss: Standard instructional determination (partially dependent on the number of students)

A: Personnel living allowance (on an ad hoc basis from 1959)

According to Steyn and De Villiers (2007:14), the remuneration received by academic lecturers in the 'basic' department along with remuneration received by librarians is depicted by Sb. The remuneration of the other departments is depicted by the component Ss. The component Ss is firstly characterised and influenced by the various faculties, including Sciences, Applied Medicine and Dentistry, Commerce and Arts. The component Ss is also influenced by the number of full-time students for funding of the library and the laboratory modules for funding of the laboratory equipment along with a predetermined provision for academic personnel to cover the cost of administration and other expenses incurred by the university.

The standard student fee can be illustrated as follows ((Steyn and De Villiers, 2007:14):

$$\hbar \times Ss$$

$$0 < \hbar < 1$$

Where$\hbar$: is the number of students (subtracted from H to determine the aggregate subsidy received by an institution).

3.5.2 The Van Wyk de Vries

One of the implications of the Holloway formula is that it did not account for the increase in costs that is associated with the inflation rate, a fundamental element of financial world since the late 1960s (Leshoro, 2008:10). The Van Wyk de Vries formula is correlated with the Holloway formula, but it has been augmented by the Holloway formula in order to improve it. The following improvements were made in the Van Wyk de Vries formula: Weighted number of students is employed in this formula as opposed to the number of students; there are two approaches of weighting are employed; course level and the method of delivery undergraduate level. Course level (Undergraduate=1, Honours=2, Master's=3 and Doctorate=3); method of delivery (full-time undergraduate =1; part-time undergraduate 0.75 and non-residential

university=0.33) (Styger, 2014:264). In addition, the weighted number of students for a particular funding year (N) is projected using the weighted number from year N-1 and N-2. The Van Wyk de Vries formula can be illustrated as follows (Styger, 2014:264):

$$VV = g(Sdep + Sadmin + Lib + Lab + Rt + Res + CS + MB\_$$

Where:

g: The government's contribution ratio, which ranges from 75% to 85%, based on the economy of scale in an institution. The ratio of contribution is an alternative to the Holloway formula's standard student fee income.

$Sdep$: The remuneration of academic staff in all of the departments, which is influenced by the weighted number of students based on student-lecture ratios and student-support ratio (which varies for Natural Sciences, Human Sciences and Medical Sciences). The following fixed norms are employed for academic personnel: 15% for professors, 25% for senior lecturers, 40% for lecturers and 15% for junior lecturers.

$Sadmin$: The remuneration of administration personnel, calculated as the remuneration of five senior personnel (up to the remuneration of a professor), in addition to a fixed percentage of $Sdep$.

Lib: Allocations for library. The remuneration for the head of library (up to the remuneration of a professor), in addition to a fixed percentage of $Sdep$. The allocation of books and journals is determined by the weighted number of students in the various faculties.

Lab: The allocation of laboratories, which is determined by the weighted number of students in the various faculties.

Rt: Recurring expenditures for teaching based on the weighted number of students.

Res: Research allocation by means of a fixed percentage of $Sdep$.

CS: Allocation of computer services, which is determined by the number of students and other factors.

MB: Building maintenance, property and furniture as determined by the student headcount.

The Van Wyk de Vries formula introduced fundamental principles, including the notion of weighted number of students, and a standardised post relative to level ratio basket for academic staff. Moreover, the model captured significant expenditures in a university; however, it failed also to account for the annual increase in inflation in higher education costs.

3.5.3 The South African Post-Secondary Education (SAPSE) information system

The SAPSE 1984 formula's main assumption is that students are determinants of their own welfare and have enough knowledge to choose an academic programme to enrol for (Styger, 2014:265). The formula therefore is mainly influenced by enrolment rates, based on funds for students enrolled at various institutions. The SAPSE formula was initially developed for universities of the House of Assembly during the tri-cameral government system during the 1980s, which were known to be the white universities (HAUS). During this era, there was an apparent fragmentation within the university sector. The formula was later applied to marginalised universities (HDU), which were administered by the House of Representative, House of Delegates and the Minister of Education and Training (Steyn & De Villers, 2007:16).

The effective subsidy (ESS) is a fundamental student input parameter in the SAPSE formula. The ESS merges the following components in equal proportions and weights to measure the student enrolment rate: enrolled number of full-time equivalent (FTE) and the (FTE) degree credit individuals (aggregate number of credited modules that have been completed the students

enrolled) (Styger, 2014). Thereafter, weighing value was based on the course level in addition to a set-up cost of 1 000 students.

Course-level weights are as follows:

Undergraduate degree: 1 (first three years)

Honours degree: 2 (years of bachelor's degree in addition to honours degree)

Master's degree: 3

Doctoral degree: 4

Distance: 0.67% of contact tuition

The SAPSE formula categorised instructional offerings or modules based on their study field as indicated in the Classification of Education Subject Matter (CESM). The modules are divided into either Natural Sciences or Human Sciences, and the ESS is calculated for each field. The start-up cost is also proportioned as 600 for the Human Sciences field and 400 for Natural Sciences. The ESS of both of the above for a particular year (i.e. year N) is calculated based on the projection for ESS for years N-2 and N-3. The projection accounts for fluctuations in the value of ESS. Research output measured in terms of units of accredited publications including accredited journals, books and patent-generated subsidies (the blind research provision). Research output was measured by the Department of Education. The SAPSE formula can be illustrated as follows (Steyn & De Villiers, 2014:18):

$$SAPSE = a.g.R$$

Where:

a: The a factor, the scale factor that indicates the government's capacity to fund the subsidy formula. ($a \leq 1$).

g: Sliding scale value, which indicates the government's contribution ratio to ascertain that institutions also contribute to their budget, their contribution is derived mostly from tuition fees.

R: The aggregate theoretical amount required by an institution to function in a year. R can also be illustrated as follows:

$$R = BnSn + BHSH + DNIN + E1L + E2M + F1V + F2W + H.A + J.X + K$$

The formula also includes provisions for additional machinery and library expansions in institutions. R also accounts for subsidies for maintenance of institutions' residences, infrastructure, and new equipment along with furniture. The provision accounts for the number of students making use of instructional using housing and the number of students not making use of institutional housing. This inclusion of residential and non-residential students is a new element in the subsidy formula. For universities with veterinary sciences, the number of experimental students and an increase in this amount generate a subsidy. The coefficients of R are linear functions and correlated to expenditures and represent unit costs of expenditures of a particular university:

A1 = Remuneration of instruction/research staff

A2 = Remuneration of support personnel

A3 = Remuneration of service employees

A4 = Supplies and services

A5 = Building and land improvement.

A6 = Equipment

A7 = Human Sciences Books

A8 = Natural Sciences Books

A9 = Human Sciences Journals

A10 = Natural Sciences Journals

The unit costs above were adapted on an annual basis based on projections on national indicators in order to account for cost increases in universities; therefore, the SAPSE formula accounted for annual increases in the inflation rate. Moreover, the SAPSE formula was not only based on input parameters and students, but included the institution's output, which is degree credits and research output by academic staff.

3.5.4 The Revised South African Post-Secondary Education (SAPSE) information system (1993)

By 1993, the number of enrolled FTE students had increased greatly, which led to the government reducing the values for the higher education, which resulted in uneven values of institutions (Styger, 1996). As a result of the above and other criticism of the SAPSE formula, the Advisory Council of Universities and Technikons proceeded to revise the formula in 1991. The revised formula was approved and employed to calculate university subsidy for the first time in 1993 (Styger, 1996).

<u>Alterations and additions of the initial formula:</u>

1. Natural Sciences students to receive a higher ESS per subsidy compared to Human Sciences students.
2. The subsidy on new fixed assets that is determined by the growth in number of students in the ESS decreased substantially.

3. The projection formula was revised so that the subsidy was as follows: 2.5% projected increase for contact students and a 5% for distance students. Therefore, the government is not liable for robust growth in the university sector.

3.5.5 Earmarked funding

The previous subsidies were determined by formula, to subsidise particular areas for government or expenses in institutions earmarked funding was employed to fund the various institutions separately during the period in which the SAPSE formula was employed as the primary source of funding for universities. Funding was earmarked for the following expenses (Steyn & De Villiers, 2017:24):

1. Capital projects (fixed assets): Earmarked funding for the acquisition of new property and for the development of existing land and property.

2. Municipal assessment rates: Municipal assessment rates were paid by the government based on receipts. There was a variety in the value of land in higher education institutions.

3. NSFAS: The National Student Financial Aid Scheme was established in 1995 under administration of the 1991 Tertiary Education Fund of South Africa (TEFSA). In 2000, TEFSA was lawfully reconstituted as the NSFAS. Since 1995, the state has every year made reserved distributions for NSFAS to every HE establishment.

4. Redress funding: Subsidising for review purposes at colleges and technikons was distributed during the monetary years from 1998/1999 to 2000/2001. Amounts of R28m, R60m and R30m, respectively, were allocated in the financial years of 1998/1999, 1999/2000, and 2000/2001 in higher education for redress purposes.

5. Incorporation of teacher training colleges: Impromptu funds for the merging of universities were made accessible to higher education establishments that were joining these colleges in

2001/2002 and 2002/2003. These assignments were institutional remuneration for the moderately low educational expenses generally paid by students.

6. Other earmarked allocations: These allocations included, *inter alia*, vehicle scheme payments for medical specialists in some institutions along with leave payment and merging of the Faculty of Veterinary Sciences at Medunsa and the University of Pretoria.

Aggregate earmarked funding, as a proportion of aggregate government funding of universities and technikons, had declined during the period 1996/1997 to 1997/1998 from 15.6% to 10.0%. This was predominantly a consequence of the end of allocations for new buildings in higher education institutions (Steyn & De Villiers, 2007:24).

3.5.6 New funding framework (NFF)

The new funding framework was published on 9 December 2003 in the Government Gazette (no. 1791) in terms of the 1997 Higher Education Act (no. 101), and implemented in the financial year of 2004/2005. The initial proposal for funding was published in 1996 by the National Commission of Higher Education, followed by a refinement of the proposal in Education White Paper 3 (WP3) in 1997. Various models were assessed and investigated by experts (SAUVCA) and other stakeholders in the higher education sector. In 2001, the Department of Education published the first draft of the funding framework; the final draft was published and implemented three years later.

In 2004, the Department of Education published a summary of the new funding framework, which presents the underlying philosophy, context and composition of NFF:

• Higher education systems need to be planned for, governed and funded as nationally coordinated systems.

• The emphasis on planning is indicated by the fact that the higher education system is to partake in national development agenda regarding access, redress and human resource development needs. The size and shape of the higher education system cannot be reliant of the direction of market, such as the uncoordinated decisions on student enrolments and course offerings in institutions.

• In the market model, the role of the government is market driven and restricted to funding student demand, along with the correction of market failures that occur.

• The higher education system therefore needs to be focused on achieving national goals and priorities by combining key elements, namely planning, financing and quality assurance.

• Steps in the planning model of higher education funding: (i) the Ministry determines national policy focus and targets; (ii) institutions carry out a three-year strategic plan demonstrating how to address the national focus and targets; (iii) interaction among the Ministry and institutions prompts the approval of institution's plans.

The NFF includes two significant components. The first are block grants, which are funds for operational expenses in a higher education institution related to teaching and research administrations. Block grants for a particular year (i.e. year N) are determined by the number of students and the number of graduates in an institution and research units in year N-2, and categorised based on the Classification of Education Subject Matter (CESM). The second are earmarked grants, which are assigned for specific expenses.

3.5.7 Blocked grants

3.5.7.1 Teaching input grants

The grant in a particularly year is determined by the number enrolled FTE students in year N-2 and weighed based on its funding group (Styger & De Villiers, 2007:33). Table 1 represents the

FTE weighted based on the course level and funding group. The table presents funding groups that are categorised based on the Classification of Education Subject Matter (CESM) (Government Gazette 2003:4).

Table 3.1: Funding weightings for teaching inputs: 2016/2017 and 2017/2018

Funding group	Undergraduate & equivalent		Honours & equivalent		Master's & equivalent		Doctoral & equivalent	
	Contact	Distance	Contact	Distance	Contact	Distance	Contact	Distance
1	1.0	0.5	2.0	1.0	3.0	3.0	4.0	4.0
2	1.5	0.75	3.0	1.5	4.5	4.5	6.0	6.0
3	2.5	1.25	5.0	2.5	7.5	7.5	10.0	10.0
4	3.5	1.75	7.0	3.5	10.5	10.5	14.0	14.0

Table 3.2: Funding groups 2016/2017 and 2017/2018

Funding Groups	Classification of Education Subject Matter (CESM)
1	07 education, 12 law, 18 psychology,19 public admin and services
2	04 business, economics and management, 05 communication, 06 computer and information, 11 languages and literature, 17 philosophy, religion and 20 social science
3	02 architecture and built environment, 08 engineering, 10 family and

	consumer sciences and 15 math and sciences
4	01 agriculture and operations, 03 performing and visual arts, health and clinical sciences, 13 life sciences and 14 physical sciences

3.5.7.2 Research output grant

The research output units of a higher education institution for a particular year can determined using the following formula (Styger, 2014:271):

$$Research\ output = Approved\ publications + Masters\ graduates + 3(Doctoral\ graduates).$$

Performance of institutions is assessed based on norms ranging from 1.1 to 2.5 for research output for each academic staff member in the higher education institutions.

Teaching output grant

Teaching output of an institutions in a particular year is determined by the number of graduates of each course based on the weights as indicated in the table below and then aggregated (Government Gazette 2003.4). To assess whether an institution's teaching output is performing or underperforming, teaching output in a particular year is compared to a normative output norm (norm multiplied the number of enrolled students) (Styger, 2016:273).

Table 3.3: Funding weighting per student graduate (distance and contact programme)

Teaching output grant	Weighting
1st certificate and diploma (2 years or less)	0.5

1st diploma and bachelors (3 years)	1.0
1st professional bachelor degree (4 years)	1.5
Postgraduate diploma	0.5
Postgraduate degree	1.0
Honours degree/ postgraduate diploma	0.5
Non-research master's degrees and diplomas	0.5

3.5.7.3 Institutional factor grants

According to the New Funding Framework, black and coloured students are disadvantaged students. The grant for disadvantaged students was based on the number of enrolled black and coloured students (Lesholo, 2008:31). All higher education institutions with more than 40% FTE contact enrolled disadvantaged students were granted the institutional factor grant. The factor value of the grant lies between 0 and 1 and is indicated as follows:

- 40% or less disadvantages students, factor =0
- 80% or more disadvantages, factor= 0.1
- More than 40%, but less 80% disadvantaged students= linear increasing factor between 0 and 0.1.

3.5.7.4 Grant based on the size of the institution.

The main principle of the grant is that there are economies of scale associated with increasing FTE student enrolment. The factor value of the grant lies between 0 and 0.15 and is determined as follows (Styger, 2007):

- Size of the institution of 40 000 or less; factor= 0, 15
- Size of the institution of 25 000 or more; factor= 0
- Size of institution more than 4 000 but less than 25 000: linear decreasing factor between 0 and 0, 1.

3.5.8 Earmarked grants

3.5.8.1 Earmarked categories

i. National Student Financial Aid Scheme (NSFAS);

ii. Teaching and community upliftment;

iii. Interest on and payment of loans approved by government before to 1 April 1991;

iv. Restructure of institutions; mergers and recapitalising;

v. Tertiary education quality assurance; and

vi. Research development grant.

3.6 National Student Financial Aid Scheme

The National Student Financial Aid Scheme (NSFAS) was founded on the basis of the National Student Financial Aid Scheme Act 56 of 1999. The primary goal of the National Student Financial Aid Scheme (NSFAS) is to provide opportunities for young people from low income

families to pursue higher education. This is critical for South Africa's skills base to develop, as well as a powerful mechanism for breaking the intergenerational cycle of poverty and exclusion in households.

Prior to 2018, the National Student Financial Aid Scheme (NSFAS) was established as a loan scheme and these loans were expected to be repaid when new graduates reach the labour market, with a repayment schedule tied to their earnings. However, if borrowers completed university successfully, a large portion of loans are transformed into bursaries. When the student had found work and received R80 000 or more a year, the loan repayment began. If a student was unemployed, they were not required to make payments until they found work. The loan will also have to be repaid if the student dropped out of university or college without completing the degree. In 2018, the National Student Financial Aid Scheme (NSFAS) was converted to fee free higher education. Former President Jacob Zuma announced on 16 December 2017 that the South African government would phase in "fully subsidised free higher education and training for poor and working class South African students over a five-year period (News24, 2018).

Despite efforts to increase university access and tertiary education attainment through NSFAS, in South Africa, tertiary education is less common; just 7% of adults have a tertiary education, which is the lowest rate of all OECD and partner nations (Education at a Glance, 2019). Tertiary enrolment remains low among young adults: only 6% of 25- to 34-year-olds have a tertiary education, the lowest among OECD and partner countries and far below the global average of 38% (Figure 3.15).

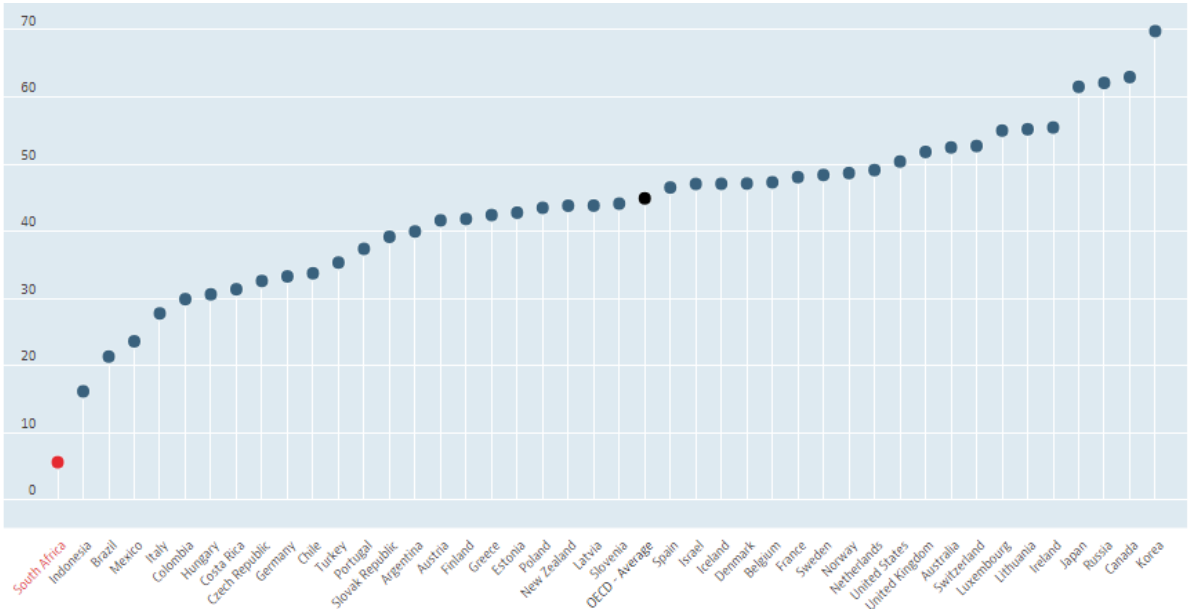


Figure 3.8: Population with tertiary education: 25- to 34-year-olds, % in same age group, 2019

Source: Education at a Glance (2019)

NSFAS has been in operation for over two decades and 25 years of democracy; however, the challenges in the higher education sector persist from the apartheid era. Mabuza (2020) found that the majority of students who dropped out did so due to NSFAS's inefficient operations and the current student-centred model. According to Mabuza (2020), insufficient funding, late allocation of funds, strict NSFAS conditions, a lack of contact, late payment or non-payment of allowances all led to student dropout. PoliticsWeb (2016) indicated that NSFAS-funded students pursuing three- or four-year degrees have a drop-out rate that is nearly double that of all students pursuing the same credentials. NSFAS graduation rates (within the time frame set for a specific degree) are less than half those of all students.

Although South Africa's overall employment rate is significantly lower than that of higher and middle-income countries, South African tertiary graduates have employment rates comparable to those of affluent countries (Mlachila & Moeletsi, 2019:40). Wildschut *et al. (*2018) analysed the labour market absorption of NSFAS-funded graduates. According to the study, the numbers of

NSFAS funded graduates with jobs have gradually increased since 2005, from 5 455 to 41 787 in 2015. In addition, Wildschut *et al.* also indicated that the jobs proportion for NSFAS-funded students who graduated in 2005 is at a high 98%. Therefore, the provision of funding has a significant and positive impact on employment and therefore on economic participation. This strengthens the case for additional funding to be channelled into the 'student support' component of the higher education funding matrices to make NSFAS to be better resourced and more efficiently ran so as to completely reduce the dropout rates of NSFAS sponsored students to a near zero. As much as financial need may be the fundamental criteria, there should also be better incentives built into this system to stimulate academic excellence and reward high performing students. In so doing the scheme will be increasing access to education to the poor but also providing incentives for academic excellence that runs across the board irrespective of the income status of the benefiting students, thus seeding a culture of excellence in higher education. It can even be argued, given the dropout rate within the secondary educational system, when coupled with the few who actually pass their matric with university exemption and the drop out rate at the university due to financial and academic reasons, that there is a strong case for full financial support and multiple incentive schemes to retain and push through every single student that qualifies and steps foot on the university campus. This argument is based on the fact that the country is in desperate need of skilled graduates and so stands to benefit from ensuring that it boosts the support of all those already within the University system to see that they are supported to graduate within minimal periods in order to join the labour force. This support should include both financial and additional academic support to also balance off the inequities coming from vast differentials in the secondary school system. Perhaps there is indeed a case for fee free higher education in South Africa, not just for the poor but for all as part of a comprehensive support system provided to the tertiary sector to make it a skills development and consolidation partner for the government. This is perhaps why serious consideration should be given to the

debate on fee-free higher education in South Africa, as an intervention perhaps with a sunset clause that sees this as an investment in human capital development for the country.

3.7 Summary and conclusion

Education and human capital development are paramount to South Africa's economic growth. Although the South African government has made considerable investment towards education since the advent of the democratic era, the returns on these investments are not reflected in the economic growth. The current education system has improved relative to the apartheid era education system, as indicated in the high enrolment rate at primary school level; however, there are still challenges in the education system, including the high dropout and extended throughput rate at tertiary level. Despite much emphasis on the importance of human capital in an economy, it is evident that the country faces a human capital challenge, which is a reflection of the poor education system.

In its current format, South Africa's economic trajectory is unstainable, and experiences low growth, which has put a strain on its capacity to combat the historical challenges of inequality, unemployment and poverty. These challenges have been exacerbated by the low quality of human capital in the country. Therefore, it is important to focus on human capital development particularly through education in order to contribute policy reform that will improve the education system in South Africa in order to combat the above challenges and other economic constraints. This chapter has provided an overview of the economy and education as sphere of human capital. The overview of the economic performance and growth trends provided insight into the challenges apparent in the country and the constraints of economic growth. The chapter also provided insight into the education system and challenges thereof. Furthermore, the chapter enabled the identification of how education, i.e. human capital, could succeed in promoting the

economic growth of the country. In order to achieve the empirical objectives, Chapter 4 proceeds to explain the methodology of this study.

CHAPTER 4

RESEARTH METHODOLOGY AND EMPIRICAL FRAMEWORK.

4.1 Introduction

The literature review in Chapter 2 laid a suitable foundation for this chapter because it reviewed both the empirical and theoretical literature on the impact of human capital on economic growth. After analysing this literature, it is evident that there is a theoretical relationship between human capital and economic growth. There are various studies that have been carried out on human capital and economic growth in other countries, but very few in the case of South Africa. In this regard, it is important to analyse the relationship between f human capital and economic growth in South Africa using more recent data and more recent econometric techniques. This chapter presents the research methodology and econometric techniques adopted by this study. It therefore presents the econometric approach adopted to attain the following empirical objectives:

- To determine the long-run relationship between human capital and the economic growth of South Africa.
- To determine the short-run relationship between human capital and the economic growth of South Africa.

The accomplishment of these empirical objectives would are part of the research objectives of this study, that of analysing the impact of human capital on the economic growth of South Africa and coming up with policy recommendations that are aimed at encouraging investments into human capital development in order to promote economic growth in South Africa. In this regard, this chapter is made up of eight sub-section, section 4.2 discusses the growth accounting

empirical framework applied in this study while section 4.3 presents the model specification. Section 4.4 discusses the estimation methods employed, section 4.5 presents and explains the variables used in the econometric model of the study while section 4.6 presents the data sources. Section 4.7 presents the diagnostic checks conducted for the model and section 4.8 summarises and concludes the chapter.

4.2 Growth accounting empirical framework

In the late 1950s, Solow attempted to analyse the growth of GDP attributing to the increase in labour force, capital stock and total factor productivity. In order to distinguish the sources of growth, growth accounting seeks to allocate growth rates in national output or production per person to the sources of output. Growth accounting methodology examines the variety in international output levels and the determinants of growth rates. The contribution of inputs is calculated as a weighted average of input growth and the total factor production growth is calculated as a residual of output growth. In its basic form, the growth accounting methodology assumes the Cobb Douglas production function and can be indicated as follows:

$$H_t = A_t \, {K_t}^{\alpha} \, H_t t^{\gamma}$$

$$H_t = L_t . h_t$$

$$(lnY_{t+u} - lnYt)$$
$$= (lnA_{t+u} - lnAt) + \alpha(lnk_{t+u} - lnKt) + \gamma(lnL_{t+u} - lnLt)$$
$$+ \gamma((lnh_{t+u} - lnht)$$

Where:

H_t: Product of the number of workers and human capital per worker

α: Share of physical capital

γ: Share of human capital

$(lnA_{t+u} - lnAt)$: Residual of output growth

In addition to the basic confines of the classical growth accounting approach, another way to empirically analyse the contribution of human capital within the general confines of the classical growth accounting methodology, is as an input of technological advancement rather than as input of total production. In this approach, total production is dependent on the inputs of labour and physical capital and is indicated as follows:

$$Yt = AtKt^{\alpha}Lt^{\beta}$$

$$H_t = A_t\, K_t{}^{\alpha}\, L_t^{\beta}$$

$$(lnY_{t+u} - lnYt) = f(ht) + \alpha(lnk_{t+u} - lnKt) + \beta(lnL_{t+u} - lnLt) + ((lni_{t+u} - lnit)$$

Where:

$\frac{At^{\circ}}{At} = f(ht)$.

Various literature sources follow these approaches: (a) estimate the production function by integrating human capital as factor input or determinant of total productivity such as Benhabib and Spiegel (1994); or (b) the appointment of values to coefficients of the production function, which indicates the share value of factor inputs in order to determine their level of contribution towards growth, which is evident in the literature of Klenow and Rodríguez Clare (1997) and Benhabib and Spiegel (2005). The general production function is specified as follows (ref):

$$Y = f(K, E, H, t)$$

Where:

Y: Aggregate output

K: Level of physical capital

E: Level of effective labour

H: Human capital

t: Technology.

Differentiation of Y with respect to time:

$$\hat{Y} = \hat{A} + \mathcal{E}_k\hat{K} + \mathcal{E}_E\hat{E} + \mathcal{E}_H\hat{H}$$

$$\hat{E}=n_L\hat{L} + n_H\hat{H}$$

$$\hat{Y} = \hat{A} + \mathcal{E}_k\hat{K} + \mathcal{E}_E n_L\hat{L} + (\mathcal{E}_E n_H + \mathcal{E}_H)\hat{H}$$

Where:

$(\hat{.})$: The growth rate

$\hat{A}$: Exogenous rate of technological change

$\mathcal{E}_Q$: Output elasticity (Q=K, E, H)

n_L: Effective labour elasticity with respect to labour

n_H: Effective labour elasticity with respect to average human capital

$(\mathcal{E}_E n_H + \mathcal{E}_H)\hat{H}$: Total contribution of human capital

$(\mathcal{E}_E n_H)\hat{H}$: Direct impact of human capital in economic growth

$(\mathcal{E}_H)\widehat{H}$: Externality effect of human capital

Total factor productivity is defined as follows:

$$\widehat{TFP} = \hat{Y} - S_L\hat{L} - S_K\hat{K}$$

$$\therefore \widehat{TFP} = \hat{A} + (\mathcal{E}_k - S_K)\hat{K} + (\mathcal{E}_E n_L - S_L)\hat{L} + +(\mathcal{E}_E n_H + \mathcal{E}_H)\hat{H}$$

Where:

S_L: Share of labour

S_K: Share of capital income

$S_L \equiv S_K$.

These growth accounting frameworks make up the theoretical foundation of the econometric model that is specified and utilised for this study as explained in the section that follows:

4.3 Model specification

As per the previous section, the model specified- for this study is based on basic economic theory and the various literature on human capital and economic growth. Since this study aims to capture human capital's impact on the economic growth of South Africa, it builds upon the theoretical framework derived from the augmented Solow model. The augmented Solow model can be attributed to Mankiw, Romer and Weil (1992). The augmented Solow human capital growth model improves on the original Solow growth model, which did not account for human capital. The integration of human capital is significant due to the heterogeneity of labour in a particular economy or, during the production process, the heterogeneity is associated with variety in the level of human capital. The augmented Solow model is based on the notion that an increase in the quality of workers, through an increase in their level of human capital, improves productivity and consequently output. The augmented Solow model can be indicated as follows:

$$Yt = kt^{\alpha} Ht^{\beta} (AtLt)^{1-\alpha-\beta}$$

The augmented Solow model can also be illustrated by the following econometric equation:

$$lnYt = \alpha + \theta_1 \ lnK_t \ + \theta_2 lnL_{t+} \ \theta_3 \ HK_t + u$$

Where:

• Y = Level of output (GDP)

• K = Level of capital

• H = Level of human capital

• A = Level of technology/total factor productivity

• L = Level of labour force

• T = Time index

• α = Elasticity of physical capital with respect to output

• β = Elasticity of human capital with respect to output

The model specified to analyse the contribution of human capital in the economic growth of South Africa is as follows:

$$RGDPP_t = F(GFCF_t, EDU_t, EMP_t FDI, TRD_t \ e_t)$$

The general function of the study can also be illustrated by the following econometric equation:

$$LogRGDPP = a_0 + a_1 LogGFCF + a_2 LogEDU + + a_3 LogEMP + a_4 LogFDI + \alpha \ LogTRD + et$$

Where:

- RGDPP = Gross domestic product per capita
- GFCF = Gross capital formation (%GDP)
- EDU = Expenditure on education
- EMP= Employment rate
- FDI= Foreign direct investment
- TRD= Trade(%GDP)
- e = Error term

4.4 Description of explanatory variables

This section will discuss the variables' meanings and the reasons for using these variables in estimating the effect of human capital on economic growth. All of the variables employed in the analysis are based on human capital and economic growth literature from around the world, mostly from developing countries. This enables a comparison between the study's findings and previous empirical research.

Some adjustment to take account of education is necessary, particularly if one is to determine the contribution of human capital to economic growth, since education as a sphere of human capital is one of the factors influencing economic growth. The earlier empirical literature mainly used enrolment rates for primary and secondary education as proxy for human capital. The most recent studies emphasise the use of stock measures such the average years of schooling of a country's labour force. Benhabib and Spiegel (1994) analysed the impact of human capital for economic development. Their study employed number of years' education of the working population as proxy of human capital; whereas Aghion *et al.* (2009) examined the impact human capital on economic growth, using investments in education as a proxy. The approach employed

by Aghion *et al* (2009) is most practical in this study due to the unavailability of data on stock measures and enrolment rates. Another problem encountered in the study was the non-stationarity of data, particularly the real GDP and real GDP per capital for the period of 1994 to 2019. To circumvent this problem, the study employed an extended period of 1980 to 2019.

4.4.1 Selected variables of the study

Independent variable

i. **Real GDP (gross domestic product) per capita:** The study employs real GDP per capita as a proxy for economic growth. The real GDP per capita measures South Africa's basket of goods produced or the aggregate economic output divided by the nation's overall population and is adjusted for price change (inflation). Various studies have employed GDP as a proxy for economic growth, including Mankiw, Romer and Weil (1992), Mutambirwa (2016) and Boadi (2019).

Dependent variables

i. **Gross fixed capital formation (GFCF):** The study employs gross fixed capital formation to measure its impact on the economy's growth. Gross fixed capital formation (investment) refers to the acquisition of produced assets (OECD, 2021). According to Meyer and Sanusi (2019), gross fixed capital formation is a fundamental component of domestic investment, and is considered as a significant tool that could accelerate economic growth. Empirical literature has suggested that there is a positive relationship between investment and an economy's growth (Levine & Renelt, 1992; Mankiw *et al.*, 1992).

ii. **Education expenditure (EDUEXP)** is a form of human capital investment. Education expenditure was also employed in the empirical studies of Romer and Weil (1992) and Mutambirwa (2016) to impact on an economy's growth. Gebrehiwot's study also

indicated human capital investment as an endogenous factor that contributes to physical capital accumulation through individuals' skills and expertise, which enhance economic growth.

iii. **The employment rate (EMP)** measures the proportion of the country's population who are of working age and are employed. The employment rate refers to the level of population that is economically active and generates productivity that contributes to the growth of the economy. Economic *a priori* expectation notes that an economy's workforce increases the level of economic growth. According to Leibbrandt *et al*. (2010, cited by Manete, 2017:25), increased unemployment leads to high inequality and poverty rates.

iv. **Foreign direct investment (FDI):** According to the OECD (2020), foreign direct investment inflows refer to the value of direct investments during a particular period into an economy. Udi *et al.* (2020) found that foreign direct investment is a significant driver of economic output, which reflects in an increased overall economic growth. Foreign direct investment promotes country-wide transfer of technology, enhances trade by enabling increased access of foreign market. Foreign direct investment has *a priori* positive impact on an economy's growth as it leads to economic integration.

v. **Trade (TRD):** Trade is measured as the value of imports and exports in proportion to the gross domestic product of a particular period. Classical theorists postulate that trade brings new technology and skills that increase efficiency and enhances economic growth. In addition, they suggest that engaging in foreign trade promotes growth through specialisation and shared benefits (Abendin, 2021). Therefore, trade has *a priori* positive impact on an economy's growth.

4.4.2 Justification for chosen variables

The concept of economic growth emerged from classical economics, whereby the increase in the national income describes the growth in the nation's wealth. Various economists have described economic growth as the increase in the quality and quantity of goods and services that are produced and consumed within an economy. GDP per capita is accepted as the measure of economic growth of a country, as it accounts for price changes and population growth. According to De Jager (2004:4), real GDP per capita should be regarded as a passive outcome of the endogenously determined rate of increase in the total real products and exogenously determined population growth rate. Therefore, a country experiences positive economic growth when the rate at which real GDP increases is greater than rate at which the population grows.

Theoretical and empirical literature suggests that investment education contributes to efficient and effective use of labour and capital resources to increase productivity. Various studies have adapted Mankiew, Romer and Weil's (1992) growth theory and assert that education is fundamental for an economy's growth. The cost-based approach to human capital estimates is imperative to determine the significance of the expenditures incurred. Education expenditure as proxy of human capital measures the stock of human capital as the aggregate value of costs incurred in human capital formation, and consequently human capital investment. This method is similar to the perpetual inventory approach that is employed to measure the stock of fixed capital. Aggregate education expenditure is used in this study because of the widespread belief that human capital development is significant for economic growth. The study seeks to capture the returns of this investment in South Africa's economic growth.

Solow (1957) found that capital accumulation leads to an increase in production levels. This further asserted in the endogenous growth theory by Romer (1986), Lucas (1988), Barro (1990) and Romer (1990), who added factors such human capital, research and development and

infrastructure development, which contribute to the gross capital formation. Economic growth theories have indicated that capital stock has an impact on the economic welfare of a country; capital formation promotes technical innovation in a country, and therefore leads to large-scale production within the country. Moreover, capital formation also promotes the adequate use of natural resources, developing industries and the increase in income permitting a better standard of living.

The employment rate represents an economy's active population who are the producers of goods and services to meet the needs of an economy. Productivity is indicated in amount of goods and services that are produced by the employed, measured by using the amount produced by labour and fixed capital. Different studies have found that there is strong relationship between the labour force rate and economic growth. The employment rate has an influence on the number goods and services that are produced in an economy; therefore, it has an impact on economic growth and development. This study employs the employment rate as proxy for human capital that directly influences productivity and consequently economic growth.

In the neoclassical growth model, foreign direct investment enhances the growth of an economy, by increasing the level of investments and the efficiency of investments. Borensztein, Gregorio, and Lee (1998) found that in the endogenous growth models foreign direct investment increases economic growth through the diffusion of technology into the host country. Empirical literature suggests that the inflow of foreign direct investment, in addition to a country's human capital development, has a significant positive impact on economic growth. According to Fadhil and Almsafir (2015:1559), foreign direct investment increases stock of knowledge in a country through the transfer of knowledge and skills, labour training and by transferring new business and production practices. Moreover, foreign direct investment increases trade openness, by

widening exports markets, and it also encourages domestic investments as a result of technological spill-overs and the increase in productivity.

The idea that trade accelerates economic growth originated in the 16th century. Smith (1977) asserted that trade enables surplus production and broadens the market. Marshall (1980) also found that economic progress is largely attributed to trade through trade integration and trade openness. Barro *et al.* (1997) emphasised that the increase in trade promotes economic growth through the facilitation of the diffusion of knowledge and technology. The Romer model suggests that trade leads to an increase in the size of the market, leads to greater output levels, promotes practical learning and therefore leads to economic growth. This study employs trade in the empirical regression in order to gauge trade and its relationship to economic growth, relative to human capital.

4.4.3 An overview of regression variables and expected outcome

Table 4.1: An overview of regression variables and expected outcomes

Variable	**Description**	***A priori* expectation**
RGDPP	Real gross domestic product per capita	
GFCF	Gross capital formation	+ (positive)
EDUEXP	Education expenditure	+ (positive)
EMP	Employment rate	+ (positive)
FDI	Foreign direct investment	+ (positive)
TRD	Trade	+ (positive)

4.5 Data source

The study employs time series data from the period 1980 to 2019. The data is obtained from the World Development Indicators and human development reports.

Table 4.2: Data sources

Variable	Description	Data source
RGDPP	Real gross domestic product per capita.	World Development Indicators
GFCF	Gross capital formation	World Development Indicators
EDUEXP	Education expenditure.	World Development Indicators
FDI	Foreign direct investment	Human development reports
EMP	Employment rate	World Development Indicators
TRD	Trade	World Development Indicators

4.6 Estimation methods and diagnostic tests.

Subsequent to the model specification above, an empirical investigation of the study is imperative to ascertain behavioural trends of the variables along with both short-run and long-run relationships of the variables. The Auto Regressive Distributed Lag (ARDL) method and the Error Correction Models (ECM) are utilised to conduct the econometric analysis of the study. . Before this, diagnostic tests are conducted to determine the stationarity of the variables and the robustness of the selected models. These include the Augmented Dickey Fuller (ADF) and Phillip Peron unit root test to detect stationarity together with a graphical analysis of the

variables. The following section further discusses the various estimation methods and diagnostic tests employed in the study.

4.6.1 Stationarity test

Stationarity tests are fundamental, as stationary data series have a significant impact on the behaviour and elements of the data. Stationarity testing for time series data is an initial regression analysis step and the unit root test has been used to observe the behaviour and characteristics of time series data. If the mean and variance do not change systemically over time, a time series is stationary (Gujarati, Porter & Gunasekar, 2012).

The stationarity of a time series can have a major impact on its properties and forecasting behaviour, and failure to make a time series to the correct type of stationarity can result in erroneous results (Van Greunen *et al*., 2014). Non-stationary data does not revolve around the mean and covariance; when observed over all normal time periods, they will not remain the same. They are inconsistent and cannot be modelled or forecasted. Therefore, non-stationary series are exceedingly difficult to measure accurately. Non-stationarity is introduced as a result of one or more external events. Otherwise, the model will treat the variability as part of the normal trend rather than as a result of external events, and the effect will be carried forward, which results in erroneous forecasting. The results obtained using non-stationary time series may be erroneous; they may imply a relationship between variables that does not exist.

Mutambirwa (2016:52) indicated that shocks in non-stationary data will remain, and the effect of these shocks during time (t) will be greater as time goes on (time t+1, t+2 and so forth). He further indicates that the R^2 and the adjusted R^2 estimates will be high, but insignificant. Moreover, t-ratios will not correlate with the t-distribution and the f-statistic will not correlate with f-distribution. Therefore, it is imperative to convert non-stationary data to stationary data in order to receive more accurate results and less erroneous future estimates. In comparison to the

non-stationary time series, which has a variable variance and a mean that does not stay close or return to a long-run mean over time, the stationary time series reverts around a fixed long-term mean and has a constant variance regardless of time. Mutambirwa (2016:52) also indicated that shocks in stationary data will decline and the effect of these shocks during time (t) will be smaller as time goes on (time t+1, t+2 and so forth). Using stationary data variables in the regression model will yield unbiased t-ratios, which will correlate with the t-distribution. F-statistics will correlate with the F-distribution, and the regression will be normally distributed.

The unit root test determines whether the time series is compatible with a first integration I (1) process with a stochastic pattern or a second integration I (0) process, which is stationary with a deterministic trend (Makaula, 2014:55). Non-stationary data used in estimation yields inaccurate t-statistics of approximate coefficients of potentially infinite variables. The following study employs a graphical analysis, autoregressive distributive lag (ARDL), and Phillips-Perron tests (PP) to test for stationarity.

4.6.1.1 Graphical analysis

The most basic methods for detecting stationarity depend on plotting the data or functions and visually deciding whether they exhibit any known property of stationary (or non-stationary) data. According to Gujarati (2004), graphical plots provide insight into how time series act over time. A stationary process is typically illustrated by a graph that reverts around the mean value, while a non-stationary sequence is illustrated by a graph that shifts randomly without any pattern.

4.6.1.2 The augmented Dickey-Fuller test

The augmented Dickey-Fuller (ADF) test is a variant of the DF test that involves modifying the Dickey-Fuller equation to include the lagged values of the dependent variable. It includes the change in the lagged variables ($\Delta Yt{-}h$) to eradicate the presence of serial correlation in ΔYt. This is done to ensure that the residuals are uncorrelated while also accounting for the probability that

ΔYt is defined by a higher-order autoregressive process. Failure to include variables designed to capture omitted dynamics results in the biasness standard errors, emphasising the importance of using the lagged definition.

The ADF can be illustrated by the following models (Mutambirwa, 2016:53):

1. There is no constant and no trend:

$$\Delta Yt = \gamma_{Yt-1} \sum_{i=2}^{p} \beta i \Delta Y_{t-i+1} + \mu t$$

2. There is a constant and no trend:

$$\Delta Yt = \alpha 0 + \gamma_{Yt-1} \sum_{i=2}^{p} \beta i \Delta Y_{t-i+1} + \mu t$$

3. There is a constant and a trend:

$$\Delta Yt = \alpha 0 + \gamma_{Yt-1}\, b2 \sum_{i=2}^{p} \beta i \Delta Y_{t-i+1} + \mu t$$

Where:

$$\mathrm{Y} = \sum_{\mathrm{i}=1}^{\mathrm{p}} \mathrm{ai} - 1$$

$$\beta = -\sum_{\mathrm{j}=1}^{\mathrm{p}} \mathrm{ai}$$

4.6.1.3 Phillips-Peron test

Philips and Perron (1988) proposed a new approach for detecting the existence of unit root. Gujarati (2003) notes that the Phillips-Perron test employs non-parametric statistical methods to account for serial correlation in error terms without the addition of lagged difference terms. Phillips-Perron test is similar to the ADF in the sense that DF procedures are automatically

corrected to compensate for auto correlated residuals. Moreover, the PP test and the ADF test have the same asymptotic distribution. As such, both often give the same conclusions, and suffer from most of the same important limitations as the ADF tests. According to Brooks (2008), a significant criticism of the two test is that the test power is poor if the series is stationary, but has a root near to the non-stationary boundary. However, using both the stationarity and unit root tests will help to minimise this.

Phillips-Peron test for unit root testing can be presented by the following model:

$$Yt = a_0 + a_2^t + a_2^t + e_t$$

In the Philips and Perron test, the null hypothesis of unit root is compared with the alternative hypothesis of no unit root. However, the PP test suffers from extreme distortions, with the autocorrelation of the error being overwhelmingly negative and the real size being much larger than the nominal size.

4.6.2 Cointegration tests

Cuthbertson and Gasparo (1995) indicated that cointegration assists researchers in dealing with the estimation hindrances that result from stochastic trend variables that may occur. Cointegration tests are employed to determine long-term relationships between variables in a non-stationary series. After determining the order of integration and stationarity of the variables, cointegration tests will be done. The cointegration test will help determine whether or not there is a long-run relationship between variables.

The following research study examined both the short- and long-run relationship of variables employed for the study. The ARDL method is used to analyse the model's long-run relationship, and ECM was used to examine the short-run disequilibrium since it introduces disequilibrium from earlier times.

4.6.2.1 Autoregressive distributed lag

The autoregressive distributive lag (ARDL) model developed by Koop, Pesaran, Potter and Smith is the primary econometric method used for this study. In this analysis, the ARDL approach is appropriate as it allows for the development of both short-run and long-run relationships between human capital and economic growth (Boadi, 2019). The ARDL has numerous advantages; Firstly unlike other cointegration tests such as the Johansen test, vector error correction (VEC), and Engle Granger test, which require variables to be of the same order of integration the ARDL can be employed when variables are intergrated at different levels (Mutambirwa, 2016), the ARDL is applicable to variables of order zero I (0), order one I (1), or a combination of both; Secondly, the ARDL is not susceptible to sample size and can be employed in small samples (Manete, 2017) and Thirdly it can be employed to estimate the ECM.

In this analysis, the the F-test of the ordinary least square (OLS) will be used to estimate the long-run impact, and the error correction model will be used to estimate the short-run impact. The ARDL unrestricted error correction of this study can be illustrated as follows:

$$\Delta LGDP = \beta_0 + \sum_{i=1}^{q1} \beta_1 \Delta lGDP_{t-1} + \sum_{i=0}^{q2} \beta_2 \Delta lGCF_{t-1} + \sum_{i=0}^{q3} \beta_3 \Delta lEDU + \sum_{i=0}^{q4} \beta_4 \Delta lEMPL_{t-1}$$
$$+ \sum_{i=0}^{q5} \beta_5 \Delta lFDI_{t-1} + \sum_{i=0}^{q6} \beta_6 \Delta lTRD_{t-1} + \alpha_1 lGDP_{t-1} + \alpha_2 lGCF_{t-1} + \alpha_3 lEDU$$
$$+ \alpha_4 lEMP_{t-1} + \alpha_5 lFDI_{t-1} + \alpha_6 lTRD_{t-1}$$

Where:

q1, q2, q3, q4, q5, q6: Optimal lags

β_0: Coefficient of GDP

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$: Coefficient of the long-run impact

$\alpha_{1,}\alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6$,: Coefficient of the short-run impact

$\alpha_{1,}\alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6 = 0$: Null hypothesis

$\alpha_{1,}\alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6 \neq 0$: Alternative hypothesis

4.6.2.2 Error correction model (ECM)

The short-run ECM model is estimated after the long-run coefficients of the growth equation are confirmed. A long-run equilibrium relationship between variables in the regression model may exist, but a short-run equilibrium may not. Therefore, to address the inconsistency that might arise in the short run, an ECM is employed.

The error-correction variable coefficient represents the percentage of the difference between the variables that can be discarded in the next timeframe. In the error correction model, the coefficients of the explanatory variables determine the short-run relationship. The ECM equation is shown below:

$$\Delta LGDP_t = \beta_0 + \sum_{i=1}^{q1} \beta_1 \Delta lGDP_{t-1} + \sum_{i=0}^{q2} \beta_2 \Delta lGCF + \sum_{i=0}^{q3} \beta_3 \Delta lEDU_{t-1} + \sum_{i=0}^{q4} \beta_4 \Delta lEMP_{t-1} + \sum_{i=0}^{q5} \beta_5 \Delta lFDI_{t-1} + \sum_{i=0}^{q6} \beta_6 \Delta lTRD_{t-1} + \omega ECM_{t-1} + e_t$$

$$ECM_{t-1} = lGDP_t - \left(\beta_0 + \sum_{i=1}^{q1} \beta_1 \Delta lGDP_{t-1} + \sum_{i=0}^{q2} \beta_2 \Delta lGCF_{t-1} + \sum_{i=0}^{q3} \beta_3 \Delta lEDU + \sum_{i=0}^{q4} \beta_4 \Delta lEMP_{t-1} + \sum_{i=0}^{q5} \beta_5 \Delta lFDI_{t-1} + \sum_{i=0}^{q6} \beta_6 \Delta lTRD_{t-1} \right)$$

Where:

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$: Short-run dynamics

ω: Short-run dynamicsDiagnostic checks

In to order detect any defects, the model will be diagnosed. This stage is imperative, since it validates the parameter estimation results obtained by the projected model. Diagnostic tests examine the model's stochastic properties. The following section further discusses the diagnostic tests employed in the study.

4.6.3 Normality test

A normally distributed error term is needed for reliable testing. Jarque-Bera is a test statistic used to determine whether data is normally distributed. Various statistical tests, such as the t-test and F-test, make normality an assumption; the Jarque-Bera test is normally performed before one of these tests to validate normality. The Jarque-Bera test is based on the sample skewness and sample kurtosis. A normally distributed function must have a skewness of zero and a kurtosis of three (Maddala & Lahiri 2009:26). A normal distribution has a skewness of zero; it is completely symmetric around the mean and a kurtosis of three; kurtosis tells you how much data is in the tails and gives you an idea of how 'peaked' the distribution is.

The skewness and kurtosis can be described as follows (Mutambirwa, 2016:61):

$$S = \frac{\mu_3^2}{\mu_2^3}$$

$$K = \frac{\mu_4}{\mu_2^2}$$

Where

μ: is the mean

The Jarque-Bera test statistic is indicated as follows:

$$JB = N\left[\frac{s^2}{6} + \frac{(k-3)^2}{24}\right]$$

The null hypothesis (H_0) is normally distributed, while the alternative hypothesis (H_1) is not normally distributed.

4.6.4 Autocorrelation test

Autocorrelation is a violation of the fourth assumption of the classical linear regression model, which states that the observations of the error term are not correlated. Autocorrelation occurs in time series data where the error term contains the effects of omitted variables and these omitted variables tend to be correlated (Maddala & Lahiri, 2009:239).

4.6.4.1 The Dublin-Watson test

The Durbin-Watson test is one of the methods of analysing residual autocorrelation in regression models. The Durbin-Watson test looks for a specific type of serial correlation, the AR (1) in residuals. The formula has a one-order time lag (Chen, 2016). According to Ghidari (2016:70), the residuals are autonomous and are not correlated to the other independent variables.

The following is the hypothesis for the Durbin-Watson statistic (Mutambirwa, 2016:63):

H_0: First-order serial correlation does not exist

H_1 = First-order serial correlation exists

The Dublin-Watson test is described below:

$$DW = \frac{\sum_{t=2}^{T}(et - et-1)^2}{\sum_{t=1}^{T} e_t^2}$$

Where: et represent the residual for time period t.

The DW calculated statistics are then compared to critical values, the derived upper value(d_u) and derived lower value(d_l). The null hypothesis is rejected if the calculated DW is less than(d_l), the null hypothesis will be accepted if the calculated DW statistic is greater than(d_u). The Durban-Watson statistic is often assumed to have a value between 0 and 4. A value of DW = 2 means that no autocorrelation exists. Where the value is less than 2, it indicates positive autocorrelation, and when it is greater than 2, it indicates negative serial correlation.

4.6.4.2 Lagrange multiplier (LM) test or Breusch-Godfrey test

While the Durbin-Watson test can only detect first-order auto regression, the Breusch-Godfrey (BG) test can detect autocorrelation up to any predetermined order. It also allows for a wider range of regressors (Maddala & Lahiri 2009:176). When using the Breusch-Godfrey test, three steps are involved:

1. Run OLS regression to get a model estimate and residuals.
2. Run an OLS regression for the model using these sample residuals, and obtain the R^2.
3. Multiply the R^2 by the number of observations.

4.6.4.3 Correlogram of residuals squared

The residuals squared correlogram were also used to endorse the Dublin-Watson and Breusch-Godfrey tests.

4.6.5 Heteroscedasticity test: The White test

The regression model's fundamental assumption is that the error term must have a constant variance, implying that the model is not heteroskedastic. Tests against heteroscedasticity are frequently employed in empirical studies. The following study utilises the White test to test for heteroscedasticity. The White test is commonly applied, and makes use of the regression's

squared residuals on of the independent variables. In the White test, the error term e_t is based on the following regressors,x^2,x^3,x^3... and the following estimation model:

$$Yt = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + e_t$$

$$e_t^2 = \sigma_0 + \sigma_1 X_2 + \sigma_2 x_{2i}^2 + \sigma_3 x_{3i}^3 + w_i$$

The conclusion of the White test is as follows:

H_0=$\sigma_i^2 = \sigma^2$ $(Constant\ Variance)$.

H_1 $\sigma_i^2 \neq \sigma^2$ $(Variance\ is\ not\ constant)$.

4.7 Stability tests

The model's stability and the results of the post-estimation diagnostics affect the validity and robustness of the results; therefore, it should be checked before proceeding. The following stability tests were employed in regression model:

4.7.1 Cusum test and Cusum of squared test

The cumulative sum test detects systematic changes in regression coefficients, while the cumulative sum of squares test detects abrupt changes in regression coefficient constancy. The Cusum test and Cusum of squared test are employed to examine the residual fluctuations. The residuals must fall between the critical values of 5% significance for the model to be stable (Mutambirwa, 2016).

4.7.2 The actual, fitted residual graph

The fitted residual graph is employed to monitor the long-run changes in residuals in the regression model.

4.8 Summary and conclusion

The aim of this chapter was to outline the methods employed to achieve the empirical objectives of the study. The chapter discussed the methodology employed in this study, highlighting the reasons behind the statistical methods chosen, the model specification, and reasons behind the data selected. The chapter begins by discussing the growth accounting framework, and proceeds to explain the model specified and the estimation methods employed in the study; thereafter, it defines and discusses the variables chosen for the model and further explains the econometric model employed in this study. The chapter emphasised the importance of stationarity prior to estimating ADRL model. The chapter also explained the various stationarity tests employed in the study. The chapter discussed the research model employed, the ADRL model and the limitation thereof, and concluded that the ADRL model can only be used when the variables are integrated to I (0) or I (1) or both. Furthermore, the chapter also explained the diagnostic tests and stability tests employed in the study to examine the reliability of the results obtained from the chosen model. Moreover, the study employed the ECM to confirm a short-run relationship between the variables of the study. Subsequent to the discussion of the models employed in the study, Chapter 5 presents the results of the models employed in the study and interpretation of the findings.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 Introduction

The primary objective of this chapter is to present the results of the econometric analysis that have been carried to accomplish the empirical objectives of this study. The overall objective of the study has been to conduct an analysis of the impact of education on the economic growth of South Africa. Chapter 2 presented a literature review of the theoretical and empirical literature on human capital and economic growth and argued that education has an impact on the economic growth of a country. It is therefore important to assess the contribution of human capital on the economic growth of South Africa. Moreover, it is fundamental to examine the long-run or short-run relationship between the variables and the economy's growth. From the analysis of South Africa's education sector and trends in economic growth it is evident that the percentage increase in education expenditure is not yet reflected in the economy's performance or growth. Consequently, the aim of this study has been to determine the contribution of human capital to the economy's growth. The chapter employs an econometric model to evaluate the impact of human capital on the economy's growth. It presents the empirical findings from the econometric models utilised.

This study utilized the ARDL method to estimate the regression model. It makes use of annual data derived from the World Development Indicator database for the period of 1980 to 2019. Accordingly, the chapter is further sub-divided into four sections. Section 5.2 presents the stationarity tests; while section 5.3 presents the ADRL model and a discussion of the long-run

and short-run cointegration results. Section 5.4 discusses the diagnostic and stability tests of the study, respectively.

5.2 Stationary tests

The stationarity or non-stationarity of time series data has an impact its properties and behaviour. It is important to test for stationarity in time series data. Prior to an ADRL estimation and cointegration, stationarity tests are significant in order to ascertain whether the variables are stationary and to determine the variable's order of integration. If a variable is non-stationary, then the assumptions of an asymptotic analysis are invalid. Therefore, to avoid spurious results, stationarity will be tested with the use of a graphical analysis, augmented Dicky-Fuller and the Phillips-Perron test. The augmented Dickey-Fuller and Phillips-Perron test the null hypothesis that the variables have a unit root, against the alternative hypothesis that the variables do not have a unit root.

Figure 5.1 presents a graphical analysis of the variables REALGDP, GFCF, EDUEXP, FDI and TRD. None of the variables of the study are stationary at default. In Figure 5.2, the graphical analysis of the variables after being differenced, the variables of this study are all stationary at first difference. The following study employs data that is stationary at first difference.

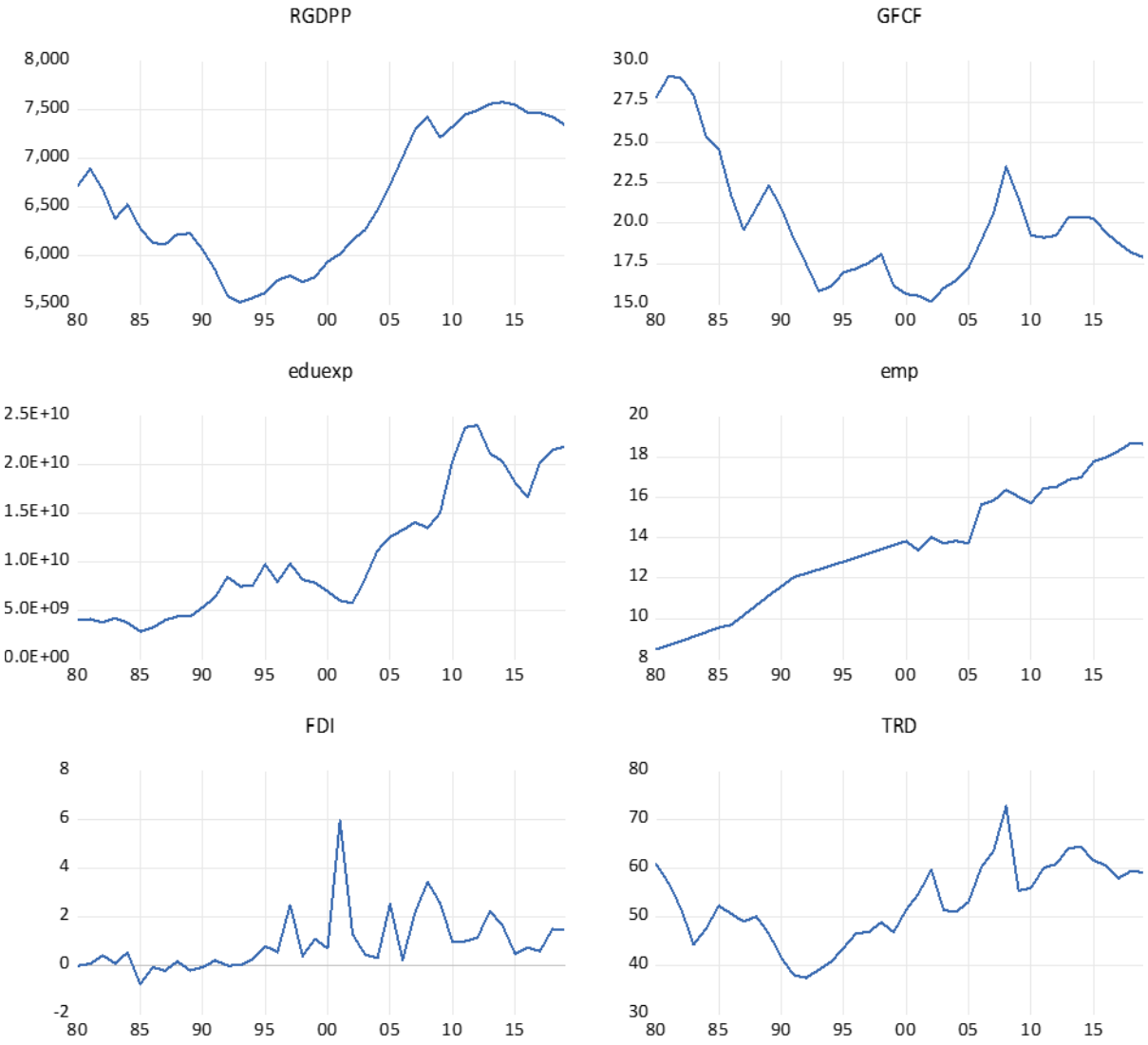


Figure 5.1: RGDPP, GFCF, EDUEXP, EMP, FDI and TRD (before differencing)

Source: Author's own compilation from data extracted from Eviews 11

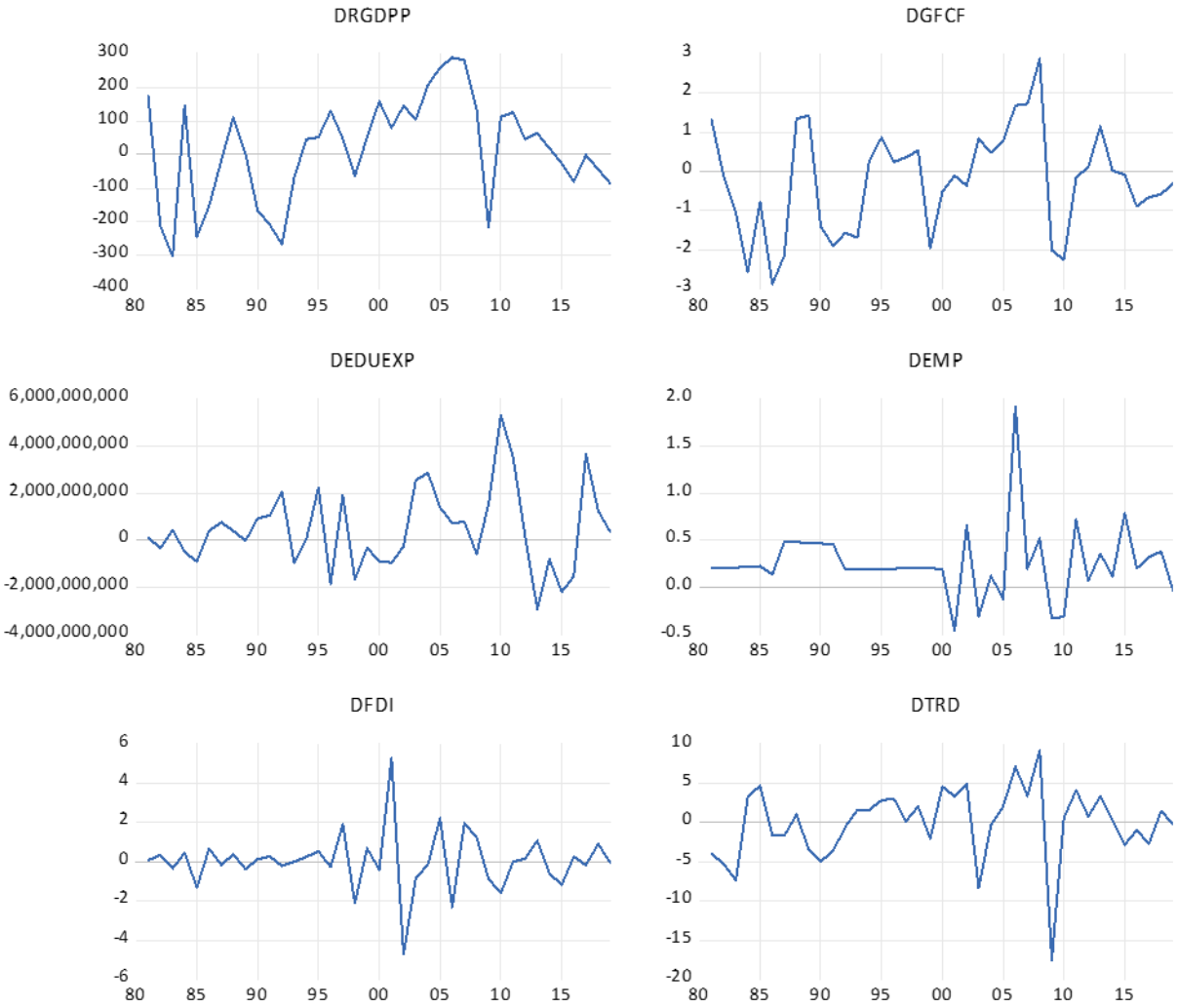


Figure 5.2: RGDPP, GCF, EDUEXP, EMP, FDI and TRD (After differencing)

Source: Author's own compilation from data extracted from Eviews 11

5.2.1 Augmented Dickey-Fuller test results

Table 5.1: Augmented Dickey-Fuller at levels

Levels						
	Intercept		**Trend and intercept**		**None**	
Variables	**Test statistic**	**5% critical value**	**Test statistic**	**5% critical value**	**Test statistic**	**5% critical value**
DRGDPP	-0.897638	-2.941145	-2.745713	-3.533083	0.071595	-1.949856
DGFCF	-3.170598*	-2.941145	-2.803697	-3.533083	-1.494317	-1.949856
DEMP	-0.420252	-2.938987	-2.947777	-3.529758	3.957100	-1.949608
DEDUEXP	-0.662557	-2.941145	-2.863612	-3.533083	0.665223	-1.949856
DFDI	-1.563886	-2.945842	-5.479241*	-3.5297578	-0.693839	-1.950394
DTRD	-1.864459	-2.938987	-3.200104	-3.529758	-0.333534	-1.949609

Source: Author's own compilation from data extracted from Eviews 11

Table 5.2: Augmented Dickey-Fuller at first difference

First difference						
	Intercept		**Trend and Intercept**		**None**	
Variables	**Test statistic**	**5% critical value**	**Test statistic**	**5% critical value**	**Test statistic**	**5% critical value**
DRGDPP	-3.830406*	-2.941145	-4.150315*	-3.533083	-3.889825*	-1.949855
DGFCF	-4.116481*	-2.941145	-2.803696	-3.533083	-4.009081*	-1.949855
DEMP	-7.472720*	-2.941145	-7.363415*	-3.533083	-2.529629*	-1.950116
DEDUEXP	-4.576515*	-2.941145	-4.552442*	-3.533083	-4.382296*	-1.949855
DFDI	-7.802929*	-2.945842	-4.274979*	3.552972	-7.894025*	-1.950394
DTRD	-6.187364*	-2.941145	-6.168035*	-3.533083	-6.273005*	-1.949856

Source: Author's own compilation from data extracted from Eviews 11

I. H_0: Unit roots exist

II. Variables stationary at 5% (*)

III. Schwarz information criterion is employed for lag length selection

IV. E-Views selected lags automatically

Tables 5.1 and 5.2 of ADF above indicate DGFCF is stationary at levels (intercept). DFDI is stationary at levels (trend and intercepts). The variables DRGDPP, DGFCF, DEDUEXP, DEMP, DFDI and DLTRD are stationary at first difference (Appendix C).

5.2.2 Phillips-Perron test results

Table 5.3: Phillips-Perron at levels

Levels						
	Intercept		**Trend and Intercept**		**None**	
Variables	**Test statistic**	**5% critical value**	**Test statistic**	**5% critical value**	**Test statistic**	**5% critical value**
DRGDPP	-0.694682	-2.938987	-1.859177	-3.529757	0.368338	-1.949609
DGFCF	-2.114600	-2.938987	-1.701657	-3.529758	-1.370574	-1.949609
DEMP	-0.205451	-2.938987	-2.996808	-3.529758	5.779654	-1.949609
DEDUEXP	-0.401137	-2.938987	-2.389660	-3.529758	1.052316	-1.949609
DFDI	-4.589279*	-2.938987	-5.487467*	-3.529758	-3.122021*	-1.949609
DTRD	-1.867861	-2.938987	-3.143819	-3.529758	-0.303756	-1.949609

Source: Author's own compilation from data extracted from Eviews 11

Table 5.4: Phillips-Perron at first difference

First difference						
	Intercept		**Trend and Intercept**		**None**	
Variable	**Test statistic**	**5% critical value**	**Test statistic**	**5% critical value**	**Test statistic**	**5% critical value**
DRGDPP	-3.879287*	-2.941145	-4.230929*	-3.533083	-3.936620*	-1.949856
DGFCF	-4.100861*	-2.941145	-4.150011*	-3.533083	-4.044652*	-1.949856
DEMP	-8.713732*	-2.941145	-8.551728*	-3.533083	-5.258876*	-1.949856
DEDUEXP	-4.378231*	-2.941145	-4.339088*	-3.533083	-4.355768*	-1.949856
DFDI	-18.67348*	-2.941145	-18.88592*	-3.533083	-17.80516*	-1.949856
DTRD	-6.577063*	-2.941145	-6.973097*	-3.533083	-6.657091*	-1.949855

Source: Author's own compilation from data extracted from Eviews 11

I. H_0: Unit roots exist.

II. Variables stationary at 5% (*).

III. Schwarz information criterion is employed for lag length selection.

IV. E- Views selected lags automatically.

Tables 5.3 and 5.4 above of Phillips-Peron produced similar outcomes, which were obtained from ADF. DFDI was stationary at level and first difference, while the variables DRGDPP, DGFCF, DEDUEXP, DEMP and DTRD are only stationary at first difference (Appendix D).

5.3 Autoregressive distributed lag (ADRL) model

Subsequent to the stationarity tests, using graphical presentations, the ADF and Philips-Peron test, the ADRL method will be applied as the variables employed in this study are I(0) and I(1). The bound test of the ADRL technique is employed to analyse cointegration and is indicated as follows (Appendix E):

Table 5.5: Results of the F-bound cointegration test

F-bound	**Null hypothesis: No levels relationship**			
Test statistics	**Value**	**Signif.**	**I(0)**	**I(1)**
f-statistics	6.298523	10%	2.08	3.0
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Source: Author's own compilation using data extracted using Eviews 11

The study employs the F-bound test of cointegration to determine whether there is a long-run relationship between gross capital formation, education expenditure, employment rate, foreign direct investment, trade and the economic growth of South Africa (real GDP). To examine the long-run relationship, the study formulates the null hypothesis that there is cointegration among the variables and an alternative hypothesis that there is no cointegration among variables. The f-bound test illustrated above in Table 5 indicates that the estimated F-value is 6.298523. The f-bound test indicates that the value of the f-statistic is greater than both the lower and upper

bound at 5% significance. Therefore, the null hypothesis of no long-run relationship is rejected. The results suggest that there is a long-run cointegrating relationship between the real gross domestic product, gross capital formation, education expenditure, foreign direct investment and trade in South Africa for the period 1980 to 2019. Furthermore, these results suggest that changes in gross capital formation, education expenditure, foreign direct investment and trade have an impact on long-run economic growth. Therefore, education as sphere of human capital is fundamental for long-run economic growth in South Africa.

After a cointegration correlation is confirmed, the ADRL model is employed to examine both the short-run and long-run effects of the regression. The South African government's commitment to increased education investment to increase economic participation has proved fruitful. The results suggest that there is indeed a long term significant relationship between Education expenditure and growth in GDP per capita in South Africa. Therefore, education expenditure is correlated with economic growth in the long run. The results are supported by Mutambirwa (2017), who established a long-run relationship between education expenditure and the economic growth of South Africa. The results are further supported by the empirical literature of Muhammad (2012), Olrinde (2014), Adeyemi and Ogunsola (2016) and Karim (2016). This suggests that the more the government invests in human capital, the higher the economic growth will be in the long run.

Table 5.6: Autoregressive distributed lag (ADRL) model

Levels equation				
Restricted constant and no trend				
Variables	**Coefficient**	**Std. error**	**t-Static**	**Prob.**
GFCF	-43.09583	48.48389	-0.888869	0.3819
EDUEXP	7.30E-08	2.05E-08	3.558352	0.0014
EMP	-138.1331	83.49768	-1.654335	0.1096
FDI	51.99618	56.25531	0.924289	0.3635
TRD	87.62681	19.88177	4.407395	0.0001
C	3642.471	943.8618	3.859115	0.0006

Source: Author's own compilation from data extracted from Eviews 11

$$\boldsymbol{RGDPP = -43.09583 * GFCF + 7.30E - 08 * EDUEXP + -138.1331 * EMP + 51.99618 * FDI + 87.62681 * TRD + 3642.471}$$

The results in equation 5.1 indicate that the variables gross fixed capital formation and the employment rate have a negative relationship to economic growth in the long run, whereas education expenditure, foreign direct investment and trade have a positive relationship with economic growth in the long run. The outcome of the table above indicates that the probabilities of education expenditure and trade is 0.14% and 0.01%, respectively, which are below the 5% significance level, and therefore these variables are statistically significant.

However, gross fixed capital formation, employment rate and foreign direct have a probability of 38.19%, 10.96% and 36.35%, respectively, which are above the 5% significance level. Therefore, the variables gross fixed capital formation, employment rate and foreign direct investment are statistically insignificant. The equation however illustrates that a one-unit increase in education expenditure will lead to 7.30E-08 increase the in economic growth. This

suggests that the more the government invests in human capital, the higher the long-run economic growth will be. A 1% increase in trade will lead to an 87.62681% increase in economic growth. In contrast, a 1% increase in gross fixed capital formation will lead to a 43.09583% decline in the real GDP per capita. Any increase in the employment rate results in a 138.1331% decrease in the real GDP per capita. Moreover, a 1% increase in foreign direct investment will yield a 189.1766% decline in real GDP per capita. In contrast, a 1% increase in foreign direct investment will lead to a 51.99618% decline in real GDP per capita. The results are in conflict with those of Van Zyl and Bonga (2009); the results of their study indicated that an increase in human capital expenditures in South Africa does not result in an increase in economic growth. However, the findings of the study coincide with that of Iwegbunam (2017), who found that gross capital formation has a negative impact on the economic growth of South Africa. Moreover, Rehman (2015) also found that economic growth is positively correlated with in investment in education. After analysing the integrating correlation in the long run, the ECM is then conducted to examine cointegration in the short run. Figure 5.3 below is the estimated ECM.

5.4 Error correction model (ECM)

Table 5.7: Error correction model

ADRL ERROR CORRECTION REGRESSION **ECM REGRESSION**				
Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
D(EMP)	89.55907	33.26731	2.692104	0.0120
D(EMP(-1))	133.5799	35.36182	3.777517	0.0007
D(TRD)	22.12104	3.140481	7.043837	0.0000
D(TRD (-1))	-15.87394	3.867805	-4.104122	0.0003

CointEq(-1)	-0.350857	0.047796	-7.340801	0.0000

Source: Author's own compilation from data extracted from Eviews 11

The primary objective of this study has been to establish whether there is a long-run relationship between human capital and economic growth in South Africa. However, it also important to determine whether there is a short-run relationship between the variables and the economy's growth. The F-bound test confirmed that there is a long-run relationship between the variables and economic growth. The error correction model presents the speed of adjustment to equilibrium after economic disturbances. The results of the error correction model indicate that the variables included above will revert back to long-run equilibrium after an economic disturbance (Appendix F). According to Manete (2017), the rule of thumb in the error correction model is that the coefficient should be negative and statistically significant. The results of the error correction model show that the coefficient is -0.350857 and the probability of the error correction model's coefficient is 0% and is statistically significant as the probability value lies below the 5% significance level. The results of the error correction model indicate that the variables included above will revert back to long-run equilibrium after an economic disturbance, foregoing disequilibrium at an annual speed of 35%. The error correction model also depicts that employment and trade have a positive and significant impact on economic growth in the short run. The outcome of the error correction model proves that there is no short-run relationship between education expenditure and economic growth, and therefore human capital does not contribute to the economic growth of South Africa in the short run.

5.5 Diagnostic tests

To ascertain the reliability of the ADRL results, the study conducted diagnostic tests (Appendix G, Appendix H and Appendix I). Diagnostics tests examine stochastic properties of the regression, including residual autocorrelation, normality and heteroscedasticity.

Table 5.8: Diagnostic tests

Test statistics		Statistic	Probability
Normality	Jarque-Bera	5.894269	0.052490
Serial correlation	Breusch-PaganGodfrey	0.416545	0.5419
Heteroskedastic	Breusch-PaganGodfrey	0.591494	0.7415
	White test	0.543849	0.7832

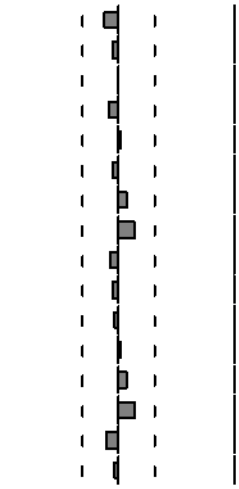
Source: Author's own compilation using data extracted using Eviews 11

The figure above presents the normality test. The Jarque-Bera value and probability are 5.894269 and 0.052490, respectively, both of which are above 5% and statistically significant. Therefore, the null hypothesis is accepted, and the residuals are normally distributed. The LM test is employed to examine serial correlation; the Breusch-Godfrey was chosen in this regard. The F-statistic and probability of chi-square are 0.416545 and 0.5419, respectively, which are above the 5% significance level; therefore, the null hypothesis of no serial correlation is accepted; the residuals are not serially correlated. The Breusch-Pagan Godfrey and White tests were employed to test the residuals for heteroscedasticity. The White test indicates that the F-statistic and probability of chi-square are 0.543849 and 0.7832, respectively. The F-statistic and probability of chi-square are 0.591494 and 0.7415, respectively. Both tests have a probability of more than 5%. Based on these results, the null hypothesis of no heteroscedasticity is accepted. Therefore, the residuals of the study are homoscedastic.

5.5.1 Correlogram of residuals squared

The correlogram of residuals squared was employed as an additional diagnostic check. The results from the correlogram of residuals squared indicate that there is no misspecification in the residuals of the regression.

Date: 07/29/21 Time: 19:45
Sample (adjusted): 1982 2019
Included observations: 38 after adjustments



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.136	-0.136	0.7631	0.382
		2	-0.053	-0.073	0.8807	0.644
		3	-0.000	-0.018	0.8807	0.830
		4	-0.086	-0.095	1.2104	0.876
		5	0.016	-0.011	1.2229	0.943
		6	-0.060	-0.074	1.3941	0.966
		7	0.081	0.061	1.7119	0.974
		8	0.146	0.156	2.7888	0.947
		9	-0.074	-0.022	3.0727	0.961
		10	-0.051	-0.057	3.2156	0.976
		11	-0.048	-0.057	3.3468	0.985
		12	0.010	0.009	3.3528	0.992
		13	0.073	0.074	3.6745	0.994
		14	0.132	0.168	4.7819	0.989
		15	-0.101	-0.093	5.4531	0.988
		16	-0.029	-0.069	5.5102	0.993

*Probabilities may not be valid for this equation specification.

Figure 5.3: Correlogram of residuals squared

Source: Author's own compilation using data extracted from Eviews 11

5.6 Stability tests

Stability tests were conducted to ensure stability in regression. Stability tests employed in this study include the Cusum tests, recursive coefficients and the actual, fitted and residual of the ADRL model.

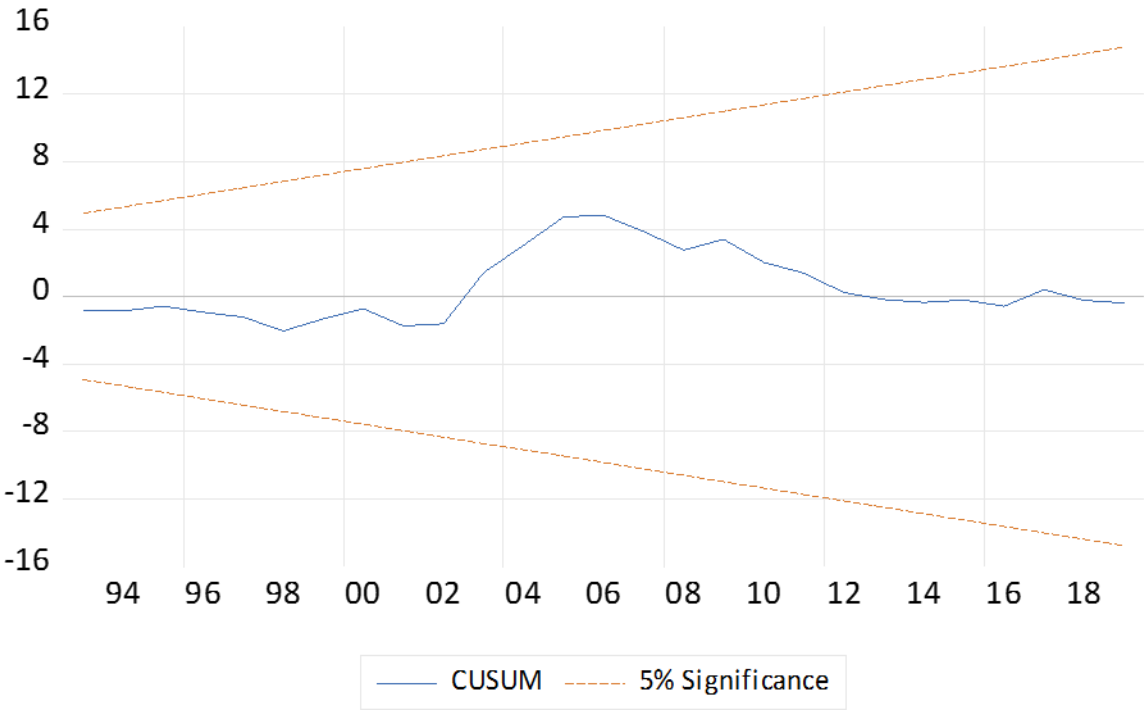


Figure 5.4: Cusum test

Source: Author's own compilation data extracted using Eviews 11

The Cusum test was employed to analyse the stability of the variables in the short run and long run. The Cusum test indicates that results are statistically significant at the 5% level of significance. Therefore, the variables education expenditure, mean years of schooling, gross capital formation, labour force rate and trade in South Africa are stable during the study period.

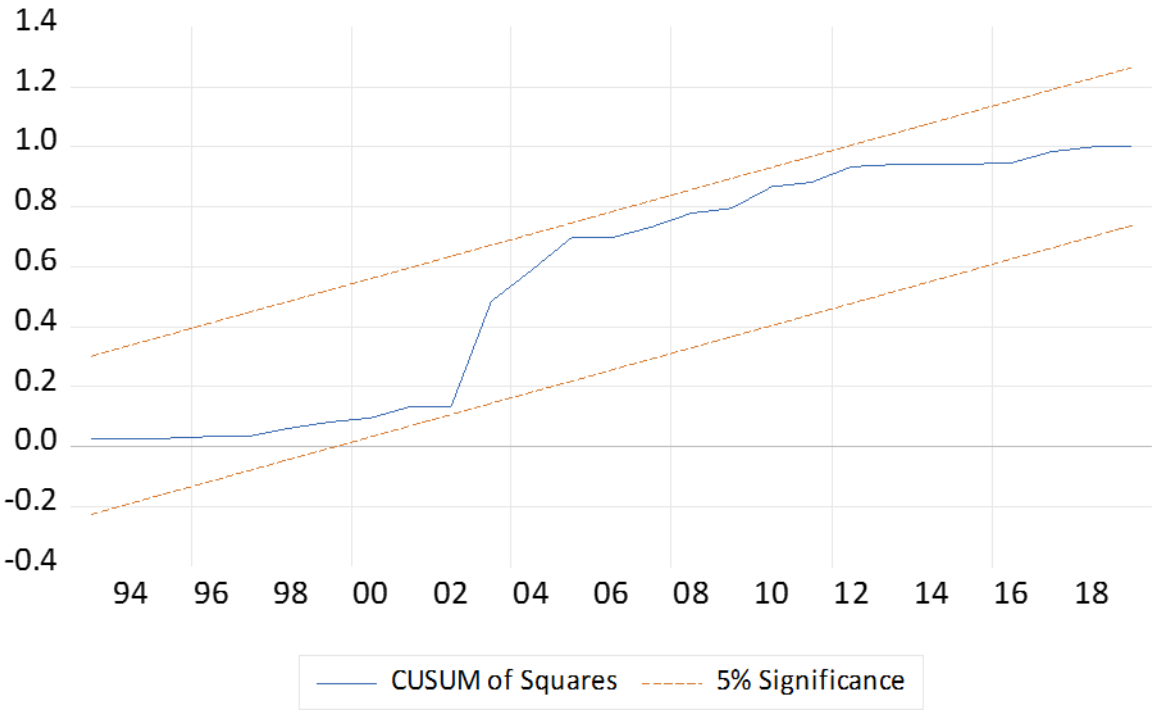


Figure 5.5: Cusum squared test

Source: Author's own compilation from data extracted using Eviews 11

The Cusum of squares stability test is also employed to ascertain the stability of the variables. The results of the Cusum of squares indicate that the regression lies between the 5% significance level, and therefore it is stable.

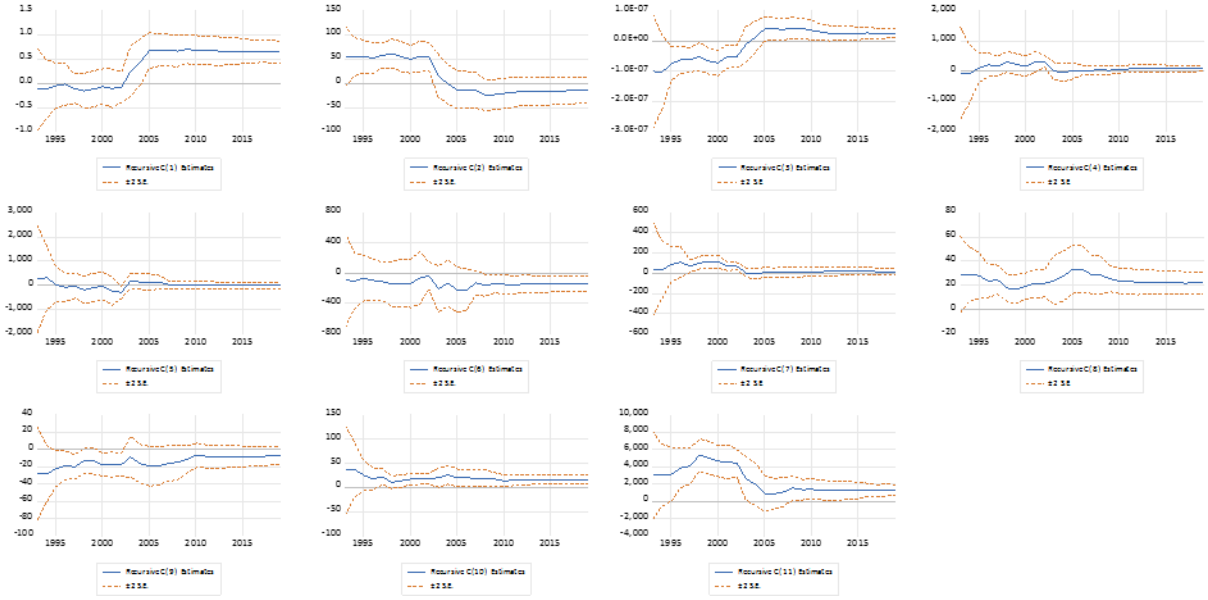


Figure 5.6: Recursive coefficient test

Source: Author's own compilation from data extracted using Eviews 11

The recursive coefficient test indicated that there is stability in the coefficients of the study. The test is estimated at a modulus of 2SE, and therefore the ADRL regression is stable and the coefficients are statistically significant.

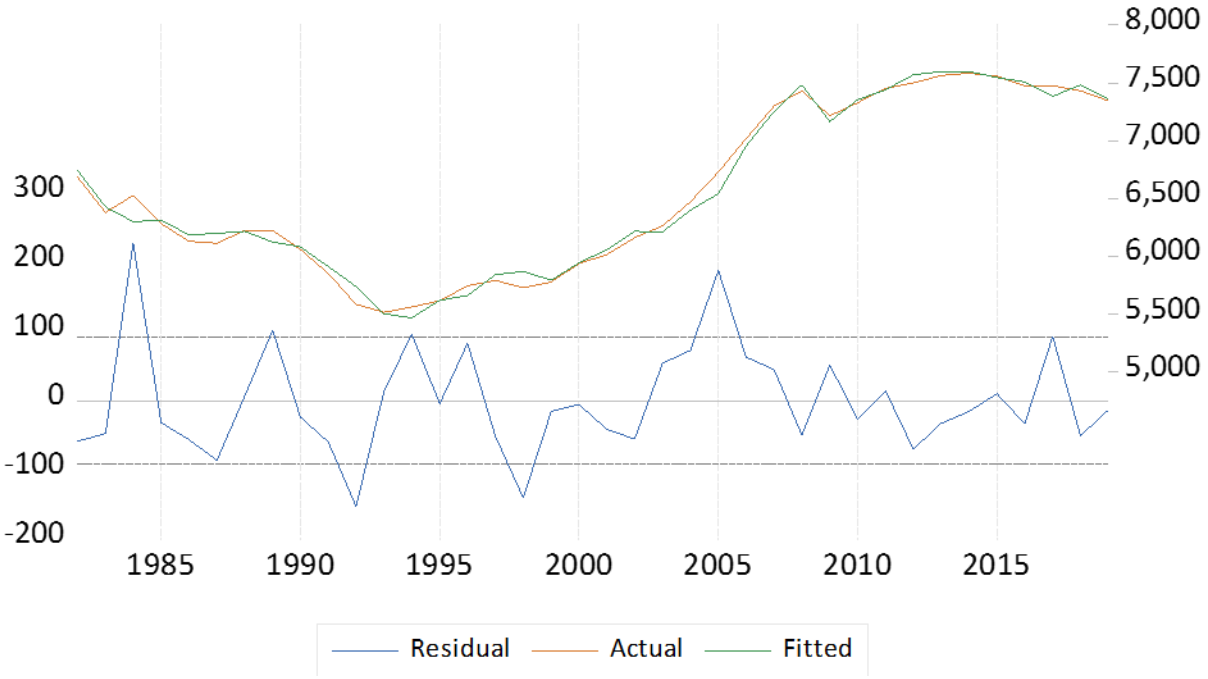


Figure 5.7: Actual, fitted, residual graph

Source: Author's own compilation from data extracted using Eviews 11

The actual, fitted, residual graph in Figure 5.13 above illustrates that the long-run model and the error correction model follow the endogenous dynamic model with minimal errors. The period of 1995 and 2000 was inconsistent due to dire political conditions; the transition from apartheid to a democratic government had an impact on investment levels in South Africa. In addition, the Asian financial crisis had an effect on output levels. Moreover, the instability of the period 2008 and 2010 may be attributed to the global financial crisis and the global recession that followed.

5.7 Summary and conclusion

Chapter 4 of this study served as foundation of this chapter. In examining the contribution of human capital to economic growth of South Africa, Chapter 5 employed the ADRL to establish education's impact on the economy's growth. The ADRL method is employed to establish

cointegration between the independent and dependent variables of the study. Furthermore, the study employed the ECM to establish a short-run relationship for the ADRL model. The diagnostic tests were fundamental to examine robustness among variables and the regression model, to ensure that the results of the study are stable and reliable. The findings indicate that the data employed in the study is well suited for the model and can be employed to analyse the economic trajectory.

When looking at the results of the ADRL f-bound test, it is evident that education expenditure and trade have a positive impact on real GDP per capita in the long run, whereas foreign direct investment has a negative impact on long-run economic growth of South Africa. The ECM revealed that there exists a short-run relationship between gross capital formation, foreign direct investment, trade and the real GDP per capita in the short run; however, there is no relationship between education expenditure and real GDP per capita. The study therefore concludes a positive relationship between human capital and economic growth in the long run.

Despite the positive relationship that education expenditure has on economic growth in the long run, education expenditure does not have a significant impact on economic growth in the short run. This suggests that the return on cost incurred in education is only significant in the long run, and does not yield any return in the short run. On the other hand, the employment rate has a significant impact on economic growth in the short run. Upon establishing the relationship between the variables and economic growth in the long run and short run, Chapter 6 provides a summary of the study, recommendations and limitations of the study.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

Economic growth is an important macroeconomic objective for every country; it leads to better living standards. It is particularly important for developing countries such as South Africa that faces severe poverty, income inequality and high unemployment rates. Human capital has been identified as a fundamental element than can boost the economic performance of country. Therefore, human capital is essential to promote the economic growth of South Africa. Previous literature has highlighted the importance of education for economic growth. In this view, the South Africa government has continuously invested in the educational sector. The investment in education is crucial for human capital development that is required to promote economic growth in the country.

This study has aimed u to capture the contribution of human capital on the economic growth of South Africa over the period of 1980 to 2019. The objective of the study was to analyse the impact of human capital on the economic growth of South Africa, and to determine whether human capital contributes to economic growth, in order to ascertain whether further increases in educational expenditure are justifiable. The primary objective assisted in determining the long-run and short-run relationship between human capital and the economic growth of South Africa. The study employed the ADRL and ECM models to determine the long-run and short-run relationship between the variables. The aim of this chapter is to provide a summary of the study, analysing the achievement of the objects, the limitations of the study and the recommendations for further research and policy. Accordingly, section 6.2 shall present a summary of the study.

6.2 Summary of the study

The study consists of six chapters, which were aimed to achieve the various objectives. The following section presents a summation of the study, presenting the findings of the previous chapters. Chapter 1 of the study provided the reader with an introduction and background of the research study. Chapter 2 was responsible for the theoretical literature on the role of human capital for economic growth, and provides theoretical background on the human capital as a key tool for economic output. Chapter 3 of the study provided an overview of human capital and economic growth of South Africa. The chapter discussed South Africa's economic trajectory, providing an overview of the trends in economic growth and human capital. Chapter 4 consisted of the methodology employed in the study, whereas Chapter 5 provided the results of the econometric model and an interpretation of the findings. The following section presents the summation of Chapters 1 to 5.

6.2.1 Summary of Chapter 1

The study began with Chapter 1, which focused on introducing the research study, presenting the objectives of the study at hand, problem statement, research hypothesis and significance of the study. The introduction discussed the concept of human capital, as key factor in economic growth. The high education expenditures and the need for economic growth in South Africa sparked interest in such a topic. The chapter proceeded to give the primary objective and subsequently the theoretical and empirical objectives that would assist in the achievement of primary objective. Consequent to formulating the objectives of the research study, Chapter 1 coordinated how the objectives will be achieved, by means of theoretical and empirical analysis. Furthermore, the chapter discussed the significance of the research study, providing an overview of the direction of the study.

6.2.2 Summary of Chapter 2

The aim of Chapter 2 was to provide theoretical explanation of human capital and economic growth theories and the growth accounting theory. Chapter 2 discussed the aforementioned concepts. The chapter explained the neoclassical growth theories, the Solow model, the augmented Solow model, the endogenous growth theories of Romer and Lucas and the growth accounting theory. Furthermore, it discussed human capital and economic growth. The review of empirical studies on human capital and economic growth in both developing and developed countries indicates that human capital has a significant impact on economic growth. The literature review highlighted the importance of human capital for economic growth. There is no consensus on the impact of human capital on economic growth in developing and developed countries. Various countries have found that education has a negative relationship with economic growth. The empirical findings therefore indicate that the relationship between human capital and economic growth differs in various countries.

6.2.3 Summary of Chapter 3

The empirical literature on human capital and economic growth indicated that there is no consensus on the relationship between human capital and economic growth. Chapter 3 of the study evaluated South Africa's economic performance in order to highlight the importance of economic growth in the country. The chapter analysed the trends in economic growth and human capital. Moreover, Chapter 3 also evaluated the educational sector and challenges apparent in the sector. It went on to discuss the history of higher education funding and the National Student Financial Aid Scheme. The aim of Chapter 3 was to discuss the various problems that affect human capital and economic growth in South Africa by analysing the economic trajectory, the level of human capital and the education sector.

6.2.4 Summary of Chapters 4 and 5

In order to examine the relationship between human capital and economic growth of South Africa with specific reference to the period 1980 to 2019, Chapter 4 discussed the methodology employed to achieve the study's objectives. To achieve the research study's primary objective, the study utilised econometric models that assisted in identifying the impact of human capital on the economic growth of South Africa. Chapter 4 commenced with a discussion of the growth accounting framework, and proceeded to present the model specified. The estimation methods employed in the study are the ADRL and the ECM, which are both explained in Chapter 4. Chapter 4 also explained the variables selected, the reasons for the selected variables and went on to discuss where the data was gathered. Moreover, Chapter 4 also discussed the diagnostic test employed along with the stability checks.

In Chapter 5, the econometric models of ADRL and ECM were employed to achieve the objectives of the study. The econometric models enabled the study to determine the contribution of human capital to the economic growth of South Africa. In examining the contribution of human capital to the economic growth of South Africa, the study employed the augmented Solow model by Mankiw, Romer and Weil (1992). The model was formulated with real GDP as per the dependent variable, and gross fixed capital formation, education expenditure, employment rate, foreign direct investment and trade as independent variables. Chapter 5 employed informal tests to check stationarity; the graphical analysis illustrated that the variables economic growth, gross fixed capital formation, education expenditure, employment rate, and foreign direct investment are stationary after differencing.

Furthermore, the results of the unit root test illustrated that the variables are stationary at I(0) and 1(0); the variable foreign direct investment is stationary at levels, whereas the variables real GDP per capita, gross fixed capital formation, education expenditure, employment rate, foreign direct

investment and trade are stationary at first difference. The results of the stationarity tests confirmed the use of the cointegration tests. The ADRL model of the study illustrated that there is a long-run relationship between the variables. With the use of the ECM, the study established a short-run relationship; however, the variables gross fixed capital formation, education expenditure and foreign direct investment do not have a relationship with economic growth in the short run.

6.3 Realisation of objectives

The study established its three main objectives that were discussed in Chapter 1, which are the primary, secondary and empirical objectives. The objectives stipulated were achieved in the various chapters of the study. Both the theoretical and empirical objectives were formed based on the primary objective. The theoretical objectives were achieved in Chapters 2 and 3. The empirical objectives were achieved throughout the rest of the study.

6.3.1 Primary objective

The study's primary objective, as stipulated in Chapter 1, serves a foundation for this study. The objectives of the study were realised by analysing both empirical and theoretical literature. The study examined the economic trajectory, growth trends and human capital of South Africa. This was imperative, as it provided an overview of the impact of human capital on South Africa's economic growth. Moreover, the study further examined the contribution of human capital to the

economic growth of South Africa and established that human capital has a significant impact on the economic growth of South Africa in the long run.

6.3.2 Theoretical objectives

Chapter 2 consisted of the theoretical review of human capital and economic growth. The chapter discussed the neoclassical growth theories and endogenous growth theories. The Solow growth model, the augmented Solow model of Mankiw, Romer and Weil (1992), the Lucas model, the Frankel-Romer model, the Romer model, which emphasised the importance of the increase in knowledge acquired, and the human capital theory (mincer, 1958) were reviewed in the study as theoretical literature that postulates a relationship between human capital and economic growth. Moreover, the chapter went on to explain the growth accounting theory and the sources of growth.

The theoretical literature on economic growth discussed in Chapter 2 emphasises the impact of human capital on productivity and economic output and highlighted the relationship between human capital and economic growth. After reviewing the empirical literature, it enabled the study to identify the impact of human capital on the economic growth of developing countries. The study further analysed South Africa's human capital and the country's economic stance to gauge an in-depth understanding of the various factors that influence the level of human capital and economic growth in South Africa. Upon achieving the theoretical objectives of the study, the study went on to realise its empirical objectives.

6.3.3 Empirical objectives

The empirical objectives are fundamental to the study as they enable the study to determine the contribution of human capital to the economic growth of South Africa. The empirical objectives of the study were achieved in Chapters 4 and 5, where the methodology of the study was explained and the results were presented and interpreted. In Chapter 5, the study established that

education expenditure has a significant impact on economic growth in the long run. Therefore, the study suggests that the investment in education yields returns in the short run. The results also indicate that trade has a positive impact on economic growth in the long run. ECM of the study indicates a short-run relationship between the employment rate, trade and the economic growth of South Africa. Overall, the study concludes that human capital contributes to the economic growth of South Africa in the long run. The increase in education expenditure will lead to economic growth in the long run. As suggested by theoretical literature, education as sphere of human capital plays a fundamental role in South Africa's economic growth; therefore, human capital investment is a prerequisite in accelerating the economy's growth.

6.4 Policy Implications for human capital development and the fee-free higher education debate in South Africa.

In 2019, South Africa's gross domestic product (GDP) had declined for the fourth consecutive quarter (StatsSA, 2021). During this period, the country was living in its longest recession in 28 years. The low economic growth, and the triple challenge of poverty, unemployment and inequality apparent in the country are of much concern. According to Grant (2017:3), education is a fundamental determinant of economic and social development for both developing and developed countries. Moreover, Ali *et al.* (2018) found that human capital is imperative for economic growth; human capital can contribute to the economic development of a country by enhancing knowledge and skills inherent in the population. Dixit *et al.* (2017) supported this view; they highlight that various developed countries improved their economy by enhancing their capacity of productive and skilled workers. Moreover, investment in human capital is a fundamental policy objective; enhancing the quality of human capital through quality education promotes equality in the labour market, and therefore combats generational poverty inherent in the country.

It is evident that South Africa is confronted with a significant human capital challenge. According to the World Bank country director for Southern Africa, Paul Noumba, at least 50% of the young people enter the workforce without the required qualification and at least 30% of the country's youth are not in the education system, labour force or any sort of training. This challenge is intrinsically linked to the economic stagnation faced by the country. Education and the quality of education are imperative for the development of human capital and therefore it is important to focus investing on the quality of education in South Africa. The inadequately educated labour force is a probable cause of low capital inflows and FDI in the country. The South African Reserve Bank (2018) indicated that gross direct investment decreased by 9% over the period 1980 to 2018. The inflow of FDI and the subsequent inflow of technology are influenced by the country or economy's absorptive capacity (Borensztein, Gregorio & Lee, 1998). Enhancing South Africa's absorption capacity through human capital development, particularly education, is fundamental to attain economic growth in the 21st century.

Previous literature on human capital and economic growth has consistently highlighted the significant role that education plays in an economy's growth. Higher education in particular has the potential to mediate social equity, economic and social growth, and democratic citizenship (De Jager & Baard, 2019:69). However, according to Badat (2016), equality, economic development and economic growth are yet to be realised in South Africa. South Africa has a legacy of major inequalities, which can be attributed to apartheid and its dire impact on higher education. This is evident from the various schemes and formulae that are built into the different University funding models that have been adopted over the years albeit with mitigated successes. There is clear evidence of efforts being invested to redress some of the challenges of the past but

the resilience of these systemic issues remain a cause for concern for all those interested in redressing the challenges of the countries past that remains till today. As a result of this past, different students have different success rates based on factors such as race, gender, class and region of origin & where they studied (urban versus rural, suburbs versus townships), as well as unequal employment opportunities and staffing resources (Waghid 2002; Shrivastava & Shrivastava, 2014, cited by De Jager & Baard, 2019:69). Human capital investment, and consequently higher education, has moved to the forefront of strategies to promote economic prosperity, full employment and social cohesion. Therefore, the question can be asked whether human capital investment through 'free' higher education will contribute to long-run economic growth in South Africa.

Endogenous growth theory suggests that the main reason of low economic growth in developing countries such as South Africa is the low human capital stock and investment in education (Keita, 2016). This insinuates that improving the quality of education is imperative for the economic development of South Africa. Fee-free higher education can play a significant role in this regard; since higher education is one of the key drivers of economic performance, economic development, and increased competiveness of a country. Therefore, fee-free higher education would constitute a fundamental part of human capital investment and such a deliberate public expenditure in education is likely to have a great impact on the long-run economic growth of South Africa, especially when one takes its historical challenges into account.

According to the World Development Indicators (2021), South Africa's gross tertiary enrolment in 2018 was 23.8%, which is significantly low relative to the country's high population. Fee-free higher education enables an increase in the access to higher education for various students including the previously marginalised population. Gymah-Bremong, Paddison and Mitiku (2006) found that there is a significant and positive correlation between human capital and the growth

rate of income per capita. Human capital accumulation is fundamental in promoting economic growth. Therefore, fee-free higher education ought to increase South Africa's economic growth in the long run, as it will lead to an increase in the country's human capital stock.

South Africa is characterised by income inequality, high crime levels and skill shortage (Wangenge-Ouma & Cloete 2008:). South Africa is still a dual economy with one of the world's highest yet most persistent inequality rates, with the consumption expenditure Gini-coefficient reaching 0.63 in 2015. It also goes without saying then that if knowledge is a source of economic growth, disparities in its distribution can also become a source of inequalities within a nation. Therefore increasing the access to higher education in poverty stricken communities is likely to yield a positive outcome. Furthermore, Hull (2015) argues that a higher number of graduates is ideal in developing countries such as South Africa, since higher education attainment is both a private and public good. According to Shrivastava (2014), the private benefits of higher education include greater employment opportunities, higher salary, improved health and a better quality of life. On the other hand, higher education can develop future leaders who will improve governance in South Africa, combating corruption. Moreover, Wangege-Ouman and Cloete (2008) indicated that the increase in access to higher education in the country promotes social demand for higher education.

Various studies have indicated that countries with low enrolment rates have high income inequalities. Moreover, disparities in the distribution of knowledge are the source of inequalities, because economic growth is dependent on the knowledge acquired in the economy. Shrivastava and Shrivastava (2014) highlighted that higher education is the main source of knowledge in an economy; the production of knowledge, dissemination and its absorption in an economy. A country's economy growth is also influenced by its ability to produce knowledge-based goods; however, to develop a knowledge economy, the capacity to produce knowledge via research and

development is imperative. In this regard, South Africa needs to promote knowledge production but also prioritise the distribution of this knowledge within the country. Fee-free education can play an important role in this regard, as it concentrates investments in the increasing the knowledge generation capacity of institutions of higher learning and places greater value on the knowledge intensity of the economy, which in itself is important to promote innovation and position the economy to be competitive within the context of the 4th Industrial Revolution and beyond. Fee Free education would therefore be a policy signal from government and all its stakeholders that indeed they belief in the critical role of higher education in developing the human capital and human capacities that the economy needs to effectively become a competitive knowledge driven economy that is at the forefront of innovation.

The quality of knowledge obtained within higher education institutions, as well as its accessibility to the rest of the economy, is becoming increasingly vital to national competitiveness. This poses a great threat to the developing world. Developing countries require higher education to educate an increasing number of students, particularly those from disadvantaged backgrounds. Higher education also produces a body of students with a broad education, which encourages flexibility and innovation, allowing for the continuous renewal of economic and social structures that are appropriate to a rapidly changing world. It involves learning not only what is known at this time, but also how to keep their knowledge current, allowing them to renew their skills as the economic environment changes. Furthermore, higher education increases the quantity and quality of research, allowing the developing world to select, absorb and create new knowledge more efficiently and quickly than it does now (World Bank, 2000).

According to Adedeji and Campbell (2013:3), initiatives to raise human capital investment were shown to result in society's economic expansion. Individual economic prosperity and performance were seen as returns on such investments. Higher education's role in human capital development has also been linked to the residual impact of globalisation, positive externalities/effects, and technology. Tertiary education can help economies keep up with or catch up with more technologically advanced societies in a knowledge economy. Higher education graduates are more likely to be aware of and capable of utilising new technologies. The World Bank report emphasised that the quality of knowledge generated within higher education institutions, as well as its availability to the wider economy, is becoming increasingly important to national competitiveness.

Furthermore, by developing governance and leadership skills, it can provide countries with the talented individuals required to create a policy environment conducive to growth. Even so, higher education has a spill-over effect because graduates can use their newly acquired knowledge and skills to improve the skills and understanding of their non-graduate colleagues. The notion that education has positive externalities is not new. Many classical economists argued vehemently for the government's active support of education on the basis of the positive externalities that a more educated labour force and populace would bring to society (Van Den Berg, 2001). Proponents of this educational viewpoint emphasise the close relationship between new product development and educational levels. Countries with the most educated populations are also those at the forefront of technology (Van Den Berg, 2001, cited by Njoku & Onyegbula, 2017:179). Smith (1976) considers education's externalities to be critical to the proper functioning of not only the economy, but also of a democratic society. Another way to

conceptualise education's role in the process of growth and development is to consider human capital as a critical input for innovation, research and development activities.

Another World Bank report (2017) provided additional motivation to higher education. This report emphasised the importance of tertiary education in developing technical and professional skills as well as supplementing primary and secondary education. In terms of the residual effect, tertiary education has indirect economic benefits. It improves the quality of primary and secondary education systems and provides secondary graduates with more opportunities for economic advancement by producing well-trained teachers. It improves a society's health and productivity at work by training physicians and other health workers.

6.5 Comprehensive Recommendations

The study concludes that human capital has contributed to the economic growth of South Africa. However, there are various issues in the education sector that hamper the level of human capital development of the country. Despite the continuous increase in education expenditure, the low economic growth may be attributed to the quality of human capital in the country. The aforementioned problems can be resolved though enhancing and supporting the education sector in order to improve educational outcomes and improve the quality of education offered. The education sector is important for human capital development, particularly for a country such as South Africa with inequality, poverty and unemployment. Implementing policies that improve the educational outcome will enhance job creation and the standard of living of the people in the

country. The government should continue to encourage education through investments in education; however, it should ensure that resources are efficiently and effectively utilised for the development of the education sector. Human capital development is a prerequisite for sustainable economic growth, and therefore the government needs to develop policies necessary to increase human capital development within the country. Implementing policies that will increase the quality of human capital will enable South Africa to be more globally competitive, increase the returns on human capital development and therefore enhance high economic growth. If much focus is dedicated to monitoring and improving the quality of education, South Africa will realise high economic growth.

It is important for South Africa to resolve the weaknesses in the education sector that diminish its contribution to economic growth. It is important for the government to formulate policies that improve education that matches the demand for skills in the country. Policymakers should take all levels of education into consideration as opposed to the Millennium Development Goals that put emphasis on primary education. Secondary and tertiary education has much significance, particularly for the absorption and transmission of technological innovation that enhances productivity and consequently the economic growth of a country.

Furthermore, there is a need for the development of a reliable and efficient database that measures human capital stock of the country at all levels, such as individually, provincially and nationally. This will enable policymakers to gauge the weaknesses and strengths of the human capital stock of the country, and therefore formulate policies that will enhance human capital's contribution to the economy's growth. Moreover, this will allow the government to direct attention to the current stock of human capital to improve the quality of human capital, and create employment, which will increase the living standards of the population. According to the findings of this study, government should provide incentives to businesses and non-governmental organisations (NGOs) in the form of tax breaks or grants to provide practical

learning workshops from secondary level. The challenges apparent in the education sector highlight a need for policy review in order to promote the relevance of education for economic growth.

6.6 Limitations and areas for further research

The study employed a cost-based method of education expenditure as proxy for human capital; however, it is important to note that in various studies there are various proxies of human capital, as identified in empirical literature, i.e. secondary enrolment rate, mean years of schooling, completion rate, literacy rate etc. There are also various other factors that have an impact on human capital such as healthcare expenditure, and on-the-job learning; however, the focus of the study was the education sector, in an attempt to gauge the implication of a further increase in education expenditure. The risk associated with using various proxies for human capital is that they may not correctly capture the actual impact, leading to inconsistency in results. Nevertheless, the results of the study indicated that the aforementioned issues were not encountered in this study, as findings of the study coincide with both theoretical and empirical literature on the relationship between human capital and economic growth.

The study only considered the time period of 1980 to 2019. This period is fundamental for policy formulation to analyse the effectiveness of educational sector policies implements since the advent of democracy. The use of education expenditure is also a limitation, as it does not capture the educational outcomes or the quality of education. This is not a complete picture of the education sector in South Africa. To capture the full contribution of human capital to the economy's growth without being biased, it is important to include various factors of education that are not covered in this study.

6.7 Conclusion

The study examined the contribution of human capital to the economic growth of South Africa over the period 1980 to 2019. The study employed two econometric models to analyse the contribution of human capital to the economic growth of South Africa, namely ADRL and ECO. The ADRL and the ECM determined the relationship between human capital and economic growth for the long run and short run, respectively. The results of the study illustrate that there are long-run and short-run relationships between the variables and the economic growth of South Africa. The results of the study indicate that the variables education expenditure and trade have a positive impact on long-run economic growth; whereas gross fixed capital and foreign direct investment are negatively correlated to South Africa's economic growth in the long run. After analysing the ADRL, it is evident that education expenditure is fundamental for long-run economic growth. The study therefore concludes that human capital contributes to economic growth of the country; the country has to invest in education and put in place measures that will support the education sector and enhance human capital to increase the economic growth of South Africa.

The ECM model indicates that there is no short-run relationship between the variables education expenditure, gross capital formation, foreign direct investment and the economic growth in the short run. However, the variables employment rate and trade have a positive relationship in the short run. Therefore, human capital does not contribute to South Africa's economic growth in the short run. The study concludes that the returns in investment in human capital are only realised in the long run. Moreover, the study suggests that in order for South Africa to realise accelerated economic growth in the short run, the country needs to focus on increasing the employment rate and promoting trade.

Human capital contributes to the economic growth of South Africa and consequently human development requires more support in order enhance the rate at which the economy grows. It is important to continue investing in education as it leads to an increase in the economic growth of South Africa in the long run. Moreover, the study concludes that the South African government should create policies that are aimed at improving the education sector, promote human capital development and long-run economic growth in order to attain sustainable economic growth and combat the triple challenge of poverty, inequality and unemployment.

BIBLIOGRAPHY

Abbas, Q. & Foreman-Peck, J. 2008. Human capital and economic growth: Pakistan, 1960-2003.*The Lahore Journal of Economics*, 13(1):1-27. https://doi.org/10.35536/lje.2008.v13.i1.a1

Abel, S., Mhaka, N. & Le Roux, P. 2019. Human capital development and economic growth nexus. *The Southern African Business Review*, 23(1), #5128. doi: 10.25159/19988125/5128.

Abendin, S. & Duan, P., 2021. International trade and economic growth in Africa: The role of the digital economy. *Cogent Economics & Finance*, 9(1):1911767.

https://doi.org/10.1080/23322039.2021.1911767

Acemoglu, D. 2012. Introduction to economic growth. *Journal of Economic Theory*, 147(2). doi: 10.1016/j.jet.2012.01.023

Adawo, M.A. 2011. Has education (human capital) contributed to the economic growth of Nigeria? *Journal of Economics and International Finance*, 3(1):46-58.

Adedeji, O. & Campbell, O. 2013. The role of higher education in human capital development. doi:10.2139/ssrn.2380878

Adelakun, O.J. 2011. Human capital development and economic growth in Nigeria. *European Journal of Business and Management*, 3(9):29-38.

Africa Business Information. 2021. Budget2019: SA budget deficit to widen as it borrows R1.2bn a day. https://www.iol.co.za/business-report/budget/budget2019-sa-budgethttps://www.iol.co.za/business-report/budget/budget2019-sa-budget-deficit-to-widen-as-it-borrows-r12bn-a-day-full-speech-19404658deficitto-widen-as-it-borrows-r12bn-a-day-full-speech-19404658 Date of access 4 Aug. 2021.

Afzal, M., Farooq, M.S., Ahmad, H.K., Begum, I. & Quddus, M.A. 2010. Relationship between school education and economic growth in Pakistan: ARDL bounds testing approach to cointegration. *Pakistan Economic and Social Review*, 48(1):39-60.

Almfraji, M.A., Almsafir, M.K. & Yao, L. 2014. Economic growth and foreign direct investment inflows: The case of Qatar. *Procedia-Social and Behavioral Sciences*, 109:10401045. https://doi.org/10.1016/j.sbspro.2013.12.586

Akpolat, A.G. 2014. The long-term impact of human capital investment on GDP: A panel co-integrated regression analysis. *Economics Research International*, 2014(2014), art. #646518. https://doi.org/10.1155/2014/646518

Ali, M., Egbetokun, A. & Memon, M.H. 2018. Human capital, social capabilities and economic growth. *Economies*, 6(1): 2. https://doi.org/10.3390/economies6010002

Ali, S., Sharif Chaudhry, I. & Farooq, F. 2012. Human capital formation and economic growth in Pakistan. *Pakistan Journal of Social Sciences (PJSS)*, 32(1):229-240. https://www.bzu.edu.pk/PJSS/Vol32No12012/Final_PJSS-32-1-18.pdf Date of access: 14 Aug 2021.

Almajdob, M.S. & Marikan, D.A.A. 2019. Effect of education sector expenditure on economic growth in Arab Spring Countries. *International Journal of Academic Research in Business and Social Sciences*, 9(9):448-460. http://dx.doi.org/10.6007/IJARBSS/v9i9/6314

Almfraji, M.A., Almsafir, M.K. & Yao, L. 2014. Economic growth and foreign direct investment inflows: The case of Qatar. *Procedia-Social and Behavioral Sciences*, 109:10401045. https://doi.org/10.1016/j.sbspro.2013.12.586

Altiner, A. & Toktas, Y. 2017. Relationship between human capital and economic growth: An application to developing countries. *Eurasian Journal of Economics and Finance*, 5(3):87-98.

Anaduaka, U.S. 2014. Human capital development and economic growth: The Nigeria experience. *International Journal of Academic Research in Business and Social Sciences*, 4(4):25-35.

Anyanwu, J.C. 2014. Does intra-African trade reduce youth unemployment in Africa? *African Development Review*, 26(2):286-309. doi:10.1111/1467-8268.12082

Anyanwu, S.O. Adam, J.A., Obi, B. & Yelwa, M. 2015. Human capital development and economic growth in Nigeria. *Journal of Economics and Sustainable Development*, 6(14):16-26.

Appleton, S. & Teal, F. 1998. Human capital and economic development. *African Development Bank Group*.

Asghar, N., Awan, A. & Rehman, H.U. 2012. Human capital and economic growth in Pakistan: A cointegration and causality analysis. *International Journal of Economics and Finance*, 4(4):135-147. https://doi.org/10.5539/ijef.v4n4p135

Asghar, N. 2012. Human capital and economic growth in Pakistan: A cointegration and causality analysis. Pakistan: GC University. (Thesis: PhD).

Asteriou D. & Agiomirgianakis G. 2001. Human capital and economic growth. *Journal of Policy Modelling*, 23(5):481-489. doi:10.1016/S01618938(01)00054-0

Ayertey Odonkor, A., Asiedu-Nketiah, K., Brown, E.O.A. & Mamun Miah, M. 2018. Human capital development and economic growth in developing economies. *Social Science Research Network*, 52. doi:10.2139/ssrn.3305421

Aghion, P., Boustan, L., Hoxby, C. &Vandenbussche, J. 2009. The causal impact of education on economic growth: Evidence from US. *Brookings Papers on Economic Activity*, 1(1):1-73.

Babatunde, M.A. & Adefabi R.A. 2005. Long run relationship between education and economic growth in Nigeria: Evidence from Johansen cointegration approach.

Badat, S. 2016. Deciphering the meanings and explaining the South African higher education student protests of 2015-16. *Pax Academica* 1&2:71-106.

Bakare, A.S. 2006. The growth implication of human capital investment in Nigeria: An empirical study. *Journal of Economics and Social Studies*, 5.

Balcerzak, A.P. & Pietrzak, M.B. 2016. Quality of human capital in the European Union in the years 2004-2013: Application of structural equation modelling. *Institute of Economic Research Working Paper*s, 3(2016):7-26.

Baldwin, N. & Borrell, S. 2008. Education and economic growth in the United States: Cross national applications for an intra-national path analysis. *Policy Science*, 41(3):183-204. doi: 10.1007/s11077-008-9062-2

Barro, R.J. 1991. Economic growth in a cross-section of countries. *Quarterly Journal of Economics*, 106(2):407-443. https://doi.org/10.2307/2937943

Barro, R.J. 2001. Education and economic growth. *The contribution of human and social capital to sustained economic growth and well-being*, 79:13-41. https://www.oecd.org/education/innovation-education/1825455.pdf

Barro, R.J. 2003. Determinants of economic growth in a panel of countries. *Annals of Economics and Finance*, 4:231-274.

Bassanini, A. & Scarpetta, S. 2002. The driving forces of economic growth. OECD economic studies, 2001(2):9-56. http://dx.doi.org/10.1787/eco_studies-v2001-art10-en

Becker, G.S. 1962. Investment in human capital: A theoretical analysis. *Journal of Political Economy*, 70(5):9-49. https://www.jstor.org/stable/1829103 Date of access 13 Aug 2021.

Becker, G.S. 1994. Human capital revisited, In Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education. Available from NBER e-books: https://www.nber.org/books-and-chapters/human-capital-theoretical-and empiricalhttps://www.nber.org/books-and-chapters/human-capital-theoretical-and-empirical-analysis-special-reference-education-third-edition/human-capital-revisitedanalysisspecial-reference-education-third-edition/human-capital-revisited Date of access: 10 Aug 2021

Benhabib, J. & Spiegel, M.M. 2002. Human capital and technology diffusion. *Handbook of Economic Growth*, 1:935-966.

Benhabib, J. & Spiegel, M.M. 1994. The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary Economics*, 34(2):143-173. https://doi.org/10.1016/0304-3932(94)90047-7

Behrman, J. & Wolfe, B. 1984. The socio-economic impact of schooling in a developing country. *Review of Economics and Statistics*, 66 (2):296-303. https://doi.org/10.2307/1925831

Beskaya, A., Savas, F. & Samiloglu, F. 2010. The impact of education on economic growth in Turkey. *The Journal of Faculty of Economics and Administrative Science*, 15(3):43-62. https://mpra.ub.uni-muenchen.de/id/eprint/83017 Date of access 13 Aug 2021.

Bezabih, B. 2018. The impact of human capital on economic growth in Ethiopia: Evidence from Johansen co-integration approach. Halifaxz; St. Mary's University. (Dissertation-PhD). http://hdl.handle.net/123456789/3946

Bloom, D.E., Canning, D. & Sevilla, J. 2004. The effect of health on economic growth: A production function approach. *World Development*, 32(1):1-13. https://doi.org/10.1016/j.worlddev.2003.07.002

Bozzoli, 2016. 63% of NSFAS funded students drop out over five-year period. *Politics Web.* https://www.politicsweb.co.za/politics/63-of-nsfas-funded-students-drop-out-over-five-yea Date of Access: 1 April 2021.

Borensztein, E., Gregorio, J.D. & Lee, J.W. 1998. How does foreign direct investment affect economic growth? *Journal of International Economics*, 45(45):115-135. https://doi.org/10.1016/S0022-1996(97)00033-0

Bucci, A. & La Torre, D. 2009. Population and economic growth with human and physical capital investments. International Review of Economics, Springer, 56:17-27. doi: 10.1007/s12232-008-0054-5

Brunschwig, M.S., Sacerdoti, M.E. &Tang, M.J. 1998. The impact of human capital on growth: Evidence from West Africa. *International Monetary Fund Working paper, No. 98.* International Monetary fund.

Businesstech. 2021. South Africa unemployment: 1994-2019. https://businesstech.co.za/news/business/353051/ Date of access: 4 Aug 2021.

Businesstech. 2020. This is the school dropout rate in South Africa. https://businesstech.co.za/news/government/438509/this-is-the-school-drop-out-rate-inhttps://businesstech.co.za/news/government/438509/this-is-the-school-drop-out-rate-in-south-africa/southafrica/ Date of access: 4 Aug 2021.

Bulbulia. 2019. South-africa-urged-to-do-more-to-develop-its's-human-capital-base. *Engineering news.*https://www.engineeringnews.co.za/article/south-africa-urged-to-do-more-to-develophttps://www.engineeringnews.co.za/article/south-africa-urged-to-do-more-to-develop-its-human-capital-base-2019-06-19/rep_id:4136itshuman-capital-base-2019-06-19/rep_id:4136 Date of access: 1 April 2021.

Chen, Y. 2016. Spatial autocorrelation approaches to testing residuals from least squares regression. *PloS one*, 11(1), p.e0146865. doi: 10.1371/journal.pone.0146865

Chirwa, T.G. & Odhiambo, N.M. 2015. The macroeconomic drivers of economic growth in Malawi. *The Scientific Journal for Theory and Practice of Socio-economic Development*, 4(7):67-82. doi: dx.doi.org/10.12803/SJSECO.4712615

Chirwa, T.G. 2016. What drives long-run economic growth? Empirical evidence from South Africa. *International Economics*, 69(4):429-456. http://www.iei1946.it/upload/rivista_articoli/allegati/119_chirwaodhiamboric100517.pdf Date of access 13 Aug 2021.

City Press. 2018. Zuma's promise of fee free higher education and its rocky start. https://www.news24.com/citypress/news/zumas-promise-of-fee-free-higher-education-anditsrocky-start-20181226 Date of Access 4 Aug 2021.

Clemens, M.A., Kenny, C.J. & Moss, T.J. 2007. The trouble with the MDGs. *World Development*, 35(5):735-751. doi:10.1016/j.worlddev.2006.08.003

Crafts, N. & Woltjer, P., 2020. Growth accounting in economic history: findings, lessons and new directions. *Journal of Economic Surveys*, 35(5). doi: http://dx.doi.org/10.1111/joes.12348

Cuthbert, K. & Gasparo, D. 1995. Fixed investment in UK manufacturing: The importance of Tobin Q output debt. *The Journal of European Economic Review*, 30(6):919-941. https://doi.org/10.1016/0014-2921(93)E0131-4

Dakhli, M. & De Clercq, D. 2004. Human capital, social capital, and innovation: a multi-country study. *Entrepreneurship & Regional Development*, 16(2):107-128. doi: 10.1080/0898562041000167783 5

Dauda, R.O. 2010. Role of human capital in economic development: An empirical study of Nigerian case. *Oxford: Oxford Business and Economics Conference Program*. doi: 10.12691/ajams-8-1-1

Denison, E.F. 1962. The sources of economic growth in the United States and the alternatives before US. *Committee for Economic Development*, Supplementary paper, No.13. doi: https://doi.org/10.1017/S0770451800028694

Denison, E.F. 1967. Why growth rates differ: Postwar experience in nine western countries. Available from Potchefstroom campus library: https://sierra.nwu.ac.za/record=b1195057~S3 Date of access 10 Aug 2021.

Dinkneh, G.B. & Jiang Y. 2015. The impact of human capital in economic growth of Ethiopia, *Journal of Economics and Sustainable Development,* 6(16). https://www.iiste.org/Journals/index.php/JEDS/article/view/25300/25900 Date of access: 14 Aug 2021.

Dissou Y., Didic S. & Yakautsava T. 2016. Government spending on education, human capital accumulation, and growth. *Economic Modelling Econ papers,* 8(C):9-21. doi:10.1016/j.econmod.2016.04.015

Dixit, S., Mandal, S.N., Sawhney, A. & Singh, S. 2017. Relationship between skill development and productivity in construction sector: A literature review. *International Journal of Civil Engineering and Technology,* 8:649-665. https://core.ac.uk/download/pdf/143476427.pdf Date of access: 15 Aug 2021.

Du Plessis, S. & Smit, B. 2005. Economic growth in South Africa since 1994. *University of Stellenbosch Economic Working paper,* No 1. Stellenbosch: University of Stellenbosch.

De Jager, E. & Baard, R. 2019. Does 'free' higher education in South Africa make economic sense? Views of commerce students. *South African Journal of Higher Education,* 33(6):70-91. http://dx.doi.org/10.20853/33-6-3084

De Jager, J.L. 2005. *Aspects of growth empirics in South Africa. Pretoria:* University of Pretoria. (Thesis-PhD). http://hdl.handle.net/2263/23183

De Mello, J.R. & Luiz, R. 1997. Foreign direct investment in developing countries and growth: A selective survey. *The Journal of Development Studies, 34*(1):1-34. https://doi.org/10.1080/00220389708422501

Department of Education (South Africa). 1997. A programme for the transformation of higher education. *Department of Education White Paper, No.3*. Pretoria: Government Printers.

Department of Research and Information (South Africa). 2020. An overview of key trends since1994.https://www.idc.co.za/wp-content/uploads/2018/11/IDC-RI-publication-Overview-of-

keyhttps://www.idc.co.za/wp-content/uploads/2018/11/IDC-RI-publication-Overview-of-key-trends-in-SA-economy-since-1994.pdftrendsin-SA-economy-since-1994.pdf Date of access: 28 Feb. 2021.

De Wet, C. & Wolhuter, C. 2009. A transitiological study of some South African educational issues. *South African Journal of Education*, 29(3). doi: 10.15700/saje.v29n3a272

De Vries, V. 1974. Commission of enquiry into South African university funding. Pretoria: Government Printers.

Edrees, A. 2016. Human capital, infrastructure and economic growth in Arab world: A panel granger causality analysis. *Business and Economics Journal,* 7(201). doi: 10.4172/21516219.1000201

Eigbiremolen, G.O. & Anaduaka, U.S. 2014. Human capital development and economic growth: The Nigeria experience. *International Journal of Academic Research in Business and Social Sciences,* 4(4):25-35.

Evenson, R.E. & Singh, L. 1997. Economic growth, international technological spillovers and public policy: Theory and empirical evidence from Asia. Yale University working paper, No. 777. Connecticut: Yale University.

Ezeoha, A.E. & Cattaneo, N. 2012. FDI flows to sub-Saharan Africa: The impact of finance, institutions, and natural resource endowment. *Comparative Economic Studies*, *54*(3):597-632. https://doi.org/10.1057/ces.2012.18

Fadhil, M.A. & Almsafir, M.K., 2015. The role of FDI inflows in economic growth in Malaysia (time series: 1975-2010). *Procedia Economics and Finance,* 23:1558-1566. doi:10.1016/S2212-5671(15)00498-0

Fedderke, J.W. 2005. Technology, human capital and growth. *Economic Research Southern Africa working paper, No.27.* Cape Town: University of Cape Town.

Feenstra, R., Inklaar R. & Timmer, M. 2015.The next generation of the Penn World Table. *American Economic Review,* 105(10):3150-3182. doi: 10.1257/aer.20130954

Fiske, E. & Ladd, H. 2006. Racial equity in education: How far has South Africa come? *Perspectives in Education Working paper series* No. 24(2):95-108.

Fiszbein, A. & Psacharopoulos, G. 1993. A cost-benefit analysis of educational investment in Venezuela: 1989 Update. *Economics of Education Review*, 12(4):293-298. doi:10.1016/02727757(93)90063-M

Fleischhauer, K.J. 2007. A review of human capital theory: Microeconomics. *University of St. Gallen, Department of Economics Discussion Paper, No. 1*. University of St. Gallen

Frankel, J.A. & Smit, B. & Sturzenegger, F. South Africa: Macroeconomic challenges after a decade of success. *Economics of Transition*, 16(4):639-677. http://dx.doi.org/10.1111/j.1468-0351.2008.00341.x

Gamede, N.W. 2017. Human capital development in South Africa: perspectives on education in the post-apartheid era. South Africa: University of South Africa. (Dissertation – MCom).

Gebrehiwot, K.G. 2015. The impact of human capital development on economic growth in Ethiopia: Evidence from ARDL approach to co-integration. *American Journal of Trade and Policy*, 1(3):127-136. doi:10.18034/AJTP.V1I3.552

Ghirdari, E. 2016. International bond market portfolio diversification in an emerging financial market. Johannesburg: University of Johannesburg. (Dissertation: PhD).

Ghosh Dastidar, S., Mohan, S. & Chatterji, M. 2013. The relationship between public education expenditure and economic growth: The case of India. *Scottish Institute for Research in Economics*, SIRE Discussion Papers 2013-07

Gillies, D. 2011. State education as high-yield investment: Human capital theory in European policy discourse. *Journal of Pedagogy*, 2(2):224-245. https://doi.org/10.2478/v10159-011-00113

Grant, C. 2017. The contribution of education to economic growth. *Institute of Development Studies.*1-25

Gujarati, D.N. 2004. Basic econometrics. 4th ed. New York: McGraw-Hill International Editions.

Gyimah-Brempong, K. & Wilson, M. 2005. Human capital and economic growth. Is Africa different? *Journal of African Development*, 7(1):73-109. https://www.jstor.org/stable/10.5325/jafrideve.7.1.0073 Date of access: 14 Aug 2021.

Gyimah-Brempong, K., Paddison, O. & Mitiku, W. 2006. Higher education and economic growth in Africa. *The Journal of Development Studies,* 42(3):509-529. doi: 10.1080/00220380600576490

Hanif, N. & Arshed, N. 2016. Relationship between school education and economic growth: SAARC countries. *International Journal of Economics and Financial Issues,* 6(1):294-300.

Hanushek, E.A. 2013. Economic growth in developing countries: The role of human capital. *Economics of Education Review*, 37:204-212. doi: 10.1016/j.econedurev.2013.04.005

Hanushek, E.A. & Woessmann, L. 2008. The role of cognitive skills in economic development. *Journal of Economic Literature,* 46(3):607-68. doi: 10.1257/jel.46.3.607

Hawkes, C. &Webster, J. 2012. National approaches to monitoring population salt intake: A trade-off between accuracy and practicality? PLoS ONE, 7(10). https://doi.org/10.1371/journal.pone.0046727

Hussin, M.Y.M., Muhammad, F., Hussin, M.A. & Razak, A.A. 2012. The relationship between oil price, exchange rate and Islamic stock market in Malaysia. *Research Journal of Finance and Accounting*, 3(5):83-92. https://www.iiste.org/Journals/index.php/RJFA/article/view/2127/2108. Date of access: 14 Aug 2021.

Hussain, M.N., Mlambo, K. & Oshikoya, T. 1999. Global financial crisis: An African perspective. *African Development Review*, 11(2):199-232.

Independent Evaluation Group, 2017. *Higher Education for Development: An Evaluation of the World Bank Group's Support*. World Bank.

Isola, W.A. & Alani, R.A. 2012. Human capital development and economic growth: Empirical evidence from Nigeria. *Asian Economic and Financial Review*, 2(7):813. http://www.aessweb.com/pdf-files/813-827.pdf Date of access: 14 Aug 2021

Iwegbunam, I.A. 2017. Government expenditure and economic growth in South Africa: Causality and cointegration nexus. South Africa: University of South Africa. (Thesis – PhD).

Jaiyeoba, S.V. 2015. Human capital investment and economic growth in Nigeria. *African Research Review*, 9(1):30-46. doi: 10.4314/afrrev.v9i1.4

Jansen, J. & Taylor, N. 2003. *Educational change in South Africa 1994-2003: Case studies in large-scale education reform*. The World Bank.

Johnson, O.A. 2011. Human capital development and economic growth in Nigeria. *European Journal of International Management*, 3(9):29-37. https://www.researchgate.net/publication/333907318_Human_Capital_Development_and_Economic_Growth_in_Nigeria Date of access: 14 Aug 2021.

Joshua, U., Babatunde, D. & Sarkodie, S.A. 2021. Sustaining economic growth in Sub-Saharan Africa: Do FDI inflows and external debt count? *Journal of Risk and Financial Management*, 14(4):146. https://doi.org/10.3390/jrfm14040146

Kapingura, F.M. 2010. Econometric determinants of liquidity of the South African bond. South Africa: University of Fort Hare. (Thesis – MSc).

Karabona, P. & Koutun, A., 2013. An empirical study of the Solow growth model. http://www.diva-portal.org/smash/get/diva2:633334/FULLTEXT01.pdf Date of access: 14 Aug 2021.

Karambakuwa, R.T., Ncwadi, R. & Phiri, A. 2020. The human capital-economic growth nexus in SSA countries: what can strengthen the relationship? *Nelson Mandela University Working paper, No. 1905*. Port Elizabeth: Nelson Mandela University.

Karambakuwa, R.T., Ncwadi, R. & Phiri, A., 2020. The human capital-economic growth nexus in SSA countries: What can strengthen the relationship?. *International Journal of Social Economics*, 47(9):1143-1159. https://doi.org/10.1108/IJSE-08-2019-0515

Keita, L., 2016. Models of economic growth and development in the context of human capital investment: The way forward for Africa. *Africa Development*, 41(1):23-48. doi:10.4314/AD.V41I1

Kiran, B. 2014. Testing the impact of educational expenditures on economic growth: New evidence from Latin American countries. Quality & Quantity. *International Journal of Methodology*, 48(3):1181-1190. https://doi.org/10.1007/s11135-013-9828-2

Klenow, P.J. & Rodriguez-Clare, A. 1997. The neoclassical revival in growth economics: Has it gone too far? *NBER Macroeconomics Annual*, 12:73-103.

Knoema. 2021. Expenditure-per-student-in-secondary-education. https://knoema.com/atlas/South-Africa/topics/Education/Expenditures-onEducation/Expenditure-per-student-in-secondary-education Date of access: 1 April 2021.

Kotsantonis, S. & Serafeim, G. 2020. Human capital and the future of work: Implications for investors and ESG integration. *Journal of Financial Transformation*, 51:115-130.

Lee, C.G. 2010. Education and economic growth: Further empirical evidence. *European Journal of Economics, Finance and Administrative Sciences*, 23(2010). https://www.researchgate.net/publication/279654315_Education_and_economic_growth_Further_empirical_evidence Date of access: 15 Aug 2021.

Leshoro, T.M. 2008. The financial crisis at historically black universities in South Africa: An analysis of the policy debates with specific reference to the University of the Western Cape. Western Cape: University of Western Cape. (Dissertation – PhD).

Levine, R. & Renelt, D. 1992. A sensitivity analysis of cross-country growth regressions. *The American Economic Review*, 82(4):942-963.

Lucas Jr, R.E. 1988. On the mechanics of economic development. *Journal of Monetary Economics*, 22(1):3-42. https://doi.org/10.1016/0304-3932(88)90168-7

Lui, G. 2007. Growth theory and application: The case of South Africa. *University of Pretoria Working Paper*. Pretoria: University of Pretoria.

Lyakurwa, W.M. 2007. Human capital and technology for development: Lessons for Africa. In African Development Bank-AfDB Annual Meetings Symposium Shanghai *(PowerPoint). https://www.afdb.org/fileadmin/uploads/afdb/Documents/Knowledge/19832270-EN-MR-LYAKURWA-HUMAN-CAPITAL-AND-TECHNOLOGY-FOR-DEVELOPMENT.PDF* Date of access: 10 Aug 2021.

Mabuza, N.H. 2020. Dropout causes of students funded by the National Student Financial Aid Scheme in South African universities. South Africa. (Dissertation – PhD).

Macrotrends. 2021. South Africa Education spending 2001-2021. https://www.macrotrends.net/countries/ZAF/south-africa/education-spending Date of access: 4 Aug 2021.

Maddala, G.S. & Lahiri K. 2009. Introduction to Econometrics. 4th ed. West Sussex: John Wiley and Sons Ltd.

Maistry, S. 2014. Education for economic growth: A neoliberal fallacy in South Africa. *Alternation*, 21(1):57-75.

Maitra, B. 2016. Investment in human capital and economic growth in Singapore. *Sage Journals*, 17(2). https://doi.org/10.1177/0972150915619819

Maitra, B. & Mukhopadhyay, C.K. 2012. Public spending on education, health care and economic growth in selected countries of Asia and the Pacific. *Health Care and Economic Growth in Selected Countries of Asia and the Pacific*, 19(2):48. https://www.unescap.org/sites/default/files/chap-2-Maitra.pdf Date of access: 14 Aug 2021.

Makaula, N.M. 2014. The impact of human capital development on economic growth in South Africa. South Africa: University of Fort Hare. (Dissertation – PhD).

Mankiw, N.G., Romer, D. & Weil, D.N. 1992. A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, 107(2):407-437. https://doi.org/10.2307/2118477

Meyer, D.F. & Sanusi, K.A. 2019. A causality analysis of the relationships between gross fixed capital formation, economic growth and employment in South Africa. *Studia Universitatis Babes-Bolyai Oeconomica*, 64(1):33-44. https://doi.org/10.2478/subboec-2019-0003

Meyer, D.F. & Sanusi, K.A. 2019. a causality analysis of the relationships between gross fixed capital formation, economic growth and employment in South Africa. *Studia Universitatis Babeș-Bolyai Oeconomica, Sciendo.* 64(1):33-44. doi: 10.2478/subboec-2019-0003

Mehrara, M. & Musai, M. 2013. The relationship between economic growth and human capital in developing countries. *International Letters of Social and Humanistic Sciences*, 5(55):55-62. doi:10.18052/www.scipress.com/ILSHS.5.55

Mincer, J. & Polachek, S. 1974. Family investments in human capital: Earnings of women. *Journal of Political Economy, 82*(2):76-108. https://www.jstor.org/stable/1829993 Date of access: 14 Aug 2021.

Mincer, J. 1958. Investment in human capital and personal income distribution. *Journal of Political Economy*, 66(4): 281-302. www.jstor.org/stable/1827422. Date of access: 10 Aug 2021.

Mincer, J. 1981. Human capital and economic growth. *National Bureau of Economic Research Working paper, No.803.* Cambridge: Massachusetts.

Milanzi, S.A. 2018. Human capital investment's contribution towards economic growth in Malawi. *International Conference on Public Administration and Development Alternatives.* http://hdl.handle.net/10386/2238

Mlachila, M.M. & Moeletsi, T. 2019. Struggling to make the grade: A review of the causes and consequences of the weak outcomes of South Africa's education system. *IMF Working Paper No. 19/47.* South Africa.

Mohan, G. &Lampert, B. 2013. Negotiating china: reinserting African agency into China-Africa relations. *African Affairs*, 112(446):92-110. doi: https://doi.org/10.1093/afraf/ads065

Mutabazi, E. 2017. Human capital development and economic growth in Rwanda: Time series analysis. Rwanda: University of Rwanda. (Thesis – MSc).

Mutambirwa, E. 2016. The impact of human capital investment on economic growth: The case of South Africa. South Africa: University of Fort Hare. (Thesis: MCom).

Muradzikwa, S. 2002. What are the implications of the SADC Protocol for the clothing and textile sector in Southern Africa? *Development and Poverty Research Unit Working Paper.* Cape Town: University of Cape Town.

Muradzikwa, S. 2000. Prospects for the clothing and textile industry in Zimbabwe: The implications of the SADC trade protocol. Discussion paper, DPRU, University of Cape Town, Cape Town, South Africa.

Murray, M. 2016. Does poor quality schooling and/or teacher quality hurt black South African students enrolling for a degree at the University of KwaZulu-Natal? *PloS One,* 11(4):p.e0153091. https://doi.org/10.1371/journal.pone.0153091

Nafukho, F.M., Hairston, N. & Brooks, K. 2004. Human capital theory: Implications for human resource development. *Human Resource Development International*, 7(4):545-551. https://doi.org/10.1080/1367886042000299843

National Commission on Higher Education (South Africa). 1996. A framework for transformation. Pretoria: Government Printers.

Ng-Kamstra, J.S., Greenberg, S.L., Abdullah, F., Amado, V., Anderson, G.A., Cossa, M., Costas-Chavarri, A., Davies, J., Debas, H.T., Dyer, G.S. & Erdene, S. 2016. Global surgery 2030: A roadmap for high income country actors. *BMJ Global Health*, 1(1). doi: 10.1136/bmjgh2015-000011

Njoku, J.U. & Onyegbula, J.C., 2017. Human capital development as a strategy for sustainable development in the Nigerian education system. *African Research Review*, *11*(2):178-189. doi: 10.4314/afrrev.v11i2.13

Nour, S.S.O.M. 2012. Assessment of science and technology indicators in Sudan. *Science, Technology and Society*, 17(2):323-354. doi:10.1177/097172181101700206

Nowak, A.Z. & Dahal, G. 2016. The contribution of education to economic growth: Evidence from Nepal. *International Journal of Economic Sciences*, 5(2):22-41. doi: 10.20472/ES.2016.5.2.002

Ogundari, K. & Awokuse, T. 2018. Human capital contribution to economic growth in Sub-Saharan Africa: Does health status matter more than education*? Economic Analysis and Policy*, 58(2018):131-140. doi:10.1016/j.eap.2018.02.001

Ogunniyi, M.B. 2018. Human capital formation and economic growth in Nigeria: A time bound testing approach (1981-2014). *African Educational Research Journal*, 6(2):80-87. doi: 10.30918/AERJ.62.17.046

Oketch, M.O. 2006. Determinants of human capital formation and economic growth of African countries. *Economics of Education Review*, 25(5):554-564. https://doi.org/10.1016/j.econedurev.2005.07.003

Olayemi, S.O. 2012. Human capital investment and industrial productivity in Nigeria. *International Journal of Humanities and Social Science*, 2(16):298-307.

Oloo, D., Machuki, E., Momanyi, E., Ogwangi, F. & Ochieng, F. 2013. Human capital development and economic growth in Kenya (1981-2011). Kenya: University of Nairobi. (BCom Thesis).

Oluwatobi, S.A. & Ogunrinola, I.O. 2011. Government expenditure on human capital development: Implications for economic growth in Nigeria. *Journal of Sustainable Development,* 4(3). **doi:**10.5539/jsd.v4n3p72

Oluwatobi, S.O., Olurinola, I.O. & Taiwo, O. 2016. Human capital development in SubSaharan Africa: The role of ICT. *Journal of Economics Studies and Research*, 2016:1-11. A# 564389. doi: 10.5171/2016.564389

Organisation for Economic Co-operation and Development (OECD). 2020. Education at a Glance. *OECD Indicators*. https://doi.org/10.1787/19991487

Organisation for Economic Co-operation and Development (OECD). 2013. New sources of growth: Knowledge-based capital key analyses and policy conclusions. https://www.oecd.org/sti/inno/knowledge-based-capital-synthesis.pdf Date of access: 10 Aug 2021

Organisation for Economic Co-operation and Development (OECD). 2008. Reviews of national policies for education: South Africa 2008. *Reviews of National Policies for Education, OECD Publishing, Paris*. https://doi.org/10.1787/9789264053526

Osiobe, E.U. 2019. A literature review of human capital and economic growth. *Business and Economic Research*, 9(4):179-196. doi:10.5296/ber.v9i4.15624

Our World in Data. 2021. Education in government expenditure. England: Our World in Data. https://ourworldindata.org/grapher/share-of-education-in-government-expenditure Date of access: 14 April 2021.

Owusu-Nantwi, V. 2015. Education expenditures and economic growth: Evidence from Ghana. *Education*, 6(16):1-6. https://core.ac.uk/download/pdf/234647197.pdf Date of access 14 Aug 2021.

Pegkas, P. 2014. The link between educational levels and economic growth: A neoclassical approach for the case of Greece. *International Journal of Applied Economics*, 11(2):38-54.

https://www2.southeastern.edu/orgs/ijae/index_files/IJAE%20SEPT%202014%20PEGKAS%207-30-2014%20RV.pdf Date of access: 14 Aug 2021.

Pegkas, P. & Tsamadias, C .2014. Does higher education affect economic growth? The case of Greece. *International Economic Journal*, 28(3):425-444. https://doi.org/10.1080/10168737.2014.89455

Rahman, A. 2015. Impact of foreign direct investment on economic growth: Empirical evidence from Bangladesh. *International Journal of Economics and Finance*, 7(2):178-185. doi:10.5539/ijef.v7n2p178

Rahman, M.M. 2011. Causal relationship among education expenditure, health expenditure and GDP: A case study for Bangladesh. *International Journal of Economics and Finance*, 3(3):149-159. doi:10.5539/IJEF.V3N3P149

Ramirez, A., Ranis, G. & Stewart, F. 1997. Economic growth and human development. Centre Discussion Paper No 787. http://hdl.handle.net/10419/98286

Ranis, G. 2004. Human development and economic growth. Economic growth center, *Yale University. Centre discussion paper no. 887*. Connecticut: Yale University.

Rauch, J.E. 1993. Productivity gains from geographic concentration of human capital: Evidence from the cities. *Journal of Urban Economics*, 34(3):380-400. https://doi.org/10.1006/juec.1993.1042

Riihelaninen, J. M. 2013. Government education expenditure in the European Union during the economic crisis (2008-2011). *Education, Audiovisual and Culture Executive Agency*, 669(1-8). doi:10.2797/24338

Romer, P. 1994. New goods, old theory, and the welfare costs of trade restrictions. *Journal of DEVELOPMENT Economics*, 43(1):5-38. https://doi.org/10.1016/0304-3878(94)90021-3

Romer, P.M. 1986: Increasing returns and long run growth. *Journal of Political Economy*, 94:1002-1037. http://dx.doi.org/10.1086/261420

Romer, P.M. 1989. Human capital and growth: theory and evidence. National Bureau of Economic Research Working paper, No. 3173. Cambridge: Massachusetts. *doi:10.3386/w3173*

Romer, P.M. 1990. Capital, labor, and productivity. *Brookings papers on economic activity. Microeconomics*, 21(1990): 337-367. https://www.brookings.edu/wp-content/uploads/1990/01/1990_bpeamicro_romer.pdf Date of access: 15 Aug 2021.

Romer, P.M. 1990. Endogenous technological change. *Journal of Political Economy*, 98:71-102. https://www.jstor.org/stable/2937632 Date of access: 15 Aug 2021.

Romer, P.M. 1994. The origins of endogenous growth. *Journal of Economic Perspectives, 8*(1):3-22. doi: 10.1257/jep.8.1.3

Sakellariou, C.N. & Patrinos, H.A., 2004. Economic volatility and returns to education in Venezuela: 1992-2002. *The World Bank*. http://hdl.handle.net/10986/14198

Sala-i-Martin, X., Doppelhofer, G. & Miller, R.I. 2004. Determinants of long-term growth: A Bayesian averaging of classical estimates (BACE) approach. *American Economic Review*, 94(4):813-835. doi: 10.1257/0002828042002570

Sankay, O.J., Ismail, R. & Shaari, A.H. 2010. The impact of human capital development on the economic growth of Nigeria. *Prosiding Perkem V, Jilid*, 1:63-72. https://www.ukm.my/fep/perkem/pdf/perkemV/PERKEM2010-1-07.pdf Date of access: 14 Aug 2021.

Sarkar, D. 2007. The role of human capital in economic growth revisited. *Applied Economics Letters*, 14(6):419-423. https://doi.org/10.1080/13504850500447323

Savvides, A. & Stengos, T. 2020. Human capital and economic growth. *Stanford University Press*. https://doi.org/10.1515/9780804769761

Schultz, T.W. & Schultz, T.W. 1982. Investing in people: The economics of population quality. *Agricultural Journal of Economics*, 65(1):99-200. https://doi.org/10.2307/1240372

Schultz, T.W. 1961. Investment in human capital. *The American Economic Review*, 51(1):1-17. https://www.jstor.org/stable/1818907 Date of access: 15 Aug 2021.

Schultz, T.W. 1971. Investment in human capital. The role of education and of research. *The American Economic Review*, 39(2):294 https://doi.org/10.1017/S0770451800009829

Schultz, T.W.1963. The economic value of education. New York: Columbia University Press.

Schwab, K. 2017. The global competitiveness report. http://www3.weforum.org/docs/GCR20162017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf Date of access: 15 Aug 2021.

Sen, A. 1983. Development: Which way now? *The Economic Journal*, 93:745-762. https://doi.org/10.2307/2232744

Shahzad, F. 2015. Role of human capital on economic growth: A case study of Pakistan. *International Journal of Accounting and Economics Studies*, 3(1):20-24. doi:10.14419/ijaes.v3i1.4120

Shaihani, M., Harisb, A., Ismaila, N. & Saida, R. 2011. Long run and short run effects on education levels: Case in Malaysia. *International Journal of Economic Research*, *2*(6):77-87. http://ijeronline.com/documents/volumes/Vol%202%20issue%206/ijer20110206ND(10)a.pdf Date of access: 15 Aug 2021.

Sharma, P. & Sahni, P. 2015. Human capital and economic growth in India: A co-integration and causality analysis. *Ushus Journal of Business Management*, 14(2):1-18. https://doi.org/10.12725/ujbm.31.1

Shrivastava, M. & Shrivastava, S. 2014. Political economy of higher education: comparing South Africa to trends in the world. *Higher Education*, 67(6):809-822. doi:10.1007/s10734-013-9709-6

Siddiqui, A. & Rehman, A. 2017. The human capital and economic growth nexus: in East and South Asia. *Applied Economics*, 49(28):2697-2710. https://doi.org/10.1080/00036846.2016.1245841

Sinnathurai, V. 2013. An empirical study on the nexus of poverty, GDP growth, dependency ratio and employment in developing countries. *Journal of Competitiveness*. doi:10.7441/joc.2013.02.05

Siraj, T. 2012. Official development assistance (ODA), public spending and economic growth in Ethiopia. *Journal of Economics and International Finance*, 4(8):173-191. https://doi.org/10.5897/JEIF11.142

Smith, A. 1776. An inquiry into the nature and causes of the wealth of nations: Volume One. London: printed for W. Strahan; and T. Cadell, 1776.

Solow R. 1956. A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, 70(1):65-94. https://doi.org/10.2307/1884513

Solow, R. 1956. Technical change and the aggregate production function. *Review of Economics and Statistics*, 39:312-320. https://doi.org/10.2307/1926047

Sulaiman, C., Bal, U., Tijani, B.A., Waziri, S.T. & Maji, I.K., 2015. Human capital, technology, and economic growth: Evidence from Nigeria. *SAGE Open*, 5(4).

South African Market Insights. 2018. *Education Statistics*. https://www.southafricanmi.com Date of access: 4 Aug 2021.

Statistics South Africa (StatsSA). 2020. Mid-year population estimates. Pretoria: Statistics South Africa. http://www.statssa.gov.za/?p=13453 Date of access: 4 Aug 2021.

Statistics South Africa (StatsSA). 2020. Economy slips into recession. Pretoria: Statistics South Africa. http://www.statssa.gov.za/?p=13049. Date of access: 4 Aug 2021.

Statistics South Africa (StatsSA). 2020. Gross domestic product (GDP), 4th quarter 2010. http://www.statssa.gov.za/?page_id=1854&PPN=P0441&SCH=7695 Date of access: 15 Feb.2021.

Statistics South Africa (StatsSA). 2021. Inflation rate. Pretoria: Statistics South Africa. http://www.statssa.gov.za/?p=13930 Date of access: 4 Aug 2021.

Statistics South Africa (StatsSA). 2020. Youth still find it difficult to secure jobs in South Africa. Pretoria: Statistics South Africa. http://www.statssa.gov.za/?p=14415 Date of access: 4 Aug 2021.

Steyn, A.G.W. & De Villiers, A.P. 2007. Public funding of higher education in South Africa by means of formulae. *Council on Higher Education (Ed). Review of Higher Education in South Africa. Selected Themes, 11-51.* Pretoria: Council on Higher Education.

Steyn, A.G.W. & De Villiers, A.P. 2006. The impact of changing funding sources on higher education institutions in South Africa. *Research Report for the Council of Higher Education. Higher Education Monitor, No.4.* Pretoria: Council on Higher Education.

Styger, A. 2014. Evaluating the South African higher education government funding framework. Potchefstroom: North-West University. (Dissertation – PhD).

Swan, T.W. 1956. Economic growth and capital accumulation. *Economic Record*, 32(63):334-361. https://doi.org/10.1111/j.1475-4932.1956.tb0043

Sweetland, S.R. 1996. Human capital theory: Foundations of a field of inquiry. *Review of Educational Research*, 66(3), pp.341-359. https://doi.org/10.2307/1170527

Taban, S. & Kar, M. 2006. Beşeri sermaye ve ekonomik büyüme: Nedensellik analizi 19692001. *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, 6(1):159-182. https://doi.org/10.1501/SBFder_0000001652

Taylor, N. & Jasnen, J. 2003. Educational change in South Africa 1994-2003: Case studies in large-scale education reform. *Country Studies Education Reform and Management Publication Series*, 2(1):1-47. https://www.jet.org.za/resources/Jansen%20and%20Taylor_World%20Bank%20report.pdf/view Date of access: 15 Aug 2021.

The Global Economy. 2020. Economic growth. South Africa: The global economy. https://www.theglobaleconomy.com/South-Africa/Economic_growth/ Date of access: 28 Feb 2021.

The Global Economy. 2020. Education spending as percentage of GDP. https://www.theglobaleconomy.com/South-Africa/Education_spending/ Date of access: 28 Feb 2021.

The Global Economic. 2021. South Africa education spending, percent of GDP-data, chart. https://www.theglobaleconomy.com/South-Africa/Education_spending/ Date of access: 4 Aug 2021.

The Global Economy. 2021. South Africa: Economic growth: The rate of change of real GDP. https://www.theglobaleconomy.com/South-Africa/Economic_growth/ Date of access: 1 April 2021.

The Global Economy. 2021. South Africa: Primary school enrolment. https://www.theglobaleconomy.com/South-Africa/Primary_school_enrollment/ Date of access: 1 April 2021.

Tilak, J.B. 1997. The dilemma of reforms in financing higher education in India. *Higher Education Policy*, 10(1):7-21. https://doi.org/10.1016/S0952-8733(96)00031-1

Udi, J., Bekun, F.V. & Adedoyin, F.F., 2020. Modeling the nexus between coal consumption, FDI inflow and economic expansion: Does industrialization matter in South Africa? *Environmental Science and Pollution Research*, 1-12. https://doi.org/10.1007/s11356-020-07691-x

Umut, G. 2015. Impact of human capital on economic growth: A panel data analysis. *Marmara University*.https://www.academia.edu/1142114/impact_of_human_capital_on_economic_growth_a_panel_data_analysis Date of access: 15 Aug 2021.

Üngör, U.Ü. 2012. The making of modern Turkey: nation and state in Eastern Anatolia, 19131950. Oxford University Press on Demand. doi:10.1093/acprof:oso/9780199603602.001.0001

United Nations Children's Fund. 2018. Education Budget Brief South Africa. https://www.unicef.org/esaro/UNICEF-South-Africa-2018-Education-Budget-Brief.pdf Date of access: 14 Aug 2021.

UNDP. 2009. Human Development Report 2009: Overcoming barriers: Human mobility and development. http://hdr.undp.org/en/content/human-development-report-2009 Date of access 14 Aug 2021.

Van der Berg, S., Burger, C., Burger, R., De Vos, M., Du Rand, G. & Gustafsson, M. 2011. Low quality education as a poverty trap. *Stellenbosch Economic Working Papers, No. 25/11*. Stellenbosch: University of Stellenbosch.

Van der Berg, S., Taylor, S., Gustafsson, M., Spaull, N. & Armstrong, P. 2011. Improving education quality in South Africa. *Report for the National Planning Commission*, 2:1-23.

Van Zyl, G. & Bonga-Bonga, L. 2009. Fiscal stimulation of human capital and resultant economic growth in South Africa. *SA Journal of Human Resource*, 6(3):1-6. doi:10.4102/sajhrm.v6i3.112

Van Greunen, J., Heymans, A., Van Heerden, C. & Van Vuuren, G. 2014. The prominence of stationarity in time series forecasting. *Studies in Economics and Econometrics*, 38(1):1-16. doi:10.1080/10800379.2014.12097260

Wang, K.M. 2011. Health care expenditure and economic growth: Quantile panel-type analysis. *Economic Modelling*, 28(4):1536-1549. https://doi.org/10.1016/j.econmod.2011.02.008

Wangenge-Ouma, G. & Cloete, N. 2008. Financing higher education in South Africa: Public funding, non-government revenue and tuition fees. *South African Journal of Higher Education*, 22(4):906-919. doi: 10.4314/sajhe.v22i4.25824

Weiss, Y. & Fershtman, C. 1998. Social status and economic performance: A survey. *European Economic Review*, 42(5):801-820. https://doi.org/10.1016/S0014-2921(97)00137-2

Wideman, M.A. 2008. Academic dishonesty in postsecondary education: A literature review. Transformative dialogues: *Teaching & Learning Journal*, 2(1):1-12.

Wildschut, A., Mncwango, B., Rogan, M., Rust, J., Fongwa, S. & Meiring, L. 2018. The National Student Financial Aid Scheme (NSFAS) and its impact: Exploring the absorption into employment of NSFAS-funded graduates. *Human Research Council.* doi:10.13140/RG.2.2.30412.26242

Wilson, R.A., Briscoe, G. & Coles, M. 2004. The impact of human capital on economic growth: A review. Impact of education and training Third report on vocational training research in Europe: background report. https://www.cedefop.europa.eu/files/BgR3_Wilson.pdf Date of access: 15 Aug 2021.

Wilson, M.K. & Vencatachellum, D.J.M. 2016. Determinants of cross-border mergers and acquisitions targeting Africa: *Economic Research Southern Africa Working paper, No. 600.* South Africa: Economic Research Southern Africa.

Wood, S.L. 2010. Technology for teaching and learning: Moodle as a tool for higher education. *International Journal of Teaching and Learning in Higher Education*, 22(3):299-307.

World Bank. 2020. World development indicators: https://databank.worldbank.org/source/worlddevelopment-indicators Date of access: 28 Feb. 2021.

World Bank. 2020. GDP (current US$) South Africa. Washington: World Bank. https://data.worldbank.org/indicator/ny.gdp.mktp.cd?locations=ZA Date of access: 4 Aug 2021.

World Bank. 2021. GDP growth (annual %): South Africa. Washington: World Bank. https://databank.worldbank.org/source/world-development-indicators#https://databank.worldbank.org/source/world-development-indicators Date of access: 14 April 2021.

Zerihun, T. 2014. Human capital and economic growth: Causality and co-integration analysis. Jimma University. (Dissertation – PhD).

Zhang, C. & Zhuang, L. 2011. The composition of human capital and economic growth: Evidence from China using dynamic panel data analysis. *China Economic Review*, 22(1):165171. https://doi.org/10.1016/j.chieco.2010.11.001

Zivengwa, T., Hazvina, F., Ndedzu, D. & Mavesere, I.M. 2013. Investigating the causal relationship between education and economic growth in Zimbabwe. *Asian Journal of Humanities and Social Studies*, 1(5). https://ajouronline.com/index.php/AJHSS/article/view/535 Date of access: 15 Aug 2021.

APPENDIX

A. DATA FOR ESTIMATION

RGDPP	GFCF	EDUEXP	EMP	FDI	TRD
5517.529	15.80554	7.50E+09	12.43764	0.008406	39.12332
5563.500	16.09264	7.55E+09	12.63153	0.267910	40.76895
5615.299	16.95994	9.78E+09	12.82845	0.803051	43.61094
5745.108	17.19573	7.95E+09	13.02858	0.553079	46.66733
5792.127	17.55568	9.86E+09	13.23184	2.497306	46.84526
5728.499	18.08712	8.19E+09	13.43822	0.399449	48.89662
5779.155	16.13268	7.87E+09	13.64547	1.100279	46.86189
5937.625	15.61611	6.99E+09	13.83476	0.710486	51.43777
6017.178	15.51001	6.04E+09	13.37329	5.983101	54.80163
6161.466	15.15028	5.78E+09	14.03267	1.281412	59.76464
6266.015	15.98148	8.33E+09	13.72883	0.446850	51.40183
6472.107	16.45999	1.12E+10	13.85043	0.306847	51.07803
6729.828	17.24644	1.26E+10	13.72708	2.530174	53.14912
7017.714	18.92492	1.33E+10	15.64883	0.229456	60.27726
7299.019	20.64696	1.41E+10	15.84869	2.199883	63.68309
7432.117	23.51128	1.35E+10	16.36720	3.447016	72.86539
7216.679	21.51154	1.51E+10	16.03942	2.576394	55.41826
7328.615	19.26599	2.04E+10	15.72752	0.983956	55.98899
7454.779	19.11637	2.39E+10	16.44773	0.994021	60.11263
7500.232	19.22777	2.41E+10	16.51795	1.167209	60.89970
7564.290	20.37397	2.12E+10	16.87590	2.244236	64.24176
7582.948	20.39102	2.04E+10	16.99268	1.650494	64.43450
7556.788	20.31110	1.82E+10	17.78372	0.478917	61.61707
7476.090	19.42052	1.67E+10	17.98497	0.747512	60.63819
7475.167	18.76455	2.03E+10	18.30284	0.588916	57.97389
7431.956	18.18725	2.16E+10	18.68636	1.512253	59.47033
7345.963	17.89966	2.19E+10	18.64271	1.455788	59.20454

B. DESCRIPTIVE STATISTICS

	RGDPP	GFCF	EDUEXP	EMP	FDI	TRD
Mean	6567.286	19.92934	1.08E+10	13.58306	0.932999	52.96181
Median	6426.357	19.17207	8.26E+09	13.54185	0.547730	51.97527
Maximum	7582.948	29.12272	2.41E+10	18.68636	5.983101	72.86539
Minimum	5517.529	15.15028	2.85E+09	8.493013	-0.766120	37.48746
Std. Dev.	705.0468	3.777739	6.71E+09	3.025187	1.237453	8.246335
Skewness	0.122589	1.046982	0.643969	-0.017922	2.001987	0.014110
Kurtosis	1.542682	3.357717	2.030119	1.972391	8.241289	2.474164
Jarque-Bera	3.639815	7.521074	4.332420	1.762109	72.50486	0.462166
Probability	0.162041	0.023271	0.114611	0.414346	0.000000	0.793673
Sum	262691.4	797.1734	4.33E+11	543.3226	37.31996	2118.473
Sum Sq. Dev.	19386549	556.5811	1.76E+21	356.9186	59.72030	2652.080
Observations	40	40	40	40	40	40

C. AUGMENTED DICKEY FULLER TEST RESULTS

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.897638	0.7782
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: RGDPP 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		-2.745713	0.2253
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: RGDPP has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.071595	0.6995
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.830406	0.0057
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(RGDPP) 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		-4.150315	0.0119
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(RGDPP) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.889825	0.0003
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.170598	0.0297
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: GFCF 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		-2.803697	0.2048
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: GFCF has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.494317	0.1246
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.116481	0.0026
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(GFCF) 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		-4.323163	0.0077
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(GFCF) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.009082	0.0002
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.230761	0.9259
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: EDUEXP 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		-2.863612	0.1851
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: EDUEXP has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.293940	0.9479
Test critical values:	1% level	-2.625606	
	5% level	-1.949609	
	10% level	-1.611593	

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

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.576515	0.0007
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(EDUEXP) 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		-4.552442	0.0043
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(EDUEXP) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.382296	0.0001
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.420252	0.8957
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: EMP 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		-2.947777	0.1595
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: EMP has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		3.957100	0.9999
Test critical values:	1% level	-2.625606	
	5% level	-1.949609	
	10% level	-1.611593	

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

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.472720	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(EMP) 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		-7.363415	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(EMP) has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.529629	0.0129
Test critical values:	1% level	-2.628961	
	5% level	-1.950117	
	10% level	-1.611339	

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

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.620907	0.0006
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: FDI 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		-5.479241	0.0003
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: FDI has a unit root
Exogenous: None
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.693839	0.4093
Test critical values:	1% level	-2.630762	
	5% level	-1.950394	
	10% level	-1.611202	

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

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.802929	0.0000
Test critical values:	1% level	-3.626784	
	5% level	-2.945842	
	10% level	-2.611531	

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

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.714123	0.0000
Test critical values:	1% level	-4.234972	
	5% level	-3.540328	
	10% level	-3.202445	

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

Null Hypothesis: D(FDI) has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.894025	0.0000
Test critical values:	1% level	-2.630762	
	5% level	-1.950394	
	10% level	-1.611202	

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

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.864459	0.3450
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: TRD 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		-3.200104	0.0993
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: TRD has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.333534	0.5586
Test critical values:	1% level	-2.625606	
	5% level	-1.949609	
	10% level	-1.611593	

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

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

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.187364	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(TRD) 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		-6.168035	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(TRD) has a unit root
Exogenous: None
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.273005	0.0000
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

D.PHILIP PERRON TEST RESULTS

Null Hypothesis: RGDPP has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.694682	0.8364
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: RGDPP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.859177	0.6562
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: RGDPP has a unit root
Exogenous: None
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.368338	0.7860
Test critical values:	1% level	-2.625606	
	5% level	-1.949609	
	10% level	-1.611593	

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

Null Hypothesis: D(RGDPP) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.879287	0.0050
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(RGDPP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.230929	0.0097
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(RGDPP) has a unit root
Exogenous: None
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.936620	0.0002
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

Null Hypothesis: GFCF has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.114600	0.2403
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: GFCF has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.701657	0.7315
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: GFCF has a unit root
Exogenous: None
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.370574	0.1556
Test critical values:	1% level	-2.625606	
	5% level	-1.949609	
	10% level	-1.611593	

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

Null Hypothesis: D(GFCF) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.100861	0.0028
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(GFCF) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.150011	0.0119
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(GFCF) has a unit root
Exogenous: None
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.044653	0.0002
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

Null Hypothesis: EDUEXP has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.401137	0.8991
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: EDUEXP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.389660	0.3789
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: EDUEXP has a unit root
Exogenous: None
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		1.052316	0.9205
Test critical values:	1% level	-2.625606	
	5% level	-1.949609	
	10% level	-1.611593	

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

Null Hypothesis: D(EDUEXP) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.378231	0.0013
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(EDUEXP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.339088	0.0074
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(EDUEXP) has a unit root
Exogenous: None
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.355768	0.0001
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

Null Hypothesis: EMP has a unit root
Exogenous: Constant
Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.205451	0.9293
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: EMP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.996808	0.1460
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: EMP has a unit root
Exogenous: None
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		5.779654	1.0000
Test critical values:	1% level	-2.625606	
	5% level	-1.949609	
	10% level	-1.611593	

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

Null Hypothesis: D(EMP) has a unit root
Exogenous: Constant
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.713732	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(EMP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.551728	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(EMP) has a unit root
Exogenous: None
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.258876	0.0000
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.589279	0.0007
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: FDI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.487467	0.0003
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: FDI has a unit root
Exogenous: None
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.122021	0.0026
Test critical values:	1% level	-2.625606	
	5% level	-1.949609	
	10% level	-1.611593	

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

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-18.67348	0.0001
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-18.88592	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(FDI) has a unit root
Exogenous: None
Bandwidth: 14 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-17.80516	0.0000
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

Null Hypothesis: TRD has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.867861	0.3435
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: TRD has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.143819	0.1108
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: TRD has a unit root
Exogenous: None
Bandwidth: 12 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.303756	0.5698
Test critical values:	1% level	-2.625606	
	5% level	-1.949609	
	10% level	-1.611593	

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

Null Hypothesis: D(TRD) has a unit root
Exogenous: Constant
Bandwidth: 17 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.577063	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

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

Null Hypothesis: D(TRD) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 19 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.973097	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

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

Null Hypothesis: D(TRD) has a unit root
Exogenous: None
Bandwidth: 17 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.657091	0.0000
Test critical values:	1% level	-2.627238	
	5% level	-1.949856	
	10% level	-1.611469	

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

E. LONG-RUN AUTOREGRESSIVE DISTRIBUTED LAG

ARDL Long Run Form and Bounds Test
Dependent Variable: D(RGDPP)
Selected Model: ARDL(1, 0, 0, 2, 0, 2)
Case 2: Restricted Constant and No Trend
Date: 09/26/21 Time: 20:27
Sample: 1 40
Included observations: 38

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1277.990	322.9739	3.956945	0.0005
RGDPP(-1)*	-0.350858	0.110432	-3.177128	0.0037
GFCF**	-15.12051	13.25452	-1.140782	0.2640
EDUEXP**	2.56E-08	8.18E-09	3.130707	0.0042
EMP(-1)	-48.46510	21.74823	-2.228462	0.0344
FDI**	18.24327	17.88545	1.020006	0.3168
TRD(-1)	30.74456	5.930748	5.183926	0.0000
D(EMP)	89.55907	51.76630	1.730065	0.0950
D(EMP(-1))	133.5799	49.73653	2.685750	0.0122
D(TRD)	22.12104	4.406947	5.019583	0.0000
D(TRD(-1))	-15.87394	4.581954	-3.464449	0.0018

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GFCF	-43.09583	48.48389	-0.888869	0.3819
EDUEXP	7.30E-08	2.05E-08	3.558352	0.0014
EMP	-138.1331	83.49768	-1.654335	0.1096
FDI	51.99618	56.25531	0.924289	0.3635
TRD	87.62681	19.88177	4.407395	0.0001
C	3642.471	943.8618	3.859115	0.0006

EC = RGDPP - (-43.0958*GFCF + 0.0000*EDUEXP -138.1331*EMP + 51.9962
*FDI + 87.6268*TRD + 3642.4714)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	6.298523	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
Actual Sample Size	38		Finite Sample: n=40	
		10%	2.306	3.353
		5%	2.734	3.92
		1%	3.657	5.256
			Finite Sample: n=35	
		10%	2.331	3.417
		5%	2.804	4.013
		1%	3.9	5.419

F. SHORT-RUN ERROR CORRECTION MODEL

ARDL Error Correction Regression
Dependent Variable: D(RGDPP)
Selected Model: ARDL(1, 0, 0, 2, 0, 2)
Case 2: Restricted Constant and No Trend
Date: 09/26/21 Time: 20:28
Sample: 1 40
Included observations: 38

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EMP)	89.55907	33.26732	2.692104	0.0120
D(EMP(-1))	133.5799	35.36182	3.777517	0.0008
D(TRD)	22.12104	3.140481	7.043837	0.0000
D(TRD(-1))	-15.87394	3.867806	-4.104122	0.0003
CointEq(-1)*	-0.350858	0.047796	-7.340801	0.0000

R-squared	0.743925	Mean dependent var	11.86459
Adjusted R-squared	0.712885	S.D. dependent var	153.7467
S.E. of regression	82.38221	Akaike info criterion	11.78270
Sum squared resid	223965.3	Schwarz criterion	11.99817
Log likelihood	-218.8712	Hannan-Quinn criter.	11.85936
Durbin-Watson stat	1.782410		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.298523	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

G. SERIAL CORRELATION: BREUSCH-PAGAN-GODFREY LM TEST

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.416545	Prob. F(2,25)	0.6638
Obs*R-squared	1.225460	Prob. Chi-Square(2)	0.5419

H. HETEROSKEDASTICITY TEST: BREUSCH-PAGAN-GODFREY

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.591494	Prob. F(10,27)	0.8066
Obs*R-squared	6.828743	Prob. Chi-Square(10)	0.7415
Scaled explained SS	5.261298	Prob. Chi-Square(10)	0.8731

I. HETEROSKEDASTICITY TEST: WHITE

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

F-statistic	0.543849	Prob. F(10,27)	0.8435
Obs*R-squared	6.370910	Prob. Chi-Square(10)	0.7832
Scaled explained SS	4.908554	Prob. Chi-Square(10)	0.8972