FEMALE EDUCATION AND ECONOMIC GROWTH: EVIDENCE FROM KENYA

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DECLARATION

The research project is my original work and hasn't been submitted to other institutions.

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This research project is submitted with my permission as the university supervisor.

Signature…… Date 2023-09-04…….....

PROF. ANTHONY WAMBUGU

DEDICATION

My husband Danson, babies Asher and Liana. You have been my motivation. The world is yours to conquer, be limitless and unapologetic in your quest for purpose.

ACKNOWLEDGEMENT

Glory to God for His eternal mercies and faithfulness. His grace has been sufficient. I wholeheartedly pass my gratitude to my supervisor, Professor Anthony Wambugu, for tirelessly guiding me through my project; his support has been consistent and immense, I genuinely appreciate it. I thank my family, who have been very instrumental in helping me achieve my goal; without them, I would not have made it. They have been a pillar. A hearty appreciation also goes to my friends and classmates, especially Socrates Majune, Lensa Apondi, Joseph Horo, among others who offered help in many ways. Be blessed.

ABSTRACT

Education has long been considered to be a significant contributor to economic growth. Kenya's Vision 2030 envisages social transformation through education and training. The Government of Kenya has consistently allocated huge funds towards education, the latest being the 2020/2021 budget which got the lion's share in the budget. Kenya has narrowed the gender gap in primary and secondary education. However, it is wide in tertiary education. This paper explores the real gdp growth effects of female and male education in Kenya. Empirical findings in existing literature on the subject are inconclusive.Time series data from 1977-2021 and appropriate econometric techniques for timeseries will be used to estimate the augmented Solow Model to include diverse variables for female and male education. The results indicated a positive relationship between growth and female completion rates

LIST OF ACRONYMS AND ABBREVIATIONS

ADF: Augmented Dickey-Fuller

ARDL: AutoRegressive Distributed Lag

GDP: Gross Domestic Product

GFCF: Gross Fixed Capital Formation

GMM: Gaussian Mixture Model

GNP: Gross National Product

GOK: Government of Kenya

KCPE: Kenya Certificate of Primary Education

KCSE: Kenya Certificate of Secondary Education

KNBS: Kenya National Bureau of Statistics

KPHC: Kenya Population and Housing Census

OLS: Ordinary Least Squares

PP: Phillips and Perron

SLS: Stage Least Squares

VAR: Vector Autoregressive

VIF: Variance Inflation Factor

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CHAPTER ONE

INTRODUCTION

1.1 Background

Growth in real GDP per capita is important for socio-economic development. Although Kenya has made significant economic progress through the years, the the country still faces a number of challenges that slow inclusive economic growth which include; poverty, gender inequality among others(World Bank, 2021). The Kenya Vision 2030 targeted to achieve and sustain average GDP growth of 10% per year until 2030 (RoK, 2003). Figure 1 shows the trend of Kenya's GDP for the period 1963 2019. As shown in figure 1, Kenya's GDP has fluctuated some years with sharp downswings and upswings. The first decade after independence recorded relatively high average GDP growth rate. Thereafter, the graph shows prolonged general decrease in GDP growth through 1977-2019. Since the launch of the Vision 2030 highest growth rate achieved is 8.4%. The GDP growth rate was 5.4% for 2019 down from 9.5% in 1977. The country's economy was hurt by the COVID-19 pandemic in 2020 though it is expected to rise to 4.9% in 2022 attributed to rebound of some sub-sectors e.g education (World Bank,2021).

One driver of economic growth is human capital (health,skills and knowledge) accumulation. Romer (1990) demonstrated human capital measured by literacy levels contributes to long-run growth. According to Mincer (1981) human capital is a means of production along being a contributor to technological change. It is also positively linked to long-term economic growth through using technologies (Barro, 2001a; Lucas, 1988; Mamuneas et al., 2001; Romer et al., 1992). Benhabib & Spiegel (1994) demonstrated that human capital is significant in economic expansion by using cross-country data of physical and human capital stocks.

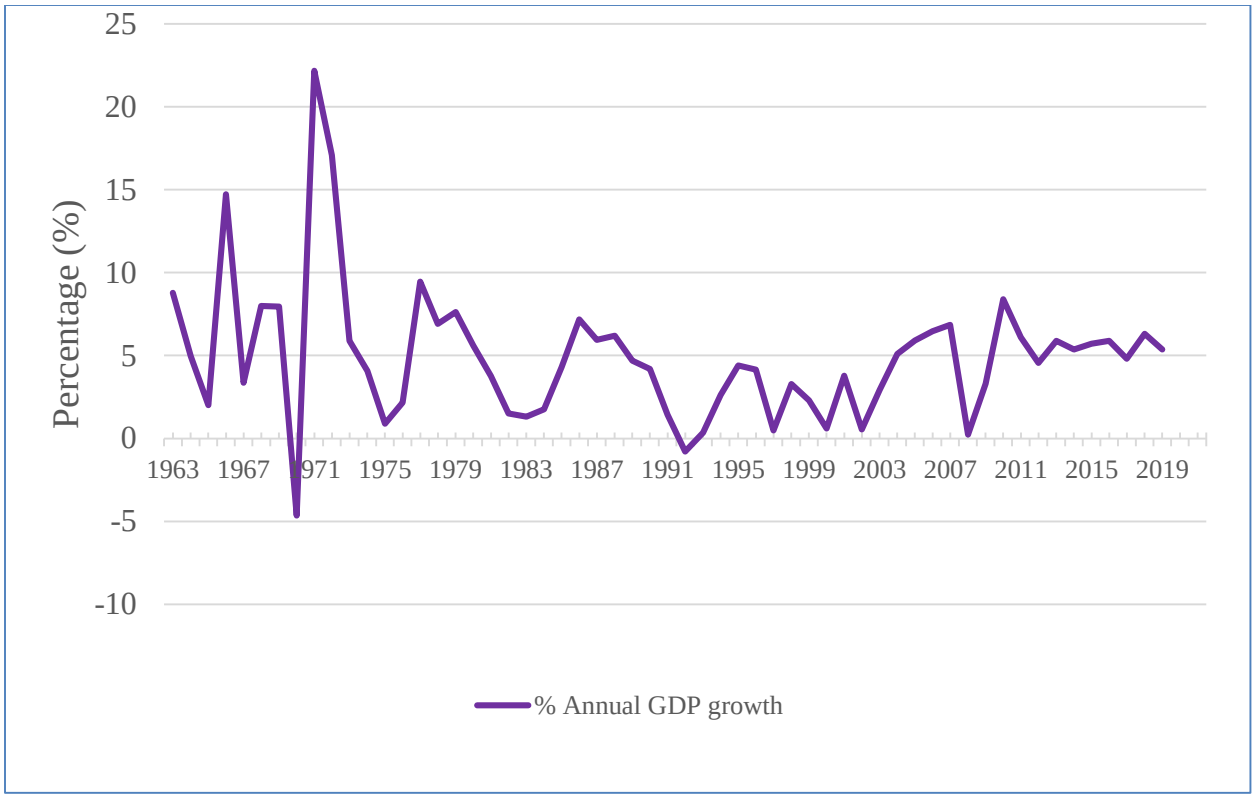


Figure 1: Kenya's GDP growth rate, 1963-2019
(Source: World Bank data)

Kenya has invested in education since independence. The following graphs show the gains made in school enrollment of males and females. Figure 2 shows gross enrolment rates at primary level of education for the period 1964 to 2021.. The main observation from the graph is that the gross enrollment rates of males and females in Kenya from year 1964 to year 2021 converged. While gross enrolment rate for males declined from 62 to 49, gross enrollment for females increased from 38 to 49 over the period.

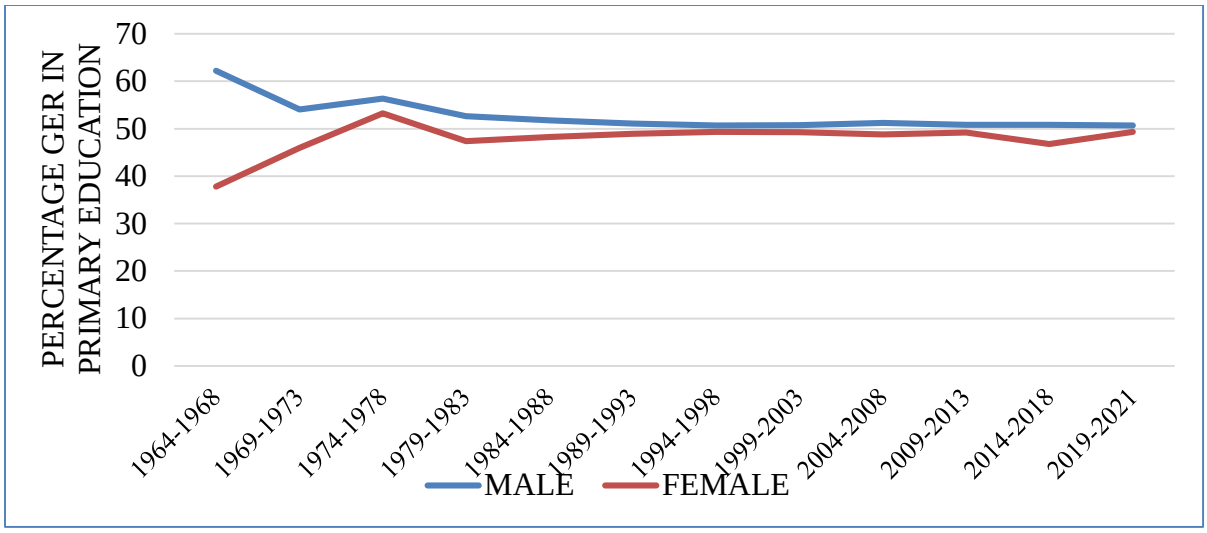


Figure 2: Gross enrollment rate for primary education for Kenya (% gross) 1964-2019 (Source KNBS data)

Figure 3 shows gross enrollment rates at secondary level of education. The main observation in is that gross enrollment rates for males declined from 67 in 1975-1979 to 49 in 2015-2019. In contrast, gross enrolment rates for females increased from 33 to 49. The male -female gap in secondary school gross enrolemnt rates has narrowed.

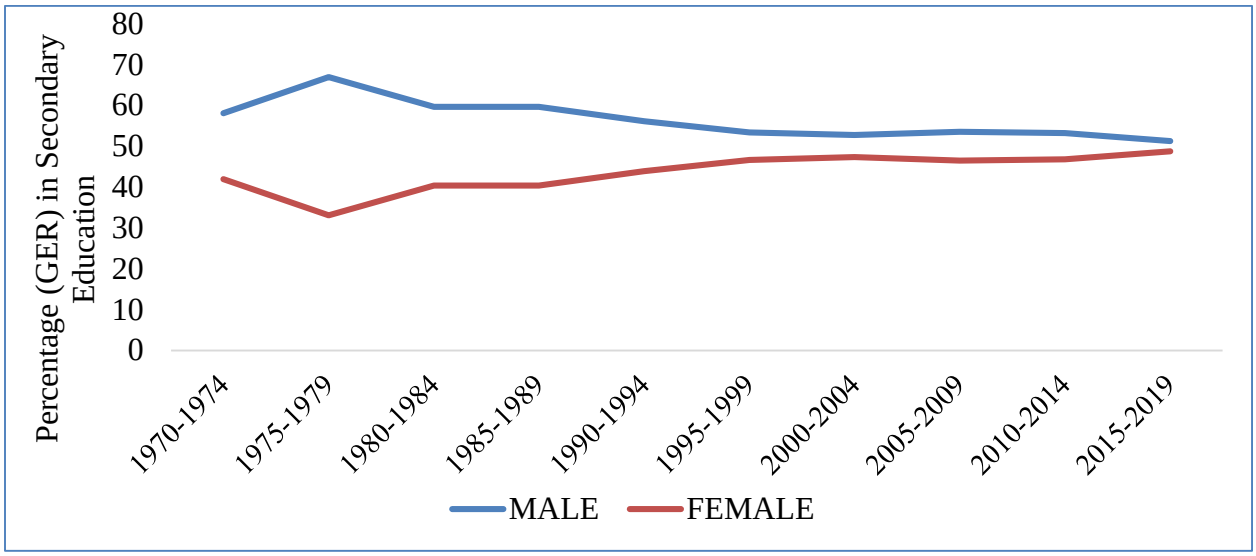


Figure 3: Gross enrollment rate for secondary education for Kenya (%gross), 1970 -2019 (Source: KNBS data)

The largest male-female gap in gross enrollment is at university level. In late 1990s and early 1980s the enrolment rate for males was 77 and that of females was 23. Over the years' female gross enrolment rate has increased steadily while that of males had declined. By 2013-2017 the gap enrolment rates for males and females were 59% and 41% respectively.

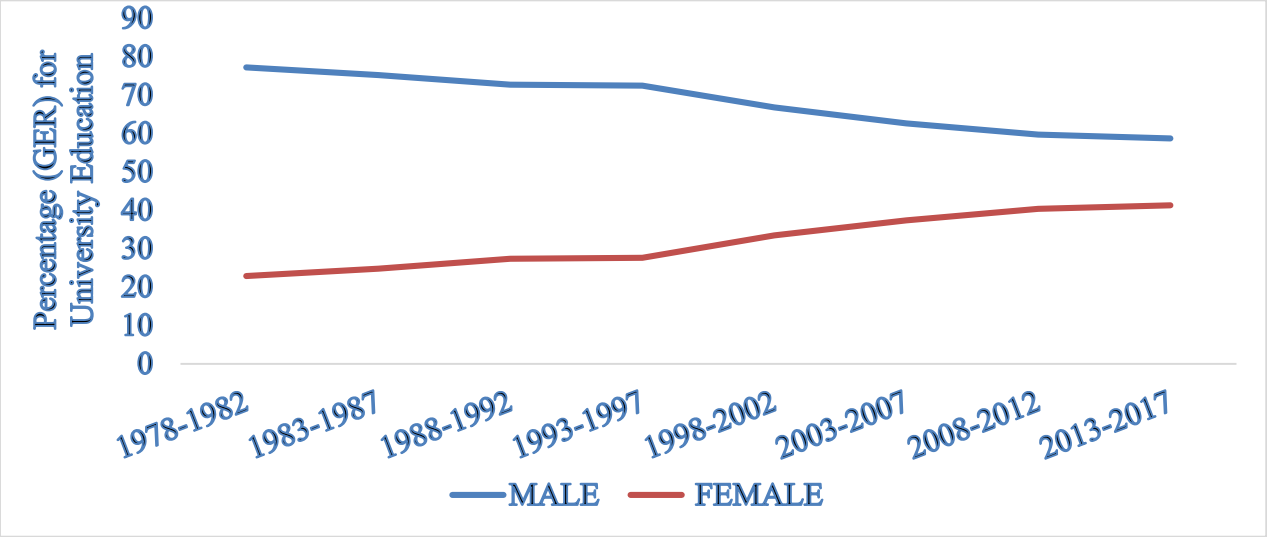


Figure 1: Gross enrollment rate for university education for Kenya (%gross), 1978 – 2017 (Source: KNBS data)

Gender inequalities in education is a source of concern.Consequently, it has been argued that investment in female education would reduce education inequalities and yield economic and social benefits. According to Hill and King (1995), social benefits arising from women's education include; positive impact on the society. Hassan & Cooray (2015a) and; Oztunc et al.(2015) revealed that female education contributes significantly to economic growth. Women's education is linked to sustained growth mostly through labour force participation as well as population demographics (Benavot, 2015). Similar observations were made by (Bloom et al., 2009; Klasen, 2002; Psacharopoulos, 1994a). Female education can advance economic growth in comparison to male education (Self and Grabowski, 2004). Women literacy has positive effects on economic development, notably in developing nations (Barro, 2001b).

It is debated that education inequalities may affect growth adversely. In particular it has negative effect on economic development. (Santos & Klasen, 2021). Further, gender difference in education and employment involvement impede economic advancement (Klasen & Lamanna, 2009a;

Knowles et al., 2002). Dollar & Gatti (1999b) concluded that the gender gap in secondary school negatively affects economical growth.Forsythe et al. (2003) argue that, increasing education expenditure reduces the gender gap in literacy levels, thus leading to significant economic growth. Similar studies have been done in African countries (Licumba et al., 2015; Seguino, 2019).

1.2 Problem statement

Kenya's development blueprint, Vision 2030, underscores the value of education for attaining goal of being an industrialized economy (Republic of Kenya, 2007). Furthermore, it envisages a democratic system that encourages equality regardless of race, ethnicity, religion, gender, or socioeconomic status.. Majority of Kenya's population since independence live in poverty especially women and girls. Kenya's has made significant economic progress though the years however the the country still faces a number of challenges that slow inclusive economic growth which include; poverty, gender inequality among others(World Bank, 2021) .To address the above challenges, education has been proposed to accelerate economic growth through investment in education so as to bridge the gender inequality gap (Omondi et al.,2014)

Though Kenya has made huge progress in equality in education, there is still inequality between men and women (USAID, 2020). It is argued, e.g., Syomwene & Kindiki (2015), economic growth in Africa can be accelerated through greater investment in female education.

Although there has been extensive research on female education and economic growth,Hassan & Cooray(2015a); Hassan & Rafaz, (2017); Hassan et al. (2015), few of them focused on the effects on African countries. Second, this literature finds that total years of female education positively impacts economic growth. However, it is unclear which education level positively relates to economic expansion. Authors, such as Oztunc et al. (2015), argue that enrollment of females in primary school positively affects annual GDP per capita. Others, e.g, Hanif & Arshed (2016),

conclude that education at high school and tertiary levels has greater effect on economic growth than other levels of school enrollment.

The few studies on the topic in Sub-Saharan Africa are limited since they cover a panel of countries, Mary (2020; Raifu (2019). There has also been the challenge of incorporating all the African countries, yet they vary in their characteristics El Alaoui (2016); Hanif & Arshed (2016). Therefore, there are diverse remedies that may be irrelevant to policymakers in specific regions. Hence, there is a dearth of country-specific empirical evidence. This study will thus focus on education at different levels in Kenya: tertiary, secondary, and primary.

1.3 Research Questions

To what extent does female education contribute to economic growth?

1.4 Study Objectives

The main objective of the paper is to examine the effect of female education and economic growth in Kenya. Specific objectives are as follows;

a) To estimate economic growth effects of female education level-specific enrollment rates.

b) To draw policy implications from the findings.

1.5 Significance of study

According to 2019 Kenya Population and Housing Census (KPHC),the percentage of women is 50.5% of the entire populace in the country which is an important percentage of the country's population.However,Kenya continues to grapple with the challenges of gender inequality especially in economic empowerment.Statistics from KNBS and UNICEF 2020 Comprehensive

Poverty Analysis reveal that 65% of women face multi-faceted poverty in comparison to 56% of their male counterparts.Additionally, 30% households that are headed by women live beneath poverty line in comparison to 26% of male headed households. According to,education and gender training policy, (Republic of Kenya,2015) there are still disparities in terms of gender in retention,access,completion,performance and transition.This study seeks to add to existing literature,to the best of our knowledge, not any of the most recent studies done in Kenya focused on how education for both genders at different levels affect economic growth. Hence the effects of educating females at different levels on economic growth is hardly known, which this study seeks to investigate. Additionally, the study can enrich policy specifically on gender equity and equality in education,the potential policy implication will accelerate growth towards Vision 2030.In addition, previous studies that have focused on gender inequalities establish inequalities, but it's not evident where the gender inequalities are high for policy intervention. The current study seeks to add to existing literature. It distinguishes itself from previous studies done in Kenya by extending the Solow Model to include human capital and introduce the gender dimension in its Cobb Douglas form to investigate how the various levels education affect economic growth in Kenya.

CHAPTER TWO

LITERATURE REVIEW

1.1 Introduction

It represents theoretical,empirical literature applicable in the paper. The first part will cover the theoretical review followed by empiricaland finally, literature overview.

1.2 Theoretical Literature Review

The Solow (1956) model reveals three ways in which education influence economic growth; These are: First, education intensifies human capital of the labor force (Mankiw et al.,1992).Secondly, education fosters economic growth through innovation by recommending new know-how that fosters growth (Howitt & Aghion, 1998; Lucas, 1988). Human capital fosters production, thus leading to innovation (Mincer,1981). Lastly, education eases the transfer of knowledge, which can actualize technologies invented by others, eventually stimulating economic expansion (Benhabib & Spiegel, 1994; Nelson & Phelps, 1966).

The endogeneous growth model as put forth by (Arrow et al.,1961) posits that development is as a result of enhanced human capital. Later, importance of technology was incorporated by Romer (1990) and supported by the 'Schumpeterian' theory developed by (Aghion & Howitt, 1990). The authors argue that advancement of both human and existing knowledge enhances economic growth. It argues that knowledge, which has spillover effects lead to long-term economic growth (Gross and Helpman, 1990).

Gender inequality in education considerably impede economic expansion (Klasen,2009). According to the author,the inequalities have a negative effect on the general well-being. Klasen (2002,1999) argues it negatively affects economic growth as it reduces human capital.

Additionally, the gender gap in education generates instrumental problems for policymakers thus impacting negatively on other development goals. The gender gap in education significantly reduces GDP (Knowles.,et al 2002).

1.3 Review of Empirical Literature

Oztunc et al. (2015) estimate a random effects model on panel data collected from eleven selected Pacific Asian countries. The results showed that female primary schooling enrollment rates was significantly and positively related to growth. Similar results were found by Hassan & Cooray (2015b) for both male and female primary schooling. The results were obtained from using used Extreme Bound Analysis on panel data on enrollment rates from a sample of fifteen Asian countries. Hong et al. (2019) used panel data from the Barro-Lee dataset on average years of schooling for primary education.They used the ordinary least squares estimation approach and concluded positive significant effect of on economic growth but only for females.

Barro (2001b) used panel data from a panel of countries. Estimation was done by three stage least squares.Findings show that average years of primary schooling for females is positive but statistically insignificant to economic growth. Average years of education for males is insignificant and negatively related. However, Mamuneas et al. (2001) found positive correlation between primary schooling and economic growth only in low-income countries. They the Barro-Lee dataset together with semi-parametric regression. Licumba et al. (2015) found that enrollment rates for females in primary education were statistically insignificant in the long term from panel data of between 1970-2010. Hill & King (1995) found that female enrollment at primary level was significantly related to GNP from regions across the world due to reduced infant mortality.

Empirical studies of effect of secondary education on economic growth shows diverse results. From a panel of up to 127 countries, Dollar & Gatti (1999a) run two stage least squares regression. The findings showed a significant and positive effect of female average years of schooling on economic growth and an insignificant negative effect on males.Similar results are established by Hill &King (1995) who estimated a GNP model relating enrollment ratios of 152 countries for the period 1960-85 and GNP per capita. This in contrast to Barro & Lee (1993, 1994); Klasen (2002); Lorgelly & Owen (1999); Klasen (1998); Barro & Lee (1994); Barro (1996), who all used the Barro-Lee dataset and real GDP per capita. The authors used; cross-section regression,instrumental variable techniques,OLS regression.According to the authors, an increase in male secondary enrollment has statistically significant and positive effect on economic growth while female secondary enrollment has a negative effect.

Dauda (2012) used co-integration and error-correction techniques on enrolment rates from 1975-2008.He realized no significant effect on female secondary enrollment on real GDP in Nigeria and a significant, positive one on male education. On the contrary, Hassan & Cooray(2015a); Hassan & Rafaz, (2017); Hassan et al. (2015) established a significant positive correlation between secondary school enrollment and economic growth for both genders. They used panel estimation techniques on enrollment rates from a panel of about fifteen Asian countries. Benavot (1989) concluded that male secondary education had more substantial positive effect on economic growth than for females from a selection of 96 countries. He used enrollment rates and panel regression analysis. When he did a sample for less developed countries, the results indicated a non-significant effect on GNP of female secondary education.

Different studies investigated the impact of tertiary education on economic growth.From a panel of specific Asian countries for the period 1990-2010, Oztunc et al.(2015) explored how women's

education infuence an economy's long-run. The outcome indicated female post secondary education negatively impacts annual GDP per capita. Mamuneas et al. (2001), used mean years of tertiary education from a panel of countries and concluded negative correlation among female education and economic growth. They employed the use of semi-parametric estimation techniques. From a panel of countries, Barro & Sala-i-Martin (1995) found positive and significant impact for males using quality of education as a proxy for education though the effects are not significant.Contrary to that, Thévenon & Del Pero (2015) concluded a significant positive correlation to GDP for average years of schooling for females in relation to tertiary education.The results indicate a higher correlation than males from cross-country data of 30 countries between 1960-2008. Gyimah-Brempong et al. (2006a), used panel data over time period 1960-2000 on African countries. By employing the use of a dynamic panel estimator, the authors conclude that higher education is statistically significant and positive on the growth rate per capita for both genders.

1.4 Literature overview

Human capital facilitates transfer of knowledge and diffusion of technology (Romer, 1990).Empirical examination on female education and economic growth have shown mixed results. Some studies reveal a positive effect on economic growth, Barro (1999); Barro & Sala-i-Martin (1995); Hassan & Cooray (2015a); Hassan & Rafaz (2017) while others reveal a negative correlation with economic growth (Dollar & Gatti, 1999b; Hill & King, 1995). The mixed findings indicate the need for more research in the area so as to add to existing literature.

The studies on Sub-Saharan Africa have been few and shows diverse results. The few studies include (Klasen, 2002; Klasen & Lamanna, 2009b; Santos & Stephan, 2021).Majority of studies generalize data in the assumption that all African countries are similar in their characteristics (El

Alaoui, 2016; Gyimah-Brempong, 2011; Isiaka, 2019). Hence there's a need for country-specific study.This study will limit itself to country-specific data, Kenya, as different countries have different characteristics and situations.

An important area to be discussed in analyzing female education and economic growth is methodological approach applied. Earlier studies that employed the use of the Solow model, Solow (1956) include ; (Barro 2013, Barro 1996,Barro & Lee, 1994; Barro & Sala-i-Martin, 1995). The Solow model has been criticized for not explaining differences in growth in the long term. Many studies have employed the augmented model in its Cobb-Douglas form, which is the most prominent. Studies that have used the model include; (Bloom et al., 2009; Cooray & Mallick, 2011; Dauda, 2012; Hanif & Arshed, 2016; Thévenon & Del Pero, 2015). According to the authors, the model would make the comparison between male and female education easier.Other studies that employed the model include; (Gyimah-Brempong et al., 2006b; Tsamidias 2012). The model incorporated technology.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The chapter features the research methods,analysis in the paper. It also enlists the source of data as well as expected outcome of the variables.

3.2 Theoretical model

This study employs the Solow-Swan neoclassical growth model(So low,1956; Swan,1956). This model depicts growth through the following variables; capital accumulation, labour, and technology. The algebraic form is shown in equation 1;

$$Y_{t=}F(A_tK_tL_t) \text{ ……1}$$

Where Y =Output,K =Capital,L =Labour and A =Knowledge and t=time

Time (t) enters the production function indirectly through $K, L,$ and A, and output changes over time depending on production inputs. Technological progress will be advanced only when the amount of knowledge/education increases.

Equation 1 can be augmented ,Weil et al.(1992)to include human capital to introduce the dimension of gender. To do so, assume it takes the Cobb-Douglas production of the form;

$$Y_{t=}A_t,K_t^{\alpha},L_t^{\beta}, H_t^{\gamma} \text{ ……2}$$

H=Human capital, α, β and γ are output elasticities of capital, labour, human capital respectively in equation 2. To transform the equation into linear form, take logarithms on both sides;

$$ln\ (Y_t)=ln(A_tK_t^{\alpha}L_t^{\beta}H_t^{y}) \text{ ……...3}$$

Expanding Logarithms;

$$ln\ (Y_t) = lnA_t + \alpha lnK_t + \beta lnL_t + ylnH_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4$$

3.3 Empirical Model

The model to be estimated is;

$$lnY_{=} B_0 + B_1 lnFP + B_2 lnFS + B_3 lnFPS + B_4 lnMP + \beta_5 lnMS +$$
$$B_6 lnMPS + B_7 lnGFCF + \quad \beta_8 lnTME + \beta_9 lnTFE + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 5$$

Where;

FP =Female Primary Education

FS =Female secondary education

FPS =Female Post-Secondary Education

MP= Male Primary Education

MS = Male Secondary Education

MPS =Male Post-Secondary Education

GFCF= Gross Fixed Capital Formation

TME= Total Male Employment

TFE= Total Female Employment

ln= Natural log

E =Error term

β_o is the intercept while $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8\ and\ \beta_9$ are the coefficients of the chosen explanatory variables

3.4 Pre-Estimation tests

3.4.1 Normality test

One of the classical regression assumptions is a normal distribution with zero mean and constant variance (Greene, 2002). The Shapiro Wilk test will be used to establish the normality of the variables due to its power to detect the non-normality (Woolridge,2012).The null hypothesis is that data are normally distributed.

3.4.2 Unit root tests

The Augmented Dickey-Fuller(ADF) unit root test, Dickey & Fuller (1981), is easy in implementing (Woolridge,2012).The (ADF) test is carried out by augmenting the regression with lagged dependent variable changes to clear any serial correlation (Wooldridge, 2012). The null hypothes is that it contains a unit root. Assuming we have a series;

$$\Delta y_{t=}\mathcal{u}+\delta y_{t-1}+\sum_{i=1}^{k}\beta i\Delta y_{t-1+}\, e_t$$

Philips and Perron (PP) test use non-parametric statistical methods, meaning it doesn't specify the form of serial correlation of Δyt under the null hypothesis Shrestha & Bhatta (2018) without adding lagged different terms to ensure that there is no serial correlation (Gujarati, 2003). The test is an alternate to ADF test,in some instances it improves on finite sample properties while it accommodates more general modelling frameworks in others (Greene,2002).Additionally,PP test rectifies the statistics to deal with autocorrelation and heteroskedasticity issues (Shrestha & Bhatta 2018) . It tests in the following form;

$$\Delta y_t =\pi y_{t-1}+\beta i D_{t-1}+e_t$$

3.4.3 Test for Multi-collinearity

Multi-collinearity is the existence of correlation amid a few or all explanatory variables of a regression model (Gujarati, 2003). The Variance Inflation Factor(VIF) will be used in the study. It shows how the presence of multicollinearity overestimate the variance of an estimator; as the degree of collinearity increases, the variance of an estimator also increases (Gujarati, 2003).

3.4.4 Heteroskedasticity

Heteroskedasticity is a scenario where variances of regression disturbances are not constant across observations(Greene, 2002). The advantage of the White test is that it doesn't depend on assumption of normality and is easy to actualize (Gujarati, 2003). The White test will be used to check this phenomenon because it does not rely on the normality assumption (Greene,2002). The null hypothesis is that the variances for the errors are equal (Gujarati,2003).In a case of a three variable regression model;

3.4.5 Test for Co-integration

The next step after testing for unit root is to test for cointegration. Two series are cointegrated if they have a continual relationship among them (Gujarati, 2003). To check whether a long term cointegrating relationship exists among variables, the Johansen Co-integration test, Johansen (1988), will be used. It checks whether or not the linear combination of the variables is stationary.

3.5 Variable Description

Table 1: Description of Variables

Variable	Nature	Description, Measurement	Expected Sign
Dependent Variable			
GDP	Dependent	The financial value of products produced in a country at a given time. Measurement: in billion U.S. dollars	
Independent Variables			
Female Primary Education (FP)	This is the completion in numbers of primary school who are females.		+ (Positive)
Female Secondary education (FS)	This is the completion in numbers of secondary school who are females.		+ (Positive)
Female Post-secondary Education (FPS)	This is the completion in numbers of post secondary school who are females.		+ (Positive)
Male Primary Education (MP)	This is the completion in numbers of primary school who are males.		+ (Positive)
Male Secondary Education (MSE)	This is the completion in numbers of secondary school who are males.		+ (Positive)
Male Post-Secondary (MPS)	This is the completion in numbers of post secondary school who are males.		+ (Positive)
Total Male Employment(TME)	This is the total males employed in mumbers.		+ (Positive)
Total Female Employment (TFE)	This the total females employed in numbers.		+ (Positive)
Gross fixed capital formation (GFCF)	This is acquisition of fixed assets by governments, households & the sectors of business.		+(Positive)

3.6 Source of Data

The educational attainment data of both females and males is from KNBS from 1950-2018. The real GDP data will be obtained Penn World table version 10.0, The wage employment for both males and females is from Kenya National Bureau of Statistics (KNBS). The Gross Fixed Capital Formation (GFCF) data is from World Bank.

CHAPTER FOUR

DATA ANALYSIS,FINDINGS AND DISCUSSIONS

4.1 Introduction

The chapter shows research findings and diagnostic tests. It discusses descriptive statistics, estimation tests and finally model results.

4.2 Descriptive Statistics

Table 2 below indicates various statistical properties of the variables included such as mean, standard deviation, maximum, minimum, skewness and kurtosis.

Table 2: Summary Statistics (N=45)

Variable	Mean	SD	Min	Max	Skew	Kurt
GDP	4.06e+10	1.84e+10	1.68e+10	11.043e+10	0.80	2.61
FP	332448.	117793	138640	517830	0.25	1.73
FS	556991	486753.99	38989	1.87e+06	1.30	3.56
FPS	49777.05	71888.95	1042.00	234120.00	1.57	3.98
MP	347365	1187.48	1584.80	5364.30	0.30	1.69
MS	628990.44	478354.05	82421.00	1.82e+06	1.17	3.06
MPS	76254.63	100179.13	3671.00	330387.00	1.55	3.96
MWE	120067	27762	73620	188810	0.51	2.98
FWE	48198	25759	15130	104020	0.65	2.48
GFCF	5.08e+09	5.56e+09	9.42e+08	1.88e+10	1.29	3.14
ER	54.51	32.94	7.42	103.41	-0.18	1.55

Averagely, GDP grew by an average of USD 40.6 billion. Averagely, GDP grew by 1.18 percent points from the year 1977 to the year 2000 (from USD 16.8 billion to USD 36.6 billion). From the year 2000 to the year 2021, GDP grew by 2.02 percent points (from USD 36.6 to USD 110.4 billion). GDP has depicted an upward trend from the minimum of USD 16.8 billion to a maximum of USD 110.4 billion.

Averagely, 332,448 female pupils completed primary school education. Girl child school completion increased by 26.2 % in the 10 years from 2011, which indicates growth of the number of girls completing primary school from 488,020 in 2011 to 504,170 girls in 2021. On the other hand, an average of 347,365 male pupils completed primary school. This indicates a 4.5% completion rate difference in favor of the boy child. Consequently, primary school completion rate for the boy child increased from 497,770 pupils in 2011 to 524,350 pupils in 2021, which indicates a 5.4% increase.

Averagely, girl's secondary school completion rate increased from 40,185 in 1977 to 1,869,300 pupils in 2021, while that of male children increased from 87,811 students to 1,822,700 students. Averagely, girls secondary school completion rate grew by 556,991 students, while for the boy child, it grew by 628,990. In the last five years from 2016, secondary school completion rate for the girls increased by 41.2 % (from 1,323,637 students to 1,869,300 students), while for the boy child, the completion rate increased by 30.5% (from 1,396,926 students to 1,822,700 students). Girl secondary school completion rate experienced lowest number of 38,989 students and highest number of 1.87 million students.

Averagely, female post-secondary school completion rate increased by 49,777 students while the male post-secondary school completion rate grew by an average of 76,254 students. In the last

decade, from 2011 to 2021, post-secondary completion rate for females increased by 1.56 percent points (from 80,560 students to 206,439) students while that of male students increased by 1.57 percent points (from 117,700 students to 303,034 students).

Averagely, the number of female in wage employment grew by 48,198 while that of male person grew by 120,067. This indicates a difference of 1.5 percent points in favor of male persons. In the last 10 years from 2011, the number of female in wage employment has realized a 60.3% increase while that of male persons in wage employment increased by 27.7%. This implies that female wage employment is growing faster as compared to male wage employment by a deviation of 32.6%.

4.3 Pre- Estimation Tests

4.3.1 Correlation Analysis

Correlation test was carried out on all the variables using the Pearson correlation test. Considering that female education completion is highly correlated with male education (at primary, secondary and post-secondary), we calculated the ratio of female to male education. Given this institution, we use the ratios to investigate the effect of female primary education while controlling for male education. Pearson correlation test was done using the ratios and the findings are as below.

Table 3: Pairwise Correlation

	GDP	PR	SR	TR	MWE	GFCF	EXCR
GDP	1.0000						
PR	-0.5928	1.0000					
SR	-0.6868	0.8647	1.0000				
TR	-0.8172	0.6249	0.6919	1.0000			
MWE	0.9743	-0.6974	-0.7652	-0.8258	1.0000		
GFCF	0.9563	-0.4073	-0.5024	-0.6904	0.8814	1.0000	
EXCR	0.8934	-0.7378	-0.8110	-0.8542	0.9108	0.7516	1.0000

Note: PR= primary ratio, SR= secondary ratio, TR= post-secondary ratio, MWE= male wage employment.

The results indicated that primary ratio was positively correlated with secondary and post-secondary education, which implied that as primary school completion rate increased, secondary and post-secondary completion rate increased. However, female wage employment was dropped from the model since it was highly correlated with male wage employment.

4.3.2 Multicollinearity test

The Variance Inflation Factor (VIF) results are shown in table 4. Using VIF, mean VIF values of below 8.0 indicates absence of multicollinearity, otherwise multicollinearity is considered present. Conventionally, variables with VIF value of 1 are considered to be uncorrelated, variables with values ranging between 1 to 5 are considered to be moderately correlated while those that are greater than 5 are considered to be highly correlated (Miles, 2014).

Table 4: Multicollinearity Test

Variable	VIF	1/VIF
SR	3.91	0.255996
PR	3.84	0.260456
GFCF	1.49	0.671390
EXCR	1.33	0.751084
MWE	1.19	0.839358
TR	1.01	0.990090
Mean VIF	2.13	

Based on the results in table 3, the VIF value indicated that all the predictor variables were moderately correlated, since they all had VIF values within the range of moderate correlation. The mean VIF was 2.13 which is below the threshold of 8.0, hence multicollinearity was not a major issue amongst the independent variables.

4.3.3 Stationarity Test

An ADF test was used to test for the Unit Root under the null hypothesis of non-stationarity. The results are as below.

Table 5: Unit Root Test for Stationarity

Variable	**Levels**			Order of	**Difference**		
	Statistic	P-Value	Comment	differencing	Statistic	P-Value	Comment
GDP	0.417	0.9821	Non- Stationary	1	-3.783	0.0031	Stationary
PR	-3.468	0.0088	Stationary	0	-3.468	0.0088	Stationary
SR	-4.180	0.0007	Stationary	0	-4.180	0.0007	Stationary
PSR	-1.746	0.4074	Non- Stationary	1	-8.820	0.0000	Stationary
MWE	1.352	0.9969	Non- Stationary	1	-6.576	0.0000	Stationary

GFCF	2.805	0.9999	Non- Stationary	1	-5.346	0.0000	Stationary
EXCR	-0.454	0.9007	Non- Stationary	1	-5.977	0.0000	Stationary

The ADF test results showed that primary education ratio and secondary education ratio were stationary at levels, while post-secondary ratio, GDP, male wage employment, gross fixed capital formation and exchange rate were non-stationary at levels. All the variable that were non stationary at levels were differenced once.

4.3.4 Lag selection criterion

Prior to carrying out cointegration test, a lag section criterion procedure was carried out to determine the maximum lag lengths. The Akaike Information Criterion (AIC), and the Schwarz Bayesian information criterion (SBIC) was used in determining the optimal lag Lengths. The outcome of the lag selection criterion is exhibited in table 6 beneath.

Table 6: Lag-Selection Criterion

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-1100.5				1.1e+16	56.7947	56.9018	57.0932
1	-838.022	524.95	49	0.000	2.0e+11*	45.8473	46.7043	48.236*
2	-792.678	90.687	49	0.000	3.1e+11	46.0348	47.6418	50.5136
3	-727.758	129.84	49	0.000	2.9e+11	45.2183	47.5752	51.7873
4	-633.21	189.09*	49	0.000	2.0e+11	42.8826*	45.9894*	51.5416

From above, the selected optimal lag length under AIC and SBIC was 4 lags was determined to be 4, this is selected by the AIC was 4 lags while SBIC was one lag. Considering that the sample size was small, we proceeded to use the SBIC criterion of one lag, hence the succeeding cointegration test.

4.3.5 Test for cointegration

To test for cointegration, we estimated the ARDL bound test under the null hypothesis on no levels relationship. This follows the establishment that the variable in the study were having different order of cointegration. The results of the bound test for cointergration are reported in table 7.

Table 7: ARDL Bounds Test for Cointegration

Pesaran/Shin/Smith (2001) ARDL Bounds Test

H0: no levels relationship F = 0.908
t = -0.051

Critical Values (0.1-0.01), **F-statistic**, Case 3

	[I_0] L_1	[I_1] L_1	[I_0] L_05	[I_1] L_05	[I_0] L_025	[I_1] L_025	[I_0] L_01	[I_1] L_01
k_6	2.12	3.23	2.45	3.61	2.75	3.99	3.15	4.43

accept if F < critical value for I(0) regressors
reject if F > critical value for I(1) regressors

From table 7 above, the F-statitic value was less than the critical value of I(0), consequently we fail to reject the null hypothsesis signifying that the variable had no long run relationship. Following this results, we proceeded to estimate the short run ARDL model:

4.4 ARDL Shortrun Model Results

Table 8: Short run ARDL model estimates

VARIABLES	GDP
L.GDP	0.110
	(0.178)
L2.GDP	0.124
	(0.184)
L3.GDP	0.425**
	(0.184)
L4.GDP	-0.215
	(0.180)
PR	0.423
	(0.284)
L.PR	-1.061**
	(0.366)
L2.PR	0.0950
	(0.390)
L3.PR	-0.499*
	(0.268)
L4.PR	-0.239
	(0.200)
SR	0.184***
	(0.0486)
TR	0.0140
	(0.0444)
L.TR	0.0282
	(0.0397)
L2.TR	-0.107*
	(0.0567)
L3.TR	-0.0619
	(0.0436)
MWE	0.345***
	(0.0737)
L.MWE	0.281**
	(0.119)
Ln_GFCF	0.170***
	(0.0310)
L.D_Ln_GFCF	0.0216
	(0.0551)
L2.Ln_GFCF	-0.0160
	(0.0410)
L3.Ln_GFCF	-0.0797**
	(0.0344)
L4.Ln_GFCF	0.0344
	(0.0211)

LN_excr	0.0675*
	(0.0339)
L.LN_excr	-0.0295
	(0.0502)
L2.LN_excr	-0.0389
	(0.0445)
L3.LN_excr	-0.0598
	(0.0404)
Constant	1.122***
	(0.334)
Observations	41
R-squared	0.910

From the results, the short run coefficients first lag of primary education ratio, secondary education ratio at levels, tertiary education at second lag, male wage employment, GFCF and exchange rate were statistically significant.

Holding other factors constant, female primary education increased GDP by 106.1% as compared to the male education. Consequently, female secondary education increased GDP by 18.4% as compared to the male secondary education. Finaly, the resuts showed that female tertiary education tertiary level education increased GDP by 10.7% in the previous year as compared to male tertiary education. The findings are in line with Hassan & Cooray(2015a, 2015b) who established a positive effect of secondary education enrolment on GDP and Licumba et al. (2015) who found positive and significant impact of female primary education on GDP. In the shortrun, the results showed that GFCF increased GDP by 17% while exchange rate increased GDP by 6.75%.

4.5 Post estimation

4.5.1 Heteroscedasticity

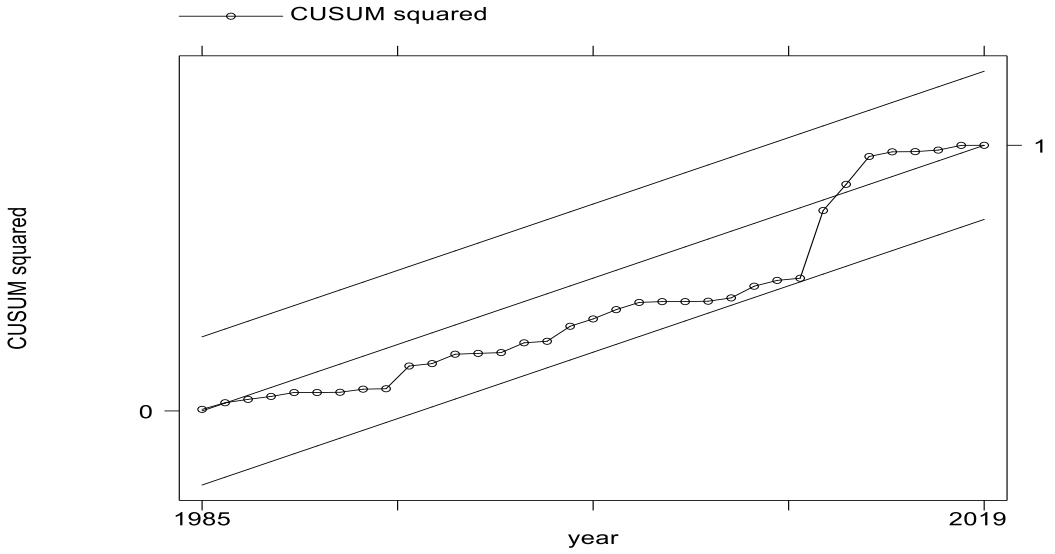
```
White's test
H0: Homoskedasticity
Ha: Unrestricted heteroskedasticity

    chi2(40) =  41.00
Prob > chi2 = 0.4265
```

The white test for hetoroskedasticity shows that our model does not suffer from heteroscedasticity.

4.5.2 Model stability

The model is stable since it lies with the cusum boundary.



CHAPTER FIVE

SUMMARY,CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the study findings,conclusion, policy recommendations and proposes further areas of the study.

5.2 Summary and conclusion

The effect of female education on economic growth in Kenya was analyzed from 1977-2021 using time series analysis.Findings indicated that male and female primary,secondary and tertiary completion ratios have relatively high effects on GDP. By Using the Autoregressive Distributed Lag,it was established that there was no long term relationship between variables. Total male employment was observed to be consistently higher than female total employment.

The results indicated a positive relationship between growth and female completion rates in all levels of education in comparison to male education.

5.3 Policy Recommendations

Female education and economic growth has crucial policy implications.The human capital theory asserts that humans are renumerated based on the knowledge and competencies.The greater the disparity in completion rates in education among males and females,the greater will be the gap in skills and competencies.Therefore,it is imperative that efforts are geared towards reducing the gender gap in completion rates across different education levels particularly on post-seconday education. From our sample,the gender gap in post-secondary education is more pronounced than the other levels of education. The Gender Global Gender Gap Index 2021 by the World Economic Forum ranks Kenya at position 95 overall out of 156 indicating that there is still gaps in education and economic empowerment in regards to women. There should be adequate investment toward female education and its enablers. Policy implications should be geared also toward enhancing equal access to employment opportunities for both genders.

The government in Kenya should increase efforts geared towards improving girl child retention and completion in all education levels so as bridge gap in employment. Studies such as Hill& King (1995) have shown that investing in woman education is akin to investing in society as a whole as has ripple effects especially to the children. Additionaly to the completion rates are the control variables which include Gross Fixed Capital Formation, exchange rate.Exchange rate has the highest growth effect on GDP in comparison to GFCF.

5.4 Suggested further research

The study uses time series data to determine the effect of female education on economic growth in Kenya.Similarly other research can be conducted using enrolment rates as proxies.It would also be interesting to note how vocational training colleges and short run courses affect economic growth in relation to female education.

The paper recommends further studies on gender inequality in education more particularly in areas where the disparities are highest.It also proposes studies for reasons of disparities.I also hope that the research will encourage more studies on female education and economic growth in Kenya via other growth models. Another area for future research is the gender gap in employment and proposals on how to reduce the gap.However,due to some limitations in data availability,our conclusion should be treated with caution.

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