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# The Relationship between government expenditure on education and fertility in Sub – Saharan Africa

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**THE RELATIONSHIP BETWEEN GOVERNMENT EXPENDITURE ON  
EDUCATION AND FERTILITY IN SUB – SAHARAN AFRICA**

**SUSAN WANJIKU MWANGI**

**ADMISSION NO: 078290**

**A Dissertation Submitted in Partial Fulfillment of the requirements for the Degree  
of Master of Science in Development Finance to the Strathmore University Business  
School**



***STRATHMORE UNIVERSITY BUSINESS SCHOOL***

**Nairobi, Kenya**

**February 2021**

## DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation itself.

Name: Susan Wanjiku Mwangi

Signature:



Date: February 15, 2021

### Approval

The dissertation of Susan Wanjiku Mwangi was reviewed and approved by:

Name: Dr. Thomas Kibua

Signature:



Date: February 15, 2021

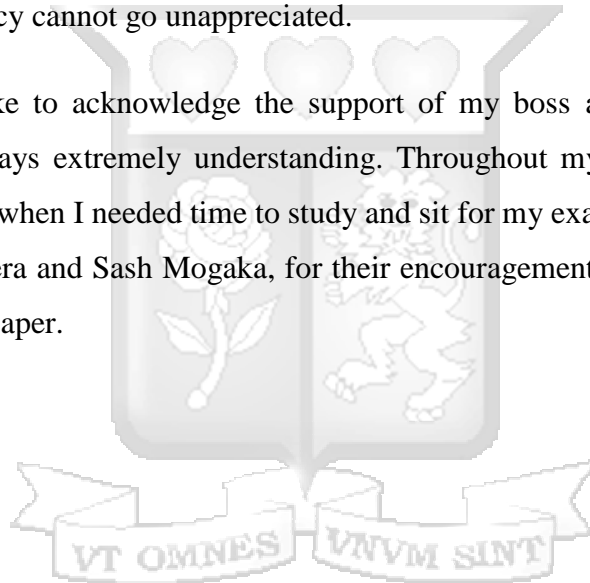


## ACKNOWLEDGEMENTS

I would like to acknowledge my supervisor, Dr. Thomas Kibua, who has walked with me throughout this journey. His indispensable advice always kept me moving, “Make sure you read and write something down every day, even if it is just a sentence. No matter what, never stop moving.”

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## ABSTRACT

This dissertation estimates the changes in fertility rates in SSA, achieved by targeting government expenditure on education towards women's education. Additional determinants of fertility were included in the model to ascertain the predictive validity and significance of government expenditure on education. They include the contraceptive prevalence, female unemployment rate, gross national income per capita, infant mortality rate, male employment rate, urbanization growth rate, and the Tax to GDP ratio. The theoretical foundation for this dissertation is the Theory of Increasing Prosperity, Theory of Human Capital and Wagner's Law of Increasing State Activities. Panel Data spanning 1980 – 2017 of a sample of twenty – one countries was coded into a series of simultaneous equations executed through a Structural Equation Modelling tool. The results reveal a positive and significant correlation between government expenditure on education and the female school enrollment rate. Additionally, the findings show a significant and negative relationship between government expenditure on education and fertility. More importantly, the magnitude of this effect intensifies with women's education as a mediator. Furthermore, the aforementioned relationships remain significant in the presence of other determinants of fertility. This dissertation concludes that government expenditure has the potential to achieve a reduction in fertility as an outcome, and specifically through women's education, resulting from the benefits of Human Capital.

*Keywords: Government Expenditure on education, Fertility, School enrollment, Structural Equation Modelling, Women's education*

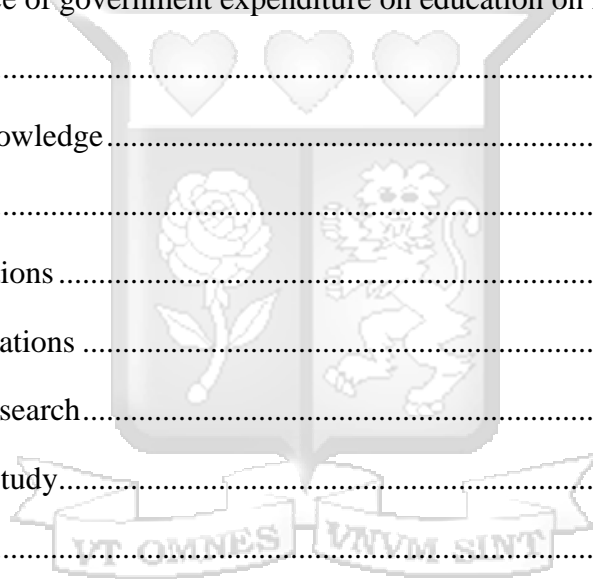
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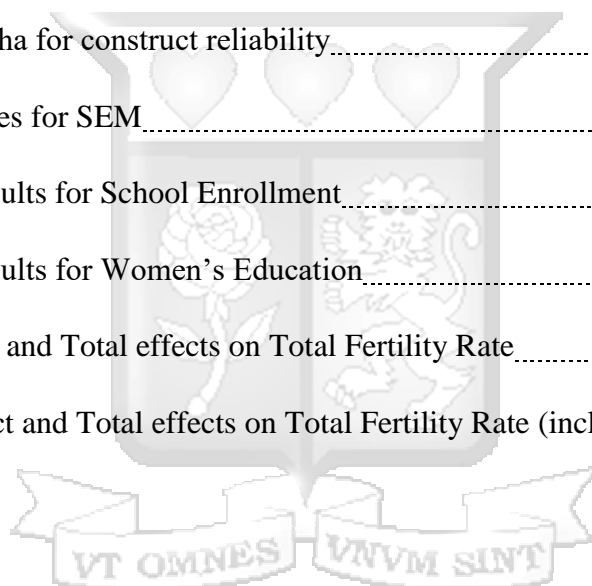
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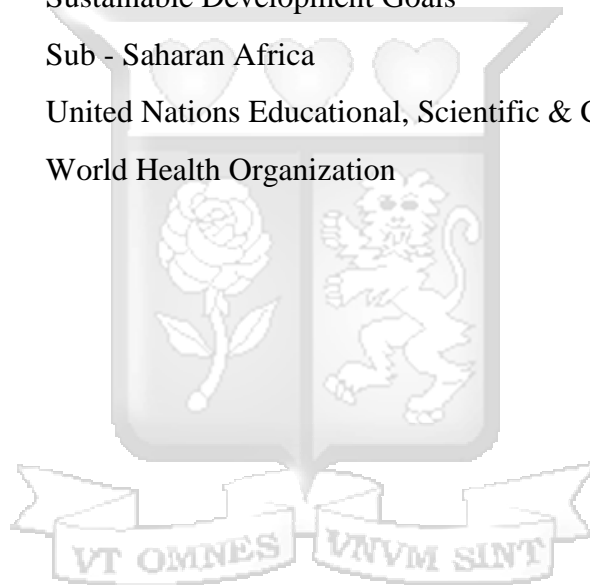
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## ABBREVIATIONS AND ACRONYMS

ECOWAS	Economic Community of West African States
GDP	Gross Domestic Product
GNI	Gross National Income
HPAE	High Performing Asian Economies
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
LDC	Least Developed Countries
SDG	Sustainable Development Goals
SSA	Sub - Saharan Africa
UNESCO	United Nations Educational, Scientific & Cultural Organization
WHO	World Health Organization



## DEFINITION OF TERMS

Ceteris Paribus	Holding all other factors constant
Externality	A spillover effect to third parties, positive or negative, arising from policy interventions
Fiscal space	The flexibility of the budgetary room to allow for provision of public goods and services without undermining fiscal sustainability (WHO, n.d.)
Income effect	Subsequent changes in demand for a good resulting from a change in disposable income
Merit good	A good in which society perceives that it should be provided based on need, rather than on the ability and willingness to pay by consumers
Opportunity cost	The benefits lost as a result of choosing one alternative to the other option
Pro – natalist	Societies which promote and support childbearing and high birth rates
Substitution effect	Shift in demand for a good and evaluation of alternative options, resulting from changes in the price of the said good
Terms of Trade	The ratio of a country's export prices to its import prices for a given period
Unmet need for contraception	Percentage of women who want to prevent childbirths but are not using any form of birth control methods

## DEDICATION

I would first like to dedicate this paper to the Almighty, who put these desires and passion in me to pursue matters economic development, and specifically education. It is through His grace and strength that I forged ahead even when it did not make sense.

Second, I dedicate this to my dad and mum, George and Penina Mwangi, and my brothers, Ian and Willis, for their never-ending support and encouragement, in my pursuit for higher education. My extended family, Wachera, Shiru, Muthoni and Njoki have also been my biggest fans. It is a true blessing to be brought up in a family of strong and independent women.



## CHAPTER ONE: INTRODUCTION

### 1.1 Introduction

This dissertation links government expenditures targeted towards women's education, as determinants of fertility. Chapter one provides a background of the study proceeded by the problem statement which explains the challenge that the dissertation seeks to solve. The sub - section that follows is an outline of the general and specific objectives of the research, and the corresponding research questions. The chapter concludes by stating the significance of the study, and listing the categories of stakeholders that will benefit from this dissertation. Subsequent chapters highlight in detail the theoretical and empirical foundation for the dissertation, research methodology, data analysis and finally concluding with the discussion of the findings, in that sequence.

### 1.2 Background of the study

The 2030 Agenda for Sustainable Development commissioned in 2015 revolved around three dimensions of sustainable development – economic, social and environmental – founded on the premises of people, planet, prosperity and partnership (United Nations, 2016). “People, and thus populations, are at the center of sustainable development” (United Nations, 2019, p. iii). This opening statement from the *World Population Prospect of 2019* explains why population growth and demographic changes, primarily fertility rates, should be a matter of concern depending on the context that the phenomenon presents itself. The report also predicts that the global population is expected to rise by one billion by the year 2050, of which, half of that figure is set to come from Sub Saharan Africa.

Fertility rates, besides mortality rates and immigration, is a major determinant of the population size, structure and population growth rate of a given country. In SSA, both mortality and birth rates have substantially reduced over the years; the former continues to decline at a faster rate than the latter, consequently accounting for the rapid population growth rate (See Appendix). Admittedly, Enke (1971) argues that it would be detrimental to the development of an economy, should the surge in the population growth rate be as a result of declining mortality rates coupled with high fertility. On the matter of fertility decline, policy design either manipulates reproductive behavior and choices, provides an incentive to reduce the demand for children or to cap the fertility at a certain level altogether. An example of such fertility capping is the one child policy in China

(Turner, 2009). Notwithstanding, the institutions and the socioeconomic state of affairs of a country may exacerbate the consequences of this rapid population growth. This further poses a challenge to the outcome response of policy efforts, whose aim is to control the population growth rate, especially through managing birth rates.

Notably, fiscal policy is a tool that has enabled the genesis of the most remarkable rates of economic growth and development. Moreover, the use of policy generates both intended and unanticipated outcomes – positive and negative; this in some circumstances includes influencing reproductive behavior and subsequently, the rate of population growth. In fact, it is for this purpose that The US National Academy of Sciences (1971) report “...placed strong emphasis on the role of human capital and on the increase in the fraction of national income that must be devoted to education when fertility is high,” (as cited in Ashraf, Weil, & Wilde, 1993, p.105). The report is titled *‘Rapid Population Growth: Consequences and Policy Implications’*.

Similarly, the more recent policy design of the global Sustainable Development Goals (SDGs) includes as a measure and indicator of the achievement of SDG one (no poverty), points to the proportion of government expenditure dedicated to the development of human capital. Briefly, human capital is the investment in the skills and intellectual capacities of an individual, with the expectation that those skills will earn him an expected future return higher than the unskilled. In addition to that, human capital development engenders other externalities that not only stand to benefit the individual, but also leads to other positive outcomes, thus benefitting the society. Chapter Two of this study provides a detailed discussion on the negative linkage between Human Capital and fertility choices.

In some instances, governments may intervene in the supply of economic goods, which take the form of merit goods such as education. Comparably, *The Education 2030 Framework for action* (as cited in United Nations, 2016) recommends that the expenditure on education should account for 15 – 20% of the total government expenditure. A consequence of investing in education is a reduction in fertility rates as explained in the *Conceptual Framework* based on theory. It embodies enculturation and the rationalization of the opportunity costs of paternity and parenthood, to other competing sources of leisure and entertainment. The Theory of Increasing Prosperity by Brentano (1992) provides the theoretical support for this mechanism of fertility decline. Likewise, Wagner’s Law of Increasing State Activities justifies the necessity for government intervention in funding

education, also as a channel to influence fertility reduction through female enrollment into school (Kuckuck, 2012; Lamartina & Zaghini, 2011; Mahalakamshi, 2017).

During the economic take – off of countries classified as High Income into higher stages of development, a massive investment in human capital was undertaken; the consequence, a significant reduction in fertility. In addition to that, despite the diminishing rates of fertility and population growth, countries with the High Income classification have maintained their expenditures on education at 12 – 14% of the total expenditure to accumulate the human capital and ensure high quality of educational resources available to each student. On the other hand, though the population growth rate of SSA remains high, the proportion allocated to developing the educational sector has remained stagnant, between 15 – 18% of total government expenditure. Could this signal a strain on expansionary fiscal policy towards education due to the pressures of high population, thus compromising the quality of education and amount of resources per child? Could the policy efforts to develop human capital be unresponsive for one reason or another, thus failing to induce a negative shift in fertility? Furthermore, a report that analyzes the issues shaping the economic future of Africa has stated that the economic growth rate of SSA is below the population growth rate (World Bank, 2019). This poses a direct threat to the ability of these economies to meet the needs of their growing populations. The contributing factors to this slurred economic growth in this particular region are high debt to GDP ratio, high poverty levels, political instability, high inflation and regulatory uncertainty.

Along with that, Bulatao (1984) suggests that the education of both men and women is negatively associated with fertility. However, this effect is greater with educating the latter gender. Furthermore, empirical evidence has substantiated women's education, citing that it not only benefits the individual, but also engenders other social and development outcomes. Among them is its influence on controlling fertility, illustrated by studies showing that the relationship between the two variables is negative (Cooray & Potracke, 2010; Kim, 2016; Macunovich, 1998; Stromquist, 1990; Weinberger, 1987). It is for this reason that the focus of this study is on women's education, as the mechanisms for fertility control are far wider. These interconnected outcomes of female education include postponement of marriage, delayed childbearing, spaced births, use of contraceptive methods and reduced lifetime fertility (Macunovich, 1998; Majgaard & Mingat, 2012; Weinberger, 1987).

### **1.2.1 Fertility rates**

Fertility is a measure of the number of children that a woman would be expected to have, should she live until the end of her child – bearing years within a certain context. Age, sex, religion, contraceptive prevalence, education, the business cycle, income, law, policy and other macroeconomic indicators are among the factors that determine fertility.

The role of education in controlling fertility occurs through various dynamic and inextricably linked channels not exclusive to a particular gender: as a consequence of human capital development; cultural erosion from a pro – natal mentality; knowledge and affordability of birth control methods; the quest for material prosperity makes the demand for and the reproduction of more children less lucrative.

### **1.2.2 Education Expenditure**

Expenditure on education is the amount of public or private financial investment dedicated to fund and develop the educational services sector, to cover the administration, operational and research & development costs. This investment aims to achieve certain interdependent objectives. First, to encourage school enrollment at all levels – primary, secondary, tertiary – of children of school going age. Second, to build capacity through construction of more schools, hiring more teachers, refurbishing and maintaining the existing institution. Third, to facilitate research and development of the curriculum in line with the demands of the labor market. Fourth, to offer subsidies to resource constrained households, subsequently lowering the burden of private investment in education. This reduces the inequality of economic opportunities in societies with wide income inequality gaps. Bodies tasked with the funds allocation process are beseeched to be sensitive to and take into account the different roles and needs of men and women in their respective societies, to achieve optimal school enrollment. (Abril & Amaah, 2009; Welham, Barnes-Robinson, Ille, & Okhandiar, 2018).

### **1.3 Statement of the Problem**

The effects of high fertility are circumstantial depending on the prevailing social and economic factors in a country. The coexistence of high fertility and rapid population growth, such as that in SSA, is particularly detrimental with weakened socioeconomic institutions. These institutional inefficiencies aggravate the capability to resolve the challenges associated with high populations:

high youth dependency affecting household savings and investment; high unemployment rate; capital shallowing; reduced per capita income. Inevitably, poverty compounds, competition for resources results to insurgency and, the country becomes vulnerable to shocks and disasters.

Globally, the countries of Sub – Saharan Africa exhibit the highest birth rates, twice the global average, thus possessing the highest births as compared to other regions. To illustrate this claim, SSA has a regional average of 4.7 births per woman, whereas the global and the High-Income Countries (HIC) average at 2.4 and 1.6 births per woman, respectively (*See Appendix*). In a span of thirty – eight years (1980 – 2017), a majority of the SSA countries have maintained a mean of 17% of the total government expenditure apportioned to education, while the High Income region has a mean of 13%. Specifically in SSA, the lowest recorded allocation thus far is 8% and the highest 37%. Even though the regional mean is higher than that of HIC, the analysis should be relative to the population size, population growth rate and the fertility of the country in question. For instance, SSA has an annual population growth rate of 2.7%, while the HIC report a rate of 0.4% (World Bank, 2020). Given the pressures of high populations primarily comprising of young cohorts, the quality of education and the quantity of educational resources available to each child may be both compromised and limited, respectively, in SSA. Under these circumstances, it may suffice to say that the efforts to invest in human capital may not manifest, failing to ignite a rapid fertility transition within the region.

To unravel the determinants of fertility, one must be cognizant of the intricate socioeconomic linkages. Due to this complexity, studies revolving around fertility, and specifically in SSA, are limited. Nonetheless, previous quantitative studies have established the relationship between fertility and other factors, albeit without demonstrating a systematic and interdependent relationship. An expected outcome of investments in education is the benefits that accrue to the development of human capital. Notwithstanding, despite the cost of investing in education being negatively correlated with fertility, the influence of government expenditure on education on fertility remains unclear, and specifically within the SSA region. Moreover, there is a significant negative correlation between the education of women and fertility. In spite of this, studies reveal that female children are less likely to enroll into school as compared to their male counterparts (Bulatao, 1984; Majgaard & Mingat, 2012; Muyanga, Olwande, Mueni, & Wambugu, 2010). Consequently, this poses a hindrance to the efforts to achieve fertility reduction through women’s education. Therefore, the essence of this study is to isolate the effects of government expenditure

on education, specifically targeting women's education, as a determining factor of fertility. This dissertation fills a locational and methodological knowledge gap, by demonstrating a systematic interdependent relationship pertaining to government expenditures on education, female school enrollment, and fertility in SSA.

## **1.4 Research Objectives**

### **1.4.1 General Objective**

The main objective of this study is to estimate the effect of government expenditures on education, targeted at women's education, on fertility, in Sub – Saharan Africa.

### **1.4.2 Specific Objectives**

The specific objectives of this study are to:

- i. Establish the direct effect of government education expenditures on women's education in SSA.
- ii. Determine the direct effect of women's education on fertility in SSA.
- iii. Estimate the indirect effect of government education expenditures on fertility, through women's education in SSA.
- iv. Determine the effect of government expenditure on education as a determinant of fertility in SSA, *ceteris paribus*.

## **1.5 Research Questions**

The research questions that this study seeks to answer are to:

- i. What is the direct effect of government education expenditures on women's education in SSA?
- ii. What is the direct effect of women's education on fertility in SSA?
- iii. What is the indirect effect of government education expenditures on fertility, through women's education in SSA?
- iv. What is the effect of government expenditure on education as a determinant of fertility in SSA, *ceteris paribus*?

## 1.6 Scope of the study

This dissertation places its focus on the Sub – Saharan Africa region, which comprises of forty – eight countries, 67% are classified as Least Developing Countries (LDCs). Regionally, the implementation of fiscal policy faces several challenges. First, the efficacy of tax policies encounters hindrances due to gross income inequalities, poverty, and transactions taking place in the informal sectors. This directly and negatively impacts revenue collection that is necessary for government services provision. Additionally, the public institutions have exhibited weaknesses in governance and credibility, manifested in mismanagement and embezzlement of funds, unaccountability and lack of transparency by those in authority (Aloy, Moreno-Dodson, & Gilles, 2003). These institutional inefficiencies may undermine the ability of the sovereignties to provide merit goods to their citizens. Consequently, their governments constantly run large budget deficits, subsequently requiring investment trade – offs and divestiture in sectoral development. The advancement of human capital, particularly investments in building capacity in education, maybe excluded depending on the priorities of the government.

Moreover, SSA economic growth rate is reported to be below the population growth rate, posing a direct threat to the ability of these economies, to meet the needs of their growing populations (World Bank, 2019). The contributing factors to this slurred economic growth in this particular region attribute to high debt to GDP ratio, political instability, high inflation and regulatory uncertainty.

On the matter of enrollment into school, though primary school enrollment has shown to increase over the years, several countries in the SSA region were yet to achieve universal primary schooling (Majgaard & Mingat, 2012). Also, SSA scores 0.573 in the Gender Inequality Index (GNI), with the data similarly suggesting that women are disadvantaged in the categories of reproductive health, empowerment with regards to having some secondary education, holding political seats, and finally participating in the workforce by either actively job searching or active employment (United Nations Development Programme, 2019). Given these statistics, one could imply that the exclusion of women from educational opportunities and productive work is among the reasons for high fertility within the region.

## **1.7 Significance of the study**

This dissertation will be of interest to the following parties:

### **1.7.1 Researchers in demographic studies**

First, researchers in the area of population, demography and gender studies will benefit from the study to answer the following questions. With the study skewed towards female education, may this have an implication on male education when expansion of the fiscal space is not a viable option? What are some unintended social impacts that may result from effect lags in interventions intended to manipulate fertility rates?

### **1.7.2 Policy Makers**

Policy makers in the area of Sustainable Development will benefit from the study due to the mutually non – exclusive nature of the seventeen SDGs. Fertility and population are both crux to economic development. Therefore, this study contributes to the interlinked attainment of SDG 1 – no poverty; SDG 2 – zero hunger; SDG 4 – inclusive and equitable quality education; SDG 5 – gender equality; SDG 11 – sustainable cities and communities.

### **1.7.3 Practitioners**

Finally, practitioners such as those in the Treasury can come to appreciate the importance of allocating a significant proportion of the budget to investing in the Educational sector to manipulate reproductive behavior, especially when population is high. Moreover, the spending actions and the efficiency of these decisions taken by governments, often reflect on the economic growth and development trajectory of their countries. Investment in education plays a crucial role in human capital development, as it increases the probability that one will be a candidate for productive employment; and can be instrumental in achieving other social outcomes. Finally, the results of this study may influence funding considerations in the area of female education.

### **1.7.4 Academia**

Development Economists acknowledge that women bear a disproportionate burden when it comes to poverty, reinforced by their domestic responsibilities; predominantly, the child – bearing responsibilities. This dissertation amplifies the premises posed in the field, concerning the positive externalities resulting from the education of women. It includes the participation in productive work, economic empowerment and the subsequent knowledge and use of contraceptive methods.

## CHAPTER TWO: LITERATURE REVIEW

### 2.1. Introduction

This chapter provides the foundation for the problem at hand and begins by discussing the fundamental theoretical frameworks that support this study, with a focus on fertility, human capital and government expenditures. Second, the empirical review section explores works revolving around the theme of fertility, government expenditure, school enrollment and women's education. The fourth section provides a summary of the literature, which is then proceeded by the identification of the research gap. The chapter concludes with a derivation of the Conceptual Framework, and outlining the units of measurement of the constructs.

### 2.2 Theoretical Review

#### 2.2.1 Theories of fertility and fertility decline

A myriad of economic, biological, psychological and socio – cultural factors at any one point in time, are responsible for shaping the attitudes and beliefs ingrained in an individual pertaining to the concept of fertility. As such, to claim that one can wholly account for all the elements that affect fertility, on a generalized basis such by region or by country, would be hyperbolic. In fact, the differences in fertility preferences and reproductive behavior are unique even at the household level. Notwithstanding, existing literature has sought to establish the connection between the individual components that may affect and influence fertility choices, *ceteris paribus*. However, the direction of causality has been subject to debate among several economists and statisticians, as many argue that fertility is a consequence rather than a cause. The theories below corroborate the existence of these relationships, their influence on fertility preferences given various circumstances, and the influence of these circumstances in facilitating the fertility – decline transition.

##### 2.2.1.1 Malthusian Population Trap

The Reverend Thomas Malthus (1803), an English scholar and economist regarded as the “father of the birth control movement” (Todaro & Smith, 2015), enunciated the negative consequences of population growth. In his theory, Malthus presents a lucid account of the general change in reproductive behavior, when the household income increased or declined. In his model, he proposed that when incomes rose above equilibrium, the death rates declined, and fertility rates

surged. On the contrary, death rates increased and birth rates decreased when incomes fell below the equilibrium level (Becker, Murphy, & Tamura, 1994).

Subsequently, to correct this disequilibrium of available resources per capita, there would be two responses, the proactive and the inevitable. The proactive measure was given the term “preventive checks” – deliberate pursuits by man to control human reproduction – including practicing abstinence and moral restraint, postponing the age at which one got married, not marrying at all during ones’ lifetime, and even to the point of infanticide (Gupta, Bongaarts, & Cleland, 2011). On the other hand, the inevitable response was termed as “positive checks”, a self-correcting mechanism by the ecosystem. It is characterized by disease, drought, famine, floods, genocides, wars, and natural calamities, with an aim to reduce the population until the equilibrium point was restored, where the available resources can be life sustaining.

This theory presents a simple overview of the determinants of fertility and the consequent challenges resulting from high population pressures, of which can be traced back to the countries of Sub-Saharan Africa. Not only does this theory set the baseline for the Theory of Increasing Prosperity, but it is also enables this dissertation to answer specific objective four.

#### ***2.2.1.2 Theory of Increasing Prosperity***

Lujo Brentano (1910) – a German liberal economist, political economics professor and writer in the areas of determinants of fertility, behaviors of the labor market and social security systems – developed his theory as a criticism to the Malthusian theory. He homogenized the effects of age and marital status on fertility, and instead introduced the construct of growing opulence in shifting individual preferences with regards to fertility, thus referred to as “increasing prosperity” (Brentano, 1992).

In his theory of fertility decline, Brentano suggests that the individuals of a lower social class encounter exclusion from mentally stimulating activities such as books and travel, due to their inability to afford these products. To be precise, they lack options. Consequently, he compensates for his limited options by instead deriving his pleasure from sexual indulgence, hence leading to high fertility. Conversely, the wealthy have access to several competing pleasures, which exist outside of the home. As a result, not only do the wealthy evaluate the time and financial costs of child upbringing against other opportunities, but also the quality of children. In the same way, the

new status of women makes them less attractive as a marriage prospect, as their heightened need for an education and building a career makes them view children as burdensome (Coontz, 2013).

However, Brentano faces critique for failure to distinguish between sexual enjoyment and the gratification derived from parenthood. Thus, sexual indulgence by the less affluent equates to the desire for offspring, while perceiving the opposite for the wealthier classes. Coontz (2013) argues that the lack of knowledge about birth control measures leads to high fertility instead. Worth noting, the wealthy too did not practice sexual continence, even though their family sizes remained small. Hence, other proactive measures to influence the desired small family sizes, must have been adopted. Therefore, regardless of the social class, one must limit his family size, due to the costs of an additional member, to have the material capacity to explore other opportunities that are available for pleasure. In support of this criticism, it corresponds to the Malthusian proposition alluding to the preventive checks in the presence of financial constraints.

In agreement, Sombart (1902) also advances that with the development of a capitalist mentality, wealthy individuals weigh their options including those of parenthood, as they may cost him his other interests, in terms of both time and material resources. In addition to that, he cites that men's interests lie outside of the family space and have a burgeoning desire to acquire power. He also insists that women too developed the same mentality as that of a capitalist, in their quest for independence as they began to work and earn an income (as cited in Coontz, 2013).

The theories of fertility and fertility decline, the latter being a progressive version of the former, resonates with this dissertation by explaining the shift in attitudes towards parenthood and family size, as they are weighed among other competing interests and pleasures that are outside of the home. As individuals become educated, so does their desire to elevate socially. The wealthy are also concerned with the quality of children and are therefore inclined to have less children. The poor lack options due to e.g. to take contraceptives or not to take, because they cannot afford them. Additionally, when women become independent and begin to work, their desire for children declines. These theories are relevant to the general objective, and specific objectives two, three and four. The Human Capital theory shall explain these dynamics further, and demonstrate the corresponding influence that it has on fertility.

### **2.2.2 Theory of Human Capital**

Human Capital refers to the investment in education, health and other metrics that increase and improve human productivity (Todaro & Smith, 2015). This draws from the fact that, despite these expenditures contributing to capital, they do not create physical or financial capital. Instead, it is referred to as human capital, because individuals are inseparable from their skills, health, and other capabilities (Becker, Human Capital Revisited, 1994). This theory goes beyond the financial returns expected from investing in education, but also recognizes other social outcomes from this investment, particularly fertility.

The concept of Human Capital dates back to the 18<sup>th</sup> century, where it first originated from Scottish economist, Adam Smith (1776). In his book “The Wealth of Nations” (as cited in Spalletti, 2014), Smith compares the returns to an individual’s expertise and skills, to that of a specialized machine. He suggests that a man who sacrifices his time and physical resources to educate himself – as opposed to devoting time to work in areas which require extraordinary skill and ability – can be compared to an expensive machine. The investment in his education will acquire him the skills, from which he will earn a wage higher than that of unskilled labor, enabling him to recover the expense of his education. Moreover, these returns expect to be generated within a reasonable amount of time, and should be with consideration to the uncertainty of the lifespan of a human (Spalletti, 2014).

Among the scholars that revisited the Human Capital proposition by Adam Smith, was American economist, Gary Stanley Becker. His premise was founded on the concept of opportunity cost, where he asserted that time was a major cost when investing in education. More significantly, he acknowledged that education and training were the most important investments in human capital. Similar to Adam Smith, he pointed out the role of education in increasing an individual’s income, even after differencing the direct and indirect costs of education. Furthermore, he stated that even though the wages of educated people were above average, these gains were much larger in least developed countries (Becker, Human Capital Revisited, 1994).

Also, Becker (1994) cites that the change in female education is a clear indication that human capital significantly responds to the benefits and costs of the investment. In the years preceding the 1960s, women were hesitant to enroll in the technical fields but instead inclined to the areas of literature and home sciences. A large proportion of women did not work for pay, and most focused

on an education that contributed to home production; this was done with the intention to increase their suitability as a spouse according to the traditional gender roles in the family. In contrast, today, many women are now enrolling in technical fields and are actively participating in the high – skill labor market. Consequently, job opportunities for women continued to rise, and women preferred to take up these opportunities as opposed to taking time off to bear and raise children. However, Becker (1994) proposes that the career advancement of women was not as a result of the opportunities presented to them, but as a result of their attachment to the labor market; this attachment was prompted by a significant drop in fertility rates, an accelerated rise in divorce rates, and a surge in demand for the services sector.

To conclude, the relevance of the Human Capital theory to this study is to demonstrate the freedoms associated with education which accrue to both men and women, further translating to reproductive behavior and fertility preferences. First, the ability to participate in productive work, and consequently earning an income. Second, a shift in traditional beliefs and attitudes of gender roles and family size. Third, weighing the marginal costs of an additional child, as opposed to using time and those same financial resources, to explore other sources of pleasure outside of parenthood, as insinuated in the Theory of Increasing Prosperity. Fourth, the acceptance, knowledge and accessibility of birth control methods, by social exposure and affordability. The theory of Human Capital is relevant to the the second and third specific research objectives.

### **2.2.3 Wagner’s Law of Increasing State Activities**

Adam Smith, in his inquiry into the “Wealth of Nations”, stated that the role of government be confined to the maintenance of law, order, peace and security, as well as to provide hard infrastructure such as development of transport networks within a country. In contrast, German economist of the 19<sup>th</sup> century, Adolph Wagner, found that, as economies approached higher levels of development, the scope of government activities increased; the state took on more functions. Consequently, they learned how to perform both the old and the new functions both effectively and efficiently. This broadening of the scope led to an increase in the government expenditure to accommodate the demands for social and cultural progress – thus referred to as “Increasing State Activities” – influenced by two major factors. First, a rising demand for government services, resulting from taxation and increased revenue collection by the state, and an expectation of a rapid increase in public expenditure than at the rate of increment of the income of the citizens. Second,

the state would encroach on the supply of economic goods initially reserved for the private sector, for the purpose of the common good of the society (Kuckuck, 2012).

Accordingly, these reasons provide justification for the direct linkage between government expenditure, and economic development in its different manifestations. As such, Peacock and Scott (1998) note that urbanization, population growth rate, demographic composition in terms of age, and the literacy levels within a society are among the variables which dictate the demand and supply of public expenditure. The social problems which are associated with rapid population growth, urbanization and industrialization necessitate the provision of the welfare services by governments as a matter of need rather than on ability to pay.

Specifically, the two major types of public expenditure are: (i) internal and external security – heightened innovation in criminal offences as economies achieve higher levels of development; (ii) social and welfare functions – larger expenditures on public education and public health, based on the premise that both are merit goods. To remain in context, this paper shall confine the discussion to the latter type of expenditure. In particular, a merit good satisfies a number of criteria. First, its consumption will generate third – party spillover benefits. Second, the society believes that the good be provided based on need rather than based on their ability to pay for the good. Third, the state finds that should the good be supplied under the laws of free – markets, it will be under – consumed, and the spillover effects to the society shall not be realized, ergo requiring public policy intervention to incentivize its consumption.

However, a criticism to the theory is that it fails to delineate the cause and effect of public expenditure to output. Despite this, Peacock and Scott (1998) acknowledge that recent econometric methods applied on public expenditure components are valid when substantiated by theory. This theory is relevant to this study because it validates the specific research objective three, that there is a relationship between government expenditure on education and school enrollment. As detailed in the theory of Human Capital, it would suffice to classify education as a merit good worthy of public investment, especially in SSA. Finally, the payoffs of government expenditure is higher when societies are at lower stages of development such as those in SSA (Kuckuck, 2012; Peacock & Scott, 1998).

## **2.3 Empirical Literature Review**

### **2.3.1 Government expenditure on education and school enrollment**

Anyanwu and Erhijakpor (2007) in their linear panel data econometric inquiry into the relationship between government expenditure on education and school enrollment at primary and secondary level, find that the former has a positive and direct significant effect on the latter. The study sample was four African countries: South Africa, Algeria, Nigeria and Egypt. More importantly, Schultz (1999 and 2002), and Strauss and Thomas (1995) postulate that government expenditure on education, through its outcome of education, is a means to reducing fertility (as cited in Anyanwu & Erhijakpor, 2007).

In like manner, Emara and Hegazy (2017) contend that government expenditure on education is key in facilitating female enrollment into school, especially when the aim of the expenditure is to build capacity. Admittedly, this is the case because in most low income households, male privilege will have them already enrolled. As a matter of fact, Sabir (2002) notes that these parities in school enrollment are more prominent at higher levels of education. A point worth noting is that advancing education quality, through diverting resources to research and development, only widens the gender disparity gap in education (Emara & Hegazy, 2017).

Petroia, Gurenco and Parea (2016) assert the importance of gender budgeting and analysis. This approach is a means to optimize and encourage the enrollment of the disadvantaged gender depending on the jurisdiction. Gender budgeting is less about proportionate allocation of expenditures towards a certain gender, but rather unravelling preconceived notions of gender neutrality and being conscious of gender bias when developing policy interventions and outcome evaluation. On the other hand, gender analysis is a subset and prerequisite of gender budgeting, involving the identification of the short and long term needs and priorities of both men and women. Therefore, existing gender disparities should be taken into account at the design, planning, execution and monitoring and evaluation of the efficacy of education policies. Furthermore, their work is consistent with the findings of Muyanga, Olwande, Mueni, and Wambugu (2010), and Emara and Hegazy (2017), that socioeconomic factors are fundamental in dictating gender education consumerism.

The challenges associated with poverty, a persistent development issue in SSA, plays a role in the dynamics of these households and their subsequent demand and preferences for the quality versus

quantity of children conundrum. Granted, these dynamics may be an impediment to achieving the outcomes that may arise from the expenditure on public education.

To illustrate, Muyanga et al. (2010) in their review on the impact of free primary education in Kenya, find that despite the subsidies offered to education as an incentive, enrollment of school – going aged children was subject to other considerations. These barriers include: age – older children have a lower probability of being enrolled into school because they can work informally and provide an additional source of income to the family; gender – female children have a less likelihood of being enrolled into school because they are perceived to be a source of domestic labour; relationship and level of schooling with/of their primary caregiver – educated mothers are more likely to educate their children; health – children who had no chronic illness were more likely to be enrolled; household income – there was a lower chance of enrolling children into higher levels of education such as the secondary and tertiary levels, if the family could not meet its basic needs.

All things considered, Birdsall (1989) prescribes to the use of the approach of welfare economics to examine the value of public policy and finance, to the incentives associated with fertility reduction. The effectiveness of these policies will depend on the coexisting factors in times of high fertility.

### **2.3.2 The role of women's education in controlling fertility**

In this section, the dissertation explores the mechanisms by which women's education, influences fertility. Richard Easterlin (1987) observed that as the male's earnings rose, so did the marriages and the fertility rates (as cited in Macunovich, 1998). However, the converse was observed as women attained schooling and gained an income, thus explaining why the focus of this study is on women's education and not male. By way of contrast, Bulatao (1984) noted that wives chose not to work, when the income of the husband increased to a certain level. Incidentally, though education has been significant in the fertility transition, its significance to fertility has been conspicuous with higher levels of education, and more years of schooling. An illustration of this was higher fertility was reported in women who had only three to ten years of schooling (Bulatao, 1984). Indeed, it would suffice to state that the optimum rewards for human capital development can be experienced and exploited with higher education attainment, and as one acquires occupational skills in various capacities, whose expertise can only be augmented over time.

The education of women leads to increased participation in productive work and subsequently higher incomes (Bulatao, 1984; Cooray & Potrafke, 2010; Emara & Hegazy, 2017; Kim, 2016; Macunovich, 1998; Stromquist, 1990). Through different mechanisms, these studies have demonstrated and implied a negative correlation between education and fertility rates. First, with this newfound economic empowerment, women opt to have fewer children due to the income that they will forego, as time is spent bearing children. What is more, education enables women to obtain knowledge that will inform their contraceptive decisions; educated women are more likely to give a definite numerical figure when prompted about their desired family size. Besides, it has been found that the development outcomes of women's education spurs beyond that of the individual gains by the woman; it contributes to better health and education investment in their offspring. In consequence, it reduces the inclination of women to bear children out of economic necessity and lower infant survival rate, as with the case in poor households with less educated women (Emara & Hegazy, 2017).

Also, Pampel and Peters (1994) state that education has been significant in challenging the traditional gender roles, changing the attitudes, beliefs and norms present in certain cultures, which promote large family sizes and reiterate that women play a passive role in making decisions on family size (as cited in Macunovich, 1998). Until recently, women were considered a paramount source of domestic labor – doing domestic chores and taking care of their siblings that poor households could not do without (Stromquist, 1990). Conversely, women from wealthier households are more educated, because their parents can afford to find alternatives to this domestic labor from external help. Nevertheless, at the time of the study, parents were still reluctant to invest in the education of their daughters, as it could potentially erode the normative role of women in the family i.e. assuming the position of a wife, bearing children.

### **2.3.3 Government expenditure on education and fertility**

In this section, the study decomposes the complex connection of investment in education and fertility, which more often than not, manifest in the long run. Bulatao (1984) emphasizes the need for education, as it results to long term improvements in income; this development of human capital increases the opportunity costs of having children.

Notably, the East Asian Growth Miracle attributes to the policies in support of human capital development, and particularly education, among the other factors that led to this sustained growth.

The High Performing Asian Economies (HPAEs) enforced policies and frameworks that prioritized human capital development, which saw a sustained economic growth rate of more than seven percent on average, consistently for a period of twenty – five years (IBRD, World Bank, 1993). Consequently, besides the human capital accumulation that acted as a catalyst for physical investments, the region also experienced an expeditious decline in fertility rates as women joined the workforce, and subsequently stabilizing the population growth rate. Most importantly, the gap between male and female school enrollment narrowed much faster in the HP AE's at the time, as compared to other countries. Despite the high initial public expenditure on education as a share of the total expenditure, the proportion of education investment eventually remained constant as fertility declined, and the economy grew rapidly. Rather than reducing the expenditure on education as population declined, these economies maintained the allocated proportion, to maintain the quality of education that each child received.

As stated by Wagner's law, the government may intervene in the supply of goods when positive externalities may arise from their consumption and out of demand by the tax paying proletariat. For instance, using utility functions, Miyake and Yasuoka (2010) observed that where investments in private education and public education coexist, fertility might either rise or decline. This is dependent on the productivities of private education and public education, and the presence of tax reductions on child – birth and income tax. Furthermore, individuals face a quality versus quantity trade off when the productivity of private education is higher than that of public education. They choose to invest in private education but encounter pressure to reduce the desired number of children, owing to a fall in disposable income. However, because they have less children, they do not benefit from the tax deduction benefits offered by the state, for each additional child they choose to have. For that reason, their taxable income is higher, further reducing the household income, and thus discourages fertility by reducing the demand for children. The state benefits from this increase in taxable income, and utilizes the increment in marginal tax revenue to invest in public education.

In contrast, fertility rises when the state increases its tax deduction for children. Miyake and Yasuoka (2010) conclude by proposing that the Asian countries may benefit from high fertility rates and economic growth, should their governments opt to increase their investment in public education. This view however is circumstantial because the Asian countries had low prevailing

fertility rates at the time of the study. In addition to that, among the consequences of public investment in human capital in the era of the East Asian Miracle, was a reduction in fertility. Furthermore, the works by Abo-Zaid (2013) demonstrates this opposing view, where he notes that there is a negative effect of government expenditures on the demand for children. However, he mentions that studies offering a clear and concise justification for this relationship are scarce. Nonetheless, authors in the area of fertility make use of deductive logic to support their claims and arrive at their conclusions.

#### **2.3.4 Economic determinants of fertility**

This section discusses the factors that influence fertility at two levels. First, at the household level and second, the macroeconomic aggregates representing the business cycle in an economy. The two influence the household demand for children, owing to the income and substitution effects.

Caldwell, Orubuloye and Caldwell (1992) contend that the fertility transitions in SSA will be different from those of other global regions as the declines in fertility will be across all age groups, as opposed to non – African regions whose changes in the fertility was largely dominated by the reproductive behavior of older women (as cited in Bongaarts & Casterline, 2013). Despite the women in Africa exhibiting a high ideal family size as compared to other regions, they also reported a high percentage of unmet needs of contraception. To complement these findings, the *World Family Planning 2017 Highlights* found that in SSA, contraceptive prevalence stood at 37%, in contrast to the world average at 63%. In addition to that, 22% of women who are married or in unions, had an unmet need for contraception, unlike the global average of 12% (United Nations, 2017). Several prevalent factors contribute to the undermining of contraceptive use in SSA. First, lack of knowledge of the modern and traditional methods of birth control. Second, inaccessibility and unaffordability of contraceptives, and cultural aversion to anti – natal practices. Third, husbands in patriarchal societies hold biased beliefs, that contraceptive use promotes sexual promiscuity and thus forbid contraception.

Nonetheless, it is important to note that even within the region, which is considered pro – natalist, the trends in fertility and contraception are distinct within the sub – regions. For instance, in East and South Africa the use of contraceptives has been increasing while the unmet need for contraceptives has been declining. Using Rwanda as their point of reference, Bongaarts and Casterline (2013) attribute this fertility differential to education, accessibility and sensitization to

various family planning methods, a rise in the enrollment of both males and females into school, a decline in infant mortality and erosion of cultural beliefs. On the other hand, Western and Central Africa have a high un-met need for contraception and low use of birth control. As expected, this sub – region reports the highest fertility.

Abo-Zaid (2013) established the relationship between macroeconomic indicators, and incorporated a moral component into his model. The analysis controlled for women’s participation in the workforce, life expectancy of females, rate of urbanization, inflation and GDP growth rates, marriage and divorce rates, and the unemployment rate of females. He found that on one hand, a rise in the ratios of debt, government expenditure and budget deficit, all individually weighted against GDP, caused a decline in fertility. Conversely, an increase in tax revenues weighted against GDP caused a rise in fertility. Along with that, he states that individuals derive their esteem from behaving morally, subsequently translating to their perception of fertility decisions depending on the income cycle in the economy. For example, where the national debt increased, households perceived it to be morally wrong to have children, as they would incur the debt burden in the future. Similarly, a decline in tax revenues to the government, such as through tax relief, signaled an economy in distress, thus discerned it to be morally wrong to have children during times of economic uncertainty. On the contrary, upon exclusion of the moral component from the model, the findings are converse of the prior observation. In this situation, education expands the discernment capability and understanding of economic conditions, and encourages conscious adoption of proactive measures to control births when any additional children may constrain the current available resources in the household.

Bulatao (1984) similarly discusses the direct (pure) and indirect effects of income on fertility. The pure effect suggests that income and fertility are positively correlated; as incomes rise, households have the financial capability to accommodate the needs of an additional child. Comparatively, the relationship is opposite in the case of the indirect effect of income. With higher income, parents opt to invest in quality education of their children thus reducing the demand for children. Additionally, individuals can access and afford various investment options preventing the need for having many children to offer an economic cushion in the future. Furthermore, with the exposure to and demand for luxury and consumer goods, the opportunity cost in essence increases with every additional child. Finally, not only do they afford and possess information on the various birth

control methods, but also invest in healthcare and improved nutrition of their children. As a result, their life expectancy increases and the child mortality rate declines, thus minimizing the propensity to have more children.

Likewise, in the findings of a cross – country study of developing countries, high fertility rates negatively affects per capita income (Ashraf et al., 2013; Brander & Dorwick, 1994). Ashraf et al. (2013) also found that the participation of women in the workforce was one of the channels through which fertility decreased. Undoubtedly, an important and expected observation made by Brander and Dorwick (1994) is the simultaneity and identification issues likely to arise in regressions involving fertility – where both the regressor (fertility) and the dependent variable simultaneously influence each other. Indeed, to concur with this opinion and to conclude this segment, increases in investments in education can lead to a decline in fertility rates. However, when a country experiences a surge in population growth owing to high fertility, a diversion of public and/or private resources to fund the education needs of the incoming cohorts may be required.

## **2.4 Summary of the Literature**

Fertility is a complex phenomenon that is more deterministic than probabilistic. As a result, it is influenced by several interlinked factors at the household and country level; more importantly, the level of human capital development. For both men and women, education has proved to be one of the most crux factors which catalyze a long term negative shift in fertility preferences, and initiates conscious decision making with regards to parenthood and childbearing, when faced with other alternatives.

Unquestionably, among the enablers of human capital development is the government expenditure on education, which are expected to incentivize and encourage enrollment into school, *ceteris paribus*. “*The output of merit goods is measured by cost, which itself depends on the expenditure*” (Mahalakamshi, 2017, p. 21). Thus, this statement by Mahalakamshi (2017) qualifies the following to support the objectives of this study: first, cost of education equals the expenditure on education; second, enrollment into school can be used as a measure of output for this expenditure; third, the benefits of human capital development catalyze a shift in fertility preferences. Empirical evidence proves that government expenditure on education promotes school enrollment. Therefore, at lower stages of development, such as the majority of the SSA countries, the focus should be on building

capacity rather than improving the quality of education. Due to these findings in the literature pertaining to the research questions, there is a locational gap in the relationship between investment in education and fertility.

## 2.5 Research Gap

This dissertation addresses various gaps from the previously conducted research. The table below outlines the research gaps at four different levels, and the corresponding propositions of this dissertation.

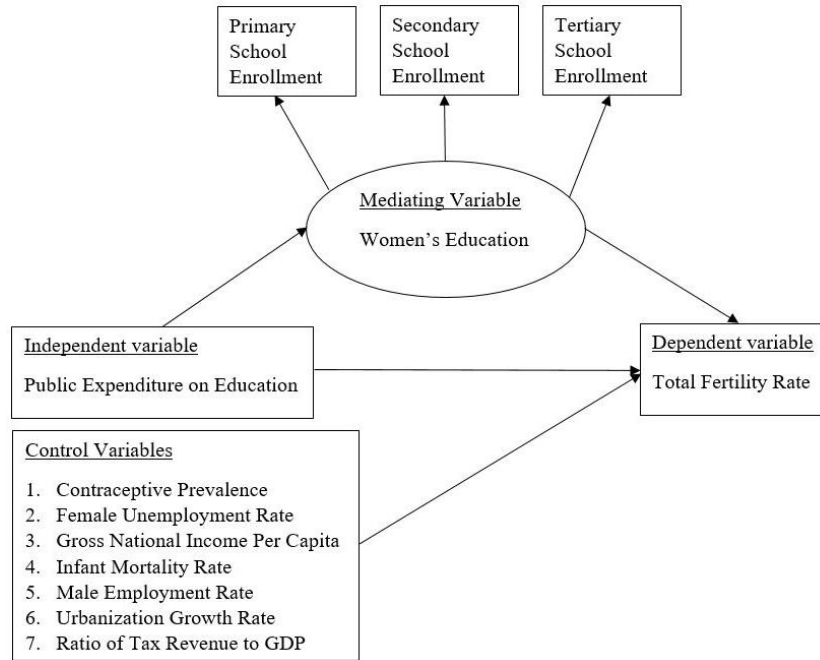
**Table 2.1 Outline of Research Gap**

<b>Gap</b>	<b>Previous Research</b>	<b>Current study</b>
Locational	Focuses on Asian and Western countries	Focus is on Sub – Saharan Africa
Variables for Government Expenditure on Education to School Enrollment	Dependent variable is general school enrollment	Dependent variable is female school enrollment
Measurement for women’s education	Average years of schooling	Female school enrollment
Data Analysis Method	Surveys, Conventional multiple regression	Systematic, Interdependent regressions using Structural Equation Modelling method.

## 2.6 Conceptual Framework

The conceptual framework is a visual representation of how the variables interact with one another.

**Figure 2.1 Conceptual Framework**



## 2.7 Operationalization of the variables

This section introduces the indicators that will enable the measurement of the concepts. In particular, the discussion entails the unit of measurement, definition and the relationship to fertility. Because this dissertation relies on secondary data made publicly available by the World Bank, the definitions are similar to those described by the institution for ease of reference and standardization purposes.

### 2.7.1 The variables of interest

First, Total Fertility Rates (TFR) is the measure of fertility in the study. It is the average number of births per woman within a particular country, recorded annually. It is the dependent variable of interest, determined by other factors as shall be specified in the quantitative model, based on the theoretical and empirical review.

Next, female school enrollment at the three levels of formal education, i.e. primary, secondary and tertiary levels is the measure of the mediating variable, i.e. women's education. Adjusted Net

Enrollment Rate (ANER) is the measurement of primary school enrollment. It is the ratio of the number of primary – school aged girls enrolled in primary or secondary school to the total population of the same age group. ANER is a more accurate indicator of primary enrollment because of the overlaps in the duration of primary and secondary school arising from differences in education systems within countries. On the other hand, the Net Enrollment Rate (NER) is the measurement of secondary school enrollment. It is the ratio of the number of secondary – school aged girls enrolled in secondary school to the population of the official secondary school age. The highest value for both ANER and NER is one. However, the unit of measurement for tertiary level is the Gross Enrollment Rate (GER). It is the ratio of the total number of women enrolled in tertiary level education regardless of age. GER, as opposed to NER, applies in this case because it may also include over – aged entrants seeking high education. In such instances, the GER can exceed one. Education and fertility have a negative correlation.

For the main independent variable, the government expenditure on education is a percentage of the total government expenditure of a country. It represents the measurement unit for expenditure on education. This indicator measures of the country’s devotion to investment in human capital. The relationship to the dependent variable is that fertility decline is a consequence of investments in human capital. There is a negative association between cost of education and fertility.

### **2.7.2 The control variables**

First, Gross National Income per capita is reflection of a country’s national output against its population size. As evidenced in the empirical review, there is a negative correlation between per capita income and fertility.

Second, the annual percentage change of the population that is living in urban areas against the total population is the measurement unit for the rate of urbanization. When the rate of urbanization is high, fertility rates decline.

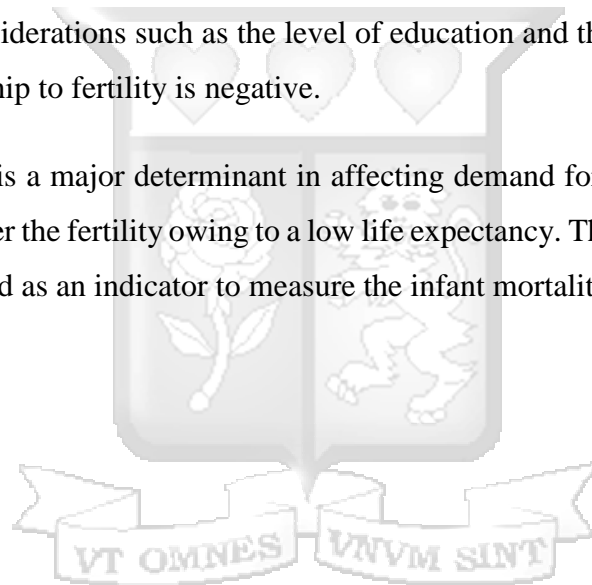
Third, male employment is the proportion of males who are in wage (paid employment that varies with the duration worked) and male salaried workers (contractual employment, as a percentage of male employment is the measurement unit for men in productive employment). This variable may affect fertility either positively or negatively; positively through the pure effect of income and influences a wife’s decision to work; and negatively through the indirect income effect

Fourth, Bulatao (1984) found that the ratio of tax revenue to GDP positively influenced fertility when individuals acted morally; tax reliefs were a sign of a struggling economy.

Fifth, the contraceptive prevalence of women aged between 15 – 49 years is the measurement unit for birth control. It is defined as the percentage of women who are married or in unions, or whose sexual partners are practicing any form of birth control, whether traditional or modern methods. Contraceptive prevalence and fertility have a negative correlation. Not only does it postpone births but also prevents births altogether during one's reproductive years.

Similarly, the proportion of unemployed females, as a percentage of the female labor force, is the measurement unit for the female unemployment rate. The effect of female unemployment on fertility is subject to considerations such as the level of education and the income of the husband. Regardless, the relationship to fertility is negative.

Finally, infant mortality is a major determinant in affecting demand for children. The higher the infant mortality, the higher the fertility owing to a low life expectancy. The number of infant deaths per 1000 livebirths is used as an indicator to measure the infant mortality rate.



## **CHAPTER THREE: METHODOLOGY**

### **3.1 Introduction**

This section provides a detailed understanding of the research process undertaken in this dissertation, with the aim of answering the general and specific objectives. It provides insights to the philosophical approach adopted. It includes the research design employed, population and sampling, the data collection methods, data analysis process, and concludes by stating the measures taken to ensure the research results are valid and reliable.

### **3.2 Research Philosophy**

Research philosophy relates to the nature, source and process that this dissertation has undertaken, with the intention of developing knowledge around the topic under study. This dissertation employs a pragmatic research philosophy. Since the problem under study revolves around the discipline of social sciences (population and demographic studies), Tashakkori and Teddlie (2010) assert the importance of pragmatism in using various approaches to understand the problem (as cited in Creswell, 2014). Kaushik and Walsh (2019) state that past experiences and beliefs of individuals cannot be separated from the individuals, and thus influence their actions; consequently, they take these actions based on their perceived consequences, hence the need for pragmatism. The dissertation appreciates and acknowledges that socio-cultural beliefs and hermeneutics which are inextricably linked to behavior, thus having an influence on their fertility preferences. However, government expenditure on education is a lever used to incentivize enrollment into school. Therefore, not only does it yield benefits of human capital, but also catalyzes the shifts in the engrained traditional attitudes and beliefs that influence fertility, through education.

### **3.3 Research Design**

This study prescribes to a correlation research design. The aim is to obtain the direction, significance and magnitude of the coefficients of the respective variables in the hypothesized relationships. The coefficients are derived from an analysis of data comprising of cross – sections with a time aspect, i.e. eleven variables in twenty - one countries, for a period of thirty – eight years in a regression model, to relate government expenditure on education and fertility, and to answer the research questions.

### **3.4 Population and Sampling**

Population refers to the sum of all the elements from which a sample is drawn. The target population for this study is the forty – seven countries of Sub – Saharan Africa. Not only does this region have rapid population growth, but also has the highest fertility rates, globally. In addition to that, the challenges of swift population growth rates, including high youth dependency and rising poverty, are visible within the region. The prerequisite condition that must be fulfilled for a country to be selected as a subject is data availability for the major variables in question, i.e. fertility rates and education expenditure, from 1980 – 2017; the collated data for government expenditure on education is unavailable prior to 1980. The final sample comprises of twenty – one countries of SSA (attached in the appendix).

### **3.5 Data Collection**

The macroeconomic data for this dissertation takes the form of secondary data obtained from the World Development Indicators, World Bank open databank. The data for all the variables is collated from various institutions such as the United Nations Population Division, United Nations Statistics Division and the UNESCO Institute for Statistics. The dataset takes the nature of a long panel data.

### **3.6 Data Analysis**

This study applies Panel Data econometrics in a set of simultaneous equations to test the hypothesized relationships. A software application tool known as Structural Equation Model (SEM) – maximum likelihood method – is utilized to obtain the regression coefficients of the simultaneous equations in a single analysis.

SEM has a number of advantages over conventional regression analysis. First, Social Science researchers apply SEM to test relationships and hypotheses founded on theory and empirical evidence. Likewise, unmeasurable constructs (hereinafter- latent variable) such as women's education can be incorporated by conjoining observable representations. Third, endogeneity is permissible to the model. In addition to that, SEM computes the coefficients of the simultaneous equations in a single analysis; also, the effects of these relationships are clearly decomposed into direct, indirect and total effects as well as testing for their significance of the paths. Moreover,

SEM is not only flexible in modelling relationships among latent variables, but also rectifies measures of unreliability (Lim & Melville, 2009).

In particular, the regression equations expressed in this study adopt a linear form, as predictors of the dependent variable. This is because current statistical software do not calculate p – values for parameter estimates in nonlinear regression models (Frost, 2018). The p – values are essential in significance testing of the regression coefficients. Equally important to note, fertility and the independent variables have a non – linear relationship, hence the logarithmic transformation; this approach preserves the linear regression model while making the effective relationship nonlinear (Benoit, 2011).

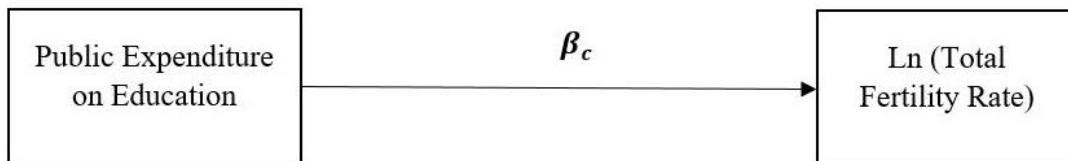
### 3.6.1 The Structural Equation Model

The SEM path analysis method calculates the total effect of public expenditure on education on fertility. Furthermore, upon the introduction of women’s education as a mediator, the total effect is decomposed into the direct ( $\beta_c$ ) and indirect effects ( $\beta_a\beta_b$ ). SEM calculates a single coefficient for women’s education, the latent variable observed through the school enrollment of women into the three levels of education. The main aim of this data analysis method is to obtain the regression coefficients  $\beta_c$ ,  $\beta_a$ ,  $\beta_b$ , to answer each of the research objectives of this paper, as illustrated below.

$$\text{Total effect} = \text{Direct effect} + \text{Indirect effect}$$

$$\beta_c = \beta_{c'} + \beta_a\beta_b$$

**Figure 3.1 Path illustration for Total effects**



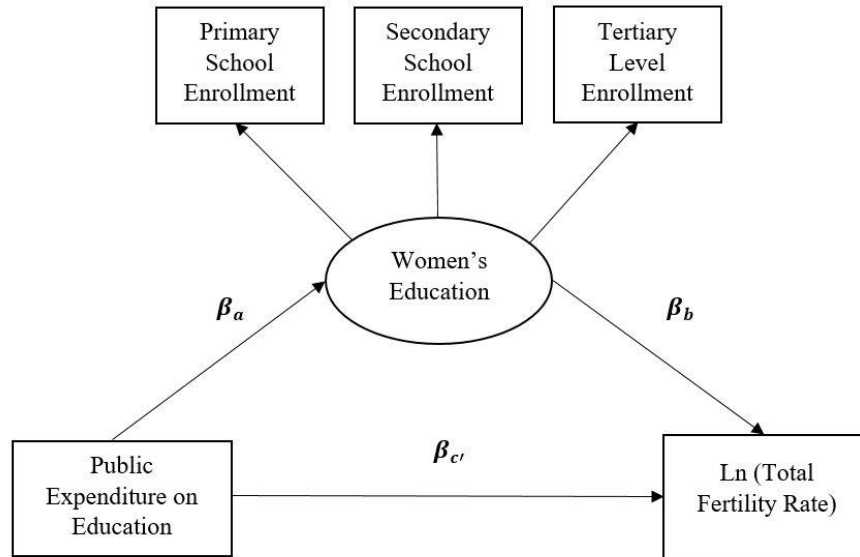
*i) To establish the relationship between government expenditure on education and fertility*

This equation calculates the regression coefficient for the unmediated effect of government expenditure on education on fertility. Figure 3.1 gives this relationship

$$\text{Ln (Total Fertility Rate)} = \beta_0 + \beta_c \text{ Public Expenditure on Education} \tag{3.1}$$

$$\ln TFR_{it} = \beta_0 + \beta_c PEXE_{it} + \varepsilon_{it}$$

**Figure 3.2 Path illustration for Direct and Indirect effects**



**ii) Establish the direct effect of government expenditure on education on women's education**

This equation calculates the regression coefficients for government expenditure on education for the each level of school enrollment, and a single coefficient for the construct.

$$Women's\ Education = \beta_0 + \beta_a Public\ Expenditure\ on\ Education \quad (3.2)$$

$$ANERP = \beta_0 + \beta_1 PEXE_{it} + \varepsilon \quad (3.2.1)$$

$$NERS = \beta_0 + \beta_1 PEXE_{it} + \varepsilon \quad (3.2.2)$$

$$GERT = \beta_0 + \beta_1 PEXE_{it} + \varepsilon \quad (3.2.3)$$

**iii) Determine the direct effect of women's education on fertility**

This equation calculates a single regression coefficient for the effect of women's education on fertility.

$$\ln (Total\ Fertility\ Rate) = \beta_0 + \beta_b Women's\ Education \quad (3.3)$$

iv) **Estimate the indirect effect of government education expenditures on fertility, through women's education**

This is the indirect effect of government expenditure on education on fertility, through a mediator i.e. women's education. It is the joint effect of the last two relationships mentioned above i.e. government expenditure on education → women's education → fertility

$$\beta_a\beta_b = \text{indirect effect}$$

v) **Determine the effect of government education expenditures on fertility, ceteris paribus**

Additional variables are included into the model to test whether the effect of government education expenditure on fertility remains significant in their presence. This equation answers specific objective (v).

$$\ln TFR_{it} = \beta_0 + \beta_1 PE_{it} + \beta_2 Women's\ Education_{it} + \beta_3 GNIP_{it} + \beta_4 MPE_{it} + \beta_5 IMR_{it} + \beta_6 URB_{it} + \beta_7 FUR_{it} + \beta_8 CP_{it} + \varepsilon$$

For  $t = 1, 2 \dots T$ , and  $I = 1, 2 \dots n$ ,  $n$  is the sample countries where  $T$  is the time period under study, and  $\beta_0 = \text{intercept}$ ,  $\beta_i = \text{slope coefficient for the variables}$ ,  $\varepsilon_{it} = \text{error term}$

**Table 3.1 Variable Definitions**

<u>Variable</u>	<u>Indicators</u>	<u>Acronym</u>
<u>Dependent variable</u>		
Fertility	Total Fertility Rate	TFR
<u>Independent variable</u>		
Expenditure on education	Public Education Expenditure (% of Total Expenditure)	PEXE
<u>Mediating variables</u>		
Primary school female enrollment	Adjusted Net Enrollment Rate, Primary, Female	ANERP
Secondary school female enrollment	Net Enrollment Rate, Secondary, Female	NERS

Tertiary level female enrollment	Gross Enrollment Rate, Tertiary, Female	GERT
<b><u>Control variables</u></b>		
Per Capita Income	Gross National Income per capita	GNIPP
Men in productive employment	Male wage and salaried workers (% of male employment)	MPE
Infant mortality	Infant mortality rate (number of infant deaths per 1000 livebirths)	IMR
Urbanization rate	Urban population growth (annual %)	URB
Female unemployment rate	Unemployment, female (% of female labor force)	FUR
Tax Revenue to GDP	Tax Revenue (% of GDP)	TRG

### 3.7 Data Quality

#### 3.7.1 Test for Diagonality of the error covariance matrix

This test determines the appropriateness of SEM as opposed to Ordinary Least Squares (OLS) in a system of equations that seem unrelated, by observing the diagonality of the covariance matrix of the disturbance terms (Breusch & Pagan, 1980). Application of the Breusch – Pagan Diagonal Covariance Matrix test for Maximum Likelihood method will confirm the suitability of SEM as the appropriate data analysis method (Shehata, 2012a).

#### 3.7.2 Diagnostic tests

##### 3.7.2.1 Autocorrelation/ Serial Correlation

Auto-correlation occurs when there is a correlation in the disturbance terms of a model, in subsequent periods. High degrees of autocorrelation increases the variance of the coefficients estimators from the true value. The Harvey (1982) and Guilkey (1975) LM test is applied to detect serial correlation in the overall SEM system (Shehata, 2012b).

##### 3.7.2.2 Heteroscedasticity

Heteroscedasticity occurs when the variance of the error term is dissimilar across all observations of the independent variables. Williams (2020) states that the consequence of heteroscedasticity is biased standard errors, and subsequently biased test statistics and confidence intervals. This study

applies the Breusch – Pagan and the Likelihood Ratio LR test to detect the presence heteroscedasticity in the overall system of the SEM (Shehata, 2012c).

### **3.7.2.3 Multi – collinearity**

Multi – collinearity occurs when the explanatory variables either have a high correlation, or are a perfect linear combination of one another. This issue considerably inflates the standard errors of the coefficients, thus increasing the likelihood of failing to reject the null hypothesis on the suitability of an independent variable as a predictor (Williams, Multicollinearity, 2015). The Pearson Correlation matrix will enable the assessment of the degree of collinearity among the independent variables.

### **3.7.2.4 Normality**

The Normality rule of linear regressions assumes that the residuals are identical and are independently distributed. The tests for normality ensure the validity of the t – test inferences (Islam, 2011). The application of the Anderson Darling Z test will authenticate the normality of the residuals in the overall SEM system (Shehata, 2012d).

### **3.7.3 Internal Consistency**

SEM measures of internal consistency assesses the reliability of a proposed construct in a model, based on the observable variables representing it (Hussain, Xuotong, & Hussain, 2020). This study applies the Cronbach’s alpha to assess the reliability of women’s education as a construct based on female enrollment into primary, secondary and tertiary level.

### **3.7.4 Model Fit**

As an alternative to F – tests, SEM models apply a variety of indices to assess model fit within a scale (McNeish, 2018). This study will assess the model fit based on four indices. First, the Root Mean Square Error or Approximation (RMSEA) whose acceptable value is less than 0.08 to imply a good fit. Second, the Comparative Fit Index (CFI) and the Tucker Lewis Index (TLI) values between 0.9 and 1.0 suggest a well – fitted model fit. Fourth, values less than 0.1 indicate of good fit for the Standardized Root Mean Squared Residual (SRMR).

### 3.8 Ethical Considerations

To carry out this study, the researcher will seek both an Ethical Approval and a NACOSTI permit, in compliance with the university requirements. In addition, since the study will utilize secondary data in its methodology, this dissertation ensures that the same is collected from credible and reliable sources in the area under study. Furthermore, the responsibility of the objectivity of data analyses throughout the study relies on the researcher. Third, because the macro – data is publicly available on the websites of the respective institutions indicated in *Section 3.5*, this study benefits by overcoming the issues associated with consent and breach of data confidentiality. Finally, this dissertation commits to giving due credit to the authors of the relevant sources used to inform this study, using the American Psychological Association (APA) style of referencing.



## CHAPTER FOUR: PRESENTATION OF RESEARCH FINDINGS

### 4.1 Introduction

The purpose of this study is to demonstrate an interdependent relationship between government investment in education, female school enrollment, and a reduction in fertility in that order. A sample of twenty – one countries from the Sub – Saharan region was obtained from the World Bank open database. It was expected that each variable would have thirty – eight observations, over the period of 1980 – 2017. However, for certain variables, the available dataset had missing annual observations. Table 4.1 below provides a breakdown of the sample, and the observation – count summary to illustrate this. The Stochastic Regression Imputation method was applied to rectify this, and to fill in the missing data. Thus, the final dataset used was a balanced long panel.

The first sub – section begins with the descriptive statistics. The second section provides results from the diagnostic tests to detect violations of the assumptions of linear regressions and a test for the suitability of SEM. Section three and four test for internal consistency in the construct measurement and the goodness – of – fit test for the SEM model respectively. The fifth section provides the tabulated regression results for women’s education, and the SEM results without control variables, in comparison to the model with controls included. The chapter then concludes with a summation of the same.



**Table 4.1 Sample breakdown and Observation – count summary**

COUNTRY	Average total fertility (number of live births)	Public expenditure on education, % total government expenditure	Female Primary school enrollment rate, %	Female Secondary school enrollment rate, %	Female Tertiary level enrollment rate, %	GNIPP (\$)	Female Unemployment Rate, %	Men in wage and salaried employment, %	Contraceptive Prevalence, %	Infant Mortality Rate, per 1000 births	Urbanization rate, annual % growth	Tax to GDP ratio
Benin	38	24	14	4	29	38	27	27	6	38	38	3
Burundi	38	25	22	17	28	38	27	27	8	38	38	12
Cabo Verde	38	22	24	15	18	38	27	27	4	38	38	13
Cameroon	38	25	7	7	16	38	27	27	7	38	38	26
Cote d'Ivoire	38	27	13	3	16	38	27	27	7	38	38	19
Eswatini	38	24	25	17	15	38	27	27	7	38	38	24
Ethiopia	38	26	23	6	28	38	27	27	9	38	38	27
Gambia, The	38	25	29	4	6	38	27	27	5	38	38	14
Ghana	38	25	12	15	17	38	27	27	15	38	38	19
Guinea	38	24	26	12	27	38	27	27	6	38	38	4
Kenya	38	29	12	9	12	38	27	27	10	38	38	27
Lesotho	38	24	36	31	28	38	27	27	9	38	38	35
Madagascar	38	26	9	10	29	38	27	27	8	38	38	28
Mali	38	24	14	10	29	38	27	27	7	38	38	26
Mauritius	38	29	18	11	34	38	27	27	4	38	38	38
Niger	38	27	23	18	22	38	27	27	8	38	38	10
Sao Tome and Principe	38	21	17	12	5	38	27	27	4	38	38	10
Senegal	38	27	30	4	18	38	27	27	11	38	38	21
Sierra Leone	38	27	20	13	17	38	27	27	10	38	38	15
South Africa	38	22	12	10	12	38	27	27	6	38	38	38
Togo	38	21	23	10	22	38	27	27	11	38	38	15
Total	798	524	409	238	428	798	567	567	162	798	798	424

## 4.2 Descriptive Statistics

The table below provides the summary statistics for the data set for which this study was based on. The data for the twenty – one sample countries is available and collated from the World Bank databank for all variables, for the period of 1980 – 2017. The table encompasses a measure of central tendency, i.e. mean, minimum and maximum values, and standard deviation for variation.

Within the SSA region (sample), women on average will give birth to 5.46 children; have at least one child and at most eight children, and a standard deviation of 1.48. Likewise, the governments regionally spend an average of 17.47% (SD = 4.52) on education, as a percentage of total government expenditure, has a), with the highest spend on education constituting 37.52%, and the lowest 5.03%.

In addition, the observations on women’s education indicate that on average, 65% of females (SD = 23.38) who are of primary school going – age, have been enrolled into the primary school level. The countries with the highest enrollment at primary level have achieved a 99.09% female enrollment rate, while the minimum at 14.89%. At secondary school level, an average of 26.7% of females of secondary school age are enrolled into school (SD = 19.0552), with the highest at 87.79% and the lowest at 1.477%. Likewise, the average enrollment rate at tertiary level is 4.356% (SD = 6.494). The highest and lowest rates enrollment rates are 47.457% and 0.0519% respectively. An important and interesting general trend to take note of is that the rate of female enrollment into school decreases with higher levels of education in Sub – Saharan Africa.

**Table 4.2 Descriptive Statistics for the sample selected**

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>Max</b>	<b>Min</b>	<b>Std. deviation</b>
<b>Dependent variable</b>					
Total Fertility Rate	798	5.46	7.89	1.36	1.48
<b>Independent variable</b>					
Public Expenditure on Education, % of Total Government Expenditure	798	17.48	37.52	5.03	4.52
<b>Mediating variables</b>					
Adjusted Female Enrollment, Primary, %	798	65.39	99.09	14.89	23.38
Net Female Enrollment Rate, Secondary, %	798	26.74	87.80	1.48	19.06
Gross Female Enrollment Rate, Tertiary, %	798	4.36	47.46	0.05	6.49
<b>Control variables</b>					
Gross National Income, per capita, \$	798	1056.45	11000.00	40.00	1491.54
Male Wage and Salaried Workers, %	798	35.36	25.88	7.55	25.88
Infant Mortality, per 1000 births	798	76.16	168.50	12.5	33.11
Urbanization Rate, %	798	3.97	8.87	-0.25	1.44
Female Unemployment Rate, %	798	10.20	47.65	0.08	11.03
Contraceptive Prevalence, %	798	25.01	75.80	1.70	19.13
Tax to GDP Ratio, %	798	14.18	39.26	4.20	39.26

Note:

<sup>1</sup> N = sample \* time period = 21 \* [(2017 – 1980) +1] = 21 \* 38 = 798 observations

<sup>2</sup>Unit of measurement does not apply to N

### 4.3 Diagnostic tests

#### 4.3.1 Summary of tests for Autocorrelation, Heteroscedasticity and Normality

Diagnostic tests were carried out to ensure the validity and reliability of the regressions i.e. the estimators are unbiased. Specific tests for autocorrelation, heteroscedasticity and normality ascertain that the OLS assumptions are not violated the overall SEM system. Nonetheless, where there are violations, remedies are possible. However, it is important to note that, as explained in the Summary of the Literature section, models of fertility are deterministic rather than stochastic. Therefore, other important factors that are unaccounted for in the model, due to measurement challenges, lead to autocorrelation. The table below provides a summary of the test results, and the subsequent remedies.

**Table 4.3 Summary of tests for Autocorrelation, Heteroscedasticity and Normality**

Phenomenon	Statistical test	Result	Remedy
Autocorrelation	Harvey LM Guilkey LM	Present	Phenomenon expected in model
Heteroscedasticity	Breusch – Pagan Likelihood Ratio LR	Present	Use Robust standard errors
Normality	Anderson Darling Z test	Residuals follow a normal distribution	None required

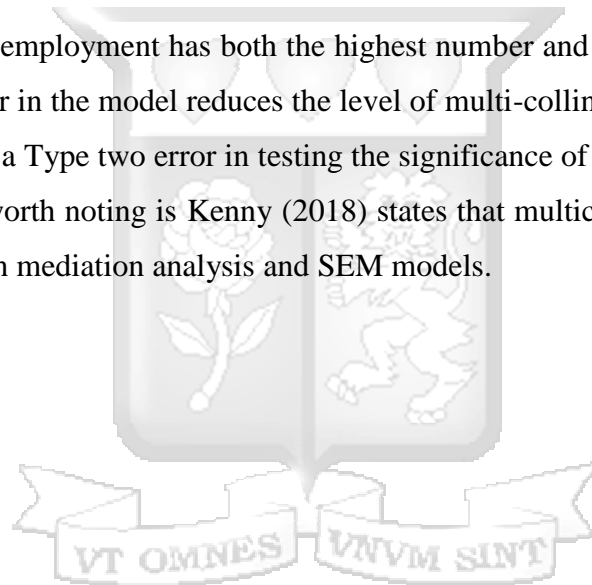
#### 4.3.2 Multicollinearity

Multicollinearity occurs when the independent variables are a perfect linear combination of one another. This study examines the Pearson correlation matrix to detect the presence of multicollinearity, and the extent to which the correlation exists; values ranging  $0.7 < x \leq 1$  are an indicator of high correlation. Based on the scale recommended, table 4.4 below displays the Pearson correlation coefficients for the independent variables. Below are highlights are provided on the independent variables for which high collinearity exists.

First, net enrollment in primary school is negatively highly correlated with infant mortality rate ( $\beta = -0.746, p < .05$ ). Second, there is a strong positive association between the net enrollment in secondary school and gross female enrollment rate in tertiary level ( $\beta = 0.767, p < .05$ ), the GNIPP

( $\beta = 0.747, p < .05$ ), and the contraceptive prevalence ( $\beta = 0.745, p < .05$ ). Third, the gross enrollment rate at tertiary level and GNIPP are positively correlated ( $\beta = 0.739, p < .05$ ). In addition to that, the percentage of males who are in waged or salaried employment is strongly and positively associated with the female unemployment rate ( $\beta = 0.847, p < .05$ ), and the rate of contraceptive use ( $\beta = 0.733, p < .05$ ). Finally, the infant mortality rate is negatively related to the contraceptive prevalence ( $\beta = -0.703, p < .05$ ). Concerning the specific research objective (1), there is a positive correlation between government expenditure on education and school enrollment at the three levels of schooling as observed from the matrix, prior to the regression. This implies that a positive link exists between government expenditure on education and women's education, i.e. research question (1).

Therefore, because male employment has both the highest number and magnitude of correlation, excluding it as a predictor in the model reduces the level of multi-collinearity. Consequently, this reduces the likelihood of a Type two error in testing the significance of the predictors on the total fertility rate. However, worth noting is Kenny (2018) states that multicollinearity is unavoidable and should be expected in mediation analysis and SEM models.



**Table 4.4 Correlation Matrix**

	PEXE	ANERP	NERS	GERT	GNIPP	FUR	TRG	URB	MPE	IMR	CP
<b>PEXE</b>	1.0										
<b>ANERP</b>	0.223 (0.00)	1.0									
<b>NERS</b>	0.218 (0.00)	0.681 (0.00)	1.0								
<b>GERT</b>	0.105 (0.00)	0.534 (0.00)	0.767 (0.00)	1.0							
<b>GNIPP</b>	0.108 (0.00)	0.483 (0.00)	0.770 (0.00)	0.739 (0.00)	1.0						
<b>FUR</b>	0.173 (0.00)	0.452 (0.00)	0.403 (0.00)	0.319 (0.00)	0.383 (0.00)	1.0					
<b>TRG</b>	0.301 (0.00)	0.437 (0.00)	0.433 (0.00)	0.374 (0.00)	0.357 (0.00)	0.660 (0.00)	1.0				
<b>URB</b>	-0.128 (0.00)	-0.350 (0.00)	-0.585 (0.00)	-0.502 (0.00)	-0.606 (0.00)	-0.259 (0.00)	-0.225 (0.00)	1.0			
<b>MPE</b>	0.205 (0.00)	0.628 (0.00)	0.678 (0.00)	0.525 (0.00)	0.615 (0.00)	0.847 (0.00)	0.679 (0.00)	-0.442 (0.00)	1.0		
<b>IMR</b>	-0.192 (0.00)	-0.746 (0.00)	-0.619 (0.00)	-0.552 (0.00)	-0.530 (0.00)	-0.335 (0.00)	-0.408 (0.00)	0.294 (0.00)	-0.558 (0.00)	1.0	
<b>CP</b>	0.195 (0.00)	0.666 (0.00)	0.745 (0.00)	0.623 (0.00)	0.684 (0.00)	0.463 (0.00)	0.514 (0.00)	-0.538 (0.00)	0.733 (0.00)	-0.703 (0.00)	1.0

*Note:* <sup>1</sup> Pearson correlation coefficients obtained at the 95% (p < .05) and 99% (p < .01) confidence interval. <sup>2</sup> Values in brackets are the p - values

Key:

PEXE	– Public Expenditure on Education
ANERP	– Adjusted Net Enrollment Rate for Primary School
NERS	– Net Enrollment Rate for Secondary School
GERT	– Gross Enrollment Rate for Tertiary Level
GNIPP	– Gross National Income Per Capita
FUR	– Female Unemployment Rate (%)
TRG	– Tax to GDP Ratio
URB	– Urbanization Growth Rate (%)
MPE	– Male in Productive employment (%)
IMR	– Infant Mortality Rate (%)
CP	– Contraceptive Prevalence (%)

### 4.3 Internal Consistency

The construct of Women’s education was measured based on three observable variables. Cronbach’s Alpha is applied in this study to assess the reliability of the primary, secondary and tertiary level enrollment as a measure of the construct (Hussain, Xueting, & Hussain, 2020). In addition to that, the overall construct reliability is also calculated. Values greater than 0.7 indicate that the construct is reliable.

**Table 4.5 Cronbach’s alpha for construct reliability**

Construct	Variable	Observations	Cronbach's $\alpha$	Verdict
Women's Education	ANER (Primary)	798	0.867	Reliable
	NER (Secondary)	798	0.696	Reliable
	GER (Tertiary)	798	0.807	Reliable
<b>Average Construct Reliability Coefficient:</b>			<b>0.753</b>	

The Cronbach’s alpha coefficient (0.753) is greater than 0.7 and thus confirms that Women’s education is a reliable construct based on the three levels of female school enrollment.

#### 4.4 Model Fit Tests

This dissertation applied the Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and the Standardized Root Mean Square Residual (SRMR) to evaluate the goodness – of – fit for the SEM model. RMSEA and SRMR are absolute fit indices, with cutoff values at  $< 0.1$  to indicate well - fit models. On the other hand, CFI and TLI are incremental indices, with a scale of (0) suggesting no fit, to (1) implying perfect fit; values  $\geq .9$  are an indicator of good fit.

Based on the baseline indices, the RMSEA value at 0.13 indicates poor fit. However, the CFI, TLI and SRMR values indicate a well - fit model at 0.98, 0.93 and 0.03 respectively. Research states that it is not uncommon to yield conflicting results because, the index cutoff points are merely intuitive without any statistical justification; and the model fit evaluation occurs from differing perspectives for each index (Lai & Green, 2016; Xia & Yang, 2019).

**Table 4.6 Model fit Indices for SEM**

<b>Model</b>	<b>RMSEA</b>	<b>CFI</b>	<b>TLI</b>	<b>SRMR</b>
Ln (Total Fertility Rate)	0.13	0.98	0.93	0.03

#### 4.6 Regression Results for the Structural Equation Model

The methodological approach of this study prescribed to a correlation research design, using regressions in a SEM model. The significance of the paths are tested at the 95% confidence intervals, with a .05 level of significance. Provided in Chapter 3 is the visual of the paths from the causal to the outcome variable.

##### 4.6.1 The measurement model for women’s education

This regression model is a representation of the path government expenditure on education → women’s education (primary, secondary, tertiary enrollment). These results provide an answer to specific objective (1), and research question (1).

Table 4.7 shows that government expenditure on education significantly predicted enrollment into primary, secondary, and tertiary level, at  $p < .05$ . In addition to that, there is a positive association between public expenditure on education and school enrollment at all levels.

**Table 4.7 Regression Results for School Enrollment**

*Dependent variables: School Enrollment at the three levels*

	<b>ANER (Primary)</b>	<b>NER (Secondary)</b>	<b>GER (Tertiary)</b>
Government Expenditure on Education	0.789	0.7486	0.233
Standard error	0.153	0.142	0.044
P - value	0.00	0.00	0.00

Note:

<sup>1</sup> Test statistics obtained at the 95% confidence interval

Furthermore, the SEM model weighs these coefficients and produces a single coefficient for the construct of women's education, as predicted by government expenditure on education. Likewise, government expenditure on education is a significant predictor of women's education at  $p < .05$  as demonstrated in Table 4.8.

**Table 4.8 Regression Results for Women's Education**

*Construct Coefficient for Women's Education*

	<b>Coefficient</b>	<b>Standard Error</b>	<b>P - value</b>
Government Expenditure on Education	0.789	0.152	0.00

Note:

<sup>1</sup>  $\beta_a = 0.789$

<sup>2</sup> Women's Education =  $\beta_0 + 0.789$  Government Expenditure on Education

<sup>3</sup> Test statistics obtained at the 95% confidence interval

#### 4.6.2 Direct, Indirect and Total effects on Fertility (excluding controls)

SEM decomposes the total effect of each of the predictors on fertility into the direct and indirect effects. In Table 4.9, the R – squared indicates that the independent variables account for 86.3% of variability of fertility in the model.

Women’s education and government expenditure on education both have a negative significant total effect on fertility ( $\beta = -0.0203, p < .05$ ;  $\beta = -0.0121, p < .05$ ). The difference between the unmediated and mediated effect of government expenditure on education on fertility, is the direct effect ( $\beta = 0.003, p < .05$ ). However, the indirect effect is the causal path from government expenditure on education  $\rightarrow$  women’s education  $\rightarrow$  fertility. This is the proportion of the relationship between government expenditure on education and fertility, which is mediated by women’s education. Table 4.9 demonstrates an increased significant negative indirect effect of public expenditure on education on fertility ( $\beta = -0.1603, p < .05$ ) through the mediating role of women’s education.

Thus, this section has provided an answer, first, to the general objective i.e. the total effect of public expenditure on education, on fertility. Second, an answer to the second specific objective, the total effect of women’s education on fertility. Third, an answer to specific objective three, i.e. the effect of public expenditure on education, on fertility, through women’s education (indirect effect).

**Table 4.9 Direct, Indirect and Total effects on Total Fertility Rate**

*Dependent variable: Ln (Total Fertility Rate)*

<b>Independent variable</b>	<b>Direct effect</b>	<b>Indirect effect</b>	<b>Total effect</b>
Women's Education	-0.0203 (0.00)	-	-0.0203 (0.00)
Public Expenditure on Education	0.0039 (0.01)	-0.1603 (0.00)	-0.0121 (0.00)
<b>R – Squared</b>	<b>0.863</b>		

Notes:

<sup>1</sup>  $\beta_a = 0.789$ ;  $\beta_b = -0.0203$ ;  $\beta_a \beta_b = -0.1603$ ;  $\beta_c = -0.0121$

<sup>2</sup>  $\text{Ln (Total Fertility)} = \beta_0 - 0.203 \text{ Women's Education}$

<sup>3</sup>Test statistics obtained at the 95% confidence interval

#### 4.6.3 Direct, Indirect and Total effects on Fertility (including controls)

This section reports the results of SEM with additional determinants of fertility, known as control variables. The aim of this section is to evaluate the significance of public expenditure on education in the presence of these other factors. The R – Squared in Table 4.10 indicates that the independent variables explain 91.3% of the variability of fertility in the model.

As stated in the previous sub – section, public expenditure on education is the only independent variable for which mediation occurs in this dissertation. Therefore, the direct and total effects are equal for all independent variables, with the exception of public expenditure on education. Important to note from Table 4.10 is, though the negative effect of public expenditure on education as a predictor of fertility remains statistically significant ( $\beta = -0.0025, p < .05$ ), the magnitude is reduced when others factors are controlled for. Similarly, the indirect effect diminishes.

Women’s education, tax to GDP ratio, urbanization growth rate, contraceptive prevalence and the change in Gross National Income Per Capita (log GNIPP) negatively and significantly affect fertility ( $p < .05$ ). Conversely, the infant mortality rate has a positive and significant influence on fertility ( $p < .05$ ). On the contrary, the effect of female unemployment rate on fertility was not found to be statistically significant ( $\beta = 0.0005, p = 0.39$ ).

Conclusively, the results of this section have provided an answer to specific objective (4) and its corresponding research question.

**Table 4.10 Direct, Indirect and Total effects on Total Fertility Rate (including controls)**

*Dependent Variable: Ln (Total Fertility Rate)*

<b>Independent variable</b>	<b>Direct effect</b>	<b>Indirect effect</b>	<b>Total effect</b>
Women's Education	-0.0082 (0.00)	-	-0.0082 (0.00)
Public Expenditure on Education	0.0038 (0.00)	-0.0064 (0.00)	-0.0025 (0.01)
Female Unemployment	0.0005	-	0.0005

	(0.391)		(0.391)
Tax to GDP ratio	-0.0032 (0.00)	-	-0.0032 (0.00)
Infant mortality rate	1.0560 (0.00)	-	1.0560 (0.00)
Urbanization growth rate	-0.048 (0.00)	-	-0.048 (0.00)
Contraceptive Prevalence	-0.0065 (0.00)	-	-0.0065 (0.00)
Log Gross National Income PP	-0.032 (0.00)	-	-0.032 (0.00)
<b>R - Squared</b>	<b>0.913</b>		

Notes:

<sup>1</sup>  $\beta_a = 0.774$ ;  $\beta_b = -0.0082$ ;  $\beta_a \beta_b = -0.0064$ ;  $\beta_c = -0.0025$

<sup>2</sup>Test statistics obtained at the 95% confidence interval

#### 4.7 Summary of the Chapter

The research findings prove that women's education is a reliable construct measured through the three levels of school enrollment. More importantly, the results exhibit that government expenditure on education significantly and positively affects women's education. In addition to that, government expenditure on education and women's education negatively influence fertility; the relationship is significant with both the inclusion and exclusion of other determinants of fertility. Important to note however is, although the relationship between government expenditure on education is significant, the magnitude of this relationship increases when women's education is included as a mediator.

## **CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS**

### **5.1 Introduction**

This chapter presents the discussion, conclusion and recommendations in accordance with the research findings in the preceding chapter. The main objective of this study was to establish the relationship of government expenditure on education and fertility. Accordingly, the structure of the discussion of the findings is with reference to the specific research objectives. Thereafter, the conclusion, policy and practice recommendations follow as a culmination the research process. As a summation, other particulars including areas for further research and the limitations of this study have been included.

### **5.2 Discussion of findings**

#### **5.2.1 The direct effect of government education expenditures on women's education**

This objective sought to determine the effect that government expenditure on education has on women's education. As per the dissertation findings, government expenditure on education has a positive correlation to female enrollment at the three levels of schooling.

The results pose that a unit increase in public expenditure in education expectedly and significantly raises the female enrollment rate at all levels. Specifically, the results are in line with Wagner's Law of Increasing State Activities, which poses that government expenditure on education incentivizes school enrollment, and thus are positively associated. Additionally, this is congruous with the findings of Anyanwu and Erhijakpor (2007) that government expenditure on education has a positive significant effect on general school enrollment at primary and secondary level. Moreover, Emara and Hegazy (2017) state that government expenditure on education has the ability to raise increase the rate of female enrollment into school.

#### **5.2.2 The direct effect of women's education on fertility**

The aim of this objective is to determine the relationship between women's education and fertility. According to the findings of the SEM system, a unit change in women's education corresponds to a decrease in fertility.

These findings are consistent with the works of Bulatao (1984), Cooray and Potrafke (2010), Kim (2016) and Macunovich (1998). The education of women negatively affects fertility through the opportunity cost of time and human capital development. The findings also validate the Theory of

Human Capital, and its effect on fertility choices. At the early years, women spend time in school, as each additional year contributes to educational attainment. In the long term, education enables women to participate in productive employment. Consequently, the opportunity cost of child rearing becomes higher.

### **5.2.3 The indirect effect of government education expenditures on fertility, through women's education**

This research objective aimed to ascertain the indirect effect of government expenditure on education on fertility, through the mediating role of women's education. The results from the SEM system show a larger decline in fertility, upon mediation of government expenditure on education, by women's education.

To explain, MacKinnon, Krull and Lockwood (2000) state that this is an occurrence in inconsistent mediation, i.e. the direct and indirect effect have different signs, and is an indicator of suppression in mediational hypothesis. Accordingly, a mediator acts as a suppressor variable when it increases the predictive validity between an independent and dependent variable. Specifically, the predictive validity refers to the magnitude of the coefficient. Moreover, the results imply partial mediation, because the effects of government expenditure on education remain significant both when women's education is controlled for, in the absence of mediation. This outcome links the theories, Wagner's Law of Increasing State Activities, Human Capital, and the Theory of Increasing Prosperity, in that sequence. In a similar way, Strauss and Thomas (1995) suggested the same, that government expenditure on education is a means to reducing fertility, through its education outcome (as cited in Anyanwu & Erhijakpor, 2007).

### **5.2.4 The significance of government expenditure on education on fertility, ceteris paribus**

The aim of this research objective is to ascertain that the effect of government expenditure on education on fertility remains significant (though diminished) after controlling for additional factors. This is harmonious with the Malthusian population trap theory; it poses that numerous factors affect fertility, aside from the primary variables in this study. Empirically, the study findings coincide with those of Abo-Zaid (2013), where he related these macroeconomic aggregates to fertility rates. Similar to his findings, the urbanization growth rate has the highest impact on fertility. Likewise Ashraf et al. (2013), and Brander and Dorwick (1994) similarly reported a negative correlation between per capita income and fertility.

### 5.3 Conclusion

The effect of government expenditure on fertility has been a matter of long standing debate among researchers. Among the benefits of Human Capital is to induce long – term changes in fertility decline. Indeed, government expenditure on education is a tool to initiate the development of human capital, particularly when channeled towards building capacity in a high population context. Thus, the main objective of this study was to establish the relationship between government expenditure on education and fertility in Sub – Saharan Africa.

The research findings corroborate the Increasing Propensity Theory and the Theory of Human Capital; women’s education and investments in education have a negative effect on fertility. Additionally, the positive correlation between government expenditure on education and the female school enrollment rates authenticate the theory by Wagner’s Law of Increasing State Activities. Therefore, this dissertation concludes despite the existence of other determinants of fertility, government expenditure on education is a negative and significant predictor of fertility in Sub – Saharan Africa, and more so, with the mediation of women’s education.

Determinants of fertility are both complex and inextricably linked. Not only is the decomposition of these linkages complex at country level, but also at household level as well. Challenges of availability of data is pre – eminent in this area, and specifically in SSA, where cultural constraints and a pro – natal attitude bias the respondents’ responses in qualitative studies. As a result, this study covers fertility to the extent of government investment in education, and the female rate of school enrollment, for ease of comparison and generalizability among countries, using secondary data.

In conclusion, countries in high fertility and high population settings should consider investing in the education sector to build capacity, before undertaking activities on improving the quality of education. Moreover, additional policy frameworks are required to encourage enrollment of girls and women of school going age. This is particularly so for least developed countries whom education will be under-consumed when left to the laws of the free market. Consequently, it leads to the failure to realize the benefits emanating from human capital development, and fail to translate to shifts in fertility trends.

## **5.4 Contribution to Knowledge**

Previous research has related the private cost of education to fertility. In spite of that, where government expenditure on education is the predictor variable, an exploratory approach has rendered the verdict inconclusive. In addition to that, the focus of most studies are the Western and Asian countries; alternatively, this study is within the context of Sub – Saharan African region. The results have indicated a significant negative relationship between government expenditure on education and fertility, despite controlling for other factors.

Besides that, multiple regression is the methodological approach applied in a majority of the quantitative studies of fertility. This study however applies a Structural Equation Modelling (SEM) approach to relate investment in education (government expenditure), to women's education (enrollment rate) to fertility.

## **5.5 Recommendations**

### **5.5.1 Policy Implications**

High fertility coupled with rapid population growth is a threat to sustainable economic development in a country. Thus, to attain the Sustainable Development Goals requires the accomplishment of the multidimensional goals, concurrently. In SSA, a large population continues to live below the poverty line. This necessitates governing bodies to divest resources from high return investments, to cater to the needs of incoming cohorts. The investment in human capital is a means reducing fertility; this averts the impending poverty, hunger, and the number of people affected by disasters and are vulnerable to shocks.

Nonetheless, policymakers are required to be cognizant to the additional policy frameworks that are a prerequisite as foundations to support the outcomes of women's education. These different sectors in education, enablers to women's rights to reproductive health and the access to economic opportunities must all work in cohesion to achieve these outcomes demonstrated by the SEM results. They include incentivizing women's participation in productive employment and knowledge of and encouragement of the use of birth control methods, in consequence, a reduction in fertility rates.

### **5.5.2 Practice Implications**

The findings of this study evidence that the fertility decline effect is greater through the channel of women's education. However, the literature review section has demonstrated that socio-cultural factors in LDCs and SSA are prime in determining the likelihood of the enrollment of girls and women into school. Notwithstanding, it is these same factors may undermine the attainment of the overall country development objectives, and the global sustainable development goal to narrow the gap in gender inequalities in access to education opportunities.

Therefore, committees tasked with allocating and evaluating the efficacy of public expenditures on education should conduct gender analysis as part of their budgeting considerations in their jurisdictions. Achieving this analysis requires providing answers to questions, including but not limited to the following. Which gender benefits from what allocation and why? Does the current government expenditure policy contribute to broadening or reduce the gap in gender access to education? To answer, the appraisal should first evaluate the gender inequalities in the levels of education and the institutional inhibitors to the access of these opportunities. Second, conduct a research to determine the demand of the education services by gender. Third, orchestrate constant programs evaluation, monitoring and learning to inform the decisions of the next financial year to improve efficiency.

### **5.6 Areas for further research**

A major advantage of the Structural Equation Modelling (SEM) is its dynamism and flexibility (Ockey & Choi, 2015). Granted, the construction of alternative models of fertility, with different structures and similar variables, is possible while maintaining the mathematical equivalence of the model in this study. As posed by theory, there are multiple mechanisms by which investment in education and education influence fertility.

Moreover, SEM is a causation model that has gained popularity in the recent years. Nonetheless, other conventional methods of testing causality such as Granger Causality test appertain to testing the long – term equilibrium relationship between government expenditure on education and fertility through women's education.

Similarly, a case where high fertility causes government expenditure on education to increase is a possibility. For this reason, a study on this reverse causality is a course worthy of exploration.

## 5.7 Limitations of the study

A common limitation encountered in studies involving macro-data and specifically on government expenditures is the inconsistency in data collection within a time trend, i.e. missing observations. The method used to deal with this shortcoming is Stochastic Regression Imputation. In this method, a regression model, derived from the non-missing data, is used to predict the values of the missing data based on the relationship between the missing variable and other variables. A randomly generated normal value,  $N(0, 1)$ , or a normally distributed noise, is then added to introduce the expected uncertainty, in order to improve the results as a simple/deterministic model will lead to a perfect linear correlation between variables. The disadvantage with this data simulation method is it leads to poor results when the data is heteroscedastic.



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## APPENDICES

### Appendix 1: Ethical Clearance Letter



28<sup>th</sup> July 2020

Ms Mwangi, Susan  
susan.mwangi@strathmore.edu

Dear Ms Mwangi,

**RE: The relationship between public expenditure on education and fertility in Sub - Saharan Africa**

This is to inform you that SU-IERC has reviewed and **approved** your above research proposal. Your application approval number is **SU-IERC0860/20**. The approval period is **28<sup>th</sup> July 2020 to 27<sup>th</sup> July 2021**.

This approval is subject to compliance with the following requirements:

- i. Only approved documents including (informed consents, study instruments, MTA) will be used
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-IERC.
- iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-IERC within 72 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-IERC within 72 hours
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to SU-IERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://oris.nacosti.go.ke> and also obtain other clearances needed.

Yours sincerely,

  
Dr Virginia Gichuru,  
Secretary; SU-IERC

Cc: Prof Fred Were,  
Chairperson; SU-IERC



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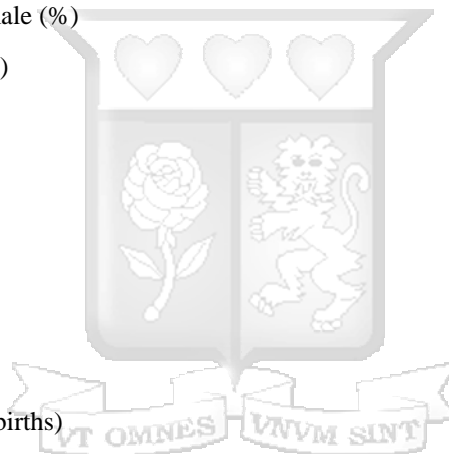
## Appendix 2: Sample of Sub-Saharan Africa countries used in the study

COUNTRY	Average total fertility (number of livebirths)	Government expenditure on education, % total government expenditure	Female Primary school enrollment rate, %	Female Secondary school enrollment rate, %	Female Tertiary level enrollment rate, %	GNIPP (\$)	Female Unemployment Rate, %	Men in wage and salaried employment, %	Contraceptive Prevalence, %	Infant Mortality Rate, per 1000 births	Urbanization rate, annual % growth	Tax to GDP, %	
1	Benin	4.84	17.71	87.93	39.81	7.47	1250	2.34	16.59	15.50	60.50	3.87	13.50
2	Burundi	5.41	19.92	94.82	31.01	3.76	280	1.01	7.75	28.50	41.00	5.66	11.52
3	Cabo Verde	2.27	16.41	92.65	74.47	28.35	3630	11.49	68.64	65.47	16.70	1.83	20.09
4	Cameroon	4.57	16.83	88.72	43.03	11.44	1500	3.87	31.34	34.40	50.60	3.63	12.25
5	Cote d'Ivoire	4.65	18.33	89.73	35.06	7.64	2290	3.77	34.30	23.56	59.40	3.45	16.18
6	Eswatini	2.99	24.80	82.47	47.09	7.25	3590	23.66	70.83	66.79	43.00	1.81	17.00
7	Ethiopia	4.25	27.10	82.05	30.31	5.25	850	2.76	15.79	40.10	39.10	4.78	7.61
8	Gambia, The	5.22	11.19	85.69	7.22	0.99	740	12.23	34.38	9.83	39.00	3.99	11.33
9	Ghana	3.87	18.60	87.17	57.88	13.57	2220	4.46	32.89	30.80	34.90	3.31	11.85
10	Guinea	4.70	14.87	70.62	26.16	7.15	950	3.32	14.94	10.90	64.90	3.83	11.74
11	Kenya	3.49	19.10	69.82	46.04	9.70	1750	2.80	56.41	60.55	30.60	4.02	15.67
12	Lesotho	3.14	13.89	91.91	50.02	12.39	1360	27.11	85.43	60.36	65.70	2.33	26.51
13	Madagascar	4.08	19.82	75.12	31.03	5.21	520	1.85	13.58	47.90	38.20	4.44	9.96
14	Mali	5.88	16.53	55.75	26.81	2.66	880	7.95	23.32	17.20	62.00	4.82	15.87
15	Mauritius	1.41	19.65	97.21	87.06	47.46	12740	9.99	75.99	65.21	13.60	-0.03	18.55
16	Niger	6.91	16.78	58.34	17.06	2.57	560	0.36	8.07	11.00	48.00	4.35	13.00
17	Sao Tome and Principe	4.32	20.12	93.98	68.69	13.90	1960	20.92	54.00	40.78	24.40	2.98	14.20
18	Senegal	4.63	21.53	80.76	39.43	10.31	1450	7.45	39.33	27.80	31.80	3.72	15.80
19	Sierra Leone	4.26	32.47	97.88	41.01	1.32	500	3.63	17.32	22.50	78.50	3.12	8.72
20	South Africa	2.41	18.87	94.65	78.52	26.38	6040	30.34	82.08	53.86	28.50	2.09	26.95
21	Togo	4.32	21.77	92.19	33.45	9.79	690	1.55	23.33	21.39	47.40	3.72	17.31

Data Source: World Bank Databank, country average 2015 - 2019

### Appendix 3: Comparison between Sub – Saharan Africa and High Income countries

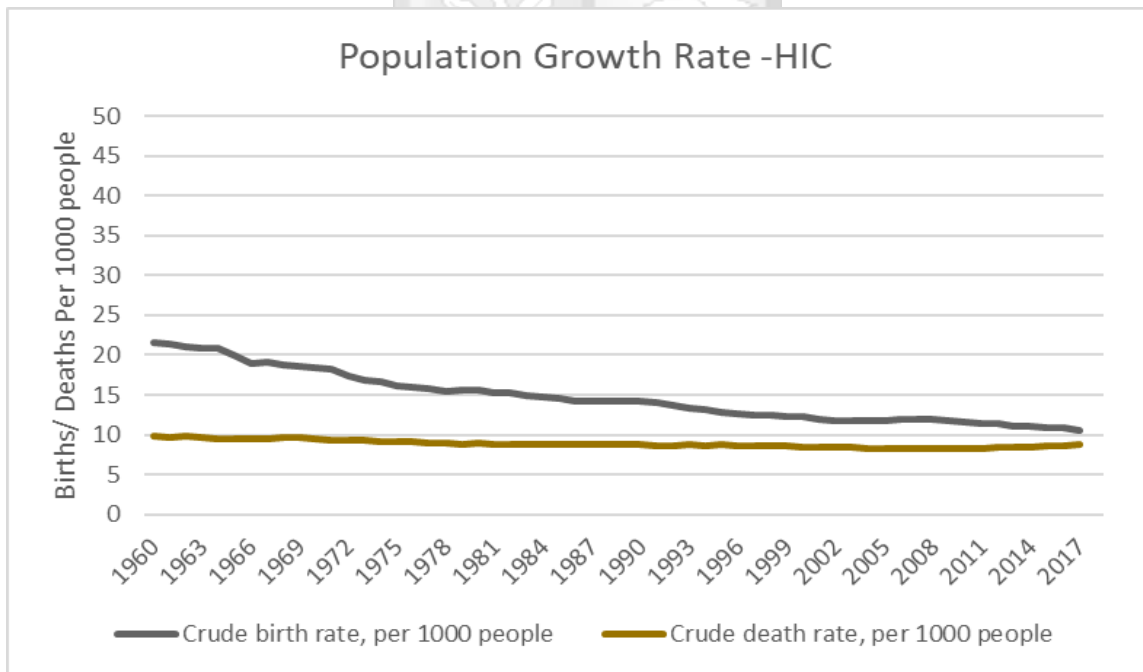
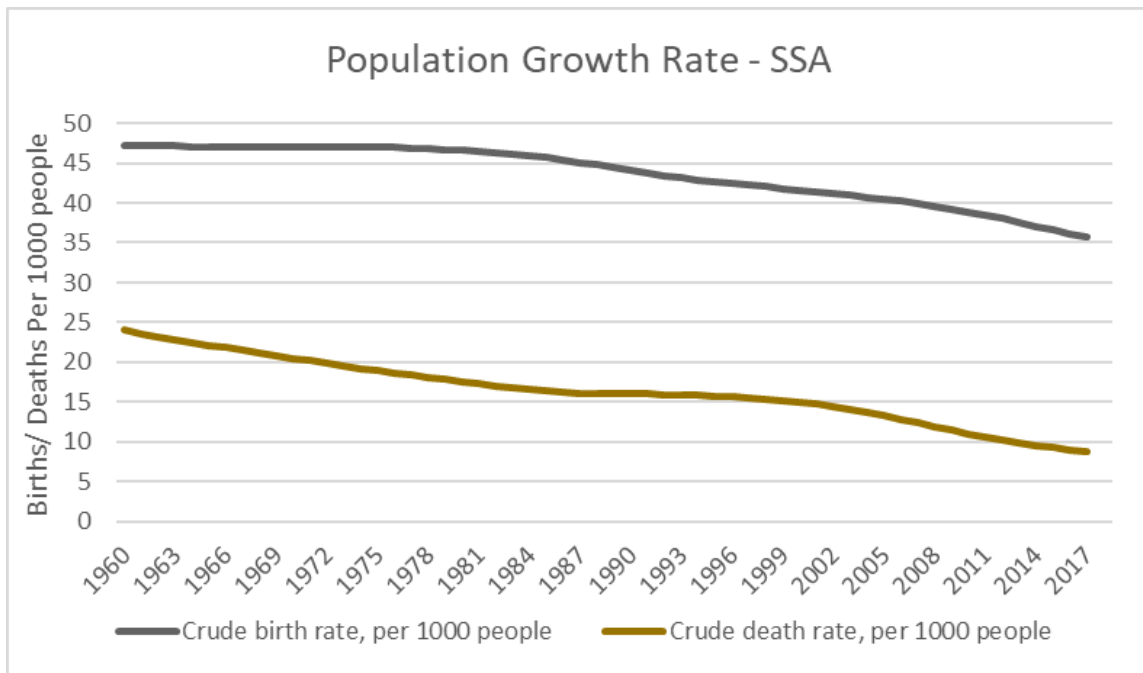
<u>Macroeconomic indicator</u>	<u>Sub - Saharan Africa</u>	<u>High Income Countries</u>
Population growth rate, annual %	2.66	0.43
Total Fertility rate, births per woman	4.70	1.60
Government expenditure on education, % of Total Government Expenditure	17.80	13.00
Adjusted net enrollment rate, Primary school, female (%)	76.09	96.35
Net enrollment rate, Secondary school, female (%)	33.98	91.27
Gross enrollment rate, Tertiary level, female (%)	8.07	83.59
Gross National Income Per Capita (\$)	1550.18	45307.29
Female Unemployment Rate (%)	6.65	5.08
Tax Revenue to GDP	18.94	15.12
Male in Salaried or Waged employment, %	29.42	85.56
Contraceptive Prevalence (%)	31.22	70.53
Infant Mortality Rate (infant deaths per 1000 livebirths)	52.70	4.30
Urbanization growth rate, annual %	4.03	0.67



*Data Source: World Bank databank, regional average 2015 - 2019*

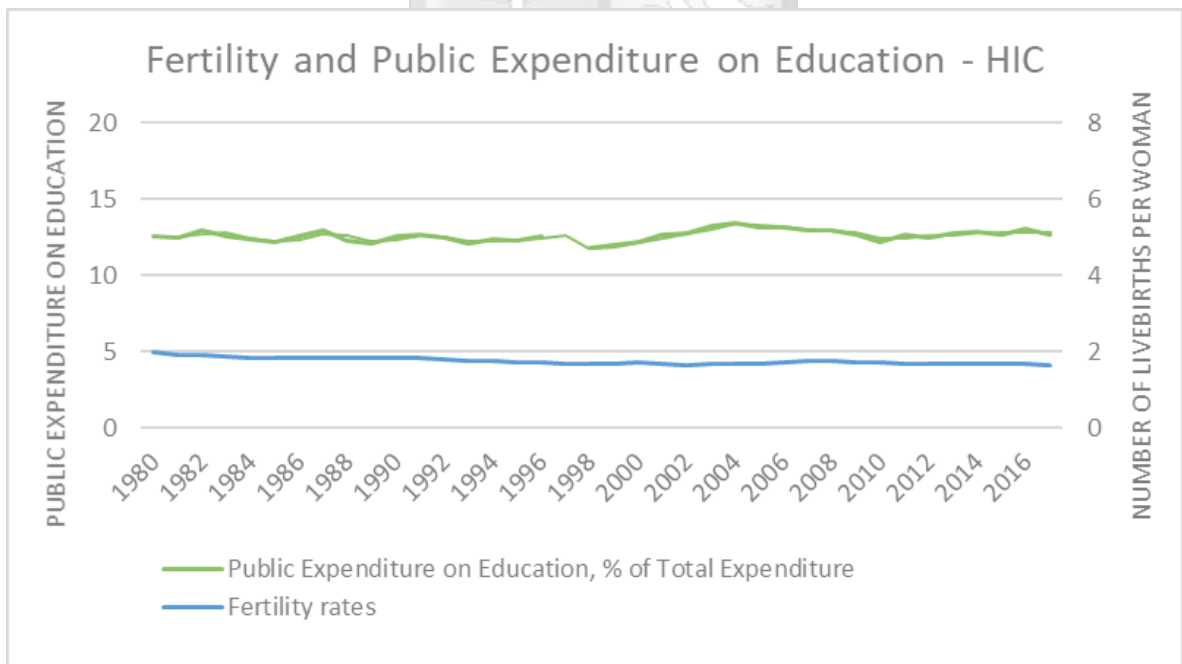
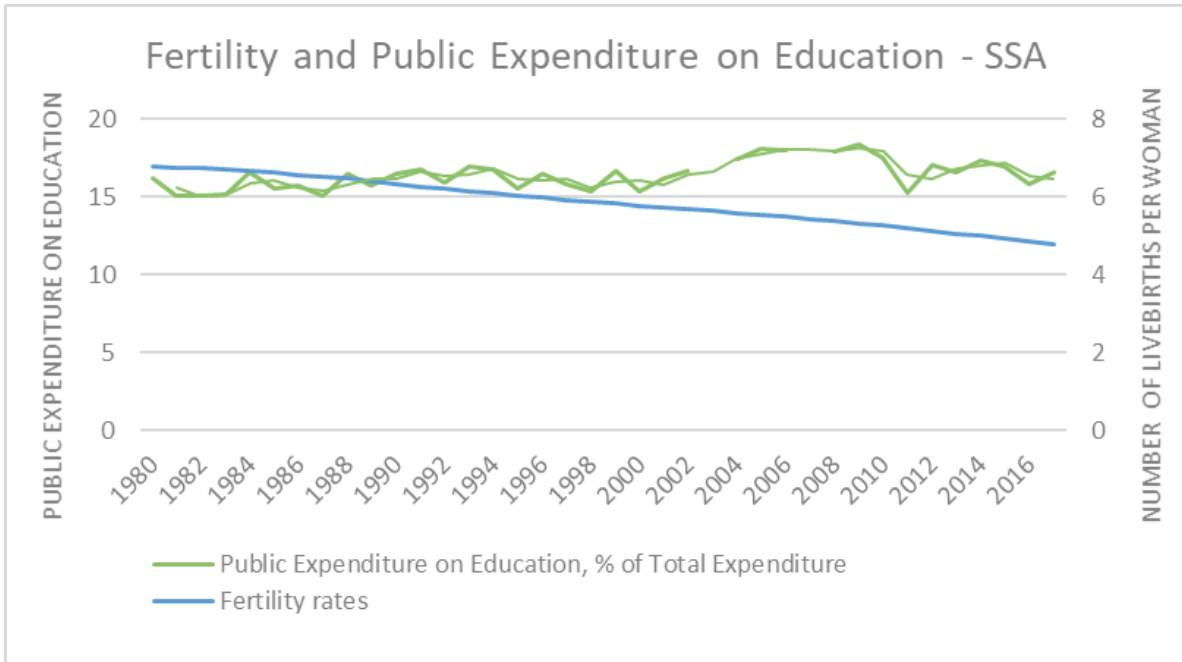
The list of High Income Countries: Andorra, Antigua and Barbuda, Aruba, Australia, Austria, The Bahamas, Bahrain, Barbados, Belgium, Bermuda, British Virgin Islands, Brunei Darussalam, Canada, Cayman Islands, Chile, Croatia, Curacao, Cyprus, Czech Republic, Denmark, Estonia, Faroe Islands, Finland, France, French Polynesia, Germany, Gibraltar, Greece, Greenland, Guam, Hong Kong Sar, Hungary, Iceland, Ireland, Isle of Man, Israel, Italy, Japan, Korea Rep., Kuwait, Latvia, Liechtenstein, Lithuania, Luxembourg, Macao Sar, Malta, Mauritius, Monaco, Nauru, Netherlands, New Caledonia, New Zealand, Northern Mariana Islands, Norway, Oman, Palau, Panama, Poland, Portugal, Puerto Rico, Qatar, Romania, San Marino, Saudi Arabia, Seychelles, Singapore, Sint Maarten, Slovak Republic, Slovenia, Spain, St. Kitts and Nevis, St. Martin, Sweden, Switzerland, Trinidad and Tobago, Turks and Caicos Islands, United Arab Emirates, United Kingdom, United States, Uruguay, Virgin Islands

**Appendix 4: Comparison of Population Growth Rate in SSA and HIC**



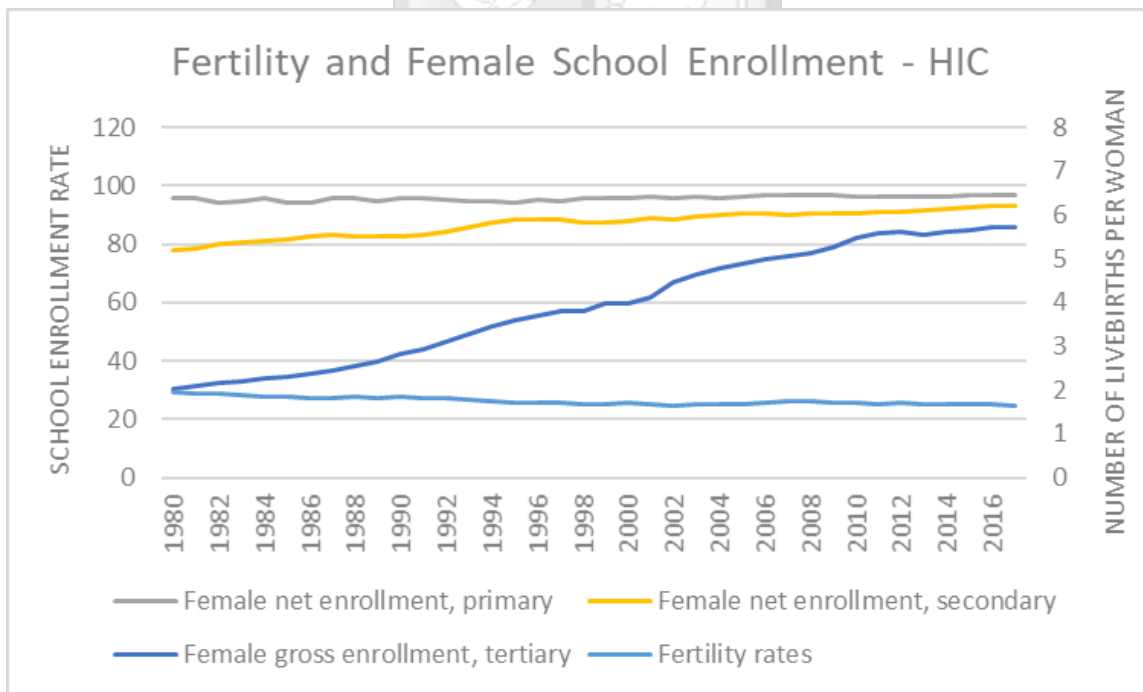
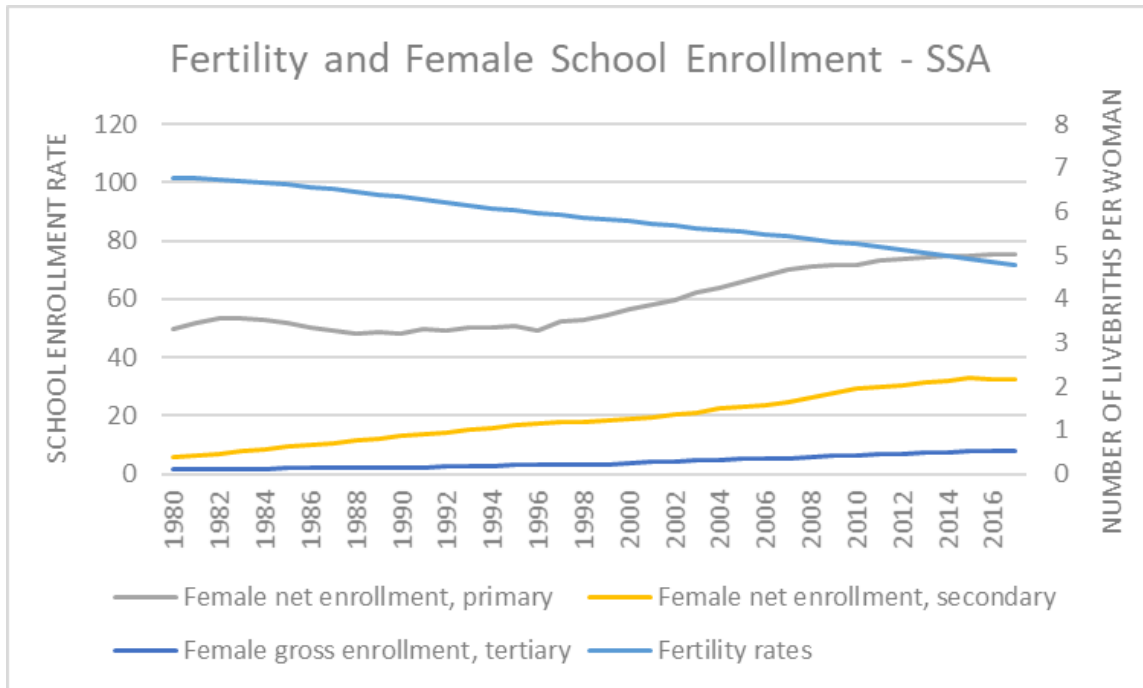
Note: The gap between the Crude birth rate and Crude death rate curves is the Population Growth Rate. The broad SSA gap depicts a higher population growth rate as compared to the HIC gap.

**Appendix 5: Comparison of Fertility and Government Expenditure on Education in SSA and HIC**



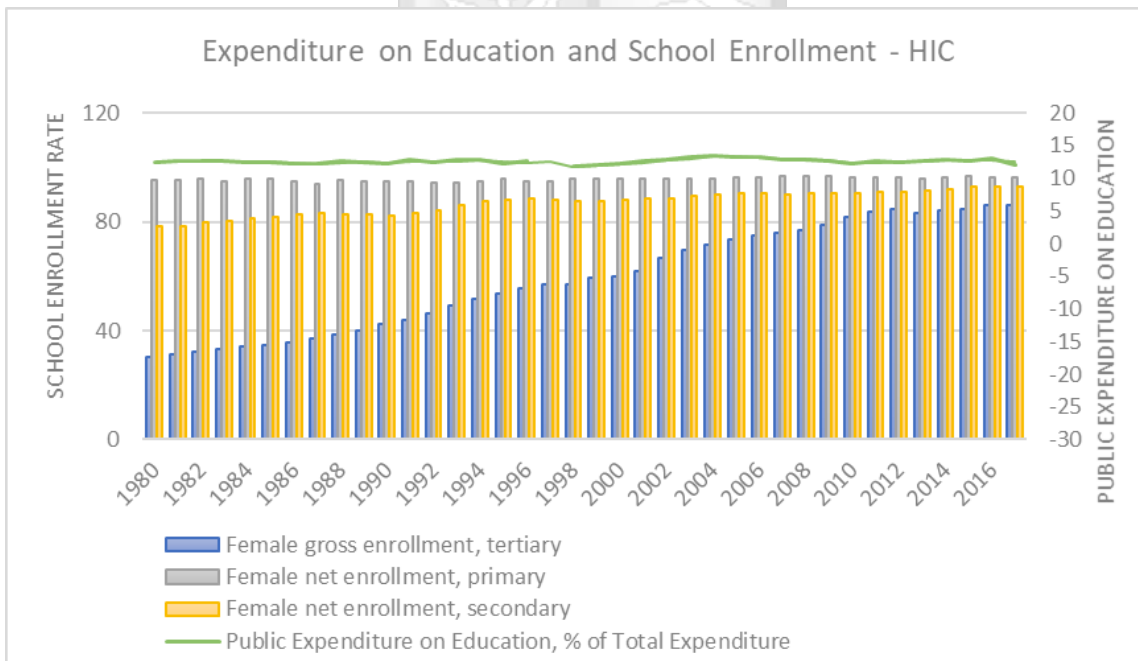
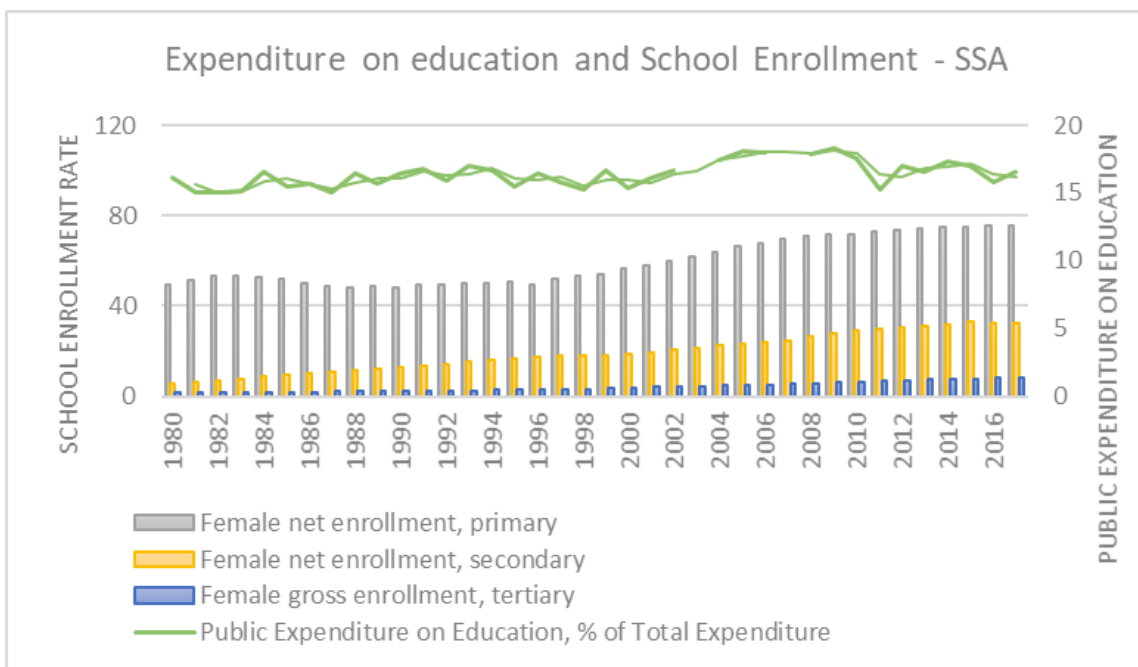
Note: Fertility remains significantly lower in HIC as compared to SSA. In spite of this, the government expenditure on education is stable, at an average of 13%. Therefore, the quantity of educational resources available to each child is considerably high.

## Appendix 6: Comparison of Fertility and Female School Enrollment in SSA and HIC



Note: The female school enrollment rate in SSA declines with higher levels of education, while the enrollment rate in HIC approaches 100% at every level. Conversely, fertility is higher in SSA double that of HIC. Regardless, fertility reduces with increased enrollment in both instances.

## Appendix 7: Comparison of Female School Enrollment and Government Expenditure on Education in SSA and HIC



Note: Female school enrollment in SSA falls at higher levels of education despite the larger investment in education. This is an indicator that (i) inadequate capacity to meet the demands of the incoming cohorts due to high fertility (ii) socioeconomic factors hindering female enrollment.

## Appendix 8: Hausman test for Fixed and Random Effects

This study applied the Hausman test to determine the appropriate model for analysis, between the Fixed Effects (FE) and the Random Effects (RE), to account for unobserved heterogeneity among the sample countries. The Hausman test (1978) compares the coefficient estimators of the random model and the fixed model, to assess whether there is a systematic difference (Park, 2011). Under the null hypothesis, the estimates are consistent and converge; therefore, RE model is preferred. The opposite holds for the alternative hypothesis, that is, the estimates of the FE and RE model significantly differ and diverge; therefore, FE model is preferred.

```
. hausman fe re
```

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
EducationE~e	-.0122847	-.0123044	.0000198	.0001325

b = consistent under Ho and Ha; obtained from xtreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(1) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
 = 0.02  
 Prob>chi2 = 0.8813

The overall  $\chi^2(k)$  is non-significant at the .05 level of significance. Thus, the study fails to reject the null hypothesis at all confidence intervals. Therefore, the random effect model is appropriate and provides consistent estimates. This implies that the difference among countries fertility rate is random and lies in their specific time-varying differences such as economic performance, use of contraception, infant mortality, women's education, government investments in education, urbanization rate, and income. One advantage that the RE model has over the FE is that it allows for inferential generalization beyond the sample.

## Appendix 9: Regression Results for Structural Equation Model (excluding controls)

DIRECT EFFECTS		Direct effects					
		OIM				[95% Conf. Interval]	
		Coef.	Std. Err.	z	P> z		
<b>Structural</b>							
Womed							
EducationExpenditure		.7893546	.1525625	5.17	0.000	.4903376	1.088372
<b>Measurement</b>							
ANERPrimary							
Womed							
EducationExpenditure		1	(constrained)				
		0	(no path)				
NERSecondary							
Womed							
EducationExpenditure		.9484016	.0342752	27.67	0.000	.8812235	1.01558
		0	(no path)				
GERTertiary							
Womed							
EducationExpenditure		.2949472	.0132481	22.26	0.000	.2689814	.320913
		0	(no path)				
<b>Structural</b>							
In_TFR							
Womed							
EducationExpenditure		-.020308	.0009176	-22.13	0.000	-.0221064	-.0185096
		.0039046	.0015344	2.54	0.011	.0008973	.006912
INDIRECT EFFECTS		Indirect effects					
		OIM				[95% Conf. Interval]	
		Coef.	Std. Err.	z	P> z		
<b>Structural</b>							
Womed							
EducationExpenditure		0	(no path)				
<b>Measurement</b>							
ANERPrimary							
Womed							
EducationExpenditure		0	(no path)				
		.7893546	.1525625	5.17	0.000	.4903376	1.088372
NERSecondary							
Womed							
EducationExpenditure		0	(no path)				
		.7486252	.1424913	5.25	0.000	.4693473	1.027903
GERTertiary							
Womed							
EducationExpenditure		0	(no path)				
		.2328179	.0441076	5.28	0.000	.1463687	.3192672
<b>Structural</b>							
In_TFR							
Womed							
EducationExpenditure		0	(no path)				
		-.0160302	.0029927	-5.36	0.000	-.0218958	-.0101646
TOTAL EFFECTS		Total effects					
		OIM				[95% Conf. Interval]	
		Coef.	Std. Err.	z	P> z		
<b>Structural</b>							
Womed							
EducationExpenditure		.7893546	.1525625	5.17	0.000	.4903376	1.088372
<b>Measurement</b>							
ANERPrimary							
Womed							
EducationExpenditure		1	(constrained)				
		.7893546	.1525625	5.17	0.000	.4903376	1.088372
NERSecondary							
Womed							
EducationExpenditure		.9484016	.0342752	27.67	0.000	.8812235	1.01558
		.7486252	.1424913	5.25	0.000	.4693473	1.027903
GERTertiary							
Womed							
EducationExpenditure		.2949472	.0132481	22.26	0.000	.2689814	.320913
		.2328179	.0441076	5.28	0.000	.1463687	.3192672
<b>Structural</b>							
In_TFR							
Womed							
EducationExpenditure		-.020308	.0009176	-22.13	0.000	-.0221064	-.0185096
		-.0121256	.0026357	-4.60	0.000	-.0172915	-.0069597

## Appendix 10: Regression Results for Structural Equation Model (including controls)

DIRECT EFFECT		. estat teffects					
Direct effects							
		OIM		z	P> z	[95% Conf. Interval]	
		Coef.	Std. Err.				
<b>Structural</b>							
Womed							
EducationExpenditure		1.067966	.1721204	6.20	0.000	.7306162	1.405316
<b>Measurement</b>							
ANERPrimary							
Womed		1	(constrained)				
EducationExpenditure		0	(no path)				
NERSecondary							
Womed		.8545506	.0502849	16.99	0.000	.755994	.9531071
EducationExpenditure		0	(no path)				
GERTertiary							
Womed		.2398616	.0229578	10.45	0.000	.1948652	.284858
EducationExpenditure		0	(no path)				
<b>Structural</b>							
In_TFR							
Womed		-.0049797	.0007681	-6.48	0.000	-.006485	-.0034743
EducationExpenditure		-.0029429	.0009168	-3.21	0.001	-.0011461	-.0047398
GNIPP		-.0000513	6.41e-06	-8.01	0.000	-.0000639	-.0000387
FemaleUnemploymentRate		-.0003942	.0007401	-0.53	0.594	-.0018447	.0010564
TaxtoGDPratio		-.0043667	.0009443	-4.62	0.000	-.0062175	-.0025159
Urbanization		.0449554	.0033599	13.38	0.000	.03837	.0515407
SalariedMales		.0007936	.0004246	1.87	0.062	-.0000386	.0016258
Infantmortality		.001219	.0001851	6.58	0.000	.0008562	.0015819
ContraceptivePrevalence		-.0064021	.0003746	-17.09	0.000	-.0071363	-.0056678
INDIRECT EFFECT		Indirect effects					
		OIM		z	P> z	[95% Conf. Interval]	
		Coef.	Std. Err.				
<b>Structural</b>							
Womed							
EducationExpenditure		0	(no path)				
<b>Measurement</b>							
ANERPrimary							
Womed		0	(no path)				
EducationExpenditure		1.067966	.1721204	6.20	0.000	.7306162	1.405316
NERSecondary							
Womed		0	(no path)				
EducationExpenditure		.912631	.1399999	6.52	0.000	.6382362	1.187026
GERTertiary							
Womed		0	(no path)				
EducationExpenditure		.256164	.0393791	6.51	0.000	.1789825	.3333456
<b>Structural</b>							
In_TFR							
Womed		0	(no path)				
EducationExpenditure		-.0053181	.001003	-5.30	0.000	-.007284	-.0033522
GNIPP		0	(no path)				
FemaleUnemploymentRate		0	(no path)				
TaxtoGDPratio		0	(no path)				
Urbanization		0	(no path)				
SalariedMales		0	(no path)				
Infantmortality		0	(no path)				
ContraceptivePrevalence		0	(no path)				
TOTAL EFFECT		Total effects					
		OIM		z	P> z	[95% Conf. Interval]	
		Coef.	Std. Err.				
<b>Structural</b>							
Womed							
EducationExpenditure		1.067966	.1721204	6.20	0.000	.7306162	1.405316
<b>Measurement</b>							
ANERPrimary							
Womed		1	(constrained)				
EducationExpenditure		1.067966	.1721204	6.20	0.000	.7306162	1.405316
NERSecondary							
Womed		.8545506	.0502849	16.99	0.000	.755994	.9531071
EducationExpenditure		.912631	.1399999	6.52	0.000	.6382362	1.187026
GERTertiary							
Womed		.2398616	.0229578	10.45	0.000	.1948652	.284858
EducationExpenditure		.256164	.0393791	6.51	0.000	.1789825	.3333456
<b>Structural</b>							
In_TFR							
Womed		-.0049797	.0007681	-6.48	0.000	-.006485	-.0034743
EducationExpenditure		-.0023752	.001083	-2.19	0.028	-.0044978	-.0002525
GNIPP		-.0000513	6.41e-06	-8.01	0.000	-.0000639	-.0000387
FemaleUnemploymentRate		-.0003942	.0007401	-0.53	0.594	-.0018447	.0010564
TaxtoGDPratio		-.0043667	.0009443	-4.62	0.000	-.0062175	-.0025159
Urbanization		.0449554	.0033599	13.38	0.000	.03837	.0515407
SalariedMales		.0007936	.0004246	1.87	0.062	-.0000386	.0016258
Infantmortality		.001219	.0001851	6.58	0.000	.0008562	.0015819
ContraceptivePrevalence		-.0064021	.0003746	-17.09	0.000	-.0071363	-.0056678