Let girls boost economic growth

A study on gender equality and human capital accumulation through female education

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Abstract

In low- and lower middle income countries, female education is known to be one of the crucial elements for generating economic growth. However, a weakness in the established literature is the tendency to focus on either gender equality or human capital accumulation through female education as the driving force behind growth. Thus, this study seeks to contribute to existing research in the area by combining the two approaches and gain further knowledge on their interconnection. To achieve the aim of the study, year data from 1999 to 2014 on gender equality and female education is collected from 76 low- and lower middle income countries within six different regions. Regressions are performed with a random effect panel data model, estimated with GLS, to investigate whether gender equality and human capital accumulation through female education are interconnected. The results later suggest interconnection and their combined effect on economic growth to be similar between regions and detectable on a global level.

Keywords: economic growth, female education, gender equality, low and lower middle income countries

Table 1

Abbreviations	
Codes and their full name	
Code	**Full name**
EAP	East Asia and the Pacific
ECA	Europe and Central Asia
GLS	Generalized Least Squares
LAC	Latin America and the Caribbean
MENA	Middle East and North Africa
OLS	Ordinary Least Squares
SA	South Asia
SSA	Sub Saharan Africa
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization

Contents

1. Introduction

Formal education (henceforth education) is one of the foundations for economic growth, where empirical findings supports its role on the course towards higher growth rates. The many positive aspects of formal training and education results in that societies' and the individuals' economic-and social welfare is built around it. A great interest in the relationship between education and growth has generated a number of studies on the topic, and it seems as especially female education is essential to boost the economy. Studies conducted in a wide range of countries and regions, finds that educating girls is one of the most efficient ways to spur economic growth. The benefits of female education, origins from its high private returns and impact on the overall human development, which is considerably higher than for men in many countries. Improved health, reduced poverty and lower child mortality are just some of the benefits of female education (Tembon, 2008).

In addition to these positive aspects, the higher income and productivity that follows increased education helps to break the vicious poverty cycles in the society. Since the benefits of female education are not isolated to the individual, but spills over to the rest of the society, it is relevant to consider the importance of social returns on female education as well. The outcomes on a social level include female empowerment, wider political and social engagement, lower crime rates and higher labour market participation. All these effects are crucial for a stable economy and economic growth. However, despite the clear private and social benefits and the high returns on female education, girls' school attainment is still lagging male in many parts of the world, and is regarded considerably less attractive. Consequently, investments in girls schooling are made to a lesser extent. Girls and women face several barriers on the road to better education and empowerment, which results in a striking gender gap hampering growth in many countries (Hertz, Subbarao, Habibi & Raney, 1991).

The relationship between female education and growth, and the benefits it brings, is well documented at both a regional level and across countries all over the world in micro- and macroeconomic studies. The picture of the relationship is clear, but one drawback in the literature is the tendency to focus on either gender equality or human capital accumulation through female education as the driving force behind growth. The gender equality view focus more on how education of girls can lead to female empowerment, equity between genders and growth, whereas the human capital view looks at the potential of female education to rise the skill levels, productivity and thereby growth. Because of the separation of the two approaches, there are still questions without solid answers.

Due to the separation of gender equality and human capital accumulation through female education, literature leaves limited empirical evidence on their mutual benefits and interconnectedness. Thus, the aim of this study is to gain further knowledge on their connection and contribute to existing literature. The reason why the study aims to combine these two approaches is to examine whether they are interconnected to

strengthen the assumption of female education and gender equality to be crucial for growth in low- and lower middle income countries. Furthermore, as focus often lays on single countries or regional cross country studies, this study also contributes to the research by comparing the effects between different regions across the world. To accomplish this, the following questions will be answered:

- Does gender equality and female human capital accumulation through primary and upper secondary education matter for economic growth?

- Is the effect on economic growth by gender equality and human capital accumulation through female education similar between regions and detectable on a global level?

The method used to answer these questions is to perform panel data regressions with a random effects model, estimated with GLS. 76 countries within six different regions, EPA, ECA, LCA, MENA, SA and SSA, are included in the data set (see table 1). A set of control variables, human capital variables and gender equality measures are used to capture the aim of the study (see table 2). Three versions of the regression equation are computed on year data to see how different lengths of education affect growth, and how these effects differ between the regions. The results are then analysed with support from previous research and theoretical framework.

The remainder of the report is organized as following: section 2 introduce a brief overview on existing literature and studies on female education and growth, highlighting the major findings and arguments found in previous research. Section 3 and 4 develops the theoretical framework and methodology used to address the questions this study aims to answer. The two main macro approaches found in previous literature is the Solow neoclassical theory and the new endogenous growth theories. This study applies the endogenous growth theory with focus on human capital, and considers the theoretical framework behind costs, benefits and the expected payoff of investments in education. Section 5 presents the empirical findings of the analysis, followed by a discussion in section 6, based on the findings and previous literature and the theoretical framework. The last section, section 7, summarizes the key findings and main conclusions drawn from this study.

2. Previous research

Studies on education and growth often emphasize the importance of human capital to generate economic growth. This approach has its origins in economic growth theories, where the accumulation and skill of human capital is the driving force behind economic growth. According to theory, different levels of human capital can explain why growth rates and GDP per capita levels differs among countries. This because the level of human capital decides how advanced technology a country can use in its production, and thereby the level of output. Also, when more advanced production techniques and technology develops, higher levels of skill are needed to maintain growth rates. Hence, the literature agrees on that investments in all education are important to reach higher growth rates and income, since it helps to build up the cognitive abilities and fundamental skills for economic advancement (Jones & Vollrath, 2013). It is further essential to understand the role of education and how it can increase the ability to take part in the technological advancement. Therefore, scholars have dedicated much effort to analyse how length and quality in education influence economic growth in low income countries.

The connection between education and growth is apparent as a number of studies find empirical evidence for its impact on economic development. The social and private returns on higher education are further substantial in low income countries. Individuals benefit largely from higher levels of education through higher income and better health. These effects later spill over to the society by increased productivity and other economic benefits. Additionally, there is an interesting observation from research on education and economic growth in the difference in returns between genders. Empirical findings reveal that even though education for all children is important for growth, educating girls is central for economic advancement. Female education is particularly central in low income countries where growth rates and income levels is low, and where females are a needed contribution to the human capital stock (Patrinos, 2008). As the importance of female education for growth is profound, research often focuses on how it affects growth and why.

Besides the focus on female education from the human capital point of view, literature further pays attention to how gender equality affect growth. The latter approach tends to focus more on female empowerment and gender equality in the society, while the former emphasizes the accumulation of skill and knowledge. However, one theme that unifies the two is the consistently interest in the costs and benefits that education brings, where the rate of returns is highlighted.

To begin with, discussions and studies on gender equality and female education are frequently occurring in the literature. For instance, Dollar and Gatti (1999) investigates how gender inequality and underinvestment in female education affects growth. The authors' research builds around how gender disparities in education and other parts of the society can be caused by underlying cultural aspects. Their study tests the relationship between inequality and growth in the regions ECA, LAC, MENA and SA (see table 1) using a fixed effects panel data model. Their findings suggest the presence of cultural

preferences for inequality and the willingness to pay the price for it. The price is high as it involves slower growth rates and lower investments in female education. Pieces of evidence in the study further suggests preferences for gender inequality to be connected to income level. Countries with lower levels of income are more likely to favour gender disparities in the society. Consequently, school attainment is in general lower for girls than for boys in low income countries (Dollar & Gatti, 1999).

Dollar and Gatti's (1999) main findings can be summarized to how reductions in gender inequality leads to higher income levels, and how sustained gender disparities have negative effects on growth. The authors also contribute to the literature by observing how the effect of inequality in education differs depending on countries' level of GDP per capita. According to their findings, gender inequality in secondary education is bad for growth, but only for lower middle income countries and above. A potential explanation is that gender disparities in education are a minor obstacle for growth when a country is less developed, but is of higher importance when the country becomes more industrialized. Following this economic transformation, the role of female empowerment becomes crucial for economic growth.

Another study by Morrison, Raju and Sinha (2007) further highlights the connection between female empowerment and economic growth. Their study is built around a conceptual framework specifying the links between education, female empowerment and its positive outcome. However, Morrison, Raju and Sinha do not believe female education to be the key to empowerment and economic growth. With the support of their conceptual framework and empirical evidence from other micro- and macroeconomic studies, they argue female empowerment and growth to depend on more than education. The authors highlight the positive aspects of girls schooling, but states it to be a minor component to achieve gender equality and economic growth. Instead, their findings suggest that labour market participation, land ownership, access to credits and the right to speak are far more crucial. Without these components, girls are back bound and cannot contribute to economic growth.

Further arguments on gender equality are presented by Tembon (2008), who deliberates how increasing rates in female primary enrolment rates has led to shrinking gender gaps in the society. The author explains this development by the recognition of female education to be central for economic growth. The author look at low income countries across the world, and build their argumentation around field studies, statistics and the empirical evidence from other scholars. Based on this, they find female education to be a priority today in low income countries, which reveals itself in less prone gender disparities and higher growth rates.

According to Tembon, the reason why female education has such an influence on economic growth, is its effect on female empowerment. Girls' economic empowerment is essential for development since it raise income and productivity, and further breaks the negative spiral of poverty. Investing in girls schooling is therefore one of the best ways for governments to spur economic growth. (Tembon, 2008)

However, female education still lag male in many parts of the world. For example, LAC, MENA and SSA have problems with low female school attainment and have a long way to go before reaching a more equal society and higher growth rates. The author find gender differentials to be widest on a secondary level of education, which also has proved to be the most important level of education to obtain equity and growth in the society. Tembon further explains the persistence of gender inequality by the existence of cultural and structural barriers toward females. (Tembon, 2008)

In contrast to scholars with focus on gender equality as the driving force behind sustained growth, other researchers apply the approach of human capital accumulation through female education. One scholar using this approach is Hanushek (2008), who reviews the evidence on the economic impact of investments in female education on human capital. Hanushek maps the economic benefits of female education, and further states the major positive aspects of such investments. Firstly, it leads to an increased labour force and thereby an economic expansion. Secondly, female education is followed by a variety of positive health aspects for both women and their families. Thirdly, it often leads to lower fertility rates, and fourth it implies a major contribution to human capital.

The fourth argument by Hanushek is claimed to be the most important effect of female education. Since girls in low income countries constitute an unutilized part of the human capital stock, there is a potential rise of human capital if they are incorporated in the economy. By higher level of human capital, higher level of GDP per capita can be accomplished. (Hanushek, 2008)

Hanushek further contributes to the understanding of female education and economic growth by adding the importance of educational quality. Namely, the rate of returns for individuals and the society is decided by the quality in education. Therefore, poor quality leads to lower levels of knowledge and skill and less children attaining school, as low returns make it less profitable for families to invest in their children's education. Further findings by Hanushek is that dropout rates are higher in countries with poor quality in education, and that girls are more affected by education investments than boys due to their disadvantageous position. (Hanushek, 2008)

Hanushek's (2008) argument about female labour force participation is further emphasized by Oztunc, Oo and Serin (2015). These authors examine the impact of female education on human capital accumulation and labour force participation in the Asian Pacific during 1990 to 2010. The study is performed with a random effects panel data model to analyse the long-term effects of female education on growth. In accordance with other studies, evidence is found on how the positive impact of increased female education on female labour force participation stimulates productivity and economic progression. An additional finding is that higher educated girls have better opportunities to enter the labour market and secure their income.

Another conclusion drawn by Oztunc, Oo and Serin (2015) is that there is no unified effect on growth through all levels of education. Primary education for instance, is found to have a positive influence on GDP per capita, but the effect is even stronger on a

secondary level. Moreover, the authors find the connection between female education and economic growth to differ across countries. For some countries, the connection appears already at primary school level, while in others the effect become visible first at secondary or tertiary level. According to these results, the effect of female education on growth depends on the initial level of human capital and countries' level of development.

The unifying theme in the literature, independent of the main approach, is the discussion around costs, benefits and returns on investments in education and barriers against female education. To begin with, Aghion and Howitt (1997) find a major barrier in all societies to be the degree of segregation, since it is correlated low levels of human capital. From this finding, the authors conclude segregation to have an overall negative impact on educational performance, as the average quality and accumulation of human capital is hampered. Also, social exclusion tends to hold back gender equality and it results in low female school attendance as girls are far more often marginalized in a segregated society.

In contribution to Aghion and Howitt's findings, barriers against education can be derived from the expected gains and losses of education. Among others, Dzator, Licumba & Zhang (2015) implies that the decision on sending children to school is an investment decision for most families in low income countries. Their study investigates underinvestment in female education by measuring how different factors affect costs and expected payoff on girls schooling in Sub Saharan Africa. According to their findings, parents in low income countries have less opportunities to invest in their children's health and schooling, and thereby cause lower enrolment rates. Even though the amount of money that parents can spend on their children's education is equal between genders, Dzator, Licumba and Zhang find large gender disparities in school investments. The gist of the problem is that female education may look decidedly less attractive for parents when deciding on sending their children to school. However, the benefits of female education are often viewed from the society's perspective, and to rise female enrolment one must convince parents to send their daughters to school. Therefore, the costs and benefits of education must be viewed from the parents' perspective. (Dzator, Licumba & Zhang, 2015)

Lastly, the study by Hertz, Subbarao, Habibi and Raney (1991) on girls' attainment in school in low income countries reviews cultural and structural barriers in the society. This study contributes to other scholars by explaining how traditions lingering in the society hamper parents' investment in their girls' education. Further findings are that market failures and unethical social structures are a major obstacle for girls since it hinders them to find payed work.

To summarize, the two main blocks in the literature on female education and growth focus on either gender equality or on human capital accumulation. The literature stressing gender equality regards female education to be a minor component in economic growth, whereas the other line of literature considers it as a major factor. The common thread unifying the views is the discussion around barriers against females in the society. The next sections will merge the different approaches together to form a broader picture.

3. Theoretical framework

3.1 Definition of human capital

The rationale behind addressing the effect of education on economic growth has its base in the role of human capital in modern growth theories. Though, the idea of human capital is somewhat unclear as it can be interpreted in different ways. In general, the concept refers to the competences, knowledge, talents, education and health of human beings (Jones & Vollrath, 2013). In economics, human capital is often referred to the accumulation of skill through formal and informal education. However, the meaning of human capital differs also within economic theory, depending on specifics models and how the role of human capital is specified. Two main definitions can be distinguished in the theories of economic growth, either as 'human as labour force' or as 'human as a creator'. The notion of human as labour force is generated by the same principle as for technology and land since it is a factor of production. The latter on the other hand evolved from recognizing the importance of knowledge, skills and competence in the economy, which is a result of education and training (Kwon, 2009).

3.2 Human capital and growth

The trade mark of endogenous growth theories is that either human capital or technology is incorporated in the model. Common for modern growth theories is to acknowledge human capital as a key factor to generate higher productivity and growth, and that growth rates differs among countries because of different levels of human capital. The new growth theories evolved after noticing how the level of human capital varies among countries due to different possibilities to invest in education (Bigsten, 2003). Since education is essential to accumulate the skill and knowledge needed to stimulate growth, different levels of investment in education leads to diverse human capital stocks and development in the world. Developed countries have an advantage over low income countries in the possibility to invest both time and money in education, and therethrough produce a large stock of skilled labour and human capital. Low income countries however do not have this advantage and thereby lack innovations and modern technology. Therefore, low income countries frequently suffer from lower efficiency in their production and must pay the price in slower growth rates. (Jones & Vollrath, 2013; Ray, 1998)

Based on the knowledge of the importance of human capital for economic growth, endogenous growth theorists claim the need of including human capital in the models. It is by the same principle on which the Solow model enable individuals to save in physical capital and technology, that the new growth models allow individuals to save by investing in education. Such savings may be of importance for individuals and families in low income countries since it has the potential to raise their value on the market in the future. (Bigsten, 2003; Ray, 1998)

Endogenous growth models often focus on either the investment in technology or in human capital. Though, in one of the easiest models by Ray (1998), individuals can choose whether to invest in technology or in human capital. Ray explains through the model that output per capita depends on both the level of technology and human capital per capita. The model is derived as follows:

$$y = k^{\propto} h^{1-\propto} \tag{1}$$

where *y* is GDP per capita, *k* is technology per capita and *h* is human capital per capita. Ray simplifies the model by assuming the population size to be constant and that there are given saving rates for technology per capita, *s*, and human capital per capita, *q*. Firstly, the saving rates for technology per capita, where *s* is the fraction saved of GDP per capita, can be illustrated as follows:

$$k(t+1) - k(t) = sg(t) \tag{2}$$

Secondly, the saving rates for human capital per capita, where *q* is the fraction saved of GDP per capita, can be illustrated as follows:

$$h(t+1) - h(t) = qg(t) \tag{3}$$

By dividing both sides of equation (2) and (3) by k(t) respectively h(t), the growth rates for technology and human capital is derived as $sr^{1-\propto}$ and $qr^{-\propto}$.

Given these simplifications, the two savings rates will eventually grow at the same rate in the long run, and thereby affect the level of GDP per capita. Therefore, one must have:

$$sr^{1-\propto} = qr^{-\propto} \tag{4}$$

which can be simplified as follows:

$$r = q/s \tag{5}$$

where *r* is the ratio of human capital to technology in the long run. By equation (5) one can use *r* to compute the long-run growth rate, *g*:

$$g = sr^{1-\propto} = s^{\propto} q^{1-\propto} \tag{6}$$

There are a couple of implications from Ray's (1998) model. Firstly, it is possible to have diminishing returns on technology without causing any convergence in GDP per capita. That means, if countries have the same saving rates and the same technology they will grow together in the long run without the tendency for income convergence. Secondly, in addition to level effects in GDP per capita, the input variables now have growth rates effects on GDP per capita. This put the model among endogenous growth models, since

the growth rate is decided within the model. Lastly, in accordance with other endogenous growth theorists, Ray strengthens the assumptions about conditional convergence and denies the existence of absolute convergence. This assumption makes it possible to explain why income per capita differs between countries. (Bigsten, 2003; Ray, 1998)

3.3 Private and social benefits and costs

Ray's (1998) simplified model suggests how investments in both technology and human capital can lead to increased growth rates and higher levels of GDP per capita. A parallel to investments in technology can be drawn to explain the outcome of investments in human capital and education. Like investments in technology, investments in human capital generate an expected stream of higher future income. These earnings can later be reinvested in the economy to raise output further. Therefore, the rate of returns on investments in human capital and education can be estimated by comparison with the returns on other investments. (Smith & Todaro 2014)

Investments in education are correlated with both social and private benefits as additional years of schooling have a positive relationship with productivity and earnings. Higher education results in increased wages in both low, middle and high income countries, where lower direct and indirect costs result in higher returns. Private returns on investments in education is calculated by comparing the estimated earnings and the direct and indirect costs it brings (see figure 1). However, one drawback with the calculations of the private returns on investments in education is the difficulty to separate human capital from other kinds of capital an individual possesses, which makes it harder to estimate the positive outcomes. The problem can be bypassed by comparing wages at different education levels which gives a sufficient, but not always correct estimate. (Patrinos, 2008; Smith & Todaro, 2014)

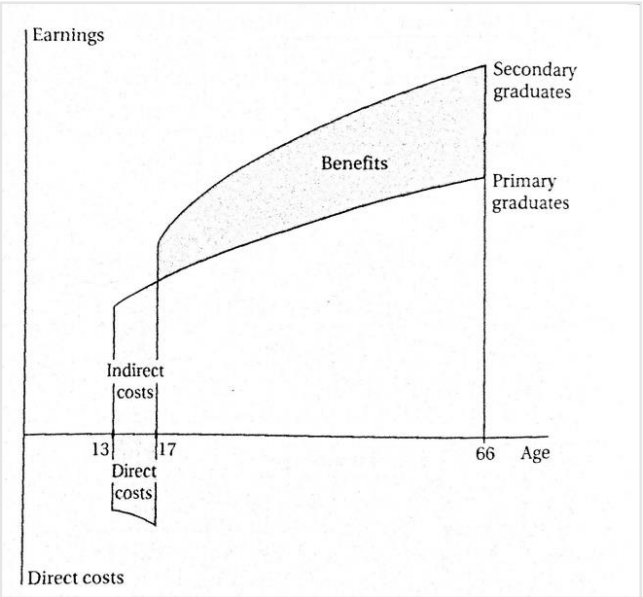
To continue school after primary education, the individual must face higher direct and indirect costs which consist of lost income, school fees, books and forgone income connected to education (see figure 1). These extra costs would not occur if the individual starts working after completing primary education life. However, the benefits of continuing school and finishing secondary education are substantially larger than for primary, and the sacrifices in time and money are compensated with better earnings throughout the individual's working life. The private benefits are strictly increasing with the level of education and include in addition to better earnings increased job opportunities, improved health and social empowerment. On average, returns and benefits of schooling are noticeable larger in low income countries than in developed countries, which indicates a shortage of education and low levels of human capital. (Smith & Todaro, 2014)

Additionally, the benefits enjoyed on a private level transfers to the society where it can be identified as the positive externalities of education, such as increased productivity, social stability and spill over effects to other institutions. The social returns of education further manifests in higher growth rates and better economic performance. Though, the

calculation of social returns is, like the calculations of private returns, problematic since they occur in many different parts of the society and in a variety of shapes. (Patrinos, 2008; Smith & Todaro, 2014)

Nevertheless, the positive outcomes of investments in education do not come without costs for either individuals or societies (see figure 2a & 2b). Despite the potential benefits families could gain from investing in education, costs may exceed the benefits and thereby hinder parents from sending their children to school. Additionally, societies investments in education mean that limited funds and asset have to be reallocated from potentially more productive sectors. Also, in contrast to private returns, societies have diminishing returns on education where the social costs for education eventually exceeds the returns. Many governments further choose to subsidize schooling and provide financial support to families with school children which diminish the social returns even more. (Patrinos, 2008; Filmer, 2008)

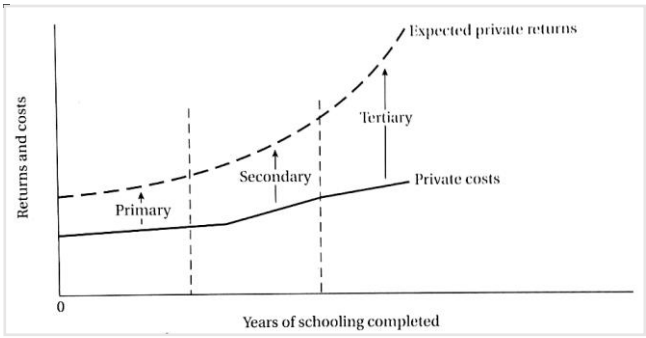
Figure 1



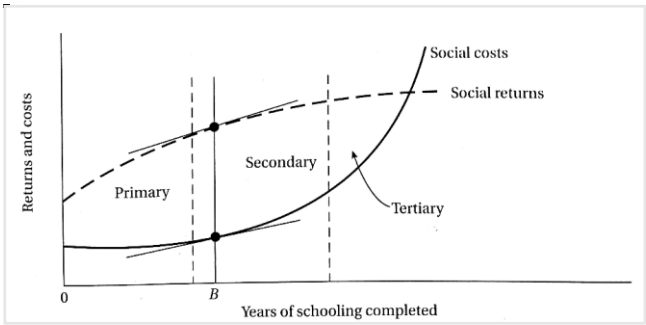
Source: Smith & Todaro, 2014

Figure 2

a) Private returns and costs



b) Social returns and costs



Source: Smith & Todaro, 2014

4. Methodology

This study is based on data from low and lower middle income countries from 1999 to 2014 to analyse the impact of female education on economic growth. Low income countries are characterised by income per capita less than $1,025/year in 2015, and lower middle income countries by income per capita between $1,026/year and $4,035/year in 2015 (WDI, 2017). The time period this study focuses on is chosen with regards to the UN Millennium Goals, which started in 2000 and were targeted to be reached in 2015. The thought behind this choice is that many of the goals and the work put down to achieve them relates to the aim of this study. The time span is however adjusted to 1999 to 2014 in order to incorporate the preconditions before the goals were sat, and due to the lack of available data after 2014.

The initial dataset consisted of 83 countries from different continents, but due to incomplete data the final results are derived on 76 countries within six regions, EAP, ECA, LAC, MENA, SA and SSA (see table 1). To analyse the effect of female education on growth, a set of regressions are carried out. The regressions are first carried out on the whole sample to test if the variables have significance on a global scale, and then for each region using dummy variables. Lastly, all regions but MENA are included in one regression to analyse similarities and differences between the regions in relation to the omitted one.

The data is retrieved from the World Bank and UNESCO, and mainly from the education databases.

4.2 Data and variables

The selection of human capital variables is based on the UN's education indicators and what is common in studies examining female education, gender equality and economic growth.

Some of the frequently occurring variables in the literature focusing on human capital are enrolment and completion rates, labour force participation and fertility rate. Therefore, following previous research, the variables in this study include female primary and secondary school enrolment rates, female primary completion rate and lastly female labour force participation and fertility rate. These variables further suit the endogenous growth theory, where economic growth is dependent on the level of human capital, a.k.a. education. Furthermore, following previous research, all variables except fertility rate are predicted to have a positive impact on growth. The motive for the variables expected effect is the literature's agreement on the positive effect of female education and the proved negative effect of high fertility rates on growth.

Moreover, variables on gender parity in education are introduced to capture the impact of gender equality on growth. These variables are common in the block of literature analysing this relationship and are therefore included in the study. The variables measure

the ratio of female to male for a given indicator, which in this study includes school enrolment and completion rates. If the ratio is larger than one, more girls than boys enrol or complete school, and the other way around if the ratio is less than one. Depending on whether the proportion is larger or smaller than one, the expected effect on growth differs. If the ratio of girls to boys is low, the effect is predicted to be negative, and positive if the ratio is higher. In contribution to measuring equality, the variables also say something about the female empowerment since the degree of gender equality is connected to female empowerment within a society. (UNESCO, 2017)

In addition to the variables measuring human capital, control variables are included in the regression to minimize the risk of spurious results. Following Barro (1991), initial GDP is introduced as a control variable. The rationale behind including initial GDP is the fact that the starting level of GDP per capita has an impact on the accumulation of human capital and economic growth. In addition to initial GDP, gross capital formation and population growth are included as control variables, as they are correlated with the dependent variable. A definition for each variable is found in table 2 below.

Table 2

Definitions and Sources of the Variables			
Variables	**Code**	**Definitions**	**Source**
GDP per capita growth	g	Annual percentage growth rate in GDP per capita	WDI
Initial GDP per capita	initial.gdp	GDP per capita level 1999	WDI
Population growth	pop.g	Annual population growth rate	WDI
Gross capital formation	gross.cap	Gross capital formation consists of outlays and fixed assets of the economy plus net changes in the level of inventories	WDI
Female labour force	labour	Female labour force as a percentage of the total labour force, age 15 and above	UNESCO
Fertility rate	fertility	The number of children that would be born to a woman if she were to live to the end of her childbearing years	WDI
Primary net enrolment rate (GPI)	p.enrl.gpi	Ratio of female to male to the male adjusted net enrolment rate for primary education	UNESCO
Primary completion rate (GPI)	p.comp.gpi	Ratio of the female to male primary completion rate	UNESCO
Upper secondary net enrolment rate (GPI)	s.enrl.gpi	Ratio of female to male to the male adjusted net enrolment rate for upper secondary education	UNESCO
Primary net enrolment rate	p.enrl	Total number of new female entrants in the last grade of primary education as percentage of the total female population in that age group	UNESCO
Primary completion rate	p.comp	Total number of new female entrants in the last grade of primary education as percentage of the total female population in that age group	UNESCO
Upper secondary net enrolment rate	s.enrl	Total number of female entrants in the last grade of secondary education, as a percentage of the total female population in that age group	UNESCO
Dummy variable for each region	dummy	Dummy variable to separate the regions and to compare similarities and differences. The dummy variables are denoted in the equations as ECA, EPA, LAC, MENA, SA and SSA	
NOTE: WDI means World Development Indicators			

4.4 Regression model

4.4.1 Panel data

One of the more frequently occurring techniques used in macro studies on education and economic growth is panel data regressions. Panel data is favoured in the literature since it has both cross-sectional and time dimensions, and allows a more complex and nuanced analysis. Following previous literature, this study applies a panel data model for the regression analysis.

A panel dataset consists of observations on numerous subjects collected over time. The collected data include different cross sectional units such as individuals or households over a specific time period, and gather information for each individual and year in the sample (Dogherty, 2011). Besides the fact that panel data allows for a more nuanced analysis, there are several other arguments stating the advantages. Firstly, it has the advantage of an increased number of data points and reduced collinearity among the explanatory variables. Secondly, panel data regressions detect and measure effects which cannot be observed in time series or normal cross-section data. Thirdly, panel data allows controlling for unobserved country-specific effects and is thereby reducing the risk of bias in the estimated coefficients. (Dogherty, 2011; Torres-Reyna, 2007)

Moreover, the dataset can be divided into two types depending on how complete the dataset is. The data is either balanced or unbalanced, where the structure of the sample has implications for the regressions. A balanced dataset is not missing any observations and the dimension of the data is the same for all countries. In contrast, the dataset is unbalanced when observations are missing. (Dogherty, 2011) For this study, there are missing observations which means that the dataset is unbalanced. Therefore, one should have in mind that absent observations might be endogenous to the regression model.

4.4.2 Random effects model

Panel data can be analysed with different techniques where the most commonly used are fixed or random effects models. Which model that is the most appropriate to use depends on the nature of the study and how the data is collected. The distinction between the two is somewhat diffuse and it may be difficult to decide which model is the most suitable. However, to help on deciding whether a fixed or a random effects model should be applied, one can perform a Hausman test. Running a Hausman test means to test if the error terms are correlated with the variables, indicating which model to use. (Torres-Reyna, 2007) In this case, the test indicates that a random effect model should be used.

Random effects models are defined by the variations in the dataset. These variations are assumed to be random and uncorrelated with the predictor or the independent variables. Additionally, a random effect model allows time invariant variables to function as explanatory factors. One way to perform efficient estimates is to use a GLS model to

address the cross correlation of the disturbance terms which occurs when working with panel data. (Dogherty, 2011; Torres-Reyna, 2007)

4.4.3 Lagged variables

Given the fact that education has an opportunity cost in lost production and labour force participation during the time in school, the effects on the economy is delayed. Students represent a cost during their time in school, and it takes some years after graduating before the costs are covered and the benefits are visible. Similarly, the effect of policy changes and school reforms are revealed first after a certain amount of time. So, to capture delayed effects of education on economic growth, all variables on education are lagged with different time periods. To begin with, the gender parity variables for both primary and secondary education and primary enrolment rates are lagged with two years to detect their postponed effect. Additionally, primary completion and secondary enrolment rates have a three-year lag to capture their influence on growth.

The motive for using a shorter lag for the GPI variables is based on the multiple benefits of gender equality for growth. Thus, the effect should be visible relatively rapidly due to the many different factors in the society affected positively by female empowerment. Why primary enrolment and completion have different lags is because one could expect a certain degree on dropouts after enrolling school. Nevertheless, a few years of schooling still have some positive effects for the individual. Completing primary level of education will bring higher returns, but need longer time before the benefits are visible in the economy. Similarly, the effect on growth is anticipated to be delayed longer for secondary enrolment because longer years of schooling and higher private and social costs. Therefore, this variable is also lagged with three years.

4.4.4 Regression equation

The regression equation is specified below where g stands for GDP per capita growth and the unlagged terms are the control variables, female labour force participation and fertility rate. The lagged terms are all the variables on education and gender parity.

$$g_{it} = C + \gamma_{it} + \beta_1 X_{it} + \beta_2 Z_{it-n} + u_{it} \quad (7)$$

Two versions of the regression equation are used to examine if different length of schooling might give different results, equation (8) and (9). Equation (8) only includes primary education variables, while equation (9) includes both primary and secondary education variables. Dummy variables are also used in both versions to identify and separate the regions. This because separate regressions are performed, which enables an analysis of the human capital variables in each region. Additionally, a final regression equation, equation (10), is used to examine whether the regions are similar or different from each other. All regions but MENA are included in order to tell which region or regions that are significantly different from the omitted one. MENA is omitted because

the variable's coefficient value lies in between the other regions. In general, this is the best option when comparing how subgroups stand in relation to one another (Gould, n.d.).

(8)

$$g_{it} = C + \gamma_{it} + \beta_1 initial.gdp + \beta_2 pop.g + \beta_3 gross.cap + \beta_4 labour + \beta_5 fertility + \beta_6 p.enrl.gpi_{t-2} + \beta_7 p.comp.gpi_{t-2} + \beta_8 p.enrl_{t-2} + \beta_9 p.comp_{t-3} + dummy + u_{it}$$

(9)

$$g_{it} = C + \gamma_{it} + \beta_1 initial.gdp + \beta_2 pop.g + \beta_3 gross.cap + \beta_4 labour + \beta_5 fertility + \beta_6 p.enrl.gpi_{t-2} + \beta_7 p.comp.gpi_{t-2} + \beta_8 s.enrl.gpi_{t-2} + \beta_9 p.enrl_{t-2} + \beta_{10} p.comp_{t-3} + \beta_{11} s.enrl_{t-3} + dummy + u_{it}$$

(10)

$$g_{it} = C + \gamma_{it} + \beta_1 initial.gdp + \beta_2 pop.g + \beta_3 gross.cap + \beta_4 labour + \beta_5 fertility + \beta_6 p.enrl.gpi_{t-2} + \beta_7 p.comp.gpi_{t-2} + \beta_8 s.enrl.gpi_{t-2} + \beta_9 p.enrl_{t-2} + \beta_{10} p.comp_{t-3} + \beta_{11} s.enrl_{t-3} + \beta_{12} s.enrl_{t-3} + EAP + ECA + LAC + SA + SSA + u_{it}$$

The regressions are performed on year data, and the results are tested and corrected for heteroscedasticity and autocorrelation using robust standard errors. The results are presented in table 3a and 3b in section 5.

4.4 Outliers

After plotting the data in a box plot in STATA 14, outliers were discovered in the sample. Outliers can have a considerable influence on the regressions as they skew the distribution of the mean and the range of the variables. This means that the mean is biased in direction of the outliers' value. Therefore, the risk is that outliers distort the impact of education and gender equality have on growth. However, one should be careful when removing outliers as it can be used to manipulate the data to derive desired results.

To determine if the outliers have an impact on the results, the regressions were run both with and without the outliers. Since the difference between the results was small and the significance of the variables did not change, the outliers were not excluded in the regressions to avoid data manipulation (Dogherty, 2011; Torres-Reyna, 2007). The results from the data analysis are presented in the next section.

4.5 Limitations

This study applies a cross-country macroeconomic approach and the findings are limited to the macro relationship between gender equality, human capital accumulation and economic growth. An additional limitation is that only gender equality and female education are considered as the factors affecting growth. Consequently, other elements with effect on economic growth are not captured in this study.

Moreover, there are limitations regarding the chosen time span of 16 years (1999 to 2014) and the selection of only low and lower middle income countries. These decisions on time and sample restricts data availability and the study's results and implications.

A further potential weakness with the data is the problem with causality and how trustworthy the variables are. Education is recognized to affect growth but due to the causal relationship between the two, the nature of the relationship is difficult to determine. There are many different channels through which education, both directly and indirectly, is connected to growth. Therefore, it is not obvious how education and growth affect each other. This means that education could generate growth, but it is also the other way around; that economic growth could improve education and human capital.

Other limitations are the diminishing social returns on education, hence also female education (see figure 2b). When higher levels of education are needed to spur growth, the social returns on the investments grows at a diminishing rate whereas the costs rise rapidly. Consequently, every additional level of education generates less payoff for the society, and costs will eventually exceed the returns. Increasing female education has therefore a limited impact on economic growth in the long run as female enrolment rates at higher levels of education cease to pay off in the end. Moreover, when female enrolment rates rise and societies become more equal, female empowerment lose importance and gender equality in school becomes less central for economic growth. Therefore, the role of female education as the engine for economic growth is not persistent.

Lastly, one might also question how reliable the human capital variables are as many of them are survey based and may not be fully accurate. These issues with data collection and variables are a common problem and should be kept in mind when performing this study. However, they are not addressed due to the ambition to focus solely on the research questions and aim of this study.

5. Empirical findings

The empirical findings from the regressions are reviewed in this section. To gain better understanding for the variables' effect on growth and their development over time, line charts have been constructed for each region (see appendix). The charts have been constructed to facilitate the analysis of the results, and to better detect the similarities and differences between the regions.

Beginning with the line charts over primary enrolment, a positive trend is displayed over the last 16 years. This indicates improvement in female education all regions, even though stagnating or declining results over primary enrolment is present for approximately the last two years. Similar results apply for completing primary education. The general pattern across regions is increasing but fluctuating rates, but with stagnating or declining rates lately.

Continuing with the development over female labour force participation, there is no consistent trend for all regions. EAP and ECA have declining rates over the period, while the other regions' rates have increased. Still, a unified trend over fertility rate is displayed by declining birth rates for all regions. The only region differing is ECA with increasing birth rates over approximately the last ten years.

Nevertheless, the main substance for the analysis is the regression outcomes that are presented in table 3a and 3b below. Table 3a includes primary education variables, while table 3b includes secondary education in addition to primary. Column (1) contains the results from the whole sample without regional dummies, while columns (2) to (7) contains the results for each region. The last column, column (8), displays the results from the regression containing all regions but MENA.

Table 3a

Dependent variable	**(1) No regional dummy**	**(2) EAP**	**(3) ECA**	**(4) LAC**	**(5) MENA**	**(6) SA**	**(7) SSA**	**(8) All regional dummies**
g								
Independent variables	**Coefficient (|z|)**							
initial.gdp	−0,0003 (0,0003)	−0,0003 (0,0004)	−0,0002 (0,0004)	−0,0001 (0,0002)	−0,0003 (0,0003)	−0,0002 (0,0004)	−0,0001 (0,0005)	0,0003 (0,005)
pop.g	0,5326 (0,3286)	0,5107 (0,3528)	0,5846 (0,3959)	0,6198 ** (0,2837)	0,5213 * (0,3165)	0,5267 (0,3285)	0,5184 (0,3166)	0,6557 ** (0,325)
gross.cap	0,0948 *** (0,0068)	0,0916 *** (0,0082)	0,0946 *** (0,0067)	0,108 *** (0,0105)	0,0954 *** (0,0074)	0,0933 *** (0,0774)	0,0959 *** (0,0093)	0,0873 *** (0,0115)
labour	0,0599 * (0,0312)	0,0513 (0,2071)	0,0589 * (0,0335)	0,0646 ** (0,0281)	0,0663 (0,0406)	0,0488 (0,0394)	0,0956 ** (0,0479)	0,1021 * (0,0569)
fertility	−0,5187 *** (0,1186)	−0,4914 *** (0,1395)	−0,4795 ** (0,1903)	−0,5731 *** (0,1261)	−0,5105 *** (0,1251)	−0,3483 (0,2536)	−0,1486 (0,2846)	−0,1097 (0,4003)
p.enrl.gpi	−2,9605 (2,6327)	−2,1117 (3,2071)	−3,045 (2,6491)	−3,3302 (2,4689)	−2,9772 (2,6272)	−8,0502 (5,7062)	−2,1194 (2,6172)	−2,1249 (2,9752)
p.comp.gpi	−3,2126 ** (1,2605)	−3,4794 ** (1,4906)	−3,1175 ** (1,336)	−3,1126 *** (1,1342)	−3,1196 ** (1,2632)	2,5276 (2,8605)	−2,8905 * (1,5114)	−2,8915 * (1,695)
p.enrl	0,0197 * (0,0101)	0,0165 (0,0106)	0,0204 ** (0,0103)	0,0229 *** (0,0087)	0,0197 ** (0,0099)	0,0331 *** (0,007)	0,0154 * (0,0083)	0,0189 ** (0,0888)
p.comp	0,0208 *** (0,0066)	0,0188 ** (0,0075)	0,0196 *** (0,0056)	0,0202 *** (0,0074)	0,0207 *** (0,0064)	−0,0195 ** (0,0078)	0,0159 *** (0,0056)	0,0128 ** (0,0054)
EAP	_	1,4249 *** (0,2072)	_	_	_	_	_	0,6888 (0,7774)
ECA	_	_	0,6365 (1,1791)	_	_	_	_	0,735 (0,8615)
LAC	_	_	_	−1,3433 *** (0,4302)	_	_	_	−1,5626 ** (0,6354)
MENA	_	_	_	_	0,3465 (0,6545)	_	_	_
SA	_	_	_	_	_	0,5005 (0,7485)	_	0,6432 (0,4954)
SSA	_	_	_	_	_	_	−1,7835 * (0,939)	−1,7212 (1,2748)
N	447	447	447	447	447	447	447	447
R-sq	0,2971	0,2966	0,3018	0,3144	0,2998	0,2909	0,2889	0,3094
NOTE: *, ** and *** denotes stationarity at 10%, 5% and 1% significance levels respectively								

Table 3b

Dependent variable	**(1) No regional dummy**	**(2) EAP**	**(3) ECA**	**(4) LAC**	**(5) MENA**	**(6) SA**	**(7) SSA**	**(8) All regional dummies**
g								
Independent variables	**Coefficient (|z|)**							
initial.gdp	0,0003	0,0003	0,0002	0,0009	0,0004	−0,0005	0,0003	0,001
	(0,0008)	(0,0008)	(0,0009)	(0,0007)	(0,0007)	(0,0007)	(0,0008)	(0,001)
pop.g	3,6925 ***	3,6643 ***	3,6555 ***	3,7724 ***	3,7945 ***	3,6447 ***	3,6715 ***	3,7714 ***
	(1,2133)	(1,2883)	(1,3086)	(1,2057)	(1,2337)	(1,1872)	(1,1995)	(1,3466)
gross.cap	0,0281	0,0291	0,0273	0,0196	0,0271	0,0253	0,0263	0,0169
	(0,0192)	(0,0194)	(0,0173)	(0,0217)	(0,019)	(0,0185)	(0,0208)	(0,0199)
labour	0,1903 ***	−0,1798 ***	0,191 ***	0,1972 ***	0,2068 ***	0,212 ***	0,1826 ***	0,2231 ***
	(0,0398)	(0,0494)	(0,0348)	(0,0366)	(0,0449)	(0,0388)	(0,0482)	(0,0521)
fertility	−2,1475 ***	−2,0798 ***	−2,1788 ***	−2,1501 ***	−2,2211 ***	−2,0253 ***	−2,2813 ***	−2,0783 ***
	(0,5737)	(0,6433)	(0,4876)	(0,617)	(0,5831)	(0,5925)	(0,6713)	(0,5264)
p.enrl.gpi	−6,1181	−4,0729	−6,012	−9,9951	−6,149	−7,5837	−7,7596	−10,309
	(5,7516)	(8,1571)	(5,8693)	(7,3001)	(5,7384)	(4,4981)	(7,4804)	(7,2373)
p.comp.gpi	1,7078	1,6409	2,0079	3,0435	3,0621	1,4486	1,9818	3,6854
	(5,3259)	(5,2936)	(4,8555)	(4,8502)	(5,1855)	(5,256)	(5,6356)	(4,3647)
s.enrl.gpi	3,2717 ***	3,0815 ***	3,1185 **	3,1072 ***	3,0122 ***	3,5348 ***	3,1817 ***	3,0565 **
	(0,9813)	(1,151)	(1,3358)	(0,8621)	(0,9278)	(0,917)	(0,9953)	(1,2174)
p.enrl	−0,017	−0,0198	−0,0159	0,0002	−0,0224	−0,0082	−0,0125	0,0032
	(0,0155)	(0,015)	(0,0197)	(0,0095)	(0,0169)	(0,0195)	(0,0142)	(0,017)
p.comp	−0,0301 *	−0,0329 *	−0,0333 (0,025)	−0,0283 *	−0,0345 **	−0,0323 *	−0,0276 (0,0192)	−0,0361 (0,0239)
	(0,0169)	(0,019)		(0,017)	(0,0151)	(0,0188)		
s.enrl	0,0565 ***	0,0606 ***	0,0621 **	0,0515 ***	0,0584 ***	0,0598 ***	0,056 ***	0,0611 **
	(0,0183)	(0,0218)	(0,0335)	(0,0181)	(0,018)	(0,0214)	(0,0184)	(0,0334)
EAP	_	0,6297 (0,5221)	_	_	_	_	_	−0,5795 (0,7273)
ECA	_	_	−0,5378 (1,4497)	_	_	_	_	−1,0921 (0,8306)
LAC	_	_	_	−2,0978 *** (0,7395)	_	_	_	−2,6868 ** (1,0692)
MENA	_	_	_	_	1,2949 ** (0,6947)	_	_	_
SA	_	_	_	_	_	1,0562 * (0,6034)	_	0,1676 (0,4637)
SSA	_	_	_	_	_	_	0,5902 (1,344)	−0,7832 (1,2033)
N	130	130	130	130	130	130	130	130
R-sq	0,5975	0,5872	0,5895	0,6426	0,6067	0,6036	0,6008	0,6424
NOTE: *, ** and *** denotes stationarity at 10%, 5% and 1% significance levels respectively								

The first results derived from the regressions on primary education are summarized in table 3a. Starting with column (1), significance is found for female labour force, fertility rate and all education variables except for gender equality in primary enrolment. Firstly, female participation in the labour force has a positive effect on growth. This goes in line with the expected outcome and is supported by previous research and theory, where higher female participation indicates increased levels of human capital and better gender equality on the labour market. Secondly, both primary enrolment and primary completion are proved to be positive for growth. This is in accordance with the literature, where enrolling and fulfilling primary school is of importance for countries' economic advancement. Moreover, the negative coefficient on the gender parity measure for completing primary school confirms the undesirable impact of gender inequality on growth. This goes in line with previous research and theory, where gender inequality is argued to be an obstacle for female empowerment and growth. Finally, fertility rate is found to be negative and significant. This is as expected since the negative impact of high fertility is generally accepted in the literature.

Moving on to the results for each region displayed in columns (2) to (7), female labour force is found significant for all regions but columns (2), (5) and (6). The regions with significant results has the same explanation as for column (1) as labour force is assumed to be positive for growth. The lack of significance for the other regions may depend on underperforming labour markets or on other factors not captured in this study. Continuing with primary enrolment and completion, all regions but column (2) have positive and significant results as in column (1). This indicates that primary education has positive effect on growth on both regional and global level. The gender equality measure further suggests inequality in primary completion rates for all regions but column (6). Lastly, the final human capital variable with significance is fertility rate, where columns (2) to (5) have negative and significant results. The interpretation of this result is that the fertility rates are not optimal in those regions, and therefore affect growth negatively.

The last column, column (8), in table 3a allows for analysing whether the regions are significantly different from MENA. What the column displays is that only LAC is different from MENA, and all other regions have similar effect of the variables on growth. The negative coefficient further explains that LAC face a lower growth rate than MENA.

Continuing with the regressions on both primary and secondary education in table 3b, column (1) has significant results for female labour force, fertility rate, gender equality in secondary enrolment, primary completion and secondary enrolment rates. Beginning with female labour force participation and fertility rate, the result and interpretation is the same as in column (1) in table 3a. Noteworthy is, when introducing secondary education variables in the regression model, the significance for gender equality in primary education disappears. Instead, significance is found for gender equality in enrolling secondary education. According to previous research, secondary education is the most

important level of education to obtain economic growth and equity in the society. Therefore, the significant result for this variable is supported by previous findings.

Finally, the last two significant variables in column (1) are primary completion and secondary enrolment. In contrast to table 3a, primary completion is now negative which may be caused by factors affecting the number of girls completing primary school. Secondary enrolment is however positive, indicating the importance of higher levels of education on growth.

Moving on to columns (2) to (7) in table 3b and the analysis for each region, different results appears compared to those in table 3a. Firstly, labour force participation is strictly significant and positive for all regions but column (2) where the effect of female labour is negative. The reason why the variable has a negative impact in the region could be explained by declining participation rates (see appendix, (16)) or on other nonobvious factors. Secondly, fertility rate is negative in column (1) and strictly significant for all regions.

Thirdly, in contrast to table 3a and the regional analysis, completing primary education is no longer significant for all regions when secondary education is included. Additionally, the coefficient is now negative as for column (1) in table 3b. Therefore, the same explanation can be applied on the regions as for the global level. Columns (2) to (7) further support the findings in previous research by strictly significant and positive results for secondary enrolment rates and the gender parity at this level of education.

Leaving the regional analysis for the final column, column (8), LAC is still the only region that is different from MENA. This means that the effects between the other regions remain similar when secondary education is included in the regressions.

6. Analysis and discussion

The aim with this study is to investigate whether there is a correlation between human capital accumulation and gender equality through female education and economic growth. Most previous literature on education and growth focus either on human capital or gender equality, or on single countries or regional cross country studies. Therefore, this analysis will further highlight the discussion by looking at a more global spectrum, and combine human capital and gender equality.

Beginning with the findings in table 3a, both column (1) and columns (3) to (7) have significant results for primary enrolment. Additionally, columns (1) to (7) have positive and significant results for completion rates. Thus, the result goes in line with previous research where primary education is proved to be an important component to achieve economic growth, independent of income level. This because girls' school enrolment is considered as the starting point for a more equal and sustainable society with better potential to generate human capital and economic growth. As primary enrolment is strictly positive for all regions but column (2), this indicates the importance of sending girls to school to support economic growth. The recognition of girls' schooling is further confirmed by the charts, where primary enrolment rates have risen fast the last couple of decades revealing itself in economic progress in many low-income countries (Hertz, Subbarao, Habibi & Raney, 1991).

Though, the fact that more girls enrol school is not enough to spur growth. Considering the negative and significant result for primary completion in table 3b, this suggests that there is more required than just higher enrolment rates to generate economic growth. The negative result for primary completion rates is unexpected, but has several potential explanations. Firstly, according to charts (8) to (14) in appendix over female primary completion, the percentage of girls finishing primary school has declined or stagnated during the last couple of years. This development can be a cause of increased dropout rates among girls, and consequently the economic- and social benefits of high enrolment rates are hampered. The reason why this negative development is occurrent could have its origins from cultural elements and the expected role of girls in the society. According to Dollar and Gatti (1999), cultural preferences on girls' role in the society have a strong impact on female education since it determines the degree of girls' education. If the societies preferences lean toward traditional views on women and inequality, girls are more likely to spend their time at home taking care of children and daily chores instead of attending school. (Dollar & Gatti,1999) Therefore, this is a possible explanation for the negative effect of primary completion in columns (1) to (7).

Secondly, high expenditures for education and low female wages makes it far less attractive to invest in girls' education than in boys' (Dzator, Licumba & Zhang, 2015). The potentially higher dropout rate for girls is reflected by the theory on private and social benefits and costs of education, which can explain the reason for why girls are taken out of school (see figure 1). According to theory, the nature of the decision on girls' schooling is an investment decision where costs and benefits are weighted against each

other. Thus, if there are no possibilities for girls to work or receive a decent wage after completing school, female education is considered as a bad investment due to high opportunity costs. Also, the expected low returns on investment in female education can be caused by the overall economic development and political climate. All investment decisions are affected negatively if the economy is in recession or the political climate is unstable, and female education is not an exception. Bad circumstances will lower the expected payoff even more, and less girls will fulfil their schooling (Morrison, Raju & Sinha, 2007). Thus, the decrease in female completion rates can be explained by the expected payoff and the economic and political situation among the regions.

Thirdly, another reason for why primary completion is negative for growth can be derived from endogenous growth theory. The theory states that economic growth is dependent on the level of human capital and following previous empirical evidence, quality in education is important to raise its level (Hanushek, 2008). Therefore, if the educational quality is poor, education will be considered as just an expenditure with neither social nor private payoffs. Efforts to improve female primary completion become ineffectual since the level of human capital does not grow and the costs for education exceed the returns (see figure 2b). Hence, the skill and knowledge provided through education is not enough to boost the economy and no contribution to the human capital stock will occur. This assumption is further supported by the evaluation of the UN Millennium Goals which concludes that even though more children enrol school and the gender gap between boys and girls has narrowed significantly, the quality of education is still poor in many low-income countries (The Millennium Development Goals Report, 2015).

Lastly, Aghion and Howitt (1997) provides an alternative explanation for the regression results. The authors argue that countries with a lower initial human capital stock may have a harder time to reach a higher level of human capital since they are not able to produce more. This might be the cause when children of less wealthy parents are segregated from the children of parents with higher income and higher human capital. Therefore, marginalised societies may face situations where their children are taught by individuals with too low human capital, which is a notable barrier against the children's learning and possibilities of becoming competitive on the labour market. Furthermore, social exclusion can be expected to limit female education more than male since girls face double disadvantages. This because female education, in a segregated society, is hampered both by barriers caused by the social exclusion and by cultural barriers toward girls. Consequently, the potential human capital accumulation through high enrolment rates is wasted which results in little or no effect on growth. (Aghion & Howitt, 1997) As a result, countries and regions in this study marked by segregation suffers from lower completion rates and growth.

Continuing the analysis and turning focus to the gender equality measures, females and males are argued to have the same potential when it comes to contributing to economic growth (Morrison, Raju & Sinha, 2007). The reason why gender inequality limits growth is because it implies a hidden source of human capital. Some of the consequences of gender inequality in the society are less social- and political involvement by females and

lower labour market participation, affecting growth negatively. Many scholars, for example Dollar and Gatti (1999) and Hanushek (2008) have presented empirical evidence on the connection between female empowerment, gender equality and economic growth. They find that reductions in gender disparities are most essential for educational outcomes and female empowerment. Their findings are further supported by this study, where significant results are found for the variables measuring gender equality.

Beginning with table 3a, equity in primary enrolment is never significant. This unexpected outcome can have its explanation in the UN Millennium Development Goal Report, which summarize and evaluates outcomes of the work to achieve the settled goals. These goals include gender equality and universal primary education, where both have been close to accomplished according to the report. (The Millennium Development Goals Report, 2015) For this reason, widespread primary education can also be assumed to apply for the countries in this study. The absent effect of gender equality in primary education is therefore reasonable, based on the knowledge of most children enrolling school independent of gender. Since primary education now is close to universal, focus has shifted towards secondary education and its effect on growth.

Moving on to the second measure on gender parity in table 3a, the negative result suggests inequality between genders. According to previous research, gender inequality is negative for growth which is also confirmed by this result. The reason why inequality in completing primary education affects growth negatively can be connected to its role for secondary education and female empowerment. If there are disparities between genders in primary education, the situation will later spill over to higher levels of education. With primary education close to universal, secondary education and above are argued to be more important for female empowerment and economic growth. Therefore, if inequality is present in primary education, higher levels of education will be affected as gender disparities follows up through the grades and thereby pose an obstacle for growth.

With the results on primary education cleared, focus now turns to secondary education. According to the results in table 3b, enrolling secondary education and the gender parity is proved to be strictly positive for growth on this level of education (see figure 2a & 2b). Following Oztunc, Oo and Serin (2015), the initial level of human capital and a country's level of development are the determinants for how education affects growth. Therefore, in line with previous research the result is not unexpected since this analysis includes a majority of lower middle countries. Assuming these countries to have higher levels of human capital and income, more education is needed to have effect on growth. Along with higher education and per capita income comes gender equality. (Morrison, Raju & Sinha, 2007; Oztunc, Oo & Serin, 2015) Thus, the positive result on gender parity in secondary education is not surprising. Secondary education is the level where gender disparities are largest, but is also the level that is most important for growth. Gender equality is of importance for growth because of its connection to female empowerment. Without education, girls cannot get access to labour markets, land ownership or other factors important for economic growth (Tembon, 2008).

Returning to the negative coefficient on female primary completion rate in table 3b, there is an additional explanation for the result related to secondary education. If girls do not complete their primary education, enrolment rates for secondary educations will remain low. Enrolment rates in secondary education could also be lowered even more by the fact that girls do not continue their education after primary schooling. This because barriers, such as social structures and culture stand in their way. (Dzator, Licumba & Zhang, 2015)

However, the girls who enrol higher education are boosting economic growth by raising the level of human capital and giving girls an opportunity of empowerment. Girls are a human capital reservoir and their education and improved skill is what is necessary for growth (Hanushek, 2008). Thus, investments in girls shall not be neglected as gender equality and female education are interconnected and further constitute a part of the foundation for a well-functioning society.

Continuing with what is necessary for a well-functioning society, female labour force and fertility rate should be considered. Beginning the analysis of female labour force in table 3a, columns (1), (3), (4) and (7) have significant results for female labour force participation. This result confirms the expectations as previous literature argues strongly for the importance of female labour. Females are still an unutilised source of labour that potentially could increase productivity if they were able to enter the working force. Therefore, the absent effect in the columns for columns (2), (5) and (6) might be because of more prone barriers to paid work, such as wage discrimination and cultural factors, stopping girls from entering the labour market (Morrison, Raju & Sinha, 2007). Chart (16) in appendix could further provide an additional explanation for column (2) where the chart indicates a declining development of females participating in the labour force throughout the time period. This explanation cannot be applied on columns (5) and (6) since those regions have a positive development instead.

One can thus assume that all the barriers which may hinder girls in columns (2), (5) and (6), works in favour for girls in the other regions. Consequently, it is of importance for the regions without significance to lower their barriers. One possible solution is to invest in girls' schooling since education helps girls to enter the labour market and gain influence. The size of the investment depends on the initial level of human capital as it is correlated with the level of education. With low levels of human capitals, a lower level of education is sufficient to have effect and thus involves smaller investments. Conversely, with higher human capital, more education and larger investments are required. Nonetheless, investments are of interest for all countries since higher education often results in greater labour participation and higher returns. (Oztunc, Oo & Serin, 2015)

Notably, the effect of the female labour force is always present when the regressions include secondary education (see table 3b). Hence, with four significant result from table 3a and for columns (1) to (7) in table 3b, the macro links between female labour force and economic growth is strong when both gender equality and enrolment- and completion rates are considered. It confirms the strong significance found in previous research looking at either or, and further indicates that gender equality and human capital

accumulation should be combined to get a complete picture of their unified effect on growth (Oztunc, Oo & Serin, 2015; Hanushek, 2008).

A potential explanation for why there is more significance for female labour force when secondary education is included, is the selection of countries in this study. The findings of Dollar and Gatti (1999) and Morrison, Raju and Sinha (2007), explains separately how gender equality and human capital accumulation through education is of importance for female labour force participation. Education facilitates a more equal society, where girls have better opportunities to work, earn money and contribute to economic growth. Furthermore, education provides girls with the level of human capital needed on the labour market to raise productivity and growth. Though, for more developed countries the effect of girls schooling is found visible first at secondary or higher level of education (Dollar & Gatti, 1999; Morrison, Raju & Sinha, 2007). This since developed societies in general, have more advanced human capital, and higher levels of education must be added to have effect. Therefore, due to the majority of lower middle income countries, the findings by Dollar and Gatti and Morrison, Raju and Sinha can explain why there is less significance for female labour force in table 3a. Consequently, higher level of education seems to be required for female labour to influence growth.

In contrast to female labour force, fertility rate appears strictly negative and significant for columns (1) to (5) in table 3a, and for columns (1) to (7) in table 3b. Following established empirical results, high fertility rates are negative for economic growth as it is correlated with poverty, low rates of female education and labour participation (Dzator, Licumba & Zhang, 2015). The charts (22) to (28) in appendix further reveals declining fertility rates, which is consistent with the increase in female education. Fertility rates tend to drop when income per capita increases. Also, fertility rates decline with improved birth control and better health care, following higher levels of education and contributes to economic growth. However, it should also be noted that declining birth rates is not always positive. When too few children are born to a woman, a country's economy will face the challenge of a lower percentage of people in the working force and an aging population (Smith & Todaro 2014). Consequently, the negative and significant results for fertility can depend on either too high or too low birth rates.

Moreover, from the charts one may argue that women in most of the regions still have too many children (see appendix). This strain the educational system, decrease the quality of education and lowers the average level of education as parents can invest less in each child's schooling (Smith & Todaro, 2014). As known from theory, education is an investment decision where the direct costs and expected returns are weighted against each other. Even though the expected returns on education are high, less investment in education will be the outcome if the direct costs of investing in education are crushing (see figure 1). Additionally, girls are more often denied an education than boys due to cultural factors and dependence on their work at home (Hertz, Subbarao, Habibi & Raney, 1991). Therefore, female enrolment and completion rates are not as high as they should be in all the regions included in this study, which has implications for their

economic development. Thus, high fertility rates are an obstacle for gender equality and female education and thereby hamper economic growth.

To summarize, the discussion of the empirical findings suggests a clear connection between gender equality and human capital accumulation through female education and economic growth. Moreover, the interconnection between gender equality and human capital accumulation through female education becomes even clearer when one looks at the tables in their entirety. Columns (1) to (8) illustrates similar or identical significant results, and thus one can confirm that the effect of education on a global level follows the effect of education in the regions. Additionally, the effect of combining gender equality and female education is equally true for all regions and therefore spills over to a global level.

7. Conclusion

This final section aims to summarize the main findings and answer the research questions formulated for this study. The aim was to combine gender equality and human capital accumulation through female education as these views were believed to be interconnected. To fulfil this aim, a panel data random effects model was used with year data from low and lower middle income countries within six regions. The results from the regressions were then analysed based on endogenous growth theory, the theoretical framework for costs and benefits of investments in education and previous research.

The regression results on primary education have as expected a positive effect on economic growth. However, the presence of secondary education diminishes the effect of primary education, suggesting the greater importance of higher education for growth in low- and lower middle income countries. Moreover, the absent effect of gender parity in primary enrolment can be derived from the UN Millennium Goals, where the objective to improve enrolment rates for both sexes was close to be achieved. The findings for female labour force participation and fertility rate further suggests positive respectively negative effects on growth. These findings are supported by previous literature and indicate the importance of gender equality and increased female human capital in the society.

To answer the first research question, one can conclude from the empirical findings that both gender equality and human capital accumulation through female education have a positive effect on growth. Therefore, the intention to contribute to previous research was achieved as the study suggests the two approaches to be interconnected. The findings further indicate both primary and secondary education to be of importance as both levels of education get significant results. However, the results suggest a switch in focus from primary to secondary education. With positive and significant results for both enrolment rates and gender parity in secondary education, the transition toward higher levels of education and the interconnection between gender equality and human capital through female education is strengthened.

The second research question, whether there is a unified effect of female education across and between regions, is affirmed. Similarities are disclosed by the comparable or identical results for the human capital variables for all columns in the tables. This proves the worldwide importance of sending girls to school and to strive for gender equality in education. From column (8), this conclusion is further strengthened as all regions but LAC are insignificant in relation to MENA. This means that the regions with insignificant result are affected similar by female education.

To conclude, this study has gained further knowledge and shed new light on the area of female education. The study's findings successfully filled a gap in the literature, but leaves more to investigate on the topic as solutions and policy implications for improved female education are not emphasized. Future research could therefore focus on how to further increase female education by investigate solutions such as reduced opportunity

costs, scholarships to encourage girls schooling and changed attitudes toward females. This since further research on gender equality and female education is required for girls' sustained potential to boost economic growth.

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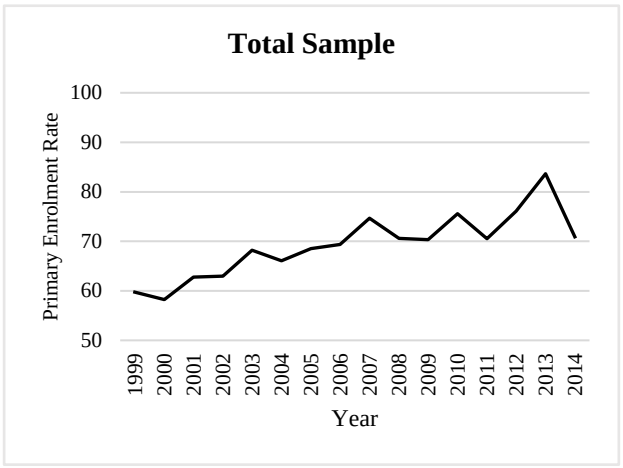
Appendix

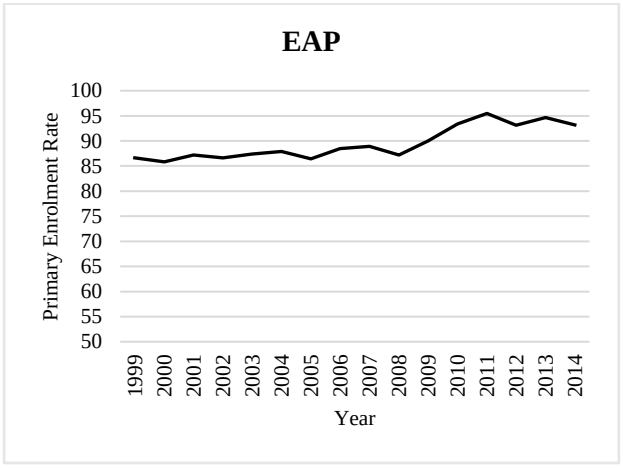
The following linear charts are constructed in Excel with the collected data from the databases. The charts display the development for primary enrolment, primary completion, female labour force and fertility rate over the time period, for all regions together and for each region separately.

Primary Enrolment Rate

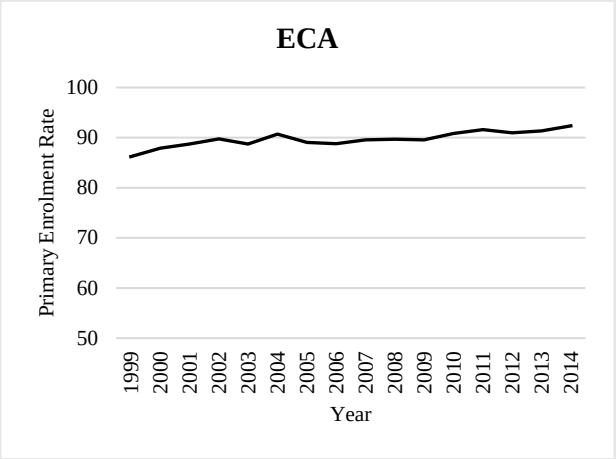
(1)



(2)



(3)


ECA
Primary Enrolment Rate
100
90
80
70
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2013
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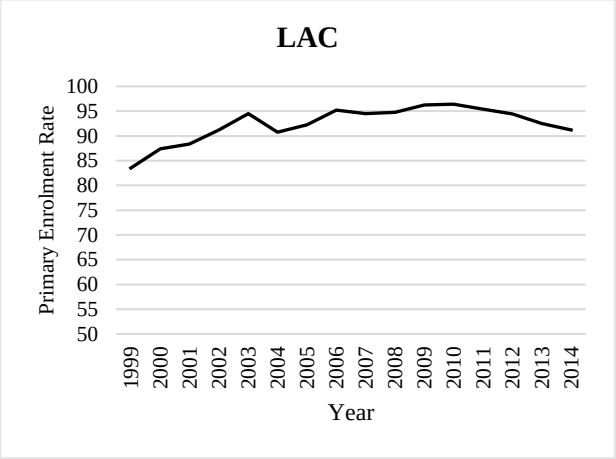
Year

(4)


LAC
Primary Enrolment Rate
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95
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75
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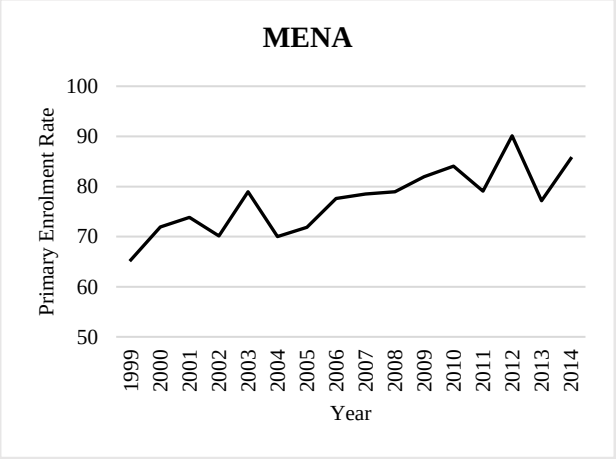
(5)


MENA
Primary Enrolment Rate
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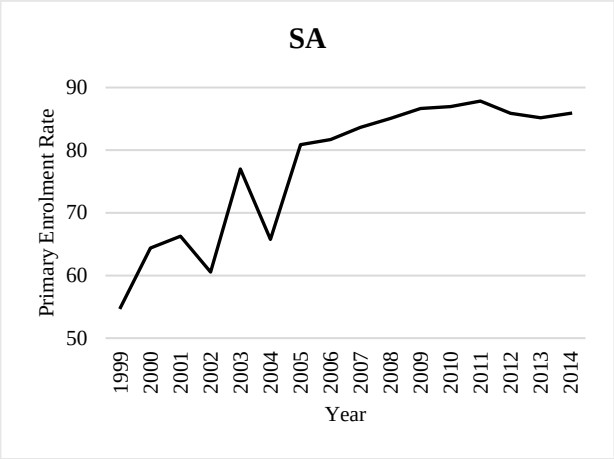
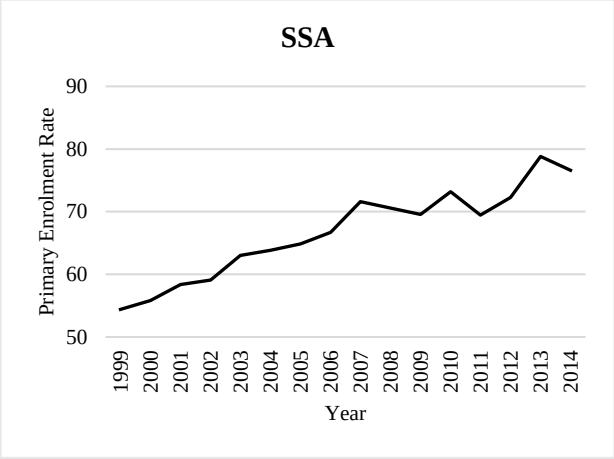
(6)

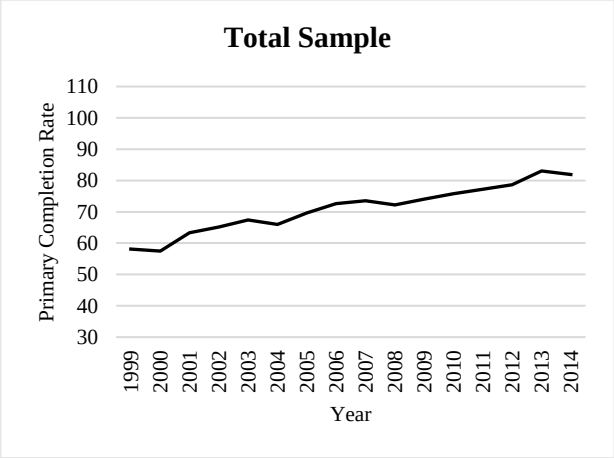


(7)

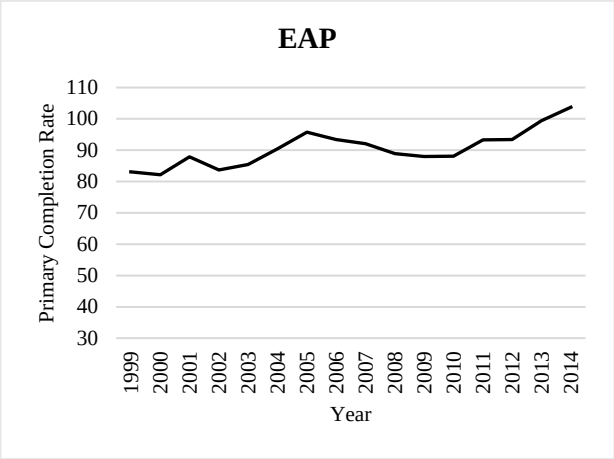


Primary Completion Rate

(8)



(9)


EAP
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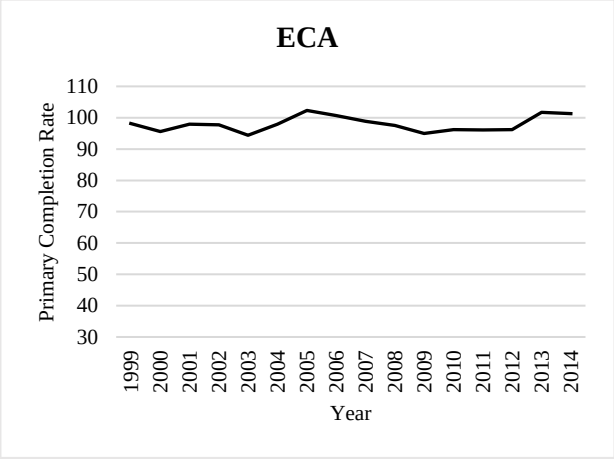
Year

(10)


ECA
Primary Completion Rate
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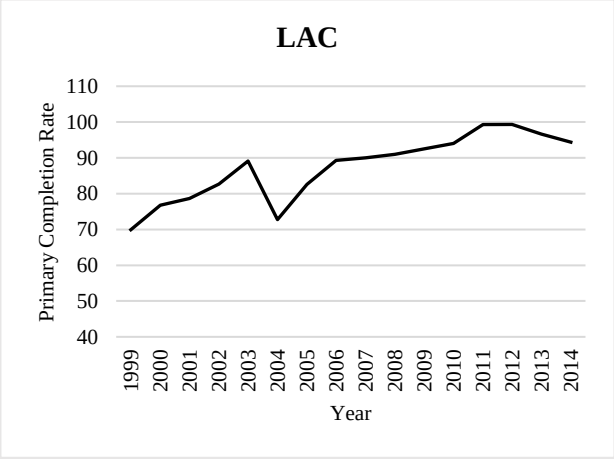
(11)


LAC
Primary Completion Rate
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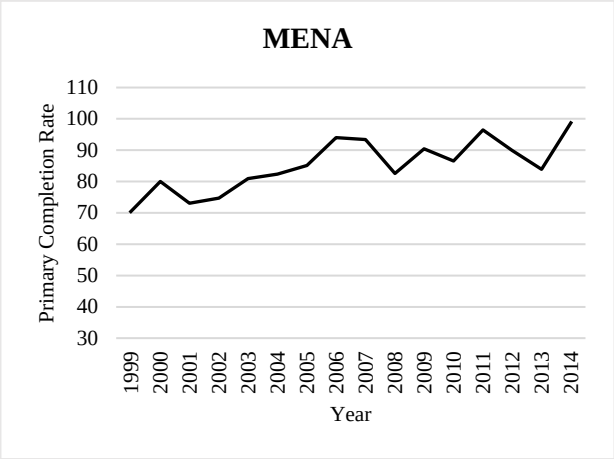
MENA
Primary Completion Rate
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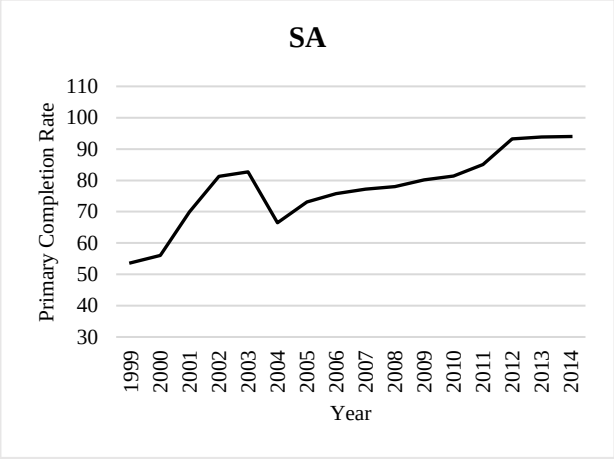
(13)


SA
Primary Completion Rate
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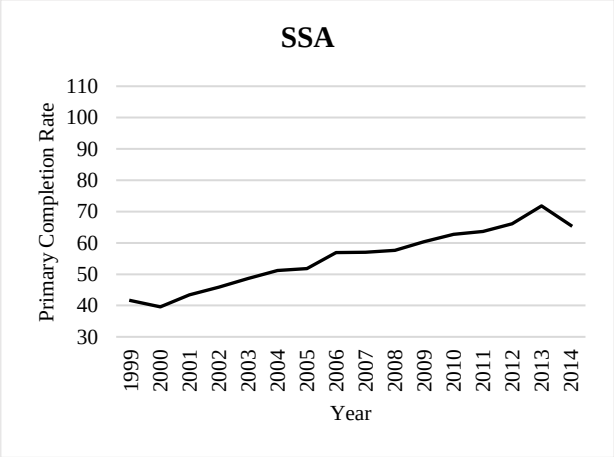
Year

(14)


SSA
Primary Completion Rate
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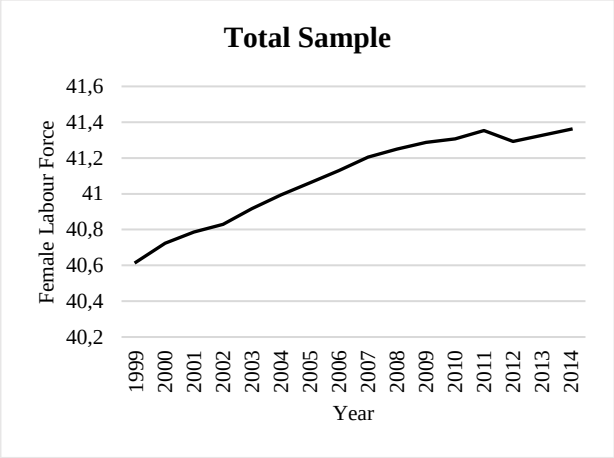
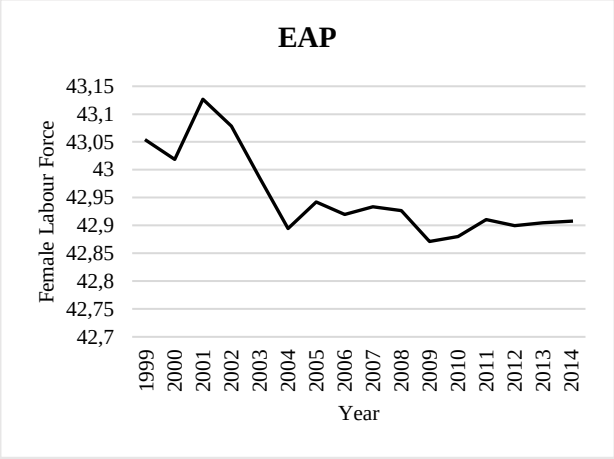
2014
Year

Female Labour Force

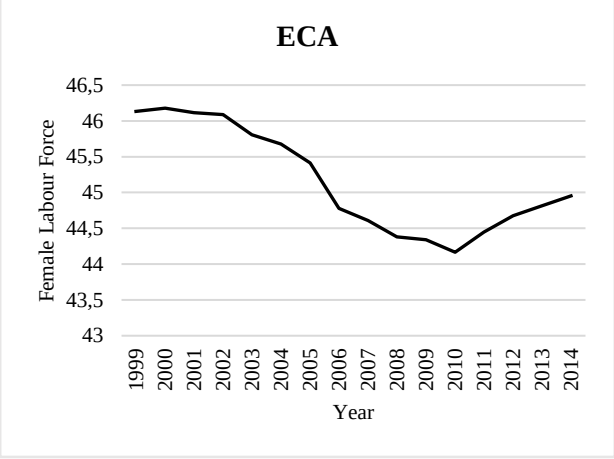
(15)



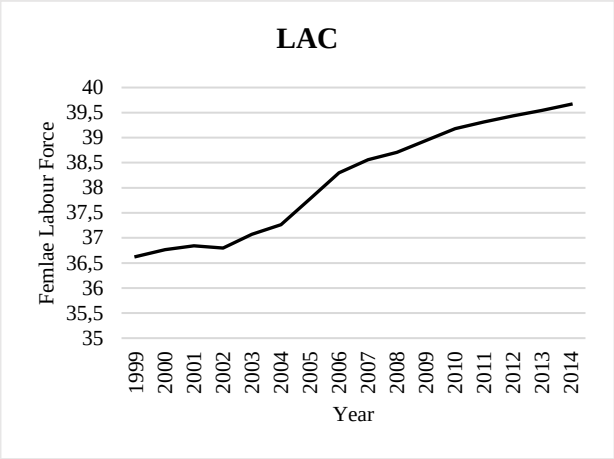
(16)



(17)



(18)


LAC
Femlae Labour Force
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39,5
39
38,5
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37,5
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36,5
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35,5
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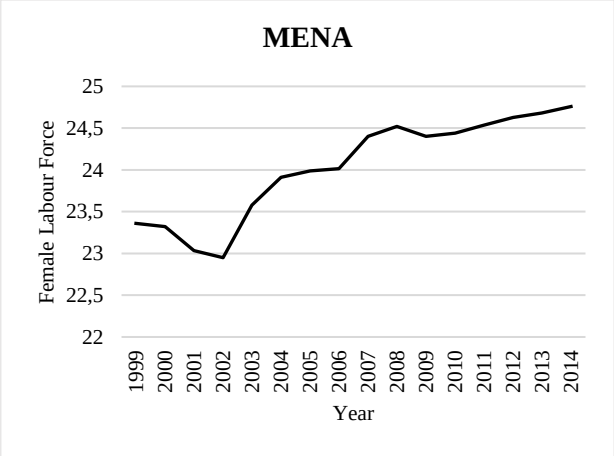
Year

(19)


MENA
Female Labour Force
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24,5
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23,5
23
22,5
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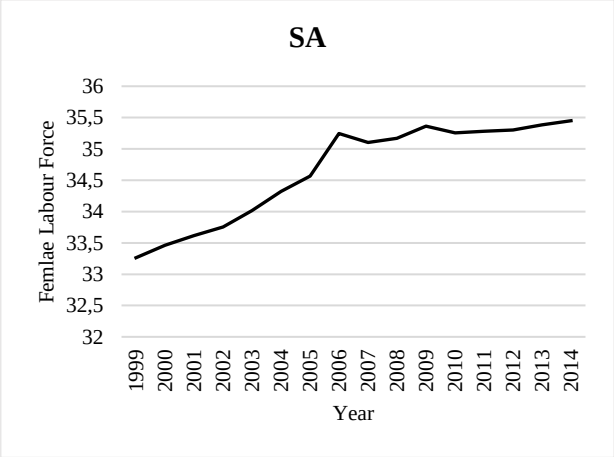
Year

(20)


SA
Femlae Labour Force
36
35,5
35
34,5
34
33,5
33
32,5
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1999
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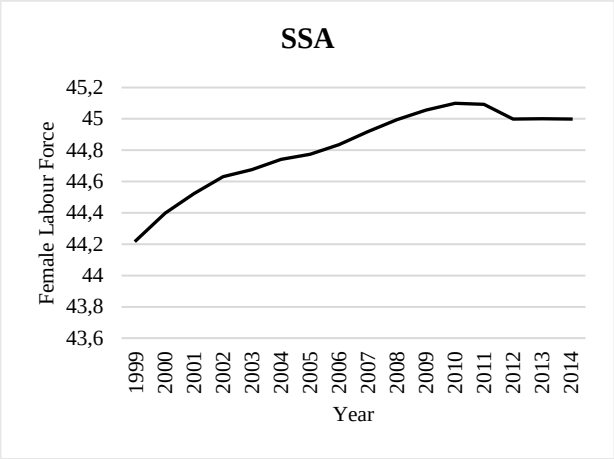
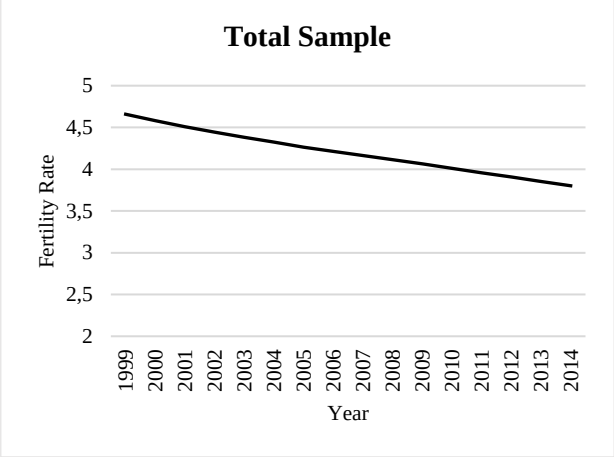
2014
Year

(21)

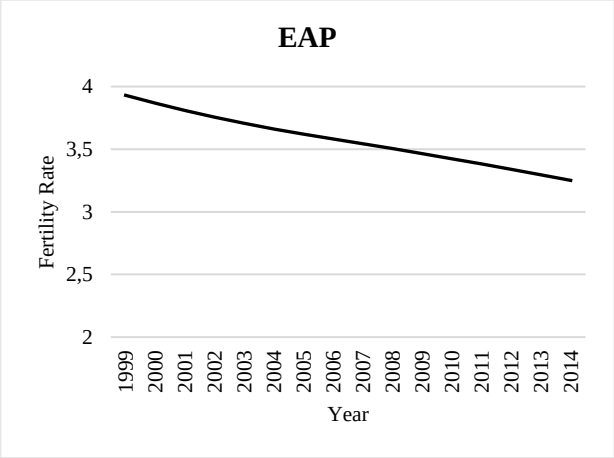


Fertility Rate

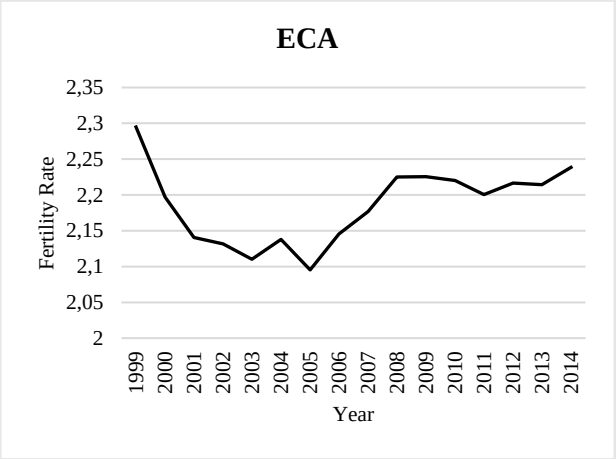
(22)



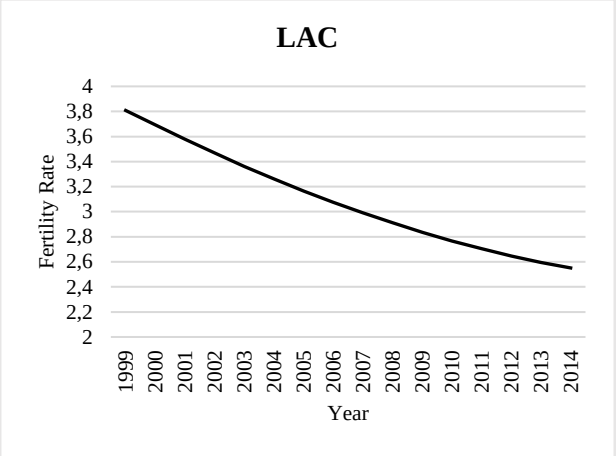
(23)



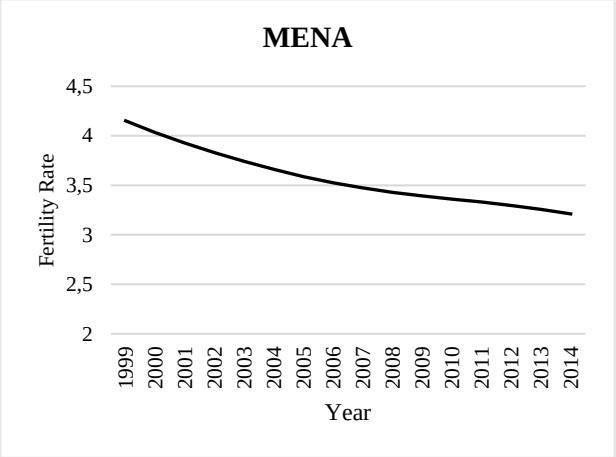
(24)


ECA
Fertility Rate
2,35
2,3
2,25
2,2
2,15
2,1
2,05
2
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Year

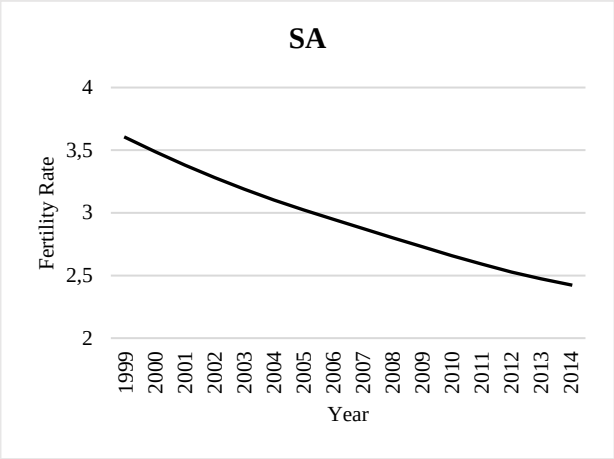
(25)


LAC
Fertility Rate
4
3,8
3,6
3,4
3,2
3
2,8
2,6
2,4
2,2
2
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Year

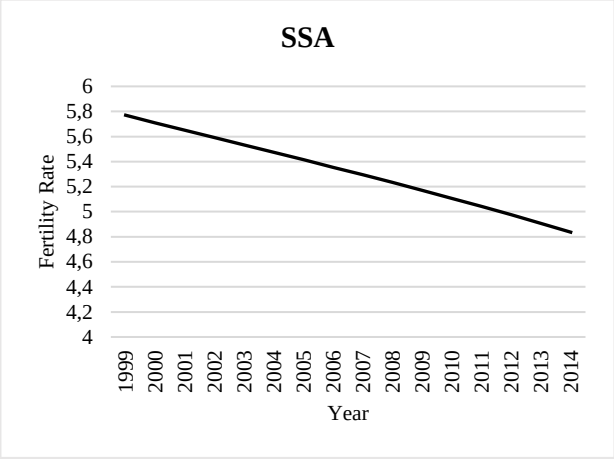
(26)


MENA
Fertility Rate
4,5
4
3,5
3
2,5
2
1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Year

(27)


SA
Fertility Rate
4
3,5
3
2,5
2
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year

(28)


SSA
Fertility Rate
6
5,8
5,6
5,4
5,2
5
4,8
4,6
4,4
4,2
4
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year