JÖNKÖPING INTERNATIONAL
BUSINESS SCHOOL
JÖNKÖPING UNIVERSITY

The Effect of Increased Gender Equality on Economic Growth in Developing Countries

Master's thesis within Economics

Author: Anette Andersson

Tutors: Johan Klaesson, Associate Professor

Hanna Larsson, Ph.D. Candidate

Jönköping June 2010

”Education is the most powerful weapon which you can use to change the world”

- *Nelson Mandela*

Master's Thesis in Economics

Title:	The Effect of Increased Gender Equality on Economic Growth in Developing Countries
Author:	Anette Andersson
Tutors:	Johan Klaesson, Hanna Larsson
Date:	2010-06-09
Subject terms:	Economic growth, Solow's augmented growth model, human capital, education, gender equality

Abstract

The purpose of this thesis is to investigate whether an increase in the level of human capital and reduction of gender inequality in the labor market affect developing nation's growth rate and welfare. The data used in this thesis cover 74 emerging and developing countries for the years of 2001 and 2007. Solow's augmented growth model has been used to estimate how increased rates of females and males completing primary school effects economic growth in order to see what effect the Millennium Development Goal's (MDG) target of universal primary education has on the economy. The rates of female and male participation rates in the labor force are also tested for to see if one can determine how reduced gender inequality affects economic growth. The main findings are that increased female and male completion rates in primary school do affect economic growth positively as expected. However, what was not expected was that an increased participation rate of female and male in the labor force affect economic growth negatively. The conclusion is that increased levels of primary education among males and females will increase economic growth. Hence the MDGs of achieving universal primary education and homogenous education between females and males in 2015 are important for economic growth and increase of welfare.

Dedication

I dedicate this thesis to those women, men, and children who has not yet learned how to write and read. I hope with all my heart that poverty will be exhausted and that economic disparities one day will come to an end.

Table of Contents

Figures

Tables

Appendices

1 Introduction

In the United Nation's Universal Declaration of Human Rights' education is stated as a human right and children of all ages are allowed to primary education. Further in Article 26 one can read that elementary education should be compulsory and free. Technical and professional education shall be available and higher education should be accessible equally to all on the basis of merits (UN, n.a. a). This is not the picture in the world today. Far from all children have the possibility to attend school. The literacy rate has improved in the world but still today in the twenty-first century 759 million people are illiterate, among these are two-thirds women (UNESCO, 2010).

Higher levels of primary education, especially among women, decrease the rates of child mortality, the spread of HIV/AIDS, and fights poverty. Since women most often do work that is not accounted for as participation in the labor force or in the output to increase GDP, the level of women in the labor force is one way to see how decreased levels of inequality in the labor market affects production output.

"On average, the poverty rate tends to fall by about one percent for every percent increase in per capita income." For the Millennium Development Goals to be met, the per capita income must rise by 50 percent in Africa to reduce poverty from 40 percent to 20 percent (Thirlwall, 2006, p. 12).

Human capital is important for economic development and increased welfare in nations is included in three of the United Nation's Millennium Development Goals (MDGs) as an instrument to break out of poverty and increase the standards of living. With less than five years left until the goals are to be reached there has been improvements but the goals are far away to be met in time.

1.1 Purpose

The purpose of this thesis is to investigate whether an increase in the level of human capital and reduction of gender inequality in the labor market affect developing nations growth rates and welfare.

This thesis will do so by estimating the rate of female and male completing primary school in order to see what effect the MDGs of universal primary education has on economic growth in emerging and developing economies. With increased levels of education among both females and males, given that the rates of females will increase to a larger extent in school enrollment than males since females are underrepresented in education today, the rates of females in the labor force will then also increase. What effect will this have on economic growth?

1.2 Disposition

The disposition of this thesis is as follows:

Section 2 provides the details of the MDGs and the progress made in educating the world and the improvements in the inequality between genders in labor enrolment. In section 3 the theory is put forward and the empirics are presented in section 4. The

empirical section begins with presenting the methodology and the data used in this thesis along with the limitations followed by the variables and their expected results. Thereafter the descriptive statistics is analyzed and discussed and the regression model is presented. In the end of section 4 the results from the regression outputs are analyzed with respect to the theoretical assumptions and the background research. The results made in this thesis are concluded in section 5 along with suggestions for further research within this field.

1.3 Literature Review

Several studies have been made within the field of growth accounting showing evidence of conditional convergence such that investments in human capital and openness to trade are associated with higher growth. Population growth on the other hand dampens economic growth and high government consumption, political instability, and ethnic diversity reduce economic growth and increase divergence. Being landlocked or having other unfavorable geographical features as being located in the tropics, having a small coastline, or having a large natural resource endowment can also appear to dampen growth (Klasen, 2002).

Solow (1956) developed a model from the neoclassical production function explaining how the level of technology is related to production output (this model is further explained in section 3 in this paper). Solow found that the steady-state level of income per capita depends on the savings rate and the population growth. The higher the rate of savings the richer is the country and the higher the rate of population growth, all else equal, the poorer is the country, due to increased respectively decreased level of per capita income.

Mankiw, Romer, and Weil (1992) expanded Solow's growth model and included human capital as an extra measure of capital in the production function to see the effects on output (this will also be explained further in section 3). Although if the countries do not vary in the levels of investment and population growth rate, there would be a strong tendency for poorer nations to grow faster than richer. If human capital is at equal levels as well, then the growth in the poorer countries is even greater and implies a faster rate of convergence between poor and rich nations (Mankiw et al., 1992).

Barro (1991) and Mankiw et al. (1992) show that various measures of education add significantly to the explanation of growth offered by saving rates alone. The effects of education on growth are of greatest importance for proposition that knowledge and its production are part of the growth process (Deaton, 1999).

Dollar and Gatti (1999) found in their study that countries with low levels of female education did not gain much from increasing it, although in countries having high levels of female education a significant increase boosts economic growth.

After doing a cross-country regression study on developing regions to see what effect gender inequality in education has on economic growth Klasen (2002) found that South Asia, the Middle East, and Africa are held back in economic growth. The results show that gender biases in education reduces the economical progress and that increased

equality increases economical growth and in particular female education which has a strong and significant positive effect on growth in developing economies.

Trying to break the poverty trap by increasing the level of equality between women and men in cases where families are very poor may however increase the level of poverty. Depending on what position in the labor force women are enrolled in, poverty may increase instead of decrease, even if income often is positively related to lower levels of poverty among women (Jackson, 1996).

Studies have shown that low female participation in the labor force affects the economy negatively to a high economic cost. The World Bank made a study in 2005 showing that annual GDP growth in Northern Africa and the Middle East in 1990 would have been nearly 1 percentage point higher if women had participated more actively in the labor force (Lehmijoki & Palokangas, 2006).

2 Background

Industrialization is the source of sustained economic growth in both developed and developing economies. The level of industrialization increased significantly over the years 1860-1913 as well as over the rest of the 20th century. The acceleration in industrialization increased demand for human capital and investments in education increased to stimulate further technological advancement. A significant increase in schooling took place in the 19th century and public education lowered the cost of education and generated a significant increase in supply of educated workers which promoted economic growth. Accumulation of human capital may be the engine of economic growth in the early stages of development for the least developed countries (LDCs) due to the importance of capital and skilled-based technologies (Galor, 2006).

The change in production patterns after the industrialization era created divergence among countries and is the source for why there are developed and less developed nations today. Countries still depending on production in primary commodities are generally poorer than countries producing manufactured commodities (Williamson, 2008).

Economic growth is said to depend on technical progress, growth rates, and improved health which are coming out of greater incentives to work when the population grows. Increased levels of savings and investments, both public and private, leads to better quality in education and improved school attendance. Due to improved health and nutrition the quality of education is increasing. When the level of education is increasing the long-run improvement of technological knowledge is improving (Todaro & Smith, 2006). Empirical studies prove that increased levels of technology and human capital do affect economic growth positively. Robert Solow developed a growth model that further will be discussed in the theoretical section 3.

2.1 The Millennium Development Goals

Article 26 in the Universal Declaration of Human Rights refers to education. It states that: “Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit” (UN, n.a. a).

The MDGs and the Targets addresses an aspect of poverty with the major goal to reduce poverty to half of what it was in 2000 when the Goals where implemented by the UN by 2015 (Thirlwall, 2006). Since education is a fundamental human right, these goals must be achieved and the sooner the better.

In 2005 the rate of people living in extreme poverty regions where accounted for slightly more than a quarter compared to almost half in 1990. Enrolment in primary education in the developing world reached 88 percent in 2007, up from 83 percent in 2000. The most progress was made in those regions lagging the furthest behind. In sub-Saharan Africa and Southern Asia, primary school enrolment increased by 15 percentage points and 11 percentage points, respectively, from 2000 to 2007 (UN, 2009).

The Goals dealing with education as a target for growth and development are as follows[1]:

Goal 2: Achieve universal primary education.
Target 3: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.

Goal 3: Promote gender equality and empower women.
Target 4: Eliminate gender disparity in primary and secondary education, preferably by 2005 and in all levels of education no later than 2015.

This thesis is focusing Goal 2 and Goal 3 in order to see if education and an increased level of human capital and equality can affect economic growth positively. In addition the ratio of increased gender equality in the labor market is discussed to see the effect on economic growth and if higher equality can help boosting out of poverty.

2.2 Human Capital and the Millennium Development Goals

The definition of human capital is; health, nutrition, and skills for each person to be economically productive. Further is knowledge capital; the scientific and technological know-how that raises productivity in business output and the promotion of physical and natural capital (Sachs, 2005). To increase economic growth in developing countries both human capital and knowledge capital is needed in addition to physical capital. By increased levels of investments in human capital one can build a foundation for economic progress and growth.

Investments in human capital are investments made in order to improve health, education, and skills of the labor force, which altogether enhance the technological progress which leads to reduced poverty and economical growth (Thirlwall, 2006). With the same capital, human capital, and technology developing countries are growing faster. Investment in female education raises national income and higher income leads to increased gender equality, both in education and in other areas (Dollar & Gatti, 1999).

Poor health, illiteracy, un-receptiveness to new knowledge, fear of change, a lack of incentive, and immobility all affect development negatively and are obstacles for productivity. By increasing the investments in human capital the level of productivity will automatically increase. The relation between education and growth is crucial for the development process, and there are three main ways in which education can improve growth performances:

1. Education improves the quality of labor, and also the quality of physical capital though the application of knowledge.
2. Education has spillover effects, externalities, on other sections of society which offset diminishing returns to capital.
3. Education is one of the most important inputs into R&D and for attracting FDI (Thirlwall, 2006).

[1] For information on all the Millennium Development Goals visit, http://www.un.org/millenniumgoals/

2.2.1 The Progress of Increased Levels of Literacy

When educating adults and children, the language used is important. Using a common language enables the students to practice outside school hours as well. At some teaching centers the education is held in English, this does not provide possibilities given to practice after school if English is not the main language spoken. The languages of teaching are especially difficult in countries in where various different languages are spoken and where numerous local dialects or tribe languages are used (Trudell, 2009).

Local-language literacy programs have, at least in Africa, been shown beneficial for development. These programs have reached population in the rural areas, the poor, women, and those who struggle to succeed within the formal education system that otherwise would not have enrolled. Whether the education is carried out in formal or informal contexts, local-language literacy facilitates are making progress in decreasing the illiteracy rates since they are included in various locally sited development efforts and hence the reduction of illiteracy is sustainable (Trudell, 2009).

The UN Literacy Decade 2002-2012 are working for increasing the number of literate people in the world, as for 2010 759 million people are illiterate in the world (UNESCO, 2010). The Education For All aims to decrease the rates of illiteracy by 50 percent by 2015 (UNESCO, n.a.).

2.2.2 School Enrolment vs. Child Labor

In some regions parents cannot afford child quality expenditure, i.e. to keep their children healthy and nourished, if not the children are contributing to the family income. If child labor was banned the family would suffer from lower income. The children need to work so that the family can have a reasonable standard of living. It is not always that simple to imply compulsory education, even if the welfare will increase in the long-run the family will face lower income in the short-run (Strulik, 2004).

Figure 2.1 below shows the extra benefits the individual and the society gain from enrolling children in school for additional years. The same pattern is also applicable for tertiary education as well as for children working instead of enrolling in primary education. There is always a direct cost of investments, but the invested money and time will bring higher returns in the future.

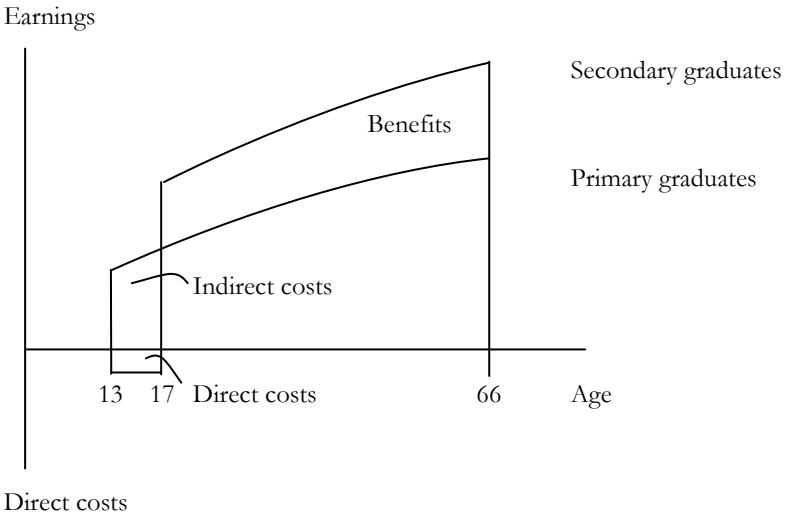

Figure 2.1 Financial trade-offs in the decision to continue in school.

Source: Author's own construction based on Todaro and Smith, 2006.

When children are enrolling extra years in school after primary school there is a direct cost of tuition fees, books, and other expenditures that the family/student/government would not have faced if the student started to work directly after graduating primary school. The indirect cost is the foregone income the student would have earned after graduation although it is clear that those extra years invested in enrolling higher level of education pays off to a larger extent in the long-run. With second-degree of education as human capital there is evidence that developing countries do catch up and less developed countries are growing faster (Todaro & Smith, 2006).

However in poor nations money is more worth today than in the future since money is scarce. For students enrolling in primary education in sub-Saharan Africa and Asia the private rate on return to investment is approximately 40 percent. In spite of this high return, not all families can afford to make this investment and dispense the extra income that a working child brings to the family in the meantime until the child graduates (Todaro & Smith, 2006).

Investments in education such as meals for all school children in primary school can improve the attendance at school, the quality of education, and the health of the children (Sachs, 2005). The World Food Programme (WFP) works with a special project to promote higher school enrolment by serving meals at school which increases the incentives for poor families to send their children to school and provide vital nourishment.

In the poorer parts of the world a school meal program can double primary school enrolment in one year and the most beneficiaries are the girls. The promise of at least one nutritious meal each day boosts the enrolment and promotes regular attendance and motivated parents to send their children to school instead of keeping them at home to work or help out with household chores or care for siblings (WFP, 2010).

The WFP's school meal programmes contribute to meet the MDGs by directly address the goals of reducing hunger by half and achieving full enrolment in primary education by 2015 (WFP, 2010).

2.2.3 Reasons for Inequality Between Women and Men

The reasons for inequality are many. Suffrage is one; the median year for women attaining the right to vote was in developed countries in 1926 while in poor countries 1962. There is econometric evidence suggesting that societies have to pay for gender inequality in terms of slower growth, and some countries are willing to pay for this inequality in order to maintain the preference for gender inequality due to religion or cultural traditions (Dollar & Gatti, 1999).

The distribution between scholarly women and men has always had a significant difference. Historically it has been a waste to distribute education resources on women. Today we know that in order to boost out of poverty it is the women that must get the resources distributed to them (Sachs, 2005).

Education of girls are in some cultures seen as a waste of investment since it is the boys who provides for the parents when they get older and the girls are married away to become part of other families (Schultz, 2002).

In some societies where the attitude towards girl's school enrolment is negative, girls also tend to perform less well in school compared to the boys in the same age. Girls are less likely to enroll in schools in settings where older siblings share child-care responsibilities since girls are more likely than boys to help with such responsibility and might even drop out of school for this reason. Gender bias between girls and boys can be greater in societies where parents, and sometimes even teachers, value education for girls less than for boys. In some cases even environmental conditions affects girls enrolment, such as lack of privacy in bathrooms or lack of personal security, especially when approaching adolescence (Merrick, 2001).

The end of poverty starts with increased levels of educated women causing population growth to slow down, due to decreased fertility rates, and thus affects the economical growth positively since it has capital deepening effects, i.e. increased levels of capital per person in the economy (Barro, 2001; Klasen, 2002; Sachs, 2005). More educated women will improve health, reduce fertility and family sizes, earn more money to the family and by that improve welfare and further improve health by higher quality in nutrition and health. In families where the mother is educated the incentive for the children to enroll in school increases (Schultz, 2002).

Increased levels of girls enrolling in school and increased levels of literacy among women allows women to join the labor force which consequently increases their earning power and the cost of women staying at home. Some studies indicate that a more equal allocation of male and female labor among industries would boost economic growth. The wage rate differentials between males and females favor females in some manufacturing industries yielding higher returns of investment in female education on economic growth (Klasen, 2002).

2.3 Human Capital and Technology

In order to break the poverty trap technology is needed, and to achieve a higher level of technology increased levels of human capital is required. As part of human capital are increased levels of education and wellbeing. If vocational training was provided in

hygiene, HIV/AIDS, and malaria control health and life quality can be improved and by educating in computer and mobile phone use along with other technical and enormously pressing topics adults can become more productive (Todaro & Smith, 2006).

The rate of technological progress determines the long-run rate of growth of income per person. Growth of income per worker is when GDP rises faster than the employment level, i.e. increasing returns to scale, and most often depends on higher productivity or lower fertility rates. The average income per worker rises due to higher output per worker when the level of technology increases efficiency in production. It is important to understand that increased levels of technology not only decrease the amount of labor needed for production but it also increase the output per worker. Hence technology is a powerful way to increase wages for low income workers in developing industries (Easterly, 2002).

Technology increases the production within a country, and a good example is Taiwan which went from being a poor low-skilled economy to becoming a high-skilled and advanced economy within just a few years. They did so by reallocating resources and by increasing the level of human capital through higher education which led to an increased level of technology.

Countries with higher levels of school enrolment and higher education are usually more technologically advanced; hence countries with higher educated people tend to attract more foreign direct investments. In a stagnant economy where there are no incentives to invest in future, i.e. education, the quality of education will be lower and the students incentives to study at higher level of education will decrease. If governments do not invest in machinery or education, skilled labor will migrate to countries where they can apply their knowledge to more advanced technologies and high-tech machines. So if a government has destroyed the incentives to grow by not investing in the future the incentives to make other investments that the high-skilled labor could have done is offset (Easterly, 2002). This is also known as the brain-drain effect and leads to lower technological improvements and hence slower economical growth.

2.4 Human Capital and International Trade

Trade helps countries achieve development by promoting the sectors in an economy where individual countries possess a comparative advantage. The comparative advantage for many developing countries is the unskilled labor which allows these countries to take advantage of economies of scale. However, competing in production where low-skilled labor is intensively required will not lead to convergence and economic growth in the long-run: both capital and technology are required and capital is needed for developing technology. Yet, the low-skilled production is a start in economies of scale production and will improve terms of trade which can be a stimulus to aggregate economic growth (Todaro & Smith, 2006).

In order to sustain economic growth poor countries must increase their exports to richer countries to earn foreign exchange so they can import capital intensive goods from richer countries. However, trade barriers in the richer countries may hinder growth of exports in poorer countries (Sachs, 2005).

Improvements in terms of trade and economic growth depend partly on these factors; capital and skilled labor. Additionally to this fact the developing countries are often discouraged in investments in capital and skills due to insecure property rights, political instability and misguided economic policies and this cause reduced economic efficiency in other ways such as technological improvements and human capital (Krugman & Obstfeld, 2006).

3 Theoretical Framework of Economic Growth

As presented in previous sections human capital and the level of technology affects the growth rate of a country. In this section the neoclassical growth model, Solow's growth constant, is put forward and derived.

3.1 The Neoclassical Growth Model

According to the neoclassical growth theory, growth of output depends of three factors: an increase in labor quantity and quality by population growth, education increase capital by savings and investments, and improvements in technology. Solow's neoclassical growth model exhibits diminishing returns to labor and capital separately and constant returns to both factors jointly (Todaro & Smith, 2006).

The neoclassical growth model stems from two papers written by Solow (1956) and Swan (1956) and are an extended version from the Harrod-Domar model of growth allowing substitution of capital and labor in the aggregate production function. Solow's neoclassical growth model must be labor-augmenting in the technical progress to have a steady state with constant growth rates, i.e. constant returns to scale (Bowen, Hollander, & Viaene, 1998).

The production function provides a link between inputs and outputs.

$$Y = Af(K, L), \tag{3.1}$$

where output, Y, depends on inputs of labor, L, capital, K, and the level of technology, A. The technology level, A, can also be defined as level of productivity since the higher level of A the more output is produced for any given level of inputs.

This model can be transformed into a Cobb-Douglas production function which is widely used in economics growth accounting (Dornbusch, Fischer, & Startz, 2004).

$$Y_t = {K_t}^{\alpha}(A_t L_t)^{1-\alpha} \qquad 0 < \alpha < 1, \tag{3.2}$$

in where α represents the share of capital income and $1 - \alpha$ represents the share of labor income (Islam, 1995). A multiplied by L is the effective labor in the economy. Labor and the level of technology are expected to grow exogenously at the rates *n* and *g* so that;

$$L_t = L(0)e^{nt} \tag{3.3}$$

$$A_t = A(0)e^{gt} \tag{3.4}$$

Assuming *s* to be the constant fraction of output being saved and invested and defining output and stock of capital per unit of effective labor, $k = K/AL$ and $y = Y/AL$ (Islam, 1995). Hence the output growth can be:

$$\dot{k_t} = sy_t - (n + \delta + g)k_t \quad (3.5)$$

$$\dot{k_t} = sk_t^{\alpha} - (n + \delta + g)k_t, \quad (3.6)$$

where δ is the constant rate of depreciation. With k at its steady-state value:

$$k^* = \left(\frac{s}{n+\delta+g}\right)^{\frac{1}{(1-\alpha)}} \quad (3.7)$$

By substituting Equation (3.7) into the production function and taking the natural logarithm one find this relation for a steady state per capita income:

$$ln\frac{Y_t}{L_t} = lnA(0) + gt + \frac{\alpha}{1-\alpha}\ln(s) - \frac{\alpha}{1-\alpha}\ln(n + \delta + g) \quad (3.8)$$

The growth rate of capital and labor are weighted by respective income share and since the weights adds up to one output will grow by 1 percent if both capital and labor grows by an extra 1 percent. The calculations above explain growth in total output, and since this thesis focuses on the increased level of welfare one needs to calculate for the growth in GDP/capita so that the growth in output is subtracted by the growth in population and capital too is subtracted by the growth in labor giving the capital to labor ratio (Dornbusch et al., 2004).

$$\frac{\Delta Y}{Y} = \left(\alpha \times \frac{\Delta K}{K}\right) + \left[(1 - \alpha) \times \frac{\Delta L}{L}\right] + \frac{\Delta A}{A} \quad (3.9)$$

$$\frac{\Delta Y}{Y} - \frac{\Delta L}{L} = \alpha\left[\frac{\Delta K}{K} - \frac{\Delta L}{L}\right] + \frac{\Delta A}{A} \quad (3.10)$$

Since $\frac{\Delta Y}{Y} - \frac{\Delta L}{L}$ is in per capita terms and so also $\alpha\left[\frac{\Delta K}{K} - \frac{\Delta L}{L}\right] + \frac{\Delta A}{A}$ one can write this as:

$$\frac{Y}{L} = AF\left(\frac{K}{L}, \frac{L}{L}\right) = AF(k, 1), \text{ so that} \quad (3.11)$$

$$y = f(k) = Ak^{\alpha} \quad (3.12)$$

When the savings associated with the capital to labor ratio equals the investments the steady state occurs as can be seen in Figure 3.1 at point k^* which generates the output y^* (Dornbusch et al., 2004).

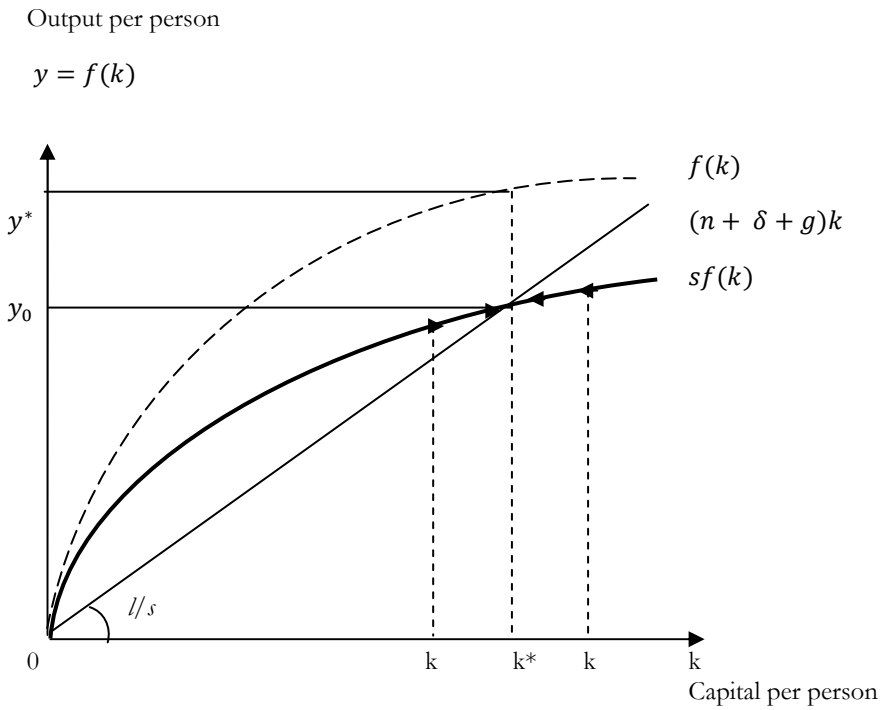

Figure 3.1 Equilibrium at the steady state capital-labor ratio and output per person.

Source: Author's own construction based on Thirlwall, 2006.

At the equilibrium savings equals investments and the capital to labor ratio is at a steady state. The steady-state values of per capita income and capital are denoted y^* respectively k^*.

$$\Delta k = sf(k) - (n + \delta + g)k, \tag{3.13}$$

since the net change in capital per capita is zero, $\Delta k = 0$, at a steady state of y^* and k^*,

$$sf(k^*) = (n + \delta + g)k^*, \tag{3.14}$$

which shows that the aggregate income is growing at the same rate as the population, that is at rate n, so that the steady state growth is not affected by the savings rate. Hence one of the key results of the neoclassical growth theory is showed (Dornbusch et.al, 2004).

3.2 The Augmented Solow Model Including Human Capital

Mankiw, Romer, and Weil claimed that not only capital and labor caused economic growth but also human capital which indirectly affects the level of technology in the economy. Hence the researchers derived the augmented Solow's growth model containing the variable for human capital, H, (Mankiw et al., 1992):

$$Y = Af(K, H, L) \tag{3.15}$$

By arranging this model into a Cobb-Douglas production function one gets:

$$Y_t = K_t^{\alpha} H_t^{\beta} (A_t L_t)^{1-\alpha-\beta} \qquad \alpha + \beta < 1, \tag{3.16}$$

were H_t is the stock of human capital and β is the share of human capital in output, $\alpha + \beta < 1$ shows an assumption of decreasing returns to scale for investments to output.

$$\dot{k_t} = s_k y_t - (n + \delta + g) k_t \tag{3.17}$$

$$\dot{h_t} = s_h y_t - (n + \delta + g) h_t, \tag{3.18}$$

where s_k is the fraction of income invested in physical capital and s_h is the fraction of capital invested in human capital. The economy's development is determined by Equations (3.17) and (3.18) in where $y = Y/AL$, $k = K/AL$, and $h = H/AL$ are quantities per effective unit of labor. If the economy is converged into a steady state then;

$$k^* = \left(\frac{s_k^{1-\beta} s_h^{\beta}}{n+\delta+g} \right)^{\frac{1}{(1-\alpha-\beta)}} \tag{3.19}$$

$$h^* = \left(\frac{s_k^{\alpha} s_h^{1-\alpha}}{n+\delta+g} \right)^{\frac{1}{(1-\alpha-\beta)}} \tag{3.20}$$

By substituting Equation (3.19) and (3.20) into the production function and then taking the natural logarithm, one find the following relation for a steady state in per capita income:

$$ln \frac{Y_t}{L_t} = lnA(0) + gt + \frac{\alpha}{1-\alpha-\beta} \ln(s_k) + \frac{\beta}{1-\alpha-\beta} \ln(s_h) - \frac{\alpha+\beta}{1-\alpha-\beta} \ln(\mathrm{n} + \mathrm{g} + \delta) \tag{3.21}$$

This variant of the production function is similar to Solow's Equation (3.8), although income per capita depends on population growth and accumulation of both physical and human capital at the steady state of income per capita (Mankiew et al., 1992).

4 Empirical Section

The data and the variables which are used in this thesis are discussed in the beginning of this section. Thereafter the regression model is presented along with the expected results and the analysis on the regression outputs.

4.1 The Data

The classifications of countries in the world made by the World Bank (WB), International Monetary Fund (IMF), and the United Nations (UN) served as templates when selecting countries for the data set. The World Bank and IMF do only classify countries that are members of the bodies while the UN classifies all countries in the world regardless of membership in the UN or not.

4.1.1 Method of Selecting the Countries

The data set of developing nations for this thesis originates from the countries classified by the IMF as emerging and developing economies. The countries, economies, and the small island states are further marked as follows; least developed country, LDC, low-income or lower-middle income (the non-marked countries belongs to the World Bank's higher middle income group of counties), land locked developing state, LLDS, small island developing state, SIDS, and as a member or non-member of the UN (IMF n.a.; UN, n.a. b; UN-OHRLLS, n.a. a; UN-OHRLLS, n.a. b; World Bank, 2010). Due to limitations in data for these countries not all countries remain from this selection as explained here. The countries investigated in this thesis along with the notifications can be found in Appendix 1, boldly marked.

4.1.2 The Data Set of Developing and Emerging Economies

A commonly used method for measuring welfare is the human development index, HDI, which depends upon life expectancy at birth, literacy rates, and standard of living. This thesis will not use the HDI to measure economic growth and welfare since the HDI includes a measurement of education which is one of the independent variables. The literacy rate is an indicator for education attainment and is calculated by combining adult literacy, with a two-third weight, and combined primary, secondary, and tertiary school enrolment ratios, by one-third weight (UNDP, 2009). Hence, using HDI as a measurement of welfare could result in correlation and therefore GDP is set to be the dependent variable as a measurement of both economic growth and welfare although GDP not is the best indicator of welfare due to inequality in earnings in economies.

As mentioned in the previous sections the economic growth rate is affected by several factors. In this thesis the relation between increased gender equality in education and labor and the effects on GDP is studied. Higher rates of school enrolment demand higher rates of investment in education, an increased cost for the government in the short-run but increases economic growth in the long-run.

This thesis tests for the level of completion of primary school enrolment for females and males however the rate of investments in education is not included. Increased ratios of females and males in the labor force will increase output and hence also economic growth. The data used in this thesis are collected from the World Bank's World Development Indicators (WDI) and from the Penn World Table.

4.1.3 Limitations in the Data

The data sets are restricted to the most common observations for the countries and years. The years having the most frequent reported data was 2001 and 2007 and those years generated the most country observations.

Overall it has been difficult to find data that is not stated in shares of GDP or of total population. The results from the regressions run on this data would have been more trustworthy if the data was given in actual numbers and not in shares. Unfortunately leveled data was restricted and the observations in these data sets for 2001 and 2007 had had to be reduced even more due to lack of data availability. To measure the change in GDP after the implementation of the MDGs in 2000 the year of 2007 is the latest year with good data availability, mainly due to limited educational data for later years. Therefore no years after 2007 were possible to test for.

The data is collected by different statistical institutions and organizations however collected in the World Bank's WDI data base. The variables on education are collected by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the variables on labor force by International Labor Organization (ILO). These organizations have collected the data in their turn from different statistical centers and hence the data can be measured in different ways or vary in credibility.

By looking at the data for share of labor enrolment in terms of the total active labor force over the age of 15 the numbers seem to be measured in different ways for different countries since the share is greater for some countries than for others. Especially noticeable is this when looking at the developed countries and comparing with the developing countries in where developing countries in some observations have higher share of labor participation than developed countries. Hence, the result on these variables may behave differently than expected.

4.2 The Variables

This study tests for the following variables:

GDP (*lnY*)
This is the dependent variable of the model as a measurement of the countries' economic growth and welfare. The variable is stated in current USD.

Capital (*lnK*)
This explanatory variable is the country's level of capital stock. The variable was calculated from the gross capital formation given in % of GDP from the WDI and multiplied with GDP for each year to find the actual gross capital formation. Capital for 2001 and 2007 was calculated by taking the sum of 1991-2001 and 1997-2007

respectively[2], assuming that the level of capital stock in 1991 and 1997 corresponds to the initial capital stock in each country observed. Some of the observations had missing values in some years. These years were filled by taking each country's sum of capital divided by the value of GDP for 2001 or 2007 to find the fraction of capital to GDP and used as a replacement for the missing observation. The data did not have any outliers, therefore allowing the average to be a fair estimate to use. This variable should have a positive impact on GDP since capital is related to investment. A higher level of capital generates higher level of capital per worker, all else equal, hence higher level of production output.

Population (*lnL*)
This explanatory variable is the country's total population shown as midyear estimates. The variable is assumed to have a positive impact on GDP, all else equal, since a larger share of population increase production.

Female primary school completion rate (lnE_f)
This explanatory variable denotes the percentage of female students completing last year of primary school stated as a share of all females in the relevant age group. An increased level of females completing last grade of primary school is expected to have a positive impact on GDP.

Male primary school completion rate (lnE_m)
This explanatory variable indicates the percentage of male students completing last year of primary school stated as a share of all males in the relevant age group. An increased level of males completing last grade of primary school is expected to have a positive impact on GDP.

Female labor participation rate (lnL_f)
This explanatory variable show the proportion females in the labor force as a share of all females in the age over 15 which are economically active, i.e. all people supplying the labor force in the production of goods and services. This variable is expected to influence GDP positively since when more females enter the labor force the output of production is expected to increase and hence also the level of GDP.

Male labor participation rate (lnL_m)
This explanatory variable show the proportion males in the labor force as a share of all males in the age over 15 which are economically active, i.e. all people supplying the labor force in the production of goods and services. This variable should also influence GDP positively since the effect of more males participating in the labor force is the same as for women.

Openness to trade (lnO_{Trade})
This explanatory variable show the openness to trade for each country and is collected from the Penn Tables. The definition of openness is the total trade flow, exports plus imports, divided by GDP. A higher level of openness is expected to affect GDP positively.

[2] The equation used, $C_t = \sum_{i=1}^{t}(1-\delta)^{t-i} I_i$, comes from a working paper written by de Silva Filho (n.a.). The depreciation rate was set to δ= 0.1, since it is the most commonly depreciation rate used when calculating capital from gross capital formation in developing countries.

Dummies are included to control for differences between the countries included in the data set, to control if the levels of GDP is affected differently within the three classes in the levels of GDP. The least developed countries and the low-income countries, defined by the UN and the World Bank respectively, are given by the intercept.

Lower-Middle Income Countries (D_{LMIC})
This dummy controls for lower-middle income countries, indicating 1 if being a LMIC and 0 if not being an LMIC. This dummy is expected to have a positive influence on GDP.

Upper-Middle Income Countries (D_{UMIC})
This dummy denotes the upper-middle income countries in the data set, indicating 1 if being an UMIC and 0 if not being an UMIC. The dummy is also expected to have a positive influence on GDP, and a slightly higher effect than D_{LMIC} since GDP is higher at start.

Oil exporting countries (D_{Oil})
This dummy is included for oil exporting countries, listed by CIA's World Factbook (n.a.), and indicates 1 if a country is exporting more than 500,000 barrels of oil per day and 0 if the country exports less oil or no oil. The quantity includes total exports in both crude oil and oil products and this is to control for the eventuality of higher GDP for those countries exporting oil, hence oil exports are expected to influence GDP positively.

Landlocked countries (D_{LL})
This dummy indicates if the countries are landlocked or not, indicating 1 for landlocked countries and 0 for non-landlocked countries. This dummy is included to control how landlocked countries are affected by the trade restrictions of being landlocked when estimating GDP. Being landlocked is expected to have a negative influence on GDP.

Capital stock in countries with missing observations (D_K)
This dummy indicate those countries having missing observations in some years, or all years in the calculations of the total capital stock in 2001 and 2007 respectively. Those observation where an average value of capital over GDP has been used as a replacement are denoted with a 1 and 0 indicates those countries with no missing observations in the capital stock. The effect of this dummy on GDP is ambiguous.

4.3 Descriptive Statistics

The descriptive statistics for the data sets of 2001 and 2007 are found in Table 4.1 and 4.2 below. The levels of GDP in the countries have increased between the years; the maximum value has increased by 5.58E+11 and the minimum value has more than doubled from 2001 to 2007, hence the mean has more than doubled and the median has increased by 6.71E+9 USD. In both 2001 and 2007 the average value is greater than the center point of the data set. This indicates that the level of GDP/capita is unevenly distributed among the countries; the level is higher in some of the countries included in this data set. One can also see that the divergence between the levels of GDP/capita has increased over the years since the standard deviation is greater in 2007 than in 2001. Thus, all countries included have faced economic growth during the years and some more than other.

A similar pattern can be seen in the variable for capital stock, it has also increased between 2001 and 2007. Both the minimum and maximum values have increased, but the average shows that more countries have larger rates of capital stock since the average is higher than the center point. This can also be seen as the standard deviation has increased as well, showing divergence between the countries capital stock.

Table 4.1 Descriptive statistics for 2001.

Variable	Mean	Median	Maximum	Minimum	Std. Div.
Y	3.23E+10	5.09E+09	6.22E+11	2.35E+08	9.30E+10
K	4.47E+10	7.44E+09	6.53E+11	3.07E+08	1.19E+11
L	31591813	8516842.0	1.03E+09	157897.0	1.22E+08
E_f	75.75744	90.82163	106.6671	14.35073	28.54206
E_m	79.00997	89.71660	108.7092	22.94426	24.45036
L_f	52.88378	50.15000	90.50000	19.70000	16.66604
L_m	77.58649	78.85000	91.60000	54.90000	8.562779
O_{Trade}	80.78793	74.07502	195.5652	26.52723	34.90193

Note: The number of observations in the data set is 74.

Table 4.2 Descriptive statistics for 2007.

Variable	Mean	Median	Maximum	Minimum	Std. Div.
Y	6.99E+10	1.18E+10	1.18E+12	5.07E+08	1.88E+11
K	4.72E+11	7.09E+10	8.06E+12	2.71E+09	1.33E+12
L	34618970	9569784.0	1.12E+09	168338.0	1.33E+08
E_f	83.03060	90.93301	125.8334	21.61357	24.62319
E_m	84.80826	89.70492	119.7715	38.29797	20.54696
L_f	53.99865	51.60000	90.80000	20.70000	16.14052
L_m	76.67432	77.95000	90.80000	49.00000	9.069867
O_{Trade}	89.87853	81.53902	204.0234	36.15276	34.77621

Note: The number of observations in the data set is 74.

The minimum value of population has increased by approximately 10,500 people while the maximum value of population has increased by 90 million inhabitants in between 2001 and 2007. The mean value has increased by more than three million people while the median value of population has increased by more than one million people. The population has increased more in some countries than it has for the average country in

the sample. Among the 74 nations included in this data set there are more countries with smaller populations than countries with large populations, as the mean value is nearly 4 times as large as the median in both 2001 and 2007.

The share of students graduating from primary school has increased both among females and males from 2001 to 2007 and there are on average nearly as many females as males graduating. The variation is narrowing as can be seen from the differences in the standard deviations. Comparing the mean and median for females and males one can see that there are still more countries in where fewer females and males graduate than countries where they graduate since the mean value for both genders is lower than the median value. What is interesting is that the completion rate for females has increased more than the rate for males. In 2001 the average completion rate for females were 75.8 percent while for males 79 percent, in 2007 the completion rate is 83 percent respectively 84.8 percent. This could be an effect from the implementation of the MDGs which has increased focus and recourses for female primary school enrollment.

Looking at the female labor participation rate, it has increased over the years while the labor participation rate for males has decreased. The lowest labor participation rate for males observed in the data set in 2001 was 54.9 percent, in 2007 the labor participation rate for males was 49 percent; the rate had decreased by 5.9 percentage points. The female participation rate was 19.7 percent in 2001 and had in 2007 increased by one percentage point. The highest observation for females had merely increased between 2001 and 2007, and the rate for males decreased by less than one percentage point. Thus, the variation is greater in the rate of female labor participation than it is for male labor participation; the standard deviation is approximately 16 for females compared to 9 for males. However, the standard deviation has increased for the male participation rate and decreased for the female participation rate. The median rate of labor participation has slightly decreased for males, by 1 percentage point, while for females the rate has increased by 1.5 percentage points. Still the mean is higher than the median among females indicating that the female participation rate is higher in some countries than it is in others.

Trade has liberalized during the years and the level of openness to trade has increased. However, the distribution of openness rates among the countries observed remains the same which can be seen on the standard deviation which has remained almost constant, a slight decrease in 2007 compared to 2001. This shows that the average distance from the mean is the same even if the value has increased. Hence, even if most of the values have converged in the middle the average is still greater than the median, which indicates that more countries have large rates of openness to trade than the middle point in the data set.

4.4 Regression Model

The econometric formula is based on the augmented Solow model that Mankiw et al. (1992) developed as was presented in Equation (3.16). To estimate the production regression function the method of ordinary least squares (OLS) was used. The econometric formula (4.1) is extended to include different control variables which are expected to affect the level of GDP in the countries examined, as were described more truly in section 4.2.

$$lnY_i = \hat{\beta}_0 + \hat{\beta}_1 lnK_i + \hat{\beta}_2 lnL_i + \hat{\beta}_3 lnE_{f,i} + \hat{\beta}_4 lnE_{m,i} + \hat{\beta}_5 lnL_{f,i} + \hat{\beta}_6 lnL_{m,i} + \hat{\beta}_7 lnO_{Trade,i} + \hat{\alpha}_8 D_{LMIC} + \hat{\alpha}_9 D_{UMIC} + \hat{\alpha}_{10} D_{Oil} + \hat{\alpha}_{11} D_{LL} + \hat{\alpha}_{12} D_K + \hat{u}_i, \quad (4.1)$$

where the subscript i denotes the country observed and $\hat{\beta}_0 = ln\hat{\beta}_0$ is the intercept. lnY_i is the GDP measured in current USD, lnK_i is the capital stock, lnL_i is the population of each observation. lnE_f and lnE_m is the completion rate of female respectively male students in primary school and lnL_f and lnL_m is the participation rate in the work force for female and male respectively. lnO_{Trade} is the openness to trade. D_{LMIC} is a dummy for lower-middle income countries and D_{UMIC} is a dummy for upper-middle income countries. D_{Oil} is a dummy for oil-exporting countries and D_{LL} is a dummy denoting landlocked countries. D_K is a dummy for those nations having missing observation in their capital stock and $\hat{u}_i$ is the estimated error coefficient.

After conducting White's General Heteroscedasticity Test it became evident that heteroscedasticity is present in the data sets. Having heteroscedasticity present in the data sets implies that the variances in the estimators can be misleading (Gujarati, 2003). Hence White's Heteroscedasticity-Consistent Standard Errors were computed and presented instead of the ordinary standard errors of the estimated variables as a remedy.

Regressions were run with the two data sets of 2001 and 2007 separately without getting satisfactory results and significances on the explanatory variables and are found in Appendix 2. Although the variance inflation factors (VIF) did not indicate multicollinearity, the variables showed signs of being collinear since the regressions had high R^2's and highly insignificant t-values. One way to address the problem with multicollinearity is to compile the two data sets of 2001 and 2007 into a pooled data set where the least-squares dummy variable (LSDV) method is used, including a dummy indicating 0 for 2001 and 1 for year 2007. One problem arising with a pooled data set is the elasticities that are interpreted in the same way for the cross-sectional data set as for the time series analysis (Gujarati, 2003).mHowever, in this pooled data set the concern of the interpretation of the elasticities are negligible since only two years are included in this study.

Running the regression model (4.1) on the pooled data set did not change the significances of the explanatory variables, which still show signs of collinearity as can be seen in Appendix 3. Therefore, regression model (4.1) has been shorted down to only include the explanatory variables of interest for this study's purpose:

$$lnY_i = \hat{\beta}_0 + \hat{\beta}_1 lnK_i + \hat{\beta}_2 lnL_i + \hat{\beta}_3 lnE_{f,i} + \hat{\beta}_4 lnE_{m,i} + \hat{\beta}_5 lnL_{f,i} + \hat{\beta}_6 lnL_{m,i} + \hat{\alpha}_7 D_{2007} + \hat{u}_i, \quad (4.2)$$

in where D_{2007} is a dummy variable for the observations in 2007, indicating 1 if the observation is found in 2007 and 0 for observations found in 2001.

The expected results of the explanatory variables on the dependent variable are presented in Table 4.3 below.

Table 4.3 Expected results.

Variable	Effect
$\boldsymbol{lnK}$	Positive
$\boldsymbol{lnL}$	Positive
$\boldsymbol{lnE_f}$	Positive
$\boldsymbol{lnE_m}$	Positive
$\boldsymbol{lnL_f}$	Positive
$\boldsymbol{lnL_m}$	Positive
$\boldsymbol{lnO_{Trade}}$	Positive

4.5 Results and Analysis

Regression model (4.2) does still show presence of collinearity among the explanatory variables in the LSDV pooled data set when the variables are regressed together. The variables on education and labor are still indicating insignificant results as can be seen in the regression output in Appendix 3 along with the results from the full regression model (4.1).

In order to avoid the persisting problem of multicollinearity in the regression model, five regressions were run testing the explanatory variables individually with capital and population to the regressand GDP. These results are found in Table 4.4 below, and the R^2's for these regressions are lower than for the regressions sets presented in Appendix 3, showing that the problem of collinearity is decoyed by running separate regressions and include different explanatory variables in the different sets. The estimated variables for female and male education and labor do all attain significant values and the model used is good at describing the variation in the value of GDP.

The other explanatory and controlling variables from regression model (4.1) did not turn out significant when regressed individually with capital and population as the variables on education and labor did, with exception for the upper-middle income country dummy variable. These results are presented in Appendix 5. The correlation matrix for these variables from regression model (4.1) is presented in Appendix 4.

In Table 4.4 the regression results on the five regressions that where run on capital and population together with the explanatory variables on female and male primary education respectively labor force participation are presented. The estimated coefficients are shown with their respectively White's Heteroscedasticity-Consistent Standard Errors within brackets and noted with the significance level.

Table 4.4 LSDV regression results from the pooled data set of 2001 and 2007.

Variable	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
C	0.560481 (0.445649)	-0.286010 (0.493615)	-0.750760 (0.601509)	2.228170* (1.159830)	4.708634*** (1.612832)
lnK	0.800714*** (0.044184)	0.706934*** (0.060716)	0.714911*** (0.059649)	0.759796*** (0.056541)	0.775128*** (0.047343)
lnL	0.233313*** (0.054027)	0.323274*** (0.068195)	0.312119*** (0.066480)	0.258331*** (0.058828)	0.264261*** (0.057567)
lnE_f	- -	0.372005*** (0.115630)	- -	- -	- -
lnE_m	- -	- -	0.470855*** (0.154230)	- -	- -
lnL_f	- -	- -	- -	-0.288016* (0.161880)	- -
lnL_m	- -	- -	- -	- -	-0.932686*** (0.340773)
D_{2007}	-1.147936*** (0.132312)	-0.984520*** (0.147539)	-0.996475*** (0.148123)	-1.044412*** (0.161300)	-1.101172*** (0.133934)
R^2	0.928718	0.934088	0.933469	0.930695	0.932236

Notes:
a. Regression 1 has d.f. 144 while Regression 2, 3, 4, and 5 have d.f. 143, * significant at 10%,
** significant at 5%, *** significant at 1%.
b. The values within the parenthesis are the White's Heteroscedasticity-Consistent Standard Errors.

For all the five sets of regressions the estimated slope coefficients for lnK and lnL are significant at the 1% level of significance. Between the five different sets of regressions the elasticity of lnY with respect to lnK varies from 0.71-0.80, meaning that a 1% increase in capital affects GDP positively, as expected, by 0.71% to 0.80%. The elasticity of lnY with respect to lnL varies between 0.23 and 0.32; hence a 1% increase in population will increase GDP by 0.23% to 0.32%. This is also in line with the hypothesis made in section 4.2 and in Table 4.3.

In regression 1, a 1% increase in capital and population will increase GDP by 0.80% respectively 0.23%, whilst in regression 2 by on average 0.71% respectively 0.32%. In regression 2 the elasticity lnY of with respect to lnE_f is 0.37 indicating that a 1% increase in the rate of female completing primary school leads to a 0.37% increase in GDP. This is in line with what was expected.

Regression 3 measure the elasticity of lnY with respect to lnE_m is 0.47, thus if the rate of male completing primary school increase by 1% GDP will increase by 0.47%. Also this is in line with the expectations.

However the signs on labor participation have not attained the signs as expected. In regression 4, an increased share of females in the labor force has a significant negative effect on GDP. When lnL_f increase by 1%, lnY decease by 0.29% and if lnL_m increase by 1%, lnY decrease by 0.93%. Hence, an increased level of both female and male participation rate in the labor force has a significant and negative effect on GDP contrary to what was expected in the hypothesis. Bear in mind that the data for these two variables might not have been reported and collected consequently in between the countries and may skew the results of these variables in this study.

The results of increased levels of female and male students completing primary school have a positive effect on the level of GDP is in line with theory and the MDGs. Universal primary education was aimed to be reached in 2005 however by 2015 the inequality among girls and boys enrolling all levels of education should be even out.

Todaro and Smith (2006) wrote that the rate of return on female education is higher than on male education. The results in this thesis do not support that statement. However there are other aspects of increased female education such as decreased mortality rates among children and improved hygiene in families that is in favor for economic growth.

In addition increased female education increase education levels in the long-run as children to educated mothers are more likely to enroll in education according to Schultz (2002). As can be seen from the results if female completion rate in primary school increases by 1% then GDP will increase by 0.37% indicating that higher enrollment is positive for economic growth in line with Klasen's (2002) results.

However not only the rate of female education is important for economic growth, education for both female and male do have positive effects on economic growth. Although the results show that the effect from males completing primary education is 0.1 percentage units higher on GDP than females. Men do generally contribute more to the labor market than women and therefore the investments in male education generate a higher return than female. At least this is an argument that is carried by critics of female education due to cultural and religious aspects in where women are to be diversified from men (Dollar & Gatti, 1999) or the loss in investments since the girls are married away to become part of other families (Schultz, 2002). Even though, increased equality among females and males in terms of education affects GDP positively.

It is already mentioned that the data on female and male labor participation could behave differently than expected due to the variation in the reported data in between the countries. The hypothesis over the results stated in section 4.2 and Table 4.3 in where expecting increased levels of female and male participation rates in the labor force should have a positive effect on GDP, although the results from the regressions are the opposite; increased equality and participation rates of female and male in the labor force have a negative effect on GDP. For females, a 1% increase in the level of females as a share of all females over the age of 15 in the active labor force GDP decreases by on average 0.29%. For males this decrease is even greater causing GDP to decrease by 0.93% if the ratio of males participating in the labor force increase by 1%. An example that possibly could explain these results are that the labor enrolment in Sweden, a developed country, is approximately 60% while the labor enrolment in Cambodia, a developing country, is above 80%. Even if Sweden is not included in this study, this example provides a reason for why the results on female and male labor enrolment do not behave as expected.

5 Conclusion

The purpose of this thesis was to investigate whether an increase in the level of human capital and an increase of gender equality in the labor market affect developing countries' growth rate and welfare. The main findings in this thesis illustrate that there is a positive relation of increased levels of female and male completion rates in primary school education on the economy. The estimated variables on both female and male education meet its expected hypotheses. However the effect is greater for males than for females and this is to some extent in line with theory and pervious research in those cases where men enroll in the labor force to a greater extent the return of investments in male education is larger.

Labor equality however, and the share of female respectively male participating in the labor force, show surprisingly a negative relation to economic growth and this is not in line with what was expected. The results show that if the shares of female and male labor participation increase, economic growth will decline.

The conclusion is that increased levels of primary education among males and females will increase economic growth. The MDGs of achieving universal primary education and homogenous education between females and males in 2015 are important for economic growth and increase of welfare. In terms of increased equality between females and males, increased levels of enrolment for males in both education and in the labor force has a stronger effect on the economy, although positive in terms of education and negative in terms of labor force participation. Thus increased female enrolment in education is positive for economic growth, but an increased level of females participating in the labor force is negative, however to a lower extent than for males.

Suggestions for further studies are to add a lag on GDP and see how investments in human capital, by that meant education, affects growth in GDP in the long-run. One could also investigate whether different levels of education affect economic growth to different extents. Further the equality between females and males in the labor force can be investigated in order to see if economic growth is affected by increased rates of equality.

List of References

Barro, R. J. (2001). Human Capital and Growth. *The American Economic Review*, 90(2), 12-17.

Bowen, H. P., Hollander, A., & Viaene, J-M. (1996). *Applied International Trade Analysis.* Basingstoke: Palgrave MacMillian.

CIA – World Factbook (n.a.). Country Comparison, Oil Exports. Retrieved May 10, 2010, from, https://www.cia.gov/library/publications/the-world-factbook/rankorder/2176rank.html

Deaton, A. (1999). Saving and Growth. In K. Schmidt-Hebbel & L. Servén (Eds.), *The Economics of Saving and Growth: Theory, Evidence, and Implications for Policy* (p. 33-70). Cambridge: Cambridge University Press.

Dollar, D. & Gatti, R. (1999). Gender Inequality, Income, and Growth: Are Good Times Good for Women? *The World Bank, Development Research Group*.

Dornbusch, R., Fischer, S., & Startz, R. (2004). *Macroeconomics* (9th ed.). New York: McGraw-Hill.

Easterly, W. (2002). *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics.* Cambridge: The MIT Press.

Galor, O. (2006). Inequality and he process of development. In N. Salvadori (Ed.), *Economic Growth and Distribution: On the Nature and Causes of the Wealth of Nations* (p. 1-39). Cheltenham: Edward Elgar Publishing Ltd.

Gujarati, D. N. (2003). *Basic Econometrics* (4th ed.). New York: McGraw-Hill/Irwin.

IMF, (n.a). *Classification of the world economies*. Retrieved April 14, 2010, from http://www.imf.org/external/pubs/ft/weo/2009/01/weodata/groups.htm#ae

Islam, N. (1995). Growth Empirics: A Panel Data Approach. *The Quarterly Journal of Economics*, 110(4), 1127-1170.

Jackson, C. (1996). Rescuing Gender From the Poverty Trap. *World Development*, 24(3), 489-504.

Klasen, S. (2002). Low Schooling for Girls, Slower Growth for All? Cross-Country Evidence on the Effect of Gender Inequality in Education in Economic Development. *The World Bank Economic Review*, 16(3), 345-373.

Krugman, P. R. & Obstfeld, M. (2006). *International Economics: Theory and Policy (7th ed.).* Boston: Pearson Education.

Lehmijoki, U. & Palokangas, T. (2006). Political Instability, Gender Discrimination, and Population Growth in Developing Countries. *Journal of Population Economics*, 19(2), 431-446.

Mankiw, G. N., Romer, D., & Weil, D. N. (1992). A Contribution to the Empirics of Economical Growth. *The Quarterly Journal of Economics*, 107(2), 407-437.

Marrick, T. (2001). Population and Poverty in Households: A Review of Reviews. In N. Birdsall, A. C. Kelly, & S. W. Sinding (Eds.), *Population Matters: Demographic Change, Economic Growth, and Poverty in the Developing World* (p. 201-212). New York: Oxford University Press Inc.

Sachs, J. D. (2005). *The End of Poverty – Economic Possibilities for Our Future.* New York: Penguin Group.

Schultz, P. T. (2002). Why Governments Should Invest More to Educate Girls. *World Development*, 30(2), 207-225.

de Silva Filho, T. N. T. (n.a.). Estimating Brazilian Potential Output: A Production Function Approach. Retrieved May 25, 2010, from http://www.cemla.org/pdf/red/BR_Nicias_texeira.pdf

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, 70(1), 65-94.

Strulik, H. (2004). Child Mortality, Child Labour and Economic Development. *The Economic Journal*, 114(497), 547-568.

Thirlwall, A. P. (2006). *Growth and Development – With Special Reference to Developing Economies* (8th ed.). Hampshire: Palgrave MacMillian.

Todaro, M. P. & Smith, S. C. (2006). *Economic Development* (9th ed.). Harlow: Pearson Education Ltd.

Trudell, B. (2009). Local-language literacy and sustainable development in Africa. *International Journal of Educational Development*, 29, 73-79.

UN, (n.a. a). *The Universal Declaration of Human Rights.* Retrieved April 19, 2010 from http://www.un.org/en/documents/udhr/

UN, (n.a. b). *Criteria for identification of LDC's*. Retrieved March 29, 2010, from http://www.unohrlls. org/en/ldc/related/59/

UN, (2009). *MDG Report 2009*. Retrieved March 29, 2010, from http://www.un.org/millenniumgoals/pdf/MDG_Report_2009_ENG.pdf

UN, (2010). *End Poverty 2015*. Retrieved April 19, 2010, from http://www.un.org/millenniumgoals/

UN-OHRLLS, (n.a. a). *List on LLDS*. Retrieved March 29, 2010, from http://www.unohrlls.org/en/lldc/39/

UN-OHRLLS, (n.a. b). *List on SIDS*. Retrieved March 29, 2010, from http://www.unohrlls.org/en/sids/44/

UNDP, (2009). *HDI interactive calculator*. Retrieved March 3, 2010, from http://hdr.undp.org/en/statistics/data/calculator/

UNESCO, (n.a.). UN Litteracy Decade. Retrieved March 29, 2010, from http://www.unesco.org/en/literacy/un-literacy-decade/

UNESCO, (2010). UNESCO Press Release. Retrieved March 29, 2010, from http://www.unesco.org/fileadmin/MULTIMEDIA/HQ/ED/GMR/pdf/gmr2010/gmr2010-pr-short.pdf

Williamson, J. G. (2008). Globalization and the Great Divergence: terms of trade booms, volatility and the poor periphery, 1782-1913. *European Review of Economic History*, 12, 355-391.

WFP, (2010). *School Meals*. Retrieved February 3, 2010, from http://www.wfp.org/school-meals

World Bank, (2010). *Country classification*. Retrieved March 29, 2010, from http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

Appendix 1: The World's Developing and Emerging Nations

The nations marked with bold are used in this study.

1.	Afghanistan, Rep. of *#	**46.**	**Ghana ***	**91.**	**Panama**
2.	Albania **	47.	Grenada ¤	92.	Papua New Guinea **¤
3.	**Algeria**	**48.**	**Guatemala ****	93.	Paraguay **#
4.	Angola *	**49.**	**Guinea ***	**94.**	**Peru**
5.	Argentina	50.	Guinea-Bissau *¤¤	**95.**	**Philippines****
6.	**Armenia **#**	**51.**	**Guyana **¤**	96.	Poland
7.	**Azerbaijan **#**	52.	Haiti *¤	**97.**	**Romania**
8.	Bangladesh *	53.	Honduras **	98.	Russia
9.	Belarus	**54.**	**India ****	99.	Rwanda *#
10.	**Belize **¤**	**55.**	**Indonesia ****	**100.**	**Samoa *¤¤**
11.	Benin *	**56.**	**Iran, I.R. of ****	101.	São Tomé and Príncipe *¤¤
12.	Bhutan *#	57.	Iraq **	**102.**	**Senegal ***
13.	**Bolivia **#**	**58.**	**Jamaica ¤**	103.	Serbia
14.	Botswana #	59.	Jordan **	104.	Seychelles
15.	Bosnia and Herzegovina	**60.**	**Kazakhstan #**	105.	Sierra Leone *
16.	Brazil	61.	Kenya *	106.	Solomon Islands *¤¤
17.	**Bulgaria**	62.	Kiribati *¤	107.	South Africa
18.	**Burkina Faso *#**	**63.**	**Kyrgyz Republic *#**	**108.**	**Sri Lanka ****
19.	Burma *	**64.**	**Lao PDR *#**	109.	St. Kitts and Nevis ¤
20.	**Burundi *#**	**65.**	**Latvia**	**110.**	**St. Lucia ¤**
21.	**Cambodia ***	66.	Lebanon	111.	St. Vincent and the Grenadines¤
22.	Cameroon **	**67.**	**Lesotho *#**	**112.**	**Sudan ***
23.	**Cape Verde **¤**	68.	Liberia *	**113.**	**Suriname ¤**
24.	Central African Republic *#	69.	Libya	**114.**	**Swaziland **#**
25.	**Chad *#**	**70.**	**Lithuania**	**115.**	**Syrian Arab Republic ****
26.	Chile	**71.**	**Macedonia, FYR #**	**116.**	**Tajikistan #**
27.	China *	**72.**	**Madagascar ***	**117.**	**Tanzania ***
28.	**Colombia**	**73.**	**Malawi *#**	118.	Thailand **
29.	Comoros *¤¤	74.	Malaysia	119.	Timor-Leste, Dem. Rep. Of *¤¤
30.	Congo, Dem. Rep. of *	75.	Maldives *¤	**120.**	**Togo ***
31.	**Congo, Rep. of ****	**76.**	**Mali *#**	121.	Tonga **¤
32.	**Costa Rica**	**77.**	**Mauritania ***	**122.**	**Tunisia ***
33.	**Côte d'Ivoire ****	**78.**	**Mauritius ¤**	123.	Turkey
34.	Djibouti *	**79.**	**Mexico**	124.	Turkmenistan **#
35.	Dominica ¤	**80.**	**Moldova **#**	**125.**	**Uganda *#**
36.	**Dominican Republic ¤**	**81.**	**Mongolia **#**	**126.**	**Ukraine ****
37.	**Ecuador ****	82.	Montenegro	**127.**	**Uruguay**
38.	**Egypt ****	**83.**	**Morocco ****	**128.**	**Uzbekistan *#**
39.	**El Salvador ****	**84.**	**Mozambique, Rep. of ***	**129.**	**Vanuatu *¤**
40.	**Eritrea ***	**85.**	**Namibia**	**130.**	**Venezuela, Rep.**
41.	**Ethiopia *#**	86.	Nepal *#	131.	Vietnam *
42.	**Fiji ¤**	**87.**	**Nicaragua ****	132.	Yemen *
43.	Gabon	**88.**	**Niger *#**	133.	Zambia *#
44.	**Gambia, The ***	89.	Nigeria **	134.	Zimbabwe *#
45.	Georgia **	90.	Pakistan **		

Notes: Burma is listed as Myanmar by the UN, WB, and IMF, although in this thesis listed as Burma.
*Least Developed Countries, defined by the UN, and Low Income Countries, defined by the World Bank 2009.
** Lower Middle Income Countries, defined by the World Bank 2009.
#Land Locked Developing Countries, defined by the UN.
¤ Small Developing Islands, UN-member, defined by the UN.
¤¤ Small Developing Islands, Non UN-member, defined by the UN.

The countries are based on the IMF classifications of emerging and developing economies. Antigua and Barbuda, the Bahamas, Bahrain, Barbados, Brunei Darussalam, Croatia, Equatorial Guinea, Estonia, Hungary, Kuwait, Oman, Qatar, Saudi Arabia, Trinidad and Tobago, and United Arab Emirates were excluded from sample since denoted as High Income Countries by the World Bank 2009. This does not indicate that these countries are higher developed only that their GDP is greater than for other developing countries although does not say anything about the welfare in these countries.

Appendix 2: Regressions on 2001 and 2007

Regressions run on the individual data sets with the variables from model (4.1).

Variable	Regression 2001	Regression 2007
C	2.646292 (2.100892)	5.568413* (2.396805)
lnK	0.534562*** (0.056739)	0.494775*** (0.059967)
lnL	0.400482*** (0.058058)	0.485796*** (0.054043)
lnE_f	0.087820 (0.209030)	0.216506 (0.329092)
lnE_m	-0.067329 (0.271777)	-0.053722 (0.452773)
lnL_f	-0.204317 (0.123869)	0.158387 (0.152142)
lnL_m	0.574629 (0.366967)	-0.829785** (0.378507)
lnO_{Trade}	-0.180818* (0.100947)	-0.126576 (0.134820)
D_{LMIC}	0.502235*** (0.108974)	0.508929** (0.124165)
D_{UMIC}	1.047663*** (0.131961)	0.932457** (0.154476)
D_{Oil}	-0.018030 (0.121835)	0.090282 (0.138445)
D_{LL}	-0.209055** (0.085287)	0.013733 (0.100588)
D_K	-0.527377*** (0.126469)	-0.559932*** (0.122453)
R^2	0.980794	0.975317

Notes:
a. The regressions have d.f. 61, * significant at 10%, ** significant at 5%, *** significant at 1%.
b. The values within the parenthesis are the White's Heteroscedasticity-Consistent Standard Errors.

Appendix 3: Regressions on the Pooled Data Set

Regressions run on the pooled data set of 2001 and 2007 with all variables from (4.1) respectively (4.2).

Variable	Regression 1	Regression 2
C	4.705558*** (1.643215)	3.574850* (1.951281)
lnK	0.499729*** (0.041973)	0.678694*** (0.046331)
lnL	0.455352*** (0.040434)	0.343695*** (0.044522)
lnE_f	0.162688 (0.191069)	0.362531 (0.287723)
lnE_m	-0.096018 (0.255901)	-0.082653 (0.389526)
lnL_f	-0.047347 (0.102790)	-0.220298 (0.141602)
lnL_m	-0.137832 (0.278277)	-0.524682 (0.361644)
lnO_{Trade}	-0.152261* (0.086072)	- -
D_{LMIC}	0.524158*** (0.087623)	- -
D_{UMIC}	1.017976*** (0.106944)	- -
D_{Oil}	0.042134 (0.096437)	- -
D_{LL}	-0.105378 (0.069816)	- -
D_K	-0.529789*** (0.088358)	- -
D_{2007}	-0.424345*** (0.107583)	-0.909778*** (0.127121)
R^2	0.973914	0.936609

Notes:
a. Regression 1 has d.f. 134 while Regression 2 has d.f. 140, * significant at 10%, ** significant at 5%, *** significant at 1%.
b. The values within the parenthesis are the White's Heteroscedasticity-Consistent Standard Errors.

Appendix 4: Correlation Matrix

Correlation matrix for the pooled data set with the variables from the regression model (4.1).

Variables	lnY	lnK	lnL	lnE_f	lnE_m	lnL_f	lnL_m	lnO_{Trade}	D_{LMIC}	D_{UMIC}	D_{Oil}	D_{LL}	D_K	D_{2007}
lnY	1.000000													
lnK	0.887134	1.000000												
lnL	0.786588	0.620486	1.000000											
lnE_f	0.287734	0.336050	-0.155552	1.000000										
lnE_m	0.309591	0.351238	-0.118730	0.956853	1.000000									
lnL_f	-0.385429	-0.330216	-0.117322	-0.335130	-0.363232	1.000000								
lnL_m	-0.079750	-0.079634	0.160129	-0.428658	-0.434769	0.280317	1.000000							
lnO_{Trade}	-0.345006	-0.200257	-0.578010	0.387333	0.361105	-0.028350	-0.415630	1.000000						
D_{LMIC}	0.196938	0.151017	0.130758	0.283293	0.297688	-0.377453	-0.089156	0.094973	1.000000					
D_{UMIC}	0.281561	0.235531	-0.156594	0.381254	0.363476	-0.170168	-0.297580	0.143362	-0.463274	1.000000				
D_{Oil}	0.533027	0.445519	0.452524	0.224411	0.236432	-0.266306	0.015089	-0.284075	0.159167	0.132605	1.000000			
D_{LL}	-0.274809	-0.257762	-0.005960	-0.261551	-0.253842	0.331401	-0.134849	-0.045148	-0.086546	-0.263252	-0.050811	1.000000		
D_K	-0.203360	-0.009879	-0.136214	-0.101285	-0.110927	0.140505	0.143425	-0.037696	-0.230558	-0.004957	-0.011966	0.086751	1.000000	
D_{2007}	0.222975	0.572829	0.027453	0.154486	0.147900	0.039423	-0.053555	0.155268	1.10E-17	0.000000	4.59E-18	0.000000	0.041345	1.000000

Appendix 5: Regression Model (4.2), Extended Version

This is the extended version of Table 4.3 including the variables from the regression model (4.1).

Variable	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5	Regression 6	Regression 7	Regression 8	Regression 9	Regression 10
C	0.560481 (0.445649)	-0.286010 (0.493615)	-0.750760 (0.601509)	2.228170* (1.159830)	4.708634*** (1.612832)	-0.114979 (0.962490)	0.647334 (0.470881)	1.456260*** (0.409586)	0.884244 (0.576663)	0.910407 (0.550385)
lnK	0.800714*** (0.044184)	0.706934*** (0.060716)	0.714911*** (0.059649)	0.759796*** (0.056541)	0.775128*** (0.047343)	0.796235*** (0.046515)	0.795038*** (0.046055)	0.660942*** (0.054309)	0.788047*** (0.047890)	0.772294*** (0.053879)
lnL	0.233313*** (0.054027)	0.323274*** (0.068195)	0.312119*** (0.066480)	0.258331*** (0.058828)	0.264261*** (0.057567)	0.253008*** (0.069097)	0.233666*** (0.053414)	0.367939*** (0.062123)	0.230033*** (0.053621)	0.255131*** (0.059466)
lnE_f	- -	0.372005*** (0.115630)	- -	- -	- -	- -	- -	- -	- -	- -
lnE_m	- -	- -	0.470855*** (0.154230)	- -	- -	- -	- -	- -	- -	- -
lnL_f	- -	- -	- -	-0.288016* (0.161880)	- -	- -	- -	- -	- -	- -
lnL_m	- -	- -	- -	- -	-0.932686*** (0.340773)	- -	- -	- -	- -	- -
lnO_{Trade}	- -	- -	- -	- -	- -	0.108577 (0.137378)	- -	- -	- -	- -
D_{LMIC}	- -	- -	- -	- -	- -	- -	0.106198 (0.075098)	- -	- -	- -
D_{UMIC}	- -	- -	- -	- -	- -	- -	- -	0.602625*** (0.117470)	- -	- -
D_{Oil}	- -	- -	- -	- -	- -	- -	- -	- -	0.144961 (0.128530)	- -
D_{LL}	- -	- -	- -	- -	- -	- -	- -	- -	- -	-0.159245 (0.118998)
D_{2007}	-1.147936*** (0.132312)	-0.984520*** (0.147539)	-0.996475*** (0.148123)	-1.044412*** (0.161300)	-1.101172*** (0.133934)	-1.153062*** (0.129702)	-1.134317*** (0.135794)	-0.823887*** (0.148783)	-1.117179*** (0.140704)	-1.081548*** (0.151105)
R^2	0.928718	0.934088	0.933469	0.930695	0.932236	0.929121	0.929492	0.942958	0.929207	0.929986

Notes:
a. Regression 1 has d.f. 144 while Regression 2, 3, 4, …, 10 have d.f. 143, * significant at 10%, ** significant at 5%, *** significant at 1%.
b. The values within the parenthesis are the White's Heteroscedasticity-Consistent Standard Errors.