Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics

Diploma Thesis

The Impact of Education on Economic Growth – Case study of India

Bc. Markéta Kopecká

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

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The Impact of Education on Economic Growth – Case Study of India

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Objectives of thesis

The goal of this thesis is to examine the impact of education on economic growth in India for the time period 1971-2011. This objective will be reached by regression analysis applied on two hypotheses.
The first hypothesis to be elaborated: secondary education has a positive impact on economic growth in India, especially female education.
The second hypothesis to be elaborated: the level of education has an indirect impact on economic growth through fertility rate in India.

Methodology

Education will be divided into categories of primary, secondary and tertiary. Time series techniques will be used to determine whether education, for each category, has a casual impact on growth. Further, the education variables will be divided by gender and analysis is implemented to determine whether the causal results vary by gender. Relationships will be examined with econometric estimation such as the Ordinary Least Square method.

The proposed extent of the thesis

60 – 80 pages

Keywords

developing country, gross enrolment rate in education, fertility rate, female education, economic growth, regression analysis, India

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The Diploma Thesis Supervisor

doc. Ing. Mansoor Maitah, Ph.D. et Ph.D.

Supervising department

Department of Economics

Electronic approval: 25. 2. 2016

prof. Ing. Miroslav Svatoš, CSc.

Head of department

Electronic approval: 26. 2. 2016

Ing. Martin Pelikán, Ph.D.

Dean

Prague on 21. 03. 2016

Declaration

I declare that I have worked on my diploma thesis titled "The Impact of Education on Economic Growth – Case study of India" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 31st of March _____

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Dopad vzdělání na ekonomický růst – Případová studie Indie

Souhrn

Cílem této práce bylo provést analýzu dopadu vzdělávání na ekonomický růst v Indii v určitém časovém období. Data byla nalezena pro období 1971-2011. Vzdělání bylo rozděleno do kategorií primární, sekundární a terciární. Techniky časových řad byly použit k určení, zda vzdělání, pro každou kategorii, má příčinný dopad na růst. Dále vzdělávací proměnné byly rozděleny podle pohlaví a analýza byla provedena k určení, zda se kauzální výsledky liší podle pohlaví. Tato práce byla založena na vědeckém článku s názvem "Does education at all levels cause growth?" který napsali Self a Grabowski, kteří si vybrali časové období 1966-1996. Tato práce se snaží, aby výsledky byly více aktuální. Vztahy byl zkoumány ekonometrickým odhadem, jako je metoda Grangerovy příčinnosti a metoda Kointegrace. Bylo zjištěno, že se jedná zejména o vysokoškolské vzdělání pro obě pohlaví, které má silný a dlouhodobý kauzální dopad na ekonomický růst. Ve srovnání s Self a Grabowski článkem, který objevil, že sekundární ženské vzdělání má kauzální dopad na vzdělávání, toto může být vysvětleno technologickým pokrokem a rozvojem vysokoškolského vzdělávání v Indii v průběhu času.

Klíčová slova: rozvojová země, hrubá míra školní docházky ve vzdělávání, míra porodnosti, ženské vzdělání, ekonomický růst, regresní analýza, Indie

The Impact of Education on Economic Growth – Case study of India

Summary

The aim of this thesis was to analyse the impact of education in India on economic growth over a period of time. The data was found for the time period 1971-2011. Education was divided into categories of primary, secondary and tertiary. Time series techniques was used to determine whether education, for each category, has a causal impact on growth. Further, the education variables was divided by gender and analysis was implemented to determine whether the causal results vary by gender. This thesis was based on the scientific paper 'Does education at all levels cause growth?' written by Self and Grabowski, who chose a time period 1966-1996. This thesis attempts to make the results more actual. Relationships was examined with econometric estimation such as Granger causality method and Cointegration method. It was discovered that it is mostly the tertiary education for both genders which has a strong long-term causal impact on economic growth. In comparison to the Self and Grabowski paper, who discovered that the secondary female education has a causal impact on education, this can be explained with the technological progress and development of tertiary education over time in India.

Keywords: developing country, gross enrolment rate in education, fertility rate, female education, economic growth, regression analysis, India

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1 Introduction

The economic transformation of developing countries is the most important and perhaps the most complex of all economic issues. This thesis is focused on one of the most populated developing country in the world – India.

Level of education reflects the status of a nation. The significance of education for the development of a country should not be underestimated because education is the tool which can liberate people of false prejudice, ignorance and representations. Education provides essential knowledges, techniques, skills and information and enables to know rights and duties towards the family and society. Education has the ability to fight ignorance, injustice, corruption, violence, disparity and communalism, which are the greatest dangers to the progress of the nation.

Since the independence in 1947, India has progressed in the field of science and technology. India is currently among the six nuclear powers of the world and in information technology is on the top position. Even after seventy years of independence nearly 35 % of total population lacks basic literacy. More than 50% of Indian children drop out of the schools at primary level, majority of the drop-outs coming from the population part, which live below survival level. Barely 7 out of 100 youths in the age group of 17-23 years get an opportunity for higher education. Number of students of basic science is decreasing and therefore standard of research in the universities is diminishing.

It is obvious that the Indian government has failed to provide compulsory primary education to the masses. India shares 34% percent of the world's illiterate population. The share for education is 3% of GDP whereas in the common minimum programme of the government public expenditure on education should be 6 % of GDP so that constitutional obligation of providing free and compulsory education of good quality to all children may be fulfilled.

Social face of India is poor. Certainly India's GDP is rising and reaching the level of 9% but there is no reflection of this rise in the standard of living in rural and urban population. Unfortunately, disparity is widening every day. A lot has to be done for India's large young and thriving masses which constitute nearly 70 % of country's total population. Education is a tool to secure employment hence there is a need to encourage and expand opportunities for career training. Education in technical branches has become so expensive

that poor parents of most of the talented students cannot afford to enrol their descendants in the universities.

Existing growth literature accepts education as one of the primary components of human capital since education, other than improving productivity of labour, has certain spillover benefits meaning that over and above benefiting the individuals who receive it, it also benefits society. In comparison, there is even more limited and somewhat unclear evidence concerning the significance and relevance of different education levels to the growth mechanism.

This thesis considers the education – growth relation over a period of time in Republic of India, with a focus on different levels of education (primary, secondary, and tertiary) and utilizing different measures of education. In addition, this study also analyses the impact of education on growth by gender. The focus of this thesis, is the impact of different education levels on India's economic growth.

2 Objectives and Methodology

2.1 Objectives

This thesis seeks to examine the impact of different educational levels on India's economic growth for the time period 1971 - 2011. The focus is on different educational levels (primary, secondary, and tertiary) and utilizing different measures of education. In addition, this study also analyses the impact of education on growth by gender.

The first hypothesis to be tested: secondary education has a positive impact on economic growth in India, especially female education.

The second hypothesis to be tested: the level of education has an indirect impact on economic growth through fertility rate in India.

Two different variables have been most commonly used to measure education: enrolment rates and average years of education, commonly referred to as human capital stock. In this thesis, both these measures are incorporated to proxy for human capital. First, enrolment rates are incorporated as a proxy for a flow of human capital. Next, the growth rate of human capital stock, measured as the change in the mean years of education at each level, is analysed. The same is repeated for individual genders.

The hypotheses are examined on the Republic of India. India was chosen due to continuing crisis of the standard of education delivered by this continent to its inhabitants.

2.2 Methodology

Data used in the empirical part are available from the World Development Indicators database, provided by the World Bank, and contain the enrolment variables and real per capita gross domestic product at market prices (2005 constant US$). The Penn World Tables 8.1 delivers annual data for physical capital per worker (2005 international prices). Average years of education at a particular level are taken from Barro and Lee (2011).

The time period for the estimation covers 40 years, 1971 – 2011. Data on per capita GDP are annual. But data on average years of schooling are available only every 5 years. Therefore an exponential growth rate is calculated between the first and fifth year and the interim years are interpolated presuming and exponential smoothing process. Measurement

errors can occur but the collected data are the most reliable because have been already based on scientific article. (Self and Grabowski, 2004)

Primary, secondary, and tertiary enrolment rates consist of the number of individuals enrolled at each level, regardless of their ages, as a % of the total population of appropriate age people at each level. These are based on UNESCO's classification of age group appropriate with education level. The growth rate of human capital stock, measured as the change in the mean years of education at each level, is analysed. The same is repeated for individual genders.

2.2.1 Granger Causality

The basic meaning of causality that is used in this thesis is defined by Granger (1969). Granger defined causality as testing whether lagged information on a variable X provides any statistically significant information about a variable Y in the presence of lagged Y.

In order to determine the causal relationship between education and economic growth, the following hypothesis is tested,

$$H_0: E(\Delta y_t|\Delta y_{t-1}, \Delta y_{t-2}, \Delta y_{t-3} \dots \Delta y_{t-n}, \Delta x_{t-1}, \Delta x_{t-2}, \Delta\, x_{t-3} \dots \Delta x_{t-m}, \Delta z_{t-1}, \Delta z_{t-2}, \Delta z_{t-3} \dots \Delta z_{t-m}) = E(\Delta y_t|\Delta y_{t-1}, \Delta y_{t-2}, \Delta y_{t-3} \dots \Delta y_{t-m}, \Delta z_{t-1}, \Delta z_{t-2}, \Delta z_{t-3} \dots \Delta z_{t-m})$$

for all $m > 0$ — No Granger causality. Against the alternative of,

$$H_1: E(\Delta y_t|\Delta y_{t-1}, \Delta y_{t-2}, \Delta y_{t-3} \dots \Delta y_{t-n}, \Delta x_{t-1}, \Delta x_{t-2}, \Delta x_{t-3} \dots \Delta x_{t-m}, \Delta z_{t-1}, \Delta z_{t-2}, \Delta z_{t-3} \dots \Delta z_{t-m}) \neq E(\Delta y_t|\Delta y_{t-1}, \Delta y_{t-2}, \Delta y_{t-3} \dots \Delta y_{t-n}, \Delta z_{t-1}, \Delta z_{t-2}, \Delta z_{t-3} \dots \Delta z_{t-m})$$

for some $m > 0$ — Granger causality.

Here the Δy represents first difference of the log of per capita GDP, Δz represents first difference of the log of the capital labour ratio, and Δx represents the first difference of the log of the education variables for each education level.

The thing to be discussed is that each education level is individually analysed in each equation while letting the constant term to account for all other influences. This, while introducing some bias in the results, increases the degrees of freedom while maintaining reliability of the results by limiting the number of explanatory variables.

2.2.2 Stationarity test

Before conducting any of the above tests, all of the relevant series are tested for stationarity, since standard inference procedures do not apply to regressions which contain an integrated dependent variable or integrated regressors. A formal method to test for stationarity of a series is the Unit Root test. To this effect the standard Augmented Dickey Fuller (ADF) test and the Phillips- Peron (PP) tests has to be utilized and all variables should be found stationary. Next, the following model is formulated to test for a causal relation,

$$\Delta y_t = \delta_0 + \sum_{j=1}^{m1} \delta_{1j} \Delta y_{t-j} + \sum_{j=1}^{m2} \delta_{2j} \Delta z_{t-j} + \sum_{j=1}^{m3} \delta_{3j} \Delta x_{t-j} + e_{1t} \quad (1)$$

For the lagged variables appearing on the right – hand – side, the number of lags is determined using the Akaike Information Criterion (AIC) and Schwartz Criterion (SC) and the lag that gives the lowest AIC and SC and best fit is chosen. Adding lagged values of the dependent variable on the right-hand-side, other than fulfilling the Granger causality requirement, also reduces or eliminates the problem of spurious results due to serial correlation. (Self and Grabowski, 2004)

A major part of the analysis depends on the choice of lag length since the results of the causality tests rely heavily on the time lags being imposed. If δ_{2j} and/or δ_{3j} are found to be statistically significant and different from zero, we reject H_0 and acceptH_1. (Self and Grabowski, 2004) In testing for the causal impact of gender based education on growth the above equation is modified as

$$\Delta y_t = \delta_0 + \sum_{j=1}^{m1} \delta_{1j} \Delta y_{t-j} + \sum_{j=1}^{m2} \delta_{2j} \Delta z_{t-j} + \sum_{j=1}^{m3} \delta_{3j} \Delta x_{ft-j} + \sum_{j=1}^{m4} \delta_{4j} \Delta R_{ft-j} + e_{1t} \quad (2)$$

$$\Delta y_t = \delta_0 + \sum_{j=1}^{m1} \delta_{1j} \Delta y_{t-j} + \sum_{j=1}^{m2} \delta_{2j} \Delta z_{t-j} + \sum_{j=1}^{m3} \delta_{3j} \Delta x_{mt-j} + e_{1t} \quad (3)$$

where x_{ft} is female education and x_{mt} is male education.

Eq. (2) represents the impact of female education at a particular level on growth and Eq. (3) represents the same for males. The only difference between the above equations and Eq. (1) is seen in Eq. (2) where an additional variable, R_t is added. R_t is the total fertility rate and measures the number of children that would be born to a woman if she were to live to the end of her child-bearing years and bear children in accordance with prevailing age-specific fertility rates. The total fertility rate is introduced as a distinguishing factor for females in order to analyse how the addition of this variable, along with education, affects the outcome.

In this thesis, the analysis is also carried out with and without the addition of the total fertility rate in Eq. (2) in order to maintain uniformity. Inclusion the total fertility rate as an additional explanatory variable seems to bring the analysis closer to reality since females attending school at all levels could be affected by child-bearing particularly in a country where, students are typically seen to be over the age criteria and marriages usually occur at very low ages. (Self and Grabowski, 2004) Data on fertility are annual and provided by the World Bank's World Development Indicator.

3 Literature Review

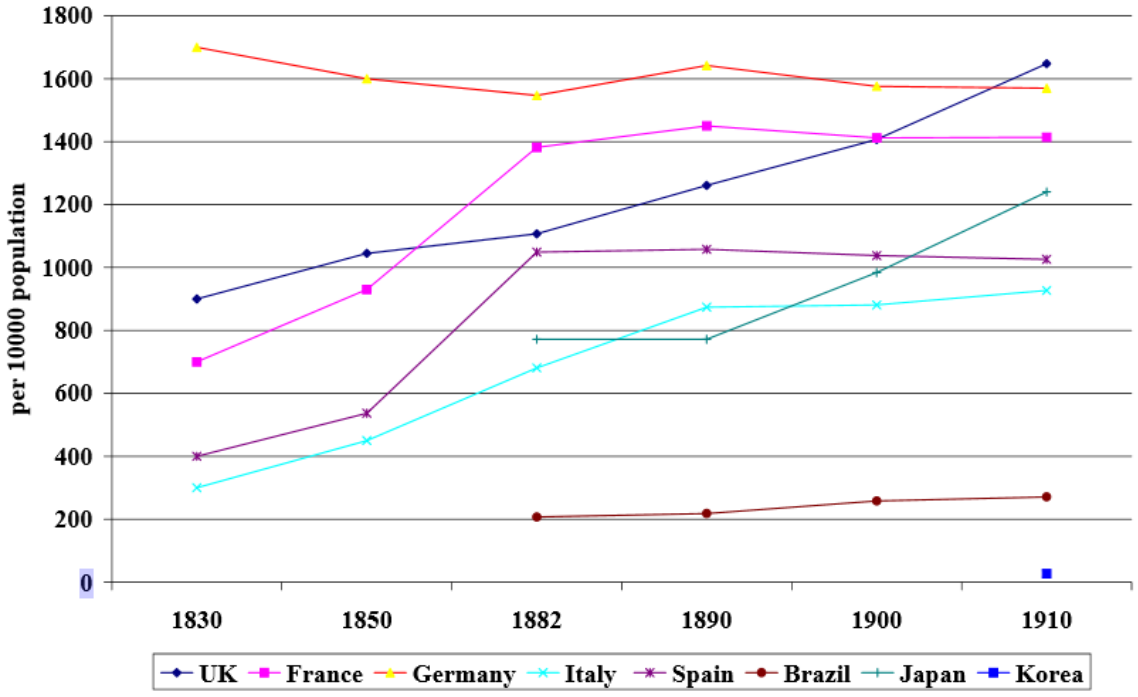
3.1 Development of education and literacy rates in the world

Some shapes of education has been existing since ancient times. In England there was quite a high degree of schools during the days of Queen Elizabeth, which was at the end of 16th century. (Stevens and Weale, 2003) On the other side the Austrian educational system was growing in the medieval monastic schools that prospered already at the end of the 11th century. The present state education system in Austria is based on the school reforms presented by Maria Theresa in 1774. The goal of this reform was system of compulsory education which came into the force in 1869 and was integrated by the Imperial Education Law. (Nations Encyclopaedia, 2011)

However the expansion of education mainly occurred in the last 200 years. In the United Kingdom elementary education did not become compulsory until 1870. Very limited free secondary education was introduced in 1907 and it was not until 1944 that universal free secondary education was introduced. Only a small minority profited from tertiary education until almost the end of the twentieth century. (Stevens and Weale, 2003)

Figure 1 shows the extension of primary education measured as the enrolment rate per 10000 population. The apparent lead of the North European developed countries such as UK, France and Germany can be seen. They held this lead throughout the period of years 1830 - 1910.

Graph No. 1: Primary school enrolment rates



Source: Stevens & Martin (2003)

Easterlin (1981) showed in 1850, that very little people outside North-Western Europe and North America had any formal education. This was still true in Africa, in much of Asia and Latin America until 1940. Glewwe & Kremer (2006) pointed out that developing countries have massively expanded their education systems in the last 40 years. Behind average figures on the remarkable expansion of schooling in developing countries lie educational miracles like Nepal, which increased primary enrolment from 10 % in 1960 to 80 % in 1990.

Behrman (1987) confirmed in his paper by his figures: "In 1960 the mean expected schooling for all 76 developing economies was 4.5 years, with a standard deviation of 2.6 years and a range from (1.3 to 10.5 years). By 1981 mean expected schooling had increased to 7.5 years, with a standard deviation of 3.0 years and a range from 1.4 to 13.7 years."

The spread of schooling amongst countries headed to a better educated population, but that was not the only purpose for extension of education. Stevens & Weale (2003) suggested that the spread of formal school seems to have preceded the beginning of modern economic growth. But in some countries the growth in schooling was not followed by the

growth in economic development. This results can be hypothetically described by Easterlin's evidence that the type of education is fundamental. For instance in Spain education was controlled by the Church, so students focused mostly on oral instruction in religion and a few manual skills. Accordingly illiteracy remained widespread despite of the level of school attendance. Easterlin (1981) argues that it was the combination of education and protestant Christianity which was responsible for the economic development of countries in North-Western Europe, at the time when there was little success in other countries.

3.1.1 Measuring the quantity of education

It follows that there exists the approaches of measuring quantity of education, a number of indicators can be defined. Glewwe & Kremer (2006) suggested that the most cited and the most widely available indicator is the gross enrolment rate. Gross enrolment rate is defined by these authors as the number of children enrolled in a particular level of education, regardless of age, as a percentage of the population in the age group associated with that level. The age range for primary school was set to 6 – 11 years.

Glewwe & Kremer (2006) also suggested an alternative measure of education, that being the net enrolment rate, "the number of children enrolled in a particular level of schooling, who are of the age associated with that level of schooling, divided by all children of the age associated with that level of schooling." In comparison to gross enrolment rate this indicator cannot exceed 100% and does not have the bias of the enrolment of "overage" children in a given level, which is caused in gross enrolment rates by repetition or delayed enrolment.

3.1.2 Education and UNESCO Goals

International organisations many times, with the aim to spread education to all children, young people and adults around the world. Objectives were first set at the inaugural 'World Conference on Education for All (EFA)' in Jomtien in 1990 and later reaffirmed by in the World Education Forum in Dakar in 2000. Representatives from all countries declared that "by 2015 all children of primary-school age would participate in free schooling of acceptable quality and that gender disparities in schooling would be eliminated." (UNESCO, 2002)

At the 2000 World Education Forum in Dakar delegates identified following six goals, which are targeted to satisfy the educational needs of all children, youth and adults by 2015: (UNESCO, 2002)

Goal 1 - Expanding and improving comprehensive early childhood care and education, especially for the most vulnerable and disadvantaged children.

Goal 2 - Ensuring that by 2015 all children, particularly girls, children in difficult circumstances and those belonging to ethnic minorities, have access to, and complete, free and compulsory primary education of good quality.

Goal 3 - Ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life-skills programmes.

Goal 4 - Achieving a 50 % improvement in levels of adult literacy by 2015, especially for women, and equitable access to basic and continuing education for all adults.

Goal 5 - Eliminating gender disparities in primary and secondary education by 2005, and achieving gender equality in education by 2015, with a focus on ensuring girls' full and equal access to and achievement in basic education of good quality.

Goal 6 - Improving all aspects of the quality of education and ensuring excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in

The EFA goals were evaluated in 2006, and a UNESCO report emphasized that literacy had been neglected and a higher importance was put on other EFA goals. At that time one-fifth of the world's adult population was without basic literacy skills. Most of them were from Sub-Saharan Africa and Asia. It was pointed out that "literacy is not prominent in most education plans and typically accounts for only 1% of public spending on education." The same report UNESCO (2006) looked at UNESCO's balance sheet and found out that aid to basic education is insufficient: "it still represents only about 2.6% of Official Development Assistance (and within this, aid for adult literacy is minuscule). It will fall far short of the US $7 billion a year estimated to be needed just for achieving universal primary education and gender parity." Aid is not allocated sufficiently to the countries with the greatest need.

UNESCO report in 2010 reviewed again the progress towards the Dakar education goals set in 2000. The report pointed out that to reach universal primary education, it is crucial to focus on getting girls into school. Between the years 1999 and 2007, out-of-school numbers for primary age children had decreased by 33million to 72million. The UNESCO

2010 report suggested that if an emphasis is not placed on marginalized groups, then potentially there could be 56 million children out of school by 2015. Some higher income countries will have to pay much more attention to their out-of-school population, because for example in the Philippines and Turkey the problem has been disregarded. Hence, they will have to target marginalized groups more systematically to deliver on the Dakar commitments. (UNESCO, 2010)

Despite the positive progress towards the EFA goals some of the poorer countries are still struggling to achieve universal school enrolment. New findings of UNESCO's researchers discovered that the official data might overestimate the number of children enrolled at school at the appropriate age due to late entry, drop out and also school attendance. A household survey showed that a number of countries are overestimating school attendance rate by 10% or more. (UNESCO, 2010)

Another issue presented in the UNESCO report 2010 was that out-of-school adolescents are frequently overlooked. Most of the effort was given towards attaining enrolment rates in primary school age children and the adolescent situation was a subject of less importance.

"There are some 71 million children of lower secondary school age currently out of school. Many have not completed a full primary cycle and face the prospect of social and economic marginalization. Counting adolescents doubles the global headline figure for out-of-school children."

UNESCO (2010) further focused on literacy statistics: "An estimated 759 million adults – around 16% of the world's population aged 15 and over – lack the basic reading, writing and numeracy skills needed in everyday life. More than half live in South and West Asia, and another one-fifth in sub-Saharan Africa. Reflecting the legacy of gender disparity in education, almost two in every three adult illiterates are female." The interesting fact about literacy rates' statistics is that only 20 countries account for 80% of global illiterates – including Bangladesh, China and Pakistan which make up over half of the total number. In conclusion UNESCO (2010) considered that the 2015 literacy target cannot be achieved on the current path. Hence it will require much more to be done to speed up the progress. A necessity will be stronger political leadership combined with governments which finally realise that investments in literacy have the possibility to create large returns to the society and also to the economy.

3.2 The Impact of educational levels on economic growth

Barro (1998) investigated in his analysis how important is an impact of number of years of schooling on the economic growth. His results suggested that the growth rate rose by 1.2% p.a. by only one extra year of education for men. In his framework countries with low incomes per capita tend to catch up with those with high incomes, Barro (1998) thus concluded that a total impact of education on growth is even bigger. Years of schooling have a positive impact on the rate of catch-up; hence for countries with a high level of education it is easier to absorb best-practice technology.

Krueger & Lindahl (2001) split countries into three groups based on education levels. In their analysis, a positive link between education and growth was found statistically significant, concerning only the countries with the lowest level of education. They examined a relationship between 'economic growth and years of education' and found that for low levels of education, education plays a contributing role towards growth, while for high levels of education, it slows down the rate of growth.

The role of different kind of education was also explored by Psacharopoulos & Patrinos (2004). They analysed a panel of 98 countries from the period of 1960 -1997 and found that: "the typical estimates of the rate of return from advanced schooling were substantially lower than those from primary schooling." The average public rate of return for primary education was 18.9 %, while for tertiary education it was just 10.8 %.

Wolff (2000) defined primary schooling as a level at which students gain the basic literacy and numerical skills that are necessary for all types of work. His results showed primary schooling as the most powerful variable for explaining growth in per capita income among countries at all levels of development.

His findings were not as positive in the case of secondary education, which was concluded as a very weak explanatory factor of productivity growth. However he further defended some types of higher education such as alternative institutional arrangements like worker based or employer-based training, apprenticeship programs, and technical education by stating that they may bear a stronger relation to productivity growth than average years of secondary schooling.

It seems that present development policy which has been applied by many countries was influenced by such as studies as that one written by Psacharopoulos & Patrinos (2004) and

Wolff (2000). Governments and major organizations *e.g.* UNESCO, put a big emphasis on primary education, while there is not as much attention paid to higher education.

3.2.1 The Impact of primary education and literacy on economic growth

Literacy has brought many benefits to society one of them being its impact on the economic development of many countries. Naudé (2004) is one of the authors who supported the positive effect of literacy. His analysis was applied on panel data for 1970-1990 for 44 African countries. He found that literacy is one of the variables which have a positive effect on GDP per capita growth. The relationship between literacy skills and economic growth was also investigated by Coulombe *et al.* (2004). He discovered that the 55% of differences in economic growth among OECD countries over 1960-1994 can be explained by differences in average literacy skills. It means that large economic returns could be yield by investing into raising the average level of skills. Moreover he found that direct measures of human capital based on literacy scores are performing better than years of schooling for the explanation of growth in output per capita per worker. The author further stated that economic benefits are more extensive with an increasing number of people with access to education. It can be also said that a country working on its development should focus on spreading strong literacy skills widely throughout its population because it will be more successful than countries with the large gap between high-skill and low-skill groups. Other authors considered that the impact of literacy on economic development is dependent on the initial level of literacy. Countries which went through rapid economic growth founded on technology transfers had first reached a literacy rate of at least 40 %. These findings are coming from work of Azardians & Drazen (1990) who called this event as a threshold effect. Sachs & Warner (1997) came up with a statistically significant S-shaped relationship. This relation depends on literacy rates and reached maximum effect, if these rates were neither very high nor very low. It means that economic growth might not be affected by small changes at high and low levels, but small changes at the intermediate levels do have a considerable impact. These small changes are typical for many developing countries.

Indirect impact of primary education on economic growth was elaborated by Colclough (1982), who concluded that labour productivity, which helps to achieve higher rates of economic growth, is increased by primary education. This works for both the urban and

rural sector. That was considered as a main reason for investment into education. Colclough (1982) names other benefits of education; such as a reduction of fertility, an improvement of health and nutrition and a promotion of other behavioural and attitudinal changes which contribute to economic development.

3.2.2 The Impact of higher education on economic growth

Despite Friedman and his wife Rose (1980) stated that there were no records proving that "higher education yields 'social benefits' over and above the benefits that accrue to the students themselves." They later hypothesized that higher education might promote "social unrest and political instability" and that higher education might create higher tax revenues, increase investment and savings, and lead to a more entrepreneurial and civic society. The following two presented studies are trying to challenge belief that tertiary education has only a small effect on economic development. Both studies were created in recent years and despite there being only a two year gap between them, authors intercepted different attitudes of the international development community. That might have been a sign of a positive progress in the community's strategies. In the study of Bloom & *et al.* (2006), authors described the attitude of organizations, such as the World Bank, and the major donor governments as being quite uninterested to the lack of higher education in developing countries. However the authors also said that they might start to rethink the importance of higher education. Two years later in a study written by Aziz Babar & *et al.* (2008) progress can already be seen in the organizations' and the governments' behaviour. The authors stated that "the developing countries realized that higher education is one of the most important means of scientific, technological and industrial progress which is a vital for economic development." It is interesting to discover that such as advancement in the attitudes to the higher education was made just in two years. Nevertheless this finding might be theoretically biased by that fact that the authors focused on different geographical areas in their analyses. Aziz Babar & *et al.* (2008) found a causal relationship between the system of higher education and employment rate and economic growth in Pakistan. Therefore, it was concluded that the system of higher education enrolment employment rates does have an impact on the GDPs. These findings supported their opinion that higher education plays an important role in the development of

any nations and that skill labour force participation rate is important with regard to their contribution to the economic growth.

Bloom & *et al* (2006) focused in their paper on Sub-Saharan Africa and reviewed evidence about the impact of tertiary education on economic development and poverty reduction. The authors suggested that this evidence highlighted higher education as a determinant and also as a result of income, and that higher education can produce public and private benefits.

The authors' analysis suggested that increasing tertiary education may be important in promoting faster technological catch-up and improving a country's ability to maximise its economic output. At the time of their study Bloom & *et al*. (2006) showed that the production level in Sub-Saharan Africa's was about 23 % below its production possibility. "Our analysis indicated that, given this shortfall, increasing the stock of tertiary education by one year would shift out Africa's production possibility frontier and increase the rate of convergence to that frontier, resulting in a 0.63 % point boost to income growth in the first year and an income gain of roughly 3 % after five years."

Another very unique study supporting the importance of higher education was introduced by researchers from the International Institute for Applied Systems Analysis (IIASA) and the Vienna Institute of Demography of the Austrian Academy of Sciences. This research analysed the role of schooling and as authors claimed the paper is "solving an old puzzle with new data." (IIASA, 2008)

The researchers defended secondary education by stating that this kind of education provides a clear boost to economic development, much more than can be achieved by universal primary education alone and therefore they considered universal primary education as an important but insufficient goal. Hence, the universal primary education must be accomplished with broad based secondary education to be likely to give poor countries that educated capital which is necessary to bring the bulk of population out of poverty. Tertiary education will play a key role in economic growth of industrialized countries.

3.3 The Indian History of education

The term education is commonly understood as developing the knowledge, skills and personal characteristics of individuals through learning both self-study and attendance in regular educational institutions or other, non-formal education centres, *etc*.

After independence the Indian Government made the first important act in the area of education. The Government appointed in December 1948 University Education Commission under the leadership of Dr. S. Radhakkrishnana. He was a significant researcher and former vice-rector of the University in Benares and later he became president of India. The Commission was in favour of introducing artistic and technical education and also recommended the adoption of three-year higher education.

Article 45 of the Constitution, which adopted a liberal India in the year 1950 provided to all children under 14 years of compulsory and free of charge education. The first five years Development Plan (1951 - 1956) spent 56% of the entire education budget on primary education. (Aggarwal, 2008)

In the year 1968 the Indian Government adopted a resolution on national education policy, in which concluded, that for the economic and cultural development of the country is necessary radical reform of education. It was required broad unified educational structure in all parts of the country. It was adopted Method according to the model of 10 years elementary school + 2 years preparation for university, higher secondary school + 3 university type. The two-year higher secondary degree can be studied in upper secondary schools, colleges, or both types according to the local situation. (Aggarwal, 2008)

In the year 1972 Ministry of Education and Social Care established a committee consisting of 11 members to propose practical steps in the implementation of this model in schools and universities of all states and union territories of the country. The committee's report has provided guide for introduction of a new model. Central Board of Secondary Education has adopted this model and at the end of 1977 was introduced in 19 States and union territories. The first attempt to reform the education system in India was made in 1985. At that time the Prime Minister Rajiv Gandhi declared that the new education policy would be set to the country economically and scientifically equipped to enter the 21st century.

3.4 The Indian Education system

The Indian education system consists of preschool, first, second, higher second, diploma and postgraduate degree. Preschool consists of a lower and higher kindergarten. In the higher kindergarten children learn already reading and writing.

In the first degree are children at the age of six to eleven years old and attend the first to fifth grade. In the secondary degree are students at the age of eleven to seventeen years old and attend the sixth to tenth grade. Sometimes grades six to eight are called middle and eight to ten grades are referred to as a secondary school (high school). (National Portal of India, 2015)

Higher education in India is specialized by field of study and consists of many technical schools, colleges and universities. Indian schools are under the control of many organs, such as *e.g.* the Central Board of Secondary Education - CBSE, Indian School Certificate Examinations - Cisco, the government's Council of State, the National Open School and International schools. These schools operate under the Central University, which is not financed by the state government but is financed by the Central Government. Higher education in India falls under the control of the Ministry for Human Resource Development and receives finances from the national governments.

Table No. 1: The Indian Education

Preschool education	Primary education		Secondary education	Tertiary education	
	First degree	Second degree	Higher secondary school	Bachelor degree	Master degree
	1. - 5. grade	6. - 10. grade	10. - 12. grade	3 years	
	alternatively				
	1. - 3. grade	6. - 8. grade	Preparation school for university	The Artistic studies	
	4. - 5. grade	9. - 10. grade	Apprenticeship training	The Technical studies	

Source: own elaboration, based on National Portal of India, 2015

Elementary school in India is the basis on which depends development of every citizen and the entire nation. However, to ensure the basic education available for all is a big problem, because the number of the country's population is growing very rapidly. Even though national governments cooperate closely with central government in order to achieve the goals of 100 % literacy and the development of the country. The most important step the Government did, that primary education until the age of fifteen years is free and compulsory. Despite all the efforts of the Indian government remains primary education for all just a dream. This is due to persistent poverty, rapid increase of population and the many prejudices that are still common in Indian society. (National Portal of India, 2015)

Many children leave school before completing primary school. In the school year 1996 - 1997 was the All India average of 38.95%, of which 39.37% boys and 38.35% girls who have completed primary school. In the school year 2000-2001 was the All India average 40.67% from what it was 39.7% of boys and 41.9% of girls who have completed primary school. These figures can be observed slightly deteriorating trend. This is the largest problem in the countries that are lagging behind in education, for example. Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Jammu and Kashmir, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh and West Bengal.

Elementary School - first stage

At the end of each school year are the final exams and according to its result it is decided whether the child will be referred to a higher class or not.

Elementary School - second stage

The main subjects at the second stage are languages, social sciences (history, industrial development), natural sciences (astronomy, gravity, friction, and physics), mathematics, art and music, working class (*e.g.* knitting, work with wood and metal, agricultural work, sewing, practice in workshops, *etc*.) and physical education.

Language teaching includes learning the local language and the official language of India, *i.e.* Hindi. For example in the state of West Bengal is taught Bengali as the local language and as a second is taught Hindi. In addition to these mandatory language the students can learn other languages, *e.g.* English. In union states (Andaman and Nicobar Islands, Chandigarh, Dadar and Nagarhavélí, Daman and Diu, Lakshadweep, Pondicherry, The National Territory of Delhi), where Hindi is the official language, the students have to learn two languages namely Hindi and English.

At the end of the ninth grade, a students must take an obligatory final exam, which is controlled by the Central Board of Secondary Education (CBSE). CBSE is an independent body that operates under the auspices of the Ministry of Human Resource Development. This commission is the oldest in India and was founded in 1929. The main activities of CBSE are:

- Implementing the annual examinations at the end of the tenth and twelfth grade (Preparatory School for the university)
- Implementation of entrance exams to professional courses for admission to universities medical and engineering.
- Updating and description of the curriculum of each school.

Throughout India, there are about 8,300 schools that are in the CBSE system and it represents most of all schools.

Preparatory school for the university

The aim of this school is for students to obtain further knowledge, skills and to gain a general overview of the subject of study that the student will be studying as his future field of study. Indian universities offer study of various professional directions in the following fields:

- Engineering and Technology
- Fields of medical, dental, nursing, pharmacy and branches of alternative medicine
- Study of computer technology, information technology, biotechnology and bioinformatics
- Agriculture / veterinary science, technology, dairy processing, fisheries
- Art-industries, humanities, social sciences, business, scientific management
- Hotel management, catering technology, tourism sectors
- Fashion design and technology.

Higher education

Higher education is offered at universities, art colleges that award an academic diploma. Studies and courses cover a wide range of subjects, from computer engineering to space research. Professional higher education in India is monitored by senior authority and is indirectly controlled by the Ministry of Human Resource Development.

3.5 The Education and Economic Growth in India

Kingdon (2007) provides a critical overview of school education in India. He compares India's educational achievements in international perspective. While India does relatively better than its South-Asian neighbours Pakistan and Bangladesh, it lags noticeably behind the other countries with which it is increasingly compared, such as BRIC countries and Sri Lanka and is also behind the average for developing countries. It is striking, that adult literacy rate is similar and female adult literacy rate lower than of the Sub-Saharan Africa. India's adult literacy rate in the early 2000s was 30 % points below that of China, in youth literacy rates below 22.5 % points. Especially in terms of secondary school participation is India at a large disadvantage with BRIC countries and China.

Self & Grabowski (2004) focused on the impact of different education level's on India's economic growth. Their study is built on premises, whether changes in education are responsible for or cause changes in economic growth and if the tested relationships change when the population is segregated by gender. To measure education they used enrolment ratios as a proxy for a flow of human capital. Another measurement is the change on the mean years of education at each level as a growth rate of a human capital. The time period of the study covers 30 years. From the data is clear that there is a large and persistent difference between male and female enrolment ratios.

The results indicate significant positive correlations between the various levels of education and growth, whether one uses enrolment or human capital stock as a measure of education. They calculated that primary education is not just strongly correlated with growth but it has a strong casual impact on growth as well. But they found that there is some difference between the primary and secondary level in terms of their impact on economic growth. The lack of any impact from human capital stock at the secondary level reduces the reliability of the estimate of the impact of the enrolment rate variable.

When the data are segregated by gender, the results do not change much at the primary level. At the secondary education it appears that the enrolment rate variable shows a casual impact on growth for males at a reduced significance level while the change in human capital stock of males shows no casual impact. However, both the female enrolment rate variable and the change in human capital stock show a casual impact on growth. It has been found that evidence of a casual impact of the female population receiving tertiary education, but not such evidence exists for males. It appears that females, who are

underrepresented in enrolment rates and in the accumulation of human capital stock at all education levels in India, are the ones having not just a strong correlation with the country's growth, but having some predictive powers over growth as well.

This study utilized "Granger causality" to analyse the predictive powers of each level of education on future growth in the presence of its own lagged values. The results showed, that education, which in correlation analysis indicated a strong positive relation between all education levels and growth, is casual only at the primary and secondary level. In terms of gender the results showed that female education at all levels has potential for generating economic growth. Males, on the other hand, appear to have a causal impact on growth only at primary level and perhaps, weekly, at the secondary level.

Kingdon (2007) examines schooling access in terms of enrolment and school attendances rates, and schooling quality in terms of literacy rates, learning achievement levels, school resources, and teacher inputs. He finds that there are several positive sides to India's educational development. Its primary school enrolment has come close to being universal and literacy rates have risen encouragingly in recent times. However, Indian achievements in other respects leave much to be desired. First, primary school attendance rates are very low in the populous northern states of Bihar and Uttar Pradesh. Second, secondary school participation is still low and unequally distributed. Since economic incentives for acquiring secondary schooling are high, demand for secondary schooling is likely to be strong, suggesting that greater participation is hindered by a combination of constrained supply of secondary schools, household credit-constraints, and conservatism about gender roles. Third, learning achievements in both primary and secondary schooling are very low, signalling poor-quality schooling. Last, and relatedly, school facilities/inputs are low and teacher absenteeism is high.

Kingdon (2007) investigates also the role of private schooling in India, examining the extent of growth of private schooling and surveying evidence on the relative effectiveness and unit costs of private and public schools. The size of this sector is greatly under-estimated in official published statistics, particularly at the primary level, owing to excluding 'unrecognized' schools, given that more than 50 % of all private primary schools are unrecognized. Even if we ignore the numerous unrecognized schools and look instead at recognized schools only, it is clear that the private schooling sector is growing extremely rapidly in urban areas and more slowly in rural areas. Household data offer a truer picture,

and they show that private schooling has grown rapidly over time. It is clear that private schooling is used by poor families, too. The literature on the relative effectiveness of private and public schools in India suggests that, controlling for student background, private schools are more effective in imparting learning and do so at a fraction of the unit cost of government schools. The major reason for private schools' massive cost advantage over public schools is that they can pay market wages while government school teachers' bureaucratically set salaries have large rents in them which teacher unions have fought hard to secure. The spread of fee-charging private schooling represents growing inequality of opportunity in education. Also, the pattern of growth of private schooling in urban areas (fastest at the primary level, slower at the middle and secondary levels) gives cause for equity concerns, since the children of the poor are best represented at the primary level of education and progressively less well represented at further levels.

Kingdon (2007) discusses some major public education initiatives. The Sarva Shiksha Abhiyan, MDM scheme, and the para-teacher scheme were each discussed briefly. Unfortunately, the impacts of these massive interventions (or of their sub-components) on children's school attendance and learning outcomes have not been rigorously evaluated. This is necessary if decision-makers are to hone future education policy-making in the light of knowledge about the cost-effectiveness of alternative interventions. Moreover, radical measures to improve teacher and school incentives have not been considered in India, perhaps because they stand to upset powerful vested interests. While the existence of fiscally demanding education initiatives and the introduction of the 3 % education cess to fund them testifies to the Indian government's increased commitment to school education and gives grounds for optimism about the future, serious challenges remain.

Tilak (2007) used most recent statistics to prove that presumption that secondary and higher education is not necessary for economic growth and development is not valid and that post-elementary education is important for reduction in poverty, in improving infant mortality and life expectancy, and for economic growth.

His paper aims at an examination of the relationship between post-elementary education and development, particularly poverty and other aspects of social and human development in India.

Based on state-wise data on stock of the population with secondary and higher education in 1995–1996 and development indicators relating to mostly around 1999–2000, and simple

regression equations, the relationship between post-elementary education and development is analysed. Despite some of the limitations of such exercises such as—they may indicate more of inter-relationship than causal relationship, it may not be wrong to conclude from the analysis the following:

(a) Secondary and higher education enhances earnings of the individuals and contributes to economic development.

(b) Post-elementary education makes a significant contribution to reduction in absolute as well as relative poverty.

(c) It also influences negatively the infant mortality rate.

(d) Life expectancy is also positively related to post elementary education.

The implications of Tilak (2007) empirical results are clear and straight forward: given the importance of post elementary education, along with literacy and elementary education, it is necessary that attention is paid to the development of sound and comprehensive education policies. Though the contribution of secondary and higher education to development is quite significant, India, like many other developing countries has not paid adequate attention to it. In fact, there has been a strong tendency to neglect secondary and higher education and to focus, rather exclusively on elementary, more particularly primary education. As a result, primary education is nearly universal in India, but the enrolment ratios in secondary and higher education are very small. The gross enrolment ratio in secondary education is 37.5% and that in higher education less than 9% in 2002–2003. The growth in enrolment ratio in secondary education also picked up only since the beginning of the 1990s. Otherwise the overall growth is somewhat flat during the 50 and odd years of development planning in India. Public policy has to clearly recognize not only the basic foundation that primary education provides for development, but also the critical importance of secondary and higher education in development, in poverty reduction, human development and economic growth. Coherent long-term policies for the development of education, including secondary and higher education, for development of the economy are critically needed.

Duraisamy (2002) provides estimates of the returns to education in wage employment and evaluates the changes in returns using data from a large national level household survey. The estimates show that the returns to education increase up to the secondary level and decline thereafter. There is evidence of substantial gender and rural–urban differences in

the returns to schooling. Investment in women's education, particularly at the middle, lower secondary and higher secondary levels, is more profitable than that for men in 1983 and also in 1993/4. The returns to women's primary and middle levels of education have declined while those to secondary and college levels have increased during the decade 1983–94.

The purpose of his paper is to estimate the returns to education for workers in wage employment, by gender, age cohort and location (by rural–urban), for the most recent period 1993/4, and also to evaluate the changes in returns over a period of time from 1983–94.

His paper estimates the private returns to education in India for persons in wage employment by gender, age-cohort and location using the Mincerian earnings function method. The changes in the returns over the period 1983 to 1993/4 are also examined using the national level NSS data. The major findings of this study are the following: First, one of the benefits of education is that it enables one to enter into regular wage work. Duraisamy (2002) results show that higher levels of education, particularly a college degree, significantly increase the likelihood of entering into wage employment. Second, for those in wage employment the private rate of return per year of education increases as the level of education increases up to the secondary level and then declines thereafter. Technical diploma/certificate fetches higher reward than college education. This implies that expansion of junior secondary education and technical institutions would be more rewarding. The low returns to primary education may be due to the declining quality of primary education in India and this implies an urgent need to increase the quality of primary schooling. It should be noted that there are other major benefits of primary education such as the high returns to basic education of farmers in the rural areas and substantial gains in non-market activities especially for women that are not captured in our returns estimates. Third, the returns to women's education exceed that to men's at the middle, secondary and higher secondary levels. Especially at the secondary level, the returns to additional schooling of women is over twice as large as the corresponding returns for men. Four, the younger age cohorts (15–29 and 30–44) receive lower returns to additional year of education at the primary, middle and secondary levels than the older age cohorts. In the case of college degree and technical diploma, wage workers in the 15–29 age group obtain higher returns compared to the others. Five, a striking finding on the

variation in returns by rural–urban residence is the higher returns to education to those residing in rural than in urban areas for primary and secondary levels and for technical diploma. The rewards for higher secondary and college education are higher for the urban compared to the rural residents. Both the rural and the urban labour markets offer higher returns to women's middle, secondary and higher secondary education than that to men. Lastly, there is evidence of considerable change in the reward for education, particularly for women, between 1983 and 1993/4. The returns to women's education for primary and middle levels have declined while those for secondary and college levels have increased during the decade 1983–94. The absolute returns to women's middle and secondary education are higher than to men in both the periods.

Dréze & Murthi (2001) examines the determinants of fertility in India in a multivariate framework, using district-level panel data. Women's education and child mortality emerge as the most important factors explaining fertility differences across the country and over time. By contrast, general indicators of modernization and development such as urbanization, poverty reduction and male literacy bear no significant association with fertility decline.

They have explored that female literacy has a negative and highly significant effect on the fertility rate and the size of this coefficient is quite stable. The robustness of this coefficient suggest that it is driven by a direct link between female education and fertility.

4 Practical Part

4.1 Introduction of the model

In this model, the dependent variable is GDP per capita. In the practical part will be tried to explain the GDP per capita in terms of education and human capital stock at all levels and with both genders and fertility rate will be added.

Where:

Endogenous variable is: Y = GDP (per capita) (constant 2005 US$)

Exogenous variables are:

X1 = Unit vector

X2 = Capital Stock at Constant National Prices (Millions of 2005 US$)

X3 = Gross School enrolment primary (%) total

X4 = Gross School enrolment secondary (%) total

X5 = Gross School enrolment tertiary (%) total

X6 = Gross School enrolment primary (%) Female

X7 = Gross School enrolment secondary (%) Female

X8 = Gross School enrolment tertiary (%) Female

X9 = Gross School enrolment primary (%) Male

X10 = Gross School enrolment secondary (%) Male

X11 = Gross School enrolment tertiary (%) Male

X12 = Average years of total schooling Female

X13 = Average years of primary schooling Female

X14 = Average years of secondary schooling Female

X15 = Average years of tertiary schooling Female

X16 = Average years of total schooling Male

X17 = Average years of primary schooling Male

X18 = Average years of secondary schooling Male

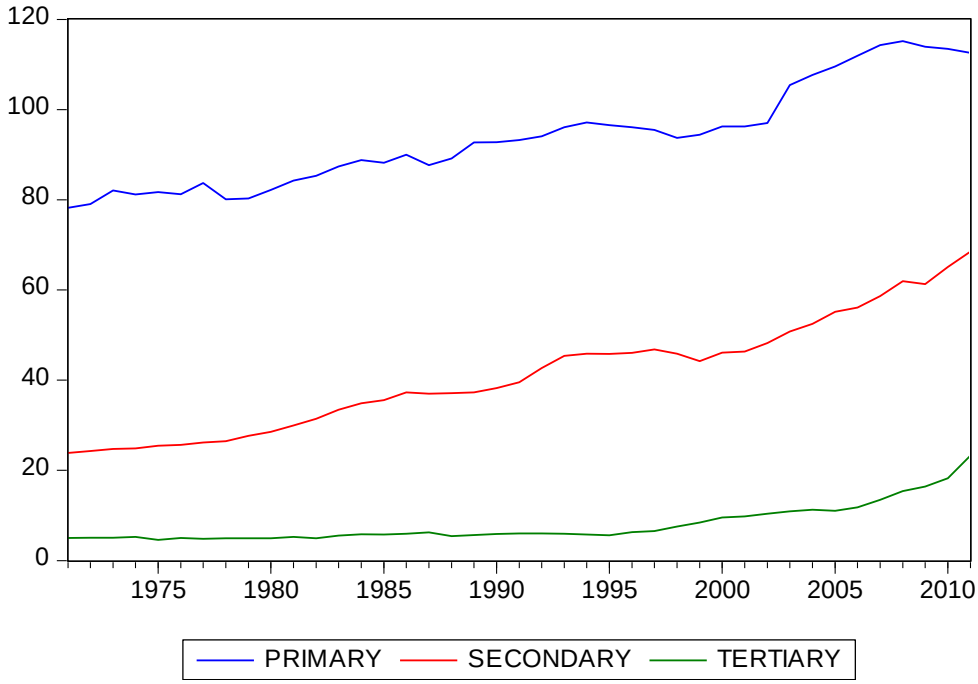
X19 = Average years of tertiary schooling Male

X20 = Fertility rate, total (births per woman)

4.2 Statistical description of variables

Enrolment rates are a suitable measure of education levels, however they do have some limitations. For example, gross enrolment rates are not limited by age requirements or repeaters. Enrolment rates can actually exceed 100% as can be seen in the graph no. 2. However, in a country where compulsory education is not enforced, net enrolment ratios based on specific ages lead to greater measurement error by not including students who fall outside certain age guidelines. (Self and Grabowski, 2004) In the graph no. 2 is displayed gross enrolment rates for primary, secondary and tertiary education in India. Children starts primary education at age 6 in India, there may be students which did not attend at this age but at the age 8 or 9 and therefore enrolment rates are more than 100 %. Gross enrolment rate reflect only attendance and do not reflect the quality of education. The number of students at secondary level is very low below 60 %. The reason may be the expectation of female students to help their parents or to take care of their babies *etc*. In the year 2000 can be seen increasing tertiary education and it may be caused by the technological progress.

Graph No. 2: Development of Gross Enrolment Rate

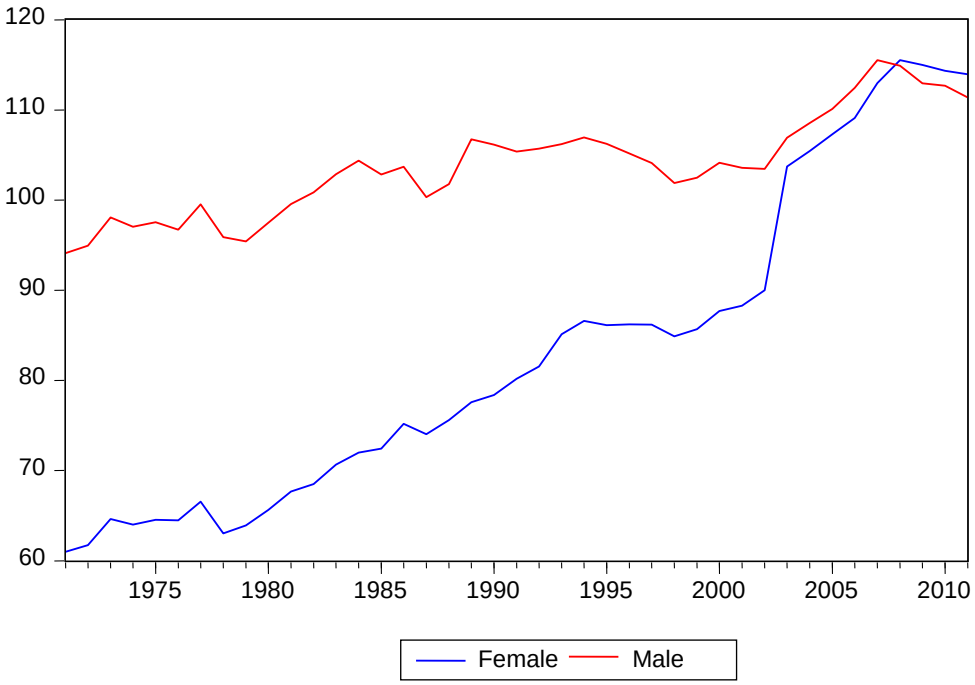


Source: own compilation based on data from World Bank 2015

In the graph no. 3 is displayed the difference between male and female enrolment rates at the primary level. The gap was very huge between the years 1971 and 2003, but from the year 2004 the gap started to diminish and since the year 2009 women has higher enrolment

than men. It is mostly because governments and people generally start to have an awareness that females has to be educated, because it brings a bright future to the families and also nation as whole.

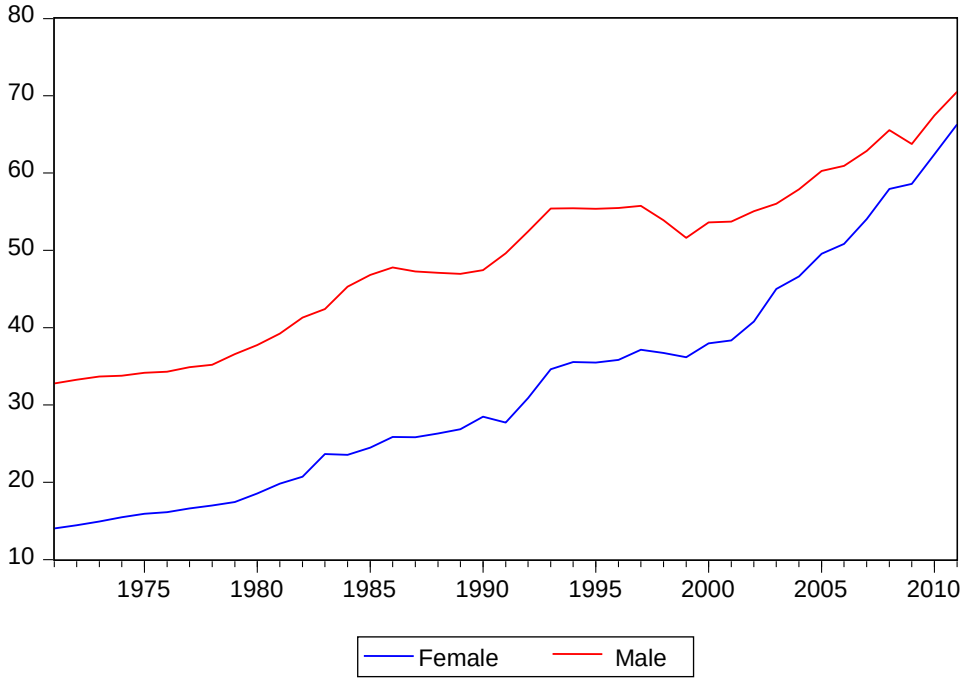
Graph No. 3: Male and Female Enrolment at Primary Level



Source: own compilation based on data from World Bank 2015

In the graph no. 4 is shown enrolment rates segregated by genders at the secondary level, where the blue curve represents female enrolment and red curve male enrolment. It can be seen again a gap between men and women. Even though the gap is narrowing down it still remain fairly constant and does not catch up with men education. Females are at this age forced to get married and have babies, therefore also parents of this females are afraid to send their female child to school.

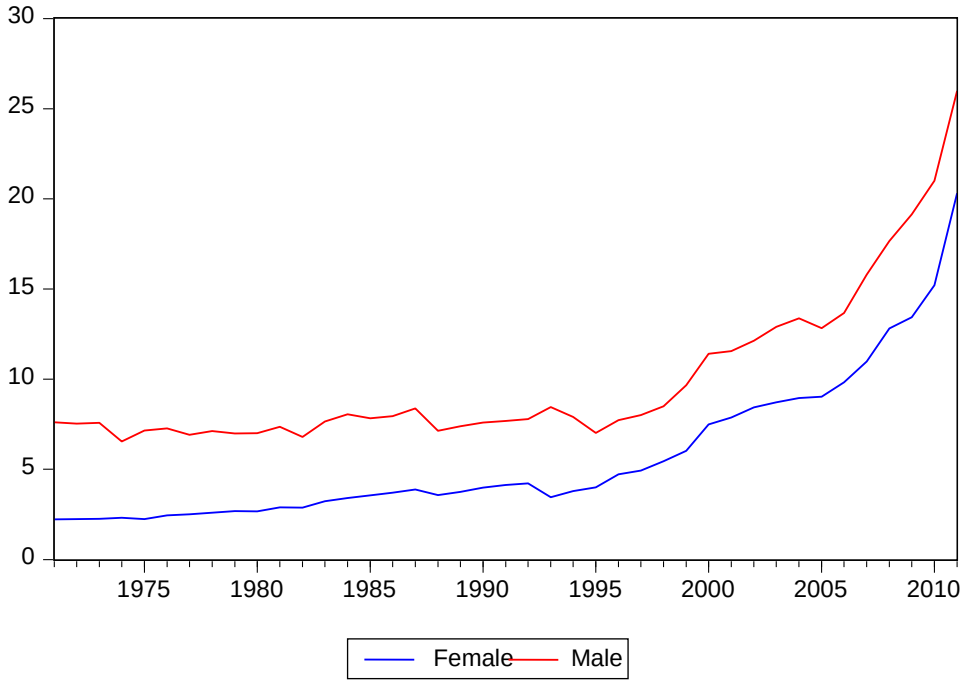
Graph No. 4: Male and Female Enrolment at Secondary Level



Source: own compilation based on data from World Bank 2015

In the following graph no. 5 is displayed the constant gap between male and female education at the tertiary level.

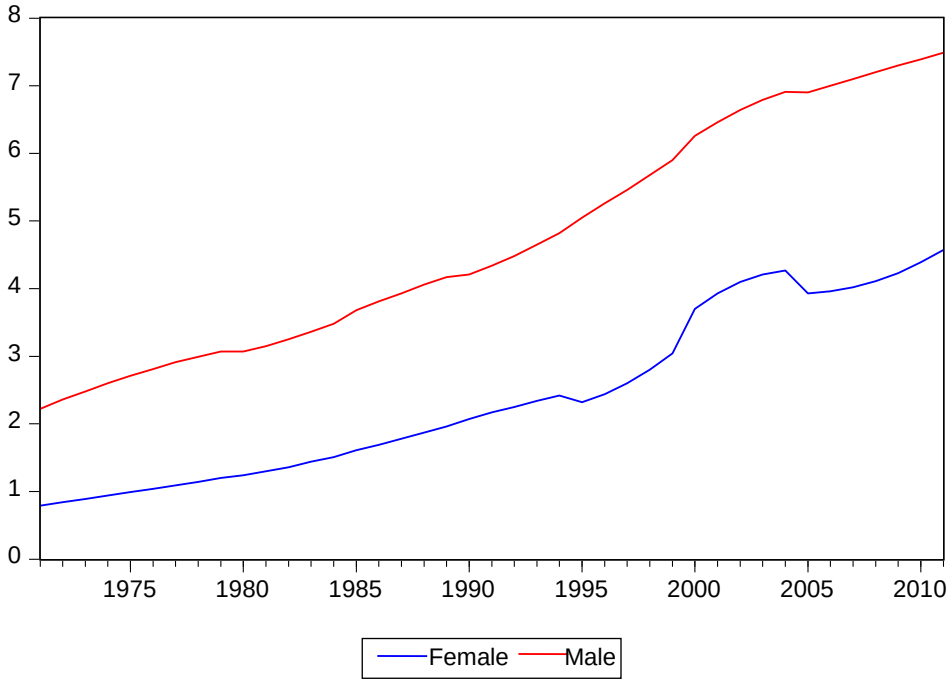
Graph No. 5: Male and Female Enrolment at Tertiary Level



Source: own compilation based on data from World Bank 2015

Following variables represent the stock of human capital. Human capital stock is measured in relations to the educational attainment, that is, the average years of a particular level of education of the population aged 15 and above. (Self and Grabowski, 2004) It can be seen from the above graphs that the human capital stock measure is typically lower than the enrolment rates. One possible explanation for this could be that new participants to the labour force are only a small fraction of those in work, hence, even large changes in enrolment rates take a much longer time to affect the average attainment level of the average population to any noticeable level. (Self and Grabowski, 2004) In the graph no. 6 is shown that the average years of education total is higher for males as compared to females.

Graph No. 6: Human Capital Stock Level, total

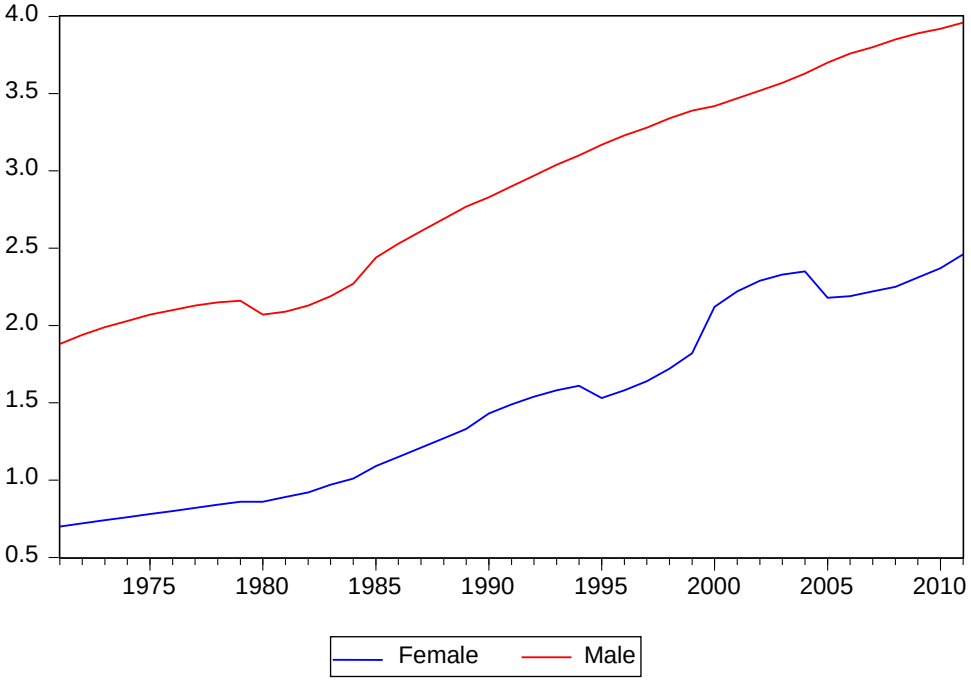


Source: own compilation

In the graphs no. 6, 7, 8 can be seen a historical events between the years 1995 and 2005. In 1992, the country suffered severe financial crisis and its foreign exchange reserves were almost exhausted. Finance Minister Sinh therefore enforced radical austerity measures and the government finally approved a program of economic liberalization, initiated privatization of loss-making public sector enterprises, and to facilitate the intrusion of foreign capital in some sectors. But he has failed to form a government, so his position takes in June 1996 D. D. Gauda leader of one division of Janata Dal. In late March 1997

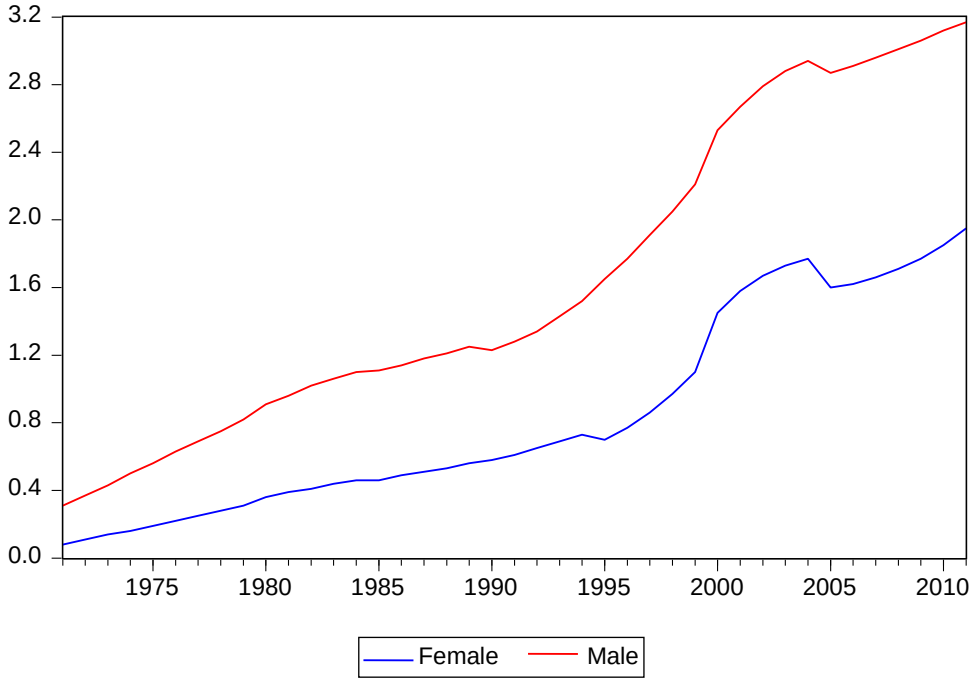
the Indian National Congress (INC), stopped supporting the government and prospects for reforms of the Indian constitutional arrangement shifted indefinitely. Another election was held in March 1998, it has increased the impact of Bharatiya Janata Party (BJP) and prime minister was again appointed Atal Bihari Vajpayee. In 1999, new elections, wins again Bharatiya Janata Party (BJP), nothing changes. A very serious problem with the new government remained Kashmir and related to it also the relations with Pakistan. On 13th of December was in New Delhi the assassination attempt on the entire state leadership, which India marked as a clear attack from Pakistan, and so the focus of the conflict continued until the second half of 2002. The appearance of Bharatiya Janata Party (BJP) was accompanied by fears that this party brings an anti-Muslim movement that could lead to a new wave of religious riots. In February and March 2001 were those storms in Gujarat.

Graph No. 7: Human Capital Stock at Primary Level



Source: own compilation

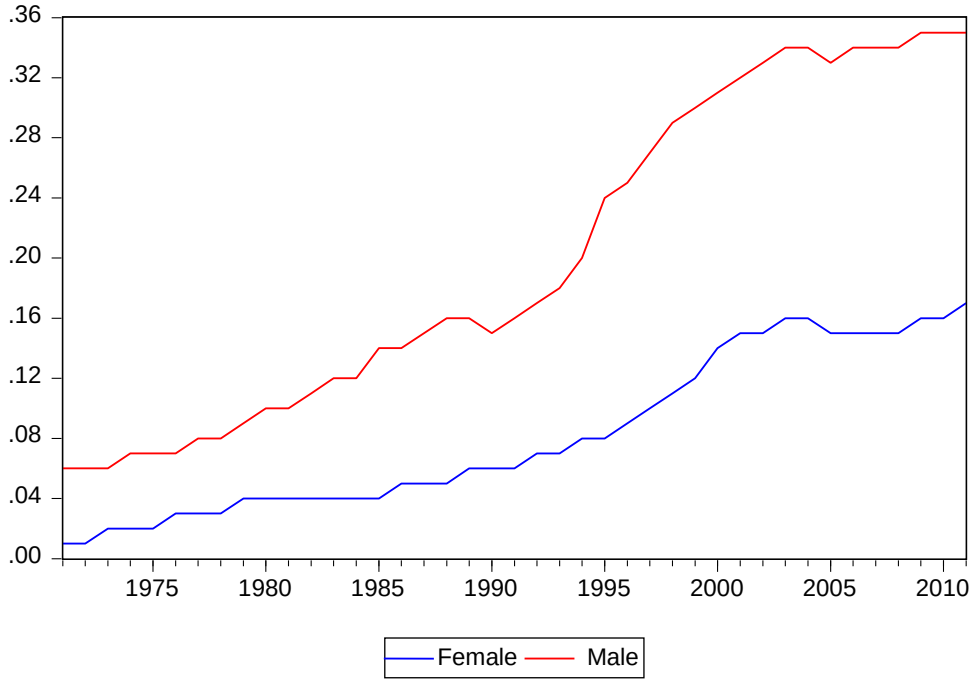
Graph No. 8: Human Capital Stock at Secondary Level



Source: own compilation

In the graph no. 9 can be seen the gap of human capital stock between male and female at the tertiary level. Surprisingly the gap was the same but from the year 1995 start to increase along with the increase of the education.

Graph No. 9: Human Capital Stock at Tertiary Level



Source: own compilation

4.3 Lag selection

In the table no. 2 can be seen the selection of lagged variables for general education. The software EViews indicated that the Final prediction error test and the Akaike information criterion predicted, that it should be used the third lagged variables. The Schwarz information criterion and the Hannan – Quinn information criterion predicted that it should be incorporated the second lagged variables. Usually, both SIC and AIC select the same variable but in this case they selected another, therefore it is needed to estimate both of them and check for Q test and LM test or Normality test.

Table No. 2: Lag selection for general education

VAR Lag Order Selection Criteria
Endogenous variables: Y X2 X3 X4 X5
Exogenous variables: C
Date: 02/06/16 Time: 13:41
Sample: 1971 2011
Included observations: 38

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	-998.8089	NA	6.06e+16	52.83205	53.04752	52.90871
1	-720.5214	468.6947	9.97e+10	39.50112	40.79396	39.96110
2	-672.6652	68.00609*	3.22e+10	38.29817	40.66836*	39.14147*
3	-640.8295	36.86242	2.72e+10*	37.93840*	41.38594	39.16501

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SIC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: own compilation

In the following table no. 3 can be seen the selection of lagged variables for female education. The software EViews indicated that all the test suggested, that it should be used the second lagged variables. In the table no. 4 is displayed the selection of lagged variables for male education. It can be seen that it should be used the second lagged variables as well.

Table No. 3: Lag selection for female education

VAR Lag Order Selection Criteria

Endogenous variables: Y X2 X6 X7 X8 X12 X13 X14 X15 X20
Exogenous variables: C
Date: 03/18/16 Time: 18:07
Sample: 1970 2011
Included observations: 39

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-607.5860	NA	26.90788	31.67108	32.09763	31.82412
1	29.18151	914.3328	3.50e-11	4.144538	8.836635*	5.828022
2	202.0298	159.5523*	2.54e-12*	0.408727*	9.366367	3.622651*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: own compilation

Table No. 4: Lag selection for male education

VAR Lag Order Selection Criteria
Endogenous variables: DLNY DDLNX2 DLNX9 DLNX10 DLNX11 DLNX16 DLNX17 DLNX18 DLNX19
Exogenous variables: C
Date: 03/18/16 Time: 18:50
Sample: 1971 2011
Included observations: 37

Lag	LogL	LR	FPE	AIC	SC
0	858.9125	NA	9.03e-32	-45.94121	-45.54937*
1	943.4100	123.3208*	8.46e-32	-46.13027	-42.21182
2	1043.421	97.30804	7.07e-32*	-47.15790*	-39.71284

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: own compilation

4.4 Causality between General Education and Economic Growth

$$dlny = dlny_{t-1} + dlny_{t-2} + dlny_{t-3} + ddlnx_2 + ddlnx_{2t-1} + ddlnx_{2t-2} + dlnx_3 + dlnx_{3t-1} + dlnx_{3t-2} + dlnx_{3t-3} + dlnx_4 + dlnx_{4t-1} + dlnx_{4t-2} + dlnx_{4t-3} + dlnx_5 + dlnx_{5t-1} + dlnx_{5t-2} + dlnx_{5t-3}$$

In the following table No. 5 is tested the impact of general education on economic growth according to the above equation of granger causality. As it can be seen in the appendix after the first differencing becomes variables GDP per capita, Gross School Enrolment primary, secondary and tertiary stationary. But the variable Capital Stock becomes stationary after the second difference. In the following table No. 5 are shown null hypotheses, if the p-value is * 0. 05 and less than the null hypothesis can be rejected at the 0. 05 significance level and the alternative hypothesis is accepted. If it is less than**0, 01 than we accept the alternative hypothesis at the 99% significance level. In the table can be seen that the alternative hypothesis DLNY is causing DLNX5 is accepted at the 0. 01 significance level. Implying that GDP per capita causes gross school enrolment tertiary total with 99% probability being true. The alternative hypothesis DLNX2 causes DLNY can be accepted at the 0. 01 significance level, implying that Capital Stock causes GDP per capita with 99% probability of being true. The alternative hypothesis DLNX2 causes DLNX5 is accepted at the 0. 05 significance level, implying that Capital Stock causes gross school enrolment tertiary total with 95% probability of being true.

Table No. 5: Granger causality between general education and growth

Pairwise Granger Causality Tests
Date: 03/20/16 Time: 14:31
Sample: 1971 2011
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DLNX3 does not Granger Cause DLNY	38	0.40254	0.6719
DLNY does not Granger Cause DLNX3		0.16110	0.8519
DLNX4 does not Granger Cause DLNY	38	2.15631	0.1318
DLNY does not Granger Cause DLNX4		0.15896	0.8537
DLNX5 does not Granger Cause DLNY	38	0.36662	0.6959
DLNY does not Granger Cause DLNX5		5.58183	0.0082
DLNX2 does not Granger Cause DLNY	38	7.89649	0.0016
DLNY does not Granger Cause DLNX2		1.01303	0.3741
DLNX4 does not Granger Cause DLNX3	38	0.16839	0.8457
DLNX3 does not Granger Cause DLNX4		0.44227	0.6463

DLNX5 does not Granger Cause DLNX3	38	0.47779	0.6244
DLNX3 does not Granger Cause DLNX5		2.48224	0.0990
DLNX2 does not Granger Cause DLNX3	38	0.78468	0.4646
DLNX3 does not Granger Cause DLNX2		1.43903	0.2517
DLNX5 does not Granger Cause DLNX4	38	0.04084	0.9600
DLNX4 does not Granger Cause DLNX5		1.68598	0.2008
DLNX2 does not Granger Cause DLNX4	38	0.24378	0.7851
DLNX4 does not Granger Cause DLNX2		2.28408	0.1177
DLNX2 does not Granger Cause DLNX5	38	5.29809	0.0101
DLNX5 does not Granger Cause DLNX2		0.16114	0.8518

Source: own compilation

Next are represented results which show a long term relationship between economic growth and the remaining variables. Here it can be seen that the significant p-values are lower than 0.01 so we can say that those variables had 99% probability to be significant. In the table no. 6 can be seen that variables Capital Stock and Gross School enrolment tertiary positively affects economic growth in the long term.

Table No. 6: Cointegration between general education and growth

Dependent Variable: DLNY
Method: Fully Modified Least Squares (FMOLS)
Date: 03/26/16 Time: 21:29
Sample (adjusted): 1974 2011
Included observations: 38 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DDLNX2	3.099346	0.754997	4.105111	0.0002
DLNX3	0.100647	0.235271	0.427793	0.6716
DLNX4	0.000440	0.185331	0.002372	0.9981
DLNX5	0.179459	0.057488	3.121695	0.0037
C	0.022926	0.006727	3.408231	0.0017

R-squared	0.285236	Mean dependent var	0.036369
Adjusted R-squared	0.198598	S.D. dependent var	0.030607
S.E. of regression	0.027400	Sum squared resid	0.024774
Long-run variance	0.000612		

Source: own compilation

In the following table is testing Q statistics, which checks if there is autocorrelation in the results. Whether we have above 0, 05 we can reject the Null hypothesis which means that our data are stationary while combining all the variables. Since the p-value is greater than 0.05 we reject the existence of autocorrelation. Therefore, the granger causality and the Cointegration result we found can be reliable interpreted.

Table No. 7: Q statistics of general education

Date: 02/06/16 Time: 16:28
Sample: 1971 2011
Included observations: 37
Q-statistic probabilities adjusted for 3 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. | . |	. | . |	1	-0.015	-0.015	0.0092	0.923
.*| . |	.*| . |	2	-0.170	-0.170	1.2011	0.549
.*| . |	.*| . |	3	-0.073	-0.081	1.4290	0.699
**| . |	**| . |	4	-0.268	-0.312	4.5793	0.333
. |*. |	. |*. |	5	0.175	0.141	5.9579	0.310
. |*. |	. | . |	6	0.145	0.042	6.9346	0.327
. | . |	. | . |	7	-0.035	-0.011	6.9940	0.430
. | . |	. | . |	8	0.036	0.015	7.0599	0.530
.*| . |	.*| . |	9	-0.188	-0.112	8.8836	0.448
.*| . |	.*| . |	10	-0.089	-0.068	9.3029	0.504
.*| . |	**| . |	11	-0.078	-0.210	9.6407	0.563
.*| . |	.*| . |	12	-0.116	-0.195	10.419	0.579
. |*. |	. | . |	13	0.163	0.002	12.016	0.526
.*| . |	.*| . |	14	-0.079	-0.198	12.410	0.573
. | . |	. | . |	15	0.000	-0.028	12.410	0.648
. |*. |	. | . |	16	0.124	0.057	13.464	0.639

*Probabilities may not be valid for this equation specification.

Source: own compilation

In the following table No. 8 we are testing serial correlation. It means whether there is correlation between exogenous variables, then it is wrong. We want correlation just between each exogenous and endogenous variables. We can see in the figure that there is no serial correlation. The results are reliable and we have the correct model. We cannot reject the null hypothesis because it is above 0, 05.

Table No. 8: LM Test of general education

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.183769	Prob. F(2,17)	0.3301
Obs*R-squared	4.401563	Prob. Chi-Square(2)	0.1107

Test Equation:

Dependent Variable: RESID
Method: Least Squares
Date: 02/06/16 Time: 16:29
Sample: 1975 2011
Included observations: 37
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNY(-1)	-0.345198	0.549218	-0.628527	0.5380
DLNY(-2)	0.447985	0.375248	1.193836	0.2489
DLNY(-3)	-0.055445	0.221282	-0.250563	0.8052
DDLNX2	-0.036945	1.323521	-0.027914	0.9781
DDLNX2(-1)	0.454927	1.742782	0.261035	0.7972
DDLNX2(-2)	-1.279834	1.452144	-0.881341	0.3904
DLNX3	0.047757	0.329804	0.144804	0.8866
DLNX3(-1)	0.120604	0.413949	0.291349	0.7743
DLNX3(-2)	0.101719	0.356539	0.285296	0.7789
DLNX3(-3)	-0.009755	0.338076	-0.028853	0.9773
DLNX4	-0.071431	0.257259	-0.277662	0.7846
DLNX4(-1)	-0.016843	0.255417	-0.065945	0.9482
DLNX4(-2)	-0.062552	0.277759	-0.225203	0.8245
DLNX4(-3)	0.063500	0.329181	0.192902	0.8493
DLNX5	0.077088	0.118868	0.648516	0.5253
DLNX5(-1)	-0.017565	0.103979	-0.168925	0.8678
DLNX5(-2)	-0.043340	0.097575	-0.444174	0.6625
DLNX5(-3)	-0.032504	0.121082	-0.268444	0.7916
RESID(-1)	0.258909	0.570712	0.453659	0.6558
RESID(-2)	-0.735797	0.481179	-1.529155	0.1446

R-squared	0.118961	Mean dependent var	0.001248
Adjusted R-squared	-0.865729	S.D. dependent var	0.020687
S.E. of regression	0.028257	Akaike info criterion	-3.991577
Sum squared resid	0.013574	Schwarz criterion	-3.120810
Log likelihood	93.84417	Hannan-Quinn criter.	-3.684591
Durbin-Watson stat	1.975899		

Source: own compilation

4.5 Causality between Female Education with Fertility Rate and Economic Growth

$$\begin{aligned} dlny = {} & dlny_{t-1} + dlny_{t-2} + dlny_{t-3} + ddlnx_2 + ddlnx_{2t-1} + ddlnx_{2t-2} + dlnx_6 \\ & + dlnx_{6t-1} + dlnx_{6t-2} + dlnx_{6t-3} + dlnx_7 + dlnx_{7t-1} + dlnx_{7t-2} \\ & + dlnx_{7t-3} + dlnx_8 + dlnx_{8t-1} + dlnx_{8t-2} + dlnx_{8t-3} + dlnx_{12} \\ & + dlnx_{12t-1} + dlnx_{12t-2} + dlnx_{12t-3} + dlnx_{13} + dlnx_{13t-1} + dlnx_{13t-2} \\ & + dlnx_{13t-3} + dlnx_{14} + dlnx_{14t-1} + dlnx_{14t-2} + dlnx_{14t-3} + dlnx_{15} \\ & + dlnx_{15t-1} + dlnx_{15t-2} + dlnx_{15t-3} + ddlnx_{20} + ddlnx_{20t-1} \\ & + ddlnx_{20t-2} \end{aligned}$$

In the table No. 9 is tested the impact of female education with fertility rate on economic growth according to the equation above. As it can be seen in the appendix after the first differencing becomes variables GDP per capita, GSE female at all levels; AYS female at all levels stationary. But the variables Capital Stock and Fertility Rate become stationary after the second difference. Here again, the results are focused on the p-value less than 0, 05 then we reject the Null hypothesis and therefore the alternative hypothesis is valid so it is significant. The one highlighted with yellow represent that they are significant. In the table No. 9 can be seen that GDP causes female Gross School enrolment tertiary. Gross School enrolment primary of female causes Capital Stock, Average years of total, primary and tertiary schooling. Gross School enrolment secondary of female causes Capital Stock, Average years of total, primary, secondary and tertiary schooling. Average years of total, primary and secondary schooling causes Fertility rate. Average years of secondary schooling causes Average years of tertiary schooling. However, we have to relay our finding on the Cointegration result.

Table No. 9: Granger causality between female education with fertility rate and growth

Pairwise Granger Causality Tests
Date: 03/18/16 Time: 18:22
Sample: 1971 2011
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DDLNX2 does not Granger Cause DLNY	37	0.61615	0.5463
DLNY does not Granger Cause DDLNX2		1.35067	0.2734
DLNX6 does not Granger Cause DLNY	38	1.10682	0.3426
DLNY does not Granger Cause DLNX6		0.29101	0.7494
DLNX7 does not Granger Cause DLNY	38	1.14396	0.3309
DLNY does not Granger Cause DLNX7		0.27098	0.7643
DLNX8 does not Granger Cause DLNY	38	0.05876	0.9430
DLNY does not Granger Cause DLNX8		6.42639	0.0044
DLNX12 does not Granger Cause DLNY	38	1.72184	0.1944
DLNY does not Granger Cause DLNX12		0.16458	0.8489
DLNX13 does not Granger Cause DLNY	38	1.58877	0.2194
DLNY does not Granger Cause DLNX13		0.31497	0.7320
DLNX14 does not Granger Cause DLNY	38	2.70640	0.0816
DLNY does not Granger Cause DLNX14		0.04414	0.9569
DLNX15 does not Granger Cause DLNY	38	1.09729	0.3456
DLNY does not Granger Cause DLNX15		0.73846	0.4856

DDDLNX20 does not Granger Cause DLNY	36	1.00438	0.3779
DLNY does not Granger Cause DDDLNX20		0.28646	0.7529
DLNX6 does not Granger Cause DDLNX2	37	3.76285	0.0341
DDLNX2 does not Granger Cause DLNX6		0.18864	0.8290
DLNX7 does not Granger Cause DDLNX2	37	3.50382	0.0421
DDLNX2 does not Granger Cause DLNX7		0.20741	0.8138
DLNX8 does not Granger Cause DDLNX2	37	2.97166	0.0655
DDLNX2 does not Granger Cause DLNX8		0.94136	0.4006
DLNX12 does not Granger Cause DDLNX2	37	0.00053	0.9995
DDLNX2 does not Granger Cause DLNX12		0.18993	0.8279
DLNX13 does not Granger Cause DDLNX2	37	0.10336	0.9021
DDLNX2 does not Granger Cause DLNX13		0.14543	0.8652
DLNX14 does not Granger Cause DDLNX2	37	0.02327	0.9770
DDLNX2 does not Granger Cause DLNX14		0.30517	0.7391
DLNX15 does not Granger Cause DDLNX2	37	0.34624	0.7100
DDLNX2 does not Granger Cause DLNX15		0.70387	0.5022
DDDLNX20 does not Granger Cause DDLNX2	36	1.00272	0.3785
DDLNX2 does not Granger Cause DDDLNX20		1.93724	0.1612
DLNX7 does not Granger Cause DLNX6	38	0.94421	0.3992
DLNX6 does not Granger Cause DLNX7		0.43253	0.6525
DLNX8 does not Granger Cause DLNX6	38	0.10921	0.8969
DLNX6 does not Granger Cause DLNX8		0.90546	0.4142
DLNX12 does not Granger Cause DLNX6	38	0.06004	0.9418
DLNX6 does not Granger Cause DLNX12		9.72821	0.0005
DLNX13 does not Granger Cause DLNX6	38	0.05965	0.9422
DLNX6 does not Granger Cause DLNX13		5.85851	0.0066
DLNX14 does not Granger Cause DLNX6	38	0.60370	0.5527
DLNX6 does not Granger Cause DLNX14		16.5855	1.E-05
DLNX15 does not Granger Cause DLNX6	38	0.99913	0.3791
DLNX6 does not Granger Cause DLNX15		5.34425	0.0098
DDDLNX20 does not Granger Cause DLNX6	36	0.33469	0.7181
DLNX6 does not Granger Cause DDDLNX20		1.34776	0.2746
DLNX8 does not Granger Cause DLNX7	38	0.56420	0.5742
DLNX7 does not Granger Cause DLNX8		0.40780	0.6684
DLNX12 does not Granger Cause DLNX7	38	0.31468	0.7322
DLNX7 does not Granger Cause DLNX12		5.48627	0.0088
DLNX13 does not Granger Cause DLNX7	38	0.32978	0.7214
DLNX7 does not Granger Cause DLNX13		3.73570	0.0345
DLNX14 does not Granger Cause DLNX7	38	0.45522	0.6382

DLNX7 does not Granger Cause DLNX14		9.42156	0.0006
DLNX15 does not Granger Cause DLNX7	38	0.75420	0.4783
DLNX7 does not Granger Cause DLNX15		3.87672	0.0307
DDDLNX20 does not Granger Cause DLNX7	36	0.27485	0.7615
DLNX7 does not Granger Cause DDDLNX20		0.40399	0.6711
DLNX12 does not Granger Cause DLNX8	38	0.73990	0.4849
DLNX8 does not Granger Cause DLNX12		1.69836	0.1986
DLNX13 does not Granger Cause DLNX8	38	1.07631	0.3525
DLNX8 does not Granger Cause DLNX13		1.65487	0.2066
DLNX14 does not Granger Cause DLNX8	38	0.53128	0.5928
DLNX8 does not Granger Cause DLNX14		0.85492	0.4345
DLNX15 does not Granger Cause DLNX8	38	0.91762	0.4094
DLNX8 does not Granger Cause DLNX15		0.98578	0.3839
DDDLNX20 does not Granger Cause DLNX8	36	1.58724	0.2207
DLNX8 does not Granger Cause DDDLNX20		1.08671	0.3498
DLNX13 does not Granger Cause DLNX12	38	0.23707	0.7903
DLNX12 does not Granger Cause DLNX13		0.00240	0.9976
DLNX14 does not Granger Cause DLNX12	38	0.10161	0.9037
DLNX12 does not Granger Cause DLNX14		0.36451	0.6973
DLNX15 does not Granger Cause DLNX12	38	0.09336	0.9111
DLNX12 does not Granger Cause DLNX15		1.33170	0.2778
DDDLNX20 does not Granger Cause DLNX12	36	0.78694	0.4641
DLNX12 does not Granger Cause DDDLNX20		6.47597	0.0045
DLNX14 does not Granger Cause DLNX13	38	0.01282	0.9873
DLNX13 does not Granger Cause DLNX14		0.56130	0.5758
DLNX15 does not Granger Cause DLNX13	38	0.06086	0.9411
DLNX13 does not Granger Cause DLNX15		0.48534	0.6198
DDDLNX20 does not Granger Cause DLNX13	36	0.60320	0.5534
DLNX13 does not Granger Cause DDDLNX20		4.87955	0.0144
DLNX15 does not Granger Cause DLNX14	38	0.55880	0.5772
DLNX14 does not Granger Cause DLNX15		4.80210	0.0148
DDDLNX20 does not Granger Cause DLNX14	36	0.61795	0.5456
DLNX14 does not Granger Cause DDDLNX20		4.16551	0.0250
DDDLNX20 does not Granger Cause DLNX15	36	1.36282	0.2708
DLNX15 does not Granger Cause DDDLNX20		1.35951	0.2717

Source: own compilation

Further are represented results which show a long term relationship between economic growth and the remaining variables. For instance, DDLNX2, DLNX8, DLNX15 = Capital Stock, Gross School enrolment tertiary, Average years of tertiary schooling positively affects economic growth in the long term.

Table No. 10: Cointegration between female education with fertility rate and growth

Dependent Variable: DLNY
Method: Fully Modified Least Squares (FMOLS)
Date: 03/18/16 Time: 18:30
Sample (adjusted): 1975 2011
Included observations: 37 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DDLNX2	2.692631	0.569356	4.729258	0.0001
DLNX6	0.076970	0.125175	0.614901	0.5438
DLNX7	-0.002141	0.100621	-0.021279	0.9832
DLNX8	0.157908	0.040354	3.913092	0.0006
DLNX12	-0.350066	0.610813	-0.573114	0.5713
DLNX13	0.289856	0.486908	0.595298	0.5566
DLNX14	0.083811	0.154731	0.541660	0.5925
DLNX15	-0.163024	0.034243	-4.760805	0.0001
DDDLNX20	1.747391	6.633830	0.263406	0.7942
C	0.032350	0.006884	4.699538	0.0001

R-squared	0.503164	Mean dependent var	0.037664
Adjusted R-squared	0.337553	S.D. dependent var	0.029956
S.E. of regression	0.024382	Sum squared resid	0.016050
Long-run variance	0.000300		

Source: own compilation

Hereafter follows the Q-test which shows that the result is stationary and we do not the problem of spurious result. Because the values are higher than 0, 05.

Table No. 11: Q statistics of female education with fertility rate

Date: 03/18/16 Time: 18:36
Sample: 1971 2011
Included observations: 37

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. | . |	. | . |	1	0.057	0.057	0.1283	0.720
.*| . |	.*| . |	2	-0.087	-0.090	0.4386	0.803
. |*. |	. |*. |	3	0.187	0.199	1.9183	0.590
. | . |	. | . |	4	-0.014	-0.051	1.9262	0.749

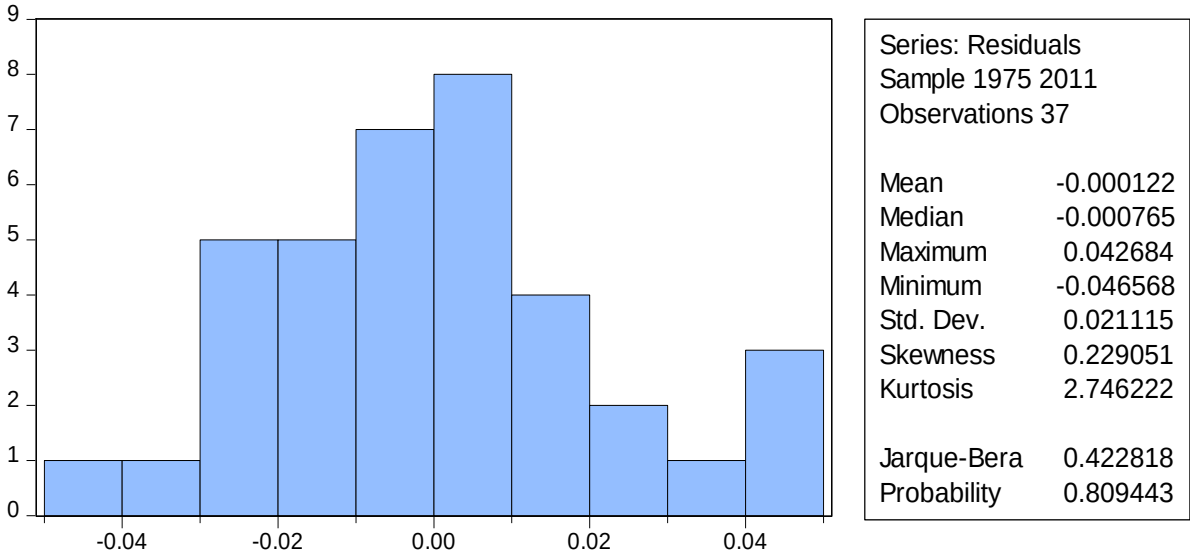
. |*. |	. |*. |	5	0.087	0.136	2.2683	0.811
.*| . |	.*| . |	6	-0.087	-0.162	2.6168	0.855
.*| . |	.*| . |	7	-0.181	-0.128	4.1862	0.758
. | . |	. | . |	8	0.070	0.028	4.4332	0.816
**| . |	**| . |	9	-0.264	-0.284	8.0144	0.533
. | . |	. |*. |	10	0.039	0.189	8.0947	0.620
. |*. |	. | . |	11	0.153	0.055	9.3971	0.585
.*| . |	. | . |	12	-0.125	0.016	10.298	0.590
. |*. |	. |*. |	13	0.129	0.110	11.306	0.585
.*| . |	**| . |	14	-0.099	-0.214	11.925	0.612
.*| . |	.*| . |	15	-0.170	-0.145	13.832	0.538
. | . |	.*| . |	16	0.060	-0.126	14.077	0.593

*Probabilities may not be valid for this equation specification.

Source: own compilation

In the figure no. 1 is displayed the Normality test. Null hypothesis is that there is no normality of residuals and Alternative hypothesis is that there is normality of residuals. If the p-value is more than 0.05 than we cannot reject the null hypothesis. It means that there is no problem on econometrics level

Figure No. 1: Normality test of female education with fertility rate



Source: own compilation

4.6 Causality between Female Education without Fertility Rate and Economic Growth

In the table No. 12 is tested the impact of female education without fertility rate on economic growth. It can be seen that the significant relations are GDP cause Gross School enrolment tertiary. Gross School enrolment primary and secondary cause Capital Stock. Gross School enrolment primary causes Average years of total, primary and tertiary schooling. Gross School enrolment secondary causes Average years of total, primary, secondary and tertiary schooling. Average years of secondary schooling causes Average years of tertiary schooling. Here can be interpreted the findings with regard to the effect of GDP on education. Since this may be translated with the income of household. The decision of parents to send their children to school can be related with the GDP. Increases in per capita GDP can make households decide to send their children to school. In developing countries, it is often possible for child labour. If the family can afford to finance their expenditure, they may not need their children to work and therefore decide to send them to school. It can be also seen that fertility rate did not change the significance of impact of educational level.

Table No. 12: Granger causality between female education and growth

Pairwise Granger Causality Tests
Date: 03/18/16 Time: 18:45
Sample: 1971 2011
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DDLNX2 does not Granger Cause DLNY	37	0.61615	0.5463
DLNY does not Granger Cause DDLNX2		1.35067	0.2734
DLNX6 does not Granger Cause DLNY	38	1.10682	0.3426
DLNY does not Granger Cause DLNX6		0.29101	0.7494
DLNX7 does not Granger Cause DLNY	38	1.14396	0.3309
DLNY does not Granger Cause DLNX7		0.27098	0.7643
DLNX12 does not Granger Cause DLNY	38	1.72184	0.1944
DLNY does not Granger Cause DLNX12		0.16458	0.8489
DLNX13 does not Granger Cause DLNY	38	1.58877	0.2194
DLNY does not Granger Cause DLNX13		0.31497	0.7320
DLNX14 does not Granger Cause DLNY	38	2.70640	0.0816
DLNY does not Granger Cause DLNX14		0.04414	0.9569
DLNX15 does not Granger Cause DLNY	38	1.09729	0.3456
DLNY does not Granger Cause DLNX15		0.73846	0.4856

DLNX8 does not Granger Cause DLNY	38	0.05876	0.9430
DLNY does not Granger Cause DLNX8		6.42639	0.0044
DLNX6 does not Granger Cause DDLNX2	37	3.76285	0.0341
DDLNX2 does not Granger Cause DLNX6		0.18864	0.8290
DLNX7 does not Granger Cause DDLNX2	37	3.50382	0.0421
DDLNX2 does not Granger Cause DLNX7		0.20741	0.8138
DLNX12 does not Granger Cause DDLNX2	37	0.00053	0.9995
DDLNX2 does not Granger Cause DLNX12		0.18993	0.8279
DLNX13 does not Granger Cause DDLNX2	37	0.10336	0.9021
DDLNX2 does not Granger Cause DLNX13		0.14543	0.8652
DLNX14 does not Granger Cause DDLNX2	37	0.02327	0.9770
DDLNX2 does not Granger Cause DLNX14		0.30517	0.7391
DLNX15 does not Granger Cause DDLNX2	37	0.34624	0.7100
DDLNX2 does not Granger Cause DLNX15		0.70387	0.5022
DLNX8 does not Granger Cause DDLNX2	37	2.97166	0.0655
DDLNX2 does not Granger Cause DLNX8		0.94136	0.4006
DLNX7 does not Granger Cause DLNX6	38	0.94421	0.3992
DLNX6 does not Granger Cause DLNX7		0.43253	0.6525
DLNX12 does not Granger Cause DLNX6	38	0.06004	0.9418
DLNX6 does not Granger Cause DLNX12		9.72821	0.0005
DLNX13 does not Granger Cause DLNX6	38	0.05965	0.9422
DLNX6 does not Granger Cause DLNX13		5.85851	0.0066
DLNX14 does not Granger Cause DLNX6	38	0.60370	0.5527
DLNX6 does not Granger Cause DLNX14		16.5855	1.E-05
DLNX15 does not Granger Cause DLNX6	38	0.99913	0.3791
DLNX6 does not Granger Cause DLNX15		5.34425	0.0098
DLNX8 does not Granger Cause DLNX6	38	0.10921	0.8969
DLNX6 does not Granger Cause DLNX8		0.90546	0.4142
DLNX12 does not Granger Cause DLNX7	38	0.31468	0.7322
DLNX7 does not Granger Cause DLNX12		5.48627	0.0088
DLNX13 does not Granger Cause DLNX7	38	0.32978	0.7214
DLNX7 does not Granger Cause DLNX13		3.73570	0.0345
DLNX14 does not Granger Cause DLNX7	38	0.45522	0.6382
DLNX7 does not Granger Cause DLNX14		9.42156	0.0006
DLNX15 does not Granger Cause DLNX7	38	0.75420	0.4783
DLNX7 does not Granger Cause DLNX15		3.87672	0.0307
DLNX8 does not Granger Cause DLNX7	38	0.56420	0.5742
DLNX7 does not Granger Cause DLNX8		0.40780	0.6684
DLNX13 does not Granger Cause DLNX12	38	0.23707	0.7903

DLNX12 does not Granger Cause DLNX13		0.00240	0.9976
DLNX14 does not Granger Cause DLNX12	38	0.10161	0.9037
DLNX12 does not Granger Cause DLNX14		0.36451	0.6973
DLNX15 does not Granger Cause DLNX12	38	0.09336	0.9111
DLNX12 does not Granger Cause DLNX15		1.33170	0.2778
DLNX8 does not Granger Cause DLNX12	38	1.69836	0.1986
DLNX12 does not Granger Cause DLNX8		0.73990	0.4849
DLNX14 does not Granger Cause DLNX13	38	0.01282	0.9873
DLNX13 does not Granger Cause DLNX14		0.56130	0.5758
DLNX15 does not Granger Cause DLNX13	38	0.06086	0.9411
DLNX13 does not Granger Cause DLNX15		0.48534	0.6198
DLNX8 does not Granger Cause DLNX13	38	1.65487	0.2066
DLNX13 does not Granger Cause DLNX8		1.07631	0.3525
DLNX15 does not Granger Cause DLNX14	38	0.55880	0.5772
DLNX14 does not Granger Cause DLNX15		4.80210	0.0148
DLNX8 does not Granger Cause DLNX14	38	0.85492	0.4345
DLNX14 does not Granger Cause DLNX8		0.53128	0.5928
DLNX8 does not Granger Cause DLNX15	38	0.98578	0.3839
DLNX15 does not Granger Cause DLNX8		0.91762	0.4094

Source: own compilation

Further are represented results which show a long term relationship between economic growth and the remaining variables. For instance, DDLNX2, DLNX8, DLNX15 = Capital Stock, Gross School enrolment tertiary, Average years of tertiary schooling positively affects economic growth in the long term.

Table No. 13: Cointegration between female education and growth

Dependent Variable: DLNY
Method: Fully Modified Least Squares (FMOLS)
Date: 03/18/16 Time: 18:47
Sample (adjusted): 1974 2011
Included observations: 38 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DDLNX2	2.349652	0.691388	3.398457	0.0020
DLNX6	0.139516	0.154347	0.903912	0.3735
DLNX7	-0.017962	0.119190	-0.150698	0.8813
DLNX8	0.165442	0.048375	3.419977	0.0019
DLNX12	-0.763246	0.740742	-1.030380	0.3113
DLNX13	0.542758	0.597412	0.908515	0.3711

DLNX14	0.195044	0.189223	1.030765	0.3112
DLNX15	-0.132538	0.041846	-3.167262	0.0036
C	0.033195	0.008382	3.960165	0.0004

R-squared	0.501272	Mean dependent var	0.036369
Adjusted R-squared	0.363692	S.D. dependent var	0.030607
S.E. of regression	0.024415	Sum squared resid	0.017286

Source: own compilation

Table No. 14: Q statistics of female education

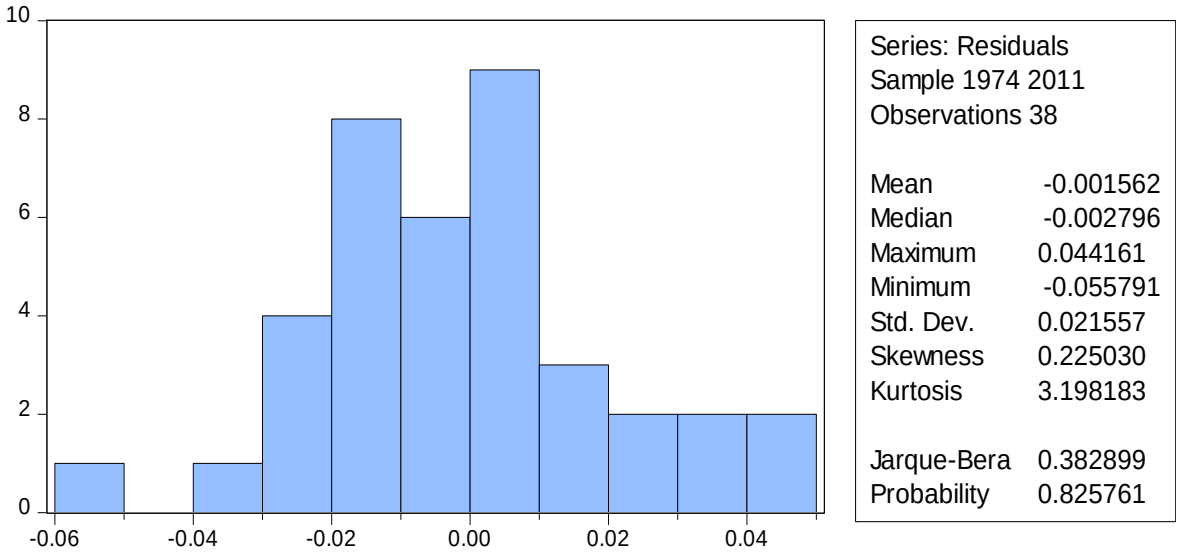
Date: 03/18/16 Time: 18:47
Sample: 1971 2011
Included observations: 38

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. | . |	. | . |	1	0.058	0.058	0.1368	0.711
.*| . |	.*| . |	2	-0.076	-0.080	0.3812	0.826
. |*. |	. |*. |	3	0.166	0.177	1.5749	0.665
. | . |	. | . |	4	-0.011	-0.043	1.5806	0.812
. |** |	. |** |	5	0.234	0.279	4.1061	0.534
. | . |	.*| . |	6	-0.051	-0.148	4.2304	0.646
.*| . |	. | . |	7	-0.108	-0.019	4.7971	0.685
. |*. |	. | . |	8	0.096	-0.013	5.2607	0.729
**| . |	**| . |	9	-0.240	-0.243	8.2788	0.506
. |*. |	. |*. |	10	0.107	0.165	8.8974	0.542
. |** |	. |*. |	11	0.229	0.186	11.854	0.375
.*| . |	. | . |	12	-0.090	0.020	12.330	0.420
. |*. |	. |*. |	13	0.143	0.141	13.577	0.404
.*| . |	**| . |	14	-0.180	-0.246	15.632	0.336
.*| . |	**| . |	15	-0.159	-0.218	17.307	0.301
. |*. |	.*| . |	16	0.102	-0.106	18.019	0.323

*Probabilities may not be valid for this equation specification.

Source: own compilation

Figure No. 2: Normality test of female education



Source: own compilation

4.7 Causality between Male Education and Economic Growth

$$\begin{aligned} dlny = {} & dlny_{t-1} + dlny_{t-2} + dlny_{t-3} + ddlnx_2 + ddlnx_{2t-1} + ddlnx_{2t-2} + dlnx_9 \\ & + dlnx_{9t-1} + dlnx_{9t-2} + dlnx_{9t-3} + dlnx_{10} + dlnx_{10t-1} + dlnx_{10t-2} \\ & + dlnx_{10t-3} + dlnx_{11} + dlnx_{11t-1} + dlnx_{11t-2} + dlnx_{11t-3} + dlnx_{16} \\ & + dlnx_{16t-1} + dlnx_{16t-2} + dlnx_{16t-3} + dlnx_{17} + dlnx_{17t-1} + dlnx_{17t-2} \\ & + dlnx_{17t-3} + dlnx_{18} + dlnx_{18t-1} + dlnx_{18t-2} + dlnx_{18t-3} + dlnx_{19} \\ & + dlnx_{19t-1} + dlnx_{19t-2} + dlnx_{19t-3} \end{aligned}$$

In the table No. 15 is tested the impact of male education rate on economic growth according to the equation above. As it can be seen in the appendix after the first differencing becomes variables GDP per capita, GSE male at all levels; AYS female at all levels stationary. But the variable Capital Stock becomes stationary after the second difference. Average years of tertiary schooling causes GDP and reverse. Gross School enrolment primary causes Average years of primary and secondary schooling. This is similar to demonstration effect. Like knowing there secondary schools and boys learning can positively affect primary schools male students.

Table No. 15: Granger causality between male education and growth

Pairwise Granger Causality Tests
Date: 03/18/16 Time: 18:51
Sample: 1971 2011
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DDLNX2 does not Granger Cause DLNY	37	0.61615	0.5463
DLNY does not Granger Cause DDLNX2		1.35067	0.2734
DLNX9 does not Granger Cause DLNY	38	0.61481	0.5468
DLNY does not Granger Cause DLNX9		0.03368	0.9669
DLNX10 does not Granger Cause DLNY	38	0.86430	0.4307
DLNY does not Granger Cause DLNX10		0.73038	0.4894
DLNX11 does not Granger Cause DLNY	38	2.53469	0.0946
DLNY does not Granger Cause DLNX11		3.08734	0.0590
DLNX16 does not Granger Cause DLNY	38	1.46515	0.2457
DLNY does not Granger Cause DLNX16		1.61105	0.2150
DLNX17 does not Granger Cause DLNY	38	0.16128	0.8517
DLNY does not Granger Cause DLNX17		2.19062	0.1278
DLNX18 does not Granger Cause DLNY	38	2.43027	0.1036
DLNY does not Granger Cause DLNX18		0.17171	0.8430
DLNX19 does not Granger Cause DLNY	38	8.61887	0.0010
DLNY does not Granger Cause DLNX19		6.98382	0.0030
DLNX9 does not Granger Cause DDLNX2	37	0.88419	0.4229
DDLNX2 does not Granger Cause DLNX9		0.99460	0.3810
DLNX10 does not Granger Cause DDLNX2	37	1.27793	0.2924
DDLNX2 does not Granger Cause DLNX10		0.37799	0.6883
DLNX11 does not Granger Cause DDLNX2	37	0.27089	0.7644
DDLNX2 does not Granger Cause DLNX11		0.12498	0.8829
DLNX16 does not Granger Cause DDLNX2	37	0.18057	0.8356
DDLNX2 does not Granger Cause DLNX16		0.56627	0.5732
DLNX17 does not Granger Cause DDLNX2	37	0.17431	0.8408
DDLNX2 does not Granger Cause DLNX17		0.42413	0.6580
DLNX18 does not Granger Cause DDLNX2	37	0.53467	0.5910
DDLNX2 does not Granger Cause DLNX18		0.07952	0.9237
DLNX19 does not Granger Cause DDLNX2	37	0.53727	0.5895
DDLNX2 does not Granger Cause DLNX19		0.76436	0.4739
DLNX10 does not Granger Cause DLNX9	38	0.34608	0.7100
DLNX9 does not Granger Cause DLNX10		0.40638	0.6693
DLNX11 does not Granger Cause DLNX9	38	0.60528	0.5519
DLNX9 does not Granger Cause DLNX11		0.76193	0.4748

DLNX16 does not Granger Cause DLNX9	38	1.95275	0.1579
DLNX9 does not Granger Cause DLNX16		0.22099	0.8029
DLNX17 does not Granger Cause DLNX9	38	1.30098	0.2859
DLNX9 does not Granger Cause DLNX17		3.77127	0.0335
DLNX18 does not Granger Cause DLNX9	38	0.29481	0.7466
DLNX9 does not Granger Cause DLNX18		4.58988	0.0174
DLNX19 does not Granger Cause DLNX9	38	0.97843	0.3865
DLNX9 does not Granger Cause DLNX19		1.19750	0.3147
DLNX11 does not Granger Cause DLNX10	38	0.67121	0.5179
DLNX10 does not Granger Cause DLNX11		1.01936	0.3719
DLNX16 does not Granger Cause DLNX10	38	3.16136	0.0554
DLNX10 does not Granger Cause DLNX16		0.31175	0.7343
DLNX17 does not Granger Cause DLNX10	38	1.66520	0.2047
DLNX10 does not Granger Cause DLNX17		1.11256	0.3407
DLNX18 does not Granger Cause DLNX10	38	0.73496	0.4872
DLNX10 does not Granger Cause DLNX18		1.36558	0.2693
DLNX19 does not Granger Cause DLNX10	38	0.57101	0.5704
DLNX10 does not Granger Cause DLNX19		0.87979	0.4244
DLNX16 does not Granger Cause DLNX11	38	1.17101	0.3226
DLNX11 does not Granger Cause DLNX16		0.07085	0.9317
DLNX17 does not Granger Cause DLNX11	38	0.50330	0.6091
DLNX11 does not Granger Cause DLNX17		0.16946	0.8449
DLNX18 does not Granger Cause DLNX11	38	1.43557	0.2525
DLNX11 does not Granger Cause DLNX18		0.17074	0.8438
DLNX19 does not Granger Cause DLNX11	38	0.40001	0.6735
DLNX11 does not Granger Cause DLNX19		1.97489	0.1548
DLNX17 does not Granger Cause DLNX16	38	0.05685	0.9448
DLNX16 does not Granger Cause DLNX17		0.08386	0.9198
DLNX18 does not Granger Cause DLNX16	38	0.05884	0.9430
DLNX16 does not Granger Cause DLNX18		0.20390	0.8166
DLNX19 does not Granger Cause DLNX16	38	0.65086	0.5282
DLNX16 does not Granger Cause DLNX19		1.80134	0.1809
DLNX18 does not Granger Cause DLNX17	38	0.19988	0.8198
DLNX17 does not Granger Cause DLNX18		0.47510	0.6260
DLNX19 does not Granger Cause DLNX17	38	1.31932	0.2810
DLNX17 does not Granger Cause DLNX19		0.09990	0.9052
DLNX19 does not Granger Cause DLNX18	38	0.05273	0.9487
DLNX18 does not Granger Cause DLNX19		1.85276	0.1727

Source: own compilation

Further are represented results which show a long term relationship between economic growth and the remaining variables. For instance, DDLNX2, DLNX11 = Capital Stock, Gross School enrolment tertiary positively affects economic growth in the long term. Here similar to the previous with the exception of few variables at 90% confidence the remaining men education do not have a significant impact on economic growth.

Table No. 16: Cointegration between male education and growth

Dependent Variable: DLNY
Method: Fully Modified Least Squares (FMOLS)
Date: 03/18/16 Time: 18:52
Sample (adjusted): 1974 2011
Included observations: 38 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DDLNX2	1.818162	0.616985	2.946851	0.0063
DLNX9	0.302644	0.200225	1.511520	0.1415
DLNX10	-0.277678	0.141953	-1.956118	0.0601
DLNX11	0.118324	0.055570	2.129295	0.0418
DLNX16	0.459521	0.795445	0.577690	0.5679
DLNX17	-0.596238	0.610077	-0.977315	0.3365
DLNX18	-0.395737	0.237500	-1.666260	0.1064
DLNX19	-0.003949	0.084302	-0.046844	0.9630
C	0.051882	0.009945	5.216620	0.0000

R-squared	0.517563	Mean dependent var	0.036369
Adjusted R-squared	0.384477	S.D. dependent var	0.030607
S.E. of regression	0.024013	Sum squared resid	0.016722
Long-run variance	0.000366		

Source: own compilation

Table No. 17: Q statistics of male education

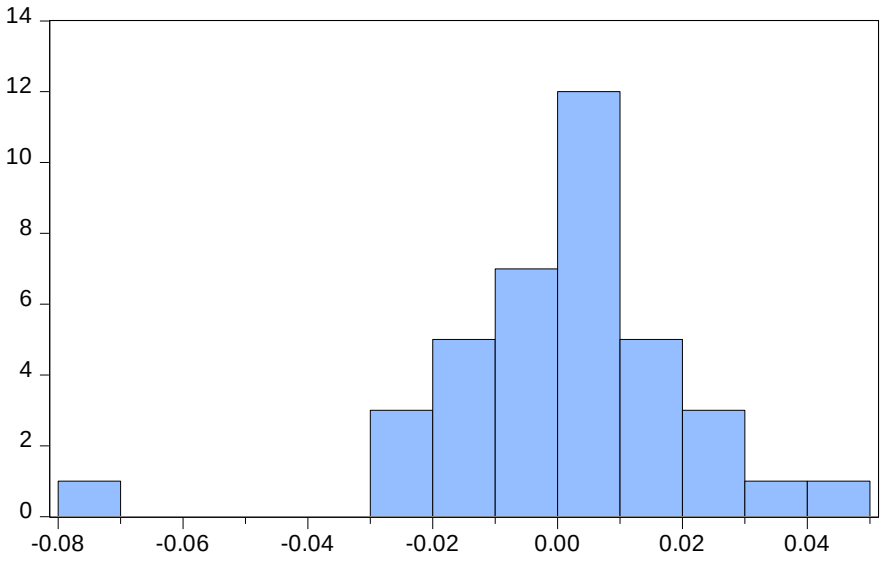
Date: 03/18/16 Time: 18:53
Sample: 1971 2011
Included observations: 38

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.*| . |	.*| . |	1	-0.067	-0.067	0.1833	0.669
.*| . |	.*| . |	2	-0.147	-0.152	1.1000	0.577
. |** |	. |*. |	3	0.215	0.199	3.1123	0.375
.*| . |	.*| . |	4	-0.125	-0.130	3.8056	0.433
. | . |	. | . |	5	-0.016	0.037	3.8177	0.576
.*| . |	**| . |	6	-0.156	-0.257	4.9746	0.547
.*| . |	. | . |	7	-0.077	-0.030	5.2662	0.628
. | . |	. | . |	8	0.065	-0.034	5.4773	0.706
**| . |	**| . |	9	-0.301	-0.264	10.220	0.333
. |*. |	. |*. |	10	0.121	0.108	11.009	0.357
. |*. |	. | . |	11	0.183	0.066	12.888	0.301
.*| . |	. | . |	12	-0.112	0.021	13.622	0.326
. | . |	. | . |	13	0.054	-0.060	13.802	0.388
. |*. |	. |*. |	14	0.100	0.078	14.438	0.418
. | . |	.*| . |	15	-0.031	-0.087	14.501	0.488
.*| . |	.*| . |	16	-0.104	-0.122	15.253	0.506

*Probabilities may not be valid for this equation specification.

Source: own compilation

Figure No. 3: Normality test of male education



Series: Residuals
Sample 1974 2011
Observations 38

Mean	0.000786
Median	0.001102
Maximum	0.048934
Minimum	-0.074798
Std. Dev.	0.021244
Skewness	-0.770009
Kurtosis	5.962048
Jarque-Bera	17.64685
Probability	0.000147

Source: own compilation

5 Results and Discussion

5.1 Primary education and growth

Two different education variables are tested for each level of education. Additionally, the same tests are conducted for each gender (for females with and without the inclusion of the total fertility rate). From table no. 18, it can be seen that primary education is not strongly correlated with growth and it may look like it has not a strong causal impact on growth. But gross enrolment rate primary female with and without fertility rate has a casual impact on capital stock with p-value 0.0341, which means that primary education has an indirect impact on economic growth with 95 % probability being true. Significant is also the demonstration effect. Enrolment into primary education of females can positively affect human capital stock with 99 % probability of being true, because the p-values are 0.0066 (total) and 0.0098 (tertiary). For the male population cannot be seen even the indirect impact, but there is also an impact on human capital stock with 95% probability being true, because the p-values are 0.0335 (primary) and 0.0174 (secondary). Years of primary schooling female positively affects fertility rate with p-value 0.0045. It means that as the primary female education increases the number of born children will decrease. It is logical, because when the women are educated, then their awareness increases and they will see the opportunity cost with not having a baby and work instead.

Table No. 18: Causal relations at primary level

Direction of causality: education to growth	G - Causality (P-value)	Cointegration (P-value)
General		
Enrolment	No (0.6719)	No (0.6716)
Gender based		
Enrolment - male	No (0.5468)	No (0.1415)
Enrolment - female - without fertility	No (0.3426)	No (0.3735)
Enrolment - female - with fertility	No (0.3426)	No (0.5438)
Change in human capital stock - male	No (0.8517)	No (0.3365)
Change in human capital stock - female without fertility	No (0.2194)	No (0.3711)
Change in human capital stock - female with fertility	No (0.2194)	No (0.5566)

Source: own compilation

5.2 Secondary education and growth

The results for the causal impact of secondary education on growth are presented in table no. 19. These results show that there is not a big difference between the primary and the secondary level in terms of their impact on economic growth. But again in the results is a significant impact of gross enrolment rate secondary female with and without fertility rate on capital stock with the p-value 0.0421, which means that there is a 95% probability of being true that the secondary female education has an indirect impact on economic growth. Another significant founding is that secondary enrolment rates of females has a strong causal impact on human capital stock with the 95% probability of being true. Unfortunately in the result cannot be seen any impact of secondary male education on economic growth. Again human capital stock secondary cause fertility rate with 0.0250, which means that secondary female education negatively affects the number of born children with 95% of being true. Another significant results is that human capital stock secondary cause human capital stock tertiary with the p-value 0.0148.

Table No. 19: Causal relations at secondary level

Direction of causality: education to growth	G - Causality (P-value)	Cointegration (P-value)
General		
Enrolment	No (0.1318)	No (0.9981)
Gender based		
Enrolment - male	No (0.4307)	No (0.0601)
Enrolment - female - without fertility	No (0.3309)	No (0.8813)
Enrolment - female - with fertility	No (0.3309)	No (0.9832)
Change in human capital stock - male	No (0.1036)	No (0.1064)
Change in human capital stock - female without fertility	No (0.0816)	No (0.3112)
Change in human capital stock - female with fertility	No (0.0816)	No (0.5925)

Source: own compilation

5.3 Tertiary education and growth

The focus now shifts to tertiary level education and its relation with economic growth. According to table no. 20, which presents results concerning the impact of tertiary education on growth, it can be seen that tertiary education is strongly correlated with growth. This causal impact is felt by growth from the tertiary enrolment rate variable. When the data are segregated by gender, the results do not change much. For the female population at tertiary level, both variables, with or without the inclusion of the fertility rate variable reflect a causal long-term impact on growth. However, for the male population, this impact is seen only for enrolment rates, but for the average years of tertiary education the impact can be seen only in short term. Even though the proportion of people undertaking such education is low but constantly growing the causal impact on economic growth is most definitely the most important one from all levels in India.

Direction GDP to gross school enrolment tertiary total is significant 0.0082. Also Capital stock to GSE tertiary total is 0.0101. GDP cause GSE tertiary female with 0.0044. Increases in per capita GDP can make households decide to send their children to school. In developing countries, it is often possible for child labour. If the family can afford to

finance their expenditure, they may not need their children to work and therefore decide to send them to school.

Table No. 20: Causal relations at tertiary level

Direction of causality: education to growth	G - Causality (P-value)	Cointegration (P-value)
General		
Enrolment	No (0.6959)	Yes** (0.0037)
Gender based		
Enrolment - male	No (0.0946)	Yes* (0.0418)
Enrolment - female - without fertility	No (0.9430)	Yes** (0.0019)
Enrolment - female - with fertility	No (0.9430)	Yes** (0.0006)
Change in human capital stock - male	Yes** (0.0010)	No (0.9630)
Change in human capital stock - female without fertility	No (0.3456)	Yes** (0.0036)
Change in human capital stock - female with fertility	No (0.3456)	Yes** (0.0001)

Source: own compilation

6 Conclusion

In this thesis, the relationship between education at primary, secondary, and tertiary level and economic growth in India has been analysed. In the equation model was defined the GDP per capita depending on capital stock, gross school enrolment rate at all levels and in both genders, average years of schooling also at all levels and in both genders and fertility rate.

In order to solve the problem with spurious regression or in another words false causality it was made a stationarity test of each variables and as a solution it was used the new data set with 1^{st} or 2^{nd} differences. It was used test for autocorrelation and normality of residuals. The P-value in all econometrics tests showed that the Null Hypotheses cannot be rejected and therefore parameters were verified statistically, economically and econometrically. According to abundance of evidence of correlations between economic growth and education the parameters of the model were estimated by using the Granger causality and Cointegration method to analyse the predictive powers of each level of education on future growth in the presence of its own lagged values. Over and above allowing for a test of causality, this technique is helpful in time series regression analysis since it also helps to eliminate any possible serial correlation by adding lagged values of the dependent variable on the right hand side. Fourteen out of 20 parameters came out to be significant (including the unit vector).

The results showed that education, which in the correlation analysis indicated a positive relation between all education levels and growth, is causal only at the tertiary level. It was discovered that female education at all levels has potential for generating economic growth. Males, on the other hand, appear to have a causal impact on growth only at the tertiary level and perhaps, weakly, at the primary level.

When the results were verified and compared with the hypotheses, it was figured out, that not all the results do not correspond with the hypotheses. The first hypothesis was, that secondary education has a positive impact on economic growth in India, especially female education. But it was discovered that it is tertiary education which cause an economic growth in India for both genders. But it can be said that the female education at primary and secondary level has an indirect effect on economic growth.

The second hypothesis was that the level of education has an indirect impact on economic growth through fertility rate in India. It was found, that fertility rate has an indirect impact on economic growth through the primary and secondary education of females, so the hypothesis is accepted.

In closing, a word of caution is in order. The conclusion that tertiary education is the main causal force in economic growth in India must be qualified since education's impact is likely to show only after long time lags and there may be important omitted variables. Thus, further research using more extensive data sets is certainly required. To conclude all parts of the model, the problems might be caused by wrong definition of the model. There could be an issue in the choice of the variables therefore it can be verified incorporating some other variables.

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8 Appendix – Stationarity Test of every series

Appendix No. 1: Stationarity test for GDP per capita

Null Hypothesis: D(LNY) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.709216	0.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNY,2)
Method: Least Squares
Date: 02/06/16 Time: 12:04
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNY(-1))	-0.886314	0.155243	-5.709216	0.0000
C	0.031848	0.007171	4.440963	0.0001

R-squared	0.468354	Mean dependent var	0.002040
Adjusted R-squared	0.453985	S.D. dependent var	0.041550
S.E. of regression	0.030702	Akaike info criterion	-4.079039
Sum squared resid	0.034877	Schwarz criterion	-3.993728
Log likelihood	81.54126	Hannan-Quinn criter.	-4.048430
F-statistic	32.59515	Durbin-Watson stat	2.101352
Prob(F-statistic)	0.000002		

Source: own compilation

Appendix No. 2: Stationarity test for Capital Stock at Constant National Prices

Null Hypothesis: D(LNX2,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.099200	0.0002
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX2,3)

Method: Least Squares
Date: 02/06/16 Time: 12:12
Sample (adjusted): 1974 2011
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX2(-1),2)	-0.828344	0.162446	-5.099200	0.0000
C	0.001225	0.001028	1.191586	0.2412

R-squared	0.419372	Mean dependent var	6.10E-05
Adjusted R-squared	0.403244	S.D. dependent var	0.007996
S.E. of regression	0.006177	Akaike info criterion	-7.284808
Sum squared resid	0.001374	Schwarz criterion	-7.198620
Log likelihood	140.4114	Hannan-Quinn criter.	-7.254143
F-statistic	26.00184	Durbin-Watson stat	1.991461
Prob(F-statistic)	0.000011		

Source: own compilation

Appendix No. 3: Stationarity test for Gross Enrolment Rate at primary level

Null Hypothesis: D(LNX3) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.869493	0.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX3,2)
Method: Least Squares
Date: 02/06/16 Time: 12:20
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX3(-1))	-0.973139	0.165796	-5.869493	0.0000
C	0.008822	0.003735	2.361725	0.0236

R-squared	0.482162	Mean dependent var	-0.000453
Adjusted R-squared	0.468167	S.D. dependent var	0.028985
S.E. of regression	0.021138	Akaike info criterion	-4.825593
Sum squared resid	0.016532	Schwarz criterion	-4.740282
Log likelihood	96.09906	Hannan-Quinn criter.	-4.794984
F-statistic	34.45095	Durbin-Watson stat	1.937937
Prob(F-statistic)	0.000001		

Source: own compilation

Appendix No. 4: Stationarity test for Gross School Enrolment Rate at Secondary Level

Null Hypothesis: D(LNX4) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.472417	0.0010
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX4,2)
Method: Least Squares
Date: 02/06/16 Time: 12:22
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX4(-1))	-0.713807	0.159602	-4.472417	0.0001
C	0.019211	0.005696	3.372446	0.0018

R-squared	0.350906	Mean dependent var	0.000847
Adjusted R-squared	0.333363	S.D. dependent var	0.030200
S.E. of regression	0.024658	Akaike info criterion	-4.517540
Sum squared resid	0.022496	Schwarz criterion	-4.432229
Log likelihood	90.09202	Hannan-Quinn criter.	-4.486931
F-statistic	20.00251	Durbin-Watson stat	2.045608
Prob(F-statistic)	0.000071		

Source: own compilation

Appendix No. 5: Stationarity test for Gross School Enrolment Rate at tertiary level

Null Hypothesis: D(LNX5) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.608648	0.0006
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX5,2)
Method: Least Squares
Date: 02/06/16 Time: 12:25
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX5(-1))	-0.840589	0.182394	-4.608648	0.0000
C	0.033991	0.013301	2.555568	0.0148

R-squared	0.364694	Mean dependent var	0.006190
Adjusted R-squared	0.347523	S.D. dependent var	0.091648
S.E. of regression	0.074030	Akaike info criterion	-2.318775
Sum squared resid	0.202776	Schwarz criterion	-2.233465
Log likelihood	47.21612	Hannan-Quinn criter.	-2.288167
F-statistic	21.23964	Durbin-Watson stat	1.904227
Prob(F-statistic)	0.000047		

Source: own compilation

Appendix No. 6: Stationarity test for Gross School Enrolment Rate for Female at primary level

Null Hypothesis: D(LNX6) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.098505	0.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX6,2)
Method: Least Squares
Date: 02/06/16 Time: 12:28
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX6(-1))	-1.008738	0.165407	-6.098505	0.0000
C	0.015851	0.005261	3.012791	0.0047

R-squared	0.501292	Mean dependent var	-0.000407
Adjusted R-squared	0.487814	S.D. dependent var	0.039579
S.E. of regression	0.028326	Akaike info criterion	-4.240186
Sum squared resid	0.029686	Schwarz criterion	-4.154875
Log likelihood	84.68362	Hannan-Quinn criter.	-4.209577
F-statistic	37.19176	Durbin-Watson stat	1.950726
Prob(F-statistic)	0.000000		

Source: own compilation

Appendix No. 7: Stationarity test for Gross School Enrolment Rate for Female at secondary level

Null Hypothesis: D(LNX7) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.113917	0.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX7,2)
Method: Least Squares
Date: 02/06/16 Time: 12:33
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX7(-1))	-1.009000	0.165033	-6.113917	0.0000
C	0.039433	0.008578	4.596883	0.0000

R-squared	0.502554	Mean dependent var	0.000773
Adjusted R-squared	0.489110	S.D. dependent var	0.050647
S.E. of regression	0.036201	Akaike info criterion	-3.749565
Sum squared resid	0.048488	Schwarz criterion	-3.664254
Log likelihood	75.11651	Hannan-Quinn criter.	-3.718956
F-statistic	37.37998	Durbin-Watson stat	1.993019
Prob(F-statistic)	0.000000		

Source: own compilation

Appendix No. 8: Stationarity test for Gross School Enrolment Rate for Female at tertiary level

Null Hypothesis: D(LNX8) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.476923	0.0009
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX8,2)
Method: Least Squares
Date: 02/06/16 Time: 12:43
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX8(-1))	-0.829964	0.185387	-4.476923	0.0001
C	0.048199	0.015512	3.107221	0.0036

R-squared	0.351365	Mean dependent var	0.007271
Adjusted R-squared	0.333834	S.D. dependent var	0.095885
S.E. of regression	0.078260	Akaike info criterion	-2.207630
Sum squared resid	0.226613	Schwarz criterion	-2.122320
Log likelihood	45.04879	Hannan-Quinn criter.	-2.177022
F-statistic	20.04284	Durbin-Watson stat	1.853452
Prob(F-statistic)	0.000070		

Source: own compilation

Appendix No. 9: Stationarity test for Gross School Enrolment Rate for Male at primary level

Null Hypothesis: D(LNX9) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.858429	0.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX9,2)
Method: Least Squares
Date: 02/06/16 Time: 12:45
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX9(-1))	-0.971824	0.165885	-5.858429	0.0000
C	0.003966	0.003063	1.294654	0.2035

R-squared	0.481220	Mean dependent var	-0.000520
Adjusted R-squared	0.467199	S.D. dependent var	0.025376
S.E. of regression	0.018523	Akaike info criterion	-5.089732
Sum squared resid	0.012694	Schwarz criterion	-5.004422
Log likelihood	101.2498	Hannan-Quinn criter.	-5.059124
F-statistic	34.32119	Durbin-Watson stat	1.931924
Prob(F-statistic)	0.000001		

Source: own compilation

Appendix No. 10: Stationarity test for Gross School Enrolment Rate at secondary level

Null Hypothesis: D(LNX10) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.419023	0.0011
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX10,2)
Method: Least Squares
Date: 02/06/16 Time: 12:49
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX10(-1))	-0.703689	0.159241	-4.419023	0.0001
C	0.013781	0.004924	2.798546	0.0081

R-squared	0.345454	Mean dependent var	0.000763
Adjusted R-squared	0.327764	S.D. dependent var	0.030055
S.E. of regression	0.024642	Akaike info criterion	-4.518768
Sum squared resid	0.022468	Schwarz criterion	-4.433458
Log likelihood	90.11598	Hannan-Quinn criter.	-4.488160
F-statistic	19.52776	Durbin-Watson stat	2.043624
Prob(F-statistic)	0.000083		

Source: own compilation

Appendix No. 11: Stationarity test for Gross School Enrolment Rate for Male at tertiary level

Null Hypothesis: D(LNX11) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.043481	0.0002
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX11,2)
Method: Least Squares
Date: 02/06/16 Time: 12:51
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX11(-1))	-0.885692	0.175611	-5.043481	0.0000
C	0.028782	0.013665	2.106271	0.0420

R-squared	0.407400	Mean dependent var	0.005726
Adjusted R-squared	0.391384	S.D. dependent var	0.103085
S.E. of regression	0.080421	Akaike info criterion	-2.153173
Sum squared resid	0.239296	Schwarz criterion	-2.067862
Log likelihood	43.98687	Hannan-Quinn criter.	-2.122564
F-statistic	25.43670	Durbin-Watson stat	1.889312
Prob(F-statistic)	0.000012		

Source: own compilation

Appendix No. 12: Stationarity test for Average years of total schooling for Female

Null Hypothesis: D(LNX12) has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.763402	0.0000
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX12,2)
Method: Least Squares
Date: 02/06/16 Time: 12:52
Sample (adjusted): 1982 2011
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX12(-1))	-3.838412	0.567527	-6.763402	0.0000
D(LNX12(-1),2)	3.154129	0.560796	5.624376	0.0000
D(LNX12(-2),2)	3.167023	0.504261	6.280522	0.0000
D(LNX12(-3),2)	3.168519	0.469214	6.752824	0.0000
D(LNX12(-4),2)	3.113187	0.421580	7.384564	0.0000
D(LNX12(-5),2)	1.374905	0.332793	4.131408	0.0006
D(LNX12(-6),2)	1.693220	0.357337	4.738440	0.0001
D(LNX12(-7),2)	1.682475	0.306435	5.490488	0.0000
D(LNX12(-8),2)	1.616366	0.267881	6.033905	0.0000
D(LNX12(-9),2)	1.501307	0.204126	7.354807	0.0000
C	0.183579	0.027751	6.615223	0.0000

R-squared	0.913556	Mean dependent var	-0.000236
Adjusted R-squared	0.868060	S.D. dependent var	0.047679
S.E. of regression	0.017319	Akaike info criterion	-4.997500
Sum squared resid	0.005699	Schwarz criterion	-4.483728
Log likelihood	85.96250	Hannan-Quinn criter.	-4.833140
F-statistic	20.07964	Durbin-Watson stat	2.010502
Prob(F-statistic)	0.000000		

Source: own compilation

Appendix No. 13: Stationarity test for Average years of primary schooling for Female

Null Hypothesis: D(LNX13) has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.361381	0.0207
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX13,2)
Method: Least Squares
Date: 02/06/16 Time: 12:55
Sample (adjusted): 1982 2011
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX13(-1))	-1.845448	0.549015	-3.361381	0.0033
D(LNX13(-1),2)	1.132944	0.532884	2.126062	0.0468
D(LNX13(-2),2)	1.419583	0.485880	2.921673	0.0088
D(LNX13(-3),2)	1.527403	0.473717	3.224292	0.0045
D(LNX13(-4),2)	1.619151	0.427501	3.787481	0.0012
D(LNX13(-5),2)	0.240002	0.328464	0.730680	0.4739
D(LNX13(-6),2)	0.424419	0.348565	1.217618	0.2383
D(LNX13(-7),2)	0.737744	0.320052	2.305072	0.0326
D(LNX13(-8),2)	0.801369	0.310758	2.578757	0.0184
D(LNX13(-9),2)	0.940616	0.259377	3.626439	0.0018
C	0.064720	0.020192	3.205257	0.0047

R-squared	0.804980	Mean dependent var	9.94E-05
Adjusted R-squared	0.702339	S.D. dependent var	0.041930
S.E. of regression	0.022876	Akaike info criterion	-4.440873
Sum squared resid	0.009943	Schwarz criterion	-3.927101
Log likelihood	77.61310	Hannan-Quinn criter.	-4.276513
F-statistic	7.842613	Durbin-Watson stat	1.368891
Prob(F-statistic)	0.000071		

Source: own compilation

Appendix No. 14: Stationarity test for Average years of secondary schooling for Female

Null Hypothesis: D(LNX14,2) has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.274889	0.0241
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX14,3)
Method: Least Squares
Date: 02/06/16 Time: 12:59
Sample (adjusted): 1978 2011
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX14(-1),2)	-1.606935	0.490684	-3.274889	0.0028
D(LNX14(-1),3)	0.302000	0.445503	0.677885	0.5034
D(LNX14(-2),3)	0.211577	0.371938	0.568849	0.5740
D(LNX14(-3),3)	0.256530	0.270364	0.948835	0.3508
D(LNX14(-4),3)	0.391111	0.158257	2.471368	0.0198
C	-0.006020	0.009734	-0.618445	0.5413

R-squared	0.771074	Mean dependent var	0.000800
Adjusted R-squared	0.730194	S.D. dependent var	0.105618
S.E. of regression	0.054861	Akaike info criterion	-2.809251
Sum squared resid	0.084272	Schwarz criterion	-2.539893
Log likelihood	53.75727	Hannan-Quinn criter.	-2.717392
F-statistic	18.86201	Durbin-Watson stat	2.119497
Prob(F-statistic)	0.000000		

Source: own compilation

Appendix No. 15: Stationarity test for Average years of tertiary schooling for Female

Null Hypothesis: D(LNX15) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.466650	0.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX15,2)
Method: Least Squares
Date: 02/06/16 Time: 13:01

Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX15(-1))	-1.198739	0.160546	-7.466650	0.0000
C	0.086775	0.024857	3.490994	0.0013

R-squared	0.601082	Mean dependent var	0.001554
Adjusted R-squared	0.590300	S.D. dependent var	0.215442
S.E. of regression	0.137899	Akaike info criterion	-1.074663
Sum squared resid	0.703602	Schwarz criterion	-0.989352
Log likelihood	22.95593	Hannan-Quinn criter.	-1.044054
F-statistic	55.75086	Durbin-Watson stat	1.410548
Prob(F-statistic)	0.000000		

Source: own compilation

Appendix No. 16: Stationarity test for Average years of total schooling for Male

Null Hypothesis: D(LNX16) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.157766	0.0304
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX16,2)
Method: Least Squares
Date: 02/06/16 Time: 13:03
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX16(-1))	-0.377143	0.119434	-3.157766	0.0032
C	0.010406	0.004061	2.562378	0.0146

R-squared	0.212288	Mean dependent var	-0.001223
Adjusted R-squared	0.190999	S.D. dependent var	0.011884
S.E. of regression	0.010689	Akaike info criterion	-6.189297
Sum squared resid	0.004227	Schwarz criterion	-6.103986
Log likelihood	122.6913	Hannan-Quinn criter.	-6.158688
F-statistic	9.971486	Durbin-Watson stat	2.258398
Prob(F-statistic)	0.003160		

Source: own compilation

Appendix No. 17: Stationarity test for Average years of primary schooling for Male

Null Hypothesis: D(LNX17,2) has a unit root
Exogenous: Constant
Lag Length: 9 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.493336	0.0155
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX17,3)
Method: Least Squares
Date: 02/06/16 Time: 13:04
Sample (adjusted): 1983 2011
Included observations: 29 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX17(-1),2)	-1.595589	0.456752	-3.493336	0.0026
D(LNX17(-1),3)	0.495359	0.423585	1.169443	0.2575
D(LNX17(-2),3)	0.646621	0.358357	1.804405	0.0879
D(LNX17(-3),3)	0.729466	0.312772	2.332263	0.0315
D(LNX17(-4),3)	0.761410	0.270969	2.809951	0.0116
D(LNX17(-5),3)	0.138700	0.232284	0.597114	0.5579
D(LNX17(-6),3)	0.116156	0.207596	0.559530	0.5827
D(LNX17(-7),3)	0.222754	0.157022	1.418615	0.1731
D(LNX17(-8),3)	0.267519	0.114937	2.327540	0.0318
D(LNX17(-9),3)	0.237726	0.069329	3.428972	0.0030
C	-0.000698	0.000949	-0.735566	0.4715

R-squared	0.941577	Mean dependent var	-0.000237
Adjusted R-squared	0.909120	S.D. dependent var	0.016574
S.E. of regression	0.004996	Akaike info criterion	-7.478485
Sum squared resid	0.000449	Schwarz criterion	-6.959855
Log likelihood	119.4380	Hannan-Quinn criter.	-7.316056
F-statistic	29.00983	Durbin-Watson stat	2.312631
Prob(F-statistic)	0.000000		

Source: own compilation

Appendix No. 18: Stationarity test for Average years of secondary schooling for Male

Null Hypothesis: D(LNX18,2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.928910	0.0000
Test critical values:	1% level	-3.615588	
	5% level	-2.941145	
	10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX18,3)
Method: Least Squares
Date: 02/06/16 Time: 13:06
Sample (adjusted): 1974 2011
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX18(-1),2)	-1.368340	0.153248	-8.928910	0.0000
C	-0.005063	0.004176	-1.212356	0.2333

R-squared	0.688919	Mean dependent var	0.000609
Adjusted R-squared	0.680278	S.D. dependent var	0.045001
S.E. of regression	0.025445	Akaike info criterion	-4.453390
Sum squared resid	0.023308	Schwarz criterion	-4.367201
Log likelihood	86.61441	Hannan-Quinn criter.	-4.422725
F-statistic	79.72544	Durbin-Watson stat	1.986388
Prob(F-statistic)	0.000000		

Source: own compilation

Appendix No. 19: Stationarity test for Average years of tertiary schooling for Male

Null Hypothesis: D(LNX19) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.322408	0.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX19,2)
Method: Least Squares
Date: 02/06/16 Time: 13:10
Sample (adjusted): 1973 2011
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX19(-1))	-1.038622	0.164276	-6.322408	0.0000
C	0.046967	0.011643	4.033811	0.0003

R-squared	0.519311	Mean dependent var	-8.39E-18
Adjusted R-squared	0.506319	S.D. dependent var	0.079687
S.E. of regression	0.055990	Akaike info criterion	-2.877370
Sum squared resid	0.115990	Schwarz criterion	-2.792059
Log likelihood	58.10872	Hannan-Quinn criter.	-2.846761
F-statistic	39.97285	Durbin-Watson stat	1.992902
Prob(F-statistic)	0.000000		

Source: own compilation

Appendix No. 20: Stationarity test for Fertility Rate total, births per woman

Null Hypothesis: D(LNX20,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.050623	0.0013
Test critical values:	1% level	-4.252879	
	5% level	-3.548490	
	10% level	-3.207094	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNX20,3)
Method: Least Squares
Date: 02/06/16 Time: 13:13
Sample (adjusted): 1978 2011
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNX20(-1),2)	-1.042700	0.206450	-5.050623	0.0000
D(LNX20(-1),3)	0.324783	0.146990	2.209552	0.0358
D(LNX20(-2),3)	0.904470	0.172879	5.231811	0.0000
D(LNX20(-3),3)	1.059546	0.237228	4.466357	0.0001
D(LNX20(-4),3)	0.457000	0.221886	2.059621	0.0492
C	-0.000549	0.000213	-2.580590	0.0156
@TREND("1971")	2.08E-05	8.36E-06	2.482658	0.0196

R-squared	0.591081	Mean dependent var	7.66E-05
Adjusted R-squared	0.500210	S.D. dependent var	0.000563
S.E. of regression	0.000398	Akaike info criterion	-12.63804
Sum squared resid	4.28E-06	Schwarz criterion	-12.32378
Log likelihood	221.8466	Hannan-Quinn criter.	-12.53087
F-statistic	6.504624	Durbin-Watson stat	1.776043
Prob(F-statistic)	0.000247		

Source: own compilation