Impact of Gender Inequality in Education on Economic Growth

By

Muhammad Ahsan Iqbal

Department of Economics

Pakistan Institute of Development Economic Islamabad,Pakistan

2014

Impact of Gender Inequality in Education on Economic Growth

Muhammad Ahsan Iqbal
11/MPhil/PIDE/2010
ahsiniqbalbhatti@gmail.com
M. Phil Economics
Session: 2010-12

Supervisor
Dr. Idrees Khawaja

Department of Economics

Pakistan Institute of Development Economic Islamabad,Pakistan

2014

Dedication

This work is dedicated to my beloved family for their unconditional support during my studies. Especially to my belated Mother.

Acknowledgment

First and Foremost, I would like to thank Almighty Allah for being my strength and guide in writing of this thesis. Without Him, I would not have had the wisdom or the physical ability to do so.

I express my gratitude to my supervisor, Dr. Idrees Khawaja for his support, valuable comments, unwavering guidance and encouragement throughout the course of this work. His special interest and knowledge enabled me the right guidance and provided me much needed motivation.

I am also very thankful for all my class fellows. When times were tough, they gave me the confidence and strength to keep pressing on to achieve all my goals. May Allah bless them all. I appreciate the feedback offered by Malik Mubashir Hussain, Abdul Hannan, Faheem Sajjad Dhariwal, Salman Ahmed, Yasir Khan, Kamran Khan, Ghulam Mustafa, and Tahira Ishaq.

Finally, I am thankful to everyone in my family for being supportive during my education, especially my parents and Uncle Muhammad Ashraf, who have contributed to and encouraged me during my studies.

Muhammad Ahsan Iqbal

Abstract

The study seeks to examine the direct and indirect effects of gender inequality in education and employment on economic growth in Pakistan. Using the Overlapping Generation Growth Model, we have derived direct and indirect effects of gender gaps in education and employment on economic growth. Using the simultaneous equations model we have empirically examined direct and indirect impact of gender gaps (education and employment) on economic growth by employing time series data through generalized Method of Moment estimation. The results of estimation show that reduction in educational gender gap positively influences economic growth of Pakistan and it also has positive indirect impact on economic growth of Pakistan through investment, fertility rate and labor force growth. Although, reduction in employment gender gap has an insignificant positive impact on growth but it indirectly positively influences growth through investment, fertility rate and labor force growth.

Contents

List of Tables

Chapter 1

Introduction

There are many reasons being concerned about the existence of gender inequalities. The gender inequalities in education, health, employment, and wage are very problematic in social well-being perspective. The gender inequalities contribute to lowering the social well-being. These inequalities cannot be justified on ethical and philosophical grounds. More importantly, these inequalities may constrain the economic growth and undermine the developmental goals.

The relationship between gender inequality and economic growth has become one of the most debated issue since last two decades and the issue has received great attention in developing countries. The subject has received attention from economists like Barro, Klasen, Gatti, Dollar, Galor, Lagerlof, Collier, Benerjee, Duflo, and many others have paid much intention towards these issues.

If south Asia, Sub-Saharan Africa, Middle East and North Africa had started with more balanced education in 1960 and tried to decrease gender gap in education these areas could have 0.9 percentage point faster annual economic growth[1].

Human capital is the engine of economic growth, and the main building block of the human capital is education. The economy requires a spectrum of skills and talent ranging from simple manual labor to the work of highly trained scientists and intellectuals. It also requires skills and abilities which are different in kind analytical power, physical strength, commercial canniness and judgment. All these skills are developed through education. In general it is true

[1] *See Klasen (2002)*

to say that the more advanced economies require a higher degree of trained and skills labor which is only possible through education.

Gender inequality in education has direct effect on economic growth by lowering average human capital and indirectly, it effects economic growth by influencing investment and population growth. The gender inequality in education reduces average human capital in an economy which constrains economic performance by restricting talent pool. The talent pool has less qualified boys instead of better qualified girls. Female education is also known to decrease the fertility levels which reduce child mortality rate and promotes the education of the next generation. These factors influence the economic growth positively[2].

Similarly, gender inequality in employment also effects economic growth directly as well as indirectly. It does so directly by limiting average ability of the labor force by employing less talented male instead more talented female in the work force. It indirectly affects the economic growth through reduction in fertility and increase female's intra family bargaining power. Decrease in the gender gap of employment decreases fertility rate which curbs the population growth, increase per capita income and also reduces the dependency ratio. Reduction in the employment gender gap increases bargaining power of women, increases savings and enhances investment in the children's education and health, which improves the human capital for the next generation[3].

Reducing the gender gap of employment would lead to significant improvement in economic growth for example; increase the United States GDP by 9 percent, Eurozone's GDP by 13 percent and Japan's GDP by 16 percent[4].

[2] *See Klasen and Lamanna (2009)*
[3] *See Klasen and Lamanna (2009)*
[4] *See, Kevin Daly (2007)*

Worldwide female have less education and worse health treatment than their male counterparts (World Bank 2000). In the countries falling in poorest quartile only 5% adult women in poorest quartile had any secondary education, one half of the level for men while on the other hand in richest quartile of countries 51% adult women had at least some secondary education, (Dollar and Gatti, 1999). Amartya Sen in their popular series of papers has concluded that due to these kinds of inequalities there were 100 million missing women[5] worldwide.

A cursory analysis of these issues for Pakistan suggests that in Pakistan gender inequities are very high. According to The Global Gender Gap Report (2013), Pakistan is placed in second last position among major countries of the world in the gender gap ranking.

In Pakistan almost fifty percent of total population is female and their participation in the market production is very low. Female participation in productive activities is low because of many factors like less access to the productive inputs, lesser participation in work force, lower investment in human capital. Despite the lack of institutional support and prevailing gender inequalities in the nutrition, health, education, employment, access to technology, access to credit and title to land, females are playing a vital role in the economic development[6].

Educational gender gap in Pakistan is greater than average the for the South Asian countries and also greater than the average among major developing countries of the world. Gender discrimination in education is significant within the country. For example, male literacy rate has increased from 35.3 percent in 1981 to 55.29 percent in 1998 and to 68.62 in 2009, whereas female literacy rate has increased from 14.77 percent in 1981 to 29.04 percent 1998

[5] *Sen refers to women who have suffered gender discriminations as missing women.*
[6] *Siddique (2006*)

and to 40.31 percent in 2009. Even though literacy rate for female has doubled from 1981 to 1998 and almost tripled by 2009 but gender gap also has widened from 20.6 percent in 1981 to 26.2 percent in1998 and 28.3 percent by 2009.[7]

Labor force participation rate of female has increased in Pakistan but the increase in unemployment is also much sharper for female than male. The main occupational categories for female are agriculture, domestic services and manufacturing (small scale). This means that the industrial and occupational choices are limited for females in Pakistan[8].

Pakistan has forgone a great opportunity in terms of not utilizing the high rate of return for female education. Larry Summers (1994) empirically finds that if in a year $ 30,000 are used on 1000 female's education it provides benefits to the turn of $ 88,000. The return to female education is much higher compared to rest of any development expenditure in Pakistan. Ashraf and Ashraf (1993) also find similar results. Klasen (2000) found that due to this large gender gap in Pakistan, there is 0.4 to 0.9 percent difference in growth rate between East Asian countries and Pakistan.

Improvement in educational gender equality not only increases the economic involvement for females, it also improves gender equality of employment. Siddique (2006) shows that gender gap in employment is almost nil for the professional females. This implies that enhancing female education will also help to decrease the gender gap in employment.

[7] *Data source World development Indicator (2013).*
[8] *See, for example, Siddique (2006)*

1.1 Significance of the study:

Most of the studies related to impact of gender gap in education on economic growth have used cross country and panel regression to analyze this issue. Only few country specific studies are available that use time series data. These country-specific studies using time series data, have only analyzed the direct effect of educational gender gap on the economy and the indirect effect has been ignored.

Using the overlapping generation model developed by Lagerlof (2003), we have derived both the direct and indirect effects of education and employment on economic growth. Lagerlof (2003) has derived only the effect of educational inequality on economic growth.

Our contribution lies in driving the effect of gender gap in employment on economic growth by relaxing the assumption of exogenously given wages in Lagerlof's model. We have used different wages for male and female and these wages are different in different time periods. Using different wages for male and female, we have derived the direct and indirect impact of education and labor market inequalities on economic growth.

1.2 Objective of the study:

The main objective of the study is to investigate that how the reduction in gender gap in education and employment will influence economic growth. We will estimate the direct as well as indirect impact of gender gap in education and employment on economic growth.

1.3 Hypothesis:

The main hypotheses of the study are that whether or not:

1. Increase in gender inequality in education has negative impact on economic growth of Pakistan.
2. Increase in Gender gap in employment has negative impact on economic growth of Pakistan.
3. The two gender gaps referred above indirectly impact economic growth via investment, population growth and labor force growth.

1.4 Organization of the study:

Rest of the study is organized as follow chapter 2 present the review of literature. Chapter 3 describes the theoretical linkages between gender inequalities in education, employment and economic growth. Chapter 4 provides description of theoretical and empirical models for the study. Chapter 5 is confined to brief discussion of estimation technique used in this study, description of the variables and brief on descriptive statistics. Chapter 6 presents the estimation results and interprets these. Chapter 7 concludes the study.

Chapter 2

Literature Review

2.1 Introduction

Impact of gender inequality in education and employment is supported by vast literature on the subject. This chapter reviews the theoretical and empirical literature on gender inequality.

2.2 Theoretical Literature

Theoretical literature suggests that gender gap in education reduces average human capital in an economy which constrains economic performance. The gender gap in education restricts the pool of talent by including relatively less qualified boys instead of more qualified girls (Dollar and Gatti, 1999). Literature suggests various benefits of promoting gender equality in education, one argument is that given gender inequality in education if there are diminishing marginal return to education the diminishing return would be higher for boys and lower for girls, therefore, educating girls is more beneficial for better economic performance (World Bank 2001; Knowles, Lorgelly, and Owen 2002). Another argument is that promoting female education is known to decrease the fertility levels, reduce child mortality rate and promote the education of the next generation. All these factors have a positive impact on the economic growth. So equality in education benefits the economy [see for example, Galor and Weil (1996) Lagerlof (2003) World Bank (2001) and King, Klasen, and Porter (2008)]. On the other hand, low level of fertility level will lead to such demographic phase which Bloom and Williamson (1998) refer to as a ‘‘demographic gift’’ for period of several decades. Working age population will grow much faster than the aggregate population, dependency ratio will decrease and hence per capita economic growth will increase.

The East Asian countries were able to compete internationally by introducing female-intensive export oriented manufacturing industries. This strategy is now finding followers in South Asian countries and individual countries across the developing world [see for example, Seguino (2000a, 2000b)].

Similarly, if we analyze the theoretical literature for the gender gap in employment we have many closely related arguments. The argument is the same as in the case of gender gap in education that gender gap distorts the economy by restricting the pool of employees less talented males are chosen as compared to highly talented females. This reduces the average ability of the labor force, (Esteve-Volart, 2004). This argument could also be made for the self-employment in agriculture and non-agriculture sectors, where unequal access to technologies, critical inputs and resources reduce the average productivity of self-employed labor force (Blackden, et al; 2006). Cavalcanti and Tavares (2007) suggest that gender inequality in employment is also positively related to the fertility rate and high fertility rate reduce the economic growth.

Another argument is related to the advantage gained by employing the relatively cheap female labor as compared to male labor in export oriented industries to compete with international markets due to gender gap in employment. This way gender gap in employment also reduces the economic growth (Seguino 2000a, 2000b).

The female's intra families bargaining power also influence economic growth. Literature suggests that female's employment and earnings enhance their bargaining power in the family [See for example Sen (1990), Haddad et al (1997), Thomas (1997), World Bank (2001), Klasen and Wink (2003) and King et al (2008)]. This increase in bargaining power not only benefits the females concerned, but also impacts economic growth. The enhancement in female empowerment may increase national savings because male and

female have different savings behavior [Seguino and Foloro (2003)]. Female empowerment also enhances investment in education and health of their children which improves the human capital for next generation and this contributes to economic growth [Thomas (1997) and World Bank (2001)].

Yet another argument is related to governance. Literature regarding this issue is growing but is still rather suggestive. This literature suggests that on average females are less inclined to corruption and nepotism than male [World Bank (2001) Sawamy et al (2003)]. If these results are robust then increasing female employment might be useful for economic performance in this sense as well.

There are two different views regarding impact of gender wage gap on economic growth. One point of view is that higher gender wage gap is associated with low female wages which has positive impact on economic growth. Because low female wages enhance competitiveness of the export oriented industries which increase economic growth [Blecker and Seguino (2002)]. However, the Galor and Weil (1996) and Calcvacanti and Tavares (2007) offer the contrasting view that the higher gender wage gaps have negative impact on the economic growth because these gaps will lead to lower the female employment this would increase fertility rate which decreases economic growth. Klasen and Lamanna (2009) suggest that these conflicting views arise due time horizon considered in models referred above. Seguino and Blecker consider the short-term demand induced impact of gender wage gap on economic growth model while Galor and Weil consider the long-term supply constrained impact.

Klasen and Lamanna (2009) has discussed that it is very difficult to analyze the gender gap in education, employment and wage, separately. Because gender gaps in one direction tend to lead to gender gaps in other directions. Educational gender gap might cause the gender gap in

employment mainly in formal sector where employers only prefer educated workers. If there is larger gender wage gap or there are hindrances to female employment then rational parents might think it is not profitable to educate the girls which tend to increase the gender gap in education. So, the gender gaps in education and in employment are closely related.

It is very important to analyze the effects of gender inequality in education and employment, separately. Because these gender inequalities are not measuring the same thing. It is possible that these two issues do not entirely depend on each other and are mostly driven by the institutional factors that govern the access to education and access to employment. For instance, it is possible that gender gap in education might reduce due to education policy that tries to achieve universal education.

The externalities of the female employment and education are not the same. Gender equality in education reduce the fertility rate, child mortality rate and improves health and education of the next generation, while gender equality in employment have little and indirect impact on these features. For example, impact of gender equality in employment works mainly through the bargaining power of females, however, the absence of female from home may be have negative impact on childcare.

2.3 Empirical Literature:

On the empirical side, Benavot (1989) was the first who estimated the impact of education inequality on economic growth. Study estimated the impact of gender inequality in education on economic growth using panel regression of 96 countries. The study finds that gender gap in primary education have significant impact on economic growth while gender gap in secondary education has non-significant effect. Barro and Lee (1994) using data of 138 countries finds that female education is inversely related to growth and argue that it is due to

the backwardness of the society. Stocky (1994), Lorgelly and Owen (1999) have analyzed these interesting results and find that these are influenced by some outlier in the data set like Asian Tigers and countries from sub Saharan African. Number of authors including Dollar and Gatti (1999), Appiah and McMahon (2002), Forbes (2000), Klasen (2002) and Yamarik and Ghosh (2003) also argue that Barro and Lee's study has econometric problems.

Using Solow growth framework many studies like Lorgelly and Owen (1999), Hill and King (1993) and Knowls, Lorggelly and Owen (2002), find that educational gender gap negatively impact on economic growth. Using overlapping generation growth model, Galor and Wiel (1996) Lagerlof (2003) also find that gender gap in education has negative impact on the economic growth. Klasen (1999, 2002, 2004) and Klasen and Lamanna (2009) in a series of paper using cross countries, panel regression investigate that gender gap in education have significant negative relation with economic growth. Tansel and Güngör (2012) using the province level data for Turkey also finds that gender equality in education is positively related to economic growth.

Alderman et al; (1996) using "cognitive skill" for output of production process of education finds that there is large gender gap in education and cognitive achievement in rural Pakistan, the authors argue that could be the reason for slower growth. Hassan and Mirza (2005) have similar result that gender inequality in education has stronger negative impact on economic growth. Chuadhry (2007) finds that enhancement in primary and secondary female enrollments have positive impact on economic growth of Pakistan. Pervaiz et al (2011) using the gender index for Pakistan instead of taking the education and labor inequality separately finds that gender index negatively impacts economic growth.

Studies that consider the impact of gender gap in employment on economic growth are relatively fewer, mostly due the nonavailability of data for wages. Klasen (2002, 2004)

Klasen and Lamanna (2009) using the panel regression for cross countries analysis finds that the rise in female participation in labor force positively impacts economic growth.

Few studies like Seguino (2000a, 2000b) and Busse and Spielmann (2006) find that gender wage gap has positive impact on the economic growth in export-oriented middle income countries. But Johnson and Baldwin (1993) describe that gender wage gap has negative impact on economic growth.

In country specific analysis Esteve-Volart (2004) using the panel data for Indian states finds that gender inequality in employment and managerial positions negatively impacts economic growth.

2.4 Conclusion:

To conclude forgoing discussion, we have considerable theoretical support for the view that gender inequalities in education and employment negatively impact economic growth. We also have substantial support from empirical studies that these inequalities generate negative impact on economic growth. But there are only fewer studies which examine this idea in country specific analysis. There is no country specific study which analyzes the impact of these inequalities indirectly on economic growth via investment, fertility rate, and growth in labor force. In this study, we make an attempt to fill this gap. We develop a framework for examining the direct and indirect impact of these inequalities on economic growth. Using this framework we estimate these impacts as well.

Chapter 3

Theoretical Linkage of Gender Gaps in Education and Employment with Economic Growth

3.1 Introduction:

In this chapter, we will discuss theoretical linkage between gender gaps in education and employment, and economic growth that might exist based on chapter 2.

3.2 Lower average human capital:

We assume that both female and male are similar in their inborn abilities, therefore, who has more abilities receives more education than other. But gender inequality decreases this possibility and the male having less ability receives more education than the female. As a result educated children have less average abilities which could have been more if male and female had equal access to education. If we consider that human capital of a person is the product of both inborn abilities and education, then gender inequality in education keeps the average human capital in the economy below its potential level and slows economic growth. Due to this reason, gender inequality in education will reduce the impact of male education and raises the impact of female education on economic growth (Knowles, Lorgelly, and Owen 2002, Dollar and Gatti 1999).

Similarly, gender inequality in employment also keeps average ability of the labor force below its potential level by restricting the pool of talent from which to draw for employment (Esteve-Volart, 2004).

Empirical findings also support the view that lower average human capital directly reduces economic growth. The countries having gender inequality in education similar to current level in Africa, have forgone 0.3 percentage point in annual per capita growth (Klasen and Lamanna 2009). The countries having lower average human capital have less return on investment. As a result, this constrains investment rate which adversely influence the economic growth. Esteve-Volart (2004) also reports for India that gender gap in employment has direct and indirect impact on Economic growth.

If we assume that male and female human capital are imperfect substitutes than there are high diminishing returns to male and lower to female education which lowers average human capital and economic growth (Knowles, Lorgelly, and Owen 2002)

3.3 Female employment and wage discrimination:

In formal employment, female experiences wage discrimination in most countries, (Klasen, 2002). This wage discrimination can enhance the investment in industries that employ female labor, if females enjoy education appropriate to enter into the labor market. Thus economic growth can be enhanced by reducing education gender gap. It enables the employer to employ low-cost female labor which enhances the investment and economic growth.

This effect also enjoys empirical support. In export oriented East Asian economies due to improvement in female's education and large wage gap between female and male, increased the female employment and caused rapid growth in female labor intensive industries. Due to this reason these countries have experienced higher growth rate (Seguino 2000b). Some researchers like Galor and Weil (1996) and Cavalcanti and Tavares (2007) hold contrasting view that wage discrimination has negative impact on the economic growth. Because these

gaps lead to lower the female employment, increases fertility rate which decreases the economic growth.

3.4 Direct effect of female education and employment:

The decrease in gender gap in education implies increase in the level of female education. This high level of female education improves the quantity and quality of human capital of the next generation which effects the economic growth positively (World Bank 2001).

Decrease in gender gap of employment also has positive impact on economic growth as it enhances the female intra family bargaining power which in term increases the savings and investment in the children's health and education. All this positively influences economic growth.

Better educated married couples can support each other through their education and can promote one another with their lifelong learning and improve the quality of education for their children. This is possible only through reduced gender gap in education.

Improvement in human capital through such effects can increase economic growth. Because these effects have positive impact on the labor productivity which can directly enhance the economic growth. These effects also have indirect impact on economic growth as these can increase the return on physical investment. This increase in investment enhances economic growth. Because wage discrimination lowers the employment rate of females and the employment rate has inverse relation with fertility. So, the decrease in the employment will lead to high fertility rate which will reduce the economic growth.

3.5 Indirect effect of education and employment:

As reduced gender inequalities in education and employment, increase the female level of education and employment and this increase in level of education employment reduces the fertility rate. Decrease in fertility rate can affect the economic growth in four different ways.

First, decrease in fertility rate decreases the population growth so this decrease in population growth will enable the economy to invest in capital deepening (increase in capital per worker) instead of capital widening (increase in capital for more workers) which could enhance the economic growth.

Second, decrease in fertility rate will reduce the dependency burden which leads to increase in saving and investment rate and this effect will also enhance the economic growth.

Bloom and Williamson (1998) discussed next two effects as demographic gift which are temporary because after few decades working age labor force decreases and the number of older people increase which lead to high dependency burden. Still, these temporary effects have considerable contribution in rapid growth of East Asia and South Asia.

Third, share of labor force in the population increases due to decrease in fertility rate for short time period. This increase in labor force is the result of previously high growth rate of population. This increase in labor force increases demand for investment in capital and social overheads. If this demand is fulfilled by the increase in domestic saving the increase in domestic saving is due to reduced dependency burden or increase in capital inflow or both it will enhance the income and then boost the economic growth. It is the indirect effect through the impact of change in the rate of population growth on investment.

Fourth, if increase in labor force is utilized well through increasing employment it will increase the per capita income even if wages and productivity remain constant. As more people share the wages and there are only few dependents, this boosts the per capita income.

Chapter 4

Theoretical and empirical Framework

4.1 Introduction

In this chapter, we develop theoretical and empirical framework to examine the impact of gender inequalities in education and employment on economic growth.

4.2 Theoretical Model

We use a variant of over lapping generation model developed by Nils-Petter Lagerlöf (2003) for gender inequality in 2003 to support the study. The model considers that people live for two time periods. In first time period they belong to childhood and in second time period they belong to adulthood. We consider two types of the people, male and female in the model. Both male and female have similar utility level and abilities but they may have different level of education, or human capital provided by their parents.

A male have h^m unit of human capital and female from the same generation have h^f unit of human capital. Every unit of male human capital earn exogenously determined wage, w^m and for female human capital w^f for every unit of time spent on work. Wages for both sexes are different. This is one main point of difference with Lagerlöf (2003).

There is no difference between male and female with respect to human capital belonging to same generation. Couples are formed randomly matching males and females. Couple_t is referred as the couple which is formed in time t. Couple has joint income equal to $(w_t^m h_t^m + w_t^f h_t^f)$, and on the basis of this income they decide to rear n_t continuous number of

children in which half are sons and half are daughters. They provide h_{t+1}^{m} and h_{t+1}^{f} unit of human capital and on basis of this human capital their sons and daughter earn w_{t+1}^{m} and w_{t+1}^{f} respectively. Here we refer to fertility as quantity of children and to human capital as quality of children.

4.2.1 Child Rearing Cost

There are three component of the cost to rear a child first time cost, second cost of providing goods for consumption to children and third cost of providing human capital to children. We first consider only time cost and consumption of goods cost for our analysis and denote it as q_t.

We consider that male has more human capital than female (for whatever reason) in time period t. To rear a child "b" unit of time cost and "a" units of consumption of goods cost has to be borne. With low human capital and less earnings female spent her full time to rear a child. She spends b units of time per child and can earn $w_t^f h_t^f$ per unit of time. The total income a couple forgoes to rear a child is $b(wh_t^f)$. By adding this loss of income to consumption of goods cost we obtain the total cost of raising a child as:

$$q_t = a + b(w_t^f h_t^f) \qquad (4.1)$$

4.2.2 Preferences

Couple makes the preference decisions keeping in mind their own consumption as well as number of children they have. They also keep in mind the income of their sons and daughters and their respective spouses in future. This is given by the sum of human capital of the wages of their own sons and daughters in law and their sons in law and their own daughters. We can define utility function as:

$$U_t = (1-\beta)\ln(C_t) + \beta[\ln(n_t) + \delta\{\ln[(w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^{-f})] + \ln[(w_{t+1}^{-m} h_{t+1}^m + w_{t+1}^f h_{t+1}^f)]\}] \quad (4.2)$$

Here, in this equation $\beta \in (0, 1)$, $\delta \in (0, 1)$ and C_t denote the combine consumption of the couple. h_{t+1}^{-m} and h_{t+1}^{-f} denotes the human capital of couple's sons and daughter in law belonging to the same generation as their children.

4.2.3 Budget Constraint

Available consumption for couple is given by:

$$(C_t) = (w_t^m h_t^m + w_t^f h_t^f) - n_t(q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f) \quad (4.3)$$

We assume that the cost of getting one unit of human capital is equal two units of consumption of good. Where q_t is the time and goods cost as we defined it above.

We can write the budget constraint in this way by assuming that the production of human capital use time and human capital as inputs. We also assume that a female bears the cost full time to raise children.

$$(C_t) = (w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f) - n_t q_t - \frac{n_t}{2}(w_{t+1}^f \tau_t^f + w_{t+1}^m \tau_t^m) h_t^f \quad (4.4)$$

Where τ_t^f and τ_t^m is the time spent for education of daughters and sons respectively. We assume that the human capital production is given by

$h_{t+1}^i = \tau_t^i A h_{t+1}^f$ (i=f, m)

4.2.4 Utility Maximization

Maximizing (4.2), subject to (4.3), and the first-order condition for n_t generate:

$$(1-\beta)[C_t]^{-1}[q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f] = \beta[n_t]^{-1} \quad (4.5)$$

The first order condition for $w_{t+1}^m h_{t+1}^m$ and $w_{t+1}^f h_{t+1}^f$ by taking $w_{t+1}^m h_{t+1}^{-m}$ and $w_{t+1}^f h_{t+1}^{-f}$ as given gives us:

$$\begin{aligned} (1-\beta)[C_t]^{-1} n_t &= \beta\delta[w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^{-f}]^{-1} \\ (1-\beta)[C_t]^{-1} n_t &= \beta\delta[w_{t+1}^m h_{t+1}^{-m} + w_{t+1}^f h_{t+1}^f]^{-1} \end{aligned} \quad (4.6)$$

The equation 3.6 states that higher is the income of the future spouses of their children the lower is the marginal utility for the atomistic parent couple from investing in their children. A high average level of human capital among men induces parents to invest little in their daughter's human capital.

4.2.5 Nash Equilibrium

In a (symmetric pure strategy) Nash equilibrium there are no differences within the sexes, so $h_{t+1}^{m} = h_{t+1}^{-m}$ and $h_{t+1}^{f} = h_{t+1}^{-f}$. The two conditions in (4.6) thus coincide. Next, using the budget constraint for consumption, c_t in (4.3), we arrive at an expression for the sum of male and female human capital:

$$w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{f} = \left(\frac{\delta}{1-\delta} \right) q_t \qquad (4.7)$$

Any combination of h_{t+1}^{m} and h_{t+1}^{f} which satisfies (4.7) is a Nash equilibrium (as long as they are both non-negative).

4.2.6 Gender Equality

We can now define the following measures of gender equality:

$$\mu_t^{e} = \frac{h_{t+1}^{f}}{h_{t+1}^{m}} \qquad \text{and} \qquad \mu_t^{l} = \frac{w_{t+1}^{f}}{w_{t+1}^{m}} \qquad (4.8)$$

μ_t^{e} shows that increase in this term means improvement in gender gap of education similarly increase in μ_t^{l} implies improvement in gender gap in employment. It follows from above that any (non-negative) level of μ_t^{e} and μ_t^{l} is Nash equilibrium, as long as (4.7) holds (lagged by one period). Note that nothing links gender equality in one period to that in the next: any sequence of (non-negative) μ_t^{e} and μ_t^{l}, is consistent with a Nash equilibrium in the game played between different parent couples in each respective period.

4.2.7 Fertility rate

Using the expressions for fertility and human-capital investment in (4.7) and (4.5), together with the child cost in (4.1), we can write population growth as

$$n_t = \frac{\beta(1-\delta)(w_t^m h_t^m + w_t^f h_t^f)}{a + b w_t^f h_t^f} = \frac{\beta(1-\delta)(1+\mu_t^e \mu_t^l)}{a / w_t^m h_t^m + b\mu_t^e \mu_t^l} \tag{4.9}$$

This shows that fertility rate depends upon gender inequalities in human capital, labor market and growth of labor force. This can be written in functional form as:

$$\mathbf{n_t = f(\mu_t^e, \mu_t^l, w_t^m h_t^m)}$$

4.2.8 Growth

Using the expressions for the parents' optimal human capital investment in (4.7) and the child rearing cost, q_t in (4.1), the growth rate of the sum of male and female level human capital, $w_t^m h_t^m + w_t^f h_t^f$ is given by:

$$\gamma_{t+1} = \frac{w_{t+1}^m h_{t+1}^m (1+\mu_{t+1}^e \mu_{t+1}^l)}{w_t^m h_t^m (1+\mu_t^e \mu_t^l)} = \left(\frac{\delta}{1-\delta}\right)\left[\frac{a / w_t^m h_t^m + b\mu_t^e \mu_t^l}{(1+\mu_t^e \mu_t^l)}\right] \tag{4.10}$$

This shows that growth rate falls initially in human capital of males. By rearranging this we can get the relationship between the growth and fertility rate:

$$\gamma_{t+1} = \frac{\beta\delta}{n_t} \tag{4.11}$$

Now we can define growth function as:

$$\gamma_{t+1} = f(\mu_t^e, \mu_t^l, w_t^m h_t^m, n_t, inv) \tag{4.12}$$

This shows that growth is the function of gender equality in education, gender equality in employment, growth in labor force, fertility rate and investment.

4.2.9 Investment

Investment is denoted as:

$$inv = \left(\frac{\delta}{1-\delta}\right) q_t \tag{4.13}$$

We have the following relationship for investment

$$inv = \left(\frac{\delta}{1-\delta}\right) w_t^m h_t^m [a / w_t^m h_t^m + b\mu_t^e \mu_t^l] \tag{4.14}$$

Similarly by rearranging this we obtain relationship between investment and fertility rate. This shows that the investment is the function of labor force growth, gender equality in education, gender equality in employment and fertility rate.

$$inv = f(w_t^m h_t^m, \mu_t^e, \mu_t^l, n_t) \tag{4.15}$$

4.3 Empirical Model

When we measure the impact of gender gap in education on economic growth a serious problem arises. Because in a system of national account many reproductive, subsistence and household activities are not included, almost two third of economic activities of female are not recorded in developing economies. Due to this reason, any outcome about the impact of gender inequality on economic growth may understate this relationship. It is possible that better female education increases inclusion of female activities in the national accounts, but on the other hand, it also increases the possibility for activities which are not included. For example, women entering in the labor force may hire child care for their children. Both activities increase the measured output, but the activity of baby sitter is just replacing the former unrecorded activities. That is why any study in which we estimate the relationship between economic growth and gender gap will be experience such type of data flaw.

Our focus is to estimate the impact of education gender gap on economic growth. We will consider both the direct and indirect effects of education gender gap on economic growth like Taylor (1998) and Klasen (2002). We will estimate a set of equations to include both direct and indirect effect on economic growth of gender gap in education. The empirical model is as under:

$$G = \alpha_1 + \beta_1 Inv + \beta_2 Fr + \beta_3 Lfg + \beta_5 Rere + \beta_6 Rfmp + \beta_7 X + \varepsilon_t \qquad (4.16)$$

$$Inv = \alpha_2 + \beta_8 Fr + \beta_9 Lfg + \beta_{10} Rere + \beta_{11} Rfmp + \beta_{12} X + \varepsilon_t \qquad (4.17)$$

$$Fr = \alpha_3 + \beta_{13} Lfg + \beta_{14} Rere + \beta_{15} Rfmp + \beta_{16} X + \varepsilon_t \qquad (4.18)$$

$$Lfg = \alpha_4 + \beta_{17} Rere + \beta_{18} Rfmp + \beta_{19} X + \varepsilon_t \qquad (4.19)$$

In the system of equations given by (4.13) to (4.19) 'G' represents the growth rate of gross domestic product per capita which is growth variable in our theoretical model, 'Inv' represents the total investment as percentage of gross domestic product, 'Fr' is for fertility rate, 'Lfg' denotes labor force growth, 'Rere' represents the Ratio of enrolment rates of females to males at primary or secondary level. The two ratios are proxies for the gender inequality in education. 'Rfmp' represents the Ratio of female to male labor force participation rates. This ratio is proxy variable for gender inequality in labor market and also the proxy variable for wages because time series data on wages is not readily available for Pakistan, X represent trade openness and ε_t represents error term in the equations.

In equation (4.16), we measure the direct impact of gender gap in education on economic growth. Equations (4.17), (4.18) and (4.19) measure the indirect effect of gender gap in education on economic growth through their impact on variables like investment, fertility rate and labor force growth. Total effect can be measured through path analysis which is defined as direct effect plus indirect effect. We can measure total effect of ratio of the enrolment rates of females to males at primary level on economic growth as,

$$\beta_5 + (\beta_{12} * \beta_1) + (\beta_{10} * \beta_1) + (\beta_{13} * \beta_8 * \beta_1) + (\beta_{10} * \beta_1) + (\beta_{16} * \beta_{10} * \beta_1)$$

Here in this equation the first term indicates the direct impact of ratio of enrolment rates of females to males at primary on economic growth. The second term indicate indirect impact through investment the third term shows indirect impact through the fertility rate, the fourth term shows indirect impact via fertility rate and investment, the fifth term shows indirect impact via labor force growth and the last term indicate indirect impact via labor force growth and investment.

We have modeled the impact of gender bias in human capital on growth. We have included female to male ratios to measure the education bias as we have derived from theoretical model and also to avoid multicollinarity because if we separately include human capital of females and males than these would high correlated. We are also using female to male enrollment ratios for primary and secondary level of education separately in two regressions because these ratios are highly correlated.

Chapter 5

Econometric Technique Data and Variables:

5.1 Introduction

This chapter provide brief introduction of estimation technique and data used in the study. Description of the variables and their descriptive statistics are also included in the chapter.

5.2 Generalized method of moment

We have to estimate the following empirical model:

$$G = \alpha_1 + \beta_1 Inv + \beta_2 Fr + \beta_3 Lfg + \beta_5 Rere + \beta_6 Rfmp + \beta_7 X + \varepsilon_t \quad (5.1)$$

$$Inv = \alpha_2 + \beta_8 Fr + \beta_9 Lfg + \beta_{10} Rere + \beta_{11} Rfmp + \beta_{12} X + \varepsilon_t \quad (5.2)$$

$$Fr = \alpha_3 + \beta_{13} Lfg + \beta_{14} Rere + \beta_{15} Rfmp + \beta_{16} X + \varepsilon_t \quad (5.3)$$

$$Lfg = \alpha_4 + \beta_{17} Rere + \beta_{18} Rfmp + \beta_{19} X + \varepsilon_t \quad (5.4)$$

As this model is the system of simultaneous equations. OLS is not a suitable technique to estimate this kind of system. Results obtained from OLS will be biased and inconsistent because in this system one or more explanatory variables are correlated with the error term. To tackle the problem of endogeniety, we have used instrumental variables to estimate the system of simultaneous equations.

We have applied the generalized method of moment (GMM) to estimate the system simultaneous equations as the GMM can be considered an extension of instrumental variables estimation method. GMM was developed by Arellano and Bond (1991) to tackle the endogeniety and omitted variable bias. Arellano and Bover (1995) use the GMM to estimate growth equations using the lagged values as instruments. The main advantage of using the GMM is that the model need not be homoscedastic and serially independent. Another advantage of GMM is that it maximizes the objective function which takes account of moment restriction in which correlation between error term and lagged regressors is zero.

5.3 Augmented Dicky-Fuller Test

As we are using the time data series for our analysis, we have to examine the stationarity of the data whether or not the unit root present in the series. For this purpose we have used the Augmented Dicky Fuller test to test unit root in the series. The Augmented Dicky Fuller test is performed by augmenting the lagged values of the dependent variable in the regression. The numbers of lagged difference terms are empirically determined. The idea is to add the enough terms so that error term of the regression becomes serially uncorrelated.

5.4 Data

We need data on the following variables:

Variables	Description of Variables
G	Growth rate of gross domestic product per capita
Rers	Ratio of enrolment rates of females to males at secondary level
Rerp	Ratio of enrolment rates of females to males at primary level
Lfg	Growth rate of labor force
Inv	Total investment as percentage of gross domestic product
Rfmp	Ratio of female-male participation rates
Fr	Fertility rate

The present study is based upon the secondary data and covers the period ranging from 1971-2012. The data has been obtained from; Economic Survey of Pakistan (various Issues), World Development Indicators and Pakistan Labor Force Survey.

5.5 Variables

The variable used in the study are discussed below

5.5.1 Economic growth

To measure economic growth we have used the growth rate of gross domestic product per capita. Data for this variable is from the WDI.

5.5.2 Investment

We have used gross capital formation as percentage of gross domestic product as proxy for the investment, the data is from the WDI.

5.5.3 Fertility rate:

To show the indirect effect of education and employment through fertility on economic growth, we have used the fertility rate. Data for fertility rate is from World Development Indicator.

5.5.4 Labor Force growth

We have used this variable to show the indirect impact of education and employment's gender gap on economic growth. Data for the labor force is taken from the Economic Survey of Pakistan.

5.5.5 Gender Inequality in Education

To capture the educational gender inequality at primary and secondary level of education we have need the ratio of female to male enrollment rate at primary and secondary level. Data for enrollment rates is from the Economic Survey of Pakistan.

5.5.6 Gender Equality in Employment

We capture gender inequality in employment through female to male ratio of labor force participation rate. Data on labor force participation rate is from the Labor Force survey of Pakistan.

5.5.7 Trade Openness

Trade openness is defined as the total trade (import plus export) divided by the gross domestic product. Data for imports, exports and gross domestic product is from WDI.

5.6 Descriptive Statistics

Some descriptive statistics are given in table 1. These statistic shows that the trade openness varies from 64 percent to 28 percent with mean of 35 percent. The average of ratio of female to male labor force participation is 18 percent with the range 4 to 31 percent. Ratio of female to male enrollment rate at primary level varies between 35 percent to 79 percent with average of 57 percent. Variation in ratio of female to male enrollment rate at secondary level is 22 to 75 percent with mean of 48 percent. Investment fluctuates between 10.2 to 20.9. On average the investment is 16.2. Average labor force growth is 2.34 percent varying from -0.76 to 7.56 percent. The mean value of fertility rate is 5.39 percent and maximum and minimum values are 6.61 and 3.34 respectively. Descriptive statistics show that average of gross domestic product per capita is 535.2 with range 325.2 to 802.4 US dollars.

Table 5.1: Descriptive Statistics

Variables	Obs.	Mean	Std. Dev	Min	Max
Trade Openness	42	0.355	0.059	0.282	0.624
Female to male Labor force participation	42	0.180	0.072	0.042	0.316
Female to male enrollment at primary level	42	0.576	0.132	0.358	0.796
Female to male enrollment at Secondary level	42	0.484	0.174	0.229	0.758
Investment	42	16.29	2.347	10.92	20.95
Fertility Rate	42	5.392	1.207	3.347	6.612
Labor Force Growth	42	2.342	1.673	-0.763	7.566
Gross Domestic product per capita (constant 2005 US dollars)	42	535.2	142.6	325.2	802.4

5.7 Correlation Matrix

Correlation matrix given in table 5.2 shows that correlation among ratios of female to male enrollment rate of primary and secondary level is very high and this might cause the problem of multicollinarity in the regression analysis. We have used these two variables in two different regressions to avoid multicollinarity.

Table 5.2: Correlation Matrix

Variables	FR	X	RFMP	INV	LFG	RERS	RERP	GDP
FR	1.000							
X	-0.189	1.000						
RFMP	-0.022	0.031	1.000					
INV	-0.237	0.320	0.0623	1.000				
LFG	-0.196	0.183	0.00021	0.348	1.000			
RERS	-0.455	0.210	0.0407	0.0185	0.343	1.000		
RERP	-0.377	0.205	0.065	0.171	0.357	0.932	1.000	
GDP	-0.426	0.212	0.067	0.103	0.401	0.922	0.929	1.000

5.8 Conclusion

We have estimated four specifications of the empirical model. First two specifications differ on the basis of variables used to estimate the impact of the educational inequality on economic growth. To reflect upon educational inequality we have used female to male ratio of enrollment at primary level and secondary level, in two separate in regressions to avoid multicollinarity. In last two specifications we have used trade openness to examine the impact of educational inequality and employment inequality in an open economy scenario.

Chapter 6

Results and Interpretation

6.1 Introduction

This chapter presents and interprets the estimations results. First we will discuss the stationarity of the variables. Next we interpret the results of econometric investigation.

6.2 Results of Unit-Root Test

We have used the Augmented Dicky-Fuller test to examine the stationarity of the data.

Table 6.1: Results of unit root test

Variables	Level			First Difference		
	No Trend	With Trend	Result	No Trend	With Trend	Result
Growth rate of GDP per capita	-5.481	-5.382	S			
Investment	-4.218	-3.891	S			
Fertility Rate	-5.214	-2.494	S			
Labor Force Growth	-4.807	-5.385	S			
Female to male enrollment at primary level	-1.359	-3.551	S			
Female to male enrollment at Secondary level	-0.683	-2.362	NS	-8.554	-8.441	S
Female to male Labor force participation	0.0499	-2.153	NS	-12.012	-11.940	S
Trade Openness	-1.989	-6.773	S			

Note: 5 percent critical value is -2.87 for case of no trend, and -3.42 when trend is included. We have used AIC for lag selection. S denotes the stationary series and NS denotes non-stationary series.

The results of Augmented Dicky Fuller test are given in the table 6.1. According to these results GDP per capita, investment, fertility rate, labor force growth, female to male enrollment at primary level and trade openness are stationary at level while the female to male enrollment rate at secondary level and female to male of labor force participation are non-stationary at level but are stationary at first difference. This means that these variables are difference stationary.

6.3 Results and Empirical Finding of the GMM Estimation

Based on empirical model given in chapter 4, we have estimated four specifications using GMM. The specifications differ in the use of proxy for educational gender gap. We use either female to male enrollment at primary level of education or at secondary level of education. We have introduced trade openness in the last two specifications to examine the impact of educational gender gap in an open economy scenario.

The results show that reduction in the educational gender gap[9] has positive impact on the growth rate of gross domestic product (GDP) per capita. Increases in investment, growth in labor force also have the positive impact on economic growth. While the increase in fertility rate negatively impacts growth rate of GDP per capita. Reduction in gender gap on account of employment[10] has positive but insignificant impact on the growth rate of GDP per capita.

The most interesting and important result in the context of this study is that the reduction in educational gender gap has positive impact on economic growth [see table 6.2 and 6.3 column 1]. This result supports the claim that by reducing gender inequality in education we

[9] Educational gender gap is defined as female to male enrollment at primary or at secondary level; increase in these ratios means increase in female enrollment with reference to male enrollment which means reduction in educational gender gap.

[10] Employment gender gap is defined female to male labor force participation rate; increase in this ratio means increase in female labor force participation rate with reference to male participation which means reduction in employment gender gap.

can improve the state of economic growth. This result also has support from the previous studies like Benavot (1989), Schultz (1995), Forbes 2000, Klasen (2002, 2004) and Klasen and Lamanna (2009).

Table 6.2: GMM Estimation of Specification 1

	1	2	3	4
Variables	Growth rate of GDP per capita	Investment	Fertility Rate	Labor Force Growth
Constant	0.0370 (0.007)***	8.892 (0.211)***	8.534 (1.679)***	1.938 (0.270)***
Investment	0.0025 (0.001)**			
Fertility Rate	-0.0029 (0.001)*	-2.909 (0.706)***		
Labor Force Growth	0.0035 (0.001)***	0.0506 (0.029)*	-1.0342 (0.577)*	
female to male enrollment at Primary level	0.1194 (0.063)*	1.852 (0.942)*	-74.346 (36.288)**	19.011 (11.182)*
female to male Labor force participation	0.022 (0.660)	5.853 (1.993)**	-14.136 (7.746)*	74.768 (26.698)***
Observation	39	41	40	40
Over identification Test	0.7229	0.6346	0.3935	0.5762
Durbin-Watson stat	1.65	1.228	1.40	2.45

Note: Standard Errors in parenthesis
*** Refers to 1 percent, ** to 5 percent, and * to 10 percent significance level

The results also show that the reduction in educational gender gap indirectly effects economic growth through influencing investment, fertility rate and labor force growth. As the reduction in the educational gender gap positively impacts investment, labor force growth and negatively impacts fertility rate [see table 6.2 and 6.3 column 2, 3, 4]. These results suggest that reduction in educational gender gap has a positive indirect impact on economic growth.

Although, the reduction in employment gender gap has an insignificant positive impact on growth rate GDP per capita [see table 6.2, column 1] but it influences the investment and labor force growth positively and the fertility rate negatively which in turn effects economic growth positively [see table 6.2 and 6.3 column 2, 3, 4]. Thus reduction in employment gender gap has an indirect positive influence on economic growth.

The positive impact of investment on growth rate of GDP per capita [see table 6.2, column 1] indicates that investment plays a vital role in enhancing employment rate and well-being of the population and hence, economic growth of the country. This result is in accord with the previous studies like Lagerlof Barro (2002), (2003) Klasen (2002, 2004) and Klasen and Lamanna (2009).

Negative impact of fertility on growth rate of GDP per capita rate [see table 6.2, column 1] suggests that by reducing the fertility rate we can increase the labor force and investment, reduced the dependency (Bloom and Williamson 1998), and improve human capital and thus contribute to the economic growth. This result is also consistent with previous studies like Klasen (2002, 2004), Barro (2002), Lagerlof (2003) and Bloom and Williamson (1998).

The positive effect of growth in labor force on growth rate of GDP per capita [see table 6.2, column 1] also confirms the theoretical background of this study and is also consistent with literature on the subject e.g. Klasen (2002 and 2004), Barro (1991), Bloom and Williamson (1998) and Mankiw et al (1992).

Growth in labor force has positive impact on investment and negative impact on fertility rate [see table 6.2, columns 3 and 4] which means that growth in labor force reduces the fertility rate and increases the investment. The decrease in fertility rate and increase in investment in turn has a positive influence on economic growth. Thus the growth in labor force also influences the economic growth.

Table 6.3: GMM Estimation of Specification 2

	1	2	3	4
Variables	Growth rate of GDP per capita	Investment	Fertility Rate	Labor Force Growth
Constant	10.526 (0.168)***	8.892 (0.211)***	9.007 (0.280)***	1.137 (0.617)*
Investment	0.0235 0.0123*			
Fertility Rate	-0.184 (0.011)***	-2.909 (0.706)***		
Labor Force Growth	0.0379 (0.018)*	0.0506 (0.029)*	-0.169 (0.062)**	
female to male enrollment at secondary level	1.094 (0.462)**	1.852 (0.942)*	-30.424 (12.25)**	2.650 (1.001)**
female to male Labor force participation	1.597 (2.184)	5.853 (1.993)**	-6.988 (0.596)***	15.128 (7.549)*
Observation	40	41	39	39
Over identification Test	0.4708	0.634	0.6022	0.8475
Durbin-Watson stat	1.1747	1.228	2.9631	1.8131

Note: Standard Errors in parenthesis
*** Refers to 1 percent, ** to 5 percent, and * to 10 percent significance level

Comparing the coefficient of the two proxies used for educational gender gap we find that female to male enrollment at secondary level has higher coefficient as compared to female to male enrollment at primary level [see table 6.2 and 6.3, columns 1]. This implies that reduction in gender gap at higher level of education will have a greater influence on economic growth.

We have introduced trade openness as control variable in the regressions [see table 6.4 and 6.5]. The introduction of trade openness in the regressions does not influence the signs of the

results discussed earlier. But the important finding is that trade openness has positive impact on growth rate of GDP per capita [see table 6.4 and 6.5, columns 1].

The positive association of trade openness with economic growth is due to benefits that emerge from the specialization, competition and economies of scale. It is also due to

Table 6.4 : GMM Estimation of Specification 3

	1	2	3	4
Variables	Growth rate of GDP per capita	Investment	Fertility Rate	Labor Force Growth
Constant	0.023 (0.011)*	7.711 (0.261)***	6.583 (0.173)***	1.525 (0.384)***
Investment	0.0044 (0.001)***			
Fertility Rate	-0.092 (0.023)*	-2.392 (0.513)***		
Labor Force Growth	0.0047 (0.001)***	0.0430 (0.015)**	-0.318 (0.083)***	
female to male enrollment at Primary level	0.0986 (0.045)**	3.552 (0.576)***	-20.635 (7.436)**	31.396 (13.15)**
female to male Labor force participation	0.0534 (0.098)	3.873 (0.862)**	-0.0572 (0.010)	62.61 (28.53)**
Trade openness	0.0927* (0.050)	0.149 (0.023)***	-36.51 (3.08)***	15.867 (5.497)**
Observation	40	41	39	40
Over identification Test	0.7572	0.6090	0.3775	0.3220
Durbin-Watson stat	1.843	1.521	1.623	2.2598

Note: Standard Errors in parenthesis *** Refers to 1 percent, ** to 5 percent, and * to 10 percent significance level

productivity improvements through the use of better technologies. This result is also consistent with the results of previous studies like Barro (2002) Klasen (2002, 2004 and 2009) Pervaiz et al (2011).

Table 6.5 : GMM Estimation of Specification 4

	1	2	3	4
Variables	Growth rate of GDP per capita	Investment	Fertility Rate	Labor Force Growth
Constant	9.369 (0.058)***	7.711 (0.261)***	6.703 (0.119)***	1.031 (0.589)*
Investment	0.0071 (0.003)*			
Fertility Rate	-1.123 (0.192)***	-2.3920 (0.513)***		
Labor Force Growth	0.0163 (0.008)*	0.043 (0.015)**	-0.092 (0.030)***	
female to male enrollment at secondary level	0.342 (0.177)*	3.552 (0.576)***	-11.947 (2.635)***	1.381 (0.752)*
female to male Labor force participation	0.480 (0.728)	3.873 (8.893)***	-3.071 (1.677)*	19.956 (7.734)**
Trade Openness	0.536 (0.145)***	0.149 (0.023)***	-4.400 (0.943)**	8.215 (1.366)***
Observation	40	41	39	40
Over identification Test	0.4708	0.6090	0.5406	0.9385
Durbin-Watson stat	1.1747	1.5217	1.3976	1.7768

Note: Standard Errors in parenthesis
*** Refers to 1 percent, ** to 5 percent, and * to 10 percent significancelevel

We have used first and second lag of dependent variable and have used population growth and literacy rate as instrumental variable for fertility rate and educational variable in regression. The value of over identification test states the validity instrument used in the study.

Chapter 7

Conclusion

The main objective of the study is to examine the direct and indirect impact of gender inequalities in education and employment on economic growth of Pakistan. We theoretically derived the direct and indirect impact of gender inequalities in education and employment using the overlapping generation growth model framework. The model which a modified version of Lagerlof (2003) indicates that these gender inequalities has direct and indirect via investment, fertility rate and labor force growth on economic growth.

To examine empirically the direct and indirect impact of the gender inequalities in education and employment on economic growth in Pakistan, we have used simultaneous equations empirical modelling. We have used Generalized Method of Moment to estimate the four specifications of the empirical model. The data span is 1971 to 2012.

The results inform that the reduction in educational gender gap positively influences economic growth directly by improving average human capital. The reduction in educational gender gap also indirectly influences growth by way of influence on investment, growth in labor force and fertility rate. This reduction in educational gender at higher level impacts more as compared to lower level.

The direct impact of reduction in employment gender gap on growth is insignificant though positive. However, the reduction in employment gender gap indirectly influences growth through significant and positive impact on investment and growth in labor force and significant negative impact on fertility rate.

Thus promoting gender equality in education and in labor market may be among the few "win-win" development strategies. It advances economic prosperity and efficiency, promotes other essential human development goals (such as lower mortality and fertility), and is intrinsically valuable as well.

References:

Alderman, H., Behrman, J. R., Ross, D. R., & Sabot, R. (1996). Decomposing the gender gap in cognitive skills in a poor rural economy. *Journal of Human Resources*, 229-254.

Appiah, E. N., & McMahon, W. W. (2002). The social outcomes of education and feedbacks on growth in Africa. *Journal of Development Studies*, *38*(4), 27-68.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The review of economic studies, 58(2), 277-29

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. Journal of econometrics, 68(1), 29-51.

Ashraf, J., & Ashraf, B. (1993). Estimating the gender wage gap in Rawalpindi city. The Journal of Development Studies, 29(2), 365-376.

Barro, R. J. (1991). Economic growth in a cross section of countries. The quarterly journal of economics, 106(2), 407-443.

Barro, R. J. (2002). Education as a determinant of economic growth. *Education in the twenty-first century*, 9-24.

Barro, R. J., & Lee, J. W. (1994, June). Sources of economic growth. In Carnegie-Rochester conference series on public *policy* (Vol. 40, pp. 1-46). North-Holland.

Benavot, A. (1989). Education, gender, and economic development: A cross-national study. *Sociology of education*, 14-32.

Blackden, M., Canagarajah, S., Klasen, S., & Lawson, D. (2006). *Gender and growth in Sub-Saharan Africa: Issues and evidence* (No. 2006/37). Research Paper, UNU-WIDER, United Nations University (UNU).

Blecker, R. A., & Seguino, S. (2002). Macroeconomic Effects of Reducing Gender Wage Inequality in an Export-Oriented, Semi-Industrialized Economy.Review of Development Economics, 6(1), 103-119.

Bloom, D. E., & Williamson, J. G. (1998). Demographic transitions and economic miracles in emerging Asia. The World Bank Economic Review, 12(3), 419-455.

Busse, M., & Spielmann, C. (2006). Gender Inequality and Trade*. Review of International Economics, 14(3), 362-379.

Castelló, A., & Doménech, R. (2002). Human capital inequality and economic growth: some new evidence. *The Economic Journal*, *112*(478), C187-C200.

Cavalcanti, T., & Tavares, J. (2007). The output cost of gender discrimination: a model-based macroeconomic estimate.

Chaudhry, I. S. (2007). Gender inequality in education and economic growth: case study of Pakistan. Pakistan Horizon, 81-91.

Collier, P. (2007). The bottom billion. ECONOMIC REVIEW-DEDDINGTON-,25(1), 17.

Daly, K. (2007). Gender inequality, growth and global ageing. BUSINESS ECONOMIST, 38(1), 7.

Dollar, D., & Gatti, R. (1999). *Gender inequality, income, and growth: are good times good for women?*. Development Research Group, The World Bank.

Esteve-Volart, B. (2004). Gender discrimination and growth: Theory and evidence from India.

Forbes, K. J. (2000). A Reassessment of the Relationship between Inequality and Growth. American economic review, 869-887.

Galor, O., & Weil, D. N. (1993). *The gender gap, fertility, and growth* (No. w4550). National Bureau of Economic Research.

Galor, Oded and David N. Weil. 1996. ‘‘The Gender Gap, Fertility, and Growth.’’ American Economic Review 86(3): 374–87.

Haddad, L., Hoddinott, J., & Alderman, H. (1997). Intrahousehold resource allocation in developing countries: models, methods, and policy. Johns Hopkins University Press.

Hassan, R., & Mirza, M. S. (2005). Education Inequality and Economic Growth: Framework for the Evaluation of Pakistan’s Education Policy.

Hill, M. A., & King, E. (1993). Women’s education in developing countries: An overview. Women’s education in developing countries: Barriers, benefits, and policies, 1-50.

Hill, M. A., & King, E. (1995). Women's education and economic well-being.Feminist Economics, 1(2), 21-46.

Johnson, W. G., & Baldwin, M. (1993). The Americans with Disabilities Act: Will it make a difference?. Policy Studies Journal, 21(4), 775-788.

Khan, A. H. (1998). Education in Pakistan: fifty years of neglect. The Pakistan development review, 36(4), pp-647.

King, E., Klasen, S., & Porter, M. (2008). Gender and development challenge paper. Copenhagen Consensus Center. Paper prepared for.

Klasen, S. (2000). Does gender inequality reduce growth and development? Evidence from cross-country regressions.

Klasen, S. (2002). Low schooling for girls, slower growth for all? Cross-country evidence on the effect of gender inequality in education on economic development. *The World Bank Economic Review*, *16*(3), 345-373.

Klasen, S. (2004). Gender-related indicators of well-being (No. 102). Discussion Papers/Universität Göttingen, Ibero-Amerika-Institut für Wirtschaftsforschung.

Klasen, S. (2006). Pro-poor growth and gender inequality (No. 151). Discussion papers//Ibero America Institute for Economic Research.

Klasen, S., & Lamanna, F. (2009). The impact of gender inequality in education and employment on economic growth: new evidence for a panel of countries. *Feminist Economics*, *15*(3), 91-132.

Klasen, S., & Wink, C. (2003). " Missing women": Revisiting the debate.Feminist Economics, 9(2-3), 263-299.

Knowles, S. and Owen, P.D. (1997) "Education and health in an effective-labour empirical growth model," Economic Record, 73, 314-28.

Knowles, S., Lorgelly, P. K., & Owen, P. D. (2002). Are educational gender gaps a brake on economic development? Some cross-country empirical evidence. *Oxford economic papers*, *54*(1), 118-149.

Lagerlöf, N. P. (2003). Gender equality and long-run growth. *Journal of Economic Growth*, *8*(4), 403-426.

Lorgelly, P. K., & Owen, P. D. (1999). The effect of female and male schooling on economic growth in the Barro-Lee model. Empirical Economics, 24(3), 537-557.

Mankiw, N. G., Romer, D. and Weil, D. N. (1992) "A contribution to the empirics of economic growth," Quarterly Journal of Economics, 107, 407-437.

Pervaiz, Z., Chani, M. I., Jan, S. A., & Chaudhary, A. R. (2011). Gender inequality and economic growth: a time series analysis for Pakistan. Middle-East Journal of Scientific Research, 10(4), 434-439.

Raza, F. A. (2007). Reasons for the Lack of Women's Participation in Pakistan's Workforce. Journal of Middle East Women's Studies, 3(3), 99-102.

Sadeghi, J. M. (1995) "The relationship of gender difference in education to economic growth: a cross-country analysis," Economic Research Forum, Working Paper No.9521, Cairo, Egypt.

Schultz, T. P. (1995) "Investments in schooling and health of women and men: Quantities and returns," in T. P. Schultz (ed.) Investment in Women's Human Capital, Chicago,Illinois: University of Chicago Press.

Seguino, S. (2000a). Accounting for gender in Asian economic growth. Feminist Economics, 6(3), 27-58.

Seguino, S. (2000b). Gender inequality and economic growth: a cross-country analysis. *World Development*, *28*(7), 1211-1230.

Seguino, S., & Floro, M. S. (2003). Does gender have any effect on aggregate saving? An empirical analysis. International Review of Applied Economics,17(2), 147-166.

Sen, Amartya, (1992). Missing Women. British Medical Journal, 304, pp. 587-588.

Siddiqui, R. (2006). Gender and empowerment: Evidence from Pakistan. Pakistan Institute of Development Economics.

Stokey, N. (1994) "Comments on Barro and Lee," Carnegie-Rochester Conference Series on Public Policy, 40, 47-57.

Summers, L. (1994). Investing in All the People. Washington, D.C.: World Bank.

Swamy, A., Knack, S., Lee, Y., & Azfar, O. (2003). Gender and corruption.Democracy, Governance and Growth, edited by Stephen Knack, 191-224.

Tansel, A., & Güngör, N. D. (2012). *Gender effects of education on economic development in Turkey* (No. 6532). Discussion Paper series, Forschungsinstitut zur Zukunft der Arbeit.

Thomas, D. (1997). Incomes, expenditures, and health outcomes: Evidence on intrahousehold resource allocation. Intrahousehold resource allocation in developing countries: Models, methods, and policy, 142-64.

WEF, F. E. M. (2013). The Global Gender Gap Report 2013. World Economic Forum.

World Bank. (2000). World Development Report 2000-2001: Attacking Poverty. World Bank Group.

World Bank. (2004). Gender and Development in the Middle East and North Africa. Washington, DC:World Bank.

World Bank. 2001. Engendering Development. Washington, DC: World Bank.

World Development Indicators (WDI). (2013). World Development Report.

Yamarik, S. and Ghosh, S. (2004) "Is female education productive? A reassessment of its effects and determinants," mimeo, Department of Economics, Tufts University, Medford, MA, USA.

Appendix

Derivation of the Model

Using the equations 4.1, 4.2 and 4.3 from the chapter we can drive the first order condition for n_t as:

Maximizing 4.2 subject to 4.3 for n_t

$$\frac{\partial U_t}{\partial n_t} = \frac{\partial}{\partial n_t}\{(1-\beta)\ln(C_t) + \beta[\ln(n_t) + \delta\{\ln[(w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^{-f})] + \ln[(w_{t+1}^{-m} h_{t+1}^m + w_{t+1}^f h_{t+1}^f)]\}]$$

$$0 = \frac{(1-\beta)}{C_t}\frac{\partial C_t}{\partial n_t} + \frac{\beta}{n_t}$$

Putting the value of C_t from 4.3

$$0 = \frac{(1-\beta)}{C_t}\frac{\partial}{\partial n_t}(w_t^m h_t^m + w_t^f h_t^f) - n_t(q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f) + \frac{\beta}{n_t}$$

$$0 = -\frac{(1-\beta)}{C_t}(q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f) + \frac{\beta}{n_t}$$

By rearranging we can get the equation 4.5 which is the first order condition for n_t.

First order condition for $w_{t+1}^{m} h_{t+1}^{m}$

The first order condition for $w_{t+1}^{m} h_{t+1}^{m}$ by taking $w_{t+1}^{m} h_{t+1}^{-m}$ given as

$$\frac{\partial U_{t}}{\partial w_{t+1}^{m} h_{t+1}^{m}} = \frac{\partial}{\partial w_{t+1}^{m} h_{t+1}^{m}} \{(1-\beta)\ln(C_{t}) + \beta[\ln(n_{t}) + \delta\{\ln[(w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{-f})] + \ln[(w_{t+1}^{-m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{f})]\}]\}$$

$$0 = \frac{1-\beta}{C_{t}} \frac{\partial C_{t}}{\partial w_{t+1}^{m} h_{t+1}^{m}} + \frac{\beta\delta}{w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{-f}}$$

Putting the value of C_{t}

$$0 = \frac{1-\beta}{C_{t}} \frac{\partial}{\partial w_{t+1}^{m} h_{t+1}^{m}} (w_{t}^{m} h_{t}^{m} + w_{t}^{f} h_{t}^{f}) - n_{t}(q_{t} + w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{f}) + \frac{\beta\delta}{w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{-f}}$$

$$0 = \frac{1-\beta}{C_{t}} \frac{\partial}{\partial w_{t+1}^{m} h_{t+1}^{m}} (w_{t}^{m} h_{t}^{m} + w_{t}^{f} h_{t}^{f}) - n_{t}(q_{t} + w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{f}) + \frac{\beta\delta}{w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{-f}}$$

$$0 = -\frac{1-\beta}{C_{t}} n_{t} + \frac{\beta\delta}{w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{-f}}$$

This is the first order condition for $w_{t+1}^{m} h_{t+1}^{m}$ similarly we can drive the first order condition for $w_{t+1}^{f} h_{t+1}^{f}$ which is equation 4.6.

Nash Equilibrium

Now we drive the expression for Nash equilibrium, by rearranging the equation 4.5 we have

$$C_t = \frac{(1-\beta)}{\beta} n_t (q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f)$$

Putting the value of C_t from equation 4.3

$$(w_t^m h_t^m + w_t^f h_t^f) - n_t (q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f) = \frac{(1-\beta)}{\beta} n_t (q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f)$$

Rearranging the equation 4.3 to get the of $w_t^m h_t^m + w_t^f h_t^f$ and putting this value in above equation

$$c_t + n_t (q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f) - n_t (q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f) = \frac{(1-\beta)}{\beta} n_t (q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f)$$

By simplifying

$$c_t = \frac{(1-\beta)}{\beta} n_t (q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f)$$

Now putting the value of c_t from equation 4.6

$$\frac{(1-\beta)(w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^{-f})}{\beta\delta} n_t = \frac{(1-\beta)}{\beta} n_t (q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f)$$

$$\frac{(w_{t+1}^{m}h_{t+1}^{m}+w_{t+1}^{f}h_{t+1}^{-f})}{\delta}=q_t+w_{t+1}^{m}h_{t+1}^{m}+w_{t+1}^{f}h_{t+1}^{f}$$

$$\frac{(w_{t+1}^{m}h_{t+1}^{m}+w_{t+1}^{f}h_{t+1}^{-f})}{\delta}-(w_{t+1}^{m}h_{t+1}^{m}+w_{t+1}^{f}h_{t+1}^{f})=q_t$$

$$\left(\frac{1-\delta}{\delta}\right)(w_{t+1}^{m}h_{t+1}^{m}+w_{t+1}^{f}h_{t+1}^{f})=q_t$$

By rearranging we have equation 4.7 which Nash equilibrium in the model.

Fertility rate:

The value c_t from equation 4.5 is given as:

$$C_t=\left(\frac{1-\beta}{\beta}\right)n_t(q_t+w_{t+1}^{m}h_{t+1}^{m}+w_{t+1}^{f}h_{t+1}^{f})$$

Putting the value c_t of from equation 4.3

$$(w_t^{m}h_t^{m}+w_t^{f}h_t^{f})-n_t(q_t+w_{t+1}^{m}h_{t+1}^{m}+w_{t+1}^{f}h_{t+1}^{f})=\left(\frac{1-\beta}{\beta}\right)n_t(q_t+w_{t+1}^{m}h_{t+1}^{m}+w_{t+1}^{f}h_{t+1}^{f})$$

$$(w_t^{m}h_t^{m}+w_t^{f}h_t^{f})=\left(\frac{1-\beta}{\beta}\right)n_t(q_t+w_{t+1}^{m}h_{t+1}^{m}+w_{t+1}^{f}h_{t+1}^{f})+n_t(q_t+w_{t+1}^{m}h_{t+1}^{m}+w_{t+1}^{f}h_{t+1}^{f})$$

$$(w_t^m h_t^m + w_t^f h_t^f) = n_t(q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f)\left(\frac{1-\beta}{\beta}+1\right)$$

$$(w_t^m h_t^m + w_t^f h_t^f) = \frac{1}{\beta} n_t(q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f)$$

$$n_t = \frac{\beta(w_t^m h_t^m + w_t^f h_t^f)}{q_t + w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f}$$

Putting the value of $w_{t+1}^m h_{t+1}^m + w_{t+1}^f h_{t+1}^f$ from Nash equilibrium

$$n_t = \frac{\beta(w_t^m h_t^m + w_t^f h_t^f)}{q_t + q_t\left(\frac{\delta}{1-\delta}\right)}$$

$$n_t = \frac{\beta(w_t^m h_t^m + w_t^f h_t^f)}{q_t\left(1+\frac{\delta}{1-\delta}\right)}$$

$$n_t = \frac{\beta\delta(w_t^m h_t^m + w_t^f h_t^f)}{q_t}$$

Putting the value of q_t from equation 4.1

$$n_t = \frac{\beta\delta(w_t^m h_t^m + w_t^f h_t^f)}{a + b(w_t^f h_t^f)}$$

Taking $w_t^m h_t^m$ common from numerator and denominator

$$n_t = \frac{\beta\delta w_t^m h_t^m \left(1 + \frac{w_t^f}{w_t^m}\frac{h_t^f}{h_t^m}\right)}{w_t^m h_t^m \left[\frac{a}{w_t^m h_t^m} + b\left(\frac{w_t^f}{w_t^m}\frac{h_t^f}{h_t^m}\right)\right]}$$

Using the equation 4.8 in this expression we can get equation 4.9 which is the expression for fertility rate in the model.

Growth rate:

Growth of human capital defines as:

$$\gamma_{t+1} = \frac{w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{f}}{w_{t}^{m} h_{t}^{m} + w_{t}^{f} h_{t}^{f}}$$

Taking $w_{t+1}^{m} h_{t+1}^{m}$ common from numerator and $w_{t}^{m} h_{t}^{m}$ from denominator

$$\gamma_{t+1} = \frac{w_{t+1}^{m} h_{t+1}^{m} \left(1 + \mu_{t+1}^{e} \mu_{t+1}^{l}\right)}{w_{t}^{m} h_{t}^{m} \left(1 + \mu_{t}^{e} \mu_{t}^{l}\right)}$$

Or

$$\gamma_{t+1} = \frac{w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{f}}{w_{t}^{m} h_{t}^{m} + w_{t}^{f} h_{t}^{f}}$$

Putting the value of $w_{t+1}^{m} h_{t+1}^{m} + w_{t+1}^{f} h_{t+1}^{f}$ from Nash equilibrium

$$\gamma_{t+1} = \frac{q_t}{w_{t}^{m} h_{t}^{m} + w_{t}^{f} h_{t}^{f}} \left(\frac{\delta}{1-\delta}\right)$$

Putting the value of q_t from equation 4.1

$$\gamma_{t+1} = \frac{a + b(w_t^f h_t^f)}{w_t^m h_t^m + w_t^f h_t^f}\left(\frac{\delta}{1-\delta}\right)$$

Taking $w_t^m h_t^m$ common from numerator and denominator

$$\gamma_{t+1} = \frac{w_t^m h_t^m\left[\frac{a}{w_t^m h_t^m} + b\left(\frac{w_t^f h_t^f}{w_t^m h_t^m}\right)\right]}{w_t^m h_t^m\left(1 + \frac{w_t^f h_t^f}{w_t^m h_t^m}\right)}\left(\frac{\delta}{1-\delta}\right)$$

Using the equation 4.8 in this expression we can get equation 4.10 which is the expression for growth rate in the model.