Journal of Applied Economics and Business Studies (JAEBS)

Journal homepage: https://pepri.edu.pk/jaebs
ISSN (Print): 2523-2614
ISSN (Online) 2663-693X

Role of Education in Economic Growth of Pakistan: A Sectoral Analysis

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ABSTRACT

Education and economic growth nexus is one of the abundantly researched topics in economics. The social returns of education in addition to its private returns makes it public good and justifies the use of public funds. While most of the studies conclude the positive relationship between the two, examples also exist of the negative relationship. However, there is a gap in the literature to find and compare the effect of education on the growth of agriculture, industry and services sector separately. This paper is particularly aimed to analyze the impact of different levels of education of employed persons on level and growth of national output, agriculture, industry & services sector output in Pakistan. The method of analysis is the autoregressive distributed lag model (ARDL). Each level of education is found to have a positive effect on the output per employed person both in the short-run and long-run except for agriculture sector. In the agriculture sector, each education level is negatively associated. The deeper analysis showed that the greater negative effect of employment evades the positive effect of education in the agriculture sector. The comparison of different sectors shows that primary education contributes more to the industrial sector. While the contribution of the secondary & tertiary education is highest in the services sector.

Keywords
Education; Economic Growth; Economic Development; Sectoral Analysis; Human capital, Economic Impact; Pakistan; Agriculture; Industry; services sector.

JEL Classification
I21;I25; I26; O11, Q10

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1. Introduction

Education as the main determinant of human capital is considered a fundamental factor of economic growth. Although in economics, the recognition of the role of education in improving productivity and economic growth is as old as the subject itself, the recent growth theories acknowledge the role of education in the following three distinct ways. First, the neoclassical growth theories that illustrate education as a source of increasing human capital embedded in the labour force which is important for increasing labour productivity and thus economic growth, for example, Mankiw et al., 1992; Barro, 1991. Second, the endogenous growth theories that demonstrate education as the basis for innovation and new knowledge, technology and improved methods of production that stimulates economic growth, for example, Lucas, 1988; Romer, 1990; Aghion & Howitt, 1998. Third, theories that acknowledge the role of education in economic growth as its ability to speed up technological catch-up and diffusion (e.g. Nelson and Phelps, 1966; Benhabib and Spiegel, 1994).

The literature of economics elaborates that in addition to private returns of education to individuals, it also has social returns due to its spillover effect. The benefits of education spread to other workers in a firm or industry, to other community members in a community, to members of the city or region and the economy in general. It is established that in addition to increase productivity, education increases economic growth by having positive externalities. For example, Barro and Lee (2001) stated that "the level and distribution of educational attainment has a strong impact on social outcomes, such as child mortality, fertility, education of children and income distribution." Furthermore, Galor & Zeira(1993) described that the main source of inequality in income is the result of inequality in education. Similarly, education helps in good parenting, wider and better political participation of individuals in a society, better community participation and curbing crime and negativity in a society (OECD, 1998). This spillover characteristic and social returns makes education a public good and provides the ground for the allocation of government funds to promote education in a country (Sianesi & Reenen, 2003).

The inability of microeconometric analysis to capture the social returns of education as well as testing the emerging growth theories motivated the use of aggregate level analysis in recent past (Krueger & Lindahl, 2001). The macroeconometric analysis of education and economic growth increased with exponential rate during the past few decades. Most of the empirical studies regarding education and economic growth have used cross-country regressions using average years of education or enrollments as a measure of education or human capital. Holland et al. (2013), Sianesi and Reeenen(2003), Temple(2001), Krueger and Lindahl(2001), Topel(1999) and Renelt(1991) provides a comprehensive review of literature in this regard. There are comparatively too few studies based on time series analysis to analyse the relationship. Temple(1999) prefers and suggests time series analysis over cross country regressions for studying growth dynamics due to the problem of heterogeneity. Moreover, majority of empirical work used average years of schooling as a proxy for measuring education or human capital and there are relatively few studies that are devoted to analyzing the impact of distinct education levels on economic growth.

The problem with using average years of schooling as a proxy for education level or human capital is that it does not differentiate between an additional year of higher education and elementary education levels. It treats the additional year of primary education same as an additional year of college or university. It implies that the increase of education in any level of education whether its primary, secondary or tertiary will have an equal effect on economic growth. This underlying assumption cannot be justified. Therefore, it is more appropriate to use different education levels instead of aggregating it to a single measure in the form of average years of schooling.

Few of the studies that are based on time series analysis and education segregated in three different levels are summarized here. Nnyanzi & Kilimani(2018) examined the effect of enrollments education levels on GDP growth of sub-Saharan Africa. The study was based on period 1995-2016. It is concluded that all levels of education have significant positive effect on growth and the impact is highest of secondary education. Kyophilavong et al.(2018) concluded that the long-run association exists at all three levels of education and economic growth using data for Laos over the years 1984 to 2013. Kotaskova et al.(2018) confirm the positive impact of primary, secondary & higher education on India's economic growth by utilizing the data from 1975 to 2016. Jenkins(1995) analysed data for the UK for years 1971-1992. It is found that as compared to a worker with no education the highly educated worker produce two times more output. Asteriou & Agiomirgianakis(2001) used data from 1960 to 1994 to find the long-run association of education and GDP per capita of Greece. All educational variables were found cointegrated with GDP per capita. Loening(2005) by using data 1951-2002 for Guatemala established that education has a positive effect on economic growth and 50% of the growth of output is explained by education. Sari & Soytas(2006) used time-series data from 1937-1996 of Turkey. It is concluded that primary &

secondary education causes national income, while the causality is bidirectional in case of university-level education. The results of VECM confirms the existence of cointegration between education variables and GDP. Lin (2003) examined the link of education and economic growth keeping in view the effect of technological advancement on economic growth in Taiwan for years 1965-2000. Education is found to have a significantly positive impact on economic growth. Self and Grabowski(2003) analyzed the impact of different education levels as well as vocational education on the growth of national income in Japan in post and pre-war era. It is concluded that primary education has a causal effect on economic growth in both periods. While secondary & higher education is found to have a causal effect in the post-war era. On the other hand, Omodero & Nwangwa(2020) by utilizing data from 2000 to 2018 concluded that long-run association exists between tertiary education and economic growth in Nigeria. However, no evidence of causality is found between tertiary education expenditure variable and economic growth or enrollment ratio and economic growth. Tsamadias and Pegkas(2012) reported a negative relationship exists between education and economic growth in Greece during 1981-2009. However, the negative coefficient was found insignificant except the case of human capital measured in the form of enrollment rates. The cointegration test showed no long-run association of education and output growth.

Pakistan is a developing country and is facing enormous challenges on economic, social and political fronts. The ability of education to deal with economic, political and social issues simultaneously makes it essential to focus on education and thereby increasing the human capital. There are numbers of studies with reference to Pakistan which analyzes the impact of education as a component of human capital on economic growth. Hafeez & Rahim(2019) found that enrollments in primary, secondary & higher education are important in determining the economic growth of Pakistan. The analysis was based on the period 1971 to 2013. Iqbal(2018) by using the data for years 1972 to 2014 for Pakistan and implying the ARDL technique concluded that the long-run association between total literacy rate and economic growth is significant but negative. Afridi(2016) attempted to find the link of human capital and the economic growth in Pakistan. Enrolments rate at primary level education, infant mortality rate and birth rate are used as proxies for human capital while GDP per capita is used as a proxy for economic growth while physical capital is used as a control variable. The study concludes that human capital has an important role in accelerating economic growth. Jangraiz et al(2015) used data from 1971-2012 to analyze the link between human capital and the economic growth of Pakistan. They used expenditure on research &

development, enrolment rates in primary, secondary & higher education, gross enrollment rate, and health as a proxy to human capital. By use of the Granger causality test, they concluded that the causal association between Human capital variables and economic growth exists. They found that the direction of causality is from research and development to economic growth while in the case of education (in the form of gross enrolment), it is from growth to education. Jalil & Idrees(2013) attempted to analyze the impact of education on economic growth by not only taking average years of schooling as a measure but also analyzing the impact through enrolments in different education levels. The analysis was based on data from 1960- 2010. Nonlinear 2SLS was used to estimate the error correction model. It was found that average years of schooling, as well as enrolment rates in primary, secondary & tertiary education, positively affected the economic growth of Pakistan. Secondary education was reported to be more contributing than primary & tertiary education. Kiani(2013) used data from 1980 to 2007 and OLS technique for analysis. The study used primary, middle, high & other school enrollments to capture the effect of education. It is concluded that each education level contributes significantly to economic growth. Amir et al(2012) used primary, secondary, college, university, vocational enrollment rates for capturing the effect of education on the economic growth of Pakistan. By using the Johansen cointegration test and error correction mechanism it is established that a long-run association between human capital and economic growth exists. Abbas & Peck(2008) attempted to find the association by using the secondary education per worker and the ratio of government expenditure on health to GDP as proxies for human capital. They used data from 1960-2005 and Johansen cointegration test. It is found that human capital has a positive contribution to GDP from the 1960s to 1990 while from 1990 to 2000 it showed the negative impact and they elaborated that this result is due to the negligence of human capital in economic policies. Khan(2005) analyzed the association between human capital and economic growth by utilizing panel data for 72 developing countries including Pakistan for the years 1980-2002. Average years of schooling, gross secondary school enrollment, adult literacy rate and life expectancy at birth were used as proxies of human capital. They concluded that along with capital formation, quality of institutions the education and health variables have a significant effect on economic growth.

From the review of studies with reference to Pakistan, it is evident that while attempts have been made to analyze the impact of different education levels on economic growth, still there is a gap in the literature to find its effect on the growth of agriculture, industry & services sector separately. Moreover, our study will be unique in considering the impact of education of those who are employed and actively participating in the production of output instead of considering overall enrollment rates in the country or a particular sector of the economy.

The current study is particularly aimed to analyze the impact of different levels of education (i.e. Primary, Secondary & Tertiary) of employed persons on level and growth of national output in Pakistan. It is also designed to find the possible differences in the impact of education in different sectors of the economy i.e. Agriculture, Industry & Services Sector. A distinct feature of this study is the use of output per employed person as a dependent variable, as most of the growth models when solved have dependent variable as Y/L denoted by y. Although per capita output is the most widely used proxy for Y/L, it is more appropriate to measure it as output per worker or employee, if there are no data issues. Benhabib and Spiegel(1994), Pritchett(1997), Bils and Klenow(1997), Hall and Jones(1999), Klenow-Rodriquez(1997) and Barro and Lee(1994) used output per worker as a dependent variable. This study is also distinct in considering the education of employed persons instead of overall enrollment rates. The number of employed persons with a particular education level i.e. primary, secondary & tertiary education in each year for the overall economy, agriculture, industrial & services sector is derived from labour force survey of Pakistan. If the dependent variable is output per worker then it is more appropriate to analyze the educational level of those who are employed and participating in the production of GDP rather than to consider the education of all the people living in the economy. Although, like all the previous studies this paper aims to find the impact of education on overall economic growth, it is distinct in using different variables for the analysis. Moreover, it is a first attempt in finding the impact of education for different major sectors of the economy.

The core aim is to analyze the impact of different education levels on the economic growth of Pakistan during the period 1985-2018. More specifically the objectives are to analyze and compare the effect education segregated in different levels of education on economic growth in Pakistan. Also to analyze and compare the impact of all three levels of education on sectoral growth in Pakistan (i.e. Agriculture, Industry & Services Sector) separately.

2 Theoretical model

It is well established in the economic literature that physical capital accumulation alone is not capable of explaining all the growth that occurs in per capita GDP (Solow, 1957; Kendrick, 1956). The new growth theories well acknowledge the role of education and provide a variety of theoretical frameworks in which education enhances economic growth. One of the basic implications of the endogenous growth theories is that technological changes bring increasing returns to scale and therefore economies tend to grow without converging to steady-state. In contrast, the Mankiw, Romer & Weil(1992) model augments human capital as a separate input in the basic Solow model and does not imply unbounded growth. Fedderke(2002) referring to the work of Mankiw et. al(1992) reports that

> "introduction of human capital into the Solow model successfully enhances its explanatory power to such a degree as to preclude the necessity of resorting to endogenous growth models of either the Romer (1986) or (1990) variants"

Following the footsteps of Mankiw, Romer & Weil(1992) our theoretical model includes human capital as a third input in production function along with labour and capital. The basic production function is given by human capital augmented Solow model well illustrated by Mankiw, Romer & Weil(1992) and given below

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} (A(t)L(t))^{1-\alpha-\beta} \tag{1}$$

Where Y is representing output, K is physical capital, 'H' is human capital, L is labour and A is representing the level of technology. $\alpha + \beta$ is assumed to be less than 1 which indicates decreasing returns. Labour and technology grow at exogenous rates and represented by textbook symbols n and g respectively.

$$L(t) = L(0)e^{nt} \tag{2}$$

$$A(t) = A(0)e^{gt} \tag{3}$$

Output can either be consumed, invested in physical capital or can be used to increase human capital. It is assumed that a constant fraction 's_k' is invested in physical capital while fraction s_h is devoted to human capital. The capital accumulation process can be written as

$$\dot{K} = s_k \mathrm{Y(t)} - \delta \mathrm{K(t)} \tag{4}$$

Where δ is denoting depreciation.

The human capital accumulation suggested by Mankiw, Romer & Weil (1992) assumes the same pattern as it is assumed for physical capital accumulation and is illustrated by the following equation.

$$\dot{H} = s_h Y(t) - \delta H(t) \quad (5)$$

The dynamics of the economy are represented by the following equations. Where y = Y/ AL , k = K/ AL and h = H/AL.

$$\dot{k}(t) = s_k y(t) - (n + g + \delta)k(t) \quad \mathbf{(6)}$$

$$\dot{h}(t) = s_h y(t) - (n + g + \delta)h(t) \quad \mathbf{((7)}$$

Steady state values are obtained by solving equation (6) and (7) and are listed below

$$k^* = \left(\frac{s_k^{1-\beta} s_h^{\beta}}{n+g+\delta}\right)^{\frac{1}{1-\alpha-\beta}} \quad (8)$$

$$h^* = \left(\frac{s_k^{\alpha} s_h^{1-\alpha}}{n+g+\delta}\right)^{\frac{1}{1-\alpha-\beta}} \quad (9)$$

By substituting steady-state values of k and h (i.e. equation 8 and 9) in production function (given by equation 1) and by taking logs the following equation for per capita income is derived.

$$\ln\left[\frac{Y(t)}{L(t)}\right] = \ln A(0) + gt - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) + \frac{\alpha}{1-\alpha-\beta}\ln(s_k) + \frac{\beta}{1-\alpha-\beta}\ln(s_h) \quad (10)$$

Equation (10) illustrates that per capita income depends not only on population growth and physical capital accumulation but also on human capital accumulation.

2.1 Econometric methodology

To empirically test the above illustrated theoretical model, we will have to make certain assumptions about the proxy of human capital. it is difficult to get exact data about share of output which is devoted to human capital i.e. to know the investment in human capital which is not only made by governments but by family and individuals themselves and also cost in form of foregone earnings which is low in case of a worker having low education and high in case of a worker having higher education (Mankiw, Romer and Weil, 1992). Keeping in view this difficulty most of the studies have used average years of schooling or percentage of the working-age population with secondary enrollments as a proxy of human capital (Barro, 1996, 2001; Mankiw, Romer and Weil, 1992). The current study used the number of employed persons with different education levels as a proxy for human capital.

ARDL approach suggested by Pesaran and Shin(1999) and Pesaran et. al(2001) is deemed fit for data analysis. The advantages of the ARDL method are that it is capable of identifying cointegration irrespective of the order of variables being one or zero. It appropriately deals with the problem of serial correlation. It is capable of dealing with the problem of endogeneity of variables under consideration (Pesaran and Shin, 1999). It is consistent in the case of small samples (Pesaran and Shin, 1999; Narayan, 2005). It is not affected by the potential bias of the cointegration test or unit root test.

Therefore, the following ARDL model is used to analyse the data

$$\Delta y_t = \alpha + \sum_{i=1}^{m1} \beta_{1i}\, \Delta y_{t-i} + \sum_{i=0}^{m2} \beta_{2i}\, \Delta k_{t-i} + \sum_{i=0}^{m3} \beta_{3i}\, \Delta Edu\_p_{t-i} + \sum_{i=0}^{mj} \beta_{ki}\, \Delta Z_{j,t-i} + \lambda_1 y_{t-1} + \lambda_2 k_{t-1} + \lambda_3 Edu_{t-1} + \lambda_j Z_{j,t-1} + \mu_t \quad (11)$$

$$\Delta y_t = \alpha + \sum_{i=1}^{m1} \beta_{1i}\, \Delta y_{t-i} + \sum_{i=0}^{m2} \beta_{2i}\, \Delta k_{t-i} + \sum_{i=0}^{m3} \beta_{3i}\, \Delta Edu\_s_{t-i} + \sum_{i=0}^{mj} \beta_{ki}\, \Delta Z_{j,t-i} + \lambda_1 y_{t-1} + \lambda_2 k_{t-1} + \lambda_3 Edu_{t-1} + \lambda_j Z_{j,t-1} + \mu_t \quad (12)$$

$$\Delta y_t = \alpha + \sum_{i=1}^{m1} \beta_{1i}\, \Delta y_{t-i} + \sum_{i=0}^{m2} \beta_{2i}\, \Delta k_{t-i} + \sum_{i=0}^{m3} \beta_{3i}\, \Delta Edu\_h_{t-i} + \sum_{i=0}^{mj} \beta_{ki}\, \Delta Z_{j,t-i} + \lambda_1 y_{t-1} + \lambda_2 k_{t-1} + \lambda_3 Edu_{t-1} + \lambda_j Z_{j,t-1} + \mu_t \quad (13)$$

Where:

y = real GDP per employed person

k = capital stock per employed person

Edu_p = Number of employed persons having primary education

Edu_s = Number of employed persons who have secondary education

Edu_h = Number of employed persons with higher education

Z_j = Set of j Control variables used in the model

Δ represents the first difference, *m* is the maximum number of lags included in the model and μ_t is the error term. Whereas, λ_i symbolizes parameters of the long-run association.

The bounds testing approach proposed by Pesaran et al (1999) is used for testing the presence of the long-run association between non-stationary variables. To show the short-run dynamics, Error correction model (ECM) is estimated.

Note: The same models will be re-estimated for Agriculture, Industry & Services Sector. However, capital, output and education variable will represent the capital, output and education of the respective sector, and control variables will also be different.

2.2 Variables and data

To execute the analysis time series data for the years, 1985-2018 is gathered. The variables used along with the definitions and sources are listed in Appendix A. The dependent variable is the real GDP per employed person. The main variable of this study the Education level is taken as the number of employed persons who have a specific education level i.e. Primary, Secondary or Tertiary Education. The data is gathered from various issues of the Labour Force Survey of Pakistan (LFS). It is important to mention here that all the data is available in data files of LFS so the data which was not printed is acquired from data files e.g. education levels of employed persons in agriculture, industry & services sector. The details of control variables used in the study are listed in Appendix A.

The data for capital per employee is generated by utilizing the series of gross fixed capital formation through the method explained below. The capital series is generated for the overall economy as well as for agriculture, industry & services sectors separately.

2.3 Construction of capital stock series

The method proposed by Berlemann and Wesselhöft(2014) is followed to construct the capital stock series. The proposed method is based on the Perpetual Inventory Method. However, it unifies three existing approaches Nehru and Dhareshwar (1993), De La Fuente and Domenech(2000) and KAMPS(2006) to have merits of all three. The method is briefly explained as under.

Step 1: Following Nehru and Dhareshwar(1993) the initial value of the investment is derived by following the regression equation reported below

$$Ln\, I_t = \alpha + \beta t + \varepsilon_t \tag{14}$$

complete investment series from period two (t_2) to T is used in estimation. Once the estimates of α and β are calculated. The value of an investment in time-period 1 is calculated by substituting t=1 in the equation. As the estimation utilized the logarithmic values of investment so the exponential value of α + β will give the investment in time-period 1.

Step 2: The second step is to find the growth rate of Investment. The method utilizes the value of β as a measure of the growth of investment.

Step 3: Following Kamps(2006), depreciation is considered as time-varying and not fixed.

After making these three modifications the method estimates the initial capital stock by the following formula

$$K_0 \approx \frac{I_1}{g_I + \delta} \tag{15}$$

And then follows the perpetual inventory method

$$K_t = (1-\delta)^{t-1} K_0 + \sum_{i=0}^{t-1} (1-\delta)^i I_{t-(i+1)} \tag{16}$$

Note: We in our study followed all the steps mentioned above except step 3 that suggests the use of time-varying depreciation rates, but due to unavailability of depreciation rates for each year we used a fixed depreciation rate of 5%.

3. Results and discussion

Section 3 reports and discusses the results comprehensively. In section 3.1, the results of unit root tests are registered. The second subsection illustrates the impact of different education levels on growth and output of the agriculture sector. The third and fourth sections are allocated for analysis of the impact of different education levels on the Industry & Services sector respectively. The fifth subsection is reserved for analysis of the overall economy. While in the last subsection, the results of different sectors are compared.

3.1 Unit root test

In order to check the stationarity of variables, the Augmented Dicky Fuller test is employed. The results of ADF τ-statistics along with their p-values are stated in Appendix A1. It is found that all the variables used in the models for the overall economy, agriculture, industry & services are integrated of order 1 i.e. they are non-stationary at levels but stationary at first difference.

3.2 Agriculture sector

3.2.1 Agriculture sector's output per employed person as the dependent variable

The impact of different educational levels on output per employed person of the agriculture sector is analyzed by estimating the model for each education level separately. In addition to the education variable, capital per employed person in the agriculture sector, land, fertilizer, improved seed distribution, water and exports of agriculture sector's products are included in each model.

The bounds test results (reported in Appendix B1) does not validate the presence of a long-run association. Hence, the results of long-run in case of models with output per employed person as the dependent variable in the agriculture sector are not reported. The results of the short-run effects of education levels on the output per employed person in the agriculture sector derived by fitting the ARDL model is given below in Table 1 along with the summary of diagnostic tests to check the accuracy of the model. The stability of the model is checked through CUSUM and CUSUM of squares and are reported in Appendix C.

The results show that capital per employed person has a significantly positive impact on output per employed person in the agriculture sector in the models estimated for primary, secondary as well as tertiary education. The coefficients associated with the education levels are found negative in all the three models. However, in the model where primary education is considered the coefficient is found insignificant, while in the case of secondary & tertiary education the coefficients are highly significant. The coefficients of land, fertilizer, seed, water and exports of agriculture product all appeared with a positive sign in all the three models for modelling the agriculture sector output per employed person with different education levels.

Table 1: Impact of Education on Growth of Agriculture Sector in Pakistan

	Short Run		
Variable	**Primary**	**Secondary**	**Tertiary**
Education	-0.149597	-0.268610	-0.145109
	(0.1406)	(0.0226)	(0.0670)
k	0.782196	0.391912	0.249492
	(0.0011)	(0.1022)	(0.1012)
Land	0.133457	0.169806	0.203712
	(0.5575)	(0.4661)	(0.5529)
Fertilizer	0.088868	0.132368	0.116934
	(0.3281)	(0.2161)	(0.2713)
Seed	0.045310	0.139053	0.017853
	(0.1820)	(0.0157)	(0.6931)
Water	0.081016	0.665697	0.524766
	(0.7857)	(0.0572)	(0.1897)
Exports_Agri	0.040790	0.000550	0.007061
	(0.3513)	(0.9899)	(0.9116)
C	5.215370	3.305193	3.387593
	(0.0060)	(0.0704)	(0.0356)
Diagnostic test results			
R^2	0.97	0.97	0.91
Serial Correlation	0.374958	2.829344	0.272629
	(0.5403)	(0.1089)	(0.6016)
Heteroskedasticity	0.963802	1.550322	0.659441
	(0.5065)	(0.1899)	(0.7209)
Ramsey RESET Test	1.176395	1.687570	2.474942
	(0.2917)	(0.2095)	(0.1299)

*p-values are given in parenthesis.
*Each variable is taken in natural log form.

The results regarding the impact of different education levels on per employed person output of agriculture sector are in contrast with what is generally expected but few examples exist in literature exhibiting the negative impact of education on agriculture sectors output. For example, Oduro-Ofori et al.(2014) in a micro-level study of farmers found that average years of schooling have a negative but insignificant coefficient in the regression of agriculture output as the dependent variable. Besides, it was observed in the study that primary & secondary education have positive but tertiary education have a negative effect on output. Similarly, Lee(2012) tested the effect of higher education on agriculture output of Japan and found that all major groups in higher education that is science, social sciences, humanities and education have a significant negative effect on the growth of agricultural output. Although few examples exist of finding the negative coefficient of education, the issue is further investigated and discussed in the subsequent section.

3.2.2 Agriculture sector's output as dependent variable

To further investigate the effect of different education levels in the agriculture sector, the analysis is repeated by taking the output of agriculture sector as dependent variable instead of output per employed person and adding the number of persons employed as an explanatory variable in the model. It helps to investigate if the negative association between education and output per employed person found in the preceding section is due to increased education or because of the surplus labour in the agriculture sector.

F-bounds test (reported in Appendix B2) confirms the presence of a long-run association in all the three models with different education levels. The speed of adjustment coefficients reported in Appendix B2 is highest for the model with tertiary education taken into account, while the speeds of adjustment in case of primary & secondary education are not very different from each other.

The results of long-run, as well as the short-run association between different education levels and agriculture's sector output, are presented in Table 2 along with the results of the diagnostic tests. While CUSUM and CUSUM of squares test showing the stability of the models are reported in Appendix C. Other variables included in the model are the capital series generated for the agriculture sector, number of persons employed in the agriculture sector, land, fertilizer, seed, water and agriculture sector exports. The results show that primary, secondary & tertiary education all have positive coefficients in the models of the output of the agriculture sector in the long-run.

Table 2: Impact of Education On Output Of Agriculture Sector In Pakistan

Variable	Primary	Secondary	Tertiary
Long-Run			
Education	0.015845	0.031673	0.097506
	(0.9345)	(0.8937)	(0.0854)
Capital	0.269164	0.274227	0.108617
	(0.0444)	(0.0555)	(0.2305)
Employment	-0.131292	-0.153764	-0.033281
	(0.7461)	(0.7324)	(0.8194)
Land	0.462884	0.473059	0.439196
	(0.2416)	(0.2474)	(0.0303)
Fertilizer	0.168229	0.161490	0.135417
	(0.2484)	(0.3111)	(0.0939)
Seed	0.114471	0.107215	0.148739
	(0.0470)	(0.1836)	(0.0003)
Water	0.499750	0.474214	0.895037
	(0.2428)	(0.3359)	(0.0003)
Exports_Agri	0.009942	0.013398	-0.003521
	(0.8920)	(0.8650)	(0.9214)
C	17.94870	18.16064	17.37172
	(0.0003)	(0.0007)	(0.0001)
Short Run			
Education	0.008603	0.017092	0.093824
	(0.9341)	(0.8923)	(0.0993)
Capital	0.146138	0.147985	0.104516
	(0.0709)	(0.0079)	(0.2493)
Employment	-0.071283	-0.082978	-0.032024
	(0.7393)	(0.7233)	(0.8194)
Land	0.251315	0.255284	0.422612
	(0.2671)	(0.2650)	(0.0515)
Fertilizer	0.091337	0.087147	0.130303
	(0.2832)	(0.3515)	(0.1034)
Seed	0.062150	0.057858	0.074639
	(0.1100)	(0.2675)	(0.0276)
Water	0.271330	0.255907	0.313988
	(0.3095)	(0.3980)	(0.1975)
Exports_Agri	0.005398	0.007230	-0.003388
	(0.8911)	(0.8630)	(0.9217)
C	9.744930	9.800301	16.71576
	(0.0090)	(0.0093)	(0.0003)
Diagnostic Tests			
R^2	0.99	0.99	0.99
Serial Correlation	2.762678	2.769776	0.420900
	(0.1113)	(0.1109)	(0.5165)
Heteroskedasticity	2.151098	2.554386	0.940793
	(0.1425)	(0.1100)	(0.3321)
Ramsey RESET Test	1.158977	1.134694	0.375970
	(0.2939)	(0.2989)	(0.5470)

*Estimation technique is ARDL, p-values are given in parenthesis.

However, the coefficient of education is significant only in the model with a tertiary education. The impact of capital is found positive in all the three models where it is found significant in the case of primary and secondary education but found insignificant in the model with a tertiary education. The employment variable has a negative sign in all three models, pointing towards surplus labour in the agriculture sector. All the control variables appear having positive signs in the model with primary and secondary education, however, the p-values show that most of the coefficients are insignificant. In the model with the tertiary education level, all other variables i.e land, fertilizer, seed and water appear as significant and positive determinants of agriculture sector output except agriculture sectors export. The analysis of the impact of different education levels in the short-run reported in Table 2 also implies the same conclusions.

Summing up, when the effect of different education levels is analyzed on output per employed person of the agriculture sector of Pakistan, education appears to have a negative impact in all the three cases. However, the issue is investigated further by taking agriculture's sector output as the dependent variable and including the number of employed persons as a determinant in the model. This modification turns the education coefficient positive for all three education levels and employment coefficients appear as negative values. Hence pointing towards the well-known 'surplus labour' phenomena of developing countries in the agriculture sector.

3.3 Industrial sector

The impact of different education levels on output per employed person of the industrial sector is analyzed through the ARDL method. The bounds test reported in Appendix B1 verifies the existence of a long-run association for all the three models. Speed of adjustment coefficients reported in Appendix B2 shows that 53% of deviations from long-run equilibrium get corrected during a year in model with primary education, it is 64%in case of secondary education and 45% for tertiary education.

Table 3 reports the impact of education levels on output per employed person in the industrial sector in the short-run and long-run along with the diagnostic test results of the models. CUSUM and CUSUM square tests reported in Appendix C confirm the stability of the models. Industrial sector's capital per employed person, foreign direct investment, credit to the private sector, the difference between the weighted average of returns on advance and deposits, external debt and exports of the manufacturing sector are included as explanatory variables in the models.

In the long-run, the coefficients of each level of education are positive in models of industrial sector output per employed person. The education coefficient is greater in the model of primary education than the coefficient of secondary education as a proxy. The coefficient is found significant in both models. However, in the model where tertiary education is used as a proxy for human capital the coefficient is found insignificant. The

Table 3: Impact of Education on output per employee in the Industrial Sector

Variable	Primary	Secondary	Tertiary
Long Run			
Education	0.411362	0.236865	0.034676
	(0.0008)	(0.0020)	(0.7134)
k	0.454421	1.049690	1.479203
	(0.0749)	(0.0001)	(0.0001)
FDI	-0.001219	0.030322	0.032754
	(0.9611)	(0.1802)	(0.3692)
CPS	0.014428	-0.000235	-0.005951
	(0.1161)	(0.9634)	(0.4177)
RS	-0.018721	-0.040559	-0.052690
	(0.2093)	(0.0002)	(0.0022)
INF	0.003494	0.005145	0.003319
	(0.1769)	(0.0694)	(0.4525)
ED	-0.006455	-0.005456	-0.011196
	(0.0230)	(0.0426)	(0.0062)
Export (Manufacturing)	0.011988	0.000797	-0.012751
	(0.3221)	(0.9403)	(0.4334)
Short Run			
Education	0.220785	0.153366	0.015775
	(0.0003)	(0.0169)	(0.7274)
k	0.871617	0.679657	0.672916
	(0.0001)	(0.0001)	(0.0001)
FDI	-0.000654	0.019633	0.014900
	(0.9607)	(0.1980)	(0.3956)
CPS	0.007744	-0.000152	-0.002707
	(0.0234)	(0.9635)	(0.4542)
RS	-0.010048	-0.026261	-0.023970
	(0.1871)	(0.0001)	(0.0009)
INF	0.001875	0.003331	0.001510
	(0.2639)	(0.1015)	(0.4758)
ED	-0.003465	-0.003533	-0.005093
	(0.0131)	(0.0271)	(0.0032)
Export (Manufacturing)	0.006434	0.000516	-0.005801
	(0.2548)	(0.9403)	(0.4374)
Diagnostic Tests			
R^2	0.98	0.96	0.95
Serial Correlation	0.002395	0.095054	0.645253
	(0.9610)	(0.7578)	(0.4218)
Heteroskedasticity	1.465420	0.423245	0.390103
	(0.2261)	(0.5153)	(0.5322)
Ramsey RESET Test	1.061815	0.291053	0.556117
	(0.3151)	(0.5950)	(0.4637)

* p-values are given in parenthesis, k is capital per employed person in the industrial sector

capital per employed person is found highly significant and positive in all the models. The deeper look at the results shows that combining a higher education level with capital makes the capital more productive. The coefficient of per employed person capital in a model with secondary education is higher than its coefficient in the model of primary education. Similarly, the coefficient is higher in model with tertiary education as compared to primary & secondary education. In conclusion, it is evident from the results that increased level of education makes capital more productive and the overall impact on output per employed person will be higher in case of increase of the higher education level as compared to the lower levels of education. The results of the impact of different education levels on the growth of industrial output per employed person in the short-run are also reported in Table 3. It is found that, in the short-run, primary education is contributing more to the output per employed person of the sector. In the model with tertiary education as a proxy for human capital the coefficient of tertiary education is found insignificant, implying that the data does not support the active role of tertiary education in increasing the per employed person output. Liu and Armer(1993) reported a significant and positive impact of primary and junior high school education on the output of the overall economy in Taiwan, while senior high school and tertiary education were found insignificant in explaining output growth. The model results for tertiary education as a proxy for human capital is pointing towards the developing country phenomenon where the lower levels of education are more effectively contributing as compared to the tertiary education level because of its underutilization.

3.4 Services Sector

The results of the analysis of services sector output per employed person are reported in this section.

The F-bound test reported in Appendix B1 approves the presence of a long-run association. Speed of adjustment coefficients reported in Appendix B2 shows that highest speed of adjustment is in case of secondary education where 71% of deviations from long-run are corrected in one year, followed by 58% for the tertiary education and 48% for primary education. The results of the impact of different education levels on output per employed person in the services sector in the long-run & short-run are illustrated in Table 4. CUSUM and CUSUM squares tests reported in Appendix C authenticate the stability of all the models. The education variable in all three cases; whether it is proxied by the primary, secondary or tertiary education is found positive and significant in the long-run. It implies that an increase in education in the services sector increases the output per employed person. The coefficients of capital per employed person are also positive and significant in all three models. It could be seen that the coefficient of capital increases as it is mixed with a higher education level pointing towards increased productivity of capital. It implies that changes in output per employed person will be higher if a higher education is combined with capital. The results of the control variables in the model are also reported in Table 4. Similarly, in the short-run, the coefficient of education variable shows that all three education levels entering into separate models as a proxy for human capital have a positive and statistically significant impact. Similarly, the coefficient of per employed person capital is statistically significant and positive.

It is found that in the short-run the highest impact on output per employed person of the services sector is of secondary education as compared to primary & tertiary education. The coefficient of capital per employed person is positive and significant in all the three models of output per employed person in the short run.

Table 4: Impact of education on output per employee of services sector

	Long Run		
Variable	**Primary**	**Secondary**	**Tertiary**
Education	0.322997	0.300007	0.166509
	(0.0001)	(0.0001)	(0.0001)
k	0.326675	0.958221	1.242560
	(0.0048)	(0.0001)	(0.0001)
FDI	0.017185	0.008182	0.008000
	(0.0284)	(0.4853)	(0.5839)
RS	-0.011215	-0.012319	-0.007629
	(0.0010)	(0.0132)	(0.1688)
ED	-0.003066	-0.004349	-0.006880
	(0.0166)	(0.0001)	(0.0001)
INF	0.001300	-0.002292	-0.001956
	(0.2701)	(0.1912)	(0.3647)
Trade	-0.009127	-0.001452	-0.003824
	(0.0009)	(0.5408)	(0.1959)
CPS	-0.004821	0.000918	0.001505
	(0.0054)	(0.7430)	(0.6705)
	Short Run		
Education	0.112493	0.215527	0.097352
	(0.0304)	(0.0001)	(0.0001)
k	0.832566	0.688392	0.726478
	(0.0001)	(0.0001)	(0.0001)
FDI	0.008315	0.005878	0.004677
	(0.0641)	(0.4841)	(0.5838)
RS	-0.005426	-0.008850	-0.004460
	(0.0036)	(0.0213)	(0.1728)
ED	-0.001484	-0.003124	-0.004022
	(0.0107)	(0.0003)	(0.0001)
INF	0.000629	-0.001647	-0.001144
	(0.2914)	(0.1854)	(0.3564)
TRADE	-0.000247	-0.001043	-0.002236
	(0.7883)	(0.5385)	(0.1976)
CPS	-0.002332	0.000660	0.000880
	(0.0201)	(0.7407)	(0.6654)
c	2.669612	3.149972	--------
	(0.0040)	(0.1190)	
	Diagnostic Tests		
R^2	0.99	0.99	0.98
Serial Correlation	1.479604	2.817507	2.139528
	(0.2238)	(0.1088)	(0.1591)
Heteroskedasticity	0.348786	0.016674	0.5324
	(0.5548)	(0.8973)	(0.4656)
Ramsey RESET Test	0.261890	2.521951	0.670621
	(0.6150)	(0.1280)	(0.4225)

* p-values are given in parenthesis, k is capital per employed person in the services sector

3.5 Overall economy

The inquiry of the impact of different education levels on the overall economic growth of Pakistan is reported and discussed below. In addition to capital per employee and education variable foreign direct investment (FDI), the difference between weighted average rate of return on advances and deposits (RS), inflation (INF), external debt (ED), exports and credit to private sector(CPS) are also included in the model. The results of F-bound test reported in Appendix B1 validates the presence of a long-run association in the models for primary, secondary & higher education. The speeds of adjustment reported in Appendix B2 shows that highest speed of adjustment is in case of primary education where 46% of deviation is corrected during a year. The speeds of adjustment are 39% and 33% for tertiary education and secondary education respectively.

The results of the effect of different education levels on the economic growth of Pakistan in the long-run are registered in Table 5. The effect of each education level is found positive and highly significant. The coefficients of capital per employed person are also positive and decidedly significant in all three models. The highest coefficient of education variable is in the case of primary education, followed by secondary education and then for tertiary education. However, if we also take the coefficients of capital per employed person in consideration, it could be seen that the coefficient of capital per employee is highest in the model with secondary education. So the sum of education and the capital variable is highest in the case of secondary education, followed by primary education and then by tertiary education.

Our results are in line with the conclusions of Petrakis and Stamatakis(2002), Gemmel(1996), Papageorgiou(2003), Loening(2005) and Tsai et al.(2010). Petrakis & Stamatakis(2002) concluded that primary education contributes more to the development of less developed countries while higher education plays an active role in the development of advanced countries. Similarly, Gemmel(1996) found that primary education has significant effects on the economic growth of developing countries while tertiary education plays a vital role in the development of OECD countries. Both studies got ambiguous results in the case of secondary education and in some cases, it has a negative sign. Moreover, Papageorgiou(2003) established based on cross-country regressions that primary education plays important role in growth of final output while post primary education promotes adoption and innovation. Loening(2005) using time series data for Guatemala (a developing country) concluded that primary education contributes more to the economic growth than secondary and higher education level.

Tsai et al.(2010) reported that for developing countries the impact of secondary education is positive and significant while it is insignificant in case of developed countries.

Table 5: Impact of different levels of education on Economic growth of Pakistan

Variable	Primary	Secondary	Tertiary
Long Run			
Education	0.447095	0.277853	0.233058
	(0.0001)	(0.0126)	(0.0014)
k	2.009052	2.234842	1.857573
	(0.0011)	(0.0353)	(0.0220)
FDI	0.053494	0.057543	0.059541
	(0.0044)	(0.0442)	(0.0116)
RS	-0.033272	-0.039448	-0.029917
	(0.0134)	(0.0752)	(0.0731)
INF	-0.000968	-0.002478	-0.002072
	(0.6616)	(0.4776)	(0.4651)
ED	-0.001842	-0.005821	-0.005278
	(0.4605)	(0.1972)	(0.1138)
Exports	0.002852	0.006079	0.003098
	(0.6383)	(0.5293)	(0.6878)
CPS	-0.007413	-0.008804	-0.007070
	(0.0651)	(0.2006)	(0.1987)
Short Run			
Education	0.208598	0.093551	0.092971
	(0.0066)	(0.1165)	(0.0500)
k	0.937347	0.752456	0.741017
	(0.0001)	(0.0007)	(0.0005)
FDI	0.024958	0.019374	0.023752
	(0.0156)	(0.0773)	(0.0375)
RS	-0.015524	-0.013282	-0.011935
	(0.0009)	(0.0080)	(0.0073)
INF	-0.000452	-0.000834	-0.000827
	(0.6571)	(0.4663)	(0.4556)
ED	-0.000859	-0.001960	-0.002106
	(0.4182)	(0.0758)	(0.0364)
Exports	0.001331	0.002047	0.001236
	(0.6378)	(0.5387)	(0.6880)
CPS	-0.003459	-0.002964	-0.002820
	(0.0762)	(0.1776)	(0.1846)
c	-9.593674	-6.966131	-5.924245
	(0.0005)	(0.0095)	(0.0229)
Diagnostic Tests			
R^2	0.982	0.977	0.979
Serial Correlation	0.0000532	0.103105	0.713092
	(0.9942)	(0.7481)	(0.3984)
Heteroskedasticity	1.412948	0.679400	0.419914
	(0.2346)	(0.4098)	(0.5170)
Ramsey RESET Test	0.859234	0.717925	1.028599
	(0.3645)	(0.4064)	(0.3220)

* p-values are given in parenthesis

The results of the control variables in the model are listed in Table 5. The impact of foreign direct investment is positive and significant in all three models. The effect of the variable 'RS' which is showing the difference of weighted average rate of return on advances and deposits is found negative and significant. It means that if the spread between returns on advances and deposits is low, that will mean the loans are available at lower rates and savings are encouraged by higher returns, then the output per employed person will be higher and vice versa. Similarly, the coefficient of inflation variable is found to be negative and insignificant in all three models. The impact of external debt is also negative in every model but the parameters are found insignificant. Exports coefficients are positive while the credit to private sector appears as having a negative effect on the output per employed person in the long run. The results reported in Table 5 show that all three education levels have a positive and significant effect on the economic growth of the overall economy in the short-run. The highest coefficient in the short-run is of primary education, then for secondary education and then tertiary education. Capital per employed person also has a positive and highly significant impact in the short run. The coefficient of capital is higher in the model of primary education and almost the same in the model with secondary & higher education. The diagnostic test results for the models are reported in Table 5 while CUSUM and CUSUM square tests are given in Appendix C showing the stability of the models.

3.6 Comparison of major sectors and the overall economy

The comparison of coefficients of different education levels across sectors and with overall economy gives an important insight about the role of different education levels in the economy of Pakistan. The results of the long-run association are summarized in Table 6. The comparison of the coefficients of Primary education as a proxy for human capital across different sectors in the economy shows that primary education is best utilized in the industrial sector. Whereas, secondary education is best deployed in the services sector. Similarly, the comparison of the coefficients of tertiary education across sectors shows that in the long-run the best utilization of tertiary education is in the services sector. In the services sector, the coefficient of the tertiary education is highest and is most significant as compared to other sectors. In the industrial sector, although the coefficient has a positive value, it is low and is also highly insignificant. Pointing towards the inefficient utilization of tertiary education in the industrial sector. In the case of the agriculture sector, when output per employed person is taken as the dependent variable, the results negate the presence of a long-run association. However, in the model for the output of the agriculture sector, the effect of tertiary education is found to be significant and positive. Yet, this positive effect is lower than the effect of tertiary education in the services sector.

Table 6: Comparison of different sectors and overall economy (Long-Run)

Variable	Primary	Secondary	Tertiary
Overall Economy	0.447095 (0.0001)	0.277853 (0.0126)	0.233058 (0.0014)
Agriculture Sector	Bounds test results show that long-run relationship doesn't exist		
Industry	0.411362 (0.0008)	0.236865 (0.0020)	0.034676 (0.7134)
Services Sector	0.322997 (0.0001)	0.300007 (0.0001)	0.166509 (0.0001)
Agriculture Sector (output)	0.015845 (0.9345)	0.031673 (0.8937)	0.097506 (0.0854)

*p-values are given in parenthesis.

The results of the impact of different education levels on output per employed person in the short run are presented in Table 7. If we compare the effect of primary education in each sector of the economy, its greatest utilization is in the industrial sector, followed by the services sector. The coefficient of primary education is negative in the agriculture sector when output per employed person is taken as a dependent variable. However, when the model for agriculture sector is modified by taking employment of agriculture sector into account and agriculture's sector output as dependent variable the education coefficients turn to positive values But the coefficient in the agriculture sector remains below the coefficient of the industrial and services sector.

Table 7: Comparison of different sectors and overall economy (Short-Run)

Variable	Primary	Secondary	Tertiary
Overall Economy	0.208598 (0.0066)	0.093551 (0.1165)	0.092971 (0.0500)
Agriculture Sector	-0.149597 (0.1406)	-0.268610 (0.0226)	-0.145109 (0.0670)
Industrial Sector	0.220785 (0.0003)	0.153366 (0.0169)	0.015775 (0.7274)
Services Sector	0.112493 (0.0304)	0.215527 (0.0001)	0.097352 (0.0001)
Agriculture Sector (Output)	0.008603 (0.9341)	0.017092 (0.8923)	0.093824 (0.0993)

*Estimation technique is ARDL, p-values are given in parenthesis.

Similarly, in case of secondary education the greater impact is in case of the services sector, then for the industrial sector and negative in agriculture sector when output per employed person is considered and positive in case of agriculture's output. In the case of the overall economy, the effect is positive and representative of all sectors. For tertiary education again the largest positive impact is in the services sector. The coefficient of tertiary education in the industrial sector is found positive but insignificant. The coefficient of tertiary education is negative and significant in the model of per employed person output of agriculture sector and significant and positive in the model of agriculture's sector output. For the overall economy, the effect is significant and positive and representative of all sectors.

4 Conclusion

The analysis of the impact of different education levels of employed persons shows that each education level whether its primary, secondary or tertiary have a positive effect on the output per employed person both in the short-run and long-run. It is true for the overall economy, industrial & services sector but the agriculture sector gives somewhat different results. In the agriculture sector, it is found that each education level is negatively associated with the output per employed person. The deeper analysis showed us that the greater negative effect of employment evades the positive effect of education in the agriculture sector. However, when the effect of education is considered on output, controlling for the effect of employment in the model, the coefficients turn to be positive.

The comparison of different sectors for each education level shows that primary education contributes more to the industrial sector. While the contribution of the secondary & tertiary education is highest in the services sector. It implies that primary education is best utilized in the industrial sector as compared to other sectors, while secondary education & tertiary education are efficiently used in the services sector as compared to the industrial & agriculture sector.

The analysis of the impact of different education levels on the agriculture sector shows the negative impact of each education level on output per employed person in the short-run. The data doesn't support the presence of a long-run association in all three models of output per employed person of the agriculture sector. The impact of education on agriculture sector is further analyzed by estimating the model for output of the sector instead of output per employed person and by including the effect of employment along with other control variables in the model. In the long-run and short-run, the coefficients of education are found positive. However, the coefficient of education variable is only significant in the case of tertiary education.

For the industrial sector, the impact of primary, secondary & tertiary education on output per employed person is found positive both in the short-run and long-run.

However, the coefficient of tertiary education remained insignificant. It is also deduced that in the long-run secondary education makes capital more productive as compared to primary education. The coefficient of capital per employed person is found higher in the model of secondary education as compared to primary education. Also, the sum of coefficients of capital and education is higher in the model of secondary education as compared to primary education in the long-run. It is found that the speed of adjustment is greater in the case of secondary education as compared to primary & tertiary education.

For the Services sector, the education variable in all three cases; whether it is proxied by the primary, secondary or higher education is found positive and significant. The coefficients of capital per employed person are also positive and significant in all three models. Moreover, the coefficient of capital increases as it is mixed with a higher education levels, it means that a higher education level escalates the productivity of capital. It implies that changes in output per employed person will be higher if a higher education levels is combined with capital. Speed of adjustment was found highest in case of secondary education followed by tertiary education and then for the primary education.

5 Policy implications

The analysis of agriculture sector shows that surplus employment in the agriculture sector is evading positive returns of education. It implies that there is a need to lower employment in the agriculture sector or to make the agriculture sector as broader as to absorb all the surplus labour efficiently. It will require to define policies that provide incentives to one's that are associated to the agriculture sector to transfer to other sectors or to increase the productivity and market size of the agriculture sector to absorb the surplus labour.

The results show that secondary & tertiary education is best utilized in the services sector. It is necessary to analyze and device policies to know the reasons why secondary & tertiary education is contributing less to other sectors. It is also required to define policies to make education at least as useful as it is in the services sector.

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Appendix A: Variables Definitions and Sources

Economic Survey of Pakistan (ESP)
Labourforce Survey of Pakistan (LFS)
World Developmetn Indicators (WDI)
Handbook of Statistics, State Bank of Pakistan (HBS)

Variables	Definition	Source
	Overall Economy	
y	GDP Local currency (constant in 2005 prices) / number of employed persons	ESP
Capital	Generated on the basis of GFCF (local currency and constant value)	ESP
k	Capital/ number of employed persons	----------
Primary Education	Number of employed persons having primary education in Pakistan	LFS
Secondary Education	Number of employed persons having secondary education	LFS
Tertiary Educaton	Number of employed persons having tertiary education	LFS
FDI	Foreign Direct Investment, net inflows (% of GDP)	WDI
RS	The difference between the weighted average rate of return on advances and deposits	HBS
INF	Inflation, Consumer Prices	WDI
ED	External debt stocks (% of GNI)	WDI
Exports	Exports of goods and services as % of GDP	WDI
CPS	Domestic credit to private sector (% of GDP)	WDI
	Agriculture Sector	
Output	Agriculture's Sector value added local currency constant in 2005 prices	ESP
y	Value added local currency,constant 2005 prices/number of employed persons in agriculture sector	ESP
k	Capital series generated on the basis of GFCF of agriculture sector and then it is divided by number of employed persons in agriculture sector	ESP
Primary Education	Number of employed persons in agriculture sector having primary level of education	LFS
Secondary Education	Number of employed persons in agriculture sector having secondary level of education	LFS
Tertiary Education	Number of employed persons in agriculture sector having tertiary level of education	LFS
Land	Cropped Area (million hactares)	ESP
Fertilizer	Fertilizer offtake(thousand Nutrient tonnes)	ESP

Water	Water availability (Million Acre Feet)	ESP
Seed	Improved Seed distribution (000 tonnes)	ESP
Export_Agri	Food Exports as percentage of GDP Food comprises food, live animals, beverages, tobacco, animal and vegetable oils and fats, oil seeds, oil nuts, and oil kernels.Some calculations are performed to take food exports as percentage of GDP	WDI
	Industry	
y	Industrial sector's Value added(local currency constant in 2005 prices) /number of employed persons industrial sector	ESP
k	Capital series generated on the basis of GFCF of industrial sector and then it is divided by number of employed persons in industrial sector	ESP
Primary Education	Number of employed persons in industrial sector having primary education	LFS
Secondary Education	Number of employed persons in industrial sector having secondary education	LFS
Tertiary Educaton	Number of employed persons in industrial sector having tertiary education	LFS
Export(Manufacturing)	Manufactures exports (% GDP)	WDI
	Services Sector	
y	Services sector's Value added(local currency constant in 2005 prices) /number of employed persons services sector	ESP
k	Capital series generated on the basis of GFCF of services sector and then it is divided by number of employed persons in services sector	ESP
Primary Education	Number of employed persons in services sector having primary education	LFS
Secondary Education	Number of employed persons in services sector having secondary education	LFS
Tertiary Education	Number of employed persons in services sector having tertiary education	LFS
Trade	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	WDI

Appendix A1: Augmented Dickey-Fuller Test results

Variables	**Levels**		**First Difference**	
	ADF	**p-value**	**ADF**	**p-value**
Overall Economy				
y	-1.5189	0.5113	-5.5019	0.0001
k	-0.6910	0.8350	-6.5593	0.0000
Primary Education	-1.8601	0.6514	-6.8798	0.0000
Secondary Education	-2.4019	0.3717	-6.2015	0.0000
Tertiary Educaton	-3.4225	0.0661	-6.7074	0.0000
FDI	-2.8995	0.0565	-3.7584	0.0077
RS	-1.3562	0.5914	-6.5675	0.0000
INF	-2.4796	0.1294	-7.0061	0.0000
ED	-0.6842	0.8371	-4.9215	0.0004
Exports	-0.6825	0.8376	-4.3999	0.0015
CPS	-1.3158	0.6104	-4.4556	0.0013
Agriculture Sector				
y	-2.3298	0.1692	-6.0502	0.0000
Output	-0.0761	0.9438	-6.2247	0.0000
k	-1.2897	0.8724	-5.4238	0.0001
Primary Education	-1.8041	0.6791	-6.7716	0.0000
Secondary Education	-2.7437	0.2271	-5.6277	0.0001
Tertiary Educaton	-1.2368	0.8853	-4.7779	0.0006
Land	-2.2917	0.1806	-8.3224	0.0000
Fertilizer	-0.1209	0.9387	-6.0584	0.0000
Water	-1.8803	0.6412	-8.3598	0.0000
Seed	-2.6586	0.2591	-14.4927	0.0000
Export_Agri	-0.4499	0.5122	-6.647544	0.0000
Industry				
y	-1.9147	0.3216	-6.5728	0.0000
k	-1.0117	0.7370	-5.1166	0.0002
Primary Education	-0.9703	0.9339	-6.1951	0.0000

Secondary Education	-1.1989	0.8938	-6.1193	0.0000
Tertiary Educaton	-0.9972	0.7422	-6.5501	0.0000
Export(Manufacturing)	-1.3700	0.5848	-5.0407	0.0003
	Levels		**First Difference**	
	ADF	**p-value**	**ADF**	**p-value**
Services Sector				
y	-1.7456	0.7070	-8.7591	0.0000
k	-2.4617	0.1339	-9.3439	0.0000
Primary Education	-0.2133	0.9269	-6.9893	0.0000
Secondary Education	-1.9917	0.5835	-5.3849	0.0001
Tertiary Educaton	-1.9382	0.6115	-6.1767	0.0000
Trade	-1.6478	0.4476	-6.8871	0.0000

* y and k represents output and capital per employed person respectively

Appendix B1: Bounds test results

	Primary	**Secondary**	**Tertiary**
Agriculture Sector (Output per worker)	2.841494	3.668981	2.235252
Agriculture sector (Output)	5.093671	5.097568	7.789563
Industrial Sector	6.567579	7.453945	5.255022
Services sector	8.197842	8.751988	8.418333
Overall Economy	5.26	3.68	4.09

* F-bound Values are listed in the table
*Critical value for F-bound test are 2.73 and 4.16 at 5% level of significance
* Critical values for overall economy are 2.22 and 3.39 at 5% level of significance

Appendix B2: Speed of adjustment

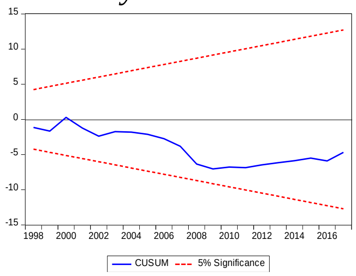
	Primary	**Secondary**	**Tertiary**
Agriculture sector (Output)	-0.542932	-0.539645	-0.962240
Industrial Sector	-0.536718	-0.647483	-0.454918
Services sector	-0.483860	-0.718406	-0.584663
Overall Economy	-0.4666	-0.3367	-0.3989

Appendix C

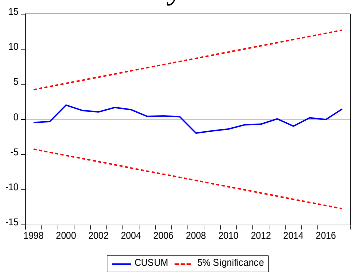
Agricultural sector (output per capita)

Cusum test

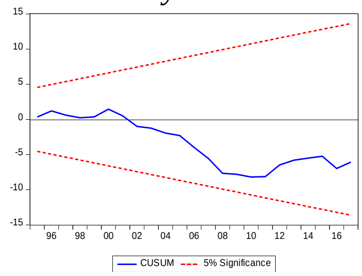
Primary Education



Secondary Education

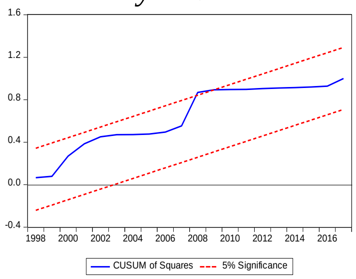


Tertiary Education

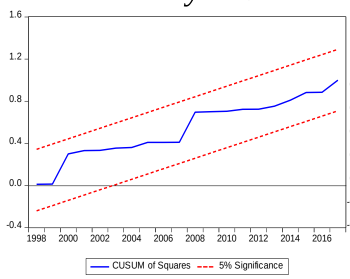


Cusum of squares test

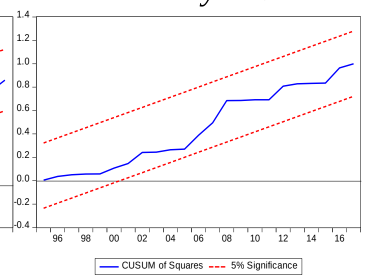
Primary Education



Secondary Education



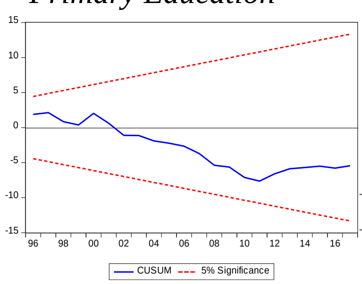
Tertiary Education



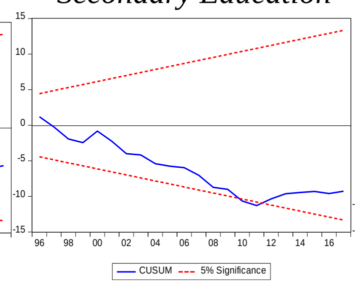
Agriculture sector (output)

Cusum test

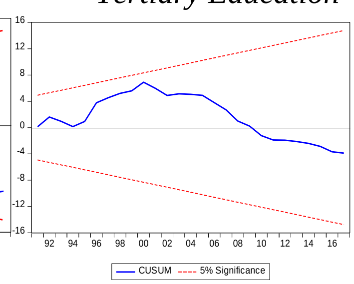
Primary Education



Secondary Education

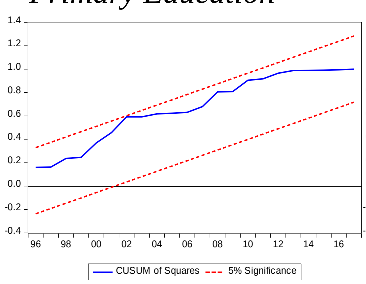


Tertiary Education

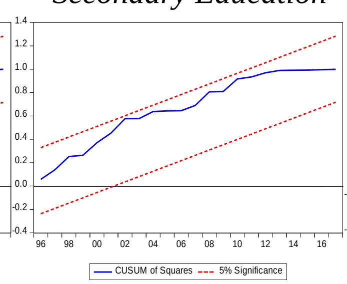


Cusum of squares test

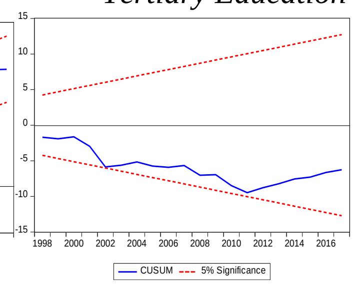
Primary Education



Secondary Education



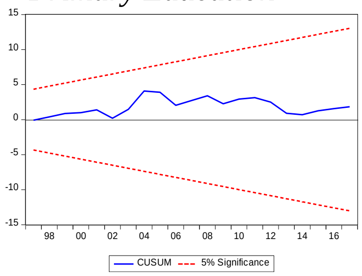
Tertiary Education

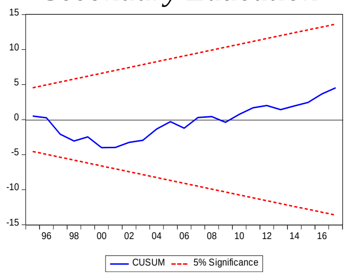


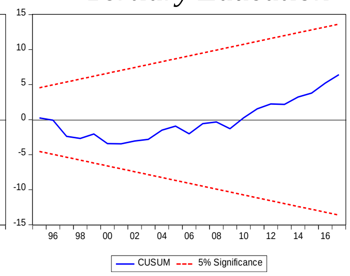
Industrial sector

Cusum test

Primary Education *Secondary Education* *Tertiary Education*

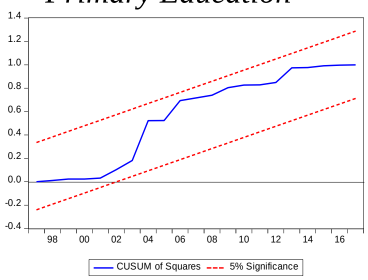


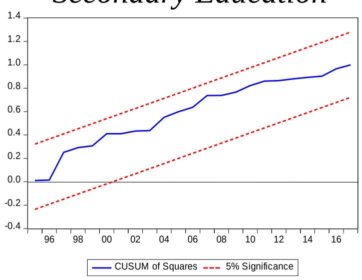


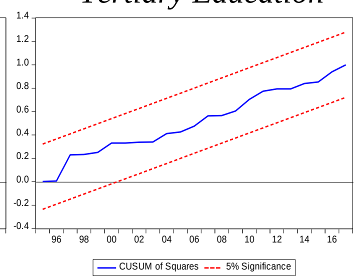


Cusum squares test

Primary Education *Secondary Education* *Tertiary Education*



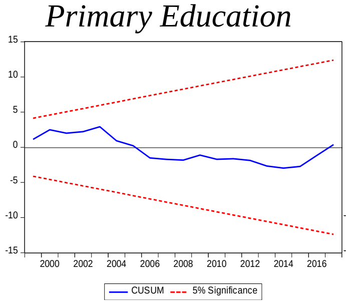


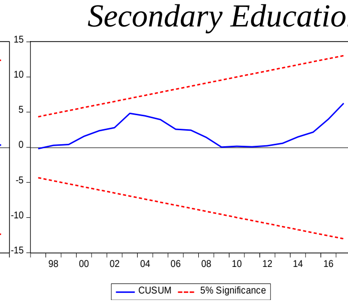


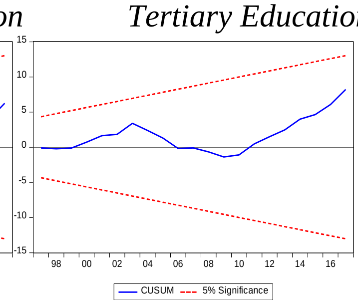
Services sector

Cusum test

Primary Education *Secondary Education* *Tertiary Education*

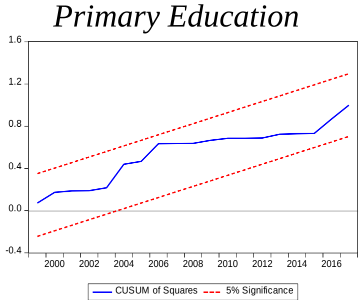


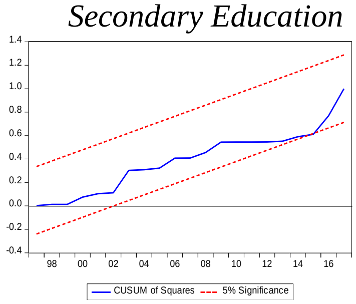


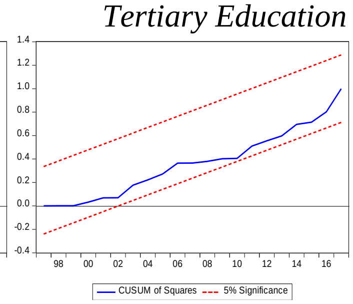


Cusum of squares test

Primary Education *Secondary Education* *Tertiary Education*

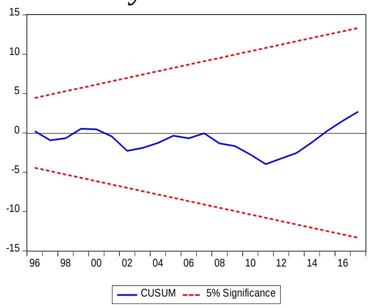




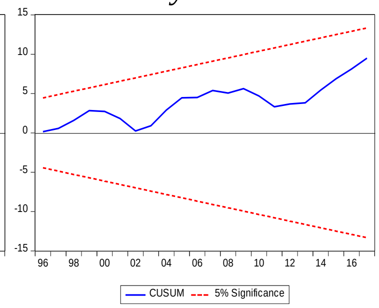


Overall economy
Cusum test

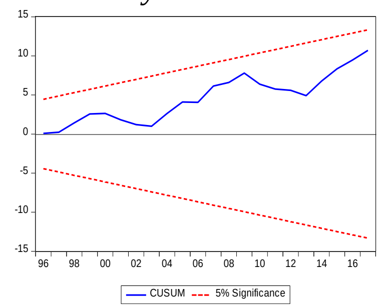
Primary Education



Secondary Education

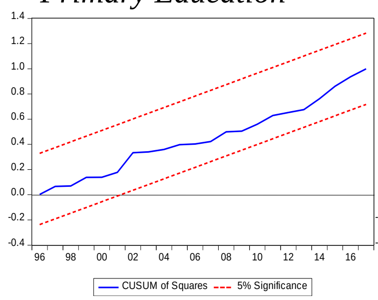


Tertiary Education

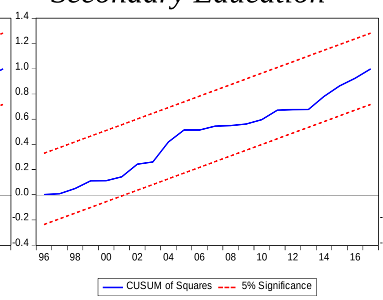


Cusum of squares test

Primary Education



Secondary Education



Tertiary Education