Research Paper

The Relationships between Higher Education and Economic Growth in Pakistan

Arshad Ali
Utara University Malaysia
Kuala Lumpur, Malaysia
E-mail: arshadswata@yahoo.com

Roslan Abdul Hakim
Othman Yeop Abdullah Graduate School of Business
Utara University Malaysia
Kuala Lumpur, Malaysia

Hussin Abdullah
Department of Economics
University Utara Malaysia
Kuala Lumpur, Malaysia
About the author

Arshad Ali received his Master of Science degree in economics from government post graduate Jahanzeb College in Saidur Sharif Swat, Pakistan in 2008, and obtained his bachelor degree in education from the University of Swat in Pakistan in 2011. In 2016, he successfully defended his Ph.D research proposal and will receive his doctoral degree in economics at Othman Yop Abdullah Graduate School of Business (OYAGSB), Utara University Malaysia.

Dr. Roslan Abdul Hakim is currently an associate Professor of Economics at Othman Yeop Abdullah Graduate School of Business, University Utara Malaysia. He obtained his doctorate (PhD in Economics) in 2001 from University of Wales, Bangor, United Kingdom under the supervision of Professor Dr. Shanti P. Chakravarty. His research interests are focused on development issues, such as poverty, income distribution, microfinance, social capital, and quality of life. He presented his papers in various international conferences and his articles appeared in national and international journals.

Dr. Hussin Abdullah is currently an assistant professor at Department of Economics at University Utara Malaysia. He received all of his education in Malaysia. He obtained Bachelor of Economics in 1987 from University Kebangsaan Malaysia, Diploma (Education) in 1993 from the Technical Teachers’ Training College, Kuala Lumpur, Master of Business Administration (MBA) in 1998 from University Kebangsaan Malaysia and PhD degree in 2008 from University Putra Malaysia, State of Selangor, Malaysia.
Abstract

This study used the Granger causality test and the Johansen co-integration test to examine higher education and economic growth relationship in Pakistan during the period of 1982-2014. The analysis of the study shows that the variables used by this study are integrated at the same level of Order I(1) to become stationary. The study found that higher education enrolment \((H_t)\) in Pakistan has a significantly long run positive impact on gross domestic product \((GDP_t)\). The study also found unidirectional Granger causality from gross domestic product \((GDP_t)\) to higher education enrolment \((H_t)\) while no causal relationship was found from higher education enrolment \((H_t)\) to gross domestic product \((GDP_t)\) in Pakistan.

**Keywords:** Higher education, human capital development, employment, economic growth

Introduction

Education is broadly considered as a prominent tool for enhancing economic growth and plays an important role in giving structure to the efficiency and capability of human, by the skills, training, knowledge and society creativity power, which eventually leads to accelerates economic growth. Generally, education is broadly accepted as a strong instrument for poverty reduction, encouraging people towards private and public earning and investment, and creating a healthy, flexible and competitive environment to enhance economic growth.

One of the most important globally recognized and accepted facts of education is to determine of promoting human capital, which has a significantly positive contribution to sustainable economic growth and social welfare in the society. Generally, education and specifically higher education play a pivotal role in enhancing productivity level by the human capital development and facilitating innovation and technology development. A study on education and economic growth relationship concluded that economic growth has been impacted positively by the higher education in Romania (Mariana, 2015). Higher education increases investment and saving, create revenue of the higher taxes and leads to a more civic competitive and entrepreneurial society. It can also make a contribution to population growth reduction, improve the health of a nation, and facilitate technological advancement and powerful governance (Woodhall, 2007). Another study investigated higher education impact on economic growth in Taiwan, and the results revealed that higher education has a significantly positive impact on economic growth for the country of Taiwan (Lin, 2004). Similarly another study using African panel data found that higher education has a significantly positive impact on economic growth (Gyimah-Brempong, Paddison and Mitiku, 2006).

This study focused on a specific country, Pakistan. The literacy rate in Pakistan was 10% when it came into being in 1947. Pakistan government’ commitment to education declared in 1947 at the National Education conference (NEC). It was the initial stage to discuss the education goals and policies in Pakistan. During the last fifty-eight years, different governments have introduced eight educational policies in Pakistan and also have set up a number of committees and commissions to determine for certain changes in the
educational system of the country (Khalid and Khan, 2006). The status of the implemented 2009 National Education policy came to an end before June 2015. Pakistan government has set up the new education policy of 2016 by upgrading and reviewing the previous education policy of 2006 and implemented it from January 2016 (Pakistan Economic Survey, 2015). However, the history of education planning and policymaking indicates the same pattern of policy making repeated in each round. It shows that the past failed efforts of education policies have repeated in Pakistan (Chaudhary, Iqbal and Gillani, 2009). Due to these ineffective education policies, the literacy rate is very low. Currently, the literacy rate in Pakistan remains 58% (Pakistan Economic Survey, 2014). Which indicates extremely worst performance of the education system of Pakistan. One of the main reasons why Pakistan government repeated failed education policies for the last six decades is specifically because of the lowest public expenditure on education as compared to the south Asian region. Public total expenditure on education as the percentage of GDP is around 2 percent for the last decades, a level which falls short of the recommended target of 4 percent set forth by UNESCO (Pakistan Economic Survey. 2015). According to the Pakistan Economic Survey (2015), Pakistan government spending on education is 2 percent of GDP for the year of 2014 and 2.1 percent for the year of 2015, where the rate of inflation is 4.8 percent for the year of 2015. If we deduct this rate of inflation from the current government spending on education, then it shows that fund allocated to education is less than the preceding year. The Government of Pakistan should enhance the fund allocation for education, especially for higher education, to make sure that the available funds are timely and properly utilized in order at least to achieve the UNESCO target to spend 4 percent of GDP on education.

The quality of higher education has been considered as the key factor for the progress and development of any country, and also as the originators of change and development of the nations. Nature have blessed the territory of Pakistan with highly talented manpower, but unfortunately due to the unavailability of the favorable sound environment of research, most of the students migrated to developed countries for their better career. The higher education enrolment ratio in Pakistan is 10%, as compared to 24% in India, 21% in Sari-Lanka and 16% in Nepal (World Bank, 2015). It is very much important for Pakistan government to take several effective steps to make possible higher levels of student enrollment. Scholarship plays a dominant role in the development of human capital, which has a directly positive impact on economic growth. The government should launch more higher education scholarship programs at the provisional and federal level in order to enhance human resource development, and eventually lead to increase economic growth in the country.

OBJECTIVES OF THE STUDY

Following are the two specific objectives mentioned by this study:

1. To examine higher education impact on economic growth in Pakistan; and
2. To examine causality between higher education and economic growth in Pakistan.
Literature Review

According to Solow (1956), economic growth could not only be achieved by the combination of labor and capital growth, but technology advancement also has sufficient contribution in the production process to achieve economic growth as a whole.

Later Lucas (1988) included human capital in his endogenous growth model and considered that human capital as a factor of production develops through education. The production process to be considered besides physical and human capital, which shows that development in the labor educational attainment has a positive contribution in the production process, which tends toward a better economic performance at the macro level.

A study (Aziz, Khan, and Aziz, 2008), which examined causality between gross domestic product and higher education in Pakistan, concluded that gross domestic product has been affected positively by the higher education. In addition, gross domestic product has been affected significantly by the higher education expenditure and higher education enrollment. Furthermore they also found that enrollment in higher education has been impacted positively by the gross domestic product and higher education expenditure (Aziz, Khan, and Aziz, 2008).

Afzal, Farooq and Ahmad (2010) examined the relationship between enrolment in school education and economic growth for the short and long run in Pakistan, using the time series data which consist of the variables, including poverty, gross domestic product, physical capital, general school enrolment ratios and inflation for the period of 1971-2009. There was found a significantly positive outcome of physical capital on economic growth for the both long and short run. The study also found that school enrollment has a significantly positive influence on economic growth for both the period of the long and short run (Afzal et al. 2010).

Chaudhary et al. (2009) used a co-integration technique to examine long run bi-directional causality between economic growth and higher education. Toda and Yamamoto (1995) causality test indicated that there exists one-sided causal effect running from economic growth to higher education, but higher education effect on economic growth appears after a gap of time (Chaudhary et al., 2009).

Mariana (2015) explored the long run association between the Romanian higher education and economic growth for the period of 1980-2012. Johansen-Juselius test was employed to determine associations between the higher education and economic growth. The conclusion drawn from the study shows that higher education has a significantly positive influence on economic growth (Mariana, 2015).

Another study found a higher education and economic growth association using the data covering the period 1980-2011. The ARDL bound testing approach used by this study indicated that higher education has a positive influence on economic growth in the long run as well as in the short run (Qazi et al., 2014).

Another study reviewed the impact of the quality education on economic growth. The conclusion drawn from the study shows the significant and robust impact of the quality education on economic growth (Hanushek et al., 2008).
Similarly, another study investigated the influence of primary, secondary and higher education on economic growth in the UK. The result of the analysis shows that during the past forty years the higher education has no significant influence on economic growth, whereas positive relationships were found in secondary and primary education, measures of capital accumulation, technical skills, and research activity (Holmes, 2013).

**Methodology**

**Specification of Econometric Model**

The empirical study relating to economic growth starts with the neoclassical Solow (1956) growth model, and then Mankiw, Romer, and Weil (1992) extended the model by including human capital. The general form of the model is:

$$Y_t = A_t K_t^\alpha H_t^\beta L_t^{1-\alpha-\beta} e_{1t}$$

(1)

where \( t = 1, 2, 3 \cdots \)

\( Y_t \) stands for the economy total output, \( A_t \) is the total outcome by combining all factors of production, \( K_t \) is the capital of the real stock, \( L_t \) is the employed labors, \( H_t \) is the enrolment ratios at higher education level and \( e_{1t} \) indicates white noise error term, which indicates the effect of other factors. To get the linear function, equation (2) is obtained by taking natural logs both sides of equation (1) (Chaudhary et. al, 2009; Mussagy and Babatunde, 2015):

$$\ln Y_t = \ln A_t + \alpha \ln K_t + \beta \ln H_t + \gamma \ln L_t + e_{2t}$$

(2)

where \( t = 1, 2, 3 \cdots \)

\( 1-\alpha-\beta, \alpha, \beta \) and \( \gamma \) show the elasticity of output with respective Labor, Human capital (enrollment at higher education), Physical Capital, \( \ln A_t \) shows fixed parameter and \( e_{2t} \) indicates *white noise error* term, reflects the external factors effect.

**Data Source**

The data used for this study is time series data covering the period of 1982 to 2014. The data on the variable gross fixed capital formation, which is a proxy of physical capital \( (K_t) \), was collected from the Federal Bureau of Statistics, Pakistan Economic Survey. The aggregate production \( (Y_t) \) is measured in the gross domestic product \( (GDP) \), which is a proxy for economic growth, and the GDP data was also collected from Federal Bureau of Statistics, Pakistan Economic Survey. Higher education \( (H_t) \), was defined as the number of students enrolled at the university level, and this data was also extracted from the Pakistan Economic Survey. And the data on labor force \( (L_t) \), defined as the number of persons who are employed each year, was collected from World Development Indicators (World Bank, 2015).
Estimation Procedure

To examine the higher education influence on economic growth and its bidirectional relationship this study uses three different tests, first the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979), secondly Johansen (1988) co-integration test and thirdly the Granger causality test (Engle et al., 1986).

Classical regression analyses assume that the variables in the model are considered to be stationary, if they have constant mean and variance over time. If these variables are non-stationary, it means that the variables have time-varying variance or time-varying mean or both; in such a state the classical regression analysis may be considered as invalid (Thomas, 1996). The relationship between the stationary variables can still be considered as spurious, even if there exists a significant relationship as indicated by the first regression analyses. Therefore, first, this study checks the unit root in all the variables by the ADF test. However, as Engle and Granger (1987) mentioned, a valid long run association exists between the variables of non-stationary. Engle and Granger (1987) also indicated that the relationship among the non-stationary variables become stationary by the procedure of residuals from the ordinary least square estimation. More precisely, the non-stationary variables are co-integrated by the stationary residuals. To find the co-integration relationship between the variables, this study uses the Johansen (1988) co-integration test. The spurious regression situation could be avoided by the co-integration test as mentioned by Engle et al. (1986). Finally, this study will analyze the causality of higher education and economic growth by using the Granger causality test (Granger 1969). If the variables both are \( I(0) \), means is integrated of order zero, then the following equations will be used by the standard Granger causality test having lag length of \( k \):

\[
GDP_t = d_1 + \alpha_1 GDP_{t-1} + ... + \alpha_k GDP_{t-k} + \beta_1 H_{t-1} + ... + \beta_k H_{t-k} + \varepsilon_1 \quad (3)
\]

\[
H_t = d_2 + \alpha_1 H_{t-1} + ... + \alpha_k H_{t-k} + \beta_1 GDP_{t-1} + ... + \beta_k GDP_{t-k} + \varepsilon_2 \quad (4)
\]

Where, in the above equations, \( d_1 \) and \( d_2 \) are constants, \( \beta_1, \beta_2, ..., \beta_k \) and \( \alpha_1, \alpha_1, ..., \alpha_k \) are the coefficients in the above equations. Wald test would be used for the joint hypothesis in finding causality between the enrolment in higher education \( (H_t) \) and gross domestic product \( (GDP_t) \).

\[
\beta_1 = \beta_2 = ... = \beta_k = 0 \quad (5)
\]

The null hypothesis for equation (3) indicates that enrollment at higher education level \( (H_t) \) does not Granger cause gross domestic product \( GDP_t \), whereas the equation 4 null hypothesis indicates that gross domestic product \( (GDP) \) does not Granger cause enrolment in higher education \( H_t \). The alternative hypothesis for both the equation (1) and (2) is that causality exists between the two variables of \( H_t \) and \( GDP_t \). That is from \( H_t \) to \( GDP_t \) and from \( GDP_t \) to \( H_t \). The Schwarz information criterion (SC), Hannan-Quinn information criterion (HQ), sequentially modified LR test statistic (LR), Akaike information criterion (AIC) and Final prediction error (FPE) are employed as a lag selection criterion.
On the other side, if the integrated variables are in the same order and there exist between the two variables as a co-integrating relationship then vector error correction models (VECMs) will be used by Granger causality test, which is based on the equations as mentioned below.

\[
\Delta GDP_t = d_1 + \alpha_1 \Delta GDP_{t-1} + ... + \alpha_k \Delta GDP_{t-k} + \beta_1 \Delta H_{t-1} + ... + \beta_k \Delta H_{t-k} + \gamma_1 EC_{t-1} + \varepsilon_1 \tag{6}
\]

\[
\Delta H_t = d_2 + \alpha_1 \Delta H_{t-1} + ... + \alpha_k \Delta H_{t-k} + \beta_1 \Delta GDP_{t-1} + ... + \beta_k \Delta GDP_{t-k} \gamma_2 EC_{t-1} + \varepsilon_2 \tag{7}
\]

where \(\Delta\) indicates the difference or change operator, \(EC_t - 1\) indicates the value of error correction term having one period lagged, and \(\gamma_1, \gamma_2\) are the slope coefficients. The Granger causality test has more advantageous by the vector error model (VECM) as compare to its standard causality test. The vector error correction model (VECM) of Granger causality test will be used in finding the causality in the short as well as in the long run. The independent variable in Wald test indicates the short run causal effect. Where \((EC_{t-1})\) is the error correction term reflects the long run causal effect. There are four possible causalities between gross domestic product \((GDP_t)\) and higher education enrolment \((H_t)\).

a. Independent

The independent relationship between variables indicates that there is no causality or association between higher education enrolment \((H_t)\) and gross domestic product \((GDP_t)\).

b. Higher education enrolment \((H_t)\) induced gross domestic product \((GDP_t)\)

Such a type of association between variables indicates the unidirectional causality, which is running from higher education enrolment \((H_t)\) to gross domestic product \((GDP)\). It means that change in higher education enrolment \((H_t)\) also induces to change gross domestic product \((GDP)\).

c. Gross domestic product \((GDP_t)\) induced higher education enrolment \((H_t)\)

Such a type of association between the variables indicates unidirectional causality but running from gross domestic product \((GDP_t)\) to higher education enrolment \((H_t)\). It means that gross domestic product \((GDP_t)\) tends to induce higher education enrolment \((H_t)\).

d. Two-way causality between higher education enrolment \((H_t)\) and gross domestic product \((GDP_t)\)

Such a type of relationship between variables indicates the bidirectional or bilateral causality between higher education enrolment \((H_t)\) and gross domestic product \((GDP_t)\). It indicates two-way causation; this means higher education enrolment \((H_t)\) granger causes gross domestic product \((GDP_t)\) and gross domestic product \((GDP_t)\) granger causes higher education enrolment \((H_t)\).

**Results**

*Empirical Result*

This section explains the consequences of the association between higher education enrolment \((H_t)\) and gross domestic product \((GDP_t)\) in Pakistan during the period of 1982-2014, which is based on statistical tests.
First to check unit roots in all the variables Augmented Dickey Fuller (ADF) test employed by this study. The outcomes of the Augmented Dickey-Fuller (ADF) test are mentioned below in Table 1.

<table>
<thead>
<tr>
<th>Variables</th>
<th>ADF test statistics</th>
<th>Order of integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln Yt</td>
<td>-0.477900 (-0.8820) -5.785421* (0.0000)</td>
<td>I(1)</td>
</tr>
<tr>
<td>Ln Kt</td>
<td>-0.829606 (-0.7960) 4.773219* (0.0000)</td>
<td>I(1)</td>
</tr>
<tr>
<td>Ln Lt</td>
<td>-1.545786 (-0.4984) -2.997864* (-0.0458)</td>
<td>I(1)</td>
</tr>
<tr>
<td>Ln Ht</td>
<td>0.696909 (-0.9900) -5.778890* (0.0000)</td>
<td>I(1)</td>
</tr>
</tbody>
</table>

Note: * indicates the significance of statistics at 5%, the value in parenthesis indicates the P value.

In Table 1 ADF test indicates that all the variables, gross domestic product (GDPt), gross fixed capital formation (Kt), employed labor force (Lt) and enrollment at higher education (Ht) are non-stationary at the level; it shows that unit roots exist in all the variables. Where by taking first difference I(1) of all the variables it becomes stationary. In other words, at the first difference the absolute t- statistics value of all the variables are greater than the critical value at 5% significance level. And also the probabilities of all the variables are less than 5%. It shows that all the variables become stationary by integrating Order I(1).

Test of Co-integration

First, the ADF test has confirmed that by taking first difference I(1) of all the variables, it become stationary. Secondly, the Johansen co-integration test was employed by this study in finding the long run association in the selected variables. But meanwhile, Final prediction error (FPE), sequentially modified LR test statistic (LR), Schwarz information criterion (SC), Hannan-Quinn information criterion (HQ) and Akaike information criterion (AIC) are employed as a lag selection criterion, K= 4 lag is preferred in the selection criterion as confirmed in Table 2.

<table>
<thead>
<tr>
<th>Lag</th>
<th>Log</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SC</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-36.49887</td>
<td>NA</td>
<td>0.000192</td>
<td>2.793026</td>
<td>2.981618</td>
<td>2.852091</td>
</tr>
<tr>
<td>1</td>
<td>96.83184</td>
<td>220.6853</td>
<td>5.96e-08</td>
<td>-5.298748</td>
<td>-4.355785</td>
<td>-5.003424</td>
</tr>
<tr>
<td>3</td>
<td>139.4804</td>
<td>35.18297</td>
<td>3.71e-08</td>
<td>-6.033133</td>
<td>-3.581430</td>
<td>-5.265291</td>
</tr>
<tr>
<td>4</td>
<td>194.0358</td>
<td>45.14930*</td>
<td>3.92e-09*</td>
<td>-8.692126*</td>
<td>-5.486053*</td>
<td>-7.688024*</td>
</tr>
</tbody>
</table>

Note: * the criterion selection of the lag order
Table 3  Johansen co-integration test: Unrestricted co-integration rank test (Trace)

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None*</td>
<td>0.879939</td>
<td>93.73382</td>
<td>47.85613</td>
<td>0.0000</td>
</tr>
<tr>
<td>At most 1*</td>
<td>0.571265</td>
<td>34.38055</td>
<td>29.79707</td>
<td>0.0138</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.309066</td>
<td>10.66691</td>
<td>15.49471</td>
<td>0.2328</td>
</tr>
<tr>
<td>At most 3</td>
<td>0.011187</td>
<td>0.315006</td>
<td>3.841466</td>
<td>0.5746</td>
</tr>
</tbody>
</table>

Note: Trace test shows 2 cointegrating equations at the level of 0.05
Note: * indicates rejection of the hypothesis at the level of 0.05
Note: **MacKinnon-Haug-Michelis (1999) p-values

Table 4  Johansen co-Integration Test: Unrestricted co-integration rank test (Maximum Eigenvalue)

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Trace Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None*</td>
<td>0.879939</td>
<td>59.35326</td>
<td>27.58434</td>
<td>0.0000</td>
</tr>
<tr>
<td>At most 1*</td>
<td>0.571265</td>
<td>23.71364</td>
<td>21.13162</td>
<td>0.0212</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.309066</td>
<td>10.35191</td>
<td>14.26460</td>
<td>0.1898</td>
</tr>
<tr>
<td>At most 3</td>
<td>0.011187</td>
<td>0.315006</td>
<td>3.841466</td>
<td>0.5746</td>
</tr>
</tbody>
</table>

Note: Max-eigenvalue test shows 2 cointegrating equations at the level of 0.05
Note: * indicates rejection of the hypothesis at the level of 0.05
Note: ** MacKinnon-Haug-Michelis (1999) p-values

Tables 3 and 4 show the Johansen test results under the value of trace statistics and Max-Eigen Statistic. The Trace and Eigen statistics of the Johansen test indicate that none of the null hypotheses was rejected at 5% level because the values of the trace and Eigen statistics are higher than its respective critical value, and also its probability is less than 5%. At most 1, the trace statistic and Eigenvalue statistics are greater than their respective critical value at 5% level and its probability is also less than 5%, which again leads to the rejection of the null hypothesis relating with one cointegration equation. At most 2 indicates two cointegration equations in the selected variables, which shows the Trace statistics value and Eigen statistics value are less than their critical values at 5% level, and also its probabilities are greater than 5%, which leads to the acceptance of the null hypothesis; it reflects that the variables have long run association.

Regression result

As shown in Table 5 and Table 6, our regression analysis indicates the prior expectation of positive influence of higher education enrolment (Ht) and gross fixed capital formation (Kt) on economic growth (Yt) in Pakistan because the coefficients of higher education and gross fixed capital are positive in the given table. The coefficient sign of employed labor force (Lt) is negative, indicating a negative effect of employed labor
The Relationships between Higher Education and Economic Growth in Pakistan

Table 5  Regression statistics

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
<td>0.9627877</td>
</tr>
<tr>
<td>R Square</td>
<td>0.9269602</td>
</tr>
<tr>
<td>Adjusted R Square</td>
<td>0.9194043</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.3873664</td>
</tr>
<tr>
<td>Observations</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 6  Regression result of higher education (Ht), labor (Lt) and capital (Kt)

<table>
<thead>
<tr>
<th></th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
<th>Lower 95%</th>
<th>Upper 95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>37.679873</td>
<td>16.201980</td>
<td>2.325634</td>
<td>0.027237</td>
<td>4.543103</td>
<td>70.816640</td>
</tr>
<tr>
<td>LnKt</td>
<td>0.585734</td>
<td>0.154108</td>
<td>3.800799</td>
<td>0.000685</td>
<td>0.270547</td>
<td>0.900920</td>
</tr>
<tr>
<td>LnLt</td>
<td>-8.531870</td>
<td>4.224808</td>
<td>-2.019469</td>
<td>0.052765</td>
<td>-17.172574</td>
<td>0.108833</td>
</tr>
<tr>
<td>LnHt</td>
<td>0.645541</td>
<td>0.215498</td>
<td>2.995584</td>
<td>0.005560</td>
<td>0.204799</td>
<td>1.086283</td>
</tr>
</tbody>
</table>

force on economic growth (Yt). The value of R-square indicates that 92% variation or fluctuation in the dependent variable is due to the explained variables. This shows the good fit of the data in the regression. The higher education enrolment (Ht) and gross fixed capital (Kt) are statistically significant as confirmed from their corresponding probabilities, such as 0.000685 and 0.005560 respectively. The effect of employed labor force (Lt) is insignificant on economic growth because its probability indicates 0.052765, which is higher than 5%.

**Granger causality test**

Table 7 below shows the Granger causality test, which is based on Toda and Yamamoto (1995). The table 2 shows K=4 as the optimum lag of the VAR model. The result of the analyses shows that no bidirectional causality exists between enrolments in higher education (Ht) and gross domestic product (GDP), while unidirectional causality exists between gross domestic product (GDP) and higher education enrolment (Ht). The result proves the unidirectional causality between gross domestic product (GDPt) and employed labor force (Lt). The two-way causality between enrolment in higher education (Ht) and employment labor force (Lt) is also indicated.

**Conclusion**

The co-integration analysis technique employed by this study revealed that long run relationship exists between the dependent variable, gross domestic product (GDPt), and explained variables (Ht, Lt, Kt). The empirical result indicated that higher education enrolment (Ht) has a significantly long run positive impact on economic growth. Toda and Yamamoto (1995) causality test has concluded unidirectional causality.
Table 7  The result of the Granger causality test between LnXt and LnLt, LnYt, LnHt based on the Toda-Yamamoto method

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Ln Yt</th>
<th>Wald statistics</th>
<th>Ln Ht</th>
<th>Ln Lt</th>
<th>Ln Kt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln Yt</td>
<td>—</td>
<td>4.094949</td>
<td>11.08145*</td>
<td>12.26358*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.3933)</td>
<td>(0.0257)</td>
<td>(0.0155)</td>
<td></td>
</tr>
<tr>
<td>Ln Ht</td>
<td>141.6772*</td>
<td>130.8232*</td>
<td>9.724049*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td>(0.0453)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln Lt</td>
<td>2.246059</td>
<td>11.83206*</td>
<td></td>
<td>1.142058</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.6906)</td>
<td>(0.0186)</td>
<td></td>
<td>(0.8875)</td>
<td></td>
</tr>
<tr>
<td>Ln Kt</td>
<td>2.314793</td>
<td>5.363822</td>
<td>2.818479</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.6781)</td>
<td>(0.2520)</td>
<td>(0.5886)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The values in the parenthesis indicates probability values, where * indicates the level of significance at 5%.

from gross domestic product (GDP) to higher education enrolment (Ht), while no causality is running from higher education enrolment (Ht) to gross domestic product (GDPt). This is because of the less number of the availability of highly qualified people or less enrollment of the students at higher education level in Pakistan. Moreover, the existing students enrolled in higher education go to foreign countries for further higher education or looking for a better job opportunity, which is a big loss for the government of Pakistan.

References


The Relationships between Higher Education and Economic Growth in Pakistan


