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Causality of Higher Education and Unemployment: An Empirical Evidence from Pakistan Economy

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Abstract *Higher education and unemployment is a substantial concern for developing countries and developed countries as well. To get the empirical evidence of the Pakistan economy, the present research is being carrying on. This study applies time series data in nature covering the period from 1985 to 2018. Assessing the long run association within the policy indicators and commuting the causality of higher education and unemployment, two different econometric techniques Johansen Co-integration and Granger Causality test is arrayed whereas the annual speed of adjustment is estimated when disequilibrium enters in the system through VECM model. The Johansen Co-integration's test reports 5 co-integrating equations and error term reveals 3% for higher education in first model which postulate speed of adjustment in case of disequilibrium. Whereas second model explains 4 co-integrated and VECM reflects The results presents that any disequilibrium transpires in short term, higher education enrollment and unemployment will be converging to equilibrium in the long run at the speed of 32 and 36 percent correspondingly. The Granger causality test's findings imply that higher education does not affect the unemployment whereas unemployment is reported to be responsive towards higher education which means unemployed labor force again enroll for higher education to absorb capacity for new professional avenues by producing innovative and constructive ideas..*

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Introduction

The strength of the human capital of any countries roots in the structure and quality of the higher education. The world has witnessed the contribution of higher education institutions. Across many countries, competency to craft human development and soaring the level of productivity of economy as a whole, the higher academic institutions come forward as catalyst (Núñez & Livanos, 2010). The aggregate production of economy soars as labor productivity improves and it furthermore results in increase in efficiency (Fischer, 1993; Gregorio, 2004). Keeping in view the worth and profound impact of human development, all countries have begun to make huge investments in institutions of higher education. This lucrative investment caused drastic rise in skilled and educated students which constitutes a major part of population of the developing nations. The era of 1970s, has experienced alone the number of universities doubled internationally (Bornstein & Davis, 2010). The world has observed a substantial rise in the establishment of higher education institutions and incremental trends in enrollment of higher education simultaneously that was more than 300% (Wolf, 2002).

The Economic Survey of Pakistan (2010-2011), defines unemployment as a person who

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has the required qualification and searches for a job but unable to get a part of employed labor force. The existence of unemployment reduces the potential utilization of the brain of the society and keep them all unproductive.

The economy efficiency to provide the large scale opportunities to deploy its educated persons is one of the imperative key for the healthy economy. It is pertinent to mention here that implication of market wage will result fostering the economic growth. The unemployed individuals in the economy is the indication of drain of the educated and skill labor which will further deteriorate the domestic or society's resources (Rothiem, 2007). The Pakistan economy is facing the similar situation that is experiencing the rate of unemployment.

The rate of unemployment has begun to rise in 1900s followed by tightening fiscal policy result. Low opportunities in industrial and service sector and its subsequent effects were the main cause root of unprecedented unemployment rate (Akhtar and Shahnz, 2005). Though, there was a declining trend in unemployment between the time periods in the mid of 2000s, and it soared up in subsequent years. In 2004, unemployment reported growing comparing to 8.3% and Pakistan economy suffered with ever lowest rate as 1.6 percent..

The labor force absorption capacity is one of the main reasons for unemployment experienced by Pakistani economy. Though it's agrarian in nature but agriculture sector contributes 45% its share in employment. Followed by inherently backwardness, unemployment in this sector aggravated with passage of time (LFS, 2011).

Higher studies has its substantial fragment in building up the compeers and enabling them prepared therefore could exposed to the learning and handling the complexities of time. Higher academic institutes literate and train people to contribute their share in assisting humanity and nation collectively. Apart form these contribution, universities also equip them technically and professionally which ultimately enable them to work batter for the improvements of living standard. The traditional economic theory also asserts that the prevalence of adverse connectivity between rate of unemployment and higher education. It implies that higher the education leads to the less probability of being unemployment. It has also been witnessed that higher education results more stability of employment. Tough it is pertinent to mention here that countries having more well established and high rate of self-employment, contribute lower in soaring unemployment (Mincer 1991). This research is an attempt to unfold the causal connection of unemployment and higher education in Pakistan. This article deploys two separate model to obtain the empirical evidence. The first model, check out the relation of higher education on unemployment whereas second model examines the impact of unemployment on higher education of Pakistan economy.

Literature Review

After reviewing the theoretical and empirical studies, this research holds the novel idea and that is to examine the causality between unemployment and higher education s an empirical evidence from Pakistan economy. A numerous studies are accomplished on the relation by considering the one way relation.

Zhang *et. al* (2018) elucidated a link between higher education and unemployment rate. Examining sway of higher education on unemployment rate, study has applied the data of six diverse potential indicators including GDP per capita, expenditures on higher education and segment of industrialized sector as portion of GDP. The inferences imply that expenses of higher education substantively and oppositely effect the unemployment.

Al-Manaseer and Al-Qudah (2018) examined the connectivity of higher education and growth with unemployment for Jordon economy testing simple linear Ordinary Least Square Method (OLS). The main conclusion of the research was that the outcomes of higher education led in positive direction with high level of significance to unemployment rate. The Jordanian economy witnessed upsurge in unemployment rate caused by higher education and found no analogy between resultant of the higher education and labor market requirement.

Assaad, et al. (2016) concluded together determinants of supply and demand side could attribute in linking the higher education with employment prospects for factor market. He asserted that academic institutions offering higher education come forward for the formation of human capital but they face impediments associated with institution structure. They emphasized on the supply side of higher education which further cater the factor market absorption.

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Ou and Zhao (2016) explored the highr education effetiveness connected with factor market requirement. The authors raised the facts that nurtured higher education duly filled the unemployment for males generally whereas left unaffected for female. They also highlighted labor market has potential absorption for highly skilled people.

Lavrinovicha, et al. (2015) found an empirical evidence for higher education graduates and their absorption for the Romanian economy. Applying the Engel-granger causality discussed the analogous connection. He concluded the adverse relation between the indicators and suggested even then proper approach toward higher education need to be inculcated for desired results.

Hanapi and Nordin (2014) revealed soaring trends in unemployment Malaysian economy. The study was primary in nature, and explicated the key factor responsible for graduate unemployment and accentuated the need for the improvement in quality of higher education.

Mirica (2014) made an attempt to highlight sustainable analogy for higher education and unemployment for Romania. He quantified the demand for the higher studies by developing the appropriate constructs. To explore the casual connection he deployed Engle-Granger technique. The adverse relation was found among the indicator and that rise in higher education result surge in unemployment.

Zhang, et al. (2012) evaluated the expanding higher education and conditionality's associated with unemployment in China. He tried to highlight the foremost threats incurred in policy implications for bridging up the connection between the indicators. He suggested policy needs to be refined and devised specific to the country environment for desirable outcomes. He also asserted on the alternatives avenues to reduce the unemployment and to embed innovative reforms in higher studies.

Núñez and Livanos (2010) made the analysis for higher education and unemployment connection for the short as well as long term analysis for the European countries. He came up with interesting finding and underscored the fact that decline in higher studies enrolment resulted upsurge in employability in these nations. This study explored the space for opponents and proponents in this area.

Livanos (2010) discovered the insignificant correlation of higher education with unemployment on the basis of statistical techniques. He concluded the persistence of rise in higher education and rising unemployment worsen the situation for the policy makers to design prudent roadmap as this situation creates oversupply. On the other hand, oversupply does not converge to its demand.

Framing the Model and Methodology

In order to obtain evidence of the effect of higher education empirically, this study consider two model to exactly disentangle the causal relation between unemployment and higher education. The algebraic expression of the models are as follows :

Model 1: Determinants of Unemployment

$$UN = \alpha + \beta_1 HEE + \beta_2 HE_X + \beta_3 GDP_{PC} + \beta_4 GDP_g + \beta_5 GDP_{agr} + \beta_6 GDP_{manu} + \beta_7 GDP_{ser} + \varepsilon$$

…… Eq. (1)

In equation 1, UN presents unemployment rate, HEE indicates Higher Education enrollment and HE presents Higher education expenses in this model while GDP_{PC} denotes the per capita GDP, GDP_g presents growth rate. GDP_{agr} reflects share of agriculture sector growth rate, portion of industrial sector in GDP is indicated by GDP_{manu} while GDP_{ser} shows proportion of services 'sector in GDP and ε presents error term.

Model 2: Determinants of Higher Education

In addition to Model 1, Model 2 assists to estimate the association between higher education and unemployment. Model 2 is expressed in algebra form as follows:

$$HEE = \alpha + \beta_1 UE + \beta_2 HE_X + \beta_3 GDP_{PC} + \beta_4 GDP_g + \beta_5 GDP_{agr} + \beta_6 GDP_{manu} + \beta_7 GDP_{ser} + \varepsilon$$ …….. Eq. (2)

In equation 2, the main characteristic of model 2 is it captures the examinations of measures of the determinants of higher education whereas all other expression are same as equation 1.

Univariate Analysis

In the time series data analysis, problem of non-stationary appears to be a potential threat to

obtain concrete findings. To deal with substantial issue, Augmented Dicky-Fulller test is applied.

$X_t = \rho Y_{t-1} + u_t$ (3)

Where $\rho = -1 \leq \rho \leq 1$

Equation 3 indicates that If the p=1 then u_t specifies white noise error term and Y_t refers to unit root problem. If the ρ value is lesser than one then series is stationary and if the ρ value is greater than 1 then series leads to explosion.

Estimation Technique

To observe the long run relation amid the policy variables, hence the Johansen co-integration technique is applied while Error correction model is also applied to capture the speed of adjustment in case of happening of disequilibrium. The course of co-integration procedure is initiated by Vector Auto-correction technique of order p expressed in equation 4,

$\Delta y_t = \mu + \pi y_{t-1} + \sum_{i=1}^{p-1} r_i \Delta y_{t-1} + \varepsilon t$ ..... (4)

Where $\pi = \sum_{i=1}^{p} A_i$-1 and $r = -\sum_{j=i+1}^{p} A_j$

There will be reduced rank r<n for the coefficients of matrix π it allows to prevail n.r matrices α and β has every r rank like π=α.β' and β'. y_t will be stationary whereas r will be showing integrating relations. The components of α will indicate adjustment notion in VECM. For any r, it reflects maximum likelihood estimators for any β delimits the blend of y_{t-1} it vintages r biggest established correlations of $\Delta \boldsymbol{yt}$ along y_{t-1} having been corrected for lagged differences of preset variable when persist. The Johansen Co-integration equation of the models 1 and 2 presented in equation 5 and 6 respectively are as follows:

$$HE_t = \alpha + \beta_1 UE_{(t-1)} + \beta_2 GDPpc_{(t-1)} + \beta_3 GDPg_{(t-1)} + \beta_4 HEx_{(t-1)} + \beta_5 GDPagr_{(t-1)} + \beta_6 GDPser_{(t-1)} + \beta_7 GDPmanu_{(t-1)} + \varepsilon t_1 \quad \text{..... (5)}$$

$$UE_t = \alpha + \beta_1 HE_{(t-1)} + \beta_2 GDPpc_{(t-1)} + \beta_3 GDPg_{(t-1)} + \beta_4 HEx_{(t-1)} + \beta_5 GDPagr_{(t-1)} + \beta_6 GDPser_{(t-1)} + \beta_7 GDPmanu_{(t-1)} + \varepsilon t_1 \quad \text{..... (6)}$$

The Egein value and T-Trace techniques are applied to have the Johansen Co-integration findings which helps assessing long run connectivity.

Engle and Granger Causality Test

Granger Causality test is an appropriate technique to get causal relations among the policy variables of the both models. It further assists to make the assessment of co-movement of the variables in the long run time span and creates a longer relationship within the policy variables after computing long run state of equilibrium and finding links within an error correction model assessed. The underlying methodology is co-integration technique in this study employed for scrutinizing the rapport amid higher education and unemployment for Pakistani economy. This technique requires two methodological steps for estimation. To begin with the general form of model to be estimated as shown in equation 7:

$Y_t = \beta_0 + \beta_1 X_t + \mu_t$

..... (7)

Having been commuted the residuals of equation 8 from equation 7:

$\hat{\mu}_t = Y_t - \hat{\beta}_0 - \hat{\beta}_1 x_t$

..... (8)

This technique help in the examination of more than two variables and consider all variables

Error Correction Model:

Equation (9) and (10) simplifies the error correction term regarding the unemployment. Ruling out other all variables from core mathematical expression and error correction equation is formed.

$HE_t = \alpha + \beta_1 UE_{(t-1)} + \varepsilon t_1$ ..... (9)

$\varepsilon t_1 = HE_t - \alpha - \beta_1 UE_{(t-1)}$

..... (10)

In the similar way, equation 11 and 12 presents the error correction term for the higher education, it is as follows:

$UE_t = \alpha + \beta_1 HE_{(t-1)} + \varepsilon t_1$ .....()

$\varepsilon t_1 = UE_t - \alpha - \beta_1 HE_{(t-1)}$

..... (10)

To achieve the objectives through the empirical evidences, the said econometric techniques will be applied.

Results and Interpretations

The article holds the main purpose to assess the causality weather unemployment is jolted by the higher education persons around or higher education results change in unemployment for Pakistani economy. This study frames two different models to get the said objectives.

Univariate Analysis Results

As discussed earlier, non-stationary time series data provides the rationale for spurious results. Therefore, it is foremost to estimate the stationary of the data to avoid misleading finding. Table 1, reflects the results of the unit root which were commuted by applying Augmented Dicky Fuller Test.

Table 1. Outcomes of Unit Root Test

Variables	Level	Prob Value	Outcomes	1st Difference	Prob value	Outcomes
HEE	-.64	.84	(0)	-5.18	.02	(1)
UE	-3.13	.23	(0)	-6.93	.00	(1)
HE_X	-2.00	.28	(0)	-7.69	.00	(1)
GDP_{Ser}	-.44	.88	(0)	-7.19	.00	(1)
GDP_{manu}	-1.26	.63	(0)	-5.30	.00	(1)
GDP_{agr}	-1.58	.47	(0)	-6.31	.00	(1)
GDP_g	-4.73	.00	(0)	-8.40	.00	(1)
GDP_{PC}	3.06	.99	(0)	-4.33	.02	(1)

The results imply all the variables of the study are stationary at first difference. All the variables are integrated at the first order.

Results of Johansen Co-integration – Indicators Affecting the Higher Education

The results of the Johansen Co-integrations explains 5 co-integrating equations which further indicates the long run relations midst the variables followed by p values less than 5 percent .The Trace statistics findings are shown in Table 2 below:

Table 2. Results of Trace statistics

Hypothesized No.of CE(s)	Eigen-value	Trace-statistic	critical - value	Prob
None*	.80	215.04	161.52	.00
At most 1*	.76	162.21	135.61	.00
At most 2*	.69	115.96	98.75	.00
At most 3*	.58	77.68	70.81	.01
At most 4*	.49	49.75	49.85	.03
At most 5	.43	27.60	25.79	.08
At most 6	.24	9.13	14.49	.35
At most 7	.12	0.04	1.84	0.83

Table 3 elucidates the results of the Max-Eigen value statistics and imply three integrating equations as their respective p values is less than 5 percent and confirms the long run link amongst the variables of model. The results are as follows:

Table 3. Max-Eigen value Statistics

Hypothesized No.of CE(s)	Eigen-value	Max-Eigen statistic	Critical value	Prob.
None*	.80	52.82	61.36	0.04
At most 1*	.76	46.26	52.24	0.07
At most 2	.69	38.20	39.75	0.07
At most 3	.58	27.74	33.68	0.21
At most 4	.49	22.17	31.53	0.21
At most 5	.43	18.47	19.13	0.11
At most 6	.24	9.08	13.26	0.27
At most 7	.01	0.07	4.84	0.83

Once the Co-integration among the variables is found, Vector error correction model is applied. Therefore, to get the speed of adjustments of the variables when any disequilibrium happens Vector error correction model is deployed

Table 4. Results of VECM (Model-1)

Variable	ECM	Coefficient	Standard error	t-statistics
HE	-.03	-.21	.01	-3.17
UE	-.20	-.16	.01	-6.52
GDP_{PC}	-.34	-.97	.40	-3.87
GDP_{g}	.28	-.18	.01	-8.50
GDP_{agr}	-.31	-.11	.09	-10.16
GDP_{manu}	.34	-.29	.07	-2.77
GDP_{ser}	.41	-.38	.04	-5.73

The results of the vector error correction models (VECM, Henceforth) are reflected in table 4. The results shows that any disequilibrium takes place in short term, higher education enrollment and unemployment would be catching up equilibrium in the long run at the speed of 3 and 20 percent respectively. These results are aligned with (Schofer and Meyer 2005), as the inferred the government expenditures on higher education does not hold substantial effect in the short run in linguistically diversified countries. The findings portray that unemployment indicates that workforce again enrolled for higher education when faces unemployment. Erdem and Tugcu (2012) discussed the similar findings .Lastly, the speed of adjustment for share in GDP remains 31 percent.

Table 5. Table of Static Model

Variable	R-Square	Adjusted-R^2	S.E	F-Stat
UE	.53	.38	1.91	.55
HEE	.39	.15	.18	1.01
GDP_{PC}	.17	-.16	.07	.52
GDP_{g}	.51	.39	1.62	1.46
GDP_{agr}	.28	-.00	.71	.96
GDP_{manu}	.25	.05	.08	.82
GDP_{serv}	.31	.04	.98	2.10

The values of value of R^2 and adjusted R square of all variables of the model are shown in in table 5. The results imply variations at the rate of 53% in the model variables has been explained by unemployment rate whereas higher education's enrollment effects at value of 39%. The Government's expenditures on higher education elucidates 17% volatility and GDP growth discusses 51% deviation of the model. Meanwhile, Sectorial share of GDP also keep ordinary impact on the other policy variables.

Results of Johansen Co-integration– Indicators Affecting the Unemployment

The results of the Johansen Co-integrations explains 5 co-integrating equations which further indicates the long run relations within variables followed by the p values less than 5 percent . Trace statistic's outcomes are depicted in Table 6 mentioned below:

Table 6. Trace Statistics

Hypothesized CE(s)	Eigen-value	Trace Stat	Critical-Value	Prob
None*	.80	215.04	160.52	.00
At most 1*	.76	162.21	131.64	.00
At most 2*	.69	115.96	96.36	.00
At most 3*	.58	77.68	70.88	.01
At most 4*	.49	49.71	50.85	.03

At most 5	.43	27.60	30.79	.08
At most 6	.24	9.13	21.49	.35
At most 7	.00	0.04	5.84	.83

The results shown in the Table 7, elucidates two co-integrating equation in the model. The values of probability less than 0.05% rejects the null hypothesis on no integration for the two equation. The results of the Max-Eigen value statistics are reflected in Table 7, are as follows:

Table 7. Max-Eigen Value staTistics

Hypothesized CE(s)	Eigen-value	Max-Eigen Stat	Critical- Value	Prob
None*	.80	60.82	59.36	.04
At most 1*	.76	50.25	48.23	.04
At most 2	.69	40.28	39.07	.07
At most 3	.58	31.96	30.87	.21
At most 4	.49	29.10	28.58	.21
At most 5	.43	11.47	18.13	.11
At most 6	.24	7.08	9.26	.27
At most 7	.00	.07	2.84	.83

The upshots of VECM reflected in table 8. The outcomes presents that any disequilibrium transpires in short term, higher education enrollment and unemployment will be converging to equilibrium in the long run at the speed of 32 and 36 percent correspondingly. As discussed earlier that the government expenditures on higher education does not hold ample effects in the short run in linguistically diversified countries and highly qualified human remains unemployed which becomes a potential impediment to halt the economic growth and also highlighted by Smith and Todaro (1998).

Table 8. Results of Vector Error Correction

Variable	ECM	coefficient	Standard error	t-statistics
HE	-.32	-.00	.00	-3.03
UE	-.36	.06	.03	3.93
GDP_{PC}	.22	.00	.02	0.67
GDP_{g}	-.26	.18	.08	1.14
GDP_{agr}	.44	-.65	.06	-.99
GDP_{manu}	.38	.05	.03	2.01
GDP_{serv}	.41	-.06	.05	-1.89

Table 9 below depicts the values of value of R^2 and adjusted R^2 of all variables of the model. The results explain variations at the rate of 43% in the model variables has been observed by unemployment rate whereas higher education enrollment effects at the rate of 37%. The results imply very interesting insights when it observes the variation of higher education expenditures, GDP growth, sectorial portion of manufacturing and service sector which are 71%, 76% and 89 percent respectively which further ensures the selection of policy variables in this analysis. The results are portrayed by Table-9 beneath as follows:

Table 9. The Results of Static Table

Variable	R square	Adjusted R^2	S.E equation	F-Stat
UE	.43	.33	2.09	.87
HEE	.37	.24	.23	.99
HE_X	.71	.38	1.99	1.89

GDP_{PC}	.19	-.23	.87	.44
GDP_{g}	.43	.87	.99	3.01
GDP_{agr}	.32	-.87	.28	.90
GDP_{manu}	.76	.98	.92	.76
GDP_{serv}	.89	.04	.98	.13

To estimate the causality between higher education and unemployment for the Pakistan economy, Granger causality technique is applied. It assesses to provide the causal relationship of variables. The Granger Causality's results presented in Table-10 as under:

Table 10. Outcomes of Granger Causality

Null Hypothesis	observations	F-Stat	Prob.
HE does not granger cause UE.	28	3.82	.45
UE does not granger cause HE.	28	1.33	.03

In this analysis, results of the Granger causality asserts rejection of the connectivity between higher education and unemployment as p value is .45 in Pakistan. Jonaidi (2012) and Farley (1987) and have also been reported the similar findings which emphasize the skilled and trained workforce results rise in the employment instead of higher education. Therefore, higher education does not have profound impact on decline of unemployment. On the other hand, results imply that unemployment does granger cause higher education. As the probability value .03 percent conforms refutation of null hypothesis. It postulates that unemployment effects the higher education as a result of enrollment of unemployed workforce for higher education. They intend to enhance their adaptive capabilities, being enable to generate new ideas and obtaining the expertise for trouble shooting.

Conclusion

The issue of Unemployment has parallel implication in both developing as well as developed nations. Traditionally speaking, higher education is thought to be a substantial instrument to reduce unemployment whereas present study reveals contrary to this fact. Johansen Co-integration results signpost long run association midst the policy variables of two models. Error correction term explains higher education is found to be insignificant to converge in long run whereas in second model results shows the convergence of unemployment towards higher education. The results of the Granger causality elucidates the interesting insight that is higher education does not affect the unemployment while unemployment do effect the higher education followed by the fact that unemployed people enroll again to enhance their ability of innovative ideas.

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