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Higher Education Expansion, Graduate Unemployment, and Brain Drain: An Economic Analysis of Pakistan's Labor Market

ABSTRACT

This paper analyzes the paradoxical increased education growth of Pakistan and the consequences of the same in brain drain and graduate unemployment. This is one of the reasons why the results of a Cost Benefit Analysis (CBA) have shown that the economic cost of graduates' production exceeds the returns. The structural dynamics of two frameworks graduate unemployment and brain drain were tested using the Auto-Regressive Distributed Lag (ARDL) model. The results demonstrate that even with less growth of GDP, and lower marginal productivity, employment creation, graduate output raises unemployment in the short and long-term significantly. The concept of brain drain shows that the remittances and graduates are important elements of migration that may be regarded as the push-pull forces in the labor market. Stability and diagnostic test entail model reliability. Overall, this evidence suggests that the absence of labor absorption and the uncontrolled expansion of affiliated colleges increases domestic unemployment and migration abroad. According to the study findings, to transform human capital into a sustainable driver of development, one should harmonize higher education policies with the labor market requirements, encourage employment intensive development, and limit uncontrolled institutional proliferations.

Keywords

Graduate Unemployment, Education–Employment Mismatch, Cost–Benefit Analysis (CBA), Labor Market Absorption, Policy Reform

JEL Classification

A23, J21, O15

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Author's contribution in the article: 1- Conceived and designed the analysis, 2- Reviewed and compiled the literature, 3- Collected the data, 4- Contributed data or analysis tools, 5- Performed the analysis, 6- Wrote the paper, 7- Financial support for the conduct of the study, 8-Other

1. INTRODUCTION

In Pakistan, higher education has been developed at a very high rate over the past two decades, and this can be attributed to the increase in institutions that are related to the state universities. Similar gains in the absorption of labor have not been matched by this quantitative growth which is observed as a substantial rise in the output of graduates annually. Nevertheless, human capital theory proposes that increased exposure to postsecondary education should lead to increased salary and productivity. According to an empirical study by (Becker, 1975), returns to education are severely conditional on the capacity of the economy to offer skilled jobs; in case the supply surpasses the demand, then wage premiums fall, and in cases where there are more degree-holders than skilled workers, it is possible that underemployment or even unemployment can occur (Psacharopoulos & Patrinos, 2018). The lack of fit between degree production and labor demand has become a recent policy concern in Pakistan: associated colleges have gained more access, yet with scarce resources, industry contacts, and poorly matched curricula, they end up producing graduates with skills poorly suited to local employment opportunities (Aziz et al., 2008; Pakistan Bureau of Statistics, 2022).

This lack of match between education and work has both social and economic consequences. On the one hand, underemployed graduates provide a perfect illustration of inefficiency: when graduates cannot apply their skills to productive activity, the resources invested in the development of human capital, both state and private, have lower paybacks. However, with degree graduates seeking superior employment opportunities and higher wages in foreign countries, endemic graduate joblessness has become a push factor towards skilled emigration, or brain drain (Docquier & Rapoport, 2012). A combined economic measure that weighs the social benefits of higher education against the benefits of remittances and productivity of hired graduates needs to be conducted to conclude whether remittances and migratory externalities offset domestic labor-market failure.

These concerns are urgent but the literature on Pakistan remains scattered. Although research on migration reveals the growing outflows of skilled and semi-skilled human resources (Bureau of Emigration & Overseas Employment, 2023), the available literature indicates the growing unemployment of graduates and identifies the lack of skills or poor connections between industries and colleges (PIDE, 2019; Mohammad, 2000). There are however, not many studies that systematically relate graduate labor-market outcomes, skilled emigration, and higher education growth specifically the proliferation of linked colleges in a coherent empirical model that incorporates both welfare (cost-benefit) and dynamic economic processes. This gap complicates the task of policymakers trying to find out whether the net social payoff of postsecondary education has decreased or whether additional expansion in the number of degree-granting capacity is socially desirable without any labor-market remedies.

This study brings together two complementary approaches to address such a gap. To compare the cost of the government spending per graduate, the economic cost of unemployed graduates versus that of remittance gain, and the contribution of productive graduates, it first conducts a cost-benefit analysis of the tertiary growth in Pakistan in the year 2000 to 2024. Second, it estimates Autoregressive Distributed Lag (ARDL) models after controlling on macroeconomic factors (GDP growth, inflation, trade openness, and remittances) to estimate the short- and long-term relationship between graduate supply, affiliated-college share, graduate unemployment, and skilled emigration. Combining CBA and time-series econometrics, the study quantifies both whether the growth in higher education has generated net social benefits and not and whether graduate unemployment is a significant contributor to brain drain. The results have direct implications to the labor market programs in Pakistan, higher education policy and management of migration.

This study has five major sections. The introductory part gives some background, highlighting the rapid development of higher education in Pakistan and the emerging problems of brain drain, unemployment of graduates, and the multiplication of affiliated colleges. The second section tries to position the situation of Pakistan in the regional and global contexts by reviewing the literature on human capital theory, migration, education-employment disjuncture, cost-benefit analysis. The third part explains the research methodology, which incorporates the application of ARDL bounds testing strategy to test the short-term and the long-term dynamics of the graduate unemployment and brain drain, and the application of Cost-Benefit Analysis (CBA) to determine the net returns of higher education expansion. The fourth section discusses the empirical findings and begins by the CBA findings and proceeds to the ARDL estimation of models, stability, and diagnostic tests. The final part is devoted to the implications of the findings, conclusions, and particular policy propositions to alleviate brain drain and align the results of higher education to the needs of the job market.

2. LITERATURE REVIEW

Over the last years, discussion of the role of higher education in promoting economic growth in Pakistan has received a new impetus. Empirical evidence based on the time series analysis suggests a positive effect of higher education on long-term economic growth, and short-term effects remain weak due to structural labor market inefficiencies (Ahmed et al., 2025). The imbalance that results as the difference between the sink and the source worsens with the inability of the employment markets to absorb the increasing number of graduates. It is perceived that curriculum innovation is the key instrument that can be used to align the requirements of the labor market with the outputs of higher education (Khattri et al., 2023). Although, these works prove that although education can trigger economic growth, its benefits are scarce when job systems fail to leverage on the development of human capital.

The education-employment gap has broader impacts notably through brain drain. Economic uncertainties reduce economic prospects in Pakistan, attributable to limited employment, expatriate workers, who are highly skilled, are continuously moving out of the country as shown by Ahsan (2024). Khan (2024) supports this argument by providing statistics indicating that brain drain effect the economic growth of Pakistan and reduces the returns on national investments on education. As Azizullah and Mughal (2024) argue, the educated people are forced to seek opportunities abroad because of the push factors like low research capacity, poor governance, and inability to find favor in the job market. These findings validate the argument which states that graduate unemployment is depriving Pakistan of its prime human capital by serving as an instrument of international migration but not merely an issue with the national labor market.

These interrelated issues are not limited to Pakistan, and they reveal a tendency in the region of migration pressures and youth unemployment pressures. Although Kaluarachchi and Jayathilaka (2024) reveal that macroeconomic instability in Sri Lanka has also contributed to increased outward migration in a similar manner, Achakzai et al., (2023) reveal that the primary reasons behind youth unemployment in Balochistan are structural imbalances and industry lack of diversification. Such comparative remarks suggest that the problems of Pakistan belong to broader South Asian dynamics of the labor market rather than being unique to the nation. The growth of higher education systems of inadequate market transformation leads to a cycle of unfulfilled dreams, increased unemployment and outbound migration. In this way, the literature highlights the urgent need to implement holistic solutions to education and employment that bridge the gap between education and employment, enhance governance, and offer incentives to retain talented young people in the country.

3. DATA AND METHODOLOGY

By combining the Autoregressive Distributed Lag (ARDL) modeling with the Cost-Benefit Analysis (CBA) as a mixed-method quantitative study, this paper assesses the association between graduate unemployment, brain drain and the expansion of higher education in Pakistan between the years 2000 and 2024. The annual time-series data is obtained through the Higher Education Commission of Pakistan (HEC), the Bureau of Emigration and Overseas Employment (BEOE), the Pakistan Bureau of Statistics (PBS), the State Bank of Pakistan (SBP), and the World Bank, the World Development Indicators (WDI).

3.1 Variables and Data

Dependent variables:

- The percentage of unemployed graduates in the labor force is known as the graduate unemployment rate.
- Skilled emigration, the yearly departure of professionals is a stand-in for brain drain.

Independent Factors:

- Total graduates, a stand-in for the growth of higher education.
- The percentage of graduates from associated institutions is a gauge of the quality and speed of the institution.
- A proxy for education investment is the amount of money the government spends on higher education per student (in constant US dollars).

Variables under control:

- GDP growth rate (percentage per year), skilled labor's economic absorption capacity.
- Macroeconomic distortions, yearly inflation rate (percentage).
- Benefit of skilled emigration, remittance inflows (as a percentage of GDP).
- Globalization and labor mobility are correlated with trade openness (as a percentage of GDP).

3.2 Cost-Benefit Analysis

The CBA framework considers both local and global factors to assess whether increasing access to higher education in Pakistan results in net social benefits:

- **Costs**
  - Per-student public spending on higher education.
  - Income lost from graduates who are unemployed or underemployed.
  - Financial burden of brain drains (productivity leakage, loss of domestic tax base).
- **Benefits**
  - Marginal productivity of domestically retained skilled workers.
  - Contribution of remittances per overseas graduate (remittances divided by skilled emigrants).
  - Spillover effects on GDP growth and innovation.
  - Long-term implications of diaspora (international networks, knowledge transfer).

Calculated the net benefit for each graduate in the year t by using equation:

$$NBG_t = RCG_t + MPG_t - PCG_t - UC_t \quad (1)$$

Where, NBG_t represents net benefits for each graduate, RCG_t represents remittance per migrant graduate and calculated as the ratio of total remittances from migrants to total of migrant graduates., MPG_t represents marginal productivity gain and calculated as the ratio of GDP growth attributable to skilled labor to total graduates employed, PCG_t represents public cost per graduate and calculated as the ratio of total public spending on higher education to total number of graduates, UC_t represents unemployment cost and calculated as product of graduate unemployment rate and average graduate wage.

According to Psacharopoulos (1995), the Net Present Value (NPV) and Benefit–Cost Ratio (BCR) as aggregate computed with:

$$NVP = \sum_{t=2000}^{2024} \frac{Benefits - Costs}{(1+r)t} \quad (2)$$

$$BCR = \sum \frac{Benefits}{(1+r)^{t-2000}} / \sum \frac{Costs}{(1+r)^{t-2000}} \quad (3)$$

Our CBA formula takes into consideration the cost of public and opportunity costs due to unemployment, and integrates remittance inflows (as returns to human capital) and productivity gains by educated labor (as in returns to education literature). In spite of the fact that the specific structure of this paper is unique, it is founded on the popular CBA and human capital models (Becker, 1993; MCC Education CBA advice, 2023), returns-to-education theory (Psacharopoulos & Patrinos, 2018), and the remittance-as-return logic (Docquier & Rapoport, 2012).

3.3 Conceptual Framework

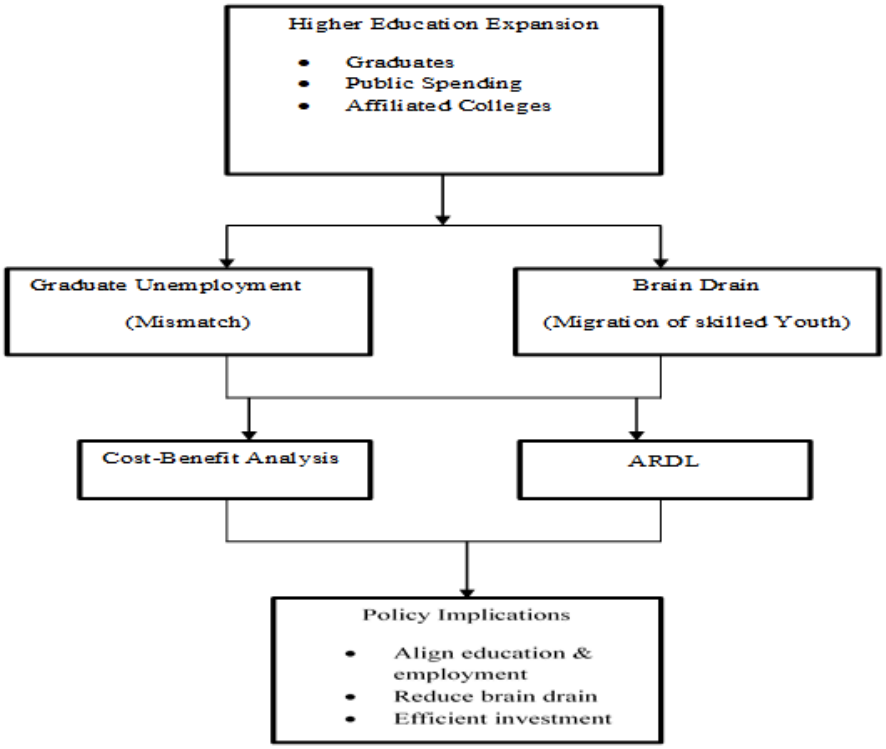


Figure 1: Conceptual Framework

3.4 Auto-Regressive Distributed lag Model (ARDL) and Bounds Test

In this study two model used under ARDL-ECM to find out both short-run dynamics and long-run equilibrium.

Model A (Graduate unemployment):

Graduate Unemployment=f (Graduate, Affiliated college share, GDP growth, Inflation)

$$\Delta \mathrm{UNEMP}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta \mathrm{UNEMP}_{t-i} + \sum_{j=0}^{q1} \beta_{1j} \Delta \mathrm{GRAD}_{t-j} + \sum_{j=0}^{q2} \beta_{2j} \Delta \mathrm{ACSH}_{t-j} + \sum_{j=0}^{q3} \beta_{3j} \Delta \mathrm{GDPG}_{t-j} + \sum_{j=0}^{q4} \beta_{4j} \Delta \mathrm{INF}_{t-j} + \Phi ECM_{t-1} + \varepsilon_t \quad (4)$$

$$ECM_{t-1} = UNEMP_{t-1} - \gamma_0 - \gamma_1 GRAD_{t-1} - \gamma_2 ACSH_{t-1} - \gamma_3 GDPG_{t-1} - \gamma_4 INF_{t-1} \quad (5)$$

Model B (Brain drain):

Brain Drain= f (graduate, unemployment, remittances, trade openness)

$$\Delta \mathrm{BDRAIN}_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta \mathrm{BDRAIN}_{t-i} + \sum_{j=0}^{q1} \beta_{1j} \Delta \mathrm{GRAD}_{t-j} + \sum_{j=0}^{q2} \beta_{2j} \Delta \mathrm{UNEMP}_{t-j} + \sum_{j=0}^{q3} \beta_{3j} \Delta \mathrm{REM}_{t-j} + \sum_{j=0}^{q4} \beta_{4j} \Delta \mathrm{TO}_{t-j} + \mu_t \quad (6)$$

$$ECM_{t-1} = BDRAIN_{t-1} - \delta_0 - \delta_1 GRAD_{t-1} - \delta_2 UNEMP_{t-1} - \delta_3 REM_{t-1} - \delta_4 TO_{t-1} \quad (7)$$

3.5 Diagnostic and stability

In this study, Serial Correlation checked through LM serial correlation, heteroscedasticity diagnostic through Breusch–Pag and normality find out by Jarque–Bera. CUSUMSQ used to check stability of models.

3.6 Anticipated signs (long term)

- $\gamma_1 > 0$ in Model A (if absorption is poor, more graduate's equal higher unemployment)
- $\gamma_2 > 0$ (a larger percentage of connected colleges show mismatch effect)
- $\gamma_3 < 0$ (more earnings lower unemployment; if pay disparities overseas predominate, it might be + for BDRAIN)
- $\delta_2 > 0$ in Model B (emigration is pushed by increasing unemployment)
- δ_3 impact remittances could be unclear (income cushioning causes to increase migration)

4. RESULTS AND DISCUSSION

4.1 Descriptive Analysis

The descriptive statistics presented in table 1 show an overview of the key factors that will be included in the analysis including affiliated college share, public spending on higher education, graduate unemployment, graduate, inflation, remittances, brain drain and trade openness.

Table 1: Descriptive Statics

Statistic	ACS	GDP G	GUNE	GRAD	CPI	R	BD	TO
Mean	55.52	4.01	14.73	240000	9.63	5.54	318800	31.05
Median	56	4.26	15	240000	8.60	5.57	320000	30.70
Maximum	68	7.67	17.90	430000	29.20	9.36	600000	38.60
Minimum	42	-0.94	9.20	50000	2.500	1.31	20000	24.80
Std. Dev.	7.99	2.20	3.28	116530	6.45	2.57	182055	3.67
Sum	1388	100.24	368.20	6000000	240.80	138.51	7970000	776.20
Observations	25	25	25	25	25	25	25	25

Source: Authors' calculation

4.2 Cost-Benefit Analysis

Increase in higher education in Pakistan is inefficient as per the cost benefit analysis, net gain was -18,9851647.50 PKR/graduate. Table 2 lists the elements of the analysis.

Table 2: Results of CBA

Component	Formula	Estimated Value	Interpretation
Remittance Contribution per Graduate (RCG)	TR / NMG	0.0875	Contribution of migrant graduates through remittances
Marginal Productivity Gain (MPG)	ΔGDP_skill / TGE	0.04693	Productivity gain from skilled employment
Public Cost per Graduate (PCG)	HE_spend / TG	0.1099	Government expenditure per graduate
Unemployment Cost (UC)	GUR × Avg. Wage	189851647.50	Loss due to unemployment of graduates
Net Benefit (NB)	RCG + MPG – PCG – UC	–18,9851647.50	Negative (mismatch costly)

Haque (2013) says that graduate unemployment stands at critical levels in Pakistan, decreasing the rate of education investment payoff. Their results are consistent with this finding. Similarly, the World Bank (2023) pointed to the issue of brain drain and underutilization of skills and their impact on higher education as a threat to the financial sustainability of higher education. The adverse finding stresses the fact that the gains of remittances and productivity expansion are not as high as the expenses of unemployment and governmental expenditures. This observation proves that, even though the higher education system generates higher graduates, it is not giving it equivalent financial benefits in the country of Pakistan. Instead, it is the lack of fit between education and employment in which graduates are ineffective to be absorbed by the household labor market.

4.3 Auto-Regressive Distributed Lag Model (ARDL)

Unit root testing was done by first using the Augmented Dickey Fuller test. The short-term dynamics are estimated using the error correction model. The error correction term (ECM_{t-1}) was huge and was also forecasted to have a negative value, of which it is reasonable to assume a stable adjustment mechanism but with a moderate rate of correction of a deviation of long-run equilibrium. The long-run coefficients also supported the existence of cointegration since they indicated that significant factors significantly and theoretically influenced the dependent variable. The results of the diagnostic tests showed that the residuals were normally distributed, and not a sign of serial correlation or heteroskedasticity was present. The stability of the ARDL specification during the sample period was confirmed by the CUSUMSQ tests, which confirmed the stability of the estimated parameters and maintained them within the 5% critical boundaries.

The Augmented Dickey-Fuller (ADF) unit root tests were used to investigate the stationarity properties of the variables. The results indicated in table 3 which reveal the order of integration of the series varies. Since they were significant at the 1 or 5 percent level, they conclude that some variables (inflation, trade openness, brain drain) are stationary at level [I(0)], which rejects the null hypothesis of a unit root. It implies that such series can be employed in estimation without transformation as well as require no differencing. Rejection of the unit root hypothesis at the first difference with 1 percent or 5 percent significance, conversely, means that other variables (affiliated college share, GDP growth, remittances) are non-stationary at level but after first differencing [I(1)]. As per these findings, discussed variables are integrated of order one and required to be differencing in order to become stationary. As the ARDL model permits integrating regressors with differing integration degrees, so long as none of the regressors is integrated two or more times the mixed order of integration (a mix of I(0) and I(1) variables) confirms the use of the ARDL bounds testing model of cointegration.

Table 3: Unit Root Test

Variables	**ADF**	
	C	**T & C**
Affiliated College Share	-10.8427 (1)***	-10.5478 (1)***
Inflation	-5.6728 (0)***	-5.6830 (0)***
Trade Openness	-3.6697 (0)***	-3.6683 (0)**
GDP Growth	0.0726 (1)*	-0.2655 (1)*
Remittances	0.7565 (1)**	-5.6198 (1)***
Brain Drain	-0.0568 (0)**	-0.0673 (0)*

*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Source: Author calculation

Table 4: Autoregressive distributed lag bounds test

Statistics	**Value**	**K**	**Statistics**	**Value**	**K**
Model A: F-Statistic	5.412875	5	Model B: F-Statistic	2974.418	4
Critical Value Bounds			**Critical Value Bounds**		
Significance	**Lower Bound**	**Upper Bound**	**Significance**	**Lower Bound**	**Upper Bound**
10%	2.08	3	10%	2.2	3.09
5%	2.39	3.38	5%	2.56	3.49
1%	3.06	4.15	1%	3.29	4.37

Source: Authors' calculations

The results of ARDL bounds testing procedure confirm that both the models are related long term associated with a co-integrating factor. The calculated F-statistic value of 5.412875 at k = 5 in above table 4 shows that the null hypothesis of no long-term relationship is certainly rejected and thus graduate unemployment is significantly affected by higher education expansion and the related variables in the long-term.

Meanwhile, F-statistic of 2974.418 with k = 4 of the brain drain model is considerably greater than the upper bound critical value of 3.49 at the 5th percentile providing strong evidence of the existence of a high-level consistency, long-run relationship between brain drain and the factors that explain it. These findings indicate that brain drain and unemployment at graduate levels are structural concerns embedded in the education to employment nexus in Pakistan that require policy responses at long term level and not separately.

The long-term ARDL estimates indicate the structural nature of the education-employment gap in Pakistan according to the migration and human capital theories. In the table 5 A (Graduate Unemployment), the coefficient of graduates is positive and significant which indicates that the expansion of higher education in the absence of labor market participation raises the unemployment. This is in line with the job-competition theory, which holds that over supply of skilled labor leads to underemployment. Economic growth affects it in a weakly negative manner thus showing that there is a limit to the number of graduates that can be absorbed by economic growth. Although inflation (CPI) and marginal productivity have adverse impacts (i.e. increased costs and low productivity reduce the creation of jobs), the positive impact of affiliated colleges implies that the improvement in quality and institutional growth contributes to workforce pressure. The highest long-term determinants in Model B (Brain Drain) are graduates and remittances, which conforms to the neoclassical migration theory, which considers wage differences and opportunities outside a country as important pull factor. The trade openness strengthens the brain drain further by exposing workers to international job markets, but graduate unemployment also

produces a positive effect. In general, the results indicate that the institutional quality, higher education development and economic dynamics are integrally related to both brain-drain and unemployment, which require education-labor market changes together.

Table 5: Long Run Coefficient of ARDL

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Model A: Graduate Unemployment				
Graduated	0.000403	0.000426	0.945092	0.0005
GDP Growth	-1.120938	0.535318	-2.093966	0.0627
Affiliated School Share	1.571843	1.084877	1.448868	0.0780
CPI	-0.715304	0.357629	-2.000129	0.0734
Marginal Productivity	-0.015944	0.012790	-1.246581	0.0410
C	-18889.42	15331.77	-1.232044	0.0246
Model B: Brain Drain				
Graduate	0.625302	0.005130	121.9025	0.0000
Graduate Unemployment	6.924897	4.132720	1.675627	0.1145
Remittances	42569.11	229.3175	185.6340	0.0000
Trade Openness	18.71113	3.129683	5.978603	0.0000
C	-385885.8	264694.6	-1.457853	0.1655

Table 6: Short Run Coefficient of ARDL

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Model A: Graduate Unemployment				
D(Graduated)	0.278118	0.033448	6	0.0000
D(GDP Growth)	-0.191234	0.035713	-5.354764	0.0003
D(CPI)	-0.047565	0.017545	-2.711051	0.0219
D(Affiliated School Share)	0.060668	0.014815	4.095040	0.0022
D(Marginal Productivity)	-0.003484	0.001039	-3.353627	0.0073
CointEq(-1)*	-0.232652	0.027980	-8.315001	0.0000
Model B: Brain Drain				
D(Graduate)	38.74863	2.366223	16.37573	0.0000
D(Graduate Unemployment)	4.62497	4.124710	1.657627	0.1152
D(Remittances)	43835.42	209.0522	209.6865	0.0000
D(Trade Openness)	7.605695	6.848370	1.110585	0.2842
CointEq(-1)	-1.899031	0.117880	-16.10980	0.0000

Model A: R^2 = 0.81, Adj. R^2 = 0.78, DW=2.91 Model B: R^2 = 0.87, Adj. R^2 = 0.79, DW= 2.04

Source: Author calculation

The ARDL short-term results (table 6) confirm the dynamic adjustment processes, which are the basis of migration and unemployment. The education-employment mismatch hypothesis suggests that high graduates will immediately rise in unemployment as observed by the positive and significantly high coefficient of D (Graduated) in Model A (Graduate Unemployment) (0.2781, $p<0.01$). Conversely, the impact of D (GDP growth) (-0.1912, $p<0.01$) is negative and it is as expected given that the Keynesian and Okun law predict that expansion in the short-term stimulates labor absorption. On the same note, D(CPI) (-0.0476, $p<0.05$) upholds the Phillips Curve trade-off, showing that moderate inflation reduces unemployment, but D(Affiliated School Share) (0.0607, $p<0.01$) highlights the effect of institutional expansion which creates short-term discrepancies. The negative contribution of D(Marginal Productivity)

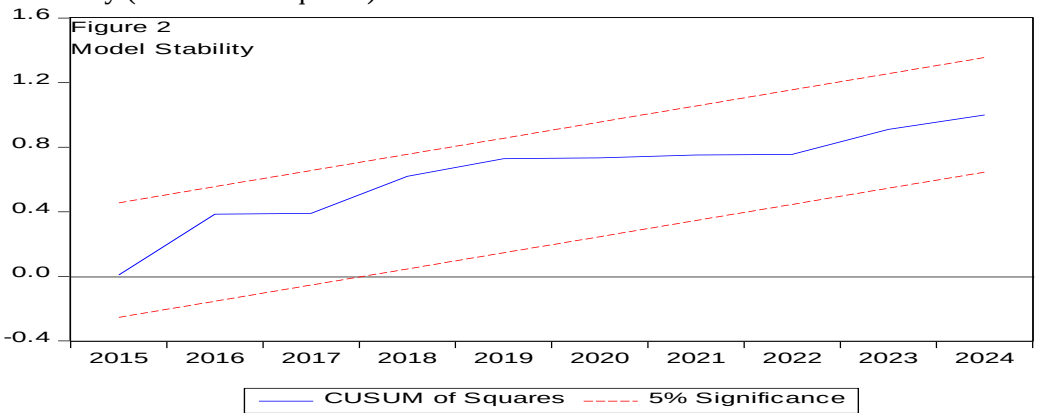
(-0.0035, p<0.01) is a sign of the short-run acceleration of the unemployment pressures. More importantly, the error correction (-0.2326, p<0.01) value indicates that there is a stable adjustment path and the error is corrected almost 23 percent in one period. Model B (Brain Drain) short-run dynamics reveal that migration is strongly determined by D(Graduates) (38.74, p<0.01) and D(Remittances) (43,835.42, p<0.01), as expected within the framework of NELM and the push-pull migration theory, whereas D(Trade Openness) and D(Graduate Unemployment) are very insignificant, meaning that their role is more structural than direct. The highly significant negative error correction term (-1.8990, p<0.01) indicates a very rapid adjustment to the long-run equilibrium in response to the short-term shock in the production and remittance incentives of the brain drain process. All these results are indicative of the volatility of skilled labor movement in Pakistan in the sense that the brain drain is responding to shocks with much more short-term dynamics compared to the unemployment which is responding to shocks slowly.

Table 7: Test for Diagnosis

Tests	**F-Statistic**	**d.f.**	**Prob.**	**F-Statistic**	**d.f.**	**Prob.**
Model A: Graduate Unemployment				**Model B: Brain Drain**		
Breusch-Pagan-Godfrey	4.251050	F (2,8)	0.0552	0.834353	F(2,13)	0.7155
Breusch–Godfrey	0.864011	F (11,11)	0.7459	0.732052	F(7,16)	0.7232

The diagnostic tests confirm the accuracy of the estimated ARDL models (table 7). The test result on whether the series is autocorrelated (Breusch-Godfrey serial correlation LM test, F = 0.864, p = 0.7459) demonstrates that no autocorrelation is present and the results are significant and do not exhibit severe heteroscedasticity problems, with the Breusch-Pagan-Godfrey test giving an F-value of 4.251 (p = 0.0552) in Model A (Graduate Unemployment), slightly greater than the 5% level. In Model B (Brain Drain), the result of the Breusch-Pagan Godfrey test (F = 0.834, p = 0.7155) shows homoscedastic residuals and the result of the Breusch-Godfrey test (F = 0.732, p = 0.7232) confirms the absence of serial correlation. All these diagnostics allow concluding that there are no serious econometric issues concerning either of the models, which increases the validity of the short- and long-term conclusions of the study.

Figure 2: Stability (CUSUM of squares)



The blue line remains within the 5 percent significance limits throughout the period as per the CUSUM of Squares test plot. This implies that the parameters of the ARDL model do not change with time. The parameters are stable and there are no structural fractures evident in the model. Due to the recursive residuals approach, the plot begins in 2015 despite the data ranging between 2000 and 2024. In sum, the model is robust and can support a short- and long-term study.

5. CONCLUSION AND POLICY IMPLICATIONS

Strong evidence that Pakistan's development of higher education has not resulted in comparable economic and social gains may be seen in the combined Cost–Benefit Analysis (CBA) and ARDL estimates. With a negative net benefit of –18,9851647.5000, the CBA finding makes it abundantly evident that the costs of generating graduates exceed the benefits that are actually achieved, highlighting the substantial financial burden that the education–employment mismatch places on society. The results of the ARDL further support this structural weakness: in the graduate unemployment model, deteriorating marginal productivity and poor GDP growth restrict labor absorption capacity, whereas an increase in the number of graduates directly increases unemployment.

The brain drain model also demonstrates that large-scale emigration is driven by strong remittance flows and increased graduate output, suggesting that domestic markets are unable to retain competent people capital. Together, our findings demonstrate that the misalignment of education with labor market demands reduces the long-term developmental benefits of expanding higher education by increasing both internal unemployment and external migration.

In short, there is a continual mismatch between education and employment since Pakistan's development of higher education has produced more graduates than the economy can handle. In addition to being economically costly, the graduation output greatly contributes to unemployment and brain drain. Thus, the findings are warranted as, although migrating becomes a reasonable response for educated young with limited possibilities, graduate unemployment becomes a structural problem at home. This issue is made worse by the unrestrained growth of affiliated colleges, which produce a huge number of graduates without matching their curricula to the demands of the job market. This reinforces both internal mismatch unemployment and foreign migration. These results highlight the urgent need for policies that combine labor market demands with higher education planning in order to ensure that human capital fosters sustained economic growth rather than unemployment and out-migration.

This study supports the need for a number of policy initiatives to alleviate Pakistan's education-employment gap and its impact on brain drain. In order to improve the quality and market relevance of programs offered, higher education policy must first move from expansion to alignment. This is especially important for affiliated colleges, which today bear a disproportionate amount of the burden of unemployable graduates. Second, to guarantee that graduates have employable skills, industry-academia cooperation, skill-oriented curriculum, and technical/vocational paths should be implemented to strengthen labor market ties. Third, economic policy needs to assist startups, SMEs, and industry diversification in order to absorb educated workers locally. Employment-intensive growth must be given priority. Fourth, incentives for return migration and the efficient use of remittances in innovation and enterprise should be established in addition to competitive local possibilities in high-skilled industries to counteract brain drain. In order to ensure that human capital development becomes an asset for sustained growth rather than a cause of unemployment and outmigration, a national education–employment framework is necessary to align higher education planning with long-term labor market projections.

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