

**Beyond Direct Effects: How Vocational Education Mediates the Impact of Educational Spending and Trade on Unemployment in Pakistan**

Mahtab Ahmad

[mahtabahmad@hnu.edu.cn](mailto:mahtabahmad@hnu.edu.cn)

PhD Scholar, School of Economics and Trade, Hunan University, Changsha, China

Dr. Deng Aiming

[aimindeng@hnu.edu.cn](mailto:aimindeng@hnu.edu.cn)

Professor, School of Economics and Trade, Hunan University, Changsha, China

Corresponding Author: Mahtab Ahmad [mahtabahmad@hnu.edu.cn](mailto:mahtabahmad@hnu.edu.cn)

Received: 15-01-2026

Revised: 01-02-2026

Accepted: 14-02-2026

Published: 04-03-2026

**ABSTRACT:**

*This study examines the mediating role of vocational education in the relationship between government education expenditure, trade openness, and unemployment in Pakistan, using time-series data from 1990 to 2024. The results of a three-stage OLS mediation model show that secondary vocational pupil enrollment (SEVP) acts as a significant transmission channel. Government spending on education reduces unemployment, with approximately 17% of its effect transmitted indirectly through increased vocational enrollment. Trade openness also lowers unemployment, with about 25% of its effect operating through vocational education. Notably, population growth exhibits indirect-only mediation: its overall effect on unemployment is not statistically significant, but when vocational enrollment is considered, the direct effect becomes strongly negative, suggesting that population growth can reduce unemployment only when accompanied by skills development. Vocational enrollment itself has a substantial direct impact on reducing unemployment, and the full model explains 82.2% of the variation in unemployment rates. Results are robust across diagnostic tests, quantile regressions, and subsample analyses. These findings indicate that weak linkages between educational expenditure, trade, and employment in Pakistan result from inadequate investment in vocational training. Policy implications indicate the need for performance-based funding for technical and vocational education and training, as well as the integration of skills development into trade and industrial strategies.*

**Keywords:** *Unemployment; Vocational Education; Mediation Analysis; Human Capital; Trade Openness; Pakistan*

**INTRODUCTION**

Pakistan's persistently high unemployment rate, particularly among its youth, poses a significant challenge to the country's social stability and economic development (Ersado et al., 2023; Dasgupta, 2022). Conventional policy frameworks have mainly addressed this issue through direct macroeconomic interventions, notably by increasing government expenditure on education (GEE) and promoting trade openness. These approaches are based on established economic theories: human capital theory asserts that investment in education enhances individual productivity and employability (Barro, 2013; Becker, 1993), while classical trade theories suggest that openness stimulates economic growth and job creation (Helpman, 2016; Haq et al., 2016).

However, the empirical relationship between these policy measures and actual reductions in unemployment in Pakistan has been inconsistent and often weaker than expected (Atif et al., 2024), revealing a significant gap between policy intentions and labor market outcomes. This discrepancy highlights a deeper, structural issue of "skills mismatch," where the education system's output does not align with the needs of a

modernizing labor market (Farooq, 2011; Ullah et al., 2024). As Hanushek and Woessmann (2015) argue, it is the relevance and quality of "knowledge capital," rather than its aggregate volume, that determines its impact on economic outcomes. Thus, the potential job-creating benefits of trade openness remain unrealized without a complementary, suitably skilled domestic workforce (Dasgupta, 2022).

This paper directly addresses this gap by introducing and testing a formal mediation hypothesis:

H<sub>1</sub>: Vocational education enrolment (SEVP) significantly mediates the relationship between government education expenditure (GEE) and the unemployment rate, such that a substantial portion of GEE's effect on unemployment operates indirectly through vocational training.

H<sub>2</sub>: Vocational education enrolment (SEVP) significantly mediates the relationship between trade openness (TRADE) and the unemployment rate, such that a substantial portion of TRADE's effect on unemployment operates indirectly through enhancing the stock of vocationally skilled labor.

The primary objective of this research is to check this dual mediation pathway within the Pakistani context. This approach allows for the decomposition of the total effects of the key predictors into direct and indirect (mediated) components, quantifying the precise role of vocational enrolment (SEVP) in transmitting policy impacts to the labor market. The remainder of this paper is organized as follows. Section 2 reviews the relevant literature. Section 3 outlines the theoretical model and econometric methodology. Section 4 presents empirical results and robustness checks. Section 5 discusses the implications and provides policy recommendations. Finally, Section 6 acknowledges the limitations and suggests directions for future research.

## **LITERATURE REVIEW**

### **Macroeconomic Drivers of Labor Demand: The Conditional Efficacy of Policy**

Research on the demand-side drivers of employment in Pakistan has evolved from establishing basic correlations to uncovering complex conditionalities. Early studies confirmed a significant long-run inverse relationship between aggregate government spending and unemployment, though with notable short-run lags (Azmi, 2013; Nazir et al., 2013). Subsequent research refined this finding by demonstrating that the composition of spending matters; only productive developmental expenditure on physical and human capital consistently reduces unemployment, whereas non-developmental spending does not (Ahmad & Bhatti, 2024; Nazir et al., 2013). More recent analyses emphasise the role of fiscal space and efficiency, noting that the employment elasticity of education spending depends on institutional quality and targeting (Ahmad & Bhatti, 2024).

A parallel literature on trade reveals a similarly nuanced picture. There is consensus supporting the export-led employment hypothesis, with robust evidence that export growth reduces unemployment (Dutta & Ahmed, 2004; Ahmad, 2018; Rasool Khan, 2013). However, the net effect of trade openness is mediated by the job-displacing potential of imports (Haq et al., 2016) and depends on complementary domestic factors. Collectively, this body of work establishes that while fiscal and trade policies are potent levers, their impact on unemployment is indirect, conditional, and transmitted through unspecified channels within the domestic economy.

### **Structural Determinants of Labor Supply: Demographics and the Education-Job Mismatch**

On the supply side, the literature consistently identifies two compounding structural challenges. First, rapid population growth acts like a persistent driver of labor force expansion, placing continuous upward pressure

on unemployment rates when not matched by equivalent job creation (Arif & Chaudhry, 2022; Minhaj & Imran, 2021). Second, paradoxically, the educational system exacerbates the supply-side problem. Research highlights a severe case of educated unemployment; higher levels of general academic attainment, particularly at the intermediate and bachelor's levels in the arts and humanities, are associated with higher unemployment rates (Arif & Farooq, 2012; Turi & Khan, 2021). This reveals a critical skills mismatch: the type of human capital produced (general academic) does not align with the type demanded by the economy (applied and technical).

### **The Potential Bridge: Secondary Vocational Education as a Macro-Level Mediator**

The convergence of conditional macro-policies and a misaligned education system logically indicates Technical and Vocational Education and Training (TVET) as a potential solution. In this study, we use the number of pupils enrolled in secondary vocational programmes (SEVP), measured in thousands, as a proxy for the development and reach of the TVET sector. Micro-level evidence strongly supports the importance of this metric: graduates of secondary vocational programmes in Pakistan have significantly higher employment rates than those with general academic qualifications (Landmesser, 2011; Siddiqui et al., 2019; Ullah et al., 2024).

However, macro-level assessments reveal a system hampered by outdated curricula, inadequate resources, and a significant disconnect from industry needs. Consequently, while vocational education is effective at the individual level, the total number of vocational pupils has remained too low to significantly affect national employment outcomes (Dale et al., 2002; Siddiqui et al., 2019; Ersado et al., 2023).

### **Synthesizing the Strands and Identifying the Gap**

The three streams of literature collectively present a clear yet unresolved puzzle. The demand-side literature shows that policy levers (fiscal and trade) have weak, conditional, and indirect effects on unemployment. The supply-side literature identifies a growing and misaligned labour supply. The SEVP literature highlights a proven but underperforming potential bridge. The crucial missing link is an integrative causal model. No study has formally specified and tested a model in which vocational enrolment (SEVP) acts as the mediating variable transmitting the influence of government education spending and trade openness to the unemployment rate (Atif et al., 2024; Ali et al., 2024). This study addresses this critical gap.

## **RESEARCH METHODOLOGY**

### **Data Characteristics and Time Frame**

The analysis uses a balanced time-series dataset with 35 annual observations for Pakistan from 1990 to 2024. With 5 to 6 predictors, the effective degrees of freedom range from 29 to 30, which is acceptable but modest; readers should interpret significance tests with this limitation in mind.

### **Variable Operationalization and Theoretical Justification**

<b>Table 1: Variable Definitions and Operationalization</b>					
<b>Variable</b>	<b>Short Form</b>	<b>Definition</b>	<b>Measurement</b>	<b>Expected Sign</b>	<b>Source</b>

Unemployment Rate	U	Share of the total labor force that is without work but available for and seeking employment	Percentage of total labor force	Dependent Variable	WDI
Government Education Expenditure	GEE	Total general government expenditure on education	Percentage of total government expenditure	Negative	WDI
Trade Openness	TRADE	The sum of exports and imports of goods and services	Percentage of GDP	Negative	WDI
Secondary Education Vocational Pupils	SEVP	Total number of students enrolled in technical and vocational education programs at the secondary level	Number of pupils	Negative	WDI
Educational Attainment	EA	Cumulative percentage of population aged 25+ that has completed at least upper secondary education	Percentage	Negative	WDI

Note: The expected sign for POPG depends on the presence of skills investment, according to demographic dividend theory (Bloom et al., 2003).

### Empirical Model and Estimation Justification

The core analysis is conducted using a multiple regression framework specified as:

$$U_t = \beta_0 + \beta_1 POPG_t + \beta_2 GEE_t + \beta_3 EA_t + \beta_4 TRADE_t + \varepsilon_t \quad (1)$$

$$SEVP_t = \alpha_0 + \alpha_1 POPG_t + \alpha_2 GEE_t + \alpha_3 EA_t + \alpha_4 TRADE_t + \mu_t \quad (2)$$

$$U_t = \gamma_0 + \gamma_1 POPG_t + \gamma_2 GEE_t + \gamma_3 EA_t + \gamma_4 TRADE_t + \gamma_5 SEVP_t + \nu_t \quad (3)$$

Where:

$U_i$  = Actual value of the dependent variable (Unemployment Rate) for observation i

$\hat{U}_i$  = Predicted value of the dependent variable (Unemployment Rate) for observation i

$e_i$  = Residual for observation i

n = Number of observations

$$e_i = U_i - \hat{U}_i$$

OLS is used to estimate the models, providing BLUE under classical assumptions (Greene, 2018; Wooldridge, 2016). Given the small sample size ( $N = 35$ ), Ordinary least squares is preferred to maximum likelihood estimators, which may be inconsistent in small samples.

### **Diagnostic Testing and Robustness Framework**

A comprehensive diagnostic protocol is implemented, including: Variance Inflation Factors (VIF) for multicollinearity (Gujarati & Porter, 2009); the Breusch-Pagan test for heteroskedasticity (Greene, 2018); the Shapiro-Wilk test for normality of residuals (Preacher & Hayes, 2008); the Ramsey RESET test for model specification (Ramsey, 1969); and the Durbin-Watson test for autocorrelation (Wooldridge, 2016). Robustness checks include OLS with robust standard errors, quantile regression at the 25th, 50th, and 75th percentiles (Koenker & Bassett, 1978), and sub-sample analysis (pre-2007 and post-2007) (Stock & Watson, 2020).

### **Mediation Analysis Protocol**

The analysis uses the causal steps approach (Baron & Kenny, 1986). Mediation is supported if GEE/TRADE significantly affects SEVP, SEVP significantly affects U, and the direct effect of GEE/TRADE on U decreases in the final model. The Sobel test is used to formally assess the significance of indirect effects (Preacher & Hayes, 2008). The percentage mediated is calculated as (indirect effect / total effect)  $\times$  100.

## **DATA ANALYSIS AND DISCUSSION**

### **Descriptive Statistics and Correlation**

This section presents the descriptive statistics and correlation matrix for the key variables analysed. Descriptive statistics provide a summary of the dataset, including measures of central tendency and dispersion, such as the mean, standard deviation, minimum, and maximum values for each variable (Gujarati & Porter, 2009). These statistics offer initial insights into the distribution and variability of the data, which are essential for understanding the context and scale of the variables before further econometric analysis. The correlation matrix then examines the pairwise linear relationships between variables, helping to identify potential multicollinearity and preliminary associations that may inform subsequent model specification (Wooldridge, 2016). Together, these analyses establish the empirical basis for the mediation and regression models discussed in the following sections.

Variables	Obs	Mean	Std. Dev.	Min	Max
U	35	4.124	1.252	.398	4.83
GEE	35	11.037	1.797	7.803	12.446
EA	35	18.755	3.153	6.759	23.718
TRADE	35	27.597	4.686	21.46	30.499
POPG	35	2.231	0.62	1.204	3.297

SEVP	35	472.955	145.66	288.097	568.114
------	----	---------	--------	---------	---------

Source: Author's calculations based on the data set.

The descriptive statistics in Table 2 summarize the key features of the dataset based on 35 observations. The unemployment rate (U) averages 4.124%, with a standard deviation of 1.252, indicating moderate consistency, although the minimum of 0.398% suggests some periods of very low unemployment. Government expenditure on education (GEE) and economic activity (EA) have means of 11.037 and 18.755, respectively, with EA showing greater variability (standard deviation = 3.153) and a wide range from 6.759 to 23.718, reflecting diverse economic conditions. Trade (TRADE) has a mean of 27.597 and a standard deviation of 4.686, indicating moderate fluctuations in trade openness. Population growth (POPG) is relatively stable, with a mean of 2.231% and low variability. Secondary education enrolment (SEVP) has the highest mean (472.955) and substantial dispersion (standard deviation = 145.66), with values ranging from 288.097 to 568.114, highlighting significant differences in educational participation across the sample.

**Table 3: Correlation Matrix**

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) U	1.000					
(2) GEE	-0.513	1.000				
(3) EA	-0.573	0.173	1.000			
(4) SEVP	-0.629	0.401	0.485	1.000		
(5) TRADE	-0.303	-0.046	-0.109	-0.227	1.000	
(6) POPG	0.344	-0.371	-0.477	-0.837	0.435	1.000

Source: Author's calculations based on the data set.

The correlation matrix reveals important preliminary relationships. Unemployment (U) shows strong negative correlations with government education expenditure (GEE, -0.513), educational attainment (EA, -0.573), and vocational enrolment (SEVP, -0.629), suggesting that higher investments and outcomes in education are associated with lower unemployment rates (Card, 1999; Barro, 2013). Conversely, unemployment has a moderate positive correlation with population growth (POPG, 0.344), indicating potential demographic pressures on the labour market (Arif & Chaudhry, 2022; Minhaj & Imran, 2021). Notably, vocational enrolment (SEVP) demonstrates strong negative associations with both unemployment (-0.629) and population growth (-0.837), reinforcing its potential mediating role. The matrix also reveals no severe multicollinearity concerns, as most correlations remain below |0.80|, though the strong negative relationship between SEVP and POPG (-0.837) warrants attention in subsequent regression diagnostics (Gujarati & Porter, 2009). These patterns provide empirical support for further investigation of vocational education as a channel through which educational and demographic factors influence unemployment outcomes (Ali et al., 2024).

**Baseline Regression Results**

<b>Table 4: Results of OLS Regression</b>	
VARIABLES	OLS Regression Results
GEE	-0.404***
	(0.108)
EA	-0.176***
	(0.0397)
TRADE	-0.160***
	(0.0438)
POPG	-1.716***
	(0.597)
SEVP	-0.0120***
	(0.00236)
Constant	26.27***
	(2.512)
Observations	35
R-squared	0.822
Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1	
Source: Author's calculations based on data collected from WDI	

The full model regression results identify significant determinants of unemployment in Pakistan from 1990 to 2024. All independent variables are statistically significant at the 1% level ( $p < 0.01$ ) and have negative coefficients, indicating that increases in each factor are associated with reductions in the unemployment rate. Government expenditure on education (GEE) has a coefficient of -0.404, suggesting that a one-percentage-point increase in education spending reduces unemployment by approximately 0.4 percentage points, highlighting the employment benefits of public investment in human capital (Barro, 2013; Becker, 1993).

Educational attainment (EA) also shows a negative relationship (-0.176), consistent with human capital theory, which posits that higher education levels enhance labor productivity and employability (Card, 1999;

Pyatt & Becker, 1966). Trade openness (TRADE) has a coefficient of -0.160, supporting the trade-induced employment hypothesis that greater integration into global markets stimulates labor demand through comparative advantage and export-led growth (Helpman, 2016; Haq et al., 2016). Most notably, population growth (POPG) has a substantial negative effect (-1.716), indicating that, contrary to Malthusian concerns, higher population growth in Pakistan is associated with lower unemployment, potentially reflecting demographic dividend effects, where a growing labor force spurs economic activity if sufficiently absorbed (Bloom et al., 2003; Arif & Chaudhry, 2022).

Secondary vocational pupil enrolment (SEVP) shows a highly significant negative coefficient (-0.0120), emphasizing the critical role of skill-specific training in reducing structural unemployment by aligning workforce competencies with market needs (Acemoglu & Autor, 2011; Landmesser, 2011; Siddiqui et al., 2019). The model explains a substantial proportion of the variation in unemployment, with an R-squared value of 0.822, indicating strong overall explanatory power (Greene, 2018). These results collectively underscore the multifaceted policy levers, including fiscal allocation, educational expansion, trade liberalization, and vocational training, that can be harnessed to mitigate unemployment in Pakistan (Ersado et al., 2023; PIDE, 2023; Atif et al., 2024).

**Diagnostic Tests**

<b>Table 5: Variance Inflation Factor (VIF)</b>		
	VIF	1/VIF
POPG	4.418	.226
SEVP	3.797	.263
TRADE	1.358	.737
EA	1.349	.741
GEE	1.21	.826
Mean VIF	2.426	.
Source: Author’s calculation based on data collected from WDI		

The Variance Inflation Factor (VIF) results indicate that multicollinearity is not a significant issue in the regression model, as the mean VIF of 2.426 is below the commonly accepted threshold of 5–10 (Gujarati & Porter, 2009). Specifically, population growth (POPG, VIF = 4.418) and secondary vocational pupil enrolment (SEVP, VIF = 3.797) exhibit elevated but not critical levels of multicollinearity. Overall, the model does not display problematic multicollinearity.

<b>Table 6: Breusch-Pagan Test for Heteroskedasticity</b>				
Ho:		Constant		variance
	Variables:	fitted	values	of
	chi2(1)	=	0.00	u
	Prob > chi2 =	0.9465		

Source: Author's calculation based on data collected from WDI

The Breusch-Pagan test results indicate that the null hypothesis of constant variance (homoskedasticity) cannot be rejected (Greene, 2018; Wooldridge, 2016). The absence of heteroskedasticity implies that the Ordinary Least Squares (OLS) estimators remain efficient and that standard errors are estimated reliably (Gujarati & Porter, 2009).

**Table 7: Durbin-Watson Test for Autocorrelation**

Test	Statistic	Decision
Durbin-Watson d	1.87	No significant autocorrelation (Wooldridge, 2016)

**Table 8: Shapiro-Wilk W Test for Normality of Residuals**

Variable	Obs	W	V	z	Prob>z
residuals	35	0.973	0.980	-0.043	0.517

Source: Author's calculation based on data collected from WDI.

The Shapiro-Wilk test results indicate that the null hypothesis of normally distributed residuals cannot be rejected ( $p = 0.517$ ), satisfying a key assumption underlying classical linear regression inference (Preacher & Hayes, 2008; Gujarati & Porter, 2009).

**Table 9: Ramsey RESET Test for Specification Error**

Ramsey RESET test using powers of the fitted values of u	Ho: $F(3, 26) = 0.19$ Prob > F = 0.9045
----------------------------------------------------------	--------------------------------------------

Source: Author's calculation based on data collected from WDI

The Ramsey RESET test results indicate no specification error or omitted variable bias, with an F-statistic of 0.19 and a p-value of 0.9045 (Ramsey, 1969; Greene, 2018).

### Robustness Checks

**Table 10: Robustness Check: Robust Standard Errors and Quantile Regression**

VARIABLES	OLS (robust)	Quantile Regression	q25	q50	q75
GEE	-0.404***	-0.420***	-0.294	-0.420*	-0.551***
	(0.126)	(0.129)	(0.268)	(0.210)	(0.189)

EA	-0.176***	-0.182***	-0.155***	-0.182***	-0.186***
	(0.0328)	(0.0474)	(0.0289)	(0.0365)	(0.0339)
SEVP	-0.0120***	-0.0133***	-0.0116***	-0.0133***	-0.0152***
	(0.00228)	(0.00282)	(0.00310)	(0.00357)	(0.00460)
TRADE	-0.160***	-0.154***	-0.194***	-0.154*	-0.116*
	(0.0408)	(0.0523)	(0.0690)	(0.0825)	(0.0631)
POPG	-1.716**	-1.628**	-1.556**	-1.628	-2.410**
	(0.643)	(0.713)	(0.711)	(0.987)	(1.107)
Constant	26.27***	26.93***	24.52***	26.93***	30.52***
	(2.378)	(3.002)	(3.174)	(3.921)	(4.598)
Observations	35	35	35	35	35
R-squared	0.822				

Robust standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculation based on data collected from WDI

The robustness checks indicate that, although the main conclusions are largely consistent across estimation techniques, significant differences emerge at different unemployment levels (Koenker & Bassett, 1978). The quantile regressions show that the strength of these relationships varies across the unemployment distribution. Notably, government education expenditure (GEE) is not statistically significant at the 25th percentile, suggesting that the effects of education spending are weaker during periods of already low unemployment.

VARIABLES	if time <= 2007	if time > 2007
GEE	-0.376*	-0.695***
	(0.203)	(0.160)
EA	-0.118	-0.186***
	(0.0709)	(0.0478)
SEVP	-0.0324***	-0.0176

	(0.00531)	(0.0126)
TRADE	-0.173***	-0.0213
	(0.0366)	(0.132)
POPG	-1.445*	-2.407*
	(0.682)	(1.150)
Constant	23.61***	29.14***
	(3.031)	(8.106)
Observations	18	17
R-squared	0.904	0.840
standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1		
Source: Author's calculations based on data collected from WDI.		

While \*Caution: Small sub-sample sizes (N=18 and N=17) may produce unstable estimates (Stock & Watson, 2020).

While the fundamental direction of relationships in the unemployment model generally remains consistent over time, the magnitude and statistical significance of key determinants changed markedly after the 2007 threshold, possibly due to the Global Financial Crisis (Stock & Watson, 2020). Government investment in education plays a strong role in reducing unemployment in both periods, with its impact increasing significantly after 2007 (Ahmad & Bhatti, 2024). However, trade openness lost statistical significance in the post-2007 period, indicating that the effects of globalization on employment are context-dependent rather than universal (Dutta & Ahmed, 2004; Helpman, 2016; Ahmad, 2018).

**Table 12: Robustness Check: Alternative Model Specification**

VARIABLES	Model 01	Model 02	Model 03	Model 04	Model 05
GEE	-0.404***	-0.488***	-0.548***	-0.534***	-0.643***
	(0.108)	(0.144)	(0.135)	(0.158)	(0.187)
EA	-0.176***	-0.207***	-0.235***	-0.218***	
	(0.0397)	(0.0531)	(0.0475)	(0.0552)	
TRADE	-0.160***	-0.214***	-0.184***		
	(0.0438)	(0.0575)	(0.0515)		

POPG	-1.716***	0.606			
	(0.597)	(0.521)			
SEVP	-0.0120***				
	(0.00236)				
Constant	26.27***	18.59***	20.20***	14.11***	11.22***
	(2.512)	(2.717)	(2.352)	(1.890)	(2.093)
Observations	35	35	35	35	35
R-squared	0.822	0.664	0.649	0.505	0.263
standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1					
Source: Author's calculations based on data collected from WDI.					

The main finding regarding government education spending is remarkably stable, remaining negative, statistically significant, and even increasing in magnitude across all five specifications (Ahmad & Bhatti, 2024; Nazir et al., 2013). This robustness check shows that the relationship between government education spending and lower unemployment is a robust empirical regularity rather than an artefact of the chosen model (Gujarati & Porter, 2009).

### Mediation Analysis

VARIABLES	Total Effect Model	Mediator Model	Direct Effect Model
SEVP			-0.0120***
			(0.00236)
POPG	0.606	-193.6***	-1.716***
	(0.521)	(29.81)	(0.597)
GEE	-0.488***	5.005**	-0.404***
	(0.144)	(2.257)	(0.108)
EA	-0.207***	2.605	-0.176***
	(0.0531)	(3.038)	(0.0397)
TRADE	-0.214***	4.530	-0.160***

	(0.0575)	(3.291)	(0.0438)
Constant	18.59***	640.0***	26.27***
	(2.717)	(155.6)	(2.512)
Observations	35	35	35
R-squared	0.664	0.737	0.822

standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Source: Author's calculation based on data collected from WDI

**Table 14: Formal Mediation Results (Sobel Test)**

Pathway	Indirect Effect (a×b)	SE	z-statistic	p-value	% of Total Effect Mediated
GEE → SEVP → U	-0.0601	0.0289	-2.079	0.038**	17.1%
TRADE → SEVP → U	-0.0544	0.0421	-1.292	0.196	25.4%

Note: The TRADE indirect effect, while economically meaningful (25.4%), does not reach statistical significance at conventional levels ( $p = 0.196$ ), likely due to the small sample size (Preacher & Hayes, 2008).

The mediation analysis strongly supports human capital theory, which posits that education is a fundamental determinant of labor market outcomes (Barro, 2013; Card, 1999; Becker, 1993). In the Direct Effect Model, the coefficient for secondary education enrolment (SEVP) is negative and statistically significant at the 1% level ( $-0.0120, p < 0.01$ ). This indicates that, holding all other factors constant, higher secondary education enrolment directly leads to lower unemployment rates (Becker, 1993; Pyatt & Becker, 1966).

The results for population growth (POPG) reveal a complex indirect-only mediation pattern, sometimes referred to as a "suppression effect", best understood by tracing its coefficient across the three models (Baron & Kenny, 1986). In the Total Effect Model, POPG has a positive but statistically insignificant relationship with unemployment (0.606). However, the Mediator Model indicates a strong, significant negative relationship between POPG and SEVP ( $-193.6, p < 0.01$ ), suggesting that rapid population growth strains educational resources and reduces per-capita enrolment (Arif & Chaudhry, 2022; Minhaj & Imran, 2021). When the model controls for this mediating effect of education in the Direct Effect Model, the direct impact of POPG on unemployment becomes strongly negative and significant ( $-1.716, p < 0.01$ ). This pattern suggests that the initial, non-significant total effect concealed two opposing forces: a harmful indirect effect, where population growth increases unemployment by reducing educational investment, and a beneficial direct effect, where a growing population, when education levels are adequate, can actually reduce unemployment. This finding directly supports the demographic dividend theory proposed by Bloom, Canning, and Sevilla (2003), which argues that population growth can spur economic growth and reduce unemployment if accompanied by strategic investments in human capital.

Government expenditure on education (GEE) demonstrates both indirect and direct pathways to reducing unemployment. The Total Effect Model confirms that higher GEE is associated with lower unemployment (-0.488,  $p < 0.01$ ). The Mediator Model shows that a significant portion of this effect operates through the education channel, as GEE has a positive and significant impact on SEVP (5.005,  $p < 0.05$ ). This indicates that government spending increases enrolment in secondary education, which in turn lowers unemployment (Ahmad & Bhatti, 2024; Nazir et al., 2013). The formal Sobel test confirms that approximately 17.1% of GEE's effect is mediated through SEVP ( $z = -2.079$ ,  $p = 0.038$ ). However, in the Direct Effect Model, GEE remains a significant negative predictor of unemployment (-0.404,  $p < 0.01$ ) even after controlling for SEVP, indicating that education spending also reduces unemployment through other mechanisms, such as improvements in the quality of education (Hanushek & Woessmann, 2015).

The analysis also finds that trade openness (TRADE) has unemployment-reducing effects, with approximately 25.4% of its impact operating through the vocational education channel. However, this indirect effect does not reach statistical significance ( $p = 0.196$ ), likely due to the small sample size (Preacher & Hayes, 2008). The direct effect of TRADE remains negative and significant (-0.160,  $p < 0.01$ ), reflecting its role in generating employment opportunities and promoting overall economic expansion (Dutta & Ahmed, 2004; Helpman, 2016; Haq et al., 2016). The high R-squared value of 0.822 in the final model confirms that these factors together provide a robust explanation for variations in unemployment (Greene, 2018; Gujarati & Porter, 2009).

## CONCLUSION AND POLICY SUGGESTIONS

### Conclusion

The empirical investigation confirms the central hypothesis that vocational education acts as a statistically significant and economically meaningful mediator. The analysis identifies a dual-channel mechanism:

First, government education expenditure (GEE) significantly reduces unemployment, with approximately 17.1% of its effect transmitted indirectly through increased SEVP (Sobel  $z = -2.079$ ,  $p < 0.05$ ). Second, trade openness (TRADE) shows an economically meaningful mediated effect (approximately 25.4%), although this is not statistically significant ( $p = 0.196$ ), likely due to the small sample size ( $N = 35$ ). Third, population growth (POPG) demonstrates indirect-only mediation: its total effect is not significant, but its direct effect becomes strongly negative (-1.716,  $p < 0.01$ ) when controlling for SEVP. This suggests that population growth reduces unemployment only when accompanied by investment in vocational skills (Bloom et al., 2003; Arif & Chaudhry, 2022).

The highly significant negative coefficient for SEVP in the direct effect model (-0.0120,  $p < 0.01$ ), together with the improved model fit ( $R^2 = 0.822$ ), strongly establishes that increasing the stock of vocationally trained individuals is a direct and effective means of reducing unemployment (Landmesser, 2011; Siddiqui et al., 2019; Ullah et al., 2024). Therefore, the weak historical link between educational spending, trade, and employment in Pakistan can be attributed to the failure to develop this crucial mediating channel (Dale et al., 2002; Ersado et al., 2023; Atif et al., 2024; Ali et al., 2024).

### POLICY RECOMMENDATIONS

**Strategic Reallocation of Education Expenditure:** Shift the composition of public education spending from blanket subsidies for general higher education to performance-based funding for TVET institutions (Ahmad & Bhatti, 2024; Nazir et al., 2013). Allocate grants linked to key outcomes such as graduate employment rates, employer satisfaction scores, and the successful transition of graduates into formal sector jobs (Ersado et al., 2023).

Demand-Driven TVET Curriculum Reform: Establish a mandatory National Skills Council co-chaired by industry leaders (particularly from the textile, IT, automotive, and agro-processing export sectors) and TVET authorities. This council should oversee a continuous cycle of curriculum review and updates, ensuring training modules are aligned with current and future technological and market demands (Ullah et al., 2024; Ali et al., 2024).

Integrate Skills Development into Trade and Industrial Policy: Embed a dedicated "Skills for Trade" chapter within Pakistan's Strategic Trade Policy Framework (STPF) and Industrial Policy (Dutta & Ahmed, 2004; Ahmad, 2018). For example, incentives for exporting firms under the STPF could be contingent on their participation in apprenticeship programmes or collaboration with designated TVET institutes (Ersado et al., 2023; PIDE, 2023).

Leverage population growth through targeted youth programmes: design and rapidly scale up a National Youth Skills Initiative focused on the most populous districts and cohorts with the highest unemployment (Arif & Farooq, 2012; Ahmad & Imran, 2024).

### **LIMITATIONS AND FUTURE RESEARCH**

This study has several limitations. First, with only 35 observations, statistical power is limited; future research should update the analysis as more data become available. Second, reliance on aggregate national-level data masks sub-national heterogeneity; future research should use provincial or district-level panel data. Third, SEVP measures scale but not quality; subsequent studies should incorporate survey-based metrics of skills proficiency. Fourth, the econometric framework establishes associations, not causality; instrumental variable techniques could strengthen causal claims. Fifth, the small sub-sample sizes (N = 18, N = 17) in robustness checks may produce unstable estimates. Finally, the model does not account for digitalisation and automation; future research should examine how vocational training must adapt for Industry 4.0.

### **REFERENCES**

- Acemoglu, D., & Autor, D. (2011). Skills, tasks and technologies: Implications for employment and earnings. In O. Ashenfelter & D. Card (Eds.), *Handbook of labor economics* (Vol. 4, pp. 1043-1171). Elsevier. [https://doi.org/10.1016/S0169-7218\(11\)02410-5](https://doi.org/10.1016/S0169-7218(11)02410-5)
- Ahmad, K. (2018). Trade liberalization-trade revenue nexus: An empirical enquiry of trade Laffer curve of Pakistan. *Sukkur IBA Journal of Management and Business*, 5(1), 66-84.
- Ahmad, R., & Bhatti, M. A. (2024). Public spending composition and its implications for economic growth and poverty reduction in Pakistan: A dynamic time series analysis. *Pakistan Journal of Humanities and Social Sciences*, 12(1). <https://doi.org/10.52131/pjhss.2024.v12i1.2155>
- Ahmad, S., & Imran, M. (2024). Exploring the drivers of youth unemployment in Pakistan: A comprehensive review. *Spry Journal of Economics and Management Sciences*, 2(1), 12-21. <https://doi.org/10.62681/sprypublishers.sjems/2/1/2>
- Alesina, A., Favero, C., & Giavazzi, F. (2019). Effects of austerity: Expenditure- and tax-based approaches. *Journal of Economic Perspectives*, 33(2), 141-162. <https://doi.org/10.1257/jep.33.2.141>

- Ali, W., Rahman, A., & Karsidi, R. (2024). Sustainable skills development in Pakistan: Bridging the gap in technical and vocational education policy. *Society*, 12(2), 656-673. <https://doi.org/10.33019/society.v12i2.734>
- Arif, G. M., & Chaudhry, N. (2022). Demographic transition and youth employment in Pakistan. *The Pakistan Development Review*, 41(1), 27-70. <https://doi.org/10.30541/v41i1pp.27-70>
- Arif, G. M., & Farooq, S. (2012). *Poverty reduction in Pakistan: Learning from the experience of China* (PIDE Monograph Series No. MS-05). Pakistan Institute of Development Economics. <https://file.pide.org.pk/pdfpideresearch/ms-05-poverty-reduction-in-pakistan-learning-from-the-experience-of-china.pdf>
- Atif, R. M., Pervaiz, B., Manzoor, M. Q., & Fatima, M. (2024). Combating unemployment in Pakistan: Empirical study of key macroeconomic factors. *Academic Journal of Social Sciences*, 8(2). <https://doi.org/10.54692/ajss.2024.822255>
- Azmi, F. B. (2013). An empirical analysis of the relationship between GDP and unemployment, interest rate and government spending. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2276817>
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182. <https://doi.org/10.1037/0022-3514.51.6.1173>
- Barro, R. J. (2013). Education and economic growth. *Annals of Economics and Finance*, 14(2), 301-328. <https://ftp.aefweb.net/WorkingPapers/w571.pdf>
- Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis, with special reference to education* (3rd ed.). University of Chicago Press. <https://doi.org/10.7208/chicago/9780226041223.001.0001>
- Bloom, D., Canning, D., & Sevilla, J. (2003). *The demographic dividend: A new perspective on the economic consequences of population change*. RAND Corporation. <https://doi.org/10.7249/mr1274>
- Card, D. (1999). The causal effect of education on earnings. In O. Ashenfelter & D. Card (Eds.), *Handbook of labor economics* (Vol. 3, pp. 1801-1863). Elsevier. [https://doi.org/10.1016/S1573-4463\(99\)03011-4](https://doi.org/10.1016/S1573-4463(99)03011-4)
- Dale, A., Shaheen, N., Kalra, V., & Fieldhouse, E. (2002). Routes into education and employment for young Pakistani and Bangladeshi women in the UK. *Ethnic and Racial Studies*, 25(6), 942-968. <https://doi.org/10.1080/0141987022000009386>
- Dasgupta, S. (2022). *Global employment trends for youth 2022*. International Labour Organization. <https://doi.org/10.54394/qsmu1809>
- Dutta, D., & Ahmed, N. (2004). Trade liberalization and industrial growth in Pakistan: A cointegration analysis. *Applied Economics*, 36(13), 1421-1429. <https://doi.org/10.1080/0003684042000206951>

- Ersado, L., Hasan, A., Geven, K. M., Kathuria, A. K., Baron, J., Bend, M., & Ahmed, S. A. (2023). *Pakistan human capital review: Building capabilities throughout life*. World Bank. <https://doi.org/10.1596/39629>
- Farooq, S. (2011). Mismatch between education and occupation: A case study of Pakistani graduates. *The Pakistan Development Review*, 50(4), 531-553. <https://doi.org/10.30541/v50i4iipp.531-553>
- Greene, W. H. (2018). *Econometric analysis* (8th ed.). Pearson.
- Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics* (5th ed.). McGraw-Hill Education.
- Hanushek, E. A., & Woessmann, L. (2015). *The knowledge capital of nations*. MIT Press. <https://doi.org/10.7551/mitpress/9780262029179.001.0001>
- Haq, M., Naqvi, S. K. H., & Luqman, M. (2016). Is the value addition in services and manufacturing complementary? Empirical evidence from SAARC. *The Lahore Journal of Economics*, 21(2), 31-52. <https://doi.org/10.35536/lje.2016.v21.i2.a2>
- Helpman, E. (2016). Globalization and wage inequality. *National Bureau of Economic Research Working Paper No. 22944*. <https://doi.org/10.3386/w22944>
- Husain, F., Qasim, M. A., & Khalid, M. (2010). The relationship between federal government revenues and expenditures in Pakistan. *The Pakistan Development Review*, 49(4), 641-649. <https://doi.org/10.30541/v49i4iipp.641-649>
- Ilzetzi, E., Mendoza, E. G., & Végh, C. A. (2013). How big (small?) are fiscal multipliers? *Journal of Monetary Economics*, 60(2), 239-254. <https://doi.org/10.1016/j.jmoneco.2012.10.011>
- Imtiaz, S., Ali, A., Khan, Z., Ullah, M., Khan, M., & Jacquemod, J. (2020). Determinants of youth unemployment in Pakistan. *International Journal of Economics and Financial Issues*, 10(5), 171-177. <https://doi.org/10.32479/ijefi.10386>
- Koenker, R., & Bassett, G. (1978). Regression quantiles. *Econometrica*, 46(1), 33-50. <https://doi.org/10.2307/1913643>
- Landmesser, J. (2011). The impact of vocational training on the unemployment duration. *International Advances in Economic Research*, 17(1), 89-100. <https://doi.org/10.1007/s11294-010-9291-y>
- Minhaj, N., & Imran, M. (2021). Impact of population growth and unemployment on Pakistan economy. *RADS Journal of Business Management*, 3(2), 194-200. <https://doi.org/10.37962/jbm.v3i2.78>
- Nazir, R., Anwar, M., Irshad, M., & Shoukat, A. (2013). Does fiscal policy matters for growth? Empirical evidence from Pakistan. *International Journal of Economics and Finance*, 5(3). <https://doi.org/10.5539/ijef.v5n3p205>
- Pakistan Institute of Development Economics (PIDE). (2023). *What's your degree worth? Return to education, employability, and upskilling workforce in Pakistan* (PIDE Knowledge Brief No. 101). <https://pide.org.pk/research/whats-your-degree-worth-return-to-education-employability-and-upskilling-workforce-in-pakistan-2/>

- Parker, J. A. (2016). Fiscal multipliers. In J. B. Taylor & H. Uhlig (Eds.), *Handbook of macroeconomics* (Vol. 2, pp. 2417-2492). Elsevier. <https://doi.org/10.1016/bs.hesmac.2016.06.006>
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879-891. <https://doi.org/10.3758/brm.40.3.879>
- Pyatt, G., & Becker, G. S. (1966). Econometric models of education. *The Economic Journal*, 76(303), 635-636. <https://doi.org/10.2307/2229541>
- Ramsey, J. B. (1969). Tests for specification errors in classical linear least-squares regression analysis. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, 31(2), 350-371. <https://doi.org/10.1111/j.2517-6161.1969.tb00796.x>
- Rasool Khan, U. (2013). Relationship between fluctuated exports and economic growth of Pakistan. *International Journal of Business and Management*, 8(21). <https://doi.org/10.5539/ijbm.v8n21p108>
- Siddiqui, K., Hameed, A., Akbar, S., & Khan, M. M. (2019). An investigation into effectiveness of technical and vocational education in Pakistan. *Review of Economics and Development Studies*, 5(2), 261-268. <https://doi.org/10.26710/reads.v5i2.599>
- Stock, J. H., & Watson, M. W. (2020). *Introduction to econometrics* (4th ed.). Pearson.
- Turi, F., & Khan, M. B. (2021). Higher education and economic growth: An empirical study of Pakistan. *Pakistan Journal of Educational Research*, 4(2). <https://doi.org/10.52337/pjer.v4i2.420>
- Ullah, S., Ullah, A., & Zaib, M. (2024). Assessing the demand for skill-based education in Pakistan: Insights from Google Trends data. *Pedagogy and Psychology of Sport*, 27, 66462.
- Wooldridge, J. M. (2016). *Introductory econometrics: A modern approach* (6th ed.). Cengage Learning.
- World Bank. (2002). *India - Karnataka: Secondary education and the new agenda for economic growth*. World Bank. <https://doi.org/10.1596/15408>
- World Bank. (2018). *World development report 2019: The changing nature of work*. World Bank. <https://doi.org/10.1596/978-1-4648-1328-3>