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Article

Labor Market Absorptive Capacity and the Employment Effects of Education Across Development Stages

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Abstract: This study examines how labor market absorptive capacity shapes the relationship between education and employment across stages of economic development in developing economies. Rather than assuming a uniform relationship, the study argues that the employment effects of education depend on the economy's ability to absorb educated labor through structural transformation and demand for skilled workers. The analysis distinguishes between lower-middle-income and upper-middle-income countries during the period 2000–2024. A dynamic Panel ARDL framework is employed to estimate short-run and long-run relationships, while the Lind–Mehlum test is used to examine nonlinearities and educational thresholds. The findings reveal significant heterogeneity across development stages. In lower-middle-income countries, the relationship between education and employment follows an inverted U-shape, suggesting that the employment gains from educational expansion decline beyond a certain threshold due to limited absorptive capacity and weak structural transformation. In upper-middle-income countries, education continues to exert a positive effect on employment, although with diminishing marginal returns and without strong evidence of a statistically significant threshold. The study concludes that the employment impact of education depends largely on the structural capacity of economies to create skilled employment opportunities, emphasizing the need to align educational expansion with labor market development and structural transformation.

Keywords: Human Capital, Labor Market Absorptive Capacity, Employment, Structural Transformation, Development Stages.

1. Introduction

Education is widely recognized as a key driver of economic growth and labor market outcomes, as it enhances productivity and expands employment opportunities. However, empirical evidence—particularly in developing economies—remains mixed. While some studies report positive effects, others document diminishing or even weak returns at higher levels of education, suggesting that the impact of education depends on factors beyond human capital accumulation.

One important explanation lies in differences in economic structure and labor market absorptive capacity. In early-stage economies, limited demand for skilled labor constrains the translation of education into employment, whereas more advanced economies benefit from more diversified production structures that better utilize human capital, albeit with diminishing marginal returns.

Building on this perspective, this study develops a theoretically grounded framework that links education to employment through labor market absorptive capacity and allows for potential nonlinearities, including the existence of an educational threshold. Despite growing recognition of these mechanisms, much of the empirical literature treats developing countries as homogeneous and rarely tests for nonlinear effects across different stages of development.

To address this gap, the study examines the education–employment relationship across lower-middle- and upper-middle-income countries, explicitly accounting for differences in absorptive capacity and potential threshold effects. Using panel data for the period 2000–2024, it applies a Panel ARDL model along with the Lind–Mehlum test

to assess whether the impact of education varies across income groups and whether a statistically significant threshold exists.

This study contributes to the literature in several important ways. First, it develops a unified development-stage framework that explains why the employment effects of education differ systematically across developing economies. Rather than treating the education–employment relationship as homogeneous, the study conceptualizes labor market absorptive capacity as a structural mechanism conditioning the transmission of human capital into employment outcomes.

Second, the study extends the literature by linking nonlinear employment returns to education with differences in structural transformation, technological upgrading, and labor market absorption across development stages. In doing so, it provides a coherent explanation for the mixed empirical evidence reported in previous studies regarding the employment effects of educational expansion.

Third, the study contributes methodologically by combining a dynamic Panel ARDL framework with a nonlinear specification and the Lind–Mehlum test to distinguish between genuine threshold effects and simple diminishing marginal returns across income groups.

Finally, the study provides policy-relevant insights by showing that expanding education alone is insufficient to generate sustainable employment gains unless accompanied by structural transformation capable of absorbing educated labor.

The remainder of the paper is structured as follows. Section Two presents the literature review and theoretical framework. Section Three describes the data and econometric methodology. Section Four discusses the empirical results. Section Five concludes with key findings and policy implications.

2. Literature Review and Theoretical Framework

The relationship between education and employment is traditionally grounded in Human Capital Theory, which posits that education enhances workers' productivity, increases employability, and improves labor market outcomes (Schultz, 1961; Becker, 1964; Blanchard & Summers, 1986). Within this framework, educational expansion is expected to contribute positively to employment by increasing the stock of productive human capital. However, this perspective implicitly assumes that labor markets are capable of efficiently absorbing the growing supply of educated labor. In practice, this assumption is often difficult to sustain in developing economies characterized by structural rigidities, weak industrial transformation, and institutional constraints (World Bank, 2019; Montenegro & Patrinos, 2021).

As a result, the relationship between education and employment cannot be understood solely through the accumulation of human capital. The employment effect of education depends critically on the structural characteristics of the economy and its ability to generate productive demand for skilled labor. This implies that the returns to education are conditioned by labor market absorptive capacity, which reflects the economy's ability to transform human capital accumulation into productive employment opportunities through structural transformation, technological adaptation, institutional efficiency, and the expansion of modern economic activities.

Despite the central role assigned to education in development theory, the expansion of educational attainment does not automatically generate proportional employment gains. In many developing economies, the supply of educated labor has expanded more rapidly than the structural transformation of the economy itself. Consequently, labor markets may fail to generate sufficient demand for skilled workers, leading to graduate unemployment, underemployment, skill mismatch, and declining employment returns to education (Pritchett, 2001; McGuinness, 2006).

This problem becomes particularly important in economies undergoing incomplete structural transformation. In lower-middle-income countries, economic activity remains concentrated in low-productivity sectors characterized by limited technological intensity and weak demand for skilled labor (ILO, 2019; Chenery, 1960). Under such conditions, educational expansion may initially improve employment opportunities by raising basic productivity and employability. However, beyond a certain level, the marginal employment effect of education may weaken as the supply of educated labor expands faster than the economy's absorptive capacity.

By contrast, upper-middle-income countries tend to exhibit more diversified production systems, greater technological upgrading, and a larger share of modern industrial and service sectors. These structural characteristics increase the economy's ability to absorb educated labor and sustain positive employment returns to education,

although diminishing marginal returns may still emerge due to technological selectivity, changing skill requirements, and increasing complexity in labor demand.

This interpretation can be further understood through the interaction between Structural Transformation Theory and Skill-Biased Technological Change. Structural transformation reallocates labor and resources from traditional low-productivity activities toward more productive industrial and modern service sectors (Lewis, 1954; Kuznets, 1973). At the same time, technological progress increasingly favors skilled and non-routine labor, thereby altering the composition of labor demand (Card & DiNardo, 2002; Goos et al., 2014). Consequently, the employment returns to education increasingly depend not only on educational attainment itself, but also on the capacity of the economy to generate skill-intensive employment opportunities.

Within this context, absorptive capacity emerges as the central transmission mechanism linking education to employment across development stages. Importantly, absorptive capacity is not treated as a fixed or purely abstract concept. Rather, it evolves with economic development itself. As economies industrialize, diversify production, improve institutions, and adopt more advanced technologies, their ability to absorb educated labor increases. Accordingly, heterogeneity in the education–employment relationship reflects differences in development stages and structural absorptive capacity rather than merely statistical variation across country groups.

The core theoretical proposition of this study is therefore that the employment effect of education varies systematically across stages of development because labor markets differ in their capacity to absorb human capital. Lower-middle-income economies are expected to exhibit stronger nonlinearities and threshold effects because educational expansion tends to outpace structural transformation and skilled labor demand. In contrast, upper-middle-income economies are expected to maintain positive employment returns to education, although with diminishing marginal effects reflecting more advanced but still imperfect absorptive capacity.

Empirical evidence supports this interpretation. While several studies find positive employment effects of education, others report diminishing or weak returns at higher levels of educational attainment, particularly in economies characterized by structural constraints and labor market mismatch (Pritchett, 2001; Hanushek & Woessmann, 2007; Montenegro & Patrinos, 2022). Evidence of nonlinearities and threshold effects has also been documented in the literature (Freeman, 1976; Psacharopoulos & Patrinos, 2018; Clark & Nilsen, 2025). However, much of the existing empirical literature treats developing countries as relatively homogeneous, without sufficiently accounting for differences in absorptive capacity across development stages.

The relationship between education and employment can therefore be conceptualized as a multi-path process shaped by absorptive capacity, as illustrated in Figure 1.

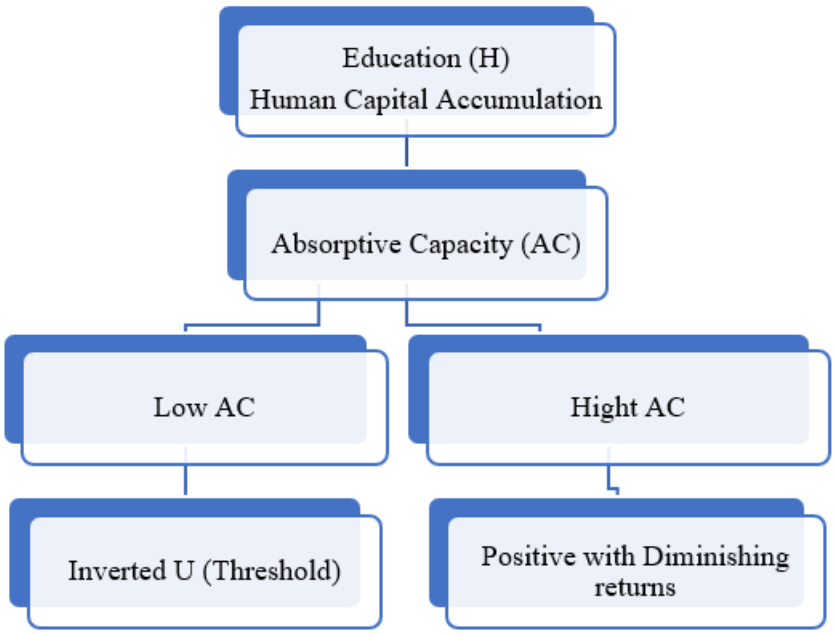

Figure 1. Theoretical Framework of the Education–Employment Relationship

Source: Author's elaboration based on the theoretical framework

To formalize these mechanisms, the economy is conceptualized as consisting of a traditional low-productivity sector and a modern high-productivity sector. The demand for skilled labor depends jointly on human capital, structural transformation, and technology (Acemoglu & Autor, 2011). Unlike conventional linear approaches, this study explicitly integrates absorptive capacity into the theoretical framework to derive nonlinear predictions across development stages.

Accordingly, the demand for skilled labor is specified as:

$$L_s^d = A.S^{\alpha}.H^{\beta} \quad , \alpha, \beta > 0 \quad \ldots\ldots\ldots (1)$$

where A represents technology, S structural transformation, and H human capital. This specification captures the interaction between technological development, economic structure, and human capital accumulation in shaping labor demand.

On the supply side:

$$L_s^s = \gamma H, \gamma{>}0 \qquad \ldots\ldots(2)$$

Equilibrium requires:

$$L_S^D = L_S^S \qquad \ldots\ldots(3)$$

This equilibrium condition implies that employment outcomes depend not only on the supply of education but also on the structural capacity of the economy to generate demand for skilled labor (Pissarides, 2000). In economies characterized by weak structural transformation and limited technological progress, labor demand may not expand sufficiently to absorb the increasing supply of educated workers, resulting in declining employment returns beyond certain educational levels (World Bank**,** 2018b; Goos et al., 2014).

Accordingly, the marginal effect of education on employment is expected to vary with absorptive capacity rather than remain constant. This provides the theoretical basis for expecting nonlinearities and threshold effects in the education–employment relationship (Harmon et al., 2003; Trostel, 2005; ILO, 2019). Therefore, the following quadratic specification is employed as a reduced-form approximation of the equilibrium relationship derived above:

$$L=\beta 0+\beta 1H+\beta 2H^2+\varepsilon \qquad \ldots\ldots(4)$$

where $\beta 1 > 0$ and $\beta 2 < 0$ indicate diminishing marginal employment returns to education and the potential existence of an educational threshold.

In lower-middle-income countries, limited absorptive capacity is expected to generate an inverted U-shaped relationship between education and employment, with an internal turning point located within the observed range of education. In upper-middle-income countries, education is expected to maintain a positive effect on employment, although with diminishing marginal returns due to increasing skill selectivity and structural adjustment pressures. (Pissarides, 2000; Leuven & Oosterbeek, 2011; OECD, 2017)

Based on this framework, the hypotheses are formulated as follows:

H1: In lower-middle-income countries, the relationship between education and employment follows an inverted U-shape, reflecting limited absorptive capacity and the presence of an educational threshold.

H2: In upper-middle-income countries, education maintains a positive effect on employment with diminishing marginal returns, without a statistically significant internal turning point.

These hypotheses emerge directly from the theoretical framework linking human capital accumulation, structural transformation, technological change, and absorptive capacity across development stages.

3. Data, Model Specification, and Econometric Methodology

3.1 Empirical Framework and Model Specification

Building on the mixed empirical evidence regarding the relationship between education and employment, as well as the theoretical arguments emphasizing variation across stages of economic development, this study adopts a dynamic panel data approach to examine how labor market absorptive capacity shapes the impact of education on employment across income groups.

In particular, the analysis focuses on a comparison between lower-middle-income and upper-middle-income countries, where differences are expected in labor market absorptive capacity, the returns to education, and the likelihood of reaching a critical level of education that influences the nature of the education–employment relationship.

In this study, labor market absorptive capacity is not treated as a directly observable single variable, but rather as a structural economic mechanism indirectly reflected through differences in economic structure, institutional quality, development stage, and the economy's ability to generate productive demand for educated labor.

To capture threshold effects that reflect the limits of labor market absorptive capacity in the education–employment relationship, the empirical model incorporates a quadratic specification of the educational attainment variable. This approach allows the marginal effect of education on employment to vary with the level of education, while also providing a direct test of the hypothesis of an educational turning point suggested by the theoretical framework. Accordingly, the long-run relationship in the baseline model, distinguishing between the main explanatory variables and control variables, can be specified as follows:

$$y_{it} = \alpha + \underbrace{\beta_1 Edu_{it} + \beta_2 Edu_{it}^2}_{\textit{Main explanatory variables}} + \underbrace{\beta_3 GDPg_{it} + \beta_4 Popg_{it} + \beta_5 Inst_{it} + \beta_6 Str_{it}}_{\textit{Control variables}} + \mu_i + \lambda_t + \varepsilon_{it}$$

This specification allows for the identification of an educational threshold that reflects the limits of labor markets' capacity to absorb human capital.

For ease of presentation, the equation can be expressed in a compact form as follows:

$$y_{it} = \alpha + \beta_1 x1_{it} + \beta_2 x2_{it}^2 + \beta_3 x3_{it} + \beta_4 x4_{it} + \beta_5 x5_{it} + \beta_6 x6_{it} + \mu_i + \lambda_i + \varepsilon_{it}$$

where the x-variables correspond respectively to the variables defined above

Country-specific fixed effects μ_i control for unobserved, time-invariant heterogeneity, while common time effects λ_t capture global shocks affecting all countries. The error term ε_{it} represents idiosyncratic disturbances.

Consistent with the theoretical framework and the research hypotheses, the coefficient on educational attainment β_1 is expected to be positive, while the coefficient on its squared term β_2 is expected to be negative, indicating diminishing marginal employment returns to education beyond a certain level. No a priori sign restrictions are imposed on the remaining control variables, as they are included primarily to capture cross-country differences rather than to test specific theoretical predictions. The variables used in this study are defined in Table (1).

Table 1: Definition of Variables

Variable	Definition	Measurement	Source	Justification
Employment (Y)	Employment to population ratio (15+, total)	% of population aged 15+	ILO (modeled estimate)	Captures overall labor absorption
Education (H)	Mean years of schooling	Average years	Global Data Lab	Proxy for human capital stock
Education²	Square of mean years of schooling	Years²	Calculated	Captures nonlinearity (threshold effect)
GDP Growth	Annual GDP growth rate	%	World Bank (WDI)	Reflects economic dynamism
Population Growth	Annual population growth	%	World Bank (WDI)	Captures demographic pressure

Institutional Quality	Composite index (WGI average)	Index	World Bank (WGI)	Reflects governance and efficiency
Economic Structure	Industry value added (% of GDP)	%	World Bank (WDI)	Proxy for absorptive capacity

Source: Author's Preparations

3.2 Identification of the Educational Threshold

Building on the nonlinear specification derived in the theoretical framework, the education–employment relationship is empirically modeled using a quadratic form. When the estimated coefficients satisfy $\beta_1 > 0$ and $\beta_2 < 0$, the relationship follows an inverted U-shape.

The corresponding turning point—referred to as the educational threshold—is calculated as:

$$\tau = -\frac{\beta_1}{2\beta_2}$$

This threshold represents the level of education at which employment reaches its maximum within the observed data range. Beyond this point, further increases in education are associated with diminishing marginal employment returns.

The use of the quadratic specification provides a tractable and widely adopted approach for testing nonlinear relationships and identifying turning points in empirical analysis. This method has been extensively applied in the literature on threshold effects (Hansen, 1999) and is commonly used in applied econometric studies (Kaplan, 2023).

3.3 Econometric Strategy

Given the dynamic nature of labor market adjustment and the relatively long-time span of the dataset, this study employs the Panel Autoregressive Distributed Lag (Panel ARDL) model to estimate both the short-run and long-run relationships between education and employment. This model is appropriate when variables are integrated of different orders, I(0) and I(1), provided that none of the variables is integrated of order two.

The Panel ARDL framework allows for a distinction between short-run dynamics and long-run structural relationships, while permitting heterogeneity in short-run coefficients across countries and imposing homogeneity on long-run coefficients. This assumption is particularly suitable in comparative studies involving countries that differ in institutional characteristics and adjustment speeds.

The study does not aim to establish strict causal identification in the experimental sense, but rather to examine long-run structural relationships across development stages under dynamic adjustment conditions. In this context, the Panel ARDL framework is particularly appropriate because it explicitly separates short-run dynamics from long-run equilibrium relationships, incorporates lag structures that mitigate simultaneity bias, and allows the analysis of persistent adjustment processes across heterogeneous economies (Pesaran et al., 2001).

Moreover, the relationship between education, employment, structural transformation, and institutional quality is inherently dynamic and mutually interconnected in developing economies. Rather than assuming isolated one-directional causality, the study conceptualizes these variables as components of a broader structural transition process in which labor market absorptive capacity conditions the long-run transmission of human capital into employment outcomes. Accordingly, the empirical analysis focuses on identifying stable long-run relationships and heterogeneous adjustment patterns across development stages rather than estimating short-run contemporaneous causal effects alone.

The Pooled Mean Group (PMG) estimator is employed due to its flexibility in allowing heterogeneous short-run dynamics while maintaining a common long-run relationship across countries. This framework also enables an analysis of how the relationship between education and employment is influenced by differences in economies' absorptive capacity for human capital.

To ensure the validity of the estimation, panel unit root tests were conducted to determine the order of integration of the variables, followed by panel cointegration tests to verify the existence of a long-run equilibrium relationship. Based on the results of these tests, the Panel ARDL model was adopted to estimate the empirical model and to analyze both the short-run effects and the long-run relationships among the variables. This approach is particularly suitable for the objectives of the study because it allows the identification of heterogeneous long-run employment responses to education across development stages while accounting for differences in economies' absorptive capacity and adjustment dynamics.

3.4 Data and Sample Description

The empirical analysis is based on a balanced panel dataset comprising 60 developing countries over the period 2000–2024. The sample exhibits substantial variation in income levels, institutional quality, and sectoral structures, which is essential for analyzing differences in labor market absorptive capacity across countries.

To improve external validity and capture variation in absorptive capacity across development stages, the sample includes countries from Asia, Africa, the Middle East, and Latin America, thereby capturing a wide range of developmental contexts and labor market characteristics. Countries are classified into lower-middle-income and upper-middle-income groups based on the World Bank's classification, reflecting differences in economic structure and labor market absorptive capacity.

All variables used in this study were obtained from the World Development Indicators (WDI) database published by the World Bank, which provides consistent and internationally comparable economic and social statistics across countries and over time (World Bank, 2025a). The only exceptions are the institutional quality variable, which is measured using the Worldwide Governance Indicators (WGI) compiled by the World Bank (World Bank, 2025b), and the educational attainment variable, which is obtained from Global Data Lab (Global Data Lab, 2025). The variables are defined consistently to ensure comparability and to allow an indirect assessment of labor market absorptive capacity through structural and institutional indicators.

Missing values were estimated using linear interpolation methods, which is a commonly applied approach in panel data analysis to preserve sample size and ensure the robustness of econometric estimation.

Table 2: Countries Covered

Upper-middle-income countries (UMICs) (between US$4,496 and US$13,935):	China, Indonesia, Thailand, Malaysia, Mongolia, Kazakhstan, Azerbaijan, Armenia, Georgia, Iraq, Iran, Ukraine, Bosnia and Herzegovina, Albania, Serbia, North Macedonia, Belarus, Moldova, South Africa, Botswana, Gabon, Brazil, Mexico, Colombia, Peru, Ecuador, Dominican Republic, Paraguay, Algeria, Guatemala
Low-middle-income countries (LMICs) (between $1,136 and $4,495):	Bangladesh, Benin, Bolivia, Cambodia, Cameroon, Cote d'Ivoire, Egypt, Ghana, Honduras, India, Jordan, Kenya, Kyrgyz Republic, Lao PDR, Morocco, Myanmar, Nepal, Nicaragua, Nigeria, Pakistan, Philippines, Senegal, Sri Lanka, Tajikistan, Tanzania, Tunisia, Uzbekistan, Vietnam, Zambia, Zimbabwe.

Source: Author's Preparations

4. Empirical Results and Analysis

4.1 Preliminary Diagnostics

This section examines whether a long-run equilibrium relationship exists among the variables and evaluates the dynamic impact of education on employment in the context of labor market absorptive capacity. It also tests the educational threshold hypothesis, which reflects limits in labor market absorptive capacity across development stages. The estimation begins with a set of diagnostic tests, including unit root and cointegration analyses, to ensure the validity of long-run relationships within structurally heterogeneous economies. Model coefficients are then estimated separately for upper-middle- and lower-middle-income countries to capture differences in absorptive capacity across country groups. The results are expected to reveal variations in employment responses that reflect differences in labor market absorptive capacity and structural transformation across income groups.

4.1.1 Descriptive Statistics for UMIC and LMIC

The descriptive results reveal notable differences between upper- and lower-middle-income countries in both educational attainment and labor-market structure. Table (3) indicates the descriptive statistics for both groups. Average schooling in UMICs -around nine years- is substantially higher than in LMICs, where it averages about six years, reflecting greater human-capital accumulation and a shift toward a more skilled labor force. The employment ratio is relatively similar across the two groups, although the higher standard deviation in LMICs (about 13.33) indicates greater heterogeneity and uneven labor-absorption capacity. The squared term of schooling exhibits wider variation in LMICs, suggesting disparities in education quality and potential nonlinear effects of human capital on employment. Overall, the statistics confirm that while UMICs display higher educational homogeneity and institutional maturity, LMICs remain more diverse—supporting the hypothesis that the education–employment relationship is nonlinear and possibly threshold-dependent across development stages.

Table 3: Descriptive Statistics for LMIC and UMIC

	LMIC		UMIC	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Y	58.13	13.33	54.50	10.63
X1	6.56	2.53	9.01	1.97
X2	49.41	36.32	85.07	35.23
X3	4.80	3.61	4.02	4.45
X4	1.84	0.84	0.77	1.10
X5	-0.65	0.41	-0.37	0.45
X6	25.99	6.06	32.54	10.05

Source: Authors' Calculations

The employment rate (Y), however, appears to be slightly higher in LMICs, which may reflect the prevalence of low-productivity or informal employment. In contrast, UMICs exhibit a higher level of structural transformation (X6), as indicated by a greater share of industry in GDP compared to LMICs. Population growth (X4) is also higher in lower-income countries, while institutional quality (X5) tends to be relatively better in higher-income economies.

Overall, these statistics highlight structural differences between the two groups in terms of education, demographic characteristics, and economic structure, thereby justifying the need to analyze the education–employment relationship separately for each group of countries.

4.1.2 Panel Unit Root Tests

To ensure the validity of the econometric specification, panel unit root tests were conducted to determine the order of integration of the variables. The Im–Pesaran–Shin (IPS) test was employed due to its suitability for heterogeneous panel datasets.

Table 4: Panel Unit Root Tests and Order of Integration

Variable	**Y**	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**
LMIC	I(1)	I(1)	I(1)	I(0)	I(1)	I(0)	I(1)
UMIC	I(1)	I(1)	I(1)	I(0)	I(1)	I(0)	I(1)

Source: Authors' Calculations

The results of the unit root tests reported in Table (4) indicate that the study variables are integrated at different orders. Specifically, the variables of employment, education and its square, population growth, and economic structure become stationary after first differencing, i.e., they are integrated of order I(1). In contrast, economic growth and institutional quality are found to be stationary at level, i.e., integrated of order I(0), thereby satisfying one of the key conditions for applying the Panel ARDL (PMG) model to estimate both short-run and long-run relationships.

4.1.3 Cointegration Test:

To examine whether a long-run equilibrium relationship exists among the variables, the Pedroni panel cointegration test was employed. The results reported in Table (5) reveal clear differences between the two income groups.

Table 5: Panel Cointegration Tests for LMIC and UMIC

Test	Statistic (LMIC)	Prob.	Statistic (UMIC)	Prob.	Conclusion
Pedroni Panel ADF	-1.9576	0.0251	-3.5591	0.0002	Cointegration
Johansen Fisher (Trace)	1542.0	0.0000	1419.0	0.0000	Strong cointegration

Source: Authors' Calculations

The results of the cointegration tests indicate the existence of a long-run equilibrium relationship among the variables in both groups of countries. The Pedroni Panel ADF test shows statistical significance for both groups, allowing the rejection of the null hypothesis of no cointegration.

Overall, the consistency between the Pedroni and Johansen test results provides sufficient evidence of a long-run relationship among the variables, thereby justifying the use of the Panel ARDL (PMG) model for estimation.

4.1.4 Heteroskedasticity Test (Breusch–Pagan)

This section presents the results of heteroskedasticity tests applied to the long-run ARDL models for both income groups. As shown in Table (6), the Breusch–Pagan yield probability values well below the conventional significance level ($\alpha = 0.05$), leading to the rejection of the null hypothesis of homoskedasticity and confirming the presence of heteroskedasticity in both models.

To ensure the validity of statistical inference, robust standard errors were employed, including heteroskedasticity-consistent (HC1) standard errors and country-clustered standard errors, to address both heteroskedasticity and within-country correlation.

Table 6: Heteroskedasticity Test

Test Component	LMIC	UMIC
Test Type	Breusch–Pagan	Breusch–Pagan
LM Statistic	77.40	60.26
p-value	0.0000	0.0000
Decision ($\alpha = 0.05$)	Reject H_0	Reject H_0
Conclusion	Presence of Heteroskedasticity	Presence of Heteroskedasticity

Source: Authors' Calculations

The Breusch–Pagan test confirms the presence of heteroskedasticity in both income groups, reflecting structural differences across countries. To ensure valid statistical inference, robust standard errors were employed.

4.1.5 Multicollinearity Test (Variance Inflation Factor – VIF)

This test aims to verify whether a high degree of linear association exists among the explanatory variables in the long-run ARDL models for both income groups. Detecting multicollinearity is crucial to ensure the stability and reliability of the estimated coefficients.

Table 7: Multicollinearity (VIF)

Variable	VIF (LMIC)	VIF (UMIC)
Education (X1)	29.60	69.53
Education² (X2)	28.29	68.79

GDP growth (X3)	1.03	1.07
Population growth (X4)	1.05	1.99
Institutional quality (X5)	1.05	1.40
Economic structure (X6)	1.26	2.07

Source: Authors' Calculations

The results reported in Table (7) indicate that the VIF values for the control variables are relatively low, ranging between 1 and 2 in both lower-middle-income countries (LMICs) and upper-middle-income countries (UMICs). This suggests the absence of serious multicollinearity among these variables, and that they provide relatively independent explanatory information.

In contrast, high VIF values are observed for the education variable (X1) and its square (X2), which is expected and arises from structural multicollinearity associated with including a variable and its squared term in a nonlinear specification. This reflects the anticipated structural multicollinearity in quadratic models and does not affect the validity of the model or the interpretation of its results. Accordingly, these values do not indicate a genuine econometric problem but rather reflect the nature of the quadratic specification used to test for nonlinearity and the existence of an educational threshold.

Overall, the results confirm that multicollinearity in the model is limited and does not affect the stability of the estimates or the interpretation of the findings, thereby justifying the inclusion of both education and its squared term in the model.

4.2 Long-run and Short-run ARDL Estimation Results:

To analyze the dynamic relationship between education and employment in middle-income countries, the study applies the ARDL model, which simultaneously captures short-run adjustments and long-run equilibrium effects, showing how education and related variables shape employment across development stages. Table (8) reported the results of the estimated ARDL model.

Table 8: Long-Run Estimation Results for LMIC and UMIC

	LMIC		**UMIC**	
Variable	**Coef.**	**Prob.**	**Coef.**	**Prob.**
X1	10.729	0.0000	5.530	0.0113
X2	-1.084	0.0000	-0.177	0.1326
X3	1.068	0.0000	0.888	0.0000
X4	1.799	0.0026	-0.219	0.6747
X5	-6.965	0.0000	4.169	0.0029
X6	0.106	0.1098	0.082	0.1521
Short-Run Estimation Results for LMIC and UMIC				
Variable	**Coef.**	**Prob.**	**Coef.**	**Prob.**
ECM	-0.0769	0.0001	-0.1995	0.0000
D(X1)	39.585	0.4087	-29.326	0.1895
D(X2)	-1.623	0.4470	1.116	0.3109
D(X3)	0.0296	0.2377	-0.0445	0.0239
D(X4)	0.6399	0.5587	0.6405	0.3677
D(X5)	1.1665	0.0953	-2.4650	0.0288
D(X6)	0.0074	0.8562	-0.0577	0.3420
C	2.049	0.0006	3.271	0.0000

Source: Authors' Calculations

The error correction term (ECM) reflects the speed at which the system returns to its long-run equilibrium following a short-run shock. The coefficient is negative and statistically significant in both groups, confirming the existence of a long-run equilibrium relationship among the variables and supporting the validity of using the Panel ARDL model (Pesaran et al., 2001).

In lower-middle-income countries (LMICs), the error correction coefficient is −0.0769, indicating that approximately 7.7% of the disequilibrium is corrected within one period, reflecting a relatively slow speed of adjustment. In contrast, in upper-middle-income countries (UMICs), the coefficient reaches −0.1995, suggesting a faster return to equilibrium. This result implies that higher-income economies possess greater absorptive capacity, enabling them to absorb economic shocks and adjust more efficiently. This finding is consistent with the literature linking the quality of economic and institutional structures to the speed of adjustment (World Bank, 2019).

The long-run results reveal clear differences between the two income groups in the nature of the relationship between education and employment. In LMICs, the coefficient of education is positive and statistically significant, while the coefficient of its square is negative and significant, indicating a nonlinear inverted U-shaped relationship. This pattern is consistent with the hypothesis that limited labor market absorptive capacity constrains the long-run employment returns to educational expansion. This interpretation is consistent with empirical studies reporting weak or declining employment returns to education in economies characterized by structural labor market imbalances.

In contrast, in upper-middle-income countries (UMICs), the coefficient of education remains positive and statistically significant, while the quadratic term is not significant, and the turning point lies outside the sample range. This suggests that the relationship is better characterized as positive with diminishing marginal returns rather than a fully developed nonlinear relationship. This reflects a relatively higher absorptive capacity, as these economies tend to have more diversified production structures and a greater ability to absorb educated labor within modern industrial and service sectors. Nevertheless, the presence of diminishing marginal returns indicates that the continued positive impact of education increasingly depends on the quality of education and the alignment of skills with labor market requirements, as emphasized in the literature on skill-biased technological change and structural shifts in labor demand.

Regarding the control variables, the results indicate that economic growth exerts a positive and statistically significant effect on employment in both income groups, although the underlying mechanisms differ across stages of development. In lower-middle-income countries (LMICs), this effect reflects the dominance of labor-intensive sectors, where economic expansion translates more directly into job creation (Nallari & Griffith, 2011). In contrast, in upper-middle-income countries (UMICs), employment dynamics increasingly reflect structural transformation toward more capital- and technology-intensive production systems, where growth tends to generate qualitative rather than quantitative changes in employment (Su & Yao, 2016; Pahl et al., 2022).

Population growth exhibits a positive effect in LMICs, consistent with the expansion of low-productivity and informal activities, and in line with the demographic dividend hypothesis, which suggests that a growing working-age population can contribute to higher employment under appropriate economic conditions (Bloom & Freeman, 1986). However, its effect is not significant in UMICs, indicating that the role of demographic dynamics diminishes as economies become more structurally advanced.

Institutional quality displays contrasting effects across the two groups. In LMICs, weaker governance frameworks and limited administrative capacity constrain the ability of institutional improvements to translate into employment gains. In contrast, in UMICs, stronger institutional environments enhance market efficiency, support investment, and facilitate job creation, consistent with evidence emphasizing the role of governance quality in shaping labor market outcomes (World Bank, 2018a).

Finally, the economic structure variable does not exhibit a statistically significant effect in either group. This result may reflect limitations associated with measuring structural transformation solely through the industrial share, as this indicator may not fully capture the complexity of sectoral dynamics or the economy's capacity to absorb skilled labor. This finding is consistent with studies suggesting that the employment effects of structural change depend not only on sectoral composition but also on the nature of technological change and the demand for skills within sectors (McMillan & Rodrik, 2011; UNIDO, 2024; Hamilton & de Vries, 2025).

4.3 Educational Thresholds Across Development Stages

The Lind–Mehlum test is used to verify the presence of a nonlinear inverted U-shaped relationship within the actual data range (Lind & Mehlum, 2007). The test evaluates whether the slope is positive at the lower bound and negative at the upper bound, and whether the turning point lies within the sample.

Table 9: Lind–Mehlum U-Test

Test component	LMIC	UMIC

Linear term β1	10.729	5.530
Squared term β2	-1.084	-0.177
Significance of β1	0.0000	0.0113
Significance of β2	0.0000	0.1326
Minimum value of education in sample	1.380	3.653
Maximum value of education in sample	11.960	13.340
Slope at minimum value	7.738	4.239
Slope at maximum value	-15.196	0.814
Turning point	4.951	15.644
Turning point within observed range	Yes	No
Implied shape	Inverted U-shape	Positive concave / not inverted U
Lind–Mehlum assessment	Supported	Not supported

Source: Authors' Calculations

The results of the Lind–Mehlum test reported in Table (9) reveal a clear divergence between the two income groups in the nature of the long-run relationship between education and employment. In the lower-middle-income group (LMICs), the inverted U-shaped relationship is clearly supported. The coefficient of the linear education term is positive and statistically significant, while the coefficient of the quadratic term is negative and significant. Moreover, the slope of the relationship is positive at the lower bound of education and negative at the upper bound, and the estimated turning point—approximately 4.95 years of schooling—lies within the sample range. This confirms that the nonlinear relationship identified in the baseline ARDL estimation reflects a genuine internal threshold rather than a simple statistical curvature.

In contrast, the results for the upper-middle-income group (UMICs) do not support the existence of an inverted U-shaped relationship in the strict sense. Although the quadratic term carries the expected negative sign, it is not statistically significant. Additionally, the slope remains positive at both the lower and upper bounds of education, while the estimated turning point—approximately 15.64 years of schooling—lies outside the observed sample range. Therefore, the relationship in this group appears to be positive with diminishing marginal returns, but it does not meet the criteria for confirming an inverted U-shape under the Lind–Mehlum test.

From an economic perspective, these findings suggest that employment returns to education in LMICs increase at early stages but begin to decline after surpassing a certain threshold (educational turning point), reflecting the limited capacity of labor markets to absorb human capital. In contrast, UMICs maintain positive employment returns to education, although these returns diminish at the margin, indicating relatively higher—but not unlimited—absorptive capacity.

These patterns imply that, while expanding education remains important in LMICs, it should be accompanied by structural transformation of the economy. In UMICs, policies should increasingly focus on improving skill quality and enhancing the alignment between educational outcomes and labor market requirements.

Overall, the findings suggest that the education–employment relationship evolves across development stages. In earlier stages of development, employment returns to education are more likely to exhibit nonlinear threshold effects due to limited absorptive capacity, whereas more advanced economies tend to maintain positive employment returns with gradually diminishing marginal effects. This interpretation is consistent with previous studies emphasizing the changing nature of employment returns to education across different stages of economic development (Hanushek & Woessmann, 2009; Psacharopoulos & Patrinos, 2018).

4.4 Robustness and Directionality Checks

The robustness and directionality checks provide additional support for the study's theoretical framework linking education to employment through labor market absorptive capacity. To further assess the temporal structure of the relationship and reduce concerns regarding simultaneity, the analysis employs both panel Granger-type directionality tests and lagged education specifications.

Table 10. Robustness and Directionality Checks

Test	UMIC	LMIC
Share of countries where education Granger-causes employment (Lag 1)	0.333	0.367
Share of countries where education Granger-causes employment (Lag 2)	0.633	0.600
Lagged Education (X1(-1))	-5.22***	3.604***
Lagged Education Squared (X2(-1))	0.317***	-0.36***
Note: *** denotes significance at the 1% level		

Source: Authors' Calculations

As reported in Table (10), the directionality assessment indicates that the predictive effect of education on employment becomes more evident when longer lag structures are considered. In both lower-middle-income countries (LMICs) and upper-middle-income countries (UMICs), the proportion of countries exhibiting statistically significant predictive effects from education to employment increases under longer lags. This finding suggests that the employment effects of educational expansion materialize gradually through dynamic structural adjustment processes rather than through immediate labor market responses.

This delayed adjustment is consistent with differences in labor market absorptive capacity across development stages. The expansion of education requires time to be translated into productive employment opportunities through gradual structural and labor market adjustment processes. Accordingly, the results support the interpretation that the education–employment relationship reflects long-run structural dynamics rather than simple contemporaneous correlations.

As an additional robustness check, the model was re-estimated using lagged educational attainment and its squared term. In lower-middle-income countries, the nonlinear relationship between education and employment remains statistically significant even after accounting for delayed labor market adjustment. The coefficient of lagged education remains positive, while the coefficient of its squared term remains negative, confirming the persistence of the inverted U-shaped relationship identified in the baseline model. This result suggests that the observed educational threshold reflects a structural characteristic of economies with limited absorptive capacity rather than a purely short-run statistical association.

In upper-middle-income countries, the lagged specification reveals more gradual and complex labor market adjustment dynamics. This finding is consistent with the notion that, as economies become more structurally advanced, the employment effects of educational expansion increasingly depend on technological upgrading, skill composition, and evolving labor market requirements. Overall, the robustness checks reinforce the main conclusion of the study that the employment effects of education are conditioned by differences in absorptive capacity across development stages.

5. Conclusions and Policy Implications

This study examined how labor market absorptive capacity conditions the employment effects of education across different stages of economic development, the study developed a development-stage framework in which the translation of human capital into employment depends fundamentally on the structural capacity of the economy to absorb educated labor.

The empirical findings reveal that the relationship between education and employment is heterogeneous across development stages. In lower-middle-income countries, the relationship follows an inverted U-shaped pattern, indicating that the employment gains associated with educational expansion diminish beyond a critical threshold. This reflects the limited absorptive capacity of economies characterized by weak structural transformation, low technological intensity, and insufficient demand for skilled labor. In contrast, upper-middle-income countries maintain

positive employment returns to education, although with diminishing marginal effects, reflecting relatively more advanced but still incomplete absorptive capacity.

These results provide a coherent explanation for the mixed findings reported in the literature. Rather than reflecting inconsistencies across studies, such variations can be understood as outcomes of differences in economic structure and development stages.

From a policy perspective, the findings carry important implications. First, they suggest that policies aimed solely at expanding access to education may not yield the expected labor market benefits in the absence of complementary economic transformations. In lower-middle-income countries, increasing educational attainment without corresponding expansion in productive, skill-intensive sectors may lead to underemployment, skill mismatch, and declining returns to education.

Second, enhancing labor market absorptive capacity should be considered a central policy objective. This requires promoting structural transformation toward higher-productivity sectors, supporting industrial development, and fostering technological upgrading. Policies that stimulate private sector growth and encourage investment in sectors capable of absorbing skilled labor are essential for translating human capital accumulation into employment gains.

Third, improving the alignment between education systems and labor market needs is crucial. This includes strengthening vocational and technical education, enhancing the relevance of curricula, and fostering linkages between educational institutions and industry. Such measures can reduce skill mismatches and improve the efficiency of labor market matching processes.

Finally, the results highlight the importance of adopting differentiated policy approaches based on countries' development stages. While upper-middle-income countries may benefit from policies that enhance the quality and efficiency of education systems, lower-middle-income countries require a broader strategy that simultaneously addresses structural constraints and labor demand deficiencies.

Overall, the study contributes to the literature by providing a unified framework that explains why the employment effects of education differ across development stages. Rather than treating education as an automatically self-generating source of employment, the findings demonstrate that the effectiveness of educational expansion depends critically on labor market absorptive capacity and the broader process of structural transformation. The study therefore suggests that the relationship between education and employment should be understood as part of a wider development process shaped by economic structure, technological change, and institutional conditions.

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