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THE RELATIONSHIP BETWEEN EDUCATION AND ECONOMIC GROWTH IN UZBEKISTAN

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Abstract

This study examines the relationship between education and economic growth in Uzbekistan using a time-series econometric approach. Grounded in human capital and endogenous growth theories, the research investigates how education expenditure, school enrollment, and labor market conditions influence economic performance. Annual data covering the period 2013–2024 were collected from the World Bank and UNESCO databases. The study employs Ordinary Least Squares (OLS) regression, supported by diagnostic tests and unit root analysis to ensure robustness.

The findings reveal that government expenditure on education has a positive and statistically significant effect on GDP growth. Similarly, improvements in secondary school enrollment significantly contribute to economic performance, highlighting the importance of intermediate-level human capital development. In contrast, the unemployment rate does not show a statistically significant impact on growth. Tertiary education enrollment was excluded from the final model due to non-stationarity issues, suggesting that its effects may be long-term and indirect.

Overall, the results confirm that education—particularly public investment and secondary education expansion—plays a crucial role in promoting economic growth in Uzbekistan. The study contributes to the limited country-specific literature by providing empirical evidence on the education–growth nexus and offers policy implications for enhancing human capital development and sustainable economic growth.

Introduction

Economic growth has long been a central objective of macroeconomic policy, particularly in developing and transition economies. Among the various determinants of long-term economic growth, education occupies a prominent position due to its role in human capital formation. Human capital theory posits that education enhances individuals' productive capacities by improving skills,

knowledge, and cognitive abilities, thereby increasing labor productivity and fostering economic growth (Barro, 2013). Over the past decades, this theoretical proposition has motivated extensive empirical research aimed at understanding the magnitude and direction of the relationship between education and economic growth. Empirical evidence suggests that countries investing more heavily in education tend to experience higher levels of economic performance in the long run. Education contributes not only to workforce productivity but also to technological adoption, innovation, and institutional development (Glewwe et al., 2014). However, the strength of this relationship varies significantly across countries, depending on structural, institutional, and policy-related factors. As a result, country-specific studies are essential for deriving meaningful conclusions and policy recommendations.

In transition economies, the education–growth nexus presents unique characteristics. These countries inherited relatively extensive education systems from centrally planned regimes, yet often struggled with inefficiencies, outdated curricula, and weak links between education systems and labor market demands. Uzbekistan, which gained independence in 1991, represents a distinctive case of gradual economic transition combined with strong state involvement in education financing and planning. Since the early 2000s, the government of Uzbekistan has prioritized education as a key pillar of socio-economic development, allocating a substantial share of public expenditure to this sector (World Bank, 2018). Despite sustained investment in education, the extent to which improvements in educational attainment have translated into economic growth remains an open empirical question. While Uzbekistan has achieved relatively stable economic growth over the past two decades, this growth has been influenced by multiple factors, including natural resource endowments, demographic trends, and state-led investment strategies. Consequently, isolating the contribution of education to economic growth is both challenging and necessary.

The relationship between education and economic growth is commonly explained through human capital and endogenous growth theories. In neoclassical growth models, education increases the effective labor input, leading to higher output levels, although long-term growth remains driven by exogenous technological progress. In contrast, endogenous growth models emphasize education as a key driver of sustained economic growth by facilitating innovation and knowledge accumulation (Benhabib & Spiegel, 2005). Education affects economic growth through multiple channels. First, higher educational attainment improves labor productivity by enabling workers to perform complex tasks more efficiently. Second, education enhances a country's capacity to absorb and adapt

new technologies, thereby accelerating technological diffusion. Third, education contributes to better governance and institutional quality by fostering social trust, political participation, and informed decision-making (Barro, 2013).

However, empirical findings regarding the education–growth relationship are far from uniform. While many studies report a positive and statistically significant effect of education on economic growth, others find weak or insignificant results, particularly when education quality is not adequately measured (Glewwe et al., 2014). These mixed results highlight the importance of methodological choices, data quality, and country-specific conditions in shaping empirical outcomes.

In Uzbekistan, the education system has historically focused on achieving broad access and high enrollment rates, particularly at the primary and secondary levels. Nonetheless, concerns persist regarding education quality, relevance to labor market needs, and efficiency in resource allocation. These issues raise questions about whether educational expansion alone is sufficient to promote economic growth or whether deeper structural reforms are required.

Despite the recognized importance of education as a driver of economic growth, empirical evidence for Uzbekistan remains limited and fragmented. Existing studies on the education–growth nexus often rely on cross-country panel data, which may obscure country-specific dynamics and institutional characteristics. Moreover, such studies frequently use aggregate education indicators that fail to capture qualitative aspects of human capital development.

Another major challenge in analyzing the relationship between education and economic growth is the issue of causality. While education may stimulate economic growth by enhancing productivity and innovation, economic growth itself can lead to increased investment in education by expanding fiscal capacity and household incomes. This bidirectional relationship complicates empirical analysis and may lead to biased estimates if not properly addressed (Benhabib & Spiegel, 2005). For Uzbekistan, where the state plays a dominant role in education financing and policy implementation, understanding the direction and strength of causality between education and economic growth is particularly important. Without clear empirical evidence, policymakers risk misallocating resources or overestimating the growth-enhancing effects of education spending.

The main objective of this study is to empirically examine the relationship between education and economic growth in Uzbekistan. Specifically, the study aims to:

- Investigate the long-run relationship between education-related indicators and economic growth in Uzbekistan.
- Analyze short-run dynamics between education and economic performance.

•Examine the direction of causality between education and economic growth.

Accordingly, the study addresses the following research questions:

1. Is there a statistically significant relationship between education and economic growth in Uzbekistan?
2. Does education contribute to long-term economic growth, or does economic growth primarily drive investment in education?
3. What implications do the empirical findings have for education and development policy in Uzbekistan?

This study contributes to the literature in several ways. First, it provides a focused country-level analysis of Uzbekistan, addressing a notable gap in empirical research on Central Asian economies. Second, by employing time-series techniques suited to country-specific data, the study offers insights into both long-run and short-run dynamics of the education–growth relationship. Finally, the findings are expected to inform policymakers about the effectiveness of education investment as a strategy for promoting sustainable economic growth.

Literature Review

The relationship between education and economic growth has its intellectual roots in human capital theory, which conceptualizes education as an investment that enhances individuals' productive capabilities. Early theoretical models emphasized the role of schooling in increasing labor efficiency, while later endogenous growth models incorporated education as a central mechanism driving technological progress and sustained economic growth (Benhabib & Spiegel, 2005). Endogenous growth theory argues that education generates positive externalities by fostering innovation and knowledge spillovers. Unlike physical capital, human capital does not necessarily exhibit diminishing returns, allowing economies to sustain long-term growth through continuous investment in education. These models provide a strong theoretical justification for public intervention in education, particularly in developing and transition economies.

However, critics argue that theoretical models often rely on simplifying assumptions that may not hold in real-world settings. In particular, they point out that the impact of education on growth depends critically on education quality, institutional environment, and labor market structures. A large body of empirical literature has examined the education–growth relationship using cross-country data. Many studies find a positive association between educational attainment and economic growth, particularly when secondary and tertiary education are emphasized (Barro, 2013). These findings suggest that higher levels of education contribute to faster economic growth by enhancing workforce skills and innovation capacity.

Nevertheless, empirical results are not universally consistent. Several studies report weak or insignificant effects of education on growth, especially when education is measured solely by years of schooling rather than learning outcomes. Glewwe et al. (2014) argue that education quality, rather than quantity, is the key determinant of growth-enhancing human capital. When test scores and cognitive skills are included, the estimated impact of education on growth becomes substantially stronger. Meta-analyses further reveal significant heterogeneity in estimated effects across studies, reflecting differences in model specifications, data sources, and estimation techniques. These findings underscore the importance of careful methodological design and context-specific analysis.

Empirical studies on education and economic growth employ a wide range of econometric techniques, including ordinary least squares (OLS), panel data models, time-series analysis, and instrumental variable approaches. Panel data studies benefit from increased variation and degrees of freedom but may mask country-specific dynamics. In contrast, time-series studies allow for detailed examination of long-run relationships within individual countries but are constrained by data availability. Recent studies increasingly emphasize the importance of addressing endogeneity and reverse causality. Techniques such as Granger causality tests, vector error correction models (VECM), and instrumental variables are commonly used to disentangle the direction of causality between education and growth. These methodological advances have improved the credibility of empirical findings, although challenges remain. Despite extensive research, several gaps persist in the literature. First, there is limited consensus regarding the magnitude and robustness of the education–growth relationship. Second, many studies focus on developed or large developing economies, leaving smaller transition economies underrepresented. Third, education quality and institutional factors are often inadequately captured due to data limitations. These gaps highlight the need for country-specific studies that account for institutional context, education system characteristics, and methodological challenges. In this regard, Uzbekistan represents an underexplored case with important implications for understanding the role of education in economic development.

The relationship between education and economic growth in transition economies has attracted growing attention since the early 2000s. These economies share several structural characteristics, including the legacy of centrally planned education systems, relatively high literacy rates, and significant state involvement in human capital formation. However, the transition to market-based systems exposed inefficiencies in education quality, skill mismatches, and weak links between education systems and labor market demands.

Empirical studies on transition economies generally confirm a positive association between education and economic growth, although the magnitude of the effect varies considerably across countries. Babatunde and Adefabi (2005) argue that in transition contexts, the growth-enhancing effects of education depend not only on enrollment rates but also on the adaptability of educational institutions to changing economic structures. Similarly, Hanushek and Woessmann (2008) emphasize that cognitive skills and education quality are more important than years of schooling in explaining growth differences among transition countries.

Several panel data studies focusing on post-socialist economies in Eastern Europe and Central Asia suggest that secondary and tertiary education play a particularly important role in promoting economic growth. These studies find that higher education contributes to technological adoption and productivity improvements, especially in countries undergoing structural transformation (Benos & Zotou, 2014). Nevertheless, the impact of education is often conditional on complementary factors such as institutional quality, openness to trade, and labor market flexibility. At the same time, some studies report weak or insignificant effects of education on economic growth in transition economies. This is frequently attributed to inefficiencies in education systems, outdated curricula, and limited absorptive capacity of labor markets. These mixed findings suggest that the education–growth relationship in transition economies is neither automatic nor uniform, reinforcing the need for country-specific analysis.

Compared to Eastern Europe, Central Asian countries remain underrepresented in the empirical literature on education and economic growth. Existing studies often group Central Asian economies into broader regional samples, limiting the ability to draw country-specific conclusions. Nevertheless, available evidence suggests that education plays a potentially important but uneven role in the region's economic development.

Some cross-country analyses indicate that Central Asian countries benefit from relatively high basic education levels inherited from the Soviet period. However, the transition period exposed weaknesses in education quality, financing mechanisms, and relevance to labor market needs. Studies focusing on Kazakhstan and Kyrgyzstan, for example, find that education contributes positively to growth only when combined with institutional reforms and economic diversification strategies. In the case of Uzbekistan, empirical evidence remains particularly scarce. Most regional studies treat Uzbekistan as part of a broader Central Asian sample, without explicitly modeling its unique institutional and policy framework. As a result, the specific channels through which education affects economic growth in Uzbekistan remain insufficiently explored.

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The limited number of studies focusing specifically on Uzbekistan generally acknowledge the importance of education as a pillar of long-term development. National and international reports emphasize that Uzbekistan has maintained high enrollment rates at primary and secondary levels and has allocated a substantial share of public expenditure to education (World Bank, 2018). However, these descriptive analyses often stop short of establishing a clear empirical link between education and economic growth. A small number of empirical studies examine the education–growth relationship in Uzbekistan using time-series or simple regression approaches. These studies typically find a positive association between education indicators—such as enrollment rates or education expenditure—and economic growth. However, their methodological frameworks are often limited by short time spans, lack of robustness checks, and failure to address endogeneity and reverse causality.

Moreover, existing studies frequently rely on quantity-based education measures, such as years of schooling or enrollment ratios, which may not adequately capture education quality. As highlighted by Glewwe et al. (2014), ignoring quality dimensions can lead to underestimation or misinterpretation of the true impact of education on economic growth. This limitation is particularly relevant for Uzbekistan, where concerns about education quality and skill relevance persist despite high enrollment levels. Another important limitation of the existing literature is the lack of causal analysis. Few studies explicitly test whether education drives economic growth or whether economic growth leads to increased investment in education. This omission is critical, given the strong role of the state in Uzbekistan's education system and the potential for feedback effects between growth and education spending.

A recurring issue in the literature on Uzbekistan and similar transition economies is methodological weakness. Many studies employ simple econometric techniques without adequately testing for stationarity, cointegration, or structural breaks. As a result, estimated relationships may be spurious or unstable over time.

Furthermore, the majority of studies do not distinguish between short-run and long-run dynamics. This is problematic because the impact of education on economic growth is likely to materialize over extended periods. Failure to account for long-run relationships may obscure the true contribution of education to economic performance. Recent advances in time-series econometrics, such as vector error correction models and Granger causality tests, offer more appropriate tools for analyzing the education–growth nexus at the country level. However, these methods remain underutilized in studies focusing on Uzbekistan.

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Based on the reviewed literature, several research gaps can be identified. First, there is a clear lack of comprehensive, country-specific empirical studies examining the relationship between education and economic growth in Uzbekistan. Second, existing studies often rely on limited datasets and simplistic methodologies, reducing the reliability of their findings. Third, the direction of causality between education and economic growth remains largely unexplored in the Uzbek context.

Additionally, the literature pays insufficient attention to the distinction between education quantity and quality, as well as the role of complementary factors such as investment, trade openness, and demographic dynamics. Addressing these gaps is essential for developing evidence-based education and growth policies.

This study seeks to address the identified gaps by providing a rigorous time-series analysis of the relationship between education and economic growth in Uzbekistan. By employing appropriate econometric techniques and focusing on both short-run and long-run dynamics, the study aims to offer more reliable empirical evidence. Furthermore, by explicitly examining causality, the study contributes to a deeper understanding of how education and economic growth interact in a transition economy context.

METHODOLOGY

This section presents the theoretical and empirical frameworks used to analyze the relationship between education and economic growth in Uzbekistan. The methodology is structured in line with established economic theory and is consistent with the objectives of the study, focusing on the role of education expenditure, school enrollment, and labor market conditions in explaining economic growth.

Theoretical Framework

The theoretical framework of this study is grounded in human capital theory and endogenous growth theory, which identify education as a central determinant of long-run economic growth. According to human capital theory, education is an investment that enhances the productive capacity of individuals by improving skills, knowledge, and cognitive abilities. A more educated workforce is therefore expected to generate higher output and contribute to sustained economic growth. Endogenous growth theory further emphasizes that education contributes to growth by fostering innovation, knowledge accumulation, and technological progress. Unlike the neoclassical growth model, which treats technological progress as exogenous, endogenous growth models consider human capital accumulation—through education—as an internal driver of economic growth. This implies that continuous investment in education can generate long-term growth

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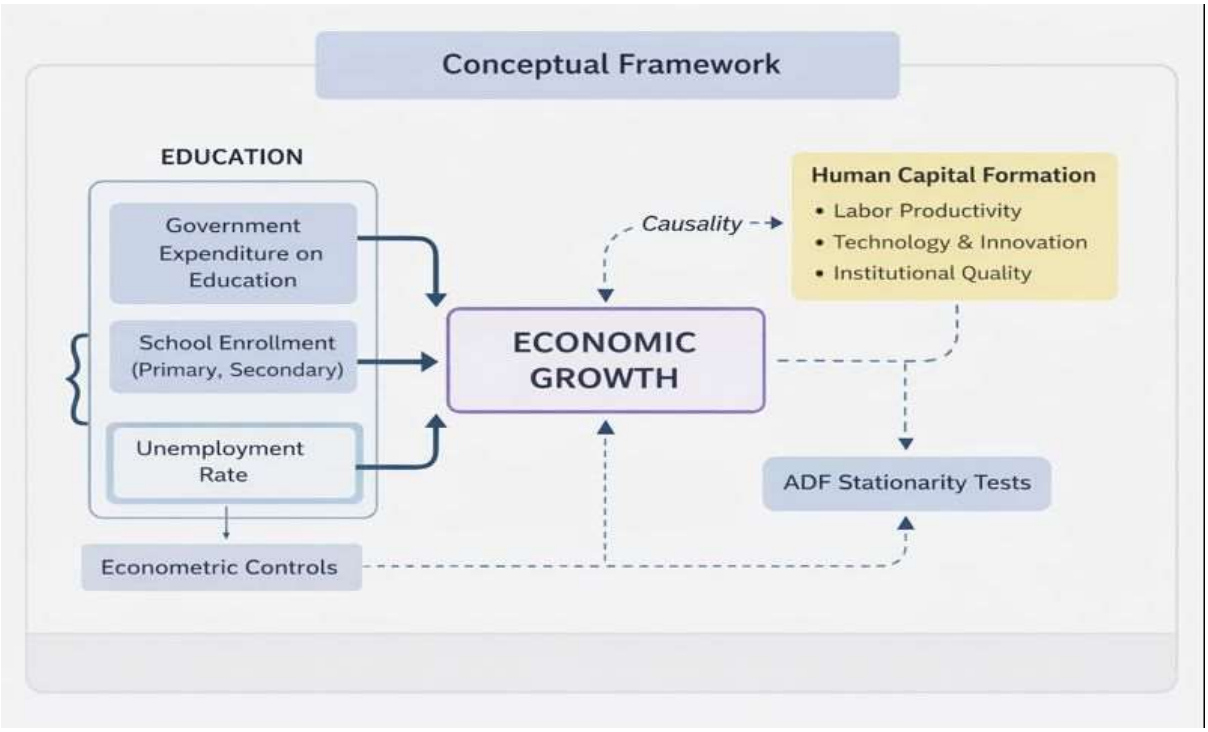
without diminishing returns. Within this theoretical context, government expenditure on education reflects the public sector's commitment to human capital development and plays a crucial role in improving both access to and quality of education. Higher enrollment rates at secondary and tertiary levels expand the stock of skilled labor, which is essential for productivity enhancement and structural transformation of the economy. At the same time, labor market conditions, particularly unemployment, influence how effectively educated individuals are absorbed into productive economic activities. Based on these theoretical considerations, economic growth in Uzbekistan is expected to be positively influenced by education expenditure, secondary school enrollment, and tertiary school enrollment, while unemployment is expected to exert a negative effect. The theoretical relationship can be summarized as follows:

$$Economic\ Growth = f(Education, Labor\ Market\ Conditions)$$

Conceptual Framework



Empirical Framework

To empirically investigate the relationship between education and economic growth in Uzbekistan, this study adopts a linear econometric model. The dependent variable is the GDP growth rate, while the explanatory variables include government expenditure on education, secondary school enrollment, tertiary school enrollment, and unemployment.

The empirical model is specified as:

$$\boldsymbol{GDPG_t = \beta_0 + \beta_1 ESE_t + \beta_2 SEC_t + \beta_3 TER_t + \beta_4 UNEMP_t + \varepsilon_t}$$

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where:

- GDPG represents the annual GDP growth rate.
- ESE denotes government expenditure on education as a percentage of GDP.
- SEC represents the gross enrollment ratio at the secondary level.
- TER denotes the gross enrollment ratio at the tertiary level.
- UNEMP represents the unemployment rate.
- $\beta 0$ is the intercept.
- $\beta 1$–$\beta 4$ are the coefficients to be estimated.
- εt is the error term.

This specification allows the study to assess the individual impact of education-related variables on economic growth while controlling for labor market conditions.

Economic growth is measured by the annual percentage growth rate of gross domestic product, which captures changes in overall economic performance. Government expenditure on education is used as a proxy for public investment in human capital and reflects policy priorities in the education sector. Secondary school enrollment represents the development of foundational and intermediate skills that are essential for workforce participation. Tertiary school enrollment captures advanced human capital formation, which is particularly important for innovation, technological progress, and productivity growth. The unemployment rate is included as a control variable to account for labor market efficiency, as high unemployment may limit the productive utilization of educated labor. This study relies exclusively on secondary data in accordance with standard practices in macroeconomic research. Annual data are collected for Uzbekistan from internationally recognized sources to ensure data reliability and consistency.

- GDP growth rate, education expenditure, tertiary enrollment, and unemployment data are obtained from the World Bank's World Development Indicators (WDI).
- Secondary school enrollment data are sourced from UNESCO.

All data are collected in CSV or Excel format and processed for econometric analysis.

The study employs the Ordinary Least Squares (OLS) regression technique to estimate the parameters of the empirical model. OLS is chosen due to its simplicity and widespread application in empirical growth studies. It provides unbiased and efficient estimates under the classical linear regression assumptions.

Prior to estimation, diagnostic tests are conducted to ensure the validity of the regression results, including tests for multicollinearity, heteroskedasticity, and

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model specification errors. These tests help improve the robustness and reliability of the empirical findings.

Based on economic theory and existing empirical literature, the expected signs of the coefficients are as follows:

- Education expenditure (β1) is expected to have a positive effect on economic growth.
- Secondary enrollment (β2) is expected to have a positive effect on economic growth.
- Tertiary enrollment (β3) is expected to exert a stronger positive impact on economic growth due to its role in advanced skill formation.
- Unemployment (β4) is expected to have a negative effect on economic growth.

In summary, this study employs a theoretically grounded and empirically structured methodology to examine the relationship between education and economic growth in Uzbekistan. By integrating human capital theory with an econometric framework that incorporates education expenditure, enrollment rates, and labor market conditions, the study aims to provide robust evidence on the growth-enhancing role of education.

RESULTS

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GDPgrowthannual	12	6.037	1.691	1.563	8.035
Governmentexpendit~t	12	5.224	.63	4.136	6.295
Schoolenrollmentse~y	12	94.402	2.598	90.064	97.384
Schoolenrollmentte~g	12	19.67	16.512	7.977	56.517
Unemploymenttotalo~l	12	5.042	.419	4.46	5.83

Table 1 presents the descriptive statistics of the variables used in the study. The dataset consists of annual observations for Uzbekistan covering the period from 2013 to 2024, with a total of 12 observations. The average GDP growth rate during the sample period is approximately 6.04 percent, indicating relatively stable economic growth. Government expenditure on education averages 5.22 percent of

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GDP, reflecting a substantial public investment in the education sector. The mean gross secondary school enrollment rate is 94.4 percent, suggesting near-universal access to secondary education. In contrast, the average tertiary enrollment rate is significantly lower at 19.7 percent, indicating limited participation in higher education. This disparity highlights structural differences in human capital formation across education levels. The unemployment rate averages 5.04 percent, with relatively low variation over the sample period, suggesting moderate labor market stability. Overall, the descriptive statistics indicate sufficient variation across variables, supporting their suitability for econometric analysis.

Correlation Analysis

	GDPgro~l	Govern~t	School~y	School~g	Unempl~l
GDPgrowtha~l	1.0000				
Government~t	0.4324	1.0000			
	0.1604				
Schoolenro~y	0.4404	0.0234	1.0000		
	0.1520	0.9426			
Schoolenro~g	0.0828	0.0344	0.6706	1.0000	
	0.7982	0.9155	0.0170		
Unemployme~l	-0.3181	-0.5821	-0.4546	-0.7192	1.0000
	0.3136	0.0470	0.1376	0.0084	

Table 2 presents the pairwise correlation matrix among the variables used in the study. The results indicate that GDP growth is positively correlated with government expenditure on education and secondary school enrollment, suggesting that higher public investment in education and broader access to secondary education are associated with higher economic growth. The correlation between GDP growth and tertiary school enrollment is relatively weak, indicating that the immediate relationship between higher education enrollment and economic growth may be limited during the sample period. In contrast, unemployment exhibits a negative correlation with GDP growth, which is consistent with economic theory, as higher unemployment is typically associated with lower economic performance.

The correlation matrix also reveals a relatively strong positive relationship between secondary and tertiary enrollment rates. While this suggests a close

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association between different levels of education, it also highlights the potential risk of multicollinearity, which is addressed in subsequent regression diagnostics. Overall, the correlation results provide preliminary evidence of meaningful relationships among the variables and justify further econometric analysis.

Unit Root Test Results

To ensure the validity of the econometric analysis, the Augmented Dickey–Fuller (ADF) test was applied to examine the stationarity properties of the variables. The results indicate that GDP growth and government expenditure on education are stationary at levels, suggesting that these variables are integrated of order zero, I(0). In contrast, secondary school enrollment, tertiary school enrollment, and the unemployment rate were found to be non-stationary at levels but became stationary after first differencing. These variables are therefore integrated of order one, I(1). To avoid spurious regression results, the first differences of the non-stationary variables were used in the regression analysis.

Regarding tertiary enrollment: Although tertiary school enrollment was initially included in the analysis, unit root test results indicate that the variable remains non-stationary even after first differencing. Given the small sample size and the strong deterministic trend in tertiary enrollment, this variable was excluded from the final regression model to avoid biased and unreliable estimates.

OLS Regression Results (Dependent Variable: GDP Growth)

Source	SS	df	MS	Number of obs	=	11
				F(3, 7)	=	16.47
Model	26.0365623	3	8.67885409	Prob > F	=	0.0015
Residual	3.68787432	7	.526839189	R-squared	=	0.8759
				Adj R-squared	=	0.8228
Total	29.7244366	10	2.97244366	Root MSE	=	.72584

GDPgrowthannual	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
Governmentexpenditureoneducat	1.397908	.4014175	3.48	0.010	.4487065	2.34711
D_schoolsecondary	.4868238	.0784979	6.20	0.000	.3012057	.6724419
D_unemployment	.0256715	.6066126	0.04	0.967	-1.408739	1.460082
_cons	-1.525423	2.088937	-0.73	0.489	-6.464975	3.414129

Regression Results

Table 4 reports the results of the final regression model examining the relationship between education and economic growth in Uzbekistan. The model includes government expenditure on education, the first difference of secondary

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school enrollment, and the first difference of the unemployment rate. The results indicate that government expenditure on education has a positive and statistically significant effect on economic growth. Specifically, a one-percentage-point increase in education expenditure is associated with an increase of approximately 1.4 percentage points in GDP growth, holding other factors constant. Similarly, changes in secondary school enrollment exert a strong and positive impact on economic growth. The coefficient on the differenced secondary enrollment variable is statistically significant at the 1 percent level, suggesting that improvements in access to secondary education play a crucial role in enhancing economic performance.

In contrast, changes in the unemployment rate do not exhibit a statistically significant relationship with GDP growth during the sample period. Overall, the model is statistically significant and explains a substantial proportion of the variation in economic growth, as reflected by the high R-squared value.

Diagnostic tests

Mean VIF = 3.88 Variance Inflation Factor (VIF) results indicate that multicollinearity is not a concern in the model, as all VIF values remain below the conventional threshold.

Prob > chi2 = 0.6677 The Breusch–Pagan test fails to reject the null hypothesis of homoskedasticity, indicating constant error variance.

Prob > z = 0.6795 The Shapiro–Wilk test confirms that the regression residuals are normally distributed.

Prob > F = 0.0203 ($p < 0.05$) The Ramsey RESET test suggests potential functional form misspecification; however, given the limited sample size, the baseline linear specification is retained.

Overall, the diagnostic test results indicate that the estimated model satisfies the key econometric assumptions and is suitable for analyzing the relationship between education and economic growth in Uzbekistan.

Discussion

This study examined the relationship between education and economic growth in Uzbekistan using annual data and a time-series econometric framework. The empirical findings provide several important insights into how different dimensions of education influence economic performance. The regression results indicate that government expenditure on education has a positive and statistically significant impact on GDP growth. This finding is consistent with endogenous growth theory, which emphasizes the role of public investment in human capital as a key driver of long-term economic growth. Increased government spending on education enhances the quality of human capital by improving access to schooling,

teacher quality, and educational infrastructure, which in turn raises labor productivity and economic output. Similar positive effects of education expenditure on growth have been documented in both developed and developing economies (Baldacci et al., 2008; Benos & Zotou, 2014). The strong and statistically significant coefficient of secondary school enrollment suggests that improvements in access to secondary education play a crucial role in supporting economic growth in Uzbekistan. Secondary education equips individuals with essential cognitive and technical skills that are directly applicable in the labor market, particularly in economies undergoing structural transformation. This result aligns with previous studies showing that basic and intermediate levels of education often have a more immediate and measurable impact on growth than higher education, especially in developing and transition economies (Gyimah-Brempong, Paddison, & Mitiku, 2006; Petrakis & Stamatakis, 2002). In contrast, changes in the unemployment rate do not exhibit a statistically significant relationship with economic growth in the estimated model. This outcome may reflect structural characteristics of the Uzbek labor market, where employment dynamics are influenced by institutional factors, informal employment, and state intervention. Moreover, short-term fluctuations in unemployment may not fully capture labor productivity or human capital utilization, which are more directly linked to growth. Similar findings have been reported in studies focusing on economies with regulated labor markets or high levels of informal employment (Aghion & Howitt, 2009). An important methodological insight from this study is the exclusion of tertiary education enrollment from the final regression model due to non-stationarity. While higher education is theoretically associated with innovation and long-term growth, its impact may materialize over a longer horizon and may not be adequately captured in small-sample time-series models. Previous research suggests that the growth effects of tertiary education are often indirect, operating through research and development, technological adoption, and institutional quality (Hanushek & Woessmann, 2015; Barro, 2013). Therefore, the absence of a direct effect in this study does not imply that higher education is unimportant, but rather that its influence may be more complex and long-term.

Overall, the findings support the view that education—particularly public investment in education and expansion of secondary schooling—plays a significant role in promoting economic growth in Uzbekistan. These results are consistent with the broader empirical literature on human capital and growth, while also highlighting country-specific dynamics related to labor markets and educational structure.

Conclusion

This study investigated the relationship between education and economic growth in Uzbekistan using annual time-series data and an econometric approach. By applying unit root tests, regression analysis, and a set of diagnostic checks, the study ensured the reliability and robustness of the empirical findings. The results provide strong evidence that government expenditure on education plays a significant and positive role in promoting economic growth. Increased public investment in education appears to enhance human capital formation, which in turn supports higher productivity and economic performance. In addition, improvements in secondary school enrollment were found to have a statistically significant and positive effect on GDP growth, highlighting the importance of expanding access to secondary education in developing and transition economies such as Uzbekistan. In contrast, changes in the unemployment rate did not exhibit a statistically significant impact on economic growth during the sample period. This finding suggests that short-term labor market fluctuations may not fully capture the underlying dynamics of productivity and human capital utilization in the Uzbek economy. Furthermore, tertiary education enrollment was excluded from the final regression model due to non-stationarity, indicating that the growth effects of higher education may be more long-term and indirect in nature.

Overall, the findings underscore the central role of education—particularly public education spending and secondary schooling—in fostering economic growth in Uzbekistan. From a policy perspective, the results suggest that sustained investment in education and targeted efforts to strengthen secondary education can contribute meaningfully to long-term economic development. Future research could extend this analysis by incorporating longer time periods, additional institutional variables, or panel data methods to better capture the long-run effects of higher education and labor market dynamics.

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