

Sustainable Economic Growth Development for the Higher Education Sector: A Smooth Transition Regression (STR) Analysis

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Abstract. This study will examine sustainable economic growth in higher education as one way of enhancing capital, leading to economic growth. Even though nonlinearities are essential, this study series commonly includes a linear relationship. This study investigates the linearity assumption within time series techniques from 1990-2019 in Syria. To answer this issue, the authors use smooth transition criteria to switch from a linear to a nonlinear framework. This study related to the Syrian economy highlights the nonlinearities between education and the growing economy for tertiary education. The linear analysis supports that economic growth was positively correlated with education: The rate of economic expansion in Syria is inversely proportional to educational tertiary. In addition, it showed similarities in positive values for Government expenditure and workforce participation rates in the model's lower regime. By contrast, value evaluation switches from negative to significant within the model's upper regime.

Keywords: higher education; economic growth; Smooth transition regressions (STR).

1. Introduction

The contribution of sustainable economic growth in higher education to society in all its forms is crucial. In this context, public investment in elementary, secondary, and higher education was discussed regarding how it affects economic growth.

Investing in sustainable education means investing in humans first by creating a skilled workforce that will influence the creation of innovations, increasing productivity and wages, reducing government demands to fund many social services, and increasing government budgets. Thus, increasing taxes is expected to contribute to economic growth. The gains of investing in education do not end there. There is a long, if not endless, list of benefits to the state and society by educating the community. Beginning with an increase in the number of skilled workers, creating appropriate profiles based on labor market requirements while responding to market needs, increasing productivity and wages, and improving the standard of living will increase social well-being and grow the national economy.

From this perspective, the primary objective of this study is to investigate the connection between sustainable economic growth in Syria and education. It would be examined the nonlinearities in this Approach, it will also support the prior study. Education expansion may occasionally significantly affect GDP growth, but it may also occasionally have a negative (or insignificant) effect. Because the effects of education may vary throughout the economic cycle, nonlinearities become more critical when examining the association between higher education and economic growth. Our specific hypothesis there is a variance that a country's economic growth performance varies depending on the growth of its human capital and, by extension, its educational system's quality.

Regarding the specific hypothesis, it is essential to note that the response to this research question should consider whether it is positive, negative, or not significant.

We include a variety of explanatory factors in our empirical study that are strongly related to economic growth and education levels because they also influence this association. Based on the scientific literature review, this research considers the impact of the labor force and public higher education spending on economic development. Both developments of a positive correlation between education and economic expansion and a nonlinear relationship can be demonstrated by this study. This analysis clarifies the issue raised by the literature regarding the benefits, if not widely acknowledged, of the effect of education on economic growth.

This research was organized as follows: first, presenting the framework of the study, which includes research objectives, research questions, and research hypotheses. Second, including a literature review. Third, discuss the research methods, data, resources, and the econometric model employed in this work. Fourthly, the empirical results and discussions; and finally, we conclude and present further recommendations.

2. Literature Review

In addition to an individual's contribution to employment or higher income, education could significantly impact both citizens and society. The significance of education was reflected in a series of social characteristics across the major skill channels.

Previous studies on higher education in Syrian universities were based on interviews with Syrian academics and students. It was concluded by Milton (2019) that, despite the system's quantitative survival for a variety of reasons, significant negative qualitative shifts have significantly altered Syrian higher education by eroding quality and equity and tightening control over campuses as a means of regime security. The case study of Syrian higher education is vital in demonstrating the need for more contextualized, middle-range theories of education in emergencies that detail the circumstances in which predictions on the impact of conflict would hold, according to one key finding of the report. Dalati's et al. (2020) research on the higher education system in Syria, focusing on the circumstances following 2011, aimed to analyze Syrian women's circumstances and autonomy in higher education. This research was utilized to pinpoint the critical constraints on higher education. A quantitative methodology was used in this study by creating a standardized questionnaire. The results demonstrated

the necessity of conducting more research on including gender equality in university strategy. As a result, there is much need for improvement and research at Syrian universities about a lack of understanding of gender equity and equality. The conclusions on female student empowerment showed sufficient interest in studying gender-focused courses and ambition to pursue a career in academia. However, universities' curricula and course options do not yet include gender concerns.

Additionally, the research's findings demonstrated the existence of stereotypes and societal expectations, which were seen as issues that need to be investigated. Deeb & Merhej (2016) explored the relationship between Tishreen University's organizational and transformational achievement. It was found that there was a positive association between the above-said factors. The method used is based on a survey that has reached the academic staff at Tishreen University (Dalati, 2016). The theoretical framework of this study is to find a sustainable leadership model to evaluate the perception of the abovementioned staff to support key leadership behaviors in this sector. In order to determine the proper conceptualization of integrated leadership traits and behavior elements, a quantitative method was used. The model made a case for the importance of leadership qualities in higher education, notably among department heads, faculty deans, vice deans, and rectors. The reliability test revealed Alpha Cronbach's very great internal consistency and importance. In this research, the higher education sector was examined. The result illustrated that academic and administrative employees strongly supported perceived leadership aspects. According to the regression study, servant leadership significantly and favorably impacted how higher education administrators view sustainability leadership. This study placed a strong emphasis the leadership values.

On the other hand, the studies related to the impact of education on GDP (Ziberi et al., 2022) seek to quantify the contribution of public spending on education to North Macedonia's economic growth from 1917 to 2020. An econometric model has been used for the least square of the two-stage instrumental variable. According to this analysis, an increase of one percentage point in public education expenditure will positively impact Northern Macedonia's economic growth. This analysis showed that in Northern Macedonia, an increase of one point in unemployment and a fall of one point in employment would stimulate economic growth. In order to determine if a higher proxy had a greater marginal influence on the growth of the selected nations (Hanif & Arshed, 2016), illustrated the South Asia Association for regional cooperation countries, which had three substitutes for human resources, was used in this analysis. Compared to enrollment in primary and secondary education, the results of panel data showed that higher education enrolment has the most significant influence on growth. Wang & Liu (2016) used the most recent educational data for 55 countries between 1960 and 2009. The research built the panel data to examine the impact of the educational wealth of humans on the growing economy. Meanwhile, it examined how different educational levels affect economic growth by categorizing human capital in education into higher education, secondary education, and primary education.

Additionally, they looked at the impact of various economic development levels and significant historical occurrences when incorporating human health capital into the model. The result demonstrated that educating human capital had a very good effect on economic growth. Higher education had a considerable beneficial effect on economic growth. Khalifa & Ayoubi (2015) investigated the educational institutions in Syrian universities and the two main types of transactional and transformational leadership. Additionally, it aimed to investigate how transformational and transactional leadership can improve educational institutions.

The data were gathered from staff in Syrian educational institutions. The findings showed that contingent reward had a significant impact on educational institutions as a transformational leadership dimension, while inspirational motivation significantly impacted a transactional leadership dimension. Devadas, Elbadawi & Loayza (2019) studied growth after the war in Syria as it negatively affected the gross domestic product, less than 12 percent annually from 2011 to 2018, bringing GDP down to about

one-third of its 2010 level. The study investigated positive and negative aspects of the Gross Domestic Product was anticipated to average 6.1, 8.2, or 3.1 percent over the next two decades, assuming the conflict was successfully resolved.

The Sustainable Development Goals (SDGs) and higher education were the subjects of this special Higher Education issue by Chankseliani & McCowan (2021), covering various socioeconomic, environmental, and technological development issues. They applied to all countries, not just those typically categorized as "developing" or "emerging." The SDGs included tertiary education and primary and secondary education as part of their broader mandate. Higher education was absent from the international development agenda before the Millennium Development Goals and Education for All, so this was a significant move. In addition, the primary focus of the study by Jellenz, Bobek & Horvat (2020) is how the drivers of higher education interact with Namibia's sustained economic growth. A quantitative analysis of statistical evidence was necessary to detect the impact of educational and economic factors connected and track their development over the past three decades in Namibia. Around the world, prominent associations between a country's tertiary schooling system and its monetary improvement are, to some degree, affirmed in Namibia. The government acknowledges the importance of education as an influential factor behind long-term economic growth. Namibia is on the right path to becoming based on knowledge and sustaining economic growth thanks to its long-term perceptiveness in 2030 and the government's National Development Program (NDP). As do subsistence conditions, the country's GDP rises due to this transformation process. Namibia's cultural diversity and inconsistent asset dispersion incite hardships for specific nationalities getting too instructive organizations. Other issues in Namibia's higher education system include inadequate infrastructure, poor curriculum quality, and worldwide experience. Based on the researchers' findings, predominate significance has to follow in developing a Namibian identification due to Namibia's late independence.

Socioeconomic actions would improve domestic self-esteem, and sustainable economic sectors would be made possible. The internationalization of Namibia's higher education system could be accelerated by improving access to and the educational quality of the system. In addition, Namibia's higher education system is affected by numerous issues, including unemployment, corruption, and multidimensional poverty. Dudzevičiūtė & Šimelytė (2018) explore the link between education and economic development in a few EU countries from 1997 to 2016. descriptive statistical analysis and econometric methods were used. The correlations between economic growth and education were statistically significant in most countries chosen for the study. However, only Belgium, France, Ireland, and the United Kingdom have shown that the variables under consideration are connected causally. In these nations, the unidirectional causality from schooling to financial advancement has shown that expansion in the portion of the populace having tertiary schooling advances financial execution. In the remaining nations, neither the increasing real GDP nor the percentage of the population with higher education benefits economic development. The research's findings may help achieve Europe 2020's goals, which included tertiary education as one of five measurable targets. Aziz, Khan & Aziz (2008) explored the profits of advanced education on the monetary development of Pakistan from 1972 to 2008 through the utilization of Cobb-Douglas creation capability. The first target of this research suggested the discovery and establishment of the connection between Pakistan's economic growth and higher education. They examined how higher education enrollment affects economic expansion. According to the study, a well-educated workforce contributed significantly to economic expansion. The study also had some implications for the policy goal of expanding higher education to reduce the use of expatriate labor in various economic fields.

Okoye et al. (2019) demonstrated that the results of their studies concerning the relationship between public expenditure and economic development were mixed. This study explores the link between government use and monetary development to decide on the extent to which development performance in Nigeria is impacted by government spending. The review depends on verifiable information somewhere between 1981 and 2017. Inflation was considered as the study examines

government spending in its entirety and its parts. According to the study, delayed current expenses significantly negatively impact short-term economic growth. It also demonstrates that the deferral of capital spending has a significant positive impact on growth. However, there is no evidence that government spending is having a long-term impact on economic growth within the scope of this study. This suggested that Nigeria's pattern of government spending is unsustainable. As a result, it was proposed that more money be given to capital expenditures to improve the capacity for long-term growth. While Onifade et al. (2020) apply an empirical study using annual time-series data from 1981 to 2017, the impact analysis was conducted using Pesaran's ARDL method.

According to empirical findings, Nigeria's economic growth is correlated moderately with indicators of public spending. Government recurrent expenditures were found to have a significant negative impact on economic growth, whereas public capital expenditures had no significant positive impact on economic growth during the study period. The Granger Causality Test also showed that the government's debt-financed fiscal expansion strongly correlates with public expenditures and domestic investment, which correlated with real economic growth. As a result, we offered some significant policy recommendations on the empirical analysis findings so that Krueger and Lindahl (2001) showed the significance of nonlinearities. These authors split their sample of nations into three subsamples based on the initial human capital endowment. They observed a positive correlation only in the subsample of nations with the lowest education levels. They either found that education had no impact on growth or that it negatively influenced the group of countries in the middle of the distribution of education levels. Also, the connection was negative in countries with more important instructive principles. Using structural equations on the impact of physical capital, higher education, government spending on higher education, and an educated workforce were all relevant education examples. The researchers applied an econometric model to determine and evaluate the implications of education on economic development. Trabelsi's (2018) study was to support the nonlinear relationship between public education spending and explained the mixed results found in most empirical studies. It utilized the structural threshold regression method STR and average cross-country data from 1980 to 2015. It used governance indicators as a threshold variable to examine the disparate effects of higher education expenditure on economic development.

It has been noticed that a positive effect on economic performance is more efficient if it is upper the threshold level while it is negative. In the case of Spain, research by Marquez-Ramos & Mourelle (2019) examines the link between tutorial and economic development to determine whether there are any nonlinearities. It implies that, under some circumstances, an increase in education may negatively influence GDP development. The 2016 World Economic Forum identified three ways education influences a nation's productivity. It enhanced the labor force's overall capacity to do jobs more quickly. Secondary and higher education significantly facilitated the conversion of information about new knowledge, materials, and techniques set up by others (Barro & Lee, 2013). Increased innovation reinforced the country's ability to improve new techniques, goods, and information (Grant, 2017).

Research hypotheses:

H1: Physical capital is correlated positively with economic growth.

H2: School enrollment and tertiary is correlated positively with economic growth.

H3: Government expenditure on tertiary education is positively related to economic growth.

H4: The labor force with advanced education is correlated positively with economic growth.

3. Methodology

In the direction of the previous research of López-Villavicencio & Mignon (2011), Seleteng et al. (2013), and Ibarra & Trupkin (2016), the core STR model may be described as follows in its simplest basic representative form:

$$y_t = \varphi'z_t + \Phi'z_tG(\gamma, c, s_t) + \mu_t \quad (1)$$

In which y_t is a benchmark; z_t constitutes the vector of interpretative growing variables; φ' and Φ' are the factor vectors of the linear and nonlinear part of the smooth transition regression, successively and μ_t is a good behavior error intervals with features $N(0, h^2t)$. The transfer function $G(\gamma, c, s_t)$ is limited into 0 and unit and selects if the economics is in the 'up regime,' the 'down regime,' or is shifted into the two. Specifically, as $G(\gamma, c, s_t) = 0$, therefore formula (1) comes to a linear model; while as $G(\gamma, c, s_t) = 1$, equation (1) formulas of a two regime's threshold autoregression as sharp regime-switching conduct. As $0 < G(\gamma, c, s_t) < 1$, after that, this is the sloping average of the 'down regime' and the 'up regime.' The threshold parameter, represented by the variable c , indicates the position of the transition function, whereas the variables s_t and measure the smoother the transfer into the regimes. The transition function was defined by using the below logical structure:

$$G(\gamma, c, s_t) = 1 + \exp \{-\gamma \prod_{k=1}^k (s_t - c)\}^{-1} \quad (2)$$

Diagnostic tests such as ARCH, proofs for no autocorrelation, and normality tests were run over the calculated regression. The characteristics of the parameters included in the empirical model are illustrated in Table 1.

Table 1: The description of parameters

The Variables	Definition
Gross Domestic Product (GDP)	Real Gross Domestic Product
Physical capital	Gross fixed capital formation
Tertiary education	General enrolment in higher education
State expenditure in higher education	Public expenditures on tertiary education
Labor force with advanced education	Labor force participation Rate with advanced education

We use data for Syria; the data acquired from World Bank Indicators during 1990–2019 have been analyzed, considering that the data are annual.

4. Research Analysis and Results

In the past, GDP and enrolment ratios for tertiary education have been used to evaluate economic activity—one way to measure Syria's workforce proportion. Physical capital may have a relevant direct effect on economic development. As a result, they were using the actual Gross Fixed Capital Formation as a proxy for actual capital, and after that, applying education spending by the government.

The selected dependent and independent in the summary of descriptive statistics are shown in Table 1 before their progression is shown in Fig. 1. We can highlight a few features by examining Table 2 and Fig. 1. Over time, tertiary education exhibits a positive trend. Before 2012, the remaining variables experienced a trend comparable to that of GDP. GDP has shown a negative trend since the beginning of the war in Syria in 2012. Consequently, studying the connection between education and economic growth using a time series approach is challenging.

Table 2: Time series variables' descriptive statistics

	GDP growth	Government expenditure on education	Gross fixed capital formation	Labor force participation rate	School enrollment, tertiary
Mean	1.691036	17.40408	18.08087	49.51333	23.34491
Median	4.750239	18.03566	20.33301	48.95500	18.09776
Maximum	12.97279	20.04848	29.95884	54.77000	43.04688
Minimum	-26.33902	15.04076	6.273485	44.83000	12.33515
Std. dev.	8.960476	2.051593	6.346485	3.682489	10.44162
Skewness	-2.091944	-0.136471	-0.468888	0.178978	0.833832
JB	42.94469	4.092197	1.547264	3.322527	4.309539
Probability	0.000000	0.129238	0.461334	0.189899	0.115930

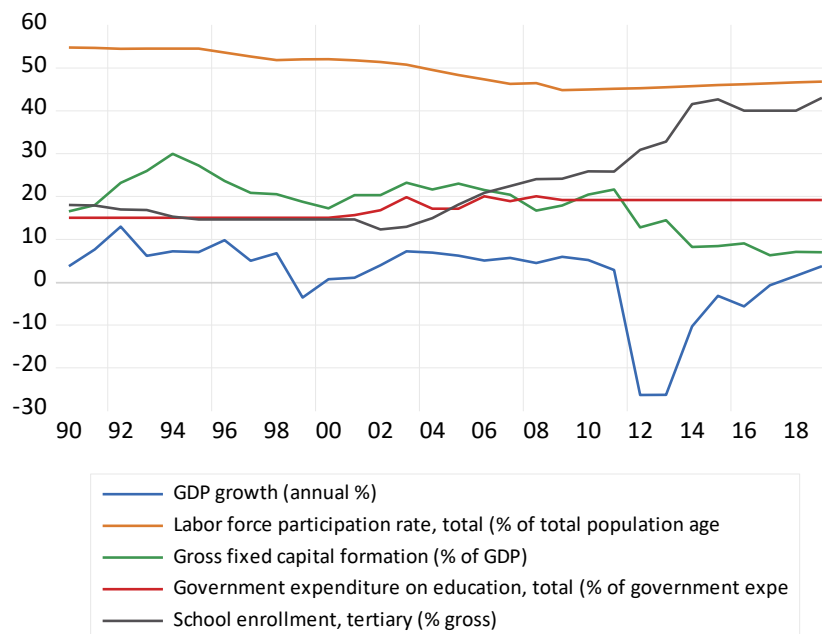


Fig. 1: GDP growth (annual %)- Government expenditure on education, total (% of government expenditure)-Gross fixed capital formation (% of GDP)- Labor force participation rate, total (% of total population age) - School enrollment, tertiary (% gross): 1990-2019

Before analyzing and estimating our STR model, we do a preliminary step to look at the integration characteristics of the different time series variables. All the variables are tested for stationarity tests by Augmented-Dickey-Fuller and Phillips-Perron per test procedure via drift and trend.

As shown as the stationarity test outputs illustrated in Table 3, used data analysis handle to reject the H0 of a stationarity method for each variable. The result shows no signs of time series variables in their levels despite whether the stationarity test has been executed with a drift or a trend. However, its first difference is the ability of the Phillips-Perron and Augmented-Dickey-Fuller statistics to disprove the stationarity hypothesis. That is critical for our practical analysis since evaluating the smooth transition regression demands that the time series be stationary.

Table 3: Stationarity tests

Variables		level		First differences		decision
		drift	trend	drift	trend	
GDP growth	ADF	-2.260526	-2.585406	-4.879142***	-4.802296***	I (1)
	PP	-2.262294	-2.478579	-6.998216***	-7.770835***	I (1)
Government expenditure on education	ADF	-1.455058	-2.817895	-7.285765***	-5.705683***	I (1)
	PP	-1.184686	-2.843808	-7.954676***	-7.829214***	I (1)
Gross fixed capital formation	ADF	-0.685190	-2.856702	-5.215198***	-5.442268***	I (1)
	PP	-0.685190	-2.873098	-5.215026***	-5.465872***	I (1)
Labor force participation rate	ADF	-1.371590	0.163248	-3.252003**	-3.511333*	I (1)
	PP	-1.253100	-0.620911	-3.273671**	-3.434808*	I (1)
School enrollment, tertiary	ADF	0.987029	-1.667485	-3.795087***	-4.324003**	I (1)
	PP	0.776837	-1.648591	-3.834289***	-4.303173**	I (1)

Representative 1 %, 5 %, 10 % ‘***’, ‘**’ ‘*’ the levels of significance

STR regression analysis. In mention to the practical results of the smooth transition regression that showed in Table 4, the threshold value is 0.754069 % with γ (SLOPE) value of 13.10144, thereby showing that the change from the lower to the upper regime is rather sudden and quick.

The value of Government expenditure on education is positive and significant at 1 % in the lower regime, while this value switches to negative and significant at 1 % in the upper regime. We also observe similar positive coefficients for School enrollment, tertiary, and Labor force participation rates in the lower regime, and this evaluation is significant at 1 %. In contrast, this value switches to negative and significant at 1 % in the upper regime.

On the other hand, in contrast to growth theory (Levine, 2005), we show a negative value on the Gross fixed capital formation variable in the lower regime. That estimate is significant at 1 %. Nevertheless, in the upper regime, the negative effect of Gross fixed capital formation on economic growth turns positive albeit insignificant.

In the last stage of our practical results, the evaluation model was subjected to various diagnostic tests on the regression residuals. The model was examined for autocorrelation, ARCH effects, and normality effects. The outcomes of the diagnostic tests are listed in Table 4. For autocorrelation, the LM statistic testing the H0 of no autocorrelation has a t-statistic of 0.518605 with a probability of 0.6081, disproving the idea that the estimated regression's error terms are identically correlated. The tests for ARCH made a t-statistic of 0.000188 and a probability of 0.9892. The regression residuals are now considered to be devoid of any ARCH. As well as in testing for normality effects, the JB a t-statistic made 63.52019 and the probability 0.00, consequently confirming that the estimated model regression has a normal distribution.

Table 4: Smooth Transition Regression Values of Education-GDP

	Value	SD (σ)	t-statistic	Probability
Linear regression				
GDP growth (-1)	-2.225859	0.003352	-663.9594	0.0000***
Government expenditure on education (-1)	32.65424	0.058374	559.3986	0.0000***
Gross fixed capital formation (-1)	-1.431736	0.002508	-570.9072	0.0000***
School enrollment, tertiary (-1)	2.736021	0.005682	481.4893	0.0000***
Labor force participation rate (-1)	39.65007	0.064788	611.9952	0.0000***
C	-2568.537	4.364020	-588.5714	0.0000***

Nonlinear regression				
GDP growth (-1)	3.029384	0.241843	12.52626	0.0000***
Government expenditure on education (-1)	-30.87765	1.656637	-18.63876	0.0000***
Gross fixed capital formation (-1)	0.758118	0.822169	0.922094	0.3721
School enrollment, tertiary (-1)	-3.182695	0.506585	-6.282647	0.0000***
Labor force participation rate (-1)	-38.12837	1.086814	-35.08269	0.0000***
C	2483.516	77.97751	31.84912	0.0000***
γ (SLOPE)	13.10144	62.87946	0.208358	0.8380
THRESHOLD	0.754069	0.464270	1.624203	0.1266
R²	0.669954			
AIC	7.131801			
SSR	754.5552			
Diagnostic tests				
	t-statistic		probability	
LM	0.518605		0.6081	
ARCH	0.000188		0.9892	
JB	63.52019		0.0000	

Representative 1 %, 5 %, 10 % ‘***’, ‘**’, ‘*’ the levels of significance

5. Discussion and Recommendations

We concentrate on how tertiary education contributes to Syria's economic growth. The linear analysis supports a positive correlation between economic growth and education: Syria's economic expansion rate is inversely proportional to educational attainment (tertiary). In addition, the study shows the same positive values for Government expenditure and Labor force participation rate in the lower regime, consistent with (Ziberi et al., 2022), a one-point increase in government spending on education will have a favorable impact on North Macedonia's economic growth. Hanif & Arshed (2016) state that higher education enrolment influences growth most. Wang & Liu (2016) educating human capital has a very good effect on economic growth, and higher education has a considerable beneficial effect on economic growth.

In contrast, this value evaluation changes from negative to significant in the model's upper regime. The significance of nonlinearities is demonstrated by Marquez-Ramos & Mourelle (2019), examining the connection between economic growth and education in Spain, where an increase in education may have a detrimental effect on GDP growth. By Krueger & Lindahl (2001), the relation is negative in nations with more significant educational standards in the nonlinearities model.

The results show that a nonlinear model is required because there are sharp transitions between regimes. More critically, we show that education plays a dual role in determining economic growth and driving that growth's nonlinear feature. However, the focus is on comparing the magnitudes of estimated coefficients for various educational levels. We have not included primary and secondary education in our analysis, even though this may also be relevant to economic growth in Syria. As a result, our objective here is not to answer which level of education is more important to boost economic growth in Syria. We will continue our investigation into this vital matter.

6. Conclusion

This study challenges the idea that the relationship between economic growth and education is linear. The study about the valuation of the STR models applied to the Syrian economy within the context of

the time series framework focused on the period from 1990 to 2019. The estimated models depict the nonlinear effects of higher education on current economic development.

The statistical evidence demonstrates that the population's educational level is considered a GDP nonlinearity factor; using STR models explores the relationship between higher education and economic development. These models have allowed us to measure how quickly economic growth responds to the education-related transitional variable. For economic growth to be sustainable in Syria, higher education is essential. As a result, researchers and decision-makers are very interested in public spending on education. Using the smooth transition regression (STR) model, researchers can examine how quickly the higher education-related transitional variable affects economic growth.

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