The Funding of Education and The Country's Overall Economic Growth in Central Asia
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Chronicle

Abstract

This study aims to provide the groundwork for further investigations into the relationship between educational expenditures and economic growth. This investigation lends credence to earlier conclusions about the amount of money spent by the federal government on education. Both the state governments and the federal government make financial contributions to education; nevertheless, the federal government's planned and operational expenditures employ their resources in a distinct manner. Since our country has had terrible rankings for a number of years and has never even cracked the top ten, one of the most crucial concerns about the money that the government spends on education is: where does it go? This indicates that not enough human capital (HC), which is beneficial to the economy, the people, and the environment, is developed via education expenditure (ECNG). Through the use of EduEx, the purpose of this study was to establish a connection between ECNG and government education funding. According to the findings of this study, EduEx variables at all three levels of education (primary, secondary, and postsecondary) reveal a distinct cointegration link (as shown in the estimated Models 1 and 2). The years 1993 through 2017 are covered in this list of facts. The projected VECM indicates that the benefits of EduEx operations and development education spending on ECNG won't become obvious for quite some time. According to the findings of this research, ECNG is impacted by the percentage of Uzbeks who have completed postsecondary education. The majority of Uzbekistan's working population has at least a bachelor's degree. The percentage of the working population that has at least some secondary education is unusually high.

Keywords: Education, economic growth, Uzbekistan

Background

According to the HC hypothesis, in order for individuals to have access to formal education, which is necessary in order to maximize national production (Adom & Asare-Yeboa, 2016), the completion of an undergraduate degree is universally regarded as the minimum standard for admission into the working world. To put it another way, it's a collection of skills.
that companies look for in the people they hire for employment. Through participation in educational and vocational programs, workers are acquiring the information and experience they need in order to prosper in today’s competitive labor market. In a great number of nations, the expansion of this sector is the single most important factor contributing to GDP growth. According to Cahyadin and Sarmidi (2019), if a country wants to produce workers who are capable of competing in the labor market, it must increase the amount of money it invests in education. Because higher levels of education are linked to increased levels of success in the labor market, it stands to reason that improving one's own level of education would result in an increase in the number of work options available to that individual (Cahyadin & Sarmidi, 2019; Falzone, 2017). As a consequence of this, much attention is paid to the educational sectors of both industrialized countries and developing ones (Ozatac, Taspinar, & Eren, 2018). If Uzbekistan wants to have a high quality of life and a world-class economy by the year 2020, it will need to make significant investments in its educational system, just as every other developing nation does. The Uzbek government has shown its commitment to enhancing the quality of education by increasing funding for educational institutions of all types. The amount of money spent every year on education is a glaring indication of this pattern (Teerawattananon & Luz, 2017). Since 1990, the Uzbek government has increased their expenditure and allocations for the education sector, which is a clear indication that they now put a greater focus on the subject. (Economic Planning Unit, 2013). In an attempt to improve the overall level of education held by the country’s labor force, the government of Uzbekistan is footing the bill for the country’s public educational institutions.

The government of Uzbekistan made significant investments in the development of EduCity Iskandar Uzbik so that it might act as a catalyst for good change and assist in the cultivation of local talent. In addition, the Entry Point Project (EPP) under the National Key Economic Area (NKEA) has recognized EduCity Iskandar Uzbik as a fully integrated center for education in the hope that it will promote the economy of Uzbekistan. This recognition came about as a result of the fact that EduCity Iskandar Uzbik is located within the NKEA (Asari, Muhamad, & Khalid, 2017). Uzbekistan’s government has increased spending on education, but it is still a long way behind other Asian nations like Singapore, Japan, Taiwan, and China in producing the human capital that the country requires (Uzbek Productivity Corporation (MPC), 2014). This is one point of view. Another point of view is that although Uzbekistan’s government has increased spending on education, it still lags far behind other Asian nations.

Despite this, there are results from previous studies that conflict with one another about the link between GovEx on education and ECNG. The vast majority of empirical studies conducted in this area provide support to the endogenous growth hypothesis, which views public policy as an instrument for bringing the ECNG up to date (Maitra, 2016; Panayotou, 2016). In addition, research concerning the expansion of EduEx has solely focused on the overall values of GovEx indicators up until this point. After that, researchers started looking at how the many different parts of GovEx influenced one another, and they came to the conclusion that spending in schools had the most effect. The acceptance of this claim, on the other hand, was never meant to be accepted at its literal face value. The purpose of this study is to investigate the subject of whether or not a larger portion of EduEx is ought to be allotted to ECNG and offer a response to that topic.

2.0. Literature Review

The link between HC and ECNG has been the subject of study for many decades, and that research has revealed that this connection is intriguing. This is true both for macroeconomics and for microeconomics. In order to investigate the aforementioned proposition from a macroeconomic vantage point, it is common practice to make use of both the neoclassical growth models developed by Solow (1956) and the endogenous growth models developed by Panayotou (2016), Ljungqvist and Sargent (2018), and Pelinsecu (2018). (2015).
studies of Walsh (2017), a neo-classical growth model, show that ECNG cannot be described by increases in labor and capital alone. Furthermore, the model acknowledges the contributions to growth rate made by production variables such as labor and capital as well as advances in technological development. Despite this, Walsh (2017) contends that the neoclassical growth model of HC, contrary to the assertions made by Panayotou, is not linked to the progression of technological innovation (2016). As a result of the neoclassical growth theory's tendency to lay an excessive amount of weight on production, it is sometimes dismissed as a "ineffectiveness" approach.

According to Panayotou (2016), receiving an education is one of the prerequisites that must be met before the emergence of HC. Acquiring a certain level of education is considered to be one of the "factors of production," alongside the more common "factors of production" such as labor and capital. His further study provided confirmation for Pelinescu's argument that an increase in the education level of the work force has a favorable impact on production and, eventually, the ECNG (2015).

The ideas about HC and ECNG that were discussed earlier shed light on the most crucial indicator elements related to HC as well as the effect that HC has on ECNG. Level of education is one of the most significant indicators used by the HC, and some of the essential components are already known for this indicator. In addition, the previous study conducted by Panayotou (2016) offers more insights into the manner in which to create a model based on economic theory. As a result of this, the methodology suggested by Panayotou (2016) is used in this study. Specifically, the EDuEx and the three levels of educational performance are utilized as stand-ins for HC. Pelinescu (2015) adds physical capital and HC to the production function as key drivers of development. This expansion of the neoclassical growth model proposed by Walsh (2017) is the result of Pelinescu's (2015) work. Pelinescu (2015) investigated the countries using a method known as cross-sectional ordinary least squares (OLS) analysis. It has been proven that the number of students enrolled in secondary schools has a significant impact on ECNG. In light of the discussion surrounding the expansion of economies in OECD countries, it would have been beneficial for Pelinescu (2015) to include an appropriate HC measurement into their research (Pelinescu, 2015).

Even Pelinescu (2015) acknowledges the need of using an HC meter that is dependable. Pelinescu (2015). According to Pelinescu (2015), key indicators of HC, like as spending for K-12 and higher education, are ignored. Pelinescu (2015) presents a more precise measure for HC by estimating the Augmented Solow model (which combines physical capital, HC) and the entire extended Walsh (2017) model. Both of these models were developed by Walsh (2017). (Incorporates physical capital, HC and technological advancement). When transitional dynamics are accounted for, the fully enlarged Solow model demonstrates a much higher rate of convergence for the OECD ECNG, as seen by the data presented. In addition, their empirical results demonstrate that policies lead to larger investments in HC, higher savings, and trade policies that allow the countries that make up the OECD to converge at the quickest feasible speed despite the transitional dynamics at play. Barro (2016) investigates the influence of HC on growth by utilizing cross-country datasets that comprise more than one hundred different countries since 1960. This is done in order to uncover the "empirical regularities." He uses the cross-sectional Ordinary Least Squares (OLS) approach of regression, placing a focus on initial levels of GDP and early levels of HC like as primary and secondary school attainment rates. In addition, he uses fertility rates and investment ratios in his analysis. According to the findings of his empirical study, there is a connection between a variety of educational characteristics and ECNG. This is something that we have learned. In the early study that deals with healthcare and economic growth using a bigger sample of countries, such as the research done by Barro (2016) and Pelinescu, the OLS regression method is utilized incorrectly (2015). They may have gotten better results by using OLS less often and panel regression more often. This is due to the fact that the OLS estimation technique is not suitable
for parameter estimation. This is because it gives statistical values (t-statistics) that look to be too excellent and often rejects the null hypothesis even when it is accurate.

Highly skilled labor is the most important input for high-tech industries, as stated by the endogenous growth model developed by Ljungqvist and Sargent (2018). This is because highly skilled labor is necessary for the production of novel concepts in the form of knowledge acquired through pursuits such as research and development (R&D). To put it another way, HC adds directly to the corpus of knowledge gathered via the production of new conceptions. As a consequence, the investment of HC leads to an increase in PC growth, which ultimately results in ECNG. Because of this, we may draw the conclusion that the relationship between GDP and education is not a straightforward one of cause and effect but rather a two-way street. This is owing to the fact that variables such as increase in the labor force, foreign direct investment (FDI), improvements in health, and development of physical capital all influence their effect. Keeping in line with the research done by Ljungqvist and Sargent (2018).

Education is often cited as being among the things that are considered among the most crucial when it comes to spreading the word about HC. There is a link between fast economic growth and improving educational levels, as shown by the historical precedents of the development of various different countries (Kangas & Palme, 2005). Therefore, academics and researchers working in a wide range of sectors have investigated the impact that education investment has on the growth of the economy.

Ozatac et al. (2018) employ an Aggregate Production Function model to analyze the influence of EDuEx and ECNG in Uzbik. The authors make use of annual data ranging from 1970 to 2010 for their research. According to what they discovered, ECNG has a strong and positive correlation with the amount of money the government invests in

Increases in Human Capital, Fixed Investment, and Labor Force Participation All Contribute to Growth in the Economy (Omar, 2019). The findings of the estimation showed that there is a positive and forward-looking causal link between educational expenditure and ECNG. According to research carried out by Geyathiri (2015), an increase of one percentage point in the literacy rate would result in an increase of 7.215% in Uzbekistan's GDP. According to Karacor, Ekinci, and Konya (2018), the expenditures made by the government on higher education as well as vocational and technical education had a positive impact on GDP between the years 1970 and 1990.

This demonstrates how important it is to make use of data that are broken down by grade level in the case of Uzbekistan. The study around ECNG's education expenditure as a proportion of the organization's overall budget for development and operations is inadequate. It is essential that disaggregated data, in particular for EDuEx, be comprehended in a way that is both clear and simple.

crucial in establishing the extent to which formal education has an effect on ECNG in the real world The use of an aggregate measure of education is also susceptible to the aggregation bias because of the way that education is measured. Therefore, the purpose of our study is to attempt to satisfy that need. On the topic of the economy of Turkey, the literature presents a number of different points of view. Mukhtarov, Mammadov, and Hamidov (2019) demonstrate that there is no such thing as bidirectional causality by pointing that that the causation runs from the real GDP per capita to the public EDuExes. The conclusion that they came to was that public EDuExes in Turkey do not provide access to ECNG. The statistics presented by Mercan and Sezer (2014), on the other hand, demonstrate that an increase in EDuEx has a favorable and significant impact on ECNG, with an increase of 0.30 percentage points in ECNG for every one percentage point increase in EDuEx (Turkish Lira, TRY) (Turkish Lira, TRY). Baptista and Leito (2015) advocate for a bigger investment in education in general and in higher education in particular. They consider the latter as an extension of the industrial process that is housed within universities and believe that a greater investment in education would be beneficial.
According to Barro (2016)’s research, the level of secondary and higher education in a select number of countries has a substantial impact on the growth of GDP. The fact that there are fewer women enrolled in higher education institutions than there are male students is evidence of gender-based discrimination in such institutions. Vu, DeWitt, and Im (2017) made use of a data set that included many countries to discover that there is a positive association between the average number of years spent in secondary education, the secondary school attainment ratio, and productivity. The findings of his empirical inquiry, on the other hand, are in fundamental disagreement with those obtained by other academics. According to the findings of empirical study, the effect of formal education on ECNG cannot be readily seen and is challenging to evaluate.

Research on the economy of Greece reveals patterns that are very comparable. Studies on the Greek economy that were carried out by Solaki (2013) indicate that alterations in the levels of education at the elementary, secondary, and postsecondary levels as well as expenditures on education have a beneficial influence on real GDP per capita. In addition, according to Pegkas and Tsamadias, there is a causal direction that runs from tertiary education, public EDuEx, and real GDP per capita. This trend travels in the following way: (2014). Instead, there seems to be an instance of backwards causation.

starts with the actual GDP on a per-capita basis and continues through the completion of primary and secondary education (Ogundari & Awokuse, 2018). However, she arrives at the verdict that there is evidence supporting a unidirectional causal relationship between the HC and the ECNG in Greece. These findings do not square with those obtained by Iamsiraroj’s investigation (2016). Iamsiraroj (2016) explores the effect that HC has on economic development by using data from across many countries. Surprisingly, the empirical study suggests that there is not much of a correlation between the amount of education and ECNG. They find no correlation between the rate of change in educational attainment and ECNG in a large sample, but they do find a relationship between the two for the wealthiest countries that is statistically significant.

Pegkas and Tsamadias (2014) conducted research covering Greece from 1960 to 2009 to evaluate the link and influence of higher education on ECNG. They merged the two problems using a modified version of the model developed by Mankiw, Romer, and Weil (1992). This model was used to evaluate the link and influence of higher education on ECNG. In addition to this, students get an understanding that the impact of higher education on the ECNG of Greece is significant and significant. In the meanwhile, Maitra (2016) explores how economic growth is driven by government investment in the education and health sectors in 12 Asian and Pacific countries. Within the context of the VECM study, a causality test was carried out, and the results indicated conflicting and contradictory conclusions about the positive influence that education spending had on ECNG in the case that was looked at. Pegkas and Tsamadias (2014) performed research encompassing both issues in Greece between the years 1960 and 2009 in order to measure the relationship and effect of higher education on ECNG. This study was done in Greece. They achieved this by making certain adjustments to the model that Mankiw and his colleagues had developed (1992). They also come to understand that the impact of Greece’s higher education institutions on the ECNG is significant and crucial.

According to study conducted by Obradovi and Lojanica, investments in higher education have been shown to have a substantial dynamic effect on ECNG in the Iranian economy. This is second only to investments in physical capital (2016). But the money spent on research has a negligible effect on Iran’s economy. According to the findings of one research, a one percent increase in the stock of higher education was associated with a short-term increase
in real production of 0.299% and a long-term increase in real production of 0.3149%. According to the findings of the study, an increased degree of education has a positive and statistically significant influence on ECNG. The progress that humanity has made over the last three decades is emphasized for the positive and considerable influence that it has had on ECNG research conducted in China. In addition, the result from the impulse response function reveals that the impact of school level on development is greatly delayed. This discovery comes from the analysis of the impulse response function. In addition to centering its efforts on expanding enrolment, the government need to likewise put out efforts to strengthen the institutional underpinnings of the country's higher education system. The findings of a second piece of study support the findings of the multivariate causality technique, which demonstrates that there is a two-way causal link between GDP and education expenditure. The findings of their study also indicate that there is a connection between one's level of academic accomplishment and their level of financial success.

Temple (1999) investigates the connection between HC and ECNG by using aggregate data from the whole world. Because of this, he does not include in the smallest and least developed countries in the globe into his calculations. There is a positive association between economic expansion and rising educational standards, which lends credence to the hypothesis that output will expand. According to the findings of a study that was conducted by Pegkas and Tsamadias (2017), the percentage of males who finish secondary education has a disproportionately high impact on the growth of Pakistan's GDP. On the other hand, the proportion of women who reach the end of their secondary education has no effect on the ECNG. Although there is no connection between the ECNG and the percentage of girls who finish elementary school, there is a powerful and significant impact that operates in the other way. Their research has shown that the secondary level of education has a much greater impact on ECNG than any of the other levels of education.

Natural Gas That Is Environmentally Confined in Pakistan; Results Are Similar to Those Obtained by Jalil and Idrees (2013). In addition to this, Jalil and Idrees (2013) highlighted the fact that the HC in Pakistan does not have sufficient material and personnel resources.

The aforementioned study highlights the significance of utilizing disaggregated data on the various levels of educational attainment as an alternative to relying on the average number of years spent in school to evaluate the influence that degrees of education attainment have on economic development. This is because the average number of years spent in school can be misleading when attempting to determine the impact that degrees of education attainment have on economic development. The relevance of taking into account the effect that a person's level of education has on their ECNG in Uzbekistan is what inspired the present study. One piece of research investigates the cointegration and causation between education and ECNG using time series data from 1970–1971 and 2008–2009. Although there is not an agreement in the literature about the economy of Pakistan, this study utilizes time series data to do so. The findings of this study differ from those obtained by Pegkas and Tsamadias (2017) as well as Jalil and Idrees (2013). and a robust and growing economy. In a manner analogous, when seen through the lens of a bivariate paradigm, there is a causal link that may run in either way between ECNG and any level of educational attainment. This relationship is causative. In contrast to the assertions made by Pegkas and Tsamadias, the researchers’ empirical data demonstrate that ECNG has no impact on significant educational parameters such as EDUEx and further education (2017). According to the findings of another piece of research, the impact of vocational education on ECNG is much greater than the impact of higher education in general. This is as a result of the fact that the expense of obtaining a higher education is always rising, and the opportunity cost of attending college is the increase in real earnings brought about by economic growth. Their findings are in line with the predominante theory of development, which asserts that
education first promotes ECNG, and then pushes greater expansion in education as wages grow. Their findings are compatible with this theory of development.

Theoretical framework

Since the early 1960s, researchers from the Chicago school of economics, which is credited with developing the notion of human capital, have been studying how education influences ECNG. In accordance with the endogenous growth hypothesis, the EDuEx has been validated (Lucas, 1988; Romer, 1990). According to the endogenous growth model, technical advancements boost productivity and speed up ECNG, both of which may be incorporated into the model via the production of HC (Maitra & Mukhopadhyay, 2012). The Lucas (1988) Growth Model will be used for this research. In this model, output is created by the production function, and shape is determined by the environment.

\[
GDP = (FP * PC^\alpha)(thc)^{1-a}hc_a \ldots (1)
\]

In (1), GDP is equivalent to Output (GDP), FP is equal to Total Factor Productivity (or the degree of technology), PC is equal to Physical Capital, thc is equal to the proportion of time spent creating the productive activity and HC, and hc is equal to the average HC in the economy. In addition to primary, secondary, and tertiary attainment, HC inputs also include the federal government’s development expenditure on education, the federal government’s administration of EduEx, and educational accomplishment. These HC inputs increase production by increasing either direct accumulation (thc) or the existing body of knowledge (hc_a), which in turn increases creativity and benefits the ECNG (Lucas, 1988; Maitra & Mukhopadhyay, 2012; Mankiw et al., 1992). Assume that the production function \((\partial > 0\) \) has positive rising returns as the scale grows if the value of is larger than zero. According to (Maitra & Mukhopadhyay, 2012).

Therefore, the establishment of HCs may contribute to the growth of economic output via the expansion and operational expenditures on education and educational attainment made by the federal government (primary, secondary, tertiary). As a consequence of this, we are able to make the following assertions on the relationship between output, EDuEx, and educational achievement at all levels (primary, secondary, and tertiary):

\[
GDP_t = (FP * EduEx_t^\alpha) (EduExFP_t^\beta \epsilon_t) : \alpha, \beta > 0 \ldots (2)
\]

Equation (2) indicates a Cobb-Douglas production function, where output = GDP, PA = Total Factor Productivity or the level of technology, EduEx_t^\alpha = Government development and operating EDuEx EduEx FP_t^\beta = (primary, secondary and tertiary) attainment, and \(\alpha, \beta = \) shares of the government EDuEx and educational attainment, \(t = \) time, and \(\epsilon_t = \) error term.

Uzbekistan’s econometric model for describing the impact of education costs on ECNG is represented by the following equation: (2). Since equation (2) is a non-linear model, we have no way of knowing what its parameters, especially A, will be in the future. Because of this, the natural logarithm model will be included into the manufacturing process. Where a predetermined length of time and the other conditions is have stayed unchanged. We can see from the preceding equation that we need to make a distinction with respect to “t,” and using the work of Maitra and Mukhopadhyay (2012), we have:

\[
lnGDP_t = A + \alpha lnEduEx_t + \beta lnEduExFP_t + ln\epsilon_t : \alpha, \beta > 0 \ldots (3)
\]

where A=lnA represents growth in output, expansion of government financing for EDuEx and other educational efforts, and growth in educational attainment. A also represents growth in the number of people who have completed their education. It has been shown that the increase in output is connected to both the establishment and functioning of EDuEx as well as the level of educational attainment (equation 3). Despite this, Maitra and Mukhopadhyay (2012) found that there is not always an obvious association between higher production and EDuEx. Using equation (3), one possible way to estimate it is as follows:
\[ \text{GDP}_{t-1} = A + \alpha \text{EduEx}_t + \beta \text{EduExFP}_t + \theta_t \ldots (4) \]

where \( \text{GDP}_{t-1}, \text{EduEx}_t, \) and \( \beta \text{EduExFP}_t \) are stands for output growth, growth of federal government development and operating education expenditure and educational attainment.

where \( \gamma \), \( \gamma' \), \( \gamma'' \), \( \gamma''' \), \ldots \) are lagged series of \( \gamma \) and \( \gamma' \) respectively.

The work of Lucas (1988) on a model of endogenous growth provided inspiration for the present study. The production function served as the theoretical basis for the model adaptation in this investigation, which argues that the HC may be modeled in production functions with constant returns to the scale since it is a discrete component of the manufacturing process. Nonetheless, the following models have been stated as such in this section in light of the theoretical relationship between GDP, development spending on education (DEVEdu), operational expenditure on education (OPREdu), and educational attainment (PRIEdu, SECEdu, and TERedu):

\[ \ln \text{GDP}_t = \gamma_0 + \gamma_1 \text{DEVEdu}_t + \gamma_2 \text{OPREdu}_t + \epsilon_t \ldots (5) \]
\[ \ln \text{GDP}_t = \gamma_0 + \gamma_1 \text{PRIEdu}_t + \gamma_2 \text{SECEdu}_t + \gamma_2 \text{TERedu}_t + \epsilon_t \ldots (6) \]

### Data and estimation

This study’s objective is to investigate the many facets of the relationship between education and gross domestic product (GDP), as well as the outcomes of EduEx and money from the federal government for education. Before determining the level of causation, there will be a thorough examination of the results of three primary tests. Whether or not a time series is stationary may be determined with the use of unit root tests like the Alexander-Darvas Function (ADF) unit root test and the Phillips Perron (PP) unit root test. In the second part of this analysis, we will apply a technique developed by Johansen and Juselius to determine whether or not the variables have cointegrated (1990). After that, we make use of the VECM framework in order to disentangle the impacts of education attainment and education spending on GDP. The Granger causality test is going to be used in order to investigate the link between GDP and the amount of money spent by the government on education, both in the short term and the long term. We are going to investigate the same method in order to find out whether or not there is a connection between education and GDP. Despite its widespread use in earlier research, the OLS estimator has been shown to have problems with omitted variable bias8 and inconsistent results when assessing the causal link between variables. This is despite the fact that the OLS estimator has been used extensively. This would imply that more cutting-edge regression tactics, such as dynamic models, perform better in terms of actual outcomes than the OLS estimator and other standard regression approaches.

The Johansen cointegration approach was used in order to carry out a longitudinal investigation of the connection. In the 1960s, Johansen and Juselius were the ones who first created this method (1990). The approach for calculating the long-term and short-term connections between variables in multivariate equations was fundamentally altered as a result of the method’s use. A significant advantage of this method is that it can identify cointegration through the counting and detection of cointegrating vectors. The exogeneity issue is circumvented by the methodology proposed by Johansen and Juselius (1990), which treats all variables as if they are endogenous latent variables. Because VECM has a built-in causality estimator, the model developed by Johansen and Juselius (1990) may be applied to obtain estimations on the link between variables. These estimations can then be used to draw conclusions. In the end, we estimate the number of cointegrating connections by making use of maximum eigenvalue and trace statistics. These are two methods that allow us to predict the signs of the coefficients. Testing whether or not the residual is stationary is
all that’s required by the Engle and Granger method for evaluating whether or not cointegration exists. The Johansen cointegration approach has the ability of expanding single equation for an error correction model to multivariate equation. Suppose that the $DEVEEx$ is represented by $Z_t$, $OPREEx W_t$.

Economic freedom $X_t$ by and GDP growth by $Y_t$ take the form as

$$Z_t = [Y_t, X_t, W_t] ... (7)$$

The AR model of equation can be

$$Z_t = A_1 Z_{t-1} + A_2 Z_{t-2} + ... + A_k Z_{t-k} + \epsilon_t$$

Equation (2) may be altered to VECM as given in equation (9)

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + ... + \Gamma_k \Delta Z_{t-k} + \Pi Z_{t-k} + \epsilon_t$$

Where, $\Gamma_1 = [1 - A_1 - A_2 - ... - A_k]$, $i=1,2,3,...,k-1$

$\Pi = -(1 - A_1 - A_2 - ... - A_k)$

Therefore, $\Pi$ is a 3 by 3 matrix because of assumed three variables. This can be broken as $\Pi = \alpha \beta$ where $\alpha$ contains the speed of adjustment towards equilibrium. Whereas the $\beta$ is the long run coefficient, and $\beta Z_{t-1}$ is an error correction term. For a simplistic example, takes $k=2$ equation (3) can be written as

$$\begin{bmatrix} \Delta Y_t \\ \Delta X_t \\ \Delta W_t \end{bmatrix} = \Gamma_1 \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \end{bmatrix} \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} \\ \beta_{21} & \beta_{22} & \beta_{23} \\ \beta_{31} & \beta_{32} & \beta_{33} \end{bmatrix} \begin{bmatrix} \Delta Y_{t-1} \\ \Delta X_{t-1} \\ \Delta W_{t-1} \end{bmatrix} + \epsilon_t$$

THE ET equation (2) can be written as

$$\Pi Z_t = \begin{bmatrix} \alpha_{11} \beta_{11} + \alpha_{21} \beta_{21} + \alpha_{31} \beta_{31} \\ \alpha_{21} \beta_{12} + \alpha_{22} \beta_{22} + \alpha_{32} \beta_{32} \\ \alpha_{31} \beta_{13} + \alpha_{32} \beta_{23} + \alpha_{33} \beta_{33} \end{bmatrix} \begin{bmatrix} Y_{t-1} \\ X_{t-1} \\ W_{t-1} \end{bmatrix}$$

The equation can be transformed into yield equation as

$$\Pi Z_{t-1} = \alpha_{11} (\beta_{11} Y_{t-1} + \beta_{12} X_{t-1} + \beta_{13} W_{t-1}) + \alpha_{21} (\beta_{21} Y_{t-1} + \beta_{22} X_{t-1} + \beta_{23} W_{t-1}) + \alpha_{31} (\beta_{31} Y_{t-1} + \beta_{32} X_{t-1} + \beta_{33} W_{t-1})... (13)$$

According to Enders (2004) $\alpha_{11}$ and $\alpha_{12}$ are speed of adjustment terms.

Results

The correlational analysis of the variables is shown in the table 1. The correlation value indicates that the all the variables used in the current study are highly correlated.

Table 1: Correlation

<table>
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<td>SECE</td>
<td>5</td>
<td>0.6456</td>
<td>-0.4363</td>
<td>0.8129</td>
<td>0.7579</td>
<td>1</td>
</tr>
<tr>
<td>TERE</td>
<td>6</td>
<td>0.7308</td>
<td>-0.7847</td>
<td>-0.7828</td>
<td>-0.7674</td>
<td>0.6882</td>
</tr>
</tbody>
</table>

The first and most important step in conducting a Johansen cointegration test is choosing the appropriate lag duration. Preferred is a lag time that corresponds with white noise. The Vector Autoregressive Model of Castro and Nevárez may be used to determine the optimal lag duration for attaining Johansen cointegration. Then, the information criteria are utilized to determine the delay order (Enders, 2004). Table 2 demonstrates that varying information requirements indicate distinct ideal lagged values for cointegration. In contrast to the Schwarz Information Criterion (Lui, Radl, and Dobromirov), the Akaike Information Criterion (AIC) chose for two lags. The two advised delays by AIC have been implemented. The goal is maximum efficiency with little effort.
Table 2: Lag Length Selection Criterion

<table>
<thead>
<tr>
<th>Lag</th>
<th>LogL</th>
<th>LR</th>
<th>FPE</th>
<th>AIC</th>
<th>SC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-420.929</td>
<td>NA</td>
<td>4.05e+12</td>
<td>46.058</td>
<td>46.332</td>
</tr>
<tr>
<td>1</td>
<td>-244.659</td>
<td>136.047*</td>
<td>5.24e+10*</td>
<td>41.667</td>
<td>43.590*</td>
</tr>
<tr>
<td>2</td>
<td>-565.566</td>
<td>46.418</td>
<td>5.58e+10</td>
<td>41.473*</td>
<td>45.046</td>
</tr>
</tbody>
</table>

Cointegration refers to the long-term link between at least two non-stationary variables. For the cointegration test, the variables must be integrated in the same sequence. The number of cointegrating equations is determined using the Johansen test using the trace test and the maximum eigenvalue test. The findings of cointegration are shown in Table 3.

Table 3: VECM

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Model 1</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>0.0177***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td></td>
</tr>
<tr>
<td>OPRE_{t-1}</td>
<td>0.0198**</td>
<td>0.0170</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.149)</td>
</tr>
<tr>
<td>PRIE_{t-1}</td>
<td>0.0254**</td>
<td>0.0243**</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.071)</td>
</tr>
<tr>
<td>SECE_{t-1}</td>
<td>0.0284*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.075)</td>
<td></td>
</tr>
<tr>
<td>TERE_{t-1}</td>
<td>0.0633**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.098)</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

The majority of the earlier studies examined the impact of the EDuEx on ECNG as a whole rather than examining the impact of the development and operation of the EDuEx individually on ECNG. This presents a challenge for the research being conducted in this particular study. This is due to the fact that both the process of developing EDuExs and running them are not standardized, and as a result, putting these two aspects together might result in aggregate bias. Because of this, the purpose of this research is to focus on education expenditure rather than the whole quantity of EDuEx spent by the government in order to differentiate the influence that spending has on growth via HC. As a result, the purpose of this research is to provide a response to the issue of whether or not the operational and development expenditures of the government in education have an effect on the Uzbekistan ECNG. Previous research, such as those conducted by Geyathiri (2015), Ozatac et al. (2018), and Maitra (2016), has shown the significance of making investments in healthcare more broadly. All of this research come to the conclusion that education, in particular, as a tool to achieve ECNG on the national level. The issue is that educational attainment is broken up into three distinct levels, such as elementary, secondary, and tertiary, where there is a dearth of study done, even within the current literature. This is a problem since it makes it more difficult to compare results. It is possible to draw the conclusion from this that not enough study has been done to determine the advantages of higher levels of educational attainment for ECNG. The amount of education directly correlates to the breadth and depth of one’s knowledge. As a result, it is regarded as an indispensable instrument for determining the prevalence of HC in a certain nation (Fitzsimons, 2017). To the best of my knowledge, there is no consensus among the earlier studies regarding the utilization of a historical series of disaggregated education data in order to investigate the levels of educational attainment on the Uzbekistan ECNG. This is the
case to the degree that my knowledge allows me to. This research is an effort to bridge that knowledge gap. In the first place, the purpose of this research is to give some suggestions to the decision-makers in charge of the education system in Uzbekistan on how to better use the resources already available in order to develop a strategy that is viable over the long run. In addition to that, given that this research has implications for ECNG, there need to be an appropriate diversification of the resources that are used for financing. For example, the government of Uzbekistan might execute a more efficient and effective strategy toward investment in education, particularly with regard to development and operation, in order to get an understanding of the value of expenditures made toward the education sector. This will result in a better execution of policy and enable the government to distribute expenditure on education in a more responsible manner. In this way, our government is able to avoid the ineffective and inefficient expenditure on education that traditionally leads to bad outcomes in creating the desired HC. This is because our government is able to avoid spending money in this manner. In other words, we are able to identify the government incentives that are being implemented in the form of policy and scheme in order to encourage the people of Uzbekistan to actively participate in the learning process in a variety of educational sectors. This finding will serve as motivation for the government to upgrade or otherwise better up the policy framework that is now in place.

Unquestionably, successful and consistent policy planning, a robust public sector, and well-functioning professional institutions are seen as necessities and necessary conditions for expansion. As a consequence of this, Uzbekistan has the opportunity to benefit from superior education on all fronts and is likely able to generate and shape the level of human capital required, thanks to the expenditures made. Following this, it is said that determining the nature of the causal interplays that exist between the three distinct levels of educational enrollment and ECNG in Uzbekistan is another crucial aspect. If similar chains of causality led to education spending and ECNG, then the economies that participated in the study have the opportunity to increase their level of investment in the education sector. This can be accomplished by determining which level of education is truly important to the development of the nation (McCombie & Thirlwall, 2016). In addition to that, the current research is possible to determine if the positive effects of the government’s EDuEx program are more visible in the short-run or the long-run. As a consequence of this, the research could be able to give corroborated between the variables (which stand in for HC) and ECNG, which follows a distinct pattern. As a result, the findings of this research will provide light on the effect that EDuEx has on ECNG at varying degrees of educational attainment. In addition, it will serve as a road map for the governments of Uzbekistan to follow in order to delve further into the requirements to invest in the education sector, particularly in determining a suitable level for the EDuEx. It is important for governments to place greater emphasis on the ECNG mechanism as well as the three various degrees of educational enrollment. In order to improve the overall quality of HC, it will be highly vital to determine the relative significance of the three distinct educational enrollment levels. This will be a very crucial effort (Faggian, Modrego, & McCann, 2019). In the future, this will be of great assistance to us in achieving a benchmark in PISA and Trends in International Mathematics and Science Studies (TIMMS), in addition to the Global Competitiveness Index. In this view, it will boost the confidence to get the future profits in terms of added value of HC and embracing high technology innovation in order to promote the lucrative growth. Specifically, this will be the case since it will promote the lucrative growth. This paper makes a significant theoretical addition by considering important inputs like the creation and operation of EDuEx, which is not at all homogenous. If the current analysis does not take into consideration the federal government’s operational EduEx expenditures or its development expenditures on education, then it will result in aggregation bias. The current research takes into account both the development education expenditure as well as the operational...
EDuEx that is incurred by the federal government in order to circumvent the issue of aggregation bias.

It also concludes, on the basis of our empirical data, that there is a one-way causality flowing from GDP to federal government development spending on education (John, 2016), and that this one-way causality operates only in the short run (Model 1). According to the findings of the estimate VECM, the advantages of spending money on educational development and running EDuEx on ECNG are only likely to become apparent in the long term. This discovery is in line with the ones that were found by Obradovic and Lojanica (2016), Pegkas and Tsamadias (2014), Jalil and Idrees (2013), and Ozatac et al (2018). For Model 2, empirical results of Granger Causality based on the VECM framework also report the existence of unidirectional causality running from GDP to primary attainment, GDP to secondary attainment, and GDP to tertiary attainment in the short run. This is true for all three levels of educational attainment. It has also been shown that the impacts of educational attainment on GDP are only visible in the long term, especially with regard to secondary and higher education.

The empirical results of the current research reveal that educational attainment of secondary and tertiary education is relatively crucial in defining ECNG of Uzbekistan. This is the conclusion that can be drawn from the findings of the study. In point of fact, the vast majority of Uzbekistan’s labor force and working individuals have at least some degrees of secondary or higher education and are thus qualified to hold jobs. In comparison to those who have completed education at a higher level, a disproportionately high percentage of working adults have only completed secondary school.

References


