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PUBLIC EXPENDITURE ON EDUCATION AND ECONOMIC GROWTH: EVIDENCE FROM NORTH MACEDONIA

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Abstract: *In this paper, we studied the impact of public education expenditure on GDP per capita in North Macedonia from 1991 to 2020. The main questions we examined were: 1) What is the relationship between public education expenditure and GDP per capita in the country in the short run?; 2) Does a long-term relationship between the aforementioned variables exist?; and 3) What are the policy implications? This research was based on the Auto-Regressive Distributed Lag (ARDL) model, originally developed by Pesaran et al. (2001). The empirical estimations produced interesting findings. In the short run, the relationship between public spending on education and GDP per capita in North Macedonia was negative and statistically significant. The long-term relationship between the variables remained negative but statistically insignificant. These results were robust and consistent with results from earlier empirical studies. The results suggested that government expenditures on education did not contribute to economic growth in North Macedonia in the analyzed period, ceteris paribus. We concluded that, from a public policy standpoint, intervention in the education system's financing is necessary to facilitate the transformation of education expenditures into productive human capital and enhance the nation's economic development.*

Keywords: *Public Education Expenditure; GDP Per Capita; North Macedonia; ARDL*

INTRODUCTION

Economic theory has long recognized the role of human capital in economic development (Romer 1986; Mankiw et al. 1992; Barro and Sala-i-Martin 2004). Schultz (1961) and Becker (1964) defined human capital as the set of knowledge, skills, competencies, and abilities that are embedded in persons and that individuals develop through time via training, education, job experience, medical treatment, and migration. Human capital can be general or specific depending on who benefits from it (Becker 1962; Lazear 2009). Specific human capital exists when the education and training of the worker are beneficial only for one company. General human capital is knowledge, skills, competencies, and abilities that benefit the individual at every company. Another approach is to categorize human capital into three separate categories regarding the nature of activities it includes. Thus, human capital can be in the form of education, health, and experience and can be acquired through better education, higher health, and new learning (Ogundari and Awokuse 2018).

Previous empirical studies on the relationship between education and economic growth confirm the relationship between these variables. Education has been regarded as an important growth-stimulating factor. The benefits of schooling and education exist not only on an individual level but also for the economy. Individuals' knowledge, predispositions, and skills improve due to investment in education. It also increases the individuals' capacity to innovate

and create new solutions. In a globalized world, education is critical for delivering the highly trained human capital required for job development, economic progress, and individual and societal success (Pegkas and Tsamadias 2014). The modern growth theory (Lucas 1988; Barro 1996) states that education is a factor of production along with labor and capital.

In certain cases, the multifaceted impact of education on economic growth has resulted in allocating a considerable amount of the government budget to education. Sweden had the greatest level of public investment in education as a proportion of GDP (7.1 percent), followed by Denmark (6.4 percent), Belgium (6.3 percent), and Finland (6.1 percent). The information is for the year 2019. In the same year, the remaining EU nations' public expenditures on education ranged from 3.2 percent (Romania) to 5.4 percent (France). Norway and Iceland have relatively high education spending to GDP ratios, 7.1 percent and 6.5 percent, respectively, among non-EU member countries (EUROSTAT2022).

According to another analysis of education expenditures in 36 OECD nations in 2018, the average overall expenditures on education institutions equaled 4.9 percent of GDP (National Center for Education Statistics 2022). Among the countries with the highest total expenditures on education institutions as a percentage of GDP are Chile (6.6 percent), Israel (6.2 percent), New Zealand (6.2 percent), the United Kingdom (6.1 percent), and the United States (6.0 percent). Ireland and Luxembourg had the lowest overall education expenditures as a percentage of GDP (both 3.3 percent), followed by Lithuania (3.4 percent), the Slovak Republic and Greece (both 3.7 percent), and Hungary (3.3 percent).

This research examines the relationship between public education spending and economic growth in the Republic of North Macedonia. Compared to other EU member nations, the Republic of North Macedonia invests a low portion of its central government budget in education as a percentage of GDP. For example, overall public education spending in 2020 was 3.3 percent of GDP, rising to 3.76 percent in 2021. The country's education expenditures are substantially below the EU (5 percent of GDP) and OECD average levels (4.9 percent of GDP) (European Commission, Directorate-General for Neighborhood and Enlargement Negotiations 2022, 88).

The main questions we aim to answer in our study are 1) What is the relationship between public education expenditures and GDP *per capita* in the country in the short run? 2) Is there a relationship between the variables mentioned above over the long term? 3) What does this mean for the Republic of North Macedonia's spending on education in terms of public policy?

The analysis covers the 1991-2020 period. The preliminary findings of our work indicate that the relationship between public expenditures on education and economic growth in the Republic of North Macedonia is negative. The result is statistically significant in the short term but statistically insignificant in the long term.

LITERATURE REVIEW

The literature on education expenditure focuses mainly on the impact of public expenditures for education on economic growth. The results of these previous studies are not unanimous, and they generate different conclusions depending on the selected countries,

periods, and model specifications. Most studies emphasize the positive relationship between education expenditures and economic prosperity. However, some previous works prove the opposite relationship, offering statistically significant evidence that higher public education spending leads to lower growth rates.

Mallick, Das, and Pradhan (2016) examine the relationship between the expenditure on education and economic growth in selected 14 major Asian countries by using balanced panel data from 1973 to 2012 (Bangladesh, China, Hong Kong, India, Japan, Nepal, Pakistan, Malaysia, the Philippines, Saudi Arabia, Singapore, Sri Lanka, Thailand, and Turkey). They discovered the existence of long-run equilibrium relationships between expenditure on education and economic growth in all the countries. Further, the authors revealed a positive and statistically significant impact of education expenditure on the economic development of all 14 Asian countries. Moreover, this work considers the education sector as one of the important ingredients of economic growth in all 14 major Asian countries. It suggests strategies for its prioritization in order to achieve long-term economic development.

Another study examines the impact of public education expenditures on GDP *per capita* in two economies - Tunisia and Morocco - during the 1980-2015 period (Ifa and Guetat 2018). The authors used an ARDL model to estimate the relationship between the variables. The results of this study are mixed. In the short run, the relationship between public spending on education and GDP *per capita* in Morocco is positive, while it is negative in Tunisia. However, in the long run, a positive relationship is confirmed in both countries.

Ogundari and Awokuse (2018) estimated a dynamic model based on the system-generalized method of moments (SGMM) and analyzed balanced panel data covering 35 countries from Sub-Saharan Africa during the 1980-2008 period. The authors use two measures of human capital: health and education. Their results show that education and health positively impact economic growth, although health contributes more than education. Moreover, the results reveal that the impact of government education expenditures on economic growth is positive but statistically insignificant.

The positive relationship between education expenditures and economic growth is also confirmed in eight European Union countries (Dudzevičiūtė, Šimelytė, and Liučvaitienė 2017). Some studies examine the relationship between expenditures at different levels of education (primary, secondary, or tertiary) and economic growth. One recent study confirms one-way short-run causal relationships running from higher education expenditure to GDP in Croatia (Radić and Paleka 2020).

Kiran (2014) discovers a co-integrating relationship between educational expenditures and economic growth in eleven countries in Latin America during the period 1970–2009. He uses the co-integration test procedure in the presence of two unknown structural breaks.

Iheanacho and Nwaogwugwu (2021) discover that the ratio of recurrent education expenditures to total expenditures, the ratio of total capital education expenditure to total expenditure, and inflation have positive relationships with economic growth in Nigeria during the period 1985-2019. The ratio of public education expenditure to total expenditure indirectly influences economic growth in the country. In the long run, only the ratio of recurrent education expenditures to total expenditures Granger causes economic growth. They use different

techniques to examine this relationship, including auto-regressive distributed lag co-integration, error correction mechanism, and Granger causality tests.

Dao (2012), by using two samples of 28 developing economies, examines the relationship between GDP *per capita* growth and public expenditure. Their results suggest that GDP *per capita* growth is dependent upon the growth of *per capita* public health expenditure in the GDP, the growth of *per capita* public spending on education in the GDP, population growth, the growth of the share of total health expenditure in the GDP, and the share of gross capital formation in the GDP.

Interesting findings are presented in a study of the link between education expenditure and growth in Côte d'Ivoire (Kouton 2018). The analysis refers to the period from 1970 to 2015. The study provides evidence of a negative and significant long-term effect of government education expenditure on economic growth for the abovementioned period. Moreover, government education expenditure has a non-significant positive effect on economic growth in the short term. The results show a unidirectional causal relationship between the two variables, running from education expenditure to economic growth.

Some research does not prove a statistically significant link between education expenditure and growth. For example, Karaçor et al. (2017) found that education expenditure has not affected GDP in selected 19 OECD countries using panel data estimation (fixed effect models) from 1998 to 2012. Coman, Lupu, and Nuta (2022) are exploring the impact of public education spending on economic growth in Central and Eastern Europe from 1990 to 2020. By using the ARDL model with structural brake, they discovered that in some Eastern European countries (Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, and Latvia), there are long-term inter-conditioning relationships between education spending and GDP, with results on the short term being positive or negative. However, there is no long-term relationship between education spending and economic growth in some countries (Lithuania, Poland, Romania, Slovakia, and Slovenia).

Finally, we have identified literature that aims to understand the mechanisms of the impact of public education expenditure on growth. For example, Annabi, Harvey, and Lan (2011), using an overlapping generations model in Canada, conclude that the impact of public expenditures on education depends on their efficiency and the distortions implied by alternative tax instruments. Blankenau and Simpson (2004) explore this expenditure-growth relationship in an endogenous growth model context. They found that the positive direct effect of public education spending on growth can be diminished or even negated when other determinants of growth are negatively affected by general equilibrium adjustments. The expenditure–growth relationship depends on the level of government spending, the tax structure, and the parameters of production technologies.

DATA

In our analysis, we use two variables: *y* and *edu*. The variable y reflects the country's GDP *per capita*, expressed in constant 2005 local currency units (Macedonian denar, MKD). This variable was collected from the World Bank Database (World Bank 2013).

The second variable, *edu*, represents government expenditure on all levels of education. Although the functional classification of the government budget (COFOG classification) has the most exact information regarding the purpose of the government-allotted funds, the Republic of North Macedonia only reports statistics on functional classification back to 2010. As a result, we utilize statistics from the country's Ministry of Education and Science's expenditures in the central government budget as a proxy for education expenditure. With this in mind, the variable *edu* represents the public resources dedicated to education. This variable is also given in 2005 constant local currency units (Macedonian denar, MKD). The information is derived from the annual financial statements of the country's central government budget.

Both variables have an annual frequency and cover the period 1991-2020. We changed the variables into their natural logarithm form to reduce heteroscedasticity in the model. The computations were performed using the statistical program EViews 10.

METHOD AND RESULTS

This research aims to assess the impact of public education expenditures on economic growth. We use the bounds test approach originally developed by Peseran et al. (2001). We assume *y* is the dependent variable, and *edu* is the independent variable. We estimated the following equation:

$$lnY_t = c + \alpha \ln Edu_t + \varepsilon_t \quad (1)$$

Before proceeding with the analysis, we conducted unit root tests to check the stationarity of the variables.

Unit Root Test

In order to avoid spurious regression, the first step in our analysis was checking the stationarity of the time series. In the test equation, we used both the individual intercept and trend. We performed the ADF-Fischer and PP-Fischer Chi-square tests, assuming individual unit root processes as a null hypothesis. These two tests are considered the most appropriate unit root tests for unbalanced panel data (Baltagi 2005). The results from the unit root tests are reported in Table 1.

Table 1: Unit Root Tests Results (Source: Author's calculations)

Variables	ADF (SIC)		Philip - Perron test	
	Level	First Difference	Level	First Difference
y	-5.039***	Æ	-4.922***	Æ
edu	-1.776	-3.785**	-1.617	-3.638**

Note: * represents 10% level of significance, ** represents 5% level of significance, *** represents 1% level of significance, respectively. Æ sign indicates that the variable is stationary at level.

The results from both of the stationarity tests suggest that the variable y is stationary at level (I(0) process), while the variable *edu* is stationary at the first difference (I(1) process). This

result requires a further test of the long-run relationship with the bound test (Iheanacho and Nwaogwugwu 2021).

Co-integration Analysis

The stationarity test of the variables used in our paper suggests that the variable y is stationary at level, while edu is stationary at the first difference. In light of this, we ran an ARDL bound test to see if there is a long-run relationship between the dependent and independent variables.

We have estimated an ARDL (1,1) model with an unrestricted constant. A decision was made not to use a trend in the model because the trend was not statistically significant at a level of significance of 5%.

Then, we have run a co-integration test to examine the long-run equilibrium of the variables. The results from the bounds test are given in Table 2. The calculated F statistic in our model is 12.822. Its value is higher than the lower and the upper critical value, at a level of significance of 1%. Because the F-statistic value is greater than the critical value, we can conclude that there is a long-term relationship between the variables (Cho et al. 2015). Alternatively, or to put it differently, the bound test results suggest that there is a co-integration between the GDP *per capita* and the education expenditures.

Table 2: Bounds Testing Results (Source: Author's calculations)

			10%		5%		1%	
Model	K	F-stat	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Model with Constant	1	12.822	4.04	4.78	4.94	5.73	6.84	7.84

We proceed with the estimation of long-run and short-run ARDL models because the results of the bounds test suggest that there is a proven long-run relationship between education expenditures and GDP *per capita*.

Short Run Analysis

The coefficient estimates and their corresponding t-statistics and p-values for the ARDL (1,1) error correction model are reported in Table 3. The test result for the error correction term (ECT) is -0.005528. The ECT value is negative and higher than -1. Also, it is statistically significant at the 1% level of significance because its p-value is below 0.01. The speed of adjustment from short-run equilibrium to long-term equilibrium is -0.005528, or 0.000055% of the model distortion that occurred in the first year. Based on the ECT value, we may conclude that ARDL (1,1) is a valid model for explaining the country's short-term dynamics between GDP *per capita* and education expenditures.

Table 3: Short-Term ARDL (1,1) Error Correction Model Estimates (Source: Author's calculations)

Variables	Coefficients	t-statistics	Probability
constant	0.6631***	5.2702	0.0000
d(edu)	-0.0205*	-1.9851	0.0582
Ect(-1)	-0.0055***	-5.1642	0.0000

Note: * represents 10% level of significance, ** represents 5% level of significance, *** represents 1% level of significance, respectively.

The *d(edu)* variable is significant at 10% level of significance. The coefficient estimate is negative, -0.0205, presupposing that all else held constant, 1% increase of public funds allocated towards education will decrease GDP *per capita* by -0.021 in the short run. This result is consistent with previous findings (Benos and Zotou 2014; Teixeira and Queiros 2016; Coman, Lupu, and Nuta 2022).

Long Run Analysis

The bound test results indicated that the country's GDP *per capita* and education expenditures are in long-term equilibrium. The long-term model results are presented in Table 4.

Table 4: Long-Term ARDL Model Estimates (Source: Author's calculations)

Variables	Coefficients	t-statistics	Probability
Edu	-4.4351	-0.2168	0.8301

Note: * represents 10% level of significance, ** represents 5% level of significance, *** represents 1% level of significance, respectively.

The coefficient estimate for education expenditures is also negative in the long term. In the long run, an increase of 1% in education expenditures will lead to a decrease in GDP *per capita* by -4.4351, on average, *ceteris paribus.* Previous studies reported a negative relationship between education expenditures and GDP (Keller 2006; Ifa and Guetat 2018).

Stability Checks

The model developed in our research is robust. We performed numerous tests to assess the stability of the chosen model, including homoscedasticity tests (White's test and Breusch-Pagan-Godfrey tests), autocorrelation tests (Durbin Watson test), and serial correlation tests (Brouch Godfrey LM test). A Ramsey RESET test was also performed to see whether there is a functional form misspecification. Table 5 displays the results of the stability testing.

Table 5: ARDL Diagnostic Tests (Source: Author's calculations)

Test	Statistics	P-value	Decision
White's test	0.4696	0.8631	No heteroscedasticity
Breusch-Pagan-Godfrey	0.3888	0.7620	No heteroscedasticity
Breusch-Godfrey LM test	0.0738	0.9291	No serial correlation
Durbin Watson	1.6528	/	No autocorrelation
Ramsey RESET test	3.8143	0.0626	No functional form misspecification

Both tests for heteroscedasticity (White's test and Breusch - Pagan - Godfrey test) have p-values greater than 5%, indicating that we cannot reject the null hypothesis of homoscedasticity between the variables in the model. For identifying serial correlation, the Breuch - Godfrey LM test is used. The p-value of the F-statistic of the test is also greater than 0.05, indicating that no serial correlation exists in the model. The Durbin - Watson statistics value is 1.6528, which falls between 1.5 and 2. Based on this conclusion, we can conclude that the model has no autocorrelation.

In addition, we ran the Remsey RESET test. This broad misspecification test is designed to discover omitted variables and incorrect functional forms. This test's computed F-statistic is 3.8143, with a corresponding p-value of 0.0626. We can conclude that we cannot reject the null hypothesis (H0: No omitted variables) because the model is sufficiently stated at a level of significance of 5%.

In the end, we performed a CUSUM test for the stability of the model. The results are presented in Figure 1. We notice there is no deviation throughout the analyzed period.

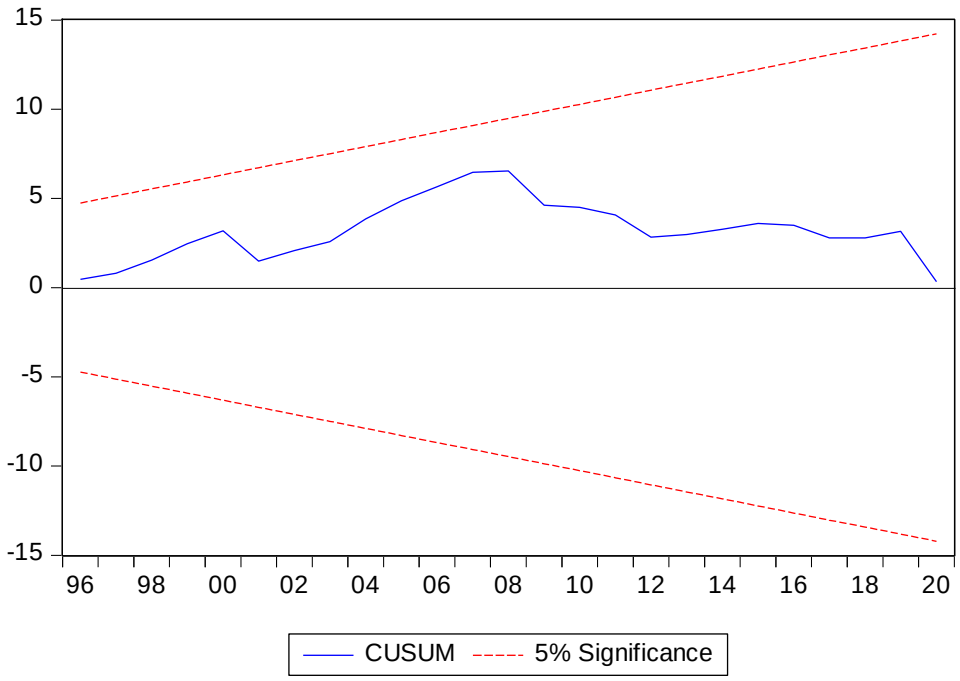

Figure 1: CUSUM Test

CONCLUSION AND POLICY IMPLICATIONS

Using an autoregressive lag distributed (ARDL) model, we calculated the influence of public education spending on economic growth in this study. The paper examines this relationship in the Republic of North Macedonia context from 1991 to 2020. We used data from the Ministry of Education and Science as a proxy for public education spending and a logarithmic transformation of real GDP *per capita* as a proxy for economic progress. First, we checked for variable stationarity, then we looked at the short-term link between public education spending and GDP *per capita*, and last, we looked at the long-term association. Stability tests confirmed that the results are robust.

We found a negative and statistically significant relationship between government expenditures on education and the economic growth of the Republic of North Macedonia. The negative association between these factors is statistically insignificant in the long run. These findings corroborate earlier country-specific research (Kouton 2018; Ifa and Guetat 2018; Coman, Lupu, and Nuta 2022).

We look at two plausible explanations for our findings. First, the country's public education expenditures are low in absolute and relative terms. As we noted at the outset of this paper, the county contributes just a small percentage of its central budget to education. Regarding government investment in education, the country trails behind the EU and OECD averages. These levels of government spending are sufficient to maintain the current educational infrastructure but insufficient to create and increase human capital. The second possible explanation for this result is the inefficient allocation of the public funds devoted to education.

From a public policy stance, we advocate for an increase in the government's education budget. In addition, we advocate for measures and initiatives that increase educational quality and accelerate human capital conversion. Priorities in this regard include optimizing the school and university network, modernizing school and university curricula, and increasing capital spending on educational infrastructure.

One potential weakness of our analysis is the proxy we utilize for government education spending. We used the Ministry of Education and Science's expenditures as a proxy for the country's public education spending. The study included the years 1991 through 20202. Another technique is the classification of government functions (COFOG) approach to differentiate education expenses. However, COFOG reporting in North Macedonia was started in 2010, making it methodologically difficult to determine the long-term relationship between education expenditures and economic growth. Furthermore, future research should consider the importance of other human capital components, such as population health, to the country's economic growth.

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Statement of Human Rights:
This article does not contain any studies with human participants performed by any authors.

Statement on the Welfare of Animals:
This article does not contain any studies with animals performed by any authors.

Informed Consent:
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