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ASSESSING THE NEXUS BETWEEN EDUCATION, ECONOMIC GROWTH, AND INNOVATION: AN EMPIRICAL ANALYSIS

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Abstract:

Countries with a higher proportion of tertiary education graduates are wealthier and offer more diverse and motivating career opportunities to individuals, including students. In recent years, an increasing number of studies have examined the impact of education on wages and economic development and the impact of R&D and innovation on economic and social progress. However, research has focused less on the specific impact of education components (competencies, learning methods, information and communications, technology, and infrastructure) on economic development and innovation. The paper uses quantitative research methodology and dynamic panel models explore the impact of education on economic development, wages, and innovation in the European Union countries and countries that participate in PISA testing, over the period 2012-2019. The data was gathered from Eurostat, and the time period studied ranged from 2012 to 2019. We found evidence that the substantial funding of R&D and education, which promote innovation, supports a country's need to develop and distinguish itself from others that underfund the most critical areas of economic development. The implications of this study are significant for Romania's academic and political environments, as it encourages changes in educational policies that will consider the multifaceted impact of educational components on development through innovation.

Key words: *education, economic growth, innovation, panel models, European Union*

1. Introduction

The year 2022 is considered by the European Commission to be the European Year of Youth (European Union, 2022). Therefore, the central theme of this research is education, which comes as a waking-up call for public authorities to provide further attention to this area and increase government spending on education. Education is the key to the sustainable development of a society. That is why countries such as France, the United Kingdom, Switzerland, and Norway have emphasized it since more than 60% of the GDP growth is generated by people with tertiary education (OECD, 2012). But education is an investment with a very long-term return and therefore studies using longer time spans should also be considered.

According to the Bloomberg Innovation Index 2021, the world's most innovative top 5 countries are South Korea, Singapore, Switzerland, Germany, and Sweden. It is not something fortuitous since these countries had high investments in R&D for a consistent and long time. World Economic Forum made a top for the countries with the highest spending on R&D, and the countries mentioned above, are in the top 10 countries regarding R&D Expenses (Jamrisko, Lu, & Tanzi, 2021). Innovation is a crucial driver of economic development, aiding consumers, businesses, and the economy as a whole. Structural measures to promote innovation include increased governmental spending on R&D and investment in education. Education is the pillar of a sustainable and innovative society. A society without sustained investment in education or a poor and underfunded educational system cannot achieve a high score in innovation and wellbeing. The most innovative countries mentioned above have the best educational system, ranked in the top 20 countries (Ireland, 2020).

A qualitative, inclusive, focused-on-gaining skills educational system allows students to explore, discover, make mistakes, learn, relearn, and upskill and reskill students. Romania needs to increase its expenses on education and R&D. Unfortunately, in the last years, the governmental expenses with education as a % of GDP decreased constantly, currently indicating 2.28% (Peticilă, 2021). Romania is the last country in the European Union regarding education expenses as a percentage of GDP. Thus, Romania needs systemic investments in education to prepare the country's future.

In 2020, educational spending from EU countries' budgets reached a total of 671 billion EUR, representing 5% of the EU`s GDP. While in the same year Romanian Government invested only 3.7% of its GDP in Education, 1.3% below the EU average (Eurostat, ec.europa.EU, 2022) – see Figure 1. According to OECD studies, there is a strong link between NEET[1] and educational attainment. Therefore, young people who fail to complete upper secondary education are at higher risk of entering the NEET category (OECD, 2022). In 2021, 13.1% of young people aged 15 to 29 in the EU belonged to the NEET category, and in Romania, more than 20% of young people aged 15 to 29 are also in this category. These are people that are not actively seeking employment and therefore they are not even considered in the unemployment rate. The higher the NEET number, the

[1] Not in Education, Employment, or Training

lower the availability of workforce. Romania has increased its NEETs rate with 0.8 percentage points in 2021 compared to 2011 (Eurostat, 2022) – see Figure 2, which is a worrying trend. At the same time, the unemployment rate is extremely low (around 2.7%, according to the Romanian Ministry of Labour).

The European Innovation Scoreboard offers a comparative evaluation of innovation performance in EU states, other European nations, and regional neighbors. The most innovative countries are Sweden, Finland, Denmark, and Belgium (European Commission, 2021). As expected, these countries had the most significant governmental R&D allocation in 2020, with their authorities investing more than 2.91% of the GDP in R&D (Figure 3). On the other hand, the Romanian Government invested only 0.47% of the GDP in 2020 (Eurostat, 2022).

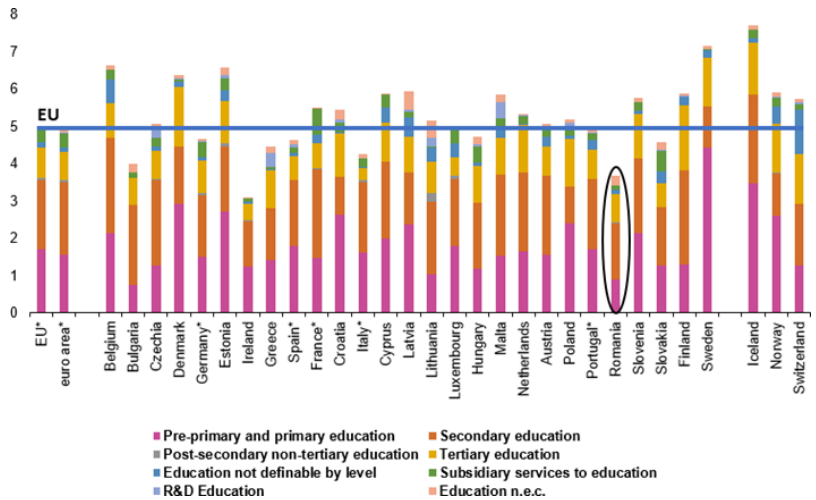


Figure 1. Total general government expenditure on education, 2020 (% of GDP)
Source: Authors' representation (Eurostat, 2022)

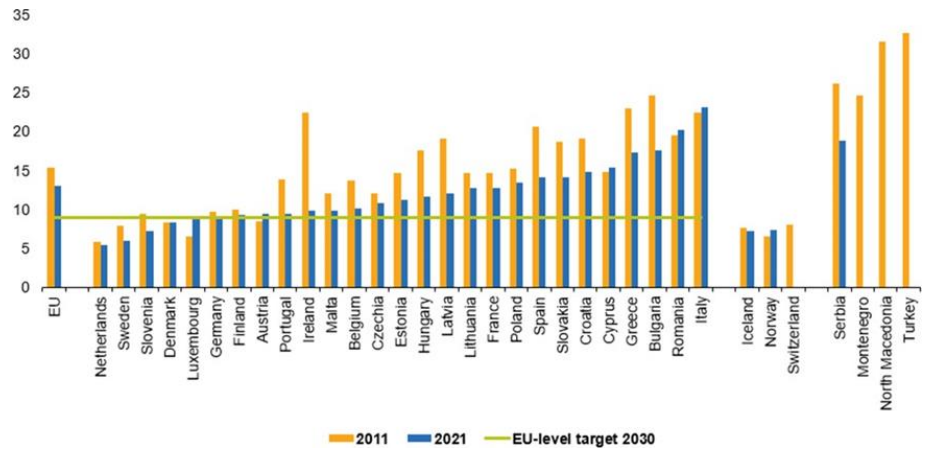


Figure 2. Young people (aged 15-29) neither in employment nor in education and training, 2021 Source: Authors' representation (Eurostat, 2022)

In this framework of redefining the relationship between economic development, education and economic growth, this paper addresses three of the current 17 SDGs, namely SDG 4 – Quality Education, SDG 8 – Decent Work and Economic Work (more focused on economic development), and SDG 9 – Industry, Innovation, and Infrastructure (Emphasis on innovation) (UN, 2022). Specifically, we focus on the paramount role that education and education financing by the government play for economic advancement, as intermediated by their support for innovation and innovative activities. We enrich the existing literature by an empirical analysis of EU and EEA countries in terms of government resources, researchers and young employment, which shows the short- versus long-term specificities of their interaction.

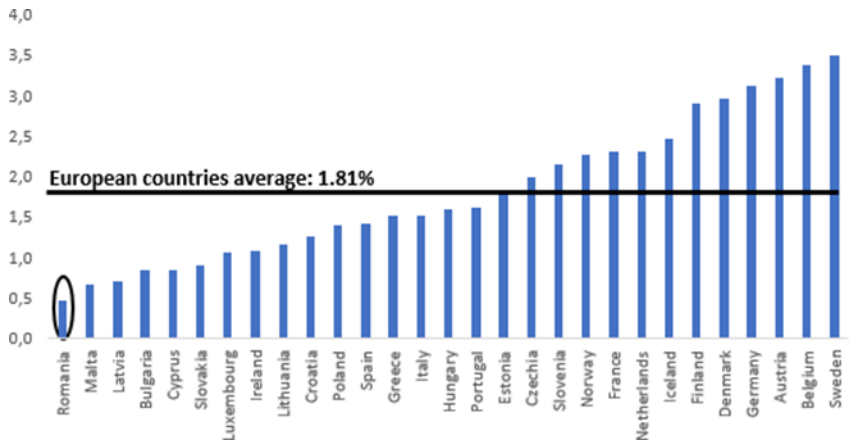


Figure 3. Research and development expenditure in European countries in 2020
Source: Authors' representation (Eurostat, 2022)

The rest of the paper is structured as follows: Section 2 provides a literature review relevant for our research, Section 3 outlines the data and research methodology, Section 4 shows and discusses the main findings, and Section 5 concludes and offers directions for future research.

2. Literature review

Education is the central development pillar, significantly contributing to economic growth (Grant, 2017). It has been proven that there is a positive and significant correlation between GDP growth and human capital accumulation when there is a greater and more efficient allocation of education resources (Judson, 1998). Another 42-year study in Turkey (1970-2012) that discussed the correlation between education expenses and economic growth showed a positive relationship between these two variables and that a better allocation of resources in education could make Turkey's economy more dynamic (Mercan & Sezer, 2014). Another study in North Macedonia, based on data from 1917 to 2020, exhibited that even a one-point increase in education spending will positively impact economic growth (Ziberi, Rexha, Ibrimi, & Avdiaj, 2022). A study conducted on the ASEAN

states (Philippines, Malaysia, Indonesia, Singapore, and Thailand) between 2000 and 2018 revealed the nonlinear effect of government spending on education for each tertiary student related to the economic growth of ASEAN countries (Manejuk & Yamaka, 2021).

Human capital encompasses knowledge, skills, and experience and is the most important factor determining economic development, according to Bassanini and Scarpetta (2001). University education is responsible for cultivating knowledge. Based on this, a nation should concentrate on the quality of educational activities from the primary level (kindergarten) to the highest level (tertiary studies, levels 5–8) if it aspires to become economically superior. However, the macroeconomic environment needs to be stable to achieve economic growth, with a steady exchange rate and no debt crises. (Fischer & Vinod, 1990). In a perpetualy changing economic environment, education also counts for professional reconversion of people into different skills / higher skills (Mitu, 2010).

With historically low unemployment rates and aging populations, EU countries should focus on NEETs, especially those countries where the NEET is significantly higher than the EU average, because young people are the engine of an economy, and what a country wants are well-being for its citizens and a sustainable and certain future. According to latest research by Peter Zeihan, the aging population is one of the most imporant factors driving down economic growth in the next few decades (Zeihan, 2022). Through perpetual investment in education and disadvantaged categories (NEET), a country can evolve economically meaningfully, having education expenditure correlated with economic growth to some extent (Aghion, Boustan, Hoxby, & Vandenbussche, 2009). Following the PISA tests in 2018, in Romania, it was found that those students from families with a good socioeconomic status had better reading results, with a difference of 109 points between them and those students from disadvantaged families/with a low socioeconomic status (Ministry of Education press release, 2019). For this reason, the state must intervene and balance the situation through sustained efforts to provide the necessary framework for equal development regardless of socioeconomic status. Otherwise, these young people with a needy socioeconomic status will fall into the NEET category.

Given the intense digitalization during the COVID-19 epidemic, more attention is now being placed on stimulating instructional strategies like simulations that can engage students more and provide them with practical skills (Paulino & Anabela, 2019). These instructional strategies should concentrate primarily on students from disadvantaged categories to motivate them to stay in the educational system so they can ultimately be prepared and competent according to the requirement of the work field.

The European Union's economic growth policy is based on technology promotion, innovation, job creation, investment stimulation, and efficient use of financial resources (Cristescu & Talvăr, 2019). A research of students from the UK, France, Russia, and Germany on a sample of 2707 students (April to June 2020) revealed that the well-being of students is negatively impacted by how worried they are about the effect of COVID-19 on their academic performance (Plakhotnik & et al., 2021).

Within the European Union, the real growth GDP (% change on previous time period) in 2020 was -5.7% compared to 2019 when it was 1.8%, showing an increase in 2021 compared to 2020 when the real growth GDP was 5.3% (Eurostat, 2022). This demonstrated the pandemic's consequences in 2020 and 2021, when the economy was

dampened. At the same time, it is expected that the quality and availability of education also went down in that period due to recurring lockdowns. That being said, the pandemic's effects will primarily be felt in 2022,2023 and potentially beyond when it comes to education. Also, the World Bank predicts that a global recession could start in 2023 (World Bank, 2022).

Innovation unquestionably contributes to economic growth (Nicholas, 2011), and it can help a nation or business raise its level of development (Boyles, 2022) by allowing them to stand out from the competition. A country-wide innovation survey based on a range of data from 2000 to 2010 (OECD countries) concluded that low-GDP nations rely more on external collaboration to innovate, while high-GDP countries that invest more in R&D fields count on domestic non-profit organizations and private businesses to boost innovation. (Raghupathi & Raghupathi, 2017). Government R&D spending is necessary for private sector innovation, and it also supports research and experimentation by establishing laws favorable to innovation (World Economic Forum, 2020). In all countries that rank good in innovation, it is the government that is the largest actor in the field.

The knowledge triangle (KT) concept is widely used in business literature – see Figure 4. It has three components: Education, Research, and Innovation, and it is central to this research as well. The interaction of these three elements depends on the national or regional ecosystem. Thus, the state has a vital role in the innovation process. The concept of education is often present when discussing innovation because innovation is primarily based on a conceptual framework, and those who innovate need the training to develop skills.

Following various research to determine the impact of education on innovation and investment in education, it has been shown that there are long-term benefits for the participants of the educational program (Raj, Hendren, Kline, & Saez, 2014) and implicitly for society.

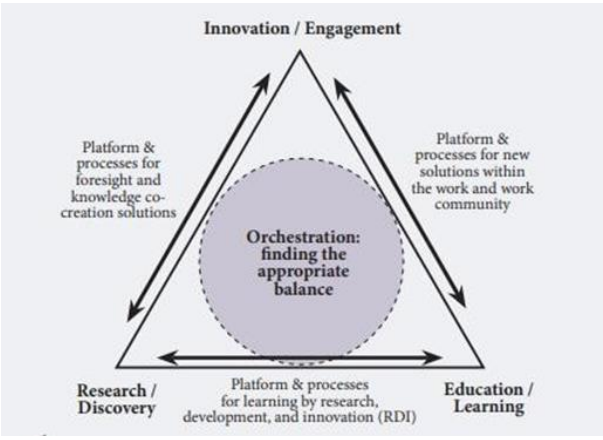


Figure 4. The Knowledge Triangle of Education, Research, and Innovation
Source: Sjoer et al., 2011

Innovation, once created, benefits the general public by enjoying the use of innovation results. Two aspects are essential for innovation: Education and Human Capital (Basi, Deming, & Moser, 2021). However, human capital contributes to knowledge acquisition through new ideas. The fact that these ideas can be applied by those who have not invented them (as long as everyone may benefit from public research) attempts to make them non-competitive, producing advantageous externalities that encourage growth. According to a study in the field of education and innovation, research universities are essential for the growth of knowledge and creativity (Basi, Deming, & Moser, 2021). However, increasing funding and investment for these institutions are also necessary because they might produce significant benefits for innovation and spillover effects.

3. Data and research methodology

The panel data analysis we undertake aims at analyzing the relationship between governmental investment in education, on the one hand, and young people's employment and the researchers employed in the economy in a sample of EU and EEA countries. Annual data between 2012 and 2020 has been collected from Eurostat, the official statistical database of the European Commission. Thirty countries have been included in the analysis, of which 27 are EU members (the current EU-27 members), and 3 are non-EU members (Switzerland, Iceland, and Norway). Therefore, a balanced panel with 270 observations (N=30 countries and T=9 years) has been used in estimations.

Table 1 presents the variables used in panel modeling. The choice of variables is based on existing literature and data availability.

Brief descriptive statistics of the variables for the sample and the entire time frame of the analysis are presented in Table 2. Results show that countries in the sample are heterogeneous for what concerns young employment (YEMP), as this varied between 25.60% and 81.20% in total employment, with a mean of 49.57%, as well in the case of researchers employed in the economy (RES): this variable varies between 788 and 450,796 people in the countries in the sample, for a mean of 57,456 people. Also, government expenses on education as a share in GDP (EDU) show high variability in European countries, varying between 2.80% and 7.70%, around a mean of 5.10%. GDP growth (GDPGR), governmental revenues (GOVR), and population income (INC) show similar variability in the sample, suggesting that European countries differ in terms of their economic development and fiscal policies, which are reflected in the size of government revenues and net income of the population. The evolution of all variables over time is also depicted in Figure 5.

Table 1. Variables description

Variable	Notation	Description
Youth employment	YEMPL	Employed people (all genders) from 15 to 29 years, all ISCED 2011 levels – percentage of total employment
Total researchers - full time equivalent	RES	Total number of researchers (all genders) employed in all economic sectors - number

Education expenses	EDU	Total general government expenditure on education – percentage of gross domestic product (GDP)
GDP growth rate	GDPGR	Real GDP growth rate – percetage year-on-year
Government revenue	GOVR	Total general government revenue – million euro
Population income	INC	Median equivalised net income (all genders) - euro

Source: Authors' work

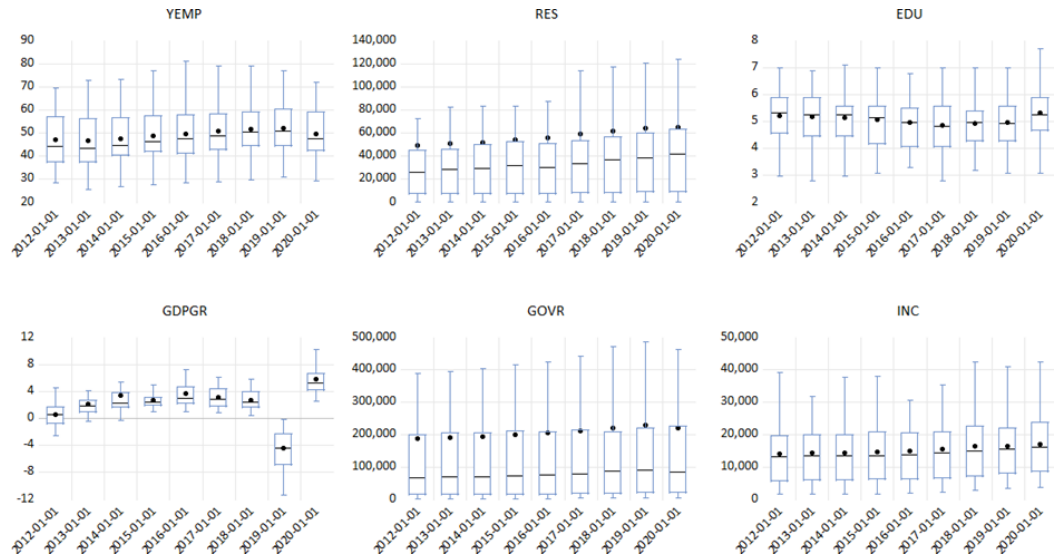
Table 2. Descriptive statistics of variables

	YEMP	RES	EDU	GDPGR	GOVR	INC
Mean	49.57	57456.48	5.09	2.27	208014.30	15458.12
Median	47.70	34304.00	5.10	2.35	82694.05	14439.00
Maximum	81.20	450796.00	7.70	24.40	1613797.00	43227.00
Minimum	25.60	788.00	2.80	-11.30	2856.60	1760.00
Standard deviation	11.59	86375.87	0.97	3.70	337835.80	9596.38
Skewness	0.37	2.80	0.04	0.09	2.56	0.73
Kurtosis	2.72	10.86	2.62	8.95	8.85	3.07

Source: Authors' work

Panel models are recognized in scientific literature as offering improved controls individual cases heterogeneity. Pesaran et al. (1999) and Pesaran et al. (2001) proposed the Autoregressive Distributed Lag (ARDL) model to handle estimations with variables of different integration orders, i.e., I(0) – variable is stationary in level - or I(1) – variable is stationary in first difference -. However, variables cannot be stationary in the second difference for the model to be implemented. This methodology differs from the cointegration approach proposed by Johansen (1988) and Engle and Granger (1991), as discussed by Nkoro and Uko (2016) or Philips (2018). Furthermore, ARDL models show higher efficiency when describing the short- versus long-run relationships between variables (Horobet et al., 2022).

The results of panel unit stationarity tests applied to the variables in their logarithmic form indicate that all are I(1), but GDPGR is I(0), which clearly points toward the panel ARDL model as the best choice for carrying out the analysis.



Note: - shows sample mean, - shows sample median.

Figure 5. Boxplots of variable evolution over the analysis time span

Source: Authors' work

Pesaran et al. (1999) built on ARDL models and advanced the Pooled Mean Group Model (PMG) as a cointegrated ARDL model adjusted to the panel data sets attributes. As mentioned above, this model can estimate both long-run and short-run coefficients that describe the links between variables in a general form given below:

$$Y_{it} = \sum_{i=1}^{p} \alpha_i Y_{i.t-i} + \sum_{i=0}^{q} \delta_{ii} X_{i.t-i} + \mu_i + \varepsilon_{it} \quad (1)$$

Where is the dependent variable (YEMPL and RES, alternatively), is a vector of explanatory variables that are I(0) or I(1), which includes EDU as the main regressor and GDPGR, GOVR, and INC as control variables and mitigators of the omitted variable bias, is the coefficient of the lagged dependent variable, are the k×1 coefficient vectors; is the unit-specific fixed effects; is the error term, i = 1, …, N; t = 1, .., T; p and q (from 1 to n) are the optimal lag orders.

Apart from the estimation described in Equation (1) that portrays the long-run relationship between variables, the ARDL panel methodology offers estimations of the short-term links between variables. This is encapsulated in a short-term Error Correction Model (ECM), understood as an adjustment process in view of a long-term equilibrium relationship between variables. An interesting feature of the ECM equation is that parameters estimated using the average group estimator are allowed to vary between individual units (cross-sections). Pooled mean group (PMG) and Mean group (MG) estimators differ in terms of parameters' estimation: thus, the PMG estimator assumes homogeneity across individual cross-sections (countries, in the current case), while the MG estimator allows for heterogeneity in short- and long-run relationships. Asteriou et al. (2020) have also shown the lower appropriateness of the MG estimator for

heterogeneous panel and its sensitivity to outliers in the case of small panels (as is the current case). There was used the Hausman test to decide between the two estimators, and the results indicated that PMG is a better estimator given the attributes of data included in the research. The ECM equation is the following:

$$\Delta Y_{it} = \varphi_i(Y_{i,t-1} - \beta'_i X_{i,t}) + \sum_{i=1}^{p-1}(\alpha^*_{i.i}\Delta Y_{i,t-i}) + \sum_{i=0}^{q-1}(\delta^*_{i.i}\Delta X_{i,t-i}) + \mu_i + e_{it} \quad (2)$$

Where $\varphi_i = -(1 - \alpha_{ij})$ is the speed of adjustment coefficient specific to the group; β'_i is the vector of long-term relationships; $(Y_{i,t-1} - \beta'_i X_{i,t})$ is the error correction term (ECM); $\alpha^*_{i.i}$ and $\delta^*_{i.i}$ are the short-term dynamic coefficients; e_{it} is the error term. EViews 12 was used to perform the estimations, using the Akaike Information Criterion (AIC) to find the optimal lag number.

4. Results and discussion

Cointegration tests

The first step of the analysis resides in testing the presence of cointegration, or long- run relationship among the variables included in the model. The Kao (1999) test of cointegrating variables has been used – this test identifies a cointegrating relationship of a linear combination of at least two-time series that is not stationary and is stationary. The results of the Kao test for both estimated models are presented in Table 3.

Table 3. Results of Kao test of cointegration

Dependent variable	ADF test			
	t-statistic	Probability	Residual variance	HAC variance
YEMPL	-4.800	0.000	0.000	0.000
RES	0.493	0.311	0.000	0.000

Note: Null hypothesis is no cointegration.
Source: Authors calculations in Eviews

The Kao test indicates a cointegrating relationship between the variables when YEMPL is the dependent variable but not when RES is the dependent variable. This finding suggests a long-run equilibrium whereby government expenses in education influence young people's employment, but it does not necessarily point to stimulating research and development in the economy. This may be an indication that R&D needs more targeted and direct measures like project funding, which, in turn, attracts more researchers, hence the RES number would likely increase.

Panel ARDL results

Long-run coefficients

The next step in the analysis is the estimation of the long-run and short-run coefficients in the panel regressions. Table 4 shows the long-term ARDL estimations, and Table 5 presents the short-run estimation for both models.

Given the evidence of cointegrating relationships between variables, the estimated coefficients in the long-term and short-term panel regressions were further explored. The results for all models are presented in Table 4 (long-term regressions) and Table 5 (short-term regressions).

Governments' expenses on education, as a share of GDP, have a positive and statistically significant impact on young people's employment and researchers employed in the economy. A 1% increase in EDU leads to a 0.89% increase in YEMP over the long run and a 0.65% increase in RES. This is in line with the opinion of Hope (2012), that sees government failure to offer opportunities for young people, including employment, as having significant economic, political, cultural, and social consequences. But, again, education spending does not necessarily attract young people into R&D. Moreover, all control variables are statistically significant, but the magnitude of their impact on the dependent variables varies from one model to the other. Thus, GDPGR positively influences both YEMPL and RES over the long run, but the impact is stronger in the case of RES: a 1% increase in GDPGR leads to an increase in RES of 0.07% but a 0.2% increase in YEMPL. Higher GDPGR affords higher goernment spending in R&D, thus better project financing and the efficient allocation theory predicts then naturally more human resources being drawn into R&D. This suggests that GDP growth's impact on employment is more nuanced or much less evident, and should be considered from other perspectives, such as specific economic sectors and technological advances. When there is higher GDPGR, there is higher demand for labor, and, all else equal, an increase in salaries which should draw more YEMPL. On the other hand, higher GDP growth stimulates researchers' employment in the economy, indicating that when economies grow, government affords to direct some of this growth toward innovation, research, and development. Moreover, this may also mean that faster-growing economies in Europe are the ones that have developed their innovative sectors in the last ten years. However, more research is needed in this area.

Table 4. Panel ARDL estimation: long-run coefficients

Dependent variable	EDU	GDPGR	GOVR	INC	SE	LL
YEMPL	0.898*	0.199*	0.042*	0.163*	0.013	995.79
RES	0.647*	0.073*	1.042*	-0.302*	0.023	915.64

Note: * and ** designate statistical significance at 1% and 5% levels, respectively. SE and LL are the standard error and log likelihood of the model

The size of government resources (GOVR) also positively Impacts YEMPL and RES. In the case of YEMPL, a 1% increase in GOVR generates a 0.04% increase in YEMPL and a 1% in RES over the long term, which may indicate that the government with higher resources available dispose of more opportunities to stimulate young people's employment, as well as innovation in the economy. Moreover, this suggests that when the government has more resources, it tends to spend more towards R&D, while spending towards increasing employment is maybe not direct proportional to GOVR. This suggests that government spending on stimulating employment may be better correlated with other indicators such as the unemployment rate in the economy or the NEET number. In this category fall measures such as cash stimulus for empoyment of graduates, for internships,

as well as temporary unemployment support. For what concerns INC, the findings diverge in the two models: the variable has a positive impact on YEMPL – a 1% increase in INC leads to a 0.16% in YEMPL – but a negative one on RES – RES decline by 0.3% when INC grows by 1%. This result indicates that, all else equal, when median incomes are high, young people are more attracted by employment status. Of course, the relative attraction can also be influenced by entry-level salaries or minimum salaries that apply in the economy, by the level of the unemployment support and by the structure of the society (e.g. in cultures where it is customary for young adults to live with their parents, there is more NEET expected). However, higher income in the economy does not seem to influence significantly the number of researchers. Again, we expect there are other factors at work, most important government funding of research projects and government policy towards R&D incentives (cash incentives and / or tax incentives). For instance, all the countries in EU which are in the top of R&D spending offer cash incentives or tax incentives for R&D activities (Cavalier et al., 2021).

Short-term coefficients

The next step in the analysis explores the short-term relationships between the variables with the help of the ECM. Table 5 shows the short-term coefficients for the two estimated models.

ECM coefficients are negative in both models, but only in the case of RES; the coefficient is statistically significant. This finding is somehow puzzling, as it contradicts the result of the Kao cointegration test. However, when we think of the timing of the cycle of education (e.g. from primary school to first employment) and the cycle of research & development (many projects span for many years), we should see then quite clearly that neither GDP growth, nor government revenue or population income can have an immediate, short-run effect on YEMPL or RES. In addition, there might be interpreted it as fractures in the long-run versus short-run educational and employment policies in the sample countries, which do not align short-term measures to long-term goals, in case the latter exists.

Table 5. Panel ARDL estimation: short-run coefficients

Dependent variable	ECM(-1)	D(EDU)	D(GDPGR)	D(GOVR)	D(INC)
YEMPL	-0.026	-0.385*	-0.018	0.228*	0.175*
RES	-0.142*	-0.024	0.017	0.333	0.168

Note: * and ** designate statistical significance at 1% and 5% levels, respectively.

On the other hand, short-term coefficients for the main regressor (EDU) and all control variables are not statistically significant for RES, although positive), indicating that government measures in the direction of stimulating innovation in the economy work only over the long run, as outlined above. For what concerns YEMPL, government expenses on education discourage young employment over the short-term. This might be due to the fact that the average number of years in education for a young person tends to increase over the long run. At the same time, government resources increase YEMPL in the short run. This may be explained by the specific measures adopted by European governments concerning education and young people, such as cash subsidies for employers hiring

graduates or NEETs, as well as the economic conditions that attract young people towards employment. This is supported by the positive and statistically significant relationship between INC and YEMPL, which suggests that a higher general population income is an attraction factor for young people, and they seek employment to have access to this higher income. Another potential explanatory factor is that declining demographics and aging populations reduce the availability of labour which, all else equal, increases the price of labour.

The distribution of short-term coefficients among the countries in the panel shows interesting patterns when EDU was explored. In the model where YEMPL is the dependent variable, eight countries have positive coefficients – of which seven are for old EU members, 1 for new EU members (Estonia), and none for non-EU countries. Also, 22 countries show negative coefficients, of which 9 in old EU members and 10 in new EU members (including Romania). This distribution suggests that the newer EU members, the former communist countries in Central and Eastern Europe, have not found the short-term mechanisms to foster young employment over the short run, while such attempts have found success in seven older EU members. Another potential explanation is that these countries experienced significant emmigration, especially by young people, and these trends were failed to be accounted for, e.g. in unemployment rates or population numbers. Nevertheless, the latter countries are diverse in terms of the relationship between government expenses on education and young employment, and this deserves more attention in future research.

In the model where RES is the dependent variable, the same diversity in the signs of coefficients was encountered for EDU in older EU members: 7 countries have positive coefficients, and 9 have negative coefficients. However, now four newer EU members have negative coefficients (including Romania), and 7 have positive coefficients. Two Non-EU countries have negative coefficients, and one country has a positive coefficient.

5. Conclusion

Education is the key to a prosperous society over the long-run, where the government allocates a significant proportion of its budget to both research & development, and education and where these areas receive valuable public and private support, encouraging innovation and growing the economy.

This study explains how substantially funding R&D and education, which promote innovation, helps a country's economy expand and distinguish itself from others that underfund the most critical areas of economic development. Advanced economies invest ever-higher funds in education because it pays long-term "high dividends".

Our findings point towards the positive impact of government resources on attracting researchers into R&D activites, as well as on young employment, which indicates that governments with more resources have more opportunities for stimulating young people's employment and economic innovation. This is typically done by cash subsidies and other R&D incentives, as well as by government support for employers of young graduates. Additionally, this suggests that, in times of economic growth, governments

allocate more resources to support economic innovation, while resources allocated to boost young employment remain rather flat. Moreover, the results of our study suggest that higher incomes would encourage more young people to seek employment, rather than rely on government support or family support. When it comes to researchers however, they seem to be more attracted by the availability of project funding, rather than by increasing income trends in the economy.

The study's value resides in urging the creation of educational policies that seek to enhance educational activities in Romania by boosting funding for education and the modernization of the curriculum to align what is taught at the university with the job market's needs. Also, Romania needs to curb its emmigration flows, and therefore policies aimed at bringing NEETs into the workforce and supporting young employment are key. Students need opportunities for personal and professional development. Therefore, one strategy that can be considered is to offer these opportunities on university campuses through NGOs and other similar organizations. Also, the government can allocate more resources for employers that either employ young graduates, or train them or both. For instance, there is an allowance for employers who want to support young people in education for tuition fees, but more needs to be done in that respect.

When it comes to the innovation perspective, it should be encouraged by promoting public and private cooperation between universities, the state, and companies so that the outcomes of university-based research can be used by corporations and the government in sectors in which they are interested. Project funding by government resources is key. Romania is in the bottom half of European nations in terms of budgetary support for both R&D and education due to a pattern of underfunding in both fields. Therefore, we urge the government to prioritize the student as the center of education; otherwise, the new graduate will have to undergo extensive training to acquire new skills, abilities, and aptitudes to enter the workforce as a skilled and prepared graduate with the necessary qualifications, while researchers will seek other countries.

A further study might include a bigger sample size from more European countries. Another limitation is the relatively small number of years analyzed at panel data regression due to the lack of data from all countries. A future research direction would be to use variables where data can be collected over a more extended period, as the effects of both education and innovation span over the very log run. Moreover, future research endeavours may approach the implications of education and R&D activities funding on Romania’s competitiveness.

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