

The unintended effects of the Cohesion Policy: The wealthiest regions attract more EU funds

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This study explores a new research direction for the European Union's (EU) Cohesion Policy. Our hypothesis is that regions with a higher GDP per capita are more successful in attracting funding under the EU's Cohesion Policy than their poorer counterparts. We test our hypothesis based on a new dataset from Romania including all those who have received EU grants. Our research was carried out using three samples. For each sample, we estimated an OLS and an IV regression. The estimations support our hypothesis: GDP per capita has a statistically significant positive effect on the EU funds secured in all three cases.

Keywords: Structural and Cohesion Funds, Cohesion Policy, European Union, Romania, Central and Eastern Europe.

JEL codes: R11, C30.

Introduction

The Cohesion Policy of the European Union (EU) has generated a considerable number of scientific studies. A simple search for “EU Structural and Cohesion Funds” (hereinafter referred to as EU funds) in the search engine of the Free University of Brussels Library returns 5,802 results for the last five years. This is not surprising since the EU's Cohesion Policy has become the second most financially supported EU policy. In 2007-2013, the new Member States (those that joined the EU in 2004 and 2007) were allocated 50.51 percent of the EU funds (excluding the European Territorial Cooperation allocation). However, despite this substantial allocation, the scientific analysis of the new Member States in relation to the Cohesion Policy seems limited, leaving room for further analysis. Romania, which became a member of the EU in 2007 and was allocated close to €19 billion under the Cohesion Policy between 2007 and 2013, is even less analysed in well-established scientific journals.

According to the EU treaties, the objective of the Cohesion Policy is to reduce disparities between regions. The allocation rule of the Cohesion Policy is based on the

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GDP per capita of the regions. The ratio between GDP per capita in purchasing power parity rates and the EU's GDP is used to differentiate between "the poorer" and "the richer" regions. The former will receive "the highest transfers relative to GDP" (Mohl 2016: 18). Several studies support the idea that richer regions benefit more from EU funds (for example, Surubaru 2021; Crescenzi–Giua 2016; Rodríguez-Pose–Garcilazo 2015; Pinho et al. 2015; Crescenzi 2009). The results of these research studies are also supported by what we have seen in practice in Romania.

After the first years of implementation of the EU's Cohesion Policy in Romania, one can note that the municipalities, companies, and NGOs (beneficiaries of the EU funds) that are in a better economic situation have a better capacity to attract funds and to allocate the necessary co-financing amounts. Since the outcomes of a region's economic sector are reflected in its GDP, we assume that the counties with a higher GDP per capita can get a higher share of EU funds. In our opinion, this can be observed not only in Romania but also in other Central and Eastern European countries.

The need to analyse whether the impact of the Cohesion Policy is different in richer and poorer regions is also highlighted by Bachtrögler et al. (2020). Regarding the impact of the Cohesion Policy on companies, they conclude that "supporting firms tends to be more effective in poorer countries and in poorer regions within countries" (Bachtrögler et al. 2020: 32).

Between the allocation at the EU level and the funds received by beneficiaries in different regions, we have the Member States' spending strategies. The influence of politics and administrative capacity on the implementation of the Cohesion Policy at Member State level has already been extensively studied (see, for example, Incaltaru et al. 2020; Hagemann 2019; Banaszewska–Bischoff 2017; Bachtler et al. 2017; Medve-Bálint 2018; Surubaru 2017; Dotti 2016; Bachtler et al. 2014; Dotti 2013; Dellmuth et al. 2017; Bouvet–Dall'Erba 2010). The characteristics of the regions and their territorial capital have also been widely researched (see Fratesi–Perucca 2019; Bachtrögler et al. 2020; Percoco 2017; Fratesi–Wishlade 2017; Fratesi–Perucca 2014; Perucca 2014). Some authors point to the need for country-specific insights (Crescenzi–Giua 2019) into the effects of the Cohesion Policy. This type of research can only be carried out now, as data of sufficient quality have only recently become available in Romania.

The implementation of the EU's Cohesion Policy at the level of Member States, including Romania, is based on a call for projects system managed by the

state authorities. An important feature of this system is that applicants are required to provide co-financing for their projects. At the same time, the assessment and verification of the way in which the money was spent often leads to delays in reimbursement requests. Therefore, due to the nature of the application system, the beneficiary must have enough money to implement the project as described in the application, then wait for the money to be refunded. The objectives of the application, the payment process, the co-financing amount, and the entire application system are determined jointly by the Member States and various EU institutions (e.g., the Parliament and the Council for the legislative part, the Commission for partnerships agreements and each operational programme).

In reviewing the scientific literature, we found that only a few studies focused on the county (NUTS-3) level distribution of EU funding beneficiaries (Bachtrögl et al. 2019), as not many suitable databases were available. For the first time in Romania, there is a database for the period 2007-2013, containing the list of all the beneficiaries at the NUTS-3 level and the amounts of actual payments. We therefore believe that the conditions are now in place to analyse the distribution of the EU funds used in Romania. In our view, the case of Romania may also be of interest to other former communist states that joined the EU in 2004 or later.

Within this context, in our study, we tested the assumption that the counties (NUTS 3 level) with a higher GDP/capita were more successful in mobilising European funds than their counterparts with a lower GDP/capita.

The aim of our study is twofold. On the one hand, we exploit the potential offered by a completely new dataset since no data was previously available for Romania, with the actual EU funds spent broken down by specific participants. On the other hand, we analyse a country that has not been one of the frequently researched Member States, despite its relative size and its share of EU funds.

Our analysis contributes to the scientific literature on the Cohesion Policy in two ways. First, we consider the actual implementation of the Cohesion Policy in Romania, which will help to understand not only one of the Union's net beneficiaries but also the issues raised by the Cohesion Policy in the Central and Eastern European (CEE) region. Second, we seek to understand the factors that explain the amount of EU funding received.

This paper is organised as follows. First, we briefly review the relevant scientific literature, highlighting the pieces related to new Member States. Second, we highlight some of the main characteristics of EU funds in Romania. Third,

we present the variables and research methodology used in our analysis and our empirical results. Finally, we summarise our conclusions, practical implications, research limitations, and future research directions.

Literature review

As Bachtrögler et al. (2020) emphasised, the literature on the effectiveness of the EU's Cohesion Policy is immense. However, studies have not reached a consensus on the effectiveness of this policy in terms of GDP per capita growth (Bachtrögler et al. 2020; Bouvet–Dall’Erba 2010; Medeiros 2017; Gagliardi–Percoco 2017; Mohl–Hagen 2010). In their meta-analysis, Dall’Erba and Fang (2017) concluded that the heterogeneity observed in the impact of EU funds on growth is due to the publication status, the period analysed, the control for endogeneity, and the different regressors.

In their 2017 editorial, Fratesi and Wishlade stress the new research direction which seeks to explain the factors influencing the impact of the Cohesion Policy. These factors are the quality of the government’s absorptive capacity and the territorial capital of regions (Fratesi–Wishlade 2017). Two years later, Bachtrögler et al. (2019) emphasised the importance of the territorial assets/capital of regions for the impact of the Cohesion Policy. Caro and Fratesi’s findings (2021: 319) suggest that “national and regional contextual factors” influence the outcomes of the Cohesion Policy. As for research on the new Member States, using the example of CEE NUTS-3 regions for the period 2004–2006, Fratesi and Perucca (2014) demonstrate that the impact of the Cohesion Policy depends on regions’ territorial capital. Their analysis also showed “that different policy axes are facilitated by different endowments of territorial capital” (Fratesi–Perucca 2014: 187).

Reviewing the existing literature, we found that GDP per capita plays a central role in analysing the impact of the Cohesion Policy. Dotti (2016: 539) notes that “according to the policy rationale, the amount of funding is expected to be inversely proportional to the level of per capita GDP”. Nonetheless, we did not find any research explaining the relationship between the amount of EU funds collected in a region and the region’s GDP per capita.

As for the new Member States, they are included in the research presented in only a small part of this large body of literature on the Cohesion Policy. Therefore, we identified a good research opportunity. Since the new Member States joined the

EU in 2004, 2007, and 2014 and the first full Multiannual Financial Framework period was 2007-2013, we conducted a systematic review of the scientific literature, focusing on journals published after 2010. The search engine of the Free University of Brussels Library was used, giving access to multiple databases. Using these tools, we prepared Table 1, which lists major articles concerning CEE that are relevant to our topic.

Looking at the above-mentioned articles, we can see that only a few analyses in the top journals focus on Romania (Surubaru 2017) and even those are about administrative capacity or governance (Incaltarau et al. 2020), not about the territorial distribution of EU funds.

Clearly, EU funds have been the subject of many studies. However, no research has asked the following question: Does a region's GDP per capita explain the amount of EU funds received by the beneficiaries of that region? This is a gap that we identified in the literature. In addition, there is no research on the distribution of EU funds in Romania in general, despite it being an important beneficiary of the European Cohesion Policy, with a novel dataset for 2007-2013.

Since the rule of eligibility for Objective 1 regions (NUTS-2 level, with a GDP that is less than 75 percent of the EU average) has not changed over the programming periods, our hypothesis is the following: a region's GDP per capita explains at least part of the total amount of EU funds received by the different beneficiaries in that region. Based on the eligibility criterion, it would be ideal to find that a higher GDP means less EU funding. However, based on the scientific literature (Fratesi–Perucca 2014; Fabrizi et al. 2016; Bachtrögler et al. 2019; Medve-Bálint 2017; Bakucs–Fertő 2019; Bourdin 2019; Dyba et al. 2018; Aiello–Pupo 2017), we expect to see the opposite, namely that a higher GDP means more EU funds. Given that our dependent variable is the amount of EU funds absorbed by a region, we will test our hypothesis with regressions. Drawing on the literature (Novosák et al. 2017; Fabrizi et al. 2016; Pellegrini et al. 2013; Gagliardi–Percoco 2017), we will use the GDP per capita and several other control variables to predict the dependent variable. The control variables were chosen based on the literature (see, for example, Medve-Bálint 2017) and their availability for Romania.

Table 1. Articles in top journals regarding the Cohesion Policy in new Member States

Authors	Focus	Country/countries
Incaltarau et al., 2020	Impact of administrative capacity and political governance on the absorption rate	EU 27
Bachtrögl et al., 2018	Impact of the Cohesion Policy on firm growth	EU 25
Hagemann, 2019	Role of politics in the absorption process	New Member States
Dyba et al., 2018	Impact of the Cohesion Policy on regional development	Albania, Bulgaria, Croatia, Czechia, Hungary, Poland, Romania, Slovakia, Slovenia, Estonia, Latvia, and Lithuania
Loewen, 2018	Cohesion Policy and institutional changes	Hungary and Estonia
Medve-Bálint, 2018	States' spending strategies	Greece, Italy, Ireland, Spain and Portugal, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia
Banaszewska-Bischoff, 2017	Impact of political factors on EU fund allocation	Poland
Gagliardi-Percoco, 2017	Impact of CP on economic performance	Objective 1 regions
Novosák et al., 2017	Spatial distribution of EU funds	Czechia
Percoco, 2017	Influence of local economic structure on policy outcomes	Objective 1 regions
Surubaru, 2017	Impact of political factors on the management and implementation of structural funds	Bulgaria and Romania
Bachtler et al., 2014	Role of administrative capacity in the performance of structural funds	Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia
Dabrowski, 2014	Partnerships	Poland, Czechia, and Hungary
Fratesi-Perucca, 2014	Impact of the structural characteristics of the region on economic growth	Central and Eastern Europe

Source: Own editing

Structural and Cohesion Funds in Romania

Currently, the international scientific literature includes no articles dealing with the territorial distribution of EU funds in Romania. Therefore, to make meaningful regressions and to explain our findings, we first describe the characteristics of the operational programmes implemented in 2007-2013, the first period when Romania fully benefited from EU funds.

Romania joined the EU in 2007 and, during the period 2007-2013, all NUTS-2 (and NUTS-3) regions of Romania were funded under the Convergence objective (Commission Decision 2007/191/EC). Romania was also supported under the European Territorial Cooperation objective. In the case of transnational projects, all NUTS-2 regions were eligible for funding. The indicative allocations were as follows (based on 2004 prices): €16,870,209,691 for the Convergence objective (€5,754,788,708 from the Cohesion Fund) and €308,930,782 for the European Territorial Cooperation (European Commission 2007a, 2007b, 2007c).

Following the Cohesion Policy rules presented by the government and after intense negotiations, the Commission approved Romania's National Strategic Reference Framework (NSRF) for 2007-2013. The NSRF established the objectives and the financial envelope for each objective (see Table 2). The approval of the NSRF was followed by the development of operational programmes, which also had to be approved by the Commission. The calls for proposals were prepared based on these programming documents. The NSRF identified the following operational programmes (OPs): transport, environment, competitiveness, regional operational programme, human resource development, administrative capacity building, and technical assistance (Government of Romania 2007). Notably, the Romanian NSRF for 2007-2013 is based on the National Development Plan and is agreed upon by the representatives of the development regions (NUTS-2 level) and by the representatives of the counties (NUTS-3 level).

Regarding the European Territorial Cooperation objective, Romania participated in 12 programmes between 2007 and 2013: Romania–Bulgaria, Hungary–Romania, Southeastern Europe, INTERREG IVC, Urbact II, Romania–Serbia, Black Sea, Romania–Ukraine–Republic of Moldova, Hungary–Slovakia–Romania–Ukraine, Interact, ESPON, and Central Europe (MDRAP 2012).

Table 2. Operational programmes in Romania under the Convergence objective, 2007-2013

Operational programme	Total funds 2007-13 euro current amounts	Percentage of total funding for Romania under the Convergence objective %
Increase of economic competitiveness	2,554,222,109	13.29
Transport	4,565,937,295	23.76
Environment	4,512,470,138	23.49
Regional	3,726,021,762	19.39
Technical assistance	170,237,790	0.89
Human resource development	3,476,144,996	18.09
Administrative capacity building	208,002,622	1.08
Total	19,213,036,712	100

Source: Own editing based on the *National Strategic Reference Framework 2007-13* (Government of Romania 2007)

In our analysis, we only use data on the Convergence objective, which accounts for 98.2 percent of the total indicative allocations for Romania from Structural and Cohesion Funds. We do not analyse the European Territorial Cooperation objective, as currently no database allows for linking the exact funding received to the respective Romanian counties (NUTS-3 regions).

According to the literature, at least three main programming characteristics influence the spatial distribution of EU funds. The first is the allocation of resources among operational programmes. In Table 2, the Environment and Transport operational programmes are the two main infrastructure programmes, and they each receive about 23 percent of EU funding. If we also include the funds allocated to the Regional Operational Programme, which is also mainly focused on infrastructure, we can see that about 67 percent of EU funds are related to infrastructure investments. We can conclude that, there is an uneven distribution of allocations for the different types of funding, which is decided by the Romanian government and approved by the European Commission.

The second characteristic is the order of priorities set in the programmes since not all actions receive the same amount of resources. For example, in the Competitiveness OP, Priority Axis 1.1. on productive investments for small- and medium-sized enterprises (SMEs) represents 20.60 percent of the total funding allocated to this OP. However, the 5.2. actions for communicating the operational

programme account for only 0.93 percent of EU funds (authors' calculations based on Ministerul Finanțelor Publice 2011).

The third main characteristic concerns the types of potential beneficiaries. Within each operational programme, each priority axis included a list of potential beneficiary categories. For example, there were priority axes for which only regional water service providers and the Bucharest Mayor's Office were eligible (Environment Operational Programme 1.1), and they represented 61.53 percent of the operational programme budget (own calculations based on Ministerul Mediului și Pădurilor 2012). However, there was also an objective which listed more than eleven categories of applicants although it was allocated only 7.72 percent of the total budget (authors' calculations based on Ministerul Muncii, Familiei, Protecției Sociale și Persoanelor Vârstnice 2013).

All these characteristics of the programmes will fundamentally affect the territorial distribution of funds. For example, if most of the beneficiaries that can apply for funding are public institutions registered in Bucharest (NUTS-3 region), the capital city will be overrepresented in the sample. However, the impact of these funds will also be felt in other counties.

Research methodology and data

We downloaded our database from the website of the Romanian Ministry of European Funds in January 2019 (Ministerul Fondurilor Europene 2016). After several e-mails and the Ministry's response, we clarified the issues raised. Thus, we created a database containing 15 930 projects spread across different programmes. For each project, we have the beneficiary's name, the name of the NUTS-3 region, the total amount paid from the EU funds (Cohesion Fund, European Social Fund, European Regional Development Fund), the OP, and the type of beneficiary. In Romania, there are 42 NUTS-3 regions, namely 41 counties and the capital city of Bucharest.

Our hypothesis is that GDP per capita explains the amount of money received by the beneficiaries in each county (NUTS-3 region), and the dependent variable is EU funds per capita. Since the amounts received from EU funds cannot be broken down by year, the variables to be used must cover the whole period analysed. We decided to use the seven-year average value (from 2007 to 2013) of all independent variables included in the regressions. Our explanatory variables were GDP per capita, the number of hospital beds (per 1000 inhabitants), the number

of students enrolled in pre-university education, the number of students registered for the final university exams, the number of retirees, the unemployment rate and state subsidies per capita. All our variables, their abbreviations and sources are shown in Table 3.

Table 3. Variables used in the research

Variable name	Abbreviation	Source
GDP per capita	GDP per capita	Romanian Statistical Institute database
Number of hospital beds per 1,000 inhabitants	HBED	Romanian Statistical Institute database
Number of students enrolled in pre-university education	ENROLLEDPREUNIV	Romanian Statistical Institute database
Number of students registered for the final university exams	STUDFINALUNIV	Romanian Statistical Institute database
Number of retirees	RETIREES	Romanian Statistical Institute database
Unemployment rate	UNEMP	Romanian Statistical Institute database
EU Structural and Cohesion Funds per capita	EU funds	Our database for EU funds Romanian Statistical Institute database for the number of people
State subsidies per capita	SUBSIDIES	Romanian Statistical Institute database

Source: Own editing

Based on our database structure and data, we need to construct multiple regressions to test our hypothesis. Apart from the database characteristics mentioned above, our database contains a total of 28 types of beneficiaries, 13 of which accounted for less than one percent of the amounts paid from EU funds. Altogether, these 13 beneficiaries accounted for 4.075 percent of the total payments received by Romania from EU funds (own calculations). It is worth noting that not all types of beneficiaries received funding under all programmes (see Appendix 1). In fact, central public administration authorities were the only type of beneficiary that received EU funds under all Romanian operational programmes. The data on the beneficiaries also shows us the concentration of funds, and the share of the different types of beneficiaries in the total amount paid is as follows: 22.62 percent, county councils, local councils, and town halls; 16.88 percent, commercial companies with majority or full state ownership; 16.70

percent, businesses (all types); 11.47 percent, regional operators; 10.74 percent, central public administration authorities or units coordinated by them (own calculations).

By analysing the amount of EU funds received by a type of beneficiary, we identified five operational programmes where the first three types of beneficiaries received more than 80 percent of the total amount. These operational programmes are the following: regional, environment, transport, administrative development, and technical assistance (own calculations). Moreover, each of these programmes includes types of beneficiaries accounting for more than 50 percent of the OP's paid amount: 50.68 percent for town halls and local councils in the Regional OP; 53.84 percent for regional operators in the Environment OP; 93.67 percent for commercial companies with majority or full state ownership in the Transport OP; 65.32 percent for central public administration authorities in the Administrative Capacity Building OP, and 81.58 percent in the Technical Assistance OP (own calculations).

All of the above observations support the construction of multiple regressions. First, we must test our hypothesis on the whole sample. Second, since municipalities and companies collected most of the money, they must be examined separately.

We are aware that the issue of endogeneity may arise when constructing a regression. There are three instances where the exogeneity condition is violated, and thus endogeneity is present: errors-in-variables, omitted variables and simultaneous causality. In estimating the impact of Structural and Cohesion Fund payments on economic growth, Mohl and Hagen (2010) attribute endogeneity to four issues: the use of imprecise data, reverse causality, unobserved or omitted variables, and the omission of regional spillover effects. We tried to mitigate these effects in the following way. On the first issue, we looked at actual payments, not at structural fund commitments. Regarding the second issue, in the case of Romania, the period 2007-2013 is the first programming period as a member of the EU, thus all NUTS-3 regions were Objective 1 regions. Consequently, the decision on funding eligibility was made several years before the actual payments and without the country being a member of the EU. On the third issue, we tried to use all the control variables available to us for that period and at that level. Regarding the fourth issue, we can consider it as not existent for that period and for this country,

since in this database we have the actual payments of EU funds for each project and for each county. Additionally, in all cases, we tested for endogeneity using the instrumental variables estimation.

Empirical results

We estimated the following three regression models: the first was estimated using the entire sample; the second only analysed the funds received by county councils, city councils and town halls, and the third focused only on the funds received by companies.

Model 1: The entire Romanian sample

In this sample, we included the projects funded for all the beneficiaries from all the counties between 2007 and 2013. As we have mentioned, the dependent variable is EU funds per capita, while the independent variables are GDP per capita, the number of hospital beds per 1,000 inhabitants, the number of students enrolled in pre-university education, the number of students registered for final university exams, the number of retirees, and the unemployment rate.

Since the relationship between EU funds per capita and GDP per capita is rather exponential, we will use their natural logarithm. We introduced a dummy variable for Bucharest, as many beneficiaries were registered in Bucharest, to see if there was a significant difference between the capital and the counties.

Appendix 2 shows the correlations between the variables used (both dependent and independent). We ran a multiple regression using the natural logarithm of EU funds per capita as the dependent variable.

We tested for endogeneity using the instrumental variables estimation. First, we tested the relevance of the instrument, namely we examined whether the chosen instrument (income) was indeed sufficiently correlated to the endogenous variable ($\log GDP/cap$), and we tested for exogeneity, that is, if the potentially endogenous variable ($\log GDP/cap$) was indeed endogenous. These diagnostic tests revealed that the instrument used was strong (Wald test: $F(2,39)=113.42$, $p<0.001$), but we could not reject the null hypothesis of the Wu-Hausman test for endogeneity ($F(1,37)=0.364$, $p=0.55$); thus, the variable of concern ($\log GDP/cap$) is uncorrelated with the error term, so the OLS estimator is consistent and therefore the OLS estimator is to be preferred. The OLS regression results and the estimation of the instrumental variable (IV) can be seen in Table 4.

Table 4. Results of Model 1 and the IV1 model

	Dependent variable logEUFundspercap	
	OLS (1)	Instrumental variable (2)
logGDPpercap	0.658*** (0.034)	0.660*** (0.035)
HBED	0.095** (0.036)	0.093** (0.037)
SUBSIDIES	0.002* (0.001)	0.002* (0.001)
Bucdummy	0.832** (0.337)	0.832** (0.337)
Observations	42	42
R ²	0.999	0.999
Adjusted R ²	0.998	0.998
Residual Std. Error	0.297	0.297
F Statistic	6,759.058***	

Note: * p<0.1; ** p<0.05; *** p<0.01

Source: Own calculations in R

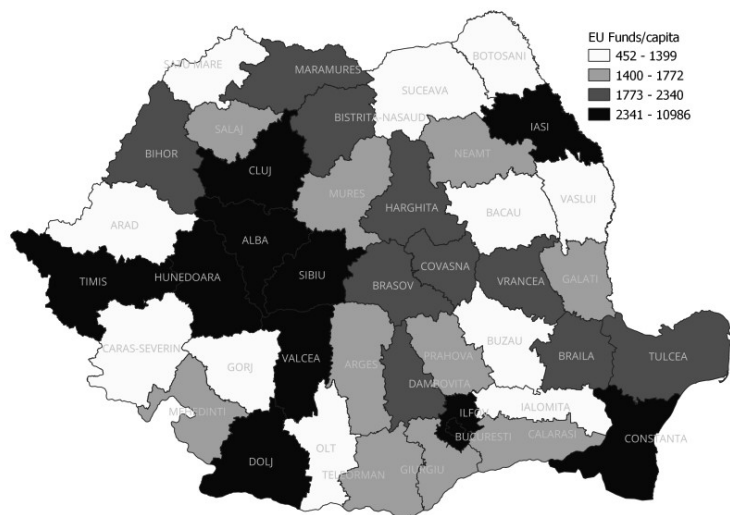
All the classical assumptions of the OLS regression were then tested (Appendix 3). The value of the adjusted R-square shows that log(GDP/cap), the number of hospital beds per 1,000 inhabitants, the state subsidies per capita and the dummy variable Bucdummy explain 99.8 percent of the variance of the log(EUfunds/cap). The regression equation takes the following form:

$$\ln(EUFunds / cap_i) = 0.658 \cdot \ln(GDP / cap_i) + 0.095 \cdot HBED_i + 0.002 \cdot SUBSIDIES_i + 0.832 \cdot Bucdummy_i + \varepsilon_i, i=\overline{1,42}$$

We can see that a 1% change in the GDP per capita implies a 0.658% change in the EU funds per capita. The Bucdummy variable shows a 0.832% increase in the case of EU funds per capita for Bucharest. The previous regression indicates that a county’s higher GDP per capita results in a higher amount of EU funds. Therefore, although the counties with a lower GDP should benefit more from European funds, our results showed that the higher the GDP of a county, the more it can benefit from these funds.

According to Scotti et al. (2022), theoretical reasons suggesting the need to consider spatial effects are related to economic integration, trade, capital

mobility, labour migration, technology transfer and knowledge spillovers, which demonstrate that regions cannot be considered as isolated entities. Figure 1 shows the spatial distribution of EU funds per capita in Romania.



Source: Own editing in QGIS

Figure 1. Spatial distribution of EU funds per capita in Romania

Figure 1 shows that a very large portion of the financial resources were received and spent in the vicinity of the Romanian capital Bucharest. This city acts as a ‘managing authority’ for all EU funds in Romania, that is, it is responsible for receiving funds from Brussels and redistributing them throughout Romania. That is why we introduced the Bucdummy dummy variable in the estimation (which takes the value 1 in the case of Bucharest). After developing the OLS model, we used Moran’s I tool to assess the presence of spatial autocorrelation in the residuals. Based on Moran’s I value, we cannot reject the null hypothesis ($p=0.2786$), so there is no spatial autocorrelation. It is quite possible that the spatial distribution of feature values is the result of random spatial processes.

Model 2: County councils, city councils, and town halls

In the following section, we will focus only on the funds secured by county councils, city councils, and town halls. Of the total amount paid from EU funds

to Romanian beneficiaries, 22.62 per cent was allocated to county councils, local councils, and town halls. We estimated a new regression model with the logarithm of EU funds per capita as the dependent variable; however, this time we computed only the amount paid to county councils, city councils, and town halls for each county (NUTS-3).

Surprisingly, however, we found that the standard deviation of the amount paid to county councils, city councils, and town halls was lower than expected (Appendix 4). Therefore, the counties managed to get similar amounts regardless of their GDP per capita. This raises the question of political influence on the allocation and design of operational programmes. Appendix 5 includes, among others, the correlation coefficients between the dependent variable and independent variables.

We tested for endogeneity in this case too, using income as an instrumental variable. The diagnostic tests revealed that the instrument used (income) was strong ($F(1,40)=5.880$, $p=0.0199$). The Wu-Hausman test for endogeneity was not significant in this case ($F(2,36)=1.130$, $p=0.3341$), thus the variable of concern ($\log\text{GDP}/\text{cap}$) is uncorrelated with the error term. The results of the OLS regression and the instrumental variable estimation can be seen in Table 5.

Table 5. Results of model 2 (county councils, city councils, and town halls) and the IV2 model

	Dependent variable $\log\text{EU Funds per cap}$	
	OLS (1)	Instrumental variable (2)
$\log\text{GDP per cap}$	0.546*** (0.032)	0.565*** (0.074)
RETIREES	-0.00001*** (0.00000)	-0.00001* (0.00001)
ENROLLED PREUNIV	0.00001** (0.00000)	0.00001 (0.00001)
SUBSIDIES	0.005*** (0.001)	0.005*** (0.002)
Observations	42	42
R²	0.998	0.998
Adjusted R²	0.998	0.998
Residual Std. Error	0.300	0.313
F Statistic	4,917.396***	

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Source: Own calculations in R

In the case of this model, each classical assumption of the OLS regression was also tested (Appendix 6), and all the assumptions were satisfied. The regression equation takes the following form:

$$\ln(EUFunds / cap_i) = 0.546 \cdot \ln(GDP / cap_i) - 0.00001 \cdot RETIREES_i + 0.00001 \cdot ENROLLEDPREUNIV_i + 0.005 \cdot Subsidies_i + \varepsilon_i, i=1,42$$

We can see that the number of retirees has a significant negative impact on EU funds, as an increase in the number of retirees can put pressure on public pension systems, which are partly funded by government contributions and taxes. As more people retire and begin to draw on their pensions, there may be less funding available to support other programmes or initiatives that are also funded by the government. An increase in the number of retirees may lead to a decrease in the size of the workforce, which could impact economic growth and tax revenues. This could have an indirect effect on the availability of EU funds, as there may be less funding available for investment in infrastructure, research and development or for other initiatives that require government funding.

The number of students enrolled in pre-university education has a significant positive influence on EU funds. EU structural and cohesion funds are often allocated to support education and training programmes aimed at improving the skills and employability of the workforce. A larger number of students enrolled in pre-university education may increase the demand for such programmes, particularly those aimed at developing technical and vocational skills, as well as programmes focused on entrepreneurship and innovation. EU funds may be used to support investments aimed at meeting the demand for pre-university and higher education, improving the skills and employability of the workforce and promoting economic growth.

Here, if we analyse only the amount of money received by the various types of councils in a NUTS-3 region, the value of the EU funds received per capita increases as the amount of state subsidies per capita increases in a given county.

Geolocalised data on beneficiaries of EU funds for the period 2007-2013 allow us to visualise the geographical distribution of EU development projects across Romania (Figure 2).

To check if the results of the OLS model were acceptable, it was necessary to test for spatial autocorrelation in the model. Moran's I diagnostics of residual for the model was not found to be statistically significant (MI = -0.139631086, p = 0.885). This result confirmed the absence of spatial autocorrelation in the model.



Figure 2. Spatial distribution of EU funds received exclusively by county councils, city councils, and town halls in Romania

In the previous sect

This time, we computed for each county (NUTS-3) the amount of money attracted by companies, so we estimated a multiple regression model, using the natural logarithm of EU funds per capita as dependent variable. The independent variables were the natural logarithm of GDP per capita, the unemployment rate, the number of hospital beds per 1,000 inhabitants, the number of students enrolled in pre-university education, the number of students enrolled in universities, and the number of retirees. In Appendix 7, we can see the correlations between the variables used (both dependent and independent variables).

We tested for endogeneity in this case too, using income as an instrumental variable. Based on the Wald test performed on the instrument in the first stage,

we rejected the null hypothesis ($p < 0.001$), thus the instrument used (income) was strong. The Wu-Hausman test for endogeneity was not significant ($F(1,39) = 1.171$, $p = 0.286$), which indicated that endogeneity did not bias the estimate of the effect of $\ln(\text{GDP/capita})$ on $\ln(\text{EU Funds/capita})$ in a problematic way. The results of the OLS regression and the instrumental variable estimation can be seen in Table 6.

Table 6. The results of the OLS regression including only the companies (Model 3) and the IV3 model

	Dependent variable logEUFundspercap	
	OLS (1)	Instrumental variable (2)
logGDPpercap	0.657*** (0.025)	0.683*** (0.035)
UNEMP	-0.103*** (0.038)	-0.145** (0.054)
Observations	42	42
R²	0.993	0.992
Adjusted R²	0.992	0.992
Residual Std. Error	0.521	0.529
F Statistic	2,648.435***	

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

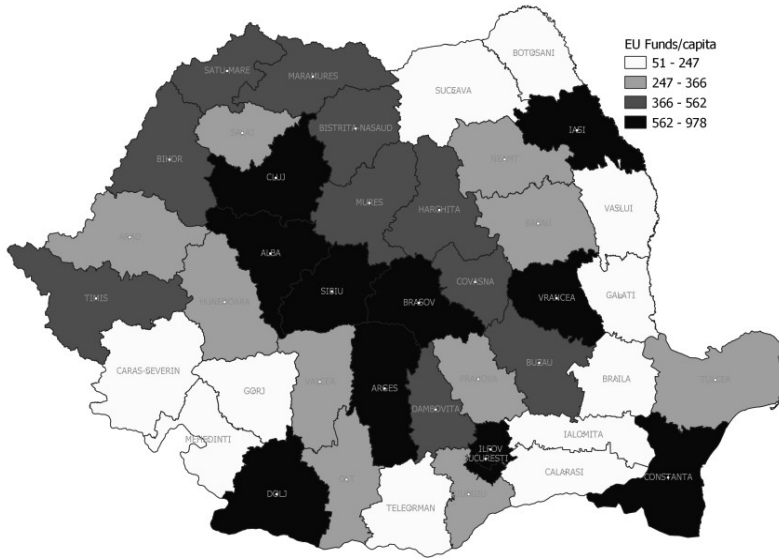
Source: Own calculations in R

Each classical assumption of the OLS regression was tested (Appendix 8). The regression equation takes the following form:

$$\ln(\text{EUFunds} / \text{cap}_i) = 0.657 \cdot \ln(\text{GDP} / \text{cap}_i) - 0.103 \cdot \text{UNEMP}_i + \varepsilon_i, i = \overline{1, 42}$$

GDP per capita has a statistically significant positive effect on EU funds per capita. Thus, our hypothesis also holds if we consider only the funds received by companies. We can see the statistically significant negative influence of the unemployment rate on the natural logarithm of EU funds per capita. The EU may allocate funds to support economic development and address imbalances in regions that are facing high levels of unemployment, including within individual countries. By addressing these issues at the county level, the EU can help to promote economic growth and reduce disparities in economic development within countries, as well as support the overall functioning of the single market. This can be particularly important for border regions, where the unemployment rate of one

county may be influenced by economic conditions in neighbouring counties. The spatial distribution of the EU funds received exclusively by companies can be seen in Figure 3.



Source: Authors' editing in QGIS

Figure 3. Spatial distribution of per capita EU funds received exclusively by companies in Romania

In Figure 3, we can see that, in the case of companies, there is a sign of spatial autocorrelation. So, to check that the results of the OLS regression were acceptable, we also examined in this case whether spatial autocorrelation could be found in the model. Moran's I diagnostics of residual for the model was statistically significant ($MI = 0.156982615$, $p = 0.02483$). Anselin (2005. 199) provides a decision tree for the Lagrange Multiplier test (LM) statistics to decide upon the nature of the estimated model. First, we should consider the LM-Error and the LM-Lag test statistics. If neither rejects the null hypothesis, then we should stick to the original model. In our case, we failed to reject the null hypothesis in both cases ($LMerr = 2.3262$, $p\text{-value} = 0.1272$; $LMlag = 0.34583$, $p\text{-value} = 0.5565$), so we stick to our original OLS estimation.

Discussion and conclusions

In our study, we examined a perspective that was previously lacking in the scientific literature on EU funds. We concentrated on the Romanian NUTS-3 regions (the counties in Romania), as this is an understudied country and regional level, filling the gap we found in the literature. Furthermore, there is a novel dataset which contains the actual payments made from EU funds to beneficiaries from Romania. We answered the question of whether the GDP per capita of a given county explains the amount of money received by beneficiaries in the same county (NUTS-3 level). Our analysis concerned all NUTS-3 regions from Romania in the period 2007-2013. During this period, all regions in Romania were Objective 1 regions. Our hypothesis was that the variance in the amount of money paid to beneficiaries in a given county can be explained by the seven-year average value of the GDP per capita (from 2007 to 2013) and other variables.

We tested our hypothesis on three databases and estimated three models that can be seen above in the empirical section.

First, the regression was estimated using the database containing all the projects that benefited from EU funds during this period. We then constructed the following two subsamples containing all winning projects and the actual payments made to them: the first subsample contains only the amounts received by county councils, city councils, and town halls; the second database contains all types of companies. We constructed three linear regression models, using the natural logarithm of EU funds per capita as dependent variable, the natural logarithm of GDP per capita as independent variable, and several other variables.

Our hypothesis was confirmed in each case. More precisely, we confirmed that when counting all the funds received by all beneficiaries in Romania (the sample), by all county councils, city councils and town halls (first subsample) or by all the companies (second subsample), GDP per capita had a statistically significant positive effect on EU funds per capita. However, apart from GDP per capita, we did not find a common influencing factor for all three cases, which seems to confirm the findings of Fratesi and Perucca (2014) for some CEE countries, excluding Romania. This finding also raises another question regarding Romania: Which factor of territorial capital differentiates the impact of EU funds in these regions? We think this is a research path worth exploring when the data for the period 2014-2020 is made public.

We know that EU funds aim to support the economic and social development of the less prosperous regions and countries within the EU. Therefore, regions and countries with lower GDP per capita and higher levels of unemployment and economic disparities may receive a higher share of EU funds. This does not apply to companies, since our results for the company subsample show that the higher the GDP per capita in a county, the higher the EU funds per capita attracted by companies in that region, which raises the question of the effectiveness of EU funds. Especially since Bachtrögler et al. (2019. 32) found that “supporting firms tends to be more effective in poorer countries and in poorer regions within countries.” However, even regions and countries with higher GDP per capita may be eligible for EU funding if they face specific economic and social challenges or if they undertake projects that align with the EU’s priorities and objectives. For example, a region with a high GDP per capita may receive funding for a research and innovation project that contributes to the EU’s goal of promoting sustainable and inclusive growth.

Therefore, our hypothesis is confirmed: for Romania, the GDP per capita of NUTS-3 regions has a statistically significant positive influence on the per capita EU funds received by beneficiaries from the same region over the analysed period. We have also confirmed that if a region has a higher GDP per capita, it will gain more EU funds per capita than a region with a lower GDP per capita. A future study could support this hypothesis based on NUTS-3 data at the EU level. This finding is also consistent with the conclusions of Bouvet and Dall’Erba, who argue that the “lower level of development of [Objective 1 regions] limits their lower capacity to accompany EU monies” (Bouvet–Dall’Erba 2010. 518). Furthermore, Dettmer and Sauer argue that the principle of additionality “tends to favour rich regions that are able to provide additional funds over poor regions that cannot” (Dettmer–Sauer 2019. 171).

The main limitation of this study is that the amounts received from EU funds cannot be broken down by year. We decided to use the seven-year average value (from 2007 to 2013) of all independent variables that were included in the regressions. Therefore, our results highlight the trends valid in the case of average values and are not applicable to each year taken separately over the analysed period. We see two new research directions arising from our methodological choices. On the one hand, the causal link between GDP per capita and EU funds per capita could be examined. On the other hand, when newer data becomes available, we will be able to test our hypothesis over a longer period, 2007-2020.

Two conclusions can be drawn from this research regarding the development of the EU's Cohesion Policy. On the one hand, if we want poorer regions to be able to attract more EU funds, they must be mainstreamed into country-level planning. All the actors involved in the programming of EU funds in the Member States must take public responsibility, from planning the use of funds to implementation. This should include responsibility for prioritisation between regions and objectives. We support the opinion of Crescenzi et al. (2020. 5), who argued that "Member States should take full responsibility and ownership of the Cohesion Policy and its impacts." In cases like Romania, where all the counties (NUTS-3) were covered by Objective 1, it would make sense to determine at Member State level, in a well-communicated and scientifically sound way, how much money can be allocated in total to beneficiaries from one county. Or like Crescenzi already suggested in 2009, a solution could be better targeting and "combining GDP per capita with further information on the socio-economic conditions of the target areas" (Crescenzi 2009. 128). The need for differentiation between the regions is also argued by Medve-Bálint (2017. 220), in whose opinion "the lack of differentiation between the more and the less prosperous regions in terms of fund eligibility has enabled unequal internal competition for the funds, which has primarily benefited the wealthier regions and localities". However, given the importance of spillover effects demonstrated by a considerable amount of research (e.g., Bourdin 2019; Kostov-Gallo 2015), it would be worthwhile to set maximum eligible amounts by region, at the NUTS-2 level. Decision makers may consider, as a partial solution, decreasing the EU co-financing rate in richer regions and increasing it in regions with lower GDP per capita. Regional programmes (NUTS-2 level) that tackle issues that are important to the regions and one or two national programmes with a transregional scope (above the NUTS-2 level) could also help solve this issue.

On the other hand, it should be decided whether the EU's regional convergence or regional development at Member State level is a priority. In the case of Romania, all the regions attracted EU funds and achieved some development with this funding. These regions would have been unable to accomplish this without EU funds. We argue that even if the ultimate goal of the Cohesion Policy – convergence between all EU regions – is not achieved, there are considerable development gains for individual Member States, and this could benefit the EU as a whole.

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Appendices

Appendix 1: Distribution of types of beneficiaries across OPs (number of winning projects)

Type of beneficiary	Regional OP	Environment	Increase of Econ. Comp.	Human Resource Development	Transport	Administrative Capacity Building	Technical Assistance	Total
Central public administration authority	36	151	204	206	46	126	96	865
Research institute	0	3	103	34	0	0	0	140
Large enterprise	0	0	284	73	5	0	0	362
Small business	79	0	2629	280	0	0	0	2988
Medium enterprise	27	2	1090	94	7	0	0	1220
Microenterprise	2157	0	1153	165	0	0	0	3475
Regional operator	0	81	0	7	0	0	0	88
Non-profit, non-governmental organisation	160	89	166	681	0	12	0	1108
Non-profit, non-governmental body of public utility, with legal personality, operating in the field of regional development	64	2	18	69	0	1	15	169
Legal person of private law and public utility	23	8	40	876	1	1	0	949
Commercial company with majority or full state ownership	1	5	0	2	71	0	0	79
Territorial administrative unit / county council	317	58	62	24	0	48	2	511
Territorial administrative unit / town hall / local council	1587	43	42	84	1	134	0	1891
Unit subordinated to or coordinated by a central public administration authority	5	59	104	446	8	53	48	723
State university	9	12	104	545	0	10	0	680

Source: Own calculations

Appendix 2: Means, standard deviations, and correlations with confidence intervals (whole sample)

Variable	M	SD	1	2	3	4	5	6	7
1. logEUFunds	7.52	0.49							
2. logGDPpercap	9.89	0.34	0.71** [.52, .84]						
3. HBED	5.45	1.50	0.63** [.41, .79]	0.58** [.34, .75]					
4. ENROLLED- PREUNIV	64603.77	31970.02	0.49** [.22, .69]	0.46** [.18, .67]	0.52** [.26, .71]				
5. STUDFINAL- UNIV	15933.50	39259.65	0.68** [.48, .82]	0.65** [.43, .80]	0.63** [.40, .78]	0.83** [.71, .91]			
6. RETIREES	111967.66	71143.30	0.59** [.35, .76]	0.59** [.35, .76]	0.56** [.30, .74]	0.94** [.88, .97]	0.91** [.84, .95]		
7. UNEMP	6.3	2.03	-0.52** [-.71, -.26]	-0.63** [-.78, -.40]	-0.27 [-.53, .03]	-0.36* [-.60, -.07]	-0.43** [-.65, -.15]	-0.40** [-.63, -.11]	
8. SUBSIDIES	220.47	42.91	-0.00 [-.31, .30]	-0.16 [-.45, .15]	-0.19 [-.47, .12]	-0.35* [-.59, -.05]	-0.29 [-.55, .01]	-0.31* [-.56, -.01]	0.01 [-.29, .31]

Source: Own calculations

Appendix 3: Testing the assumptions of the OLS regression for all (Model 1)

Linearity	RAMSEY RESET test: $F(2,36) = 0.065809$, p-value = 0.9364 Rainbow test: $F(21,17) = 1.4044$, p-value = 0.2407
Homoscedasticity	studentized Breusch-Pagan test: $\chi^2(3) = 6.2587$, p-value = 0.09968 Goldfeld-Quandt test: $F(17,17) = 1.4741$, p-value = 0.216 White test: $\chi^2(8) = 13.0$, p-value = 0.113
Autocorrelation	Durbin-Watson test: $DW = 2.1567$, p-value = 0.7175 Breusch-Godfrey test for serial correlation of order up to 4: $F(4) = 2.474$, p-value = 0.6493
Normality of residuals	Shapiro-Wilk normality test: $W = 0.94774$, p-value = 0.05362 Anderson-Darling normality test: $A = 0.62609$, p-value = 0.09619

Source: Own calculations in R

Appendix 4: Descriptive statistics for EU funds/capita received by county councils, city councils and town halls

	N	Minimum	Maximum	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
EU funds/capita	42	241.126	1257.479	701.383	37.470	242.839	0.247	0.365	-0.461	0.717

Source: Own calculations

**Appendix 5: Means, standard deviations, and correlations
with confidence intervals in the case of funds received exclusively
by county councils, city councils and town halls**

Variable	M	SD	1	2	3	4	5	6	7
1. logEUFunds	6.49	0.38							
2. logGDPpercap	9.89	0.34	-0.08 [-.37, .23]						
3. HBED	5.45	1.50	0.13 [-.18, .42]	0.58** [.34, .75]					
4. ENROLLED- PREUNIV	64603.77	31970.02	-0.32* [-.57, -.02]	0.46** [.18, .67]	0.52** [.26, .71]				
5. STUDFINAL- UNIV	15933.50	39259.65	-0.35* [-.59, -.05]	0.65** [.43, .80]	0.63** [.40, .78]	0.83** [.71, .91]			
6. RETIREES	111967.66	71143.30	-0.35* [-.59, .05]	0.59** [.35, .76]	0.56** [.30, .74]	0.94** [.88, .97]	0.91** [.84, .95]		
7. UNEMP	6.3	2.03	-0.01 [-.31, .30]	-0.63** [-.78, -.40]	-0.27 [-.53, .03]	-0.36* [-.60, -.07]	-0.43** [-.65, -.15]	-0.40** [-.63, -.11]	
8. SUBSIDIES	220.47	42.91	0.61** [.38, .77]	-0.16 [-.45, .15]	-0.19 [-.47, .12]	-0.35* [-.59, -.05]	-0.29 [-.55, .01]	-0.31* [-.56, -.01]	0.01 [-.29, .31]

Note: M and SD are used for mean and standard deviations. Values in square brackets indicate the 95% confidence interval. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014).

* $p < .05$. ** $p < .01$.

Source: Own calculations

**Appendix 6: Testing the assumptions of the OLS regression
for county councils, city councils and town halls (Model 2)**

Linearity	RAMSEY RESET test: $F(2,36) = 1.0015$, p -value = 0.3773 Rainbow test: $F(21,17) = 2.1343$, p -value = 0.0586
Homoscedasticity	studentized Breusch-Pagan test: $\chi^2(3) = 6.0398$, p -value = 0.1097 Goldfeld-Quandt test: $F(17,17) = 0.53678$, p -value = 0.8951 White test: $\chi^2(8) = 13.7$, p -value = 0.0890
Autocorrelation	Durbin-Watson test: $DW = 1.9724$, p -value = 0.4847 Breusch-Godfrey test for serial correlation of order up to 4: $F(4) = 2.0467$, p -value = 0.7272
Normality of residuals	Shapiro-Wilk normality test: $W = 0.98609$, p -value = 0.8817 Anderson-Darling normality test: $A = 0.20706$, p -value = 0.8586

Source: Own calculations in R

Appendix 7: Means, standard deviations, and correlations with confidence intervals in the case of funds received exclusively by companies

Variable	M	SD	1	2	3	4	5	6
1. logEUFunds	5.84	0.38						
2. logGDPpercap	9.89	0.34	0.60** [.36, .76]					
3. HBED	5.45	1.50	0.40** [.11, .63]	0.58** [.34, .75]				
4. ENROLLEDPRE-UNIVper1000	122.25	10.21	-0.31* [-.56, -.00]	-0.47** [-.68, -.20]	-0.12** [-.41, .19]			
5. STUDFINAL-UNIVper1000	18.65	25.48	0.52* [.26, .71]	0.71** [.52, .84]	0.74** [.56, .85]	-0.35* [-.59, -.06]		
6. RETIREES	111967.66	71143.30	0.37* [.08, .61]	0.59** [.35, .76]	0.56** [.30, .74]	-0.35* [-.59, -.05]	0.76** [.59, .86]	
7. UNEMP	6.30	2.03	-0.53** [-.72, -.26]	-0.63** [-.78, -.40]	-0.27 [-.53, .03]	0.34* [.04, .58]	-0.46** [-.67, -.19]	-0.40* [-.63, -.11]

Note: M and SD are used for mean and standard deviations. Values in square brackets indicate the 95% confidence interval. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014).

* $p < .05$. ** $p < .01$.

Source: Own calculations in R

Appendix 8: Testing the assumptions of the OLS regression for companies (Model 3)

Linearity	RAMSEY RESET test: $F(2,38) = 2.0004$, p-value = 0.1493 Rainbow test: $F(21,19) = 0.95451$, p-value = 0.5439
Homoscedasticity	studentized Breusch-Pagan test: $\chi^2(1) = 2.5245$, p-value = 0.1121 Goldfeld-Quandt test: $F(19,19) = 0.73154$, p-value = 0.7489 White test: $\chi^2(4) = 3.47$, p-value = 0.482
Autocorrelation	Durbin-Watson test: $DW = 2.1076$, p-value = 0.6381 Breusch-Godfrey test for serial correlation of order up to 4: $F(4) = 2.8963$, p-value = 0.5753
Normality of residuals	Shapiro-Wilk normality test: $W = 0.96181$, p-value = 0.1713 Anderson-Darling normality test: $A = 0.33915$, p-value = 0.4838

Source: Own calculations in R