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Money talks, but can it run? Assessing the territorial dynamics of EU funds absorption capacity

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Money talks, but can it run? Assessing the territorial dynamics of EU funds absorption capacity

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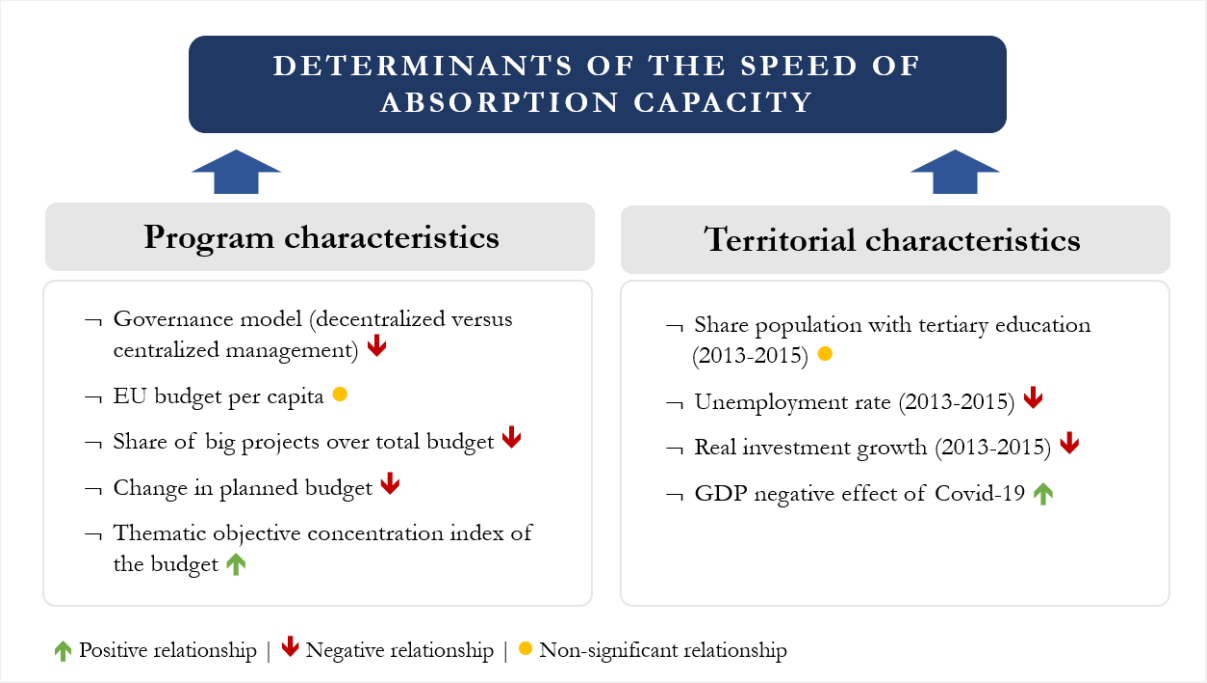
Executive Summary

The EU's long-term budget for 2021-2027 and the NextGenerationEU instrument account for an unprecedented budget of around 2 trillion euros. Concerns have been raised about the ability of Member States or their regions to absorb such an amount of funds. The present paper aims to provide an in-depth analysis of the capacity of European territories to absorb EU funds in a timely manner, based on data of 2014-2020 cohesion policy funds. We introduce a novel metrics to measure the speed of absorption capacity of European funds, considering time performance. Our analysis is important to support the implementation of the 2021-2027 EU budget and NextGenerationEU, as well as to contribute to the on-going debate on the future of cohesion policy.

We define the speed of absorption capacity as the territory's performance in spending the allocated budget for the programming period 2014-2020 at faster or slower pace. A territory could represent a region at Nuts 1- or Nuts 2-level or a country, depending on the geographical coverage of the programmes. The analysis reveals significant heterogeneity in relation to EU funds speed of absorption both between and within EU countries, as well as across different thematic areas. Programmes and territorial characteristics are main drivers of these differences.



- The governance model of EU programmes is an important factor in explaining the capacity of the territory to absorb the funds. Territories with a decentralized (regional) governance model are associated with lower values in terms of the speed of absorption. Although this finding suggests

that a centralised, national approach increases the speed of absorption, this result may be influenced by the specific characteristics of the territories or the programmes. For instance, territories with a decentralized governance model have on average a lower share of population with higher education and higher unemployment which in turn may affect the capacity to develop projects. This is also reflected in their less good performance in attracting competitive funding such as the EU's Framework Programme for Research and Technological Development.

- Changes to the budget of programmes through reprogramming or reallocation affects negatively their financial execution, as they may interfere on the planning, leading to delays in implementation.
- Concentrating funding on a fewer thematic areas can speed up the territorial absorption of funds, as it may be easier to plan and implement programmes.
- A higher share of big projects (more than 50 billion EUR) is negatively related to the absorption capacity, possibly due to the characteristics of this type of projects. Bigger projects may take longer to be implemented.
- Territories with higher unemployment and higher investment growth at the beginning of the programming period seem to have lower values of the speed absorption. As higher unemployment could be a *proxy* for the lack of entrepreneurship, this could justify that in regions with higher unemployment there is less demand for investment projects and consequently to use EU funds. Additionally, the negative relationship with investment growth could be symptomatic that the territories are not willing to absorb additional financing due to a more crowded market (lack of demand).

The study also reveals differences between thematic areas in terms of the speed of absorption capacity. The highest absorption is observed on measures to support of SMEs, which may be partially explained by Covid-19 pandemic. Indeed, most of the EU countries used cohesion policy funds to mitigate the effect of the crisis on SMEs, which explains the previous ranking. Among the determinants explaining the thematic areas with the highest speed of absorption capacity, programme characteristics seem on average to be more relevant than territorial characteristics, although each thematic area is explained by a specific combination of variables, without similar patterns.

Money talks, but can it run? Assessing the territorial dynamics of EU funds absorption capacity

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Abstract

Using data from the execution of 2014-2020 cohesion policy, the paper offers a comprehensive analysis of the speed of absorption capacity of European funds by introducing novel metrics. It evaluates absorption capacity considering time performance and distinguishing between national and regional governance models. The study employs a Tobit model to explain the overall speed of absorption and a multinomial regression model to describe the drivers of the thematic area with the highest absorption capacity. Programmes and territorial characteristics are both relevant factors explaining the level of absorption of funds. However, when explaining the thematic area with the highest absorption capacity, programme characteristics are more relevant than territorial ones.

Keywords: Cohesion policy; Absorption capacity; European Union.
JEL code: R11; R58; O18.

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1. Introduction

The absorption capacity of European Union (EU) funds reflects the ability of a country or territory to spend the financial resources allocated to them (Moreno, 2020). Since this concept primarily quantifies the ability to spend, it does not capture the qualitative aspects of expenditures. Nevertheless, the absorption rate of EU funds stands as a pivotal metric, often regarded as a key measure of the programmes' performance. This metric has undergone comprehensive examination from diverse perspectives, including in the context of the impact assessment of cohesion policy funds (Polverari et al., 2007; Kersan-Škabić and Tijanić, 2017; Aivazidou et al., 2020; Dicharry, 2023).

In the last two decades, the understanding of the factors that explain the absorption capacity has gained increasing attention among policy makers and academics (e.g. Tosun, 2014; Kersan-Škabić and Tijanić, 2017; Incaltarau et al., 2020). Such interest has grown even more in recent years given the unprecedented spending delays in the programming periods 2014-2020 and 2021-2027, due to various reasons: e.g. late adoption of funds legislation, new legal requirements or changing provisions, additional burden owing to implementation of parallel funding streams (REACT-EU; Recovery and Resilience Facility), impact of downturns on implementation (Böhme et al., 2022; Molica, 2021). Furthermore, the overall size of EU investments for the period 2021-2027 will be by far the largest ever recorded: the EU Multiannual Financial Framework (MFF) has a budget of about 2 trillion euros, with 800 billion euros from NextGenerationEU (NGEU) programme and 392 billion from cohesion policy. Such unprecedented EU budget has raised concerns from both policy-makers and academics about the absorption capacity of EU Member States (see e.g. Codogno and Van den Noord, 2022; Alcidi et al., 2020; Crescenzi et al, 2021).

With this in mind, the paper aims to complement the existing research on the absorption capacity of cohesion policy funds with a more detailed and in-depth analysis. First, we propose a novel approach to measure the absorption capacity, combining both the performance over time and the cumulative spending achieved in the last year observed; by contrast, existing studies (see e.g. Tosun, 2014; Kersan-Škabić and Tijanić, 2017; Incaltarau et al., 2020) have only focused on the analysis of the annual rate of absorption (payments over planned funds). Our indicator called the "speed of absorption capacity" measures the capacity of a territory to absorb the funds in a timely manner. "Capacity" has a two-fold meaning in our indicator. It refers to the capacity to spend the resources by the authorities managing the funds and the absorptive capacity of a territorial context in which funds are mobilised as both influence the absorption speed.

Second, our indicator takes into account the different governance models of operational programmes, notably whether they are nationally (centralised) or regionally (descentralised)-managed (Nuts 1 or Nuts 2-level); previous research focuses on country (e.g. Tosun, 2014; Incaltarau et al., 2020) or regional absorption (Kersan-Škabić and Tijanić, 2017) without making this distinction. Third, we estimate the speed of absorption capacity by thematic areas, which has never been done before. Altogether, this allows us to determine which territories absorb faster, but also which of the two governance models (national *versus*

regional programmes) perform better as well as what are the thematic areas with a higher absorption capacity. Additionally, using a Tobit regression model we seek to identify the main determinants of the speed of absorption capacity in the 2014-2020 period using a set of explanatory variables related to the programmes features and territories characteristics. As a complementary analysis, a multinomial regression model is used to explain the thematic area with the highest speed of absorption capacity. To conduct such analysis, we combine data from different sources: Cohesion Open data platform, EUROSTAT and Kohesio platform. We consider that the paper might bring new evidence to inform the future design of cohesion policy in such a way to improve its overall spending performance.

The paper is structured in five sections. After the introduction, section 2 provides a review of the literature. Section 3 describes the data used and methodological approach. Section 4 discusses the results. Section 5 concludes.

2. Literary review

Assessing the spending capacity of cohesion policy and understanding its determinants is important for several reasons. First, as noted by Mendez and Bachtler (2022), absorption is a critical measure of the administrative performance of cohesion policy programmes alongside the regularity of spending and the capacity to achieve their objectives. In this sense, the capacity to spend in a timely manner depends on the quality of the administrations managing the funds (Cace et al., 2009). The link between administrative or political factors and policy implementation has been demonstrated by several empirical studies (e.g. Incaltarau et al., 2020). At the same time, the spending capacity may also be influenced by governance arrangements and the specific institutional organization of a country (Dabrowski et al., 2014; Crescenzi et al., 2021).

The second reason is that a good absorption is a pre-requisite for the funds to deliver the expected impact and achieve their objectives (Tosun, 2014). The literature on the economic impact of cohesion policy does not reach unanimous conclusions, although on average studies tend to show a positive effect of EU funds on economic performance (Mohl and Hagen, 2010). More recently, studies (Di Caro and Fratesi, 2022; Crescenzi and Giua, 2020; Bachtrögler et al., 2020) have highlighted the heterogeneous effect of cohesion policy funds across EU regions. The absorption rate of EU funds may be one of the factors explaining these different effects (Kersan-Škabić and Tijanić, 2017). The introduction of expenditure conditionality in the form of de-commitment rules since the 2000-2006 period (i.e. the possibility to spend the budget until N+3) rests upon this assumption (Bachtler and Ferry, 2015).

The third reason is "reputational". The issue of absorption has fuelled negative narratives about cohesion policy, which have become a recurring feature of the public discourse (Molica and Salvai, 2019). The slower spending of cohesion policy, especially compared to other EU funds, is one of the main arguments used by critics of the policy. Moreover, as highlighted by the Barca report, the issue of slow financial execution

attracts too much of attention from policy-makers overshadowing discussions on "the objectives of the policy" and its "conceptual foundations" (Barca, 2009).

The scope of existing studies on the field of absorption capacity varies considerably (see some examples in Table A1 in Appendix A). They focus on all EU Member States (Tosun, 2014; Incaltarau et al., 2020; Achim and Borlea, 2015), a group of countries (e.g. Horvat, 2005; Tiganasu et al., 2018 - Central and Eastern European countries; Surubaru, 2017 – Romania and Bulgaria) or a single country (e.g. Šumpíková et al., 2004 - Czech Republic - Oprescu et al., 2005; Georgescu, 2008; Zaman and Georgescu, 2009 – Romania – Zubek and Henning, 2016 – Slovakia – Aivazidou et al., 2020 – Italy). All these studies explore country data whereas only a limited number of papers investigate absorption capacity at sub-national level, though only in specific countries (e.g. Komorowski et al., 2020; Novosák et al., 2017).

Understandably, a central area of interest in the study of absorptive capacity concerns its determinants. In this respect, the literature has focused on several explanatory factors, whether endogenous or contextual/exogenous, through qualitative and quantitative analyses. Administrative capacity is a prominent area that has been investigated. In a study focusing on Italy's Mezzogiorno, Milio (2007) provides evidence suggesting that administrative capacity is positively correlated to spending rate. Other qualitative studies on Eastern or Central countries come to similar conclusions (Bachtler et al., 2014; Boeckhout et al., 2002; Horvat, 2005). From a broader perspective, Surubaru (2017) investigates how the interplay between administrative capacity and political factors influences the implementation. Similarly, Cunico et al. (2022) use two case studies from Italy to look into how decision-making mechanisms within local administrations can explain differences in absorption performance. Other empirical studies have looked more broadly at the relationship between absorption and the quality of government (Mendez and Bachtler, 2022), institutional framework (Incaltarau et al., 2020) or the governance of the funds (Markovič et al., 2008).

There are also works exploring the impact of macroeconomic variables on absorption. Kersan-Škabić and Tijanić (2017) find that Gross Fixed Capital Formation (GFCF) and unemployment have respectively a positive and negative influence on absorption. Incaltarau et al. (2020) estimate that economic downturns, amongst others, could negatively affect EU funds absorption. However, there seems to be no consensus on whether Gross Domestic Product (GDP) influences the absorption rate. Tosun (2014) finds that high-income Member States have a lower absorption capacity, while Achim and Borlea (2015) estimate a positive but non-significant relationship between absorption and GDP. Finally, another determinant of absorption is the so-called gold-plating, i.e. the setting of additional rules or procedures by national or regional bodies which might slow down implementation because they increase the administrative burden on programmes' authorities and beneficiaries (Cunico et al., 2022). Unfortunately, the systematic effects of this factor cannot be easily measured because of data limitations (Mendez and Bachtler, 2017).

Overall, the literature on cohesion policy absorption has been less prolific than that on the macroeconomic effects of cohesion policy funds. As a result, there remain significant research gaps that would need to be addressed in order to gain a better understanding of the issue. First, studies on absorption have almost

exclusively used country-level data, however, the place-based focus and multi-level governance of cohesion policy call for a more granular analysis. Second, cohesion policy finances very different areas and projects, which in turn may have very different levels of absorption. Nonetheless, there has been so far no analysis of absorption trends by thematic area. Third, empirical analyses of absorption rates are either static, meaning that they measure the absorption rate at a specific point in time, or they do not take into account possible non-linear patterns when looking at the variation over time. Fourth, there has been too little research on the governance of the funds and characteristics of programmes as explanatory variables. This paper fills these gaps altogether paving the way for a more holistic approach to the topic of absorption.

3. Data and methods

3.1. Speed of absorption capacity indicator

3.1.1. Methodological approach

To measure the speed of absorption capacity (**SAC**) of EU funds we use data from the Cohesion Open Data Platform on European Structural and Investment Funds (https://cohesiondata.ec.europa.eu/): in particular, the resources planned and spent under the cohesion policy funds[1] for the programming period 2014-2020.[2] We excluded all resources classified under Thematic Objective 13 (Fostering crisis repair and resilience) like REACT-EU, since they are related to new actions created from 2020 due to unexpected events. Inter-regional collaboration programmes (like INTERREG), as well as Thematic Objective 12 (Outermost & Sparsely Populated) and Technical Assistance programmes or axes, are also not included in the analysis due to their specific geographical scope. Programmes that are discontinued over time because are merged with other are also left out from the analysis.

The speed of absorption capacity of EU funds for territory i (SAC_{it}) is defined as the product of the Average Performance of the territory i (AP_i) multiplied by its Global Absorption Capacity (GAC_i) and 100 as expressed in equation (1).

$$SAC_i = (AP_i \times GAC_i) \times 100 \quad (1)$$

The AP_i is computed as the mean of the Annual Cumulative Absorption Rate (AAR_{it}) over the analysed period as expressed in equation (2), where N is the duration in years of the analysed period (for example N = 7, if the analysed period goes from 2016 to 2022) and t indicates the year of the period, t = 2016, …, $t + N$.

[1] European Regional Development Fund (ERDF), European Social Fund (ESF), Cohesion Fund (CF) and Youth Employment Initiative (YEI).

[2] We use dataset "ESIF 2014-2020 categorisation ERDF-ESF-CF planned vs implemented" available here: https://cohesiondata.ec.europa.eu/2014-2020-Categorisation/ESIF-2014-2020-categorisation-ERDF-ESF-CF-planned-/3kkx-ekfq (extracted on 30 July 2023).

$$AP_i = \frac{1}{N} \sum_{t=2016}^{t+N} AAR_{it} \quad (2)$$

The AAR_{it} (3) refers to the ratio between the cumulative expenditure up to year t for territory i (S_{it}) and the total EU planned amount for the analyzed programming period for territory i (P_{it}). It should be noted that although this analysis covers the programing period 2014-2020, it considers 2016 as the first year of implementation given delays in launching the programmes. Moreover, the analysis does not cover the whole programming period as expenses can be incurred until 2023.

$$AAR_{it} = \frac{S_{it}}{P_{it}} \quad (3)$$

The GAC_i corresponds to the Annual Cumulative Absorption Rate at the end of the period (AAR_{iN}) as follows:

$$GAC_i = AAR_{iN} = \frac{S_{iN}}{P_{iN}} \quad (4)$$

The earlier in time S_{it} is closer to P_{it}, the larger the indicator SAC_{it} will be, since an AAR_{it} closer to 1 will appear with a higher frequency in our average estimated. A territory could be a region (Nuts 1- or Nuts 2-level) or a country, depending on the governance model of the programme (national or regional). However, because we are not only interested in the average performance (AP_i) but also in the overall level of expenditure in the last year (2022), we corrected the AP_i by the level of absorption in 2022. This step allows to ensure that territories with a lower average performance but able to spend the full budget in 2022 are better ranked than territories with good average performance but unable to spend the full budget until 2022 (see Appendix B for an illustrative example).

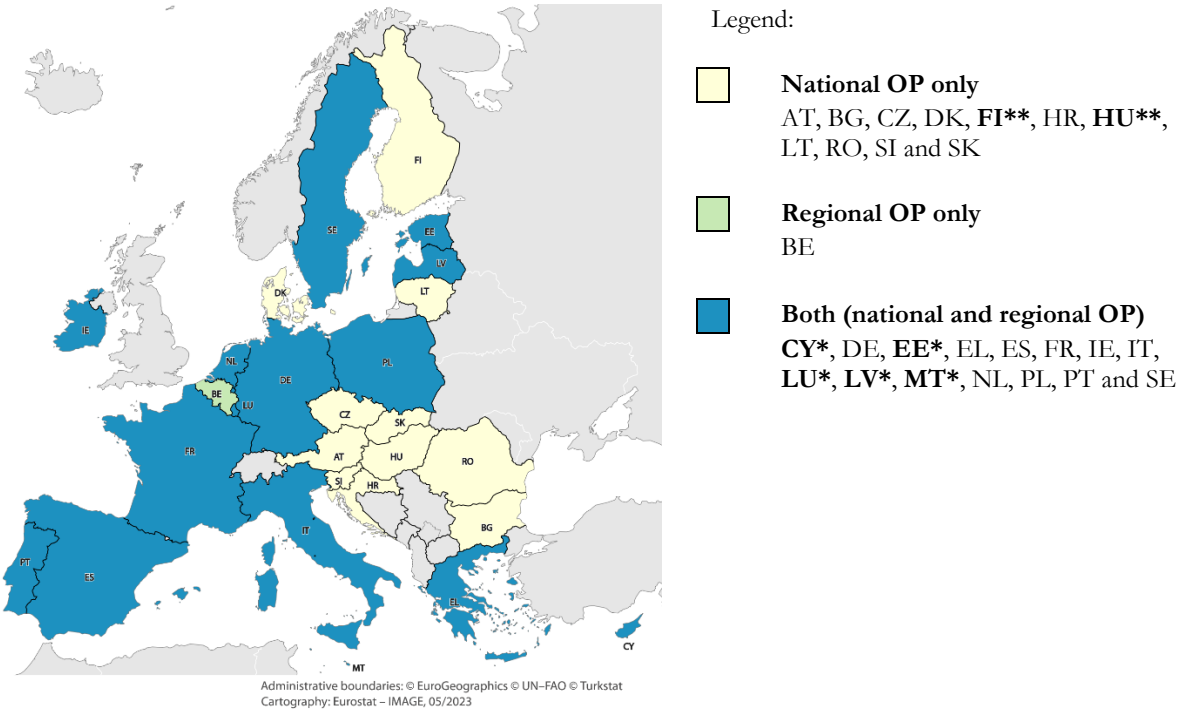
To identify the territory responsible for the governance of each operational programme (OP), we use the description in the title of the OP. When the name of a region (Nuts 1- or Nuts 2-level) is included in the title, the OP is classified as regional OP or as national OP otherwise (see Figure 1). Then, to attribute a Nuts code to each OP, we use the correspondence tables between region names and Nuts codes available in the Eurostat webpage (https://ec.europa.eu/eurostat/web/nuts/history). We use the Nuts version 2021 classification for all the regional OP, except for OPs in Ireland[3] where we use the Nuts version 2013 due to the impossibility to attribute a single Nuts classification to these programmes when using the Nuts version 2021. For this reason, multi-regional OPs[4] and territorial cooperation OPs (like Interreg) are also

[3] Border Midland and Western Regional – ERDF (2014IE16RFOP001): IE01 Nuts version 2013 corresponding to IE04 and IE06 in the Nuts version 2021; Southern & Eastern Regional Programme - IE – ERDF (2014IE16RFOP002): IE02 Nuts version 2013 corresponding to IE05 and IE06 in the Nuts version 2021.

[4] Wallonie-Bruxelles 2020.eu - ESF/YEI (2014BE05M9OP001), Interregional Alpes - ERDF (2014FR16RFOP001), Interregional Loire - ERDF (2014FR16RFOP002), Interregional Massif Central - ERDF (2014FR16RFOP003),

excluded from the analysis. Indeed, in the presence of multi-regional OPs not covering all the regions of a country or including territories in different countries, the information about the EU planned budget refers to the total amount for more than one region (Nuts 1- or Nuts 2-level). Therefore, if we want to analyse the performance of a specific territory to use the EU budget allocated to them, we cannot include multi-regional OPs, because the result can be biased by the fact the governance is in effect "shared" between different territories.

Figure 1. EU countries by typology of governance model of cohesion policy funds 2014-2020



Source: Own elaboration based on Cohesion Open Data Platform.
Note: * Mono-region country (where Nuts 2-level classification corresponds to the entire country). ** Country with a regional OP for one region only out of 5 (FI) or 8 (HU) regions (Nuts 2 level) the county has.

The **SAC** represents a *proxy* measure for the effectiveness of a territory to spend the EU budget allocated to the different OPs. Additionally, to assess if there are differences in term of performance depending on the thematic areas of the OPs, we regroup the thematic objectives of the 2014-2020 period in five broader thematic areas (similar to the Policy Objectives of cohesion policy 2021-2027) and estimate the SAC for each, as described in the Table 1.

Interregional Pyrénées - ERDF (2014FR16RFOP004), Interregional Rhône Saône - ERDF (2014FR16RFOP005), Continental Greece - ERDF/ESF (2014GR16M2OP007) and Development of Eastern Poland - ERDF (2014PL16RFOP003).

Table 1. Thematic areas of the speed of absorption of EU funds

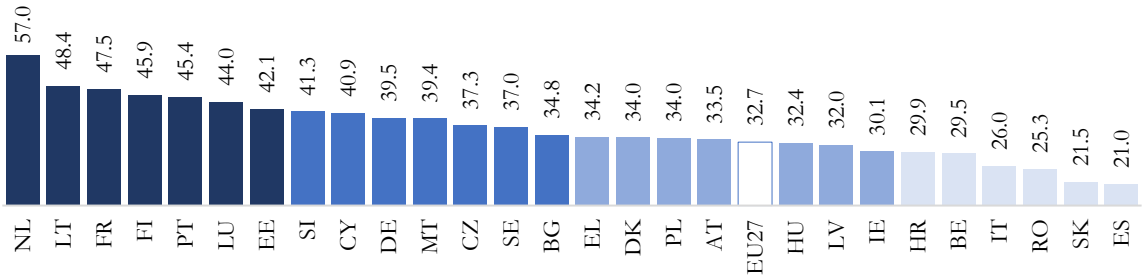
Thematic areas of the SAC	Thematic Objectives (TO) 2014-2020	Policy Objectives 2021-2027
1. Innovation	TO01 - Strengthening research, technological development and innovation	PO01: A smarter Europe by promoting innovative and smart economic transformation
2. SMEs	TO03 - Enhancing the competitiveness of SMEs	
3. Green transition	TO04 - Supporting the shift towards a low-carbon economy in all sectors	PO02: A greener, low-carbon Europe, by promoting clean and fair energy transition, green and blue investment, the circular economy, climate adaptation and risk prevention and management
	TO05 - Promoting climate change adaptation, risk prevention and management	
	TO06 - Preserving and protecting the environment and promoting resource efficiency	
4. Infrastructure and networks	TO02 - Enhancing access to, and use and quality of, ICT (part)	PO03: A more Connected Europe, with strategic transport and digital networks
	TO07 - Promoting sustainable transport and removing bottlenecks in key network infrastructures	
5. Employment, inclusion and education	TO08 - Promoting sustainable and quality employment and supporting labour mobility	PO04: A More Social Europe – Implementing the European Pillar of Social Rights
	TO09 - Promoting social inclusion, combating poverty and any discrimination	
	TO10 - Investing in education, training and vocational training for skills and lifelong learning	

Source: Own elaboration.

3.1.2. Interpretation of the indicator

The **SAC** indicator is estimated for 163 territories both at Nuts 1- and Nuts 2-level, as well as country-level, depending on the governance of the programmes (see list in Table C1 in Appendix C). The EU27 average is 32.7 (Figure 2). The Netherlands has the highest value (57) and Spain the lowest (21). There is a considerable difference between the best and worst scored countries, confirming very heterogeneous absorption performances. At first sight, there does not appear to be a clear trend in relation to country characteristics.

Figure 2. Speed of absorption on a scale from 0 to 100, cohesion policy 2014-2020, by EU Member States

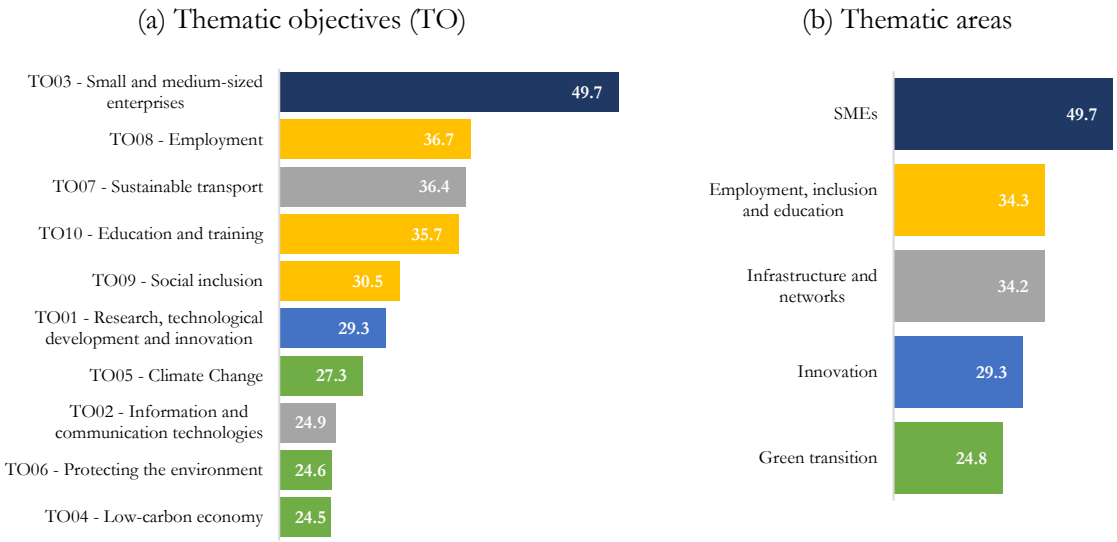


Source: Own estimation based on equation (1).

Note: The values do not correspond to the average, they are estimated using the total values by country

The estimation of **SAC** by thematic area (Figure 3) shows that the value attributed to investments targeting Small and Medium-sized Enterprises (SMEs) is much higher (49.7) than in the other areas. A possible explanation is the significant use of cohesion policy funds to shore up distressed business fabric throughout the Covid-19 pandemic, as well as during the shocks generated by the Russian war of aggression against Ukraine (Böhme et al., 2022). Overall, the nature of cohesion policy subsidies for SMEs (amounts capped by state aid rules; in many instance, financing of intangible investments) might suggest faster spending compared to other areas. It is noteworthy that the thematic area related to the green transition has the lowest value (24.8), while when looking at the breakdown by thematic objective (reflecting the thematic 'menu' for 2014-2020), resources for the digital transition show also a low value. Finally, it is important to highlight that some TOs may hide uneven levels of absorption between different investment priorities covered (for instance, within TO7, rail and road investments exhibit very different spending rates) but the analysis does not have the granularity to capture these differences. Moreover, the thematic structure in the period 2021-2027 has been changed, with various TOs having been merged, which may result in different absorption rates. For instance, TO1, part of TO2 and TO3 are merged into one single objective.

Figure 3. Speed of absorption capacity, cohesion policy 2014-2020, by areas



Source: Own estimation based on equation (1).

Note: The values do not correspond to the average; they are estimated using the total values by areas.

It is also important to look at how the **SAC** performs in relation to different governance arrangements. Table 2 shows the scores for regional and national OPs in countries with both types of governance. The EU average for both types is very similar – 33.0 for national OPs versus 32.2 for regional ones –, but there are important in-country differences. For instance, in France or Ireland national programmes perform better than regional ones, whereas in Spain or Sweden the opposite occurs. This might also be explained by differences in the characteristics of the programmes (e.g. size, thematic concentration, etc.). Figure 4

shows the speed of absorption capacity by regional (map on the left) and national programmes (map on the right). Within most countries, we also observe a strong heterogeneity of the **SAC**. For instance, Italy, France and Spain are home to both some of the worst performing OPs (e.g. Calabria, Corsica, Andalusia) and the best performing ones such as Emilia Romagna, Cantabria, Centre-Val de Loire. Overall, the picture is less diversified in Germany although the OP with the highest **SAC** (Hamburg) has a value double the OP with lowest **SAC** (Saxony-Anhalt).

Table 2. Speed of absorption, cohesion policy 2014-2020, by typology of governance model

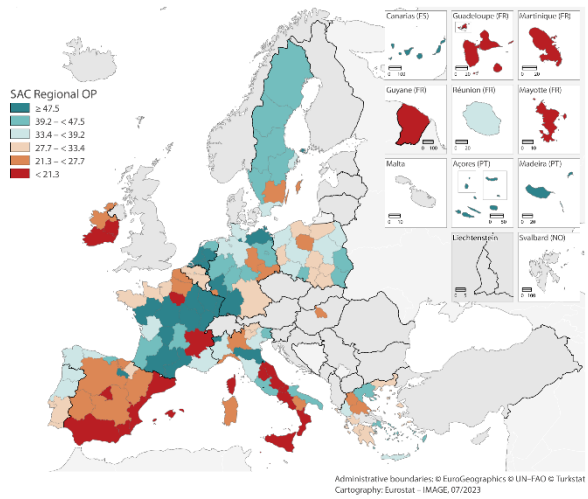
Country	National OP	Regional OP	Difference
FR	62.3	40.4	21.9
NL	61.4	52.6	8.8
PT	53.1	36.2	16.9
DE	51.1	37.6	13.4
IE	38.4	21.4	17.0
PL	34.4	33.4	1.0
SE	34.1	40.6	-6.5
EL	33.3	36.7	-3.4
IT	26.1	26.0	0.1
ES	19.6	22.8	-3.2
EU27	33.0	32.2	0.8

Source: Own estimation based on equation (1).

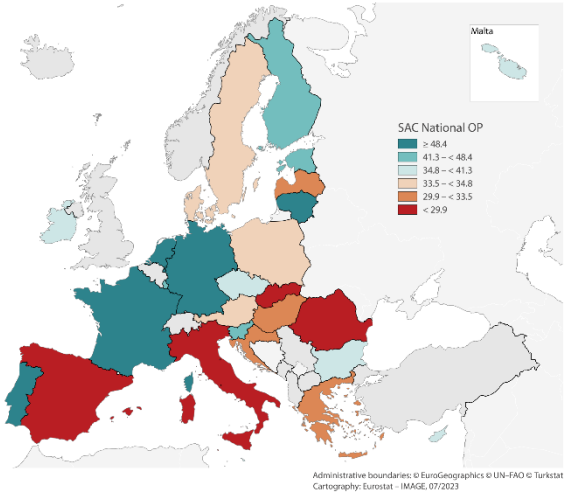
Note: The values do not correspond to the average, they are estimated using the total values by country and governance model of the Operational programmes.

Figure 4. Speed of absorption capacity, cohesion policy 2014-2020, by typology of governance model

(a) Regional operational programmes



(b) National operational programmes



Source: Own estimation based on equation (1).

Finally, we looked at territorial differences in terms of the thematic area with the highest **SAC**. Table 3, Figure 5 and Figure 6 show in which thematic area regions have the highest and second highest **SAC**, when we have regional programmes. More specifically, Table 3 shows the number of regions with the highest or second highest **SAC** for each thematic area while Figure 5 and Figure 6 illustrate the geographical distribution of these regions. The order of the primary area with the highest **SAC** (Table 3) is the same as the average (Figure 3), with around 70% of the EU regions reporting the highest **SAC** for support to SMEs. Employment, inclusion and education is the best performing thematic area for 20% of the regions, mainly located in Germany, Italy and France. The secondary best performing thematic area (Figure 6) shows a more heterogeneous geographical distribution between and within countries, with employment, inclusion and education in the first place (40%), followed by infrastructures and networks (23%). Green transition is the thematic area with the lowest number of regions with the highest **SAC** in this area, and is mainly concentrated in regions of Spain, Ireland and the Netherlands.

Table 3. Thematic areas with the highest and second highest speed of absorption capacity (**SAC**): median and number of regions, regional OP

Thematic area	**Highest SAC**			**Second highest SAC**		
	Median	Nr regions		Median	Nr regions	
Innovation	37.6	6	4%	33.2	20	15%
SMEs	42.2	94	69%	32.8	21	15%
Green transition	28.4	4	3%	33.1	10	7%
Infrastructure and networks	38.9	6	4%	36.2	31	23%
Employment, inclusion and education	39.8	27	20%	36.2	54	40%

Source: Own estimation based on equation (1).

Note: The total number of regions in primary area is 137 and 136 for the secondary area. The difference is due to the fact that the some territories are concentrating mainly its cohesion policy funds in one single area.

Figure 5. Thematic area with the highest speed of absorption capacity, regional OP

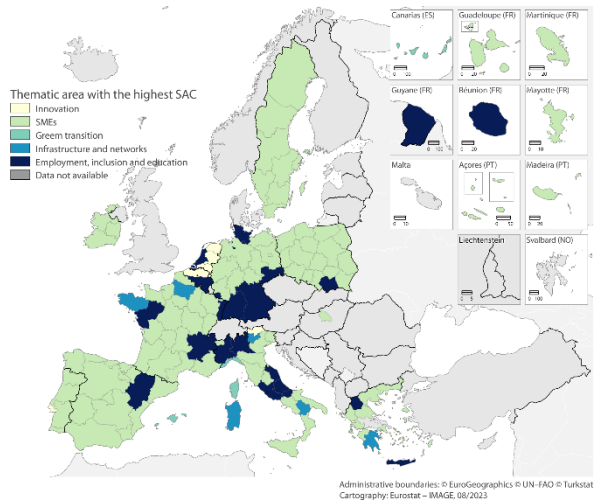
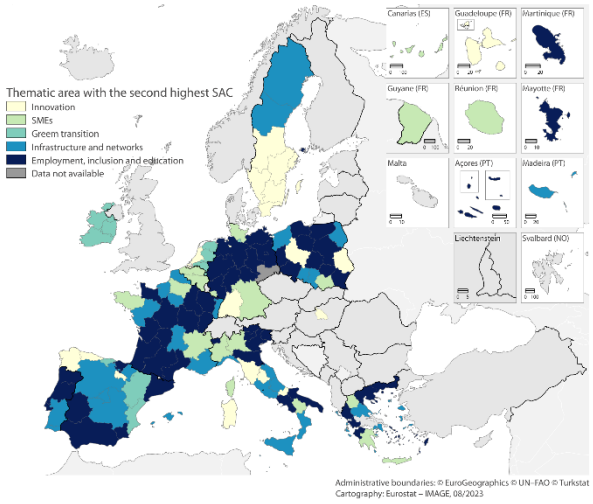


Figure 6. Thematic area with the second highest speed of absorption capacity, regional OP



Source: Own estimation based on equation (1).

Note: Dark grey area in Figure 6 means that some territories are concentrating mainly its cohesion policy funds in one single area.

Lastly, Figure 7 and Figure 8 illustrate the distribution of the highest and second highest **SAC** at country-level (national programmes). SMEs is the best performing area in the majority of Member States followed by Employment, inclusion and education; only Czechia and Denmark have the highest speed of absorption in areas other than the aforementioned two. Some Member States have ESF national programmes only, which explains why they do not have a second best thematic area.

Figure 7. Thematic area with the highest speed of absorption capacity, national OP

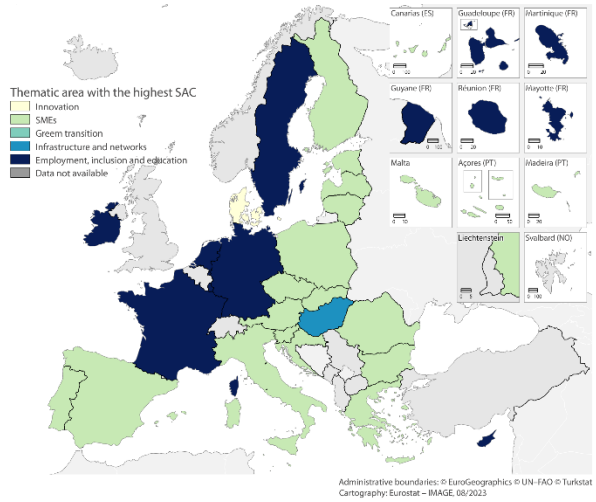
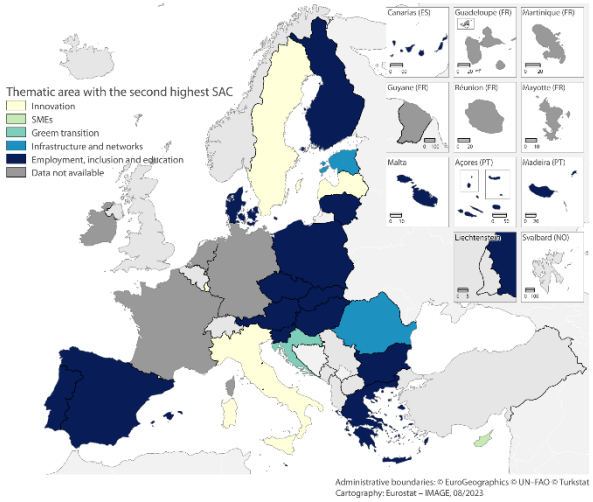


Figure 8. Thematic area with the second highest speed of absorption capacity, national OP



Source: Own estimation based on equation (1).

Note: Dark grey area in Figure 6 means that some territories are concentrating mainly its cohesion policy funds in one single area.

3.2. Explaining the speed of absorption capacity: econometric model

Following previous studies (see e.g. Tosun, 2014; Kersan-Škabić and Tijanić, 2017; Incaltarau et al., 2020; Achim & Borlea, 2020), to explain the SAC of the different EU territories we use the model expressed in equation (5):

$$SAC_i^{2016-22} = f(PC_i^{2016-22}, TC_i^{2013-15}) \quad (5)$$

Where PC_i refers to the programmes characteristics in territory i over the period 2016-2022. TC_i includes several socio-economic characteristics of territory i in the period before the implementation of the programmes (2013-2015 average) to avoid reverse causality. The equation (5) assumes a cross-sectional form since the **SAC** is estimated for the overall period 2016-2022, as expressed in equation (1).

Programmes' characteristics include the following variables estimated using data from Cohesion Open data[5] and Kohesio platforms[6]:

- Programme governance characteristics as a categorical variable: classified in three categories: (i) decentralized management at regional level; (ii) centralized at national-level in mono-regions; (iii) centralized at national-level in non-mono-regions (reference category). Mono-region, in the context of Nuts classification, refers to a situation where the entire country is also treated for statistical purpose as a single region at Nuts 2 level. Based on the Nuts classification version 2013, mono-region category includes Estonia (EE), Luxembourg (LU), Malta (MT), Cyprus (CY) and Lithuania (LT).

- EU budget per capita: average EU budget (2016-2022) per capita of the territory i (source: estimated using data from Cohesion Open data platform and Eurostat data for the population in the territory - demo_r_d2jan). As the total EU budget for the 2014-2020 programming period may change during the execution, we used the average amount observed in the period under analysis;

- Share of EU funds allocated to projects with an eligible expenditure higher than 50 million EUR in territory i over the programming period 2014-2020 (source: estimated using data from Kohesio);

- Change in EU budget: average (2016-2022) percentage change of the EU budget in territory i between year t and $t-1$ (source: estimated using data from Cohesion Open data platform);

- Average (2016-2022) thematic objective concentration index (TOCI): estimated using a similar methodological approach to the Herfindahl (1950) and Hirschman (1945) index, as expressed in equation (6), where $s_{i,j}$ refers to the share of EU planned budget in thematic objective j in territory i over the total EU planned budget in territory i (source: estimated using data from Cohesion Open data platform).

$$TOCI_i = \sum_{t=1}^{11} (s_{i,j})^2 \, , where \sum_{t=1}^{11} s_{i,j} = 1 \qquad (6)$$

Territorial characteristics include variables estimated using Eurostat data:

- Share population with tertiary education: average (2013-2015) share of population with tertiary education (source: estimated using Eurostat data - lfst_r_lfsd2pop and demo_r_d2jan);

- Unemployment rate: average (2013-2015) share of unemployed population over total population (source: estimated using Eurostat data - lfst_r_lfu3pers and demo_r_d2jan);

[5] File including ESIF 2014-2020 categorisation ERDF-ESF-CF planned vs implemented (updated on 6 March 2023).

[6] Database about final beneficiaries of cohesion policy (https://kohesio.ec.europa.eu/en/).

- Investment growth: average (2013-2015) real growth rate of Gross Fixed Capital Formation (GFGF) between t and t-1 (source: estimated using Eurostat data - nama_10r_2gfcf and nama_10_gdp);
- GDP negative effect of Covid-19: dummy variable =1 if real change in Gross Domestic Product (GDP) between 2019 and 2020 is negative, 0 otherwise (source: estimated using Eurostat - nama_10r_2gdp and nama_10_gdp);
- Geographical territory group dummies: Northern, Southern, Eastern and Western. Northern Europe comprises Denmark (DK), Estonia (EE), Finland (FI), Ireland (IE), Latvia (LV), Lithuania (LT), and Sweden (SE). Southern Europe includes Croatia (HR), Cyprus (CY), Greece (EL), Italy (IT), Malta (MT), Portugal (PT), Slovenia (SI), and Spain (ES). Western Europe consists of Austria (AT), Belgium (BE), France (FR), Germany (DE), Luxembourg (LU), and the Netherlands (NL). Eastern Europe encompasses Bulgaria (BG), Czech Republic (CZ), Hungary (HU), Poland (PL), Romania (RO), and Slovakia (SK).

All the above-mentioned variables are according to scientific literature important factors to explain the territories´ capacity to absorb funds:

- A decentralized (or regional) governance may affect negatively the effectiveness to spend the fund if coordination with central government is complex, generating administrative burden and potential delays in the implementation (Milio, 2007; Bachtler and McMaster, 2008). However, under an adequate political and institutional environment (Sow and Razafimahefa, 2015), a decentralized governance may increase efficiency of public spending (O'dwyer and Ziblatt, 2006; Charbit, 2011), as regional governments have a deeper understanding of local preferences and needs (Kahkonen and Lanyi, 2001).
- The allocated amount of EU funds may also affect negatively the absorption capacity, as it could be more difficult for public bodies (especially with limited capacity) to manage and implement a higher number of complex and large projects (Darvas et al., 2019) or simply due to the lack of demand for some type of EU funds in less developed regions (Marques Santos and Conte, 2023). Similarly, changes in the EU budget of programmes through reprogramming or reallocation could also affect their implementation. Budgetary fluctuations can have a negative impact on the speed of implementation as they are reflected in the planning of programmes and public authorities have to adapt to these changes by reassessing their priorities, which may lead to delays in implementation (Bachtler et al., 2020; Molica, 2021).
- The speed of the implementation of programmes may be affected by the size of the investment projects financed. Largescale projects often entail more complex planning, coordination, and execution, which can lead to a slower absorption of funds (Milio, 2007).

- Concentrating funding on a few thematic areas can speed up the territorial absorption of funds, as it may be easier to plan and implement programmes, whereas the management of programmes covering several thematic areas may be more complex and time-consuming from an administrative point of view (Bachtler et al., 2017).
- Territories with a higher share of skilled labor force are more likely to have higher values of absorption for several reasons. First, these territories tend to attract more investors and additional investments because better educated labour force tend to be more productive (Basile et al, 2008), and generating faster absorption of available funds. Secondly, skilled labor force are more likely to better plan and execute funded investment projects, improving resource efficiency (Becker et al., 2013; Hussain et al, 2020).
- The unemployment rate has been shown to have a positive effect on the absorption rate of developing regions and a negative effect on that of less developed regions (Kersan-Škabić and Tijanić, 2017). High levels of unemployment can also be seen as a proxy for the lack of entrepreneurship or adverse economic conditions, discouraging investment (Basile et al, 2008).
- Past investment growth may affect positively financial absorption as regions with higher investment growth rates tend to have a more active and dynamic economy (Cuaresma et al., 2014). However, in a context where investment is cyclical (Bernanke, 1983), a negative relationship between past investment growth and the speed of absorption of EU funds can be found.
- Periods of economic crisis are expected to negatively affect the absorption of EU funds, since they tend to discourage investment due to economic uncertainty and reduces financial liquidity (Cace et al, 2009; Tosun, 2014; Incaltarau et al., 2020).

Following Tosun (2014) and Incaltarau et al. (2020), to estimate the speed of absorption of funds we use a Tobit model due to the characteristics of the dependent variable. The SAC could theoretically range from 0 to 100 but observed values only fall within a certain range from 11.2 to 64.3 (Table D1 – Appendix D). In the presence of censored data, an Ordinary Least Squares (OLS) estimator would be biased and Tobit model has demonstrated to be a more suitable model to handle censored data (Weimann and Brosig-Koch, 2019). The Tobit estimation method uses maximum likelihood to combine two components: (i) a probit regression associated with the probability that the dependent variable (conditional on a set of explanatory variables) falls within a specific interval and; (ii) a linear regression specification explaining the relationship between the dependent variable and independent variables (Baum, 2006). Both components are estimated simultaneously using the maximum likelihood estimation (MLE) method. Accordingly the model can be specified as expressed in (7):

$$SAC_i^{2016-22} = \begin{cases} SAC_i^* \; if \; SAC_L < SAC_i^* < SAC_U \\ SAC_L \; if \; SAC_i^* \leq SAC_L \\ SAC_U \; if \; SAC_i^* \geq SAC_U \end{cases} \quad (7)$$

Where $SAC_i^{2016-22}$ is the observed variable between a lower (SAC_L) and upper (SAC_U) limits and SAC_i^* is the latent variable (not always observed) explained by the set of explanatory variables (X_i) listed above (equation 8). The vector of parameters is expressed by β and μ_i is a normally distributed error term.

$$SAC_i^* = \beta X_i + \mu_i \quad (8)$$

The equation (8) is estimated for 162 observations (instead of the 163), because after visual inspection of box plots and scatter plots to identify any data points deviating significantly from the overall data distribution (Figure E1 in Appendix E), we detected an outlier for the planned EU budget per capita variable. Although the direction and significance of the parameters remained consistent with or without the outlier (Table E1 in Appendix E), excluding it resulted in an improvement in the model specification quality.

As a complementary analysis, we also estimate a multinomial logistic regression (9) to explain the thematic area with the highest speed of absorption capacity (**HSAC**), as reported in Figure 5 and Figure 7. In such case, the dependent variable is a categorical variable with more than two possible discrete outcomes that cannot be ordered. In our model, we have five categories (j) as reported in Table 1 and equivalent to thematic areas. In a situation with five possible outcomes (m), we estimate four ($m-1$) binary logistic regression models, in which the fifth outcome (J) is chosen as reference category. These regressions are explained by the same set of explanatory variables (X) used in the Tobit model, but with the difference that programme characteristics refer to the ones related to the thematic area (m) and not the overall as in equation (2).

$$\widehat{Pr}(HSAC = m|X) = \frac{exp\left(X\hat{\beta}_{m|J}\right)}{\sum_{j=1}^{J} exp\left(X\hat{\beta}_{j|J}\right)} \quad (9)$$

4. Results and discussion

4.1. Determinants of the speed of absorption capacity

Table 4 reports the marginal effects of the two-limit Tobit regression model (equation 7), where the unit of observation corresponds to a territory i, which could be a region (Nuts 1- or Nuts 2-level) or a country, depending on the governance model of the programme (national or regional). The model shows a good fit to the data and is not biased by the presence of omitted variables, based on the results of the Wald and

Ramsey tests at the bottom of Table 4. The VIF and the correlation matrix (Table D2 in Appendix D) also don't reveal the presence of multi-collinearity biasing the results. We also tested the robustness the results using a different specifications (Table F1 in Appendix F) and we confirmed the stability and reliability of the findings.

Table 4. Tobit model, dependent variable: Speed of absorption capacity (**SAC**) – Marginal effects

Variables	dy/dx				X
	(1)		(2)		(3)
Decentralized governance (Y/N)	-6.826	***	-7.366	***	0.840
	(2.156)		(2.143)		
Centralized governance in mono-regions (Y/N)	3.974		-		0.031
	(4.598)		-		
EU budget per capita (1,000 EUR)	-1.518		-1.053		0.527
	(2.295)		(2.24)		
Share big projects (> 50 M. EUR) - %	-0.242	***	-0.252	***	7.383
	(0.049)		(0.044)		
Change in EU budget - %	-1.820	***	-1.825	***	0.284
	(0.443)		(0.457)		
Concentration index (budget by TO)	0.318	***	0.305	***	19.504
	(0.089)		(0.093)		
Share pop. with tertiary education (2013-15) - %	0.238		0.294	***	15.544
	(0.219)		(0.212)		
Unemployment rate (2013-15) - %	-0.439	**	-0.486	***	7.881
	(0.185)		(0.171)		
Investment growth (2013-15) - %	-0.279	**	-0.271	**	1.439
	(0.133)		(0.133)		
GDP negative effect of Covid-19 (Y/N)	5.666	***	5.657	***	0.963
	(1.694)		(1.665)		
Observations	162		162		
Log pseudolikelihood	-596.33		-596.59		
Joint significance test (p-value)	0.0000		0.0000		
Pseudo R2	0.0538		0.0533		
Ramsey test (p-value)	0.3997		0.3522		
mean VIF	1.74		1.67		
max VIF	2.45		2.37		

Source: Own elaboration.

Note: Number of observation = 162. Country-cluster robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Marginal effects calculated at the means of the independent variables as reported in column (3) above. The full results of the Tobit coefficient estimation with lower limit set at 11.2 (minimum observed value) and the upper limit set at 64.3 (maximum observed value) are reported in column (2) of Table E1 in Annex E. The reference category for governance model refers to centralized governance excluding mono-regions in column (1) and centralized governance in column (2).

The results in Table 4 show that per capita budget is not a statistically significant programme characteristic explaining the speed of absorption[7], as we initially expected, but the change in the programme budget and the share of funds allocated to big projects are both negatively correlated with the dependent variable. For instance, one percentage point increase in the share of big projects is associated with a decrease of 0.242 units in the speed of absorption of funds. Our findings indicate that it is not the budget *per se* that causes delays in the financial implementation of programmes but the changes that occur overtime in the volume of the budget, . Indeed, changes in the budget may lead to the need to re-plan priorities and allocate such additional budget, which may not be immediate and may cause delays in the absorption of funds. On the other hand, larger projects are more resource-intensive, both financially and in terms of human resources, and more complex to implement. They may therefore require additional time for proper allocation and mobilisation, leading to delays in the overall absorption process.

The thematic concentration of the fund is positively correlated with the speed of absorption, suggesting that the less dispersed the use of the funds in different areas, the faster is the financial implementation. This finding could also be linked to the fact that the funds are easier to manage when priorities are more concentrated.

With regards to the regional characteristics of the territories, all the variables are statistically significant, with the exception of the education level of the population. Territories with higher unemployment at the beginning of the programming period seem to have lower values of the speed of absorption, which is partly consistent with the findings of Kersan-Škabic and Tijanic (2017) for convergence regions. In the present study, the negative coefficient of the unemployment rate could be due to the fact that higher values of the **SAC** are essentially driven by measures to support to SMEs, as observed in Figure 3. As higher unemployment could be a *proxy* for the lack of entrepreneurship, this could justify that regions with higher unemployment are less capable of developing investment projects and consequently to use EU funds.

The level of investment growth at the beginning of the programming period is negatively correlated with the **SAC**. Given that cohesion policy funds are more concentrated in less developed regions, high initial investment levels in such regions could lead to a more saturated market, reducing the immediate need for additional investment and subsequent absorption of funds. Such findings, could be also related to the previous one and be associated with the lack of strong entrepreneurship in less developed regions.

Being negatively affected by Covid-19 between 2019 and 2020 seems to be positively associated with higher SAC values, which is probably due to the use of cohesion policy funds to mitigate the effect of the health crisis. Indeed, even if previous studies (see e.g. Incaltarau et al., 2020), have shown that periods of economic crisis are associated with negative effects on the absorption of funds, the different origin and nature of the policy responses to the Covid-19 pandemic may justify our findings.

[7] As robustness test, Table F1 in Appendix F reports the results of mono-variables regression estimation - column (1) to (6). Result in column (3) confirms that there is no significant relationship between the budget and the **SAC**.

Regional (decentralized) governance model has a negative effect on the speed of absorption and it decreases by 7.4 units the speed of absorption of funds in comparison with territories under a national (centralized) model - column (2) – or by 6.8 units in comparison with non-mono regions territories under a national (centralized) model - column (1) of Table 4. When looking at differences between centralized governance in mono-region and non-mono-region, we didn't find any statistical difference between these two groups (Table F2 in Appendix F).

As we have a particular interest in understanding whether the effect of territories (or programmes) characteristics on the speed of absorption depends on the governance model, we re-estimate equation (7) including non-factorial interaction terms. Results displayed on Table H1 in Appendix H show that budget per capita and share of big projects are only affecting negatively the speed of absorption under a decentralized governance model, which may be strongly related to the structural problems of the territories, as unemployment rate and investment growth. Indeed, these factors are also both negatively correlated to the speed of absorption in territories with a decentralized governance model. Conversely, unemployment rate is positively correlated with the speed of absorption in territories centrally managed. Such differences in terms of unemployment relationship with our dependent variable are aligned with the findings of Kersan-Škabic and Tijanic (2017), if we consider that territories under a decentralized governance model possess a distinct socio-economic profile characterized by factors indicative of regions in a different stage of development (lower GDP, higher unemployment and less educated population – Table G1 in Appendix G) compared to their counterpart under analysis. Furthermore, territories with a decentralized governance also attracted less competitive EU funds[8] than the territories with a centralised governance (Table G1 in Appendix G), which may also reflect the investment dynamics in these territories due to challenges in their innovation eco-system, capacity building and infrastructures.

On the other side, change in the EU budget planned and the thematic concentration of funds are both affecting the speed of absorption in a similar way in both governance models (column (3) and (4) in Table H1 in Appendix H), without statistical differences between the two coefficients.

4.2. Understanding the performance of different thematic area

Table I1 in Appendix I reports the results of the multinomial logit regression (equation 9) explaining the ranking displayed in the Figure 5 and Figure 7. The dependent variable is categorical and refers to the thematic area with highest **SAC**. The reference category corresponds to have the social thematic area with the highest **SAC**. Each column shows the results of the logit regression model comparing, for instance, innovation as the area with the highest SAC in contrast to social as the area with the highest **SAC** - column (1) in Table I1 in Appendix I. Looking at the results of the Wald tests for independent variables (Table 5),

[8] Namely the EU's Seventh Framework Programme for Research and Technological Development (FP7), which runs from 2007 to 2013.

we observe that both programmes and territories characteristics are relevant explaining the area with the highest **SAC**.

Table 5. Wald tests for independent variables, dependent variable: area with the highest **SAC** (reference category: social thematic area)

Variables	chi2 (1)	P>chi2 (2)	chi2 (3)	P>chi2 (4)
Decentralized governance (Y/N)	4.798	0.309	4.854	0.303
Centralized governance in mono-regions (Y/N)	-	-	121.1	0.000
EU budget per capita	14.77	0.005	14.40	0.006
Share big projects (> 50 M. EUR)	50.1	0.000	72.1	0.000
Change in EU budget	10.988	0.027	8.761	0.067
Concentration index (budget by TO)	12.36	0.015	14.298	0.006
Share pop. with tertiary education (2013-15)	14.315	0.006	11.776	0.019
Unemployment rate (2013-15)	7.041	0.134	6.104	0.192
Investment growth (2013-15)	5.11	0.276	8.262	0.082
GDP negative effect of Covid-19 (Y/N)	11.679	0.020	14.516	0.006

Source: Own elaboration

Note: Number of observation = 162. Results of Wald test considering as *H0: All coefficients associated with given variable(s) are 0*. Full results available in Table I1 in Appendix I.

In contrast to Table 4, which details the results of the Tobit model, the variable decentralized governance doesn't exhibit a significant effect on ranking the thematic area with the highest speed of absorption capacity. Furthermore results in Table I1 in Appendix I also revealed that the variables that emerge as influential in explaining each thematic area diverge. For instance, both budget per capita and the share of large projects influence negatively the likelihood of 'Innovation' or 'Green' being identified as the thematic areas with the highest **SAC** in comparison to the reference category 'Social'. This suggests that territories with higher budget per capita and a greater share of large projects in thematic areas 'Innovation' or 'Green' are less likely to be associated to have this thematic area ('Innovation' or 'Green') as areas with the highest **SAC**, comparing the 'Social' area. Inversely it is also implies that having 'Social' as area with the highest **SAC**, compared to 'Innovation' or 'Green' is associated with higher budget and share of big projects. Indeed, compared to 'Innovation' or 'Green' thematic areas, the share of big projects and the budget per capita is higher for investment in 'Social' area (Table D1 in Appendix D).

Similarly, the concentration of planned budget and the change in the budget in thematic area 'Infrastructure' has a negative impact on the probability of the thematic area 'Infrastructure' being identified as the area with the highest **SAC**. This implies that territories with a concentrated budget allocation in specific thematic areas and a positive change in the budget are less likely to have 'Infrastructure' as area with the highest of the speed of absorption capacity. Complementary, having 'Infrastructure' as the area with the highest **SAC**, comparing to 'Social', is also associated with a higher share of big projects and higher investment growth. These results may reflect the characteristics of investment infrastructure compared to the social ones. For

instance, investment in infrastructure are by nature larger in size, and they tend to attract additional investment to the region (Khadaroo and Seetanah, 2008).

Being negatively impacted by Covid-19 is a significant variable exclusively in explaining the likelihood of 'SMEs' and 'Infrastructure' as areas with the highest **SAC**, in comparison with 'Social'. This finding is aligned with the reasoning that the Covid-19 pandemic challenges have driven governments the use of EU funds to support companies to survive and to support economic recovery in the aftermath of a crisis.

In essence, the multinomial logit regression analysis provides a comprehensive view of the complex relationships between different explanatory variables and their influence on the thematic areas with the highest **SAC**, enriching the understanding of the dynamics at play in the absorption of EU funds.

5. Conclusion

The EU's long-term budget for 2021-2027 and the NextGenerationEU instrument consist of an unprecedented budget of around 2 trillion euros. Concerns have been raised about the ability of EU territories to absorb such an amount of funds (see e.g. Codogno and Van den Noord, 2022). The present paper aims to provide an in-depth analysis of the absorption capacity of EU territories for the 2014-2020 cohesion policy funds. Such an analysis is crucial for informing the design and implementation of current instruments under the 2021-2027 period as well as future instruments in such a way to ensure a timely and smooth absorption. The constructed indicator allows to measure not only the financial execution but also its performance over time, and it shows a strong heterogeneity between and within EU Member States. For example, Spain, Slovakia, Romania and Italy are the countries with the lowest speed of absorption capacity, while the Netherlands and Lithuania have the highest values. Italy and Spain are among the top 3 beneficiaries of NGEU and cohesion policy funds for 2021-2027. NGEU funding is around three times higher than cohesion policy funding. As both countries are among the worst performers in terms of financial execution of 2014-2020 cohesion policy funds, the present analysis shows that it is crucial to better understand the main drivers favouring the financial execution of the EU budget. Moreover, as our results show that a budget increase negatively correlates with absorption, it is possible that, by extension, NGEU, even if it represents a separate instrument, affects the spending rate of cohesion policy. This aspect could be explored in future empirical studies.

One key takeaway from the analysis is the role of programme and territorial characteristics in influencing absorption capacity. The governance model of EU programmes is an important factor in explaining the capacity of the territory to absorb the funds. Territories with a decentralized (regional) governance model are associated with lower values of the speed of absorption of EU funds. Although this finding suggests that a centralised, national approach increases the speed of absorption capacity, it may be related to the specific characteristics of the territories or the programmes managed centrally or regionally. For instance, territories with a decentralized governance model have on average a lower share of population with higher education and, higher unemployment which in turn may affect the capacity to develop projects. This also

shown by their less good performance in attracting competitive funds such as the EU's Framework Programme for Research and Technological Development (Table G1 in Appendix G). However, in terms of the characteristics of the programmes managed in these territories, they have a smaller planned budget and a smaller share of large projects than in territories with a national (centralized) model (Table G1 in Appendix G). It can therefore be concluded that it is the characteristics of territories rather than the characteristics of programmes that determine the difference in the absorption speed of the two different governance models.

Other programme characteristics, such as the increase in the budget allocation, share of big projects and the thematic concentration of funds are also robust explanatory variables. Increasing the budget allocation influences negatively the absorption capacity. While a larger budget implies a greater financial commitment for achieving expected targets, it is equally important to ensure that the funds are absorbed in a timely and effective manner. This finding calls for a trade-off between political ambition and the feasibility of budget implementation. In addition, thematic concentration of funds is a feature that is positively correlated with absorption capacity, suggesting that focusing on a smaller number of intervention areas, by allowing a more targeted approach, facilitates faster absorption of funds. One policy implication is that thematic concentration requirements should not be diluted in the future. The higher share of big projects may influence implementation timelines, because it may programs achievement may slower due to the nature and characteristics of this project.

The level of unemployment and investment growth at the beginning of the programming period are negatively correlated with the absorption of EU funds, highlighting the importance of entrepreneurial capacity and dynamism in shaping a region's ability to effectively use the financial resources allocated. Regions with higher unemployment rates may also face additional challenges in absorbing EU funds due to economic instability.

The value of the absorption capacity attributed to investments targeting SMEs is much higher than in the other areas, which may be partially explained by the massive use of cohesion policy funds to support enterprises during the Covid-19 pandemic. Conversely, the thematic area linked to the green transition has the lowest value. This last finding is particularly relevant in the current context, when considering that estimated climate expenditure amounts to about 40% of the overall estimated costs included in the recovery and resilience plans financed by the NGEU. Among the determinants explaining the thematic areas with the highest **SAC**, programme characteristics seem on average to be more relevant than territorial characteristics, although each thematic area is explained by a specific combination of variables, without similar patterns.

The disparities observed in the absorption capacity of cohesion policy funds for 2014-2020 highlight the importance of tailoring strategies to the specific characteristics of each EU territory. Understanding the factors that contribute to heterogeneity is crucial for developing targeted interventions that address the causes of slow absorption. Differences in the performance of EU territories highlight the need for nuanced

approaches that take into account the specific challenges faced by different Member States. It may be also useful to reassess, to some extent, the current one-size-fits-all approach to spending rules (**Dicharry, 2023**). Our model cannot capture all factors influencing the absorption capacity, some of which may require more qualitative analysis. For instance, the effects of gold-plating cannot be accounted for by the model. It is important to recognise that a one-size-fits-all strategy may not be effective in maximising the impact of the upcoming budget and recovery instrument. By drawing on the lessons learned from the analysis of the 2014-2020 cohesion policy funds, the EU can pave the way for a more efficient and impactful use of the unprecedented financial resources at its disposal.

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Appendix

Appendix A. Some studies about EU funds absorption capacity

Table A1. Some studies about EU funds absorption capacity: scope, indicator structure, model and main findings

Scope	Absorption indicator	Model and variables	Findings
Tosun (2014)			
· 2000-2006 · EU25 country data · ERDF	· ERDF payments as % of total allocation by the end of 2008	· Cross-sectional data · Tobit model *Explanatory variables:* · Government effectiveness (Worldwide Governance Indicators – World Bank) · Political decentralization (regional authority index) · Sub-national share of total government expenditure · Sub-national share of total government revenue · GDP per capita (constant price, PPP) · % change in GDP 2007/2008 · Member States entered in 2004 (dummy) · Absorption capacity in 2004 · Absorption capacity in 2007	· Government effectiveness/Capacity: (+) · GDP per capita: (-) · EU10: (+) · Absorption capacity 2007: (+) · Government revenue: (-) · Government expense: (-)
Kersan-Škabić and Tijanić (2017)			
· 2000-2006 + 2007-2013 · 272 Nuts 2 regions · ERDF, ESF and CF (sum)	· Payment per capita · Paid/committed	· Dynamic panel model (GMM) · Two estimations done separately: developed regions and convergence regions *Explanatory variables:* · Region size (km²) · Infrastructure (motorways in km per 1000 km²) · Labour force characteristics (unemployment rate and share of employment with at least upper secondary education) · Gross fixed capital formation · European Quality of Governance · Control of corruption index · Programming period (dummy) · Institutions and fiscal decentralization (dummy)	*Model developed regions*: · Education: (+) Paid/committed; (-) Payment per capita · GFCF: (+) both · Unemployment: (+) both · Fiscal decentralization: (+) Paid/committed *Model convergence regions*: · Infrastructure: (+) both · Education: (+) both · Fiscal decentralization: (+) both

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Table A1. Some studies about EU funds absorption capacity: scope, indicator structure, model and main findings (Continuation)

Scope	Absorption indicator	Model and variables	Findings
Incaltarau et al. (2020)			
· 2007-2015 (2013+2) · EU27 country data · ERDF, ESF and CF (sum)	· Payment/(gross fixed capital formation by general government) · Annual indicator expressed in cumulative term	· Dynamic panel model · Tobit model (*xttobit*) *Explanatory variables:* · Macroeconomic absorption capacity (total amounts allocated to GDP before the start of the programming period) · GDP per capita · Political decentralization (regional authority index) · Economic crisis (dummy) · New Member States (dummy) · Government effectiveness	· Macroeconomic capacity: (+) · Economic crisis: (-) · New Member States: (-) · Government effectiveness: (+)
Achim & Borlea (2020)			
· 2007-2015 (2013+2) · EU27 country data · ERDF, ESF and CF (sum)	· Paid amounts/decided amounts	· Dynamic panel model · Tobit model (*xttobit*) *Explanatory variables:* · Voice and Accountability · Political Stability and Absence of Violence · Government Effectiveness · Regulatory Quality · Rule of Law · Control of Corruption · (Worldwide Governance Indicators – World Bank) · GDP	· Voice and Accountability: (+) · Government Effectiveness: (+) · Regulatory Quality: (+) · Government effectiveness: (+) · Rule of Law (+) · Control of Corruption (+)

Source: Authors' own elaboration based on cited papers.

Appendix B. An illustrative example of the Speed of the Absorption Capacity

Table B1. Description of four fictional regions

	Year 2018	Year 2019	Year 2020	Year 2021	Year 2022
EU planned amount for the period 2014-2020 (P)					
Region A, B, C and D	10	10	10	10	10
Accumulated EU amount of expenditure/spending reported by the selected projects (S)					
Region A	1	2	5	7	10
Region B	2	3	6	8	10
Region C	0	1	1	10	10
Region D	2	3	6	6	6
Average annual absorption rate (AAR)					
Region A	0.1	0.2	0.5	0.7	1.0
Region B	0.2	0.3	0.6	0.8	1.0
Region C	0.0	0.1	0.1	1.0	1.0
Region D	0.2	0.3	0.6	0.6	0.6

Table B2. Stepwise estimation of the speed of absorption of EU funds

	Average performance (mean AAR)		Level of achievement in the last year (2022)		Speed of absorption (SAC)	
	Value	Ranking	Value	Ranking	Value	Ranking
Region A	0.50	2	1.0	1	50	2
Region B	0.58	1	1.0	1	58	1
Region C	0.44	4	1.0	1	44	3
Region D	0.46	3	0.6	2	28	4

Note: estimation of SAEF based on equation 1.

Appendix C. List of territories included in the analysis

Table C1. List of territories included in the analysis

Country	Nuts code	Nuts name
AT	AT	Austria (Österreich)
BE	BE1	Région de Bruxelles-Capitale/Brussels Hoofdstedelijk Gewest
BE	BE2	Vlaams Gewest
BE	BE3	Région wallonne
BG	BG	Bulgaria (България)
CY	CY	Cyprus (Κύπρος)
CZ	CZ	Czech Republic (Česko)
DE	DE	Germany (Deutschland)
DE	DE1	Baden-Württemberg
DE	DE2	Bayern
DE	DE3	Berlin
DE	DE4	Brandenburg
DE	DE5	Bremen
DE	DE6	Hamburg
DE	DE7	Hessen
DE	DE8	Mecklenburg-Vorpommern
DE	DE9	Niedersachsen
DE	DEA	Nordrhein-Westfalen
DE	DEB	Rheinland-Pfalz
DE	DEC	Saarland
DE	DED	Sachsen
DE	DEE	Sachsen-Anhalt
DE	DEF	Schleswig-Holstein
DE	DEG	Thüringen
DK	DK	Denmark (Danmark)
EE	EE	Estonia (Eesti)
EL	EL	Greece (Ελλάδα)
EL	EL30	Attica (Αττική)
EL	EL41	North Aegean (Βόρειο Αιγαίο)
EL	EL42	South Aegean (Νότιο Αιγαίο)
EL	EL43	Crete (Κρήτη)
EL	EL51	Eastern Macedonia and Thrace (Ανατολική Μακεδονία, Θράκη)
EL	EL52	Central Macedonia (Κεντρική Μακεδονία)
EL	EL53	Western Macedonia (Δυτική Μακεδονία)
EL	EL54	Epirus (Ήπειρος)
EL	EL61	Thessaly (Θεσσαλία)
EL	EL62	Ionian Islands (Ιόνια Νησιά)

Continued in the next page…

Table C1. List of territories included in the analysis (continuation)

Country	Nuts code	Nuts name
EL	EL63	Western Greece (Δυτική Ελλάδα)
EL	EL65	Peloponnese (Πελοπόννησος)
ES	ES	Spain (España)
ES	ES11	Galicia
ES	ES12	Principado de Asturias
ES	ES13	Cantabria
ES	ES21	País Vasco
ES	ES22	Comunidad Foral de Navarra
ES	ES23	La Rioja
ES	ES24	Aragón
ES	ES30	Comunidad de Madrid
ES	ES41	Castilla y León
ES	ES42	Castilla-La Mancha
ES	ES43	Extremadura
ES	ES51	Cataluña
ES	ES52	Comunitat Valenciana
ES	ES53	Illes Balears
ES	ES61	Andalucía
ES	ES62	Región de Murcia
ES	ES63	Ciudad de Ceuta
ES	ES64	Ciudad de Melilla
ES	ES70	Canarias
FI	FI	Finland (Suomi/Finland)
FI	FI20	Åland
FR	FR	France
FR	FR10	Ile-de-France
FR	FRB0	Centre — Val de Loire
FR	FRC1	Bourgogne
FR	FRC2	Franche-Comté
FR	FRD1	Basse-Normandie
FR	FRD2	Haute-Normandie
FR	FRE1	Nord-Pas de Calais
FR	FRE2	Picardie
FR	FRF1	Alsace
FR	FRF2	Champagne-Ardenne
FR	FRF3	Lorraine
FR	FRG0	Pays de la Loire
FR	FRH0	Bretagne

Continued in the next page…

Table C1. List of territories included in the analysis (continuation)

Country	Nuts code	Nuts name
FR	FRI1	Aquitaine
FR	FRI2	Limousin
FR	FRI3	Poitou-Charentes
FR	FRJ1	Languedoc-Roussillon
FR	FRJ2	Midi-Pyrénées
FR	FRK1	Auvergne
FR	FRK2	Rhône-Alpes
FR	FRL0	Provence-Alpes-Côte d'Azur
FR	FRM0	Corse
FR	FRY1	Guadeloupe
FR	FRY2	Martinique
FR	FRY3	Guyane
FR	FRY4	La Réunion
FR	FRY5	Mayotte
HR	HR	Croatia (Hrvatska)
HU	HU	Hungary (Magyarország)
HU	HU1	Central Hungary (Közép-Magyarország)
IE	IE	Ireland (Éire/Ireland)
IE	IE01	Border, Midland and Western
IE	IE02	Southern and Eastern
IT	IT	Italy (Italia)
IT	ITC1	Piemonte
IT	ITC2	Valle d'Aosta/Vallée d'Aoste
IT	ITC3	Liguria
IT	ITC4	Lombardia
IT	ITF1	Abruzzo
IT	ITF2	Molise
IT	ITF3	Campania
IT	ITF4	Puglia
IT	ITF5	Basilicata
IT	ITF6	Calabria
IT	ITG1	Sicilia
IT	ITG2	Sardegna
IT	ITH1	Provincia Autonoma di Bolzano/Bozen
IT	ITH2	Provincia Autonoma di Trento
IT	ITH3	Veneto
IT	ITH4	Friuli-Venezia Giulia
IT	ITH5	Emilia-Romagna

Continued in the next page…

Table C1. List of territories included in the analysis (continuation)

Country	Nuts code	Nuts name
IT	ITI1	Toscana
IT	ITI2	Umbria
IT	ITI3	Marche
IT	ITI4	Lazio
LT	LT	Lithuania (Lietuva)
LU	LU	Luxembourg
LV	LV	Latvia (Latvija)
MT	MT	Malta
NL	NL	Netherlands (Nederland)
NL	NL1	Noord-Nederland
NL	NL2	Oost-Nederland
NL	NL3	West-Nederland
NL	NL4	Zuid-Nederland
PL	PL	Poland (Polska)
PL	PL21	Małopolskie
PL	PL22	Śląskie
PL	PL41	Wielkopolskie
PL	PL42	Zachodniopomorskie
PL	PL43	Lubuskie
PL	PL51	Dolnośląskie
PL	PL52	Opolskie
PL	PL61	Kujawsko-pomorskie
PL	PL62	Warmińsko-mazurskie
PL	PL63	Pomorskie
PL	PL71	Łódzkie
PL	PL72	Świętokrzyskie
PL	PL81	Lubelskie
PL	PL82	Podkarpackie
PL	PL84	Podlaskie
PL	PL9	Makroregion województwo mazowieckie
PT	PT	Portugal
PT	PT11	Norte
PT	PT15	Algarve
PT	PT16	Centro (PT)
PT	PT17	Área Metropolitana de Lisboa
PT	PT18	Alentejo
PT	PT20	Região Autónoma dos Açores
PT	PT30	Região Autónoma da Madeira

Continued in the next page…

Table C1. List of territories included in the analysis (continuation)

Country	Nuts code	Nuts name
RO	RO	Romania (România)
SE	SE	Sweden (Sverige)
SE	SE11	Stockholm (Stockholm)
SE	SE12	East Middle Sweden (Östra Mellansverige)
SE	SE21	Småland and the islands (Småland med öarna)
SE	SE22	South Sweden (Sydsverige)
SE	SE23	West Sweden (Västsverige)
SE	SE31	North Middle Sweden (Norra Mellansverige)
SE	SE32	Middle Norrland (Mellersta Norrland)
SE	SE33	Upper Norrland (Övre Norrland)
SI	SI	Slovenia (Slovenija)
SK	SK	Slovakia (Slovensko)

Appendix D. Descriptive Statistics and multi-collinearity diagnostics

Table D1. Descriptive statistics: Mean, Standard deviation, Minimum and Maximum

Variable	Obs	Mean	Std. dev.	Min	Max
Speed of absorption capacity (SAC)	163	35.01	12.01	11.25	64.30
Decentralized governance (Y/N)	163	0.840	0.367	0	1
Centralized governance excluding mono-regions (Y/N)	163	0.129	0.336	0	1
Centralized governance in mono-regions (Y/N)	163	0.031	0.173	0	1
EU budget per capita (1,000 EUR)	163	0.55	0.64	0.02	4.42
Share big projects (> 50 M) - %	163	7.37	11.39	0.00	43.26
Change in EU budget - %	163	0.28	1.36	-1.80	8.18
Concentration index (budget by TO)	163	19.49	9.57	11.02	67.16
Share pop. with tertiary education (2013-15) - %	163	15.50	4.68	5.04	28.06
Unemployment rate (2013-15) - %	163	7.89	4.27	2.04	21.50
Investment growth (2013-15) - %	163	1.39	5.90	-12.53	22.24
GDP negative effect of Covid-19 (Y/N)	163	0.96	0.19	0	1
Northern territories (Y/N)	163	0.11	0.31	0	1
Southern territories (Y/N)	163	0.41	0.49	0	1
Eastern territories (Y/N)	163	0.14	0.35	0	1
EU budget per capita (1,000 EUR) - in primary area	163	0.10	0.13	0.00	1.15
EU budget per capita (1,000 EUR) - in secondary area	158	0.14	0.22	0.00	2.13
Share big projects (> 50 M) - in primary area	163	9.86	18.74	0.00	82.64
Share big projects (> 50 M) - in secondary area	158	5.86	14.12	0.00	87.94
Change in EU budget - in primary area	163	2.80	8.89	-23.34	47.50
Change in EU budget - in secondary area	158	0.18	5.58	-15.24	34.59
Concentration index (budget by TO) - in primary area	163	9.59	19.34	0.02	100
Concentration index (budget by TO) - in secondary area	158	8.03	8.00	0.00	39.21
EU budget per capita (1,000 EUR) - 'Innovation' area	155	0.07	0.10	0.00	0.99
EU budget per capita (1,000 EUR) - 'SMEs' area	150	0.08	0.12	0.00	1.15
EU budget per capita (1,000 EUR) - 'Green' area	157	0.15	0.17	0.00	0.80
EU budget per capita (1,000 EUR) - 'Infrastructure' area	124	0.11	0.14	0.00	0.79
EU budget per capita (1,000 EUR) - 'Social' area	150	0.20	0.24	0.00	2.13
Share big projects (> 50 M) - 'Innovation' area - %	163	1.66	5.42	0.00	32.58
Share big projects (> 50 M) - 'SMEs' area - %	163	9.94	18.86	0.00	82.64
Share big projects (> 50 M) - 'Green' area - %	163	4.08	10.81	0.00	58.56
Share big projects (> 50 M) - 'Infrastructure' area - %	163	7.80	19.70	0.00	87.94
Share big projects (> 50 M) - 'Social' area - %	163	6.08	13.37	0.00	97.31
Change in EU budget - 'Innovation' area - %	155	0.82	8.00	-19.72	45.49
Change in EU budget - 'SMEs' area - %	150	4.75	10.61	-25.54	47.50
Change in EU budget - 'Green' area - %	157	-1.34	3.57	-12.88	18.19
Change in EU budget - 'Infrastructure' area - %	124	-2.34	6.18	-23.34	31.62
Change in EU budget - 'Social' area - %	150	0.76	1.60	-4.13	6.45
Concentration of budget in 'Innovation' area - %	155	5.33	9.14	0.02	63
Concentration of budget in 'SMEs' area - %	150	3.02	3.85	0.01	27
Concentration of budget in 'Green' area - %	157	6.36	4.73	0.29	28
Concentration of budget in 'Infrastructure' area - %	124	2.80	3.44	0.00	24
Concentration of budget in 'Social' area - %	150	16.83	18.19	0.32	100

Source: Own elaboration.

Table D2. Correlation matrix and variance inflation factor (VIF)

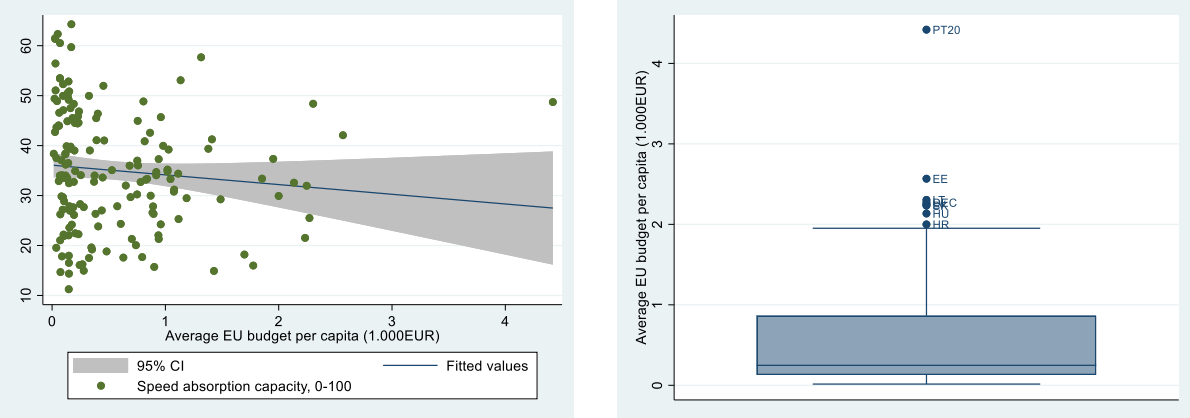
Variables		VIF	Correlation matrix												
			#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13
#1	Decentralized governance (Y/N)	1.67	1												
#2	Centralized governance in mono-regions (Y/N)	1.51	-0.41	1											
#3	EU budget per capita (1,000 EUR)	1.82	-0.30	0.24	1										
#4	Share big projects (> 50 M EUR)	1.43	-0.33	-0.01	0.20	1									
#5	Change in EU budget	1.17	-0.10	-0.03	-0.10	0.13	1								
#6	Concentration index (budget by TO)	1.65	-0.04	-0.08	-0.35	-0.18	0.06	1							
#7	Share pop. with tertiary education (2013-15)	1.83	-0.15	0.19	-0.33	-0.02	0.15	0.36	1						
#8	Unemployment rate (2013-15)	2.14	0.13	-0.09	0.10	0.19	0.18	-0.16	0.05	1					
#9	Investment growth (2013-15)	1.46	-0.10	0.07	0.01	-0.14	0.08	0.28	0.18	-0.05	1				
#10	GDP negative effect of Covid-19 (Y/N)	1.33	0.00	0.03	0.01	0.11	-0.24	-0.16	-0.07	-0.04	-0.38	1			
#11	Northern territories (Y/N)	1.46	-0.22	0.16	-0.03	-0.14	0.08	0.32	0.34	-0.13	0.22	-0.24	1		
#12	Southern territories (Y/N)	2.38	0.09	0.00	0.04	0.24	0.06	-0.28	-0.26	0.60	-0.24	0.16	-0.29	1	
#13	Eastern territories (Y/N)	1.81	-0.11	-0.07	0.30	0.15	0.00	-0.24	-0.07	-0.24	0.25	-0.11	-0.14	-0.34	1
	Mean VIF	1.67													

Source: Own elaboration.

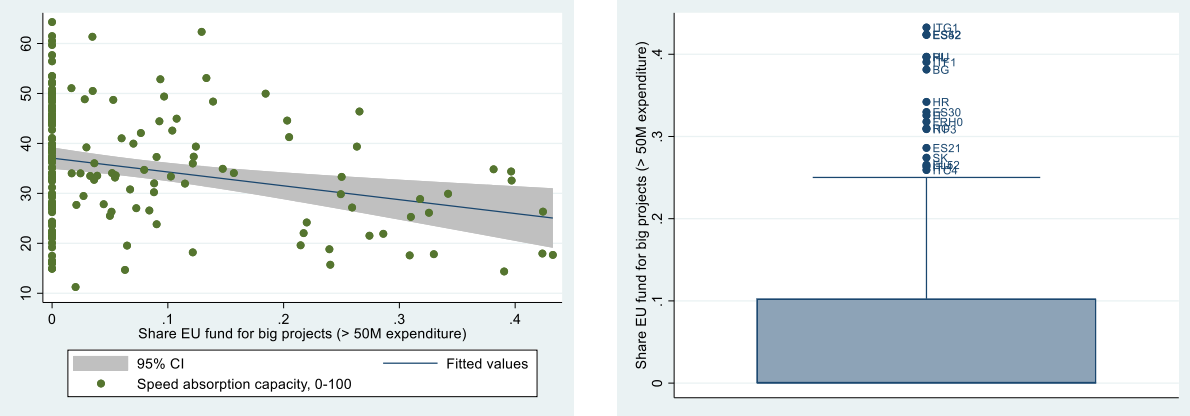
Appendix E. Checking for outliers

Figure E1. Two-way scatterplot between **SAF** and dependent variable (graphs in the left) and graph box plots (graphs in the right)

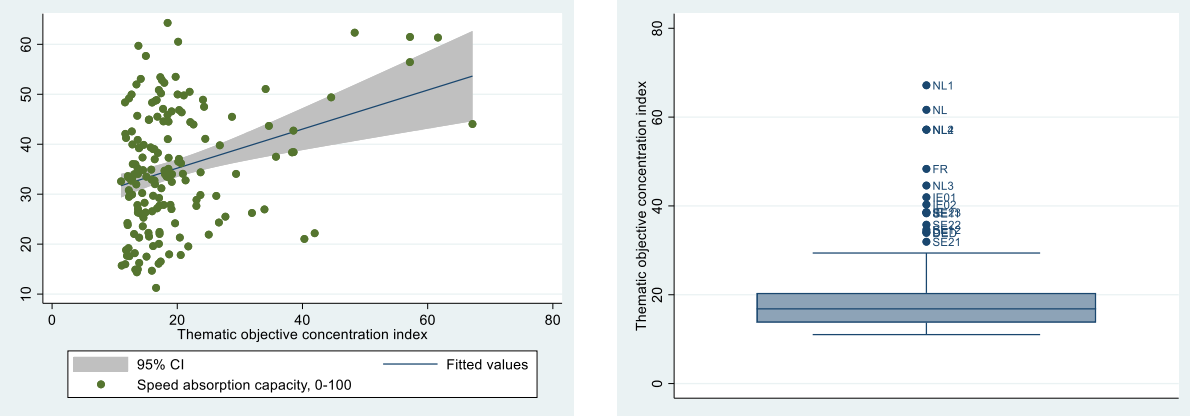
(A) Planned EU budget per capita (1,000 EUR)



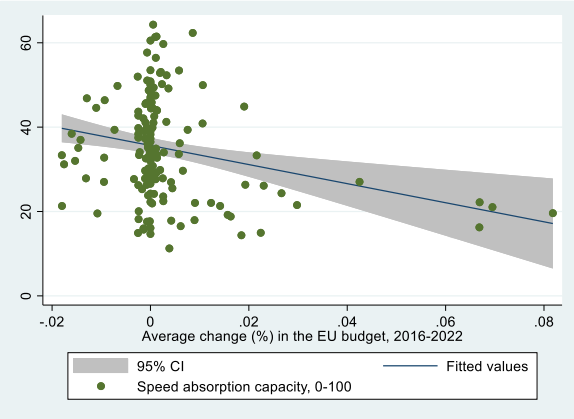
(B) Share EU fund for big projects (> 50 Million EUR of expenditures)

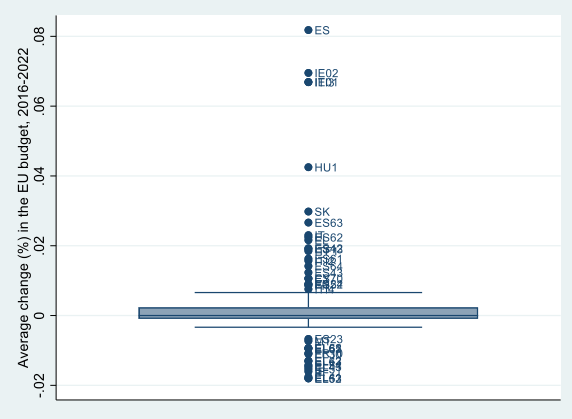


(C) Thematic objective concentration index

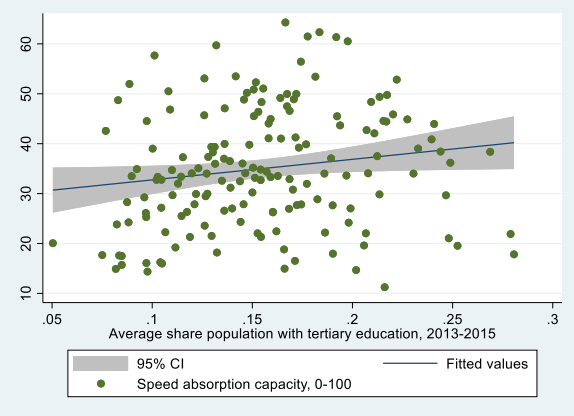


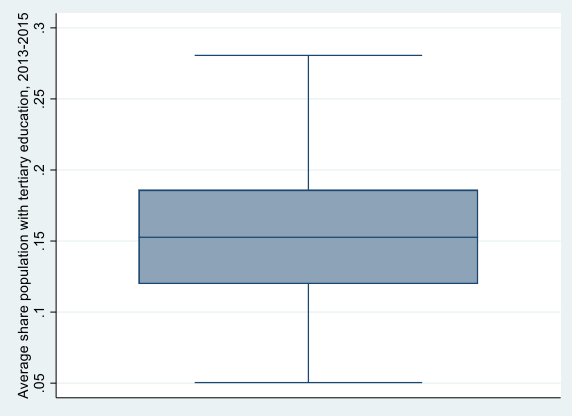
(D) Average change (%) in the EU budget



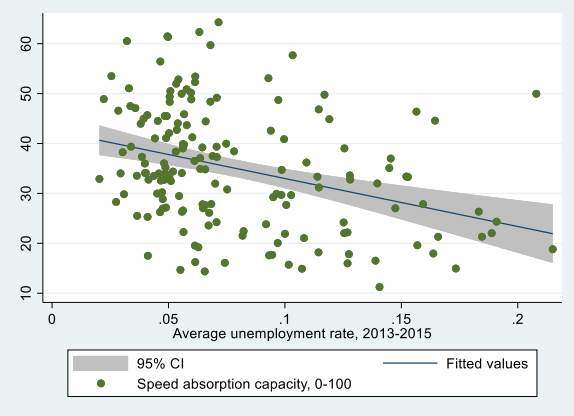


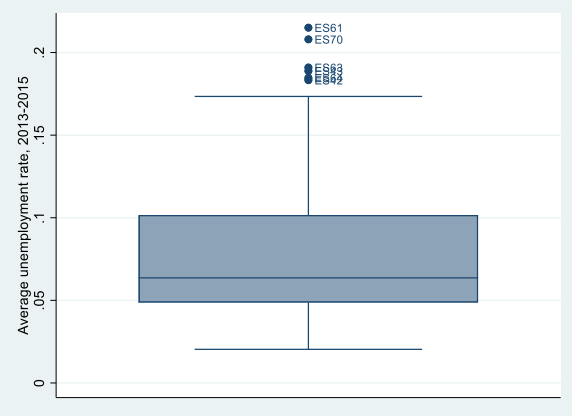
(E) Share of population with tertiary education, average 2013-2015



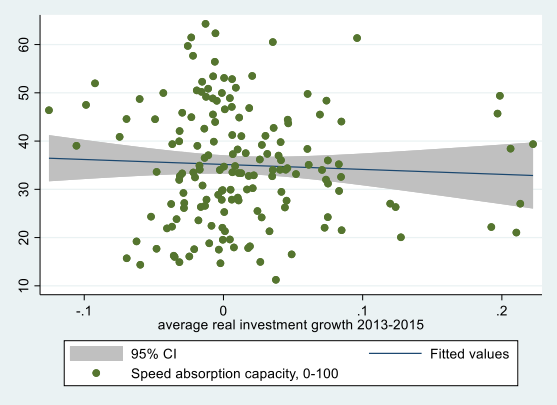


(F) Unemployment rate, average 2013-2015





(G) Real investment growth, average 2013-2015



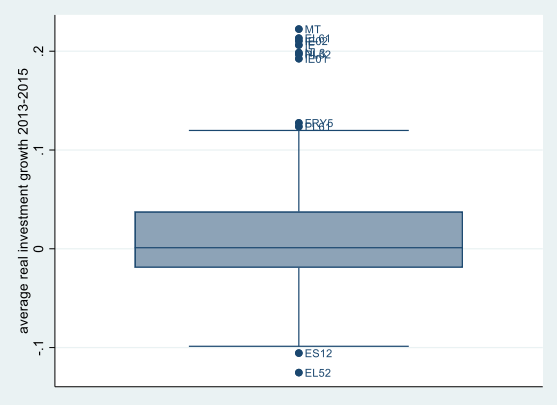


Table E1. Tobit model with and without outlier, dependent variable: Speed of absorption (SAC)

Variables	With outlier (1)	Without outlier (2)
Decentralized governance (Y/N)	-5.926***	-6.835***
	(1.825)	(2.166)
Centralized governance in mono-regions (Y/N)	2.245	3.979
	(4.502)	(4.602)
EU budget per capita (1,000 EUR)	0.637	-1.521
	(2.353)	(2.303)
Share big projects (> 50 Million EUR)	-0.255***	-0.242***
	(0.0521)	(0.0497)
Change in EU budget	-1.725***	-1.824***
	(0.462)	(0.441)
Concentration index (budget by TO)	0.351***	0.318***
	(0.0873)	(0.0897)
Share pop. with tertiary education (2013-15)	0.323	0.238
	(0.234)	(0.220)
Unemployment rate (2013-15)	-0.549**	-0.440**
	(0.217)	(0.186)
Investment growth (2013-15)	-0.310**	-0.280**
	(0.136)	(0.133)
GDP negative effect of Covid-19 (Y/N)	5.345***	5.701***
	(1.793)	(1.731)
Geographical group and constant	Yes	Yes
Variance of the error term	96.05***	94.83***
	(21.38)	(20.68)
Observations	163	162
Log pseudolikelihood	-601.06	-596.33
Joint significance test (p-value)	0.0000	0.0000
Pseudo R2	0.0524	0.0538
Ramsey test (p-value)	0.2919	0.3997
mean VIF	1.67	1.74
max VIF	2.38	2.45

Source: Own elaboration.

Note: Country-cluster robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Appendix F. Sensitive Analysis

Table F1. Results of Pooled OLS, dependent variable: Speed of absorption capacity (SAC)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Decentralized governance (Y/N)	-4.049**	-	-	-	-	-	-6.848***
	(1.608)	-	-	-	-	-	(2.265)
Centralized governance in mono-regions (Y/N)	-	8.258***	-	-	-	-	3.902
	-	(2.289)	-	-	-	-	(4.788)
EU budget per capita (1,000 EUR)	-	-	-3.533	-	-	-	-1.529
	-	-	(2.623)	-	-	-	(2.400)
Share big projects (> 50 Million EUR) - %	-	-	-	-0.276***	-	-	-0.244***
	-	-	-	(0.0679)	-	-	(0.0514)
Change in EU budget - %	-	-	-	-	-2.247***	-	-1.828***
	-	-	-	-	(0.560)	-	(0.458)
Concentration index (budget by TO)	-	-	-	-	-	0.394***	0.316***
	-	-	-	-	-	(0.107)	(0.0938)
Share pop. with tertiary education (2013-15) - %	-	-	-	-	-	-	0.248
	-	-	-	-	-	-	(0.224)
Unemployment rate (2013-15) - %	-	-	-	-	-	-	-0.437**
	-	-	-	-	-	-	(0.193)
Investment growth (2013-15) - %	-	-	-	-	-	-	-0.277*
	-	-	-	-	-	-	(0.138)
GDP negative effect of Covid-19 (Y/N)	-	-	-	-	-	-	5.728***
	-	-	-	-	-	-	(1.796)
Geographical group	No	No	No	No	No	No	Yes
Constant	38.33***	34.67***	36.79***	36.97***	35.57***	27.25***	33.26***
	(2.123)	(1.793)	(2.792)	(1.520)	(1.476)	(2.574)	(5.063)
Observations	162	162	162	162	162	162	162
R-squared	0.015	0.014	0.028	0.069	0.065	0.099	0.344

Source: Own elaboration.

Note: Country-cluster robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Continued on next page...

Table F1. Results of Pooled OLS, dependent variable: Speed of absorption capacity (SAC) - Continuation

Variables	(8)	(9)	(10)	(11)	(12)
Decentralized governance (Y/N)	-3.965*	-6.222***	-5.770**	-8.058***	-7.746***
	(2.133)	(1.897)	(2.277)	(2.848)	(2.394)
Centralized governance in mono-regions (Y/N)	6.885	2.561	4.115	1.146	6.096
	(4.191)	(4.230)	(4.874)	(4.749)	(4.695)
EU budget per capita (1,000 EUR)	-2.187	-	-0.571	-2.895	-2.827
	(2.593)	-	(2.490)	(2.375)	(2.473)
Share big projects (> 50 Million EUR) - %	-	-0.251***	-0.266***	-0.248***	-0.250***
	-	(0.0507)	(0.0469)	(0.0535)	(0.0540)
Change in EU budget - %	-1.994***	-1.755***	-	-1.870***	-1.979***
	(0.462)	(0.491)	-	(0.529)	(0.373)
Concentration index (budget by TO)	0.322***	0.334***	0.323***	-	0.325***
	(0.0919)	(0.0866)	(0.0985)	-	(0.0927)
Share pop. with tertiary education (2013-15) - %	0.168	0.327	0.227	0.341	0.0927
	(0.251)	(0.240)	(0.211)	(0.242)	(0.168)
Unemployment rate (2013-15) - %	-0.473**	-0.517**	-0.559**	-0.477**	-
	(0.194)	(0.219)	(0.211)	(0.205)	-
Investment growth (2013-15) - %	-0.209*	-0.284*	-0.275**	-0.141	-0.296**
	(0.119)	(0.140)	(0.119)	(0.148)	(0.141)
GDP negative effect of Covid-19 (Y/N)	5.126***	5.562***	8.698***	5.322**	6.803***
	(1.789)	(1.707)	(1.344)	(2.222)	(2.144)
Geographical group	Yes	Yes	Yes	Yes	Yes
Constant	31.94***	31.18***	29.86***	41.12***	33.25***
	(5.626)	(4.208)	(5.731)	(4.601)	(4.960)
Observations	162	162	162	162	162
R-squared	0.307	0.342	0.307	0.306	0.333

Source: Own elaboration.

Note: Country-cluster robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Table F2. Tobit model with different reference category for the governance variable, dependent variable: Speed of absorption capacity (SAC)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Decentralized governance (Y/N)	-7.375***	-	-	-6.835***	-10.81**	-
	(2.153)	-	-	(2.166)	(4.780)	-
Centralized governance in mono-regions (Y/N)	-	7.770*	-	3.979	-	10.81**
	-	(4.199)	-	(4.602)	-	(4.780)
Centralized governance (Y/N)	-	-	5.620**	-	-3.979	6.835***
	-	-	(2.265)	-	(4.602)	(2.166)
Other variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	33.49***	24.86***	24.64***	33.39***	37.37***	26.56***
	(5.064)	(4.434)	(4.244)	(4.884)	(7.072)	(4.092)
Variance of the error term	95.12***	98.52***	97.12***	94.83***	94.83***	94.83***
	(20.69)	(22.02)	(21.26)	(20.68)	(20.68)	(20.68)
Observations	162	162	162	162	162	162
Log pseudolikelihood	-596.59	-599.39	-598.27	-596.33	-596.33	-596.33
Joint significance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0533	0.0489	0.0507	0.0538	0.0538	0.0538

Source: Own elaboration.

Note: Country-cluster robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Appendix G. Results differences of means: territories characteristics by governance model

Table G1. T-test for difference of means: territories characteristics by governance model

Variables	Observation		Mean		Difference		St Err
	Decentralized	Centralised	Decentralized	Centralised			
Budget (Million EUR)	136	26	767	8,182	-7,414	***	(1,899)
EU budget per capita (1,000 EUR)	136	26	437.9	992.0	-554.2	***	(174.7)
Share big projects (> 50 M. EUR) - %	136	26	5.72	16.09	-10.37	***	(2.775)
Concentration index (budget by TO)	136	26	19.33	20.43	-1.106		(2.532)
Change in EU budget - %	136	26	0.22	0.60	-0.377		(0.366)
Share pop. with tertiary education (2013-15) - %	136	26	15.25	17.08	-1.831	*	(0.928)
Unemployment rate (2013-15) - %	136	26	8.11	6.66	1.454	**	(0.729)
Investment growth (2013-15) - %	136	26	1.18	2.81	-1.628		(1.413)
EU funds under FP7 per capita - Log	136	26	3.25	4.03	-0.779	***	(0.225)
Gross Domestic Product - GDP (Million EUR, 2015)	136	26	77,967	453,786	-375,819	**	(144,419)

Source: Own elaboration.

Note: FP7 refers to the EU's Seventh Framework Programme for Research and Technological Development, which runs from 2007 to 2013. Data were extracted from European Commission's Horizon dashboard. Country-cluster robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Appendix H. Interaction terms of governance model with territories (or programmes) characteristics

Table H1. Results of Tobit model with interaction terms between governance variable and other explanatory variable, dependent variable: Speed of absorption capacity (SAC)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EU budget per capita (1,000 EUR)							
Decentralized governance (Y/N)	-4.096*	-	-	-	-	-	-
	(2.393)	-	-	-	-	-	-
Centralized governance (Y/N)	3.576**	-	-	-	-	-	-
	(1.526)	-	-	-	-	-	-
Share big projects (> 50 M. EUR)							
Decentralized governance (Y/N)	-	-0.288***	-	-	-	-	-
	-	(0.0528)	-	-	-	-	-
Centralized governance (Y/N)	-	0.0148	-	-	-	-	-
	-	(0.0833)	-	-	-	-	-
Change in EU budget							
Decentralized governance (Y/N)	-	-	-1.984***	-	-	-	-
	-	-	(0.565)	-	-	-	-
Centralized governance (Y/N)	-	-	-0.781**	-	-	-	-
	-	-	(0.320)	-	-	-	-
Concentration index (budget by TO)							
Decentralized governance (Y/N)	-	-	-	0.252**	-	-	-
	-	-	-	(0.111)	-	-	-
Centralized governance (Y/N)	-	-	-	0.499***	-	-	-
	-	-	-	(0.0906)	-	-	-
Share pop. with tertiary educ. (2013-15)							
Decentralized governance (Y/N)	-	-	-	-	0.259	-	-
	-	-	-	-	(0.210)	-	-
Centralized governance (Y/N)	-	-	-	-	0.644***	-	-
	-	-	-	-	(0.213)	-	-
Unemployment rate (2013-15)							
Decentralized governance (Y/N)	-	-	-	-	-	-0.548***	-
	-	-	-	-	-	(0.179)	-
Centralized governance (Y/N)	-	-	-	-	-	0.483*	-
	-	-	-	-	-	(0.246)	-
Investment growth (2013-15)							
Decentralized governance (Y/N)	-	-	-	-	-	-	-0.329**
	-	-	-	-	-	-	(0.136)
Centralized governance (Y/N)	-	-	-	-	-	-	0.0165
	-	-	-	-	-	-	(0.150)
Other variables and constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	162	162	162	162	162	162	162
Log pseudolikelihood	-595.96	-596.82	-598.94	-596.85	-596.86	-595.52	-599.02
Joint significance test (p-value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.0544	0.0530	0.0496	0.0529	0.0529	0.0550	0.0495
Wald test (p-value)							
H0: Coeff. in interaction term are equal	0.021	0.195	0.777	0.636	0.392	0.013	0.638

Source: Own elaboration.

Note: Country-cluster robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1.

Appendix I. Results Multinomial logistic regression

Table I1. Results of multinomial logit regression model, dependent variable: thematic area with the highest **SAC** (reference category social thematic area)

Variables	(A)				(B)			
	Innovation	SMEs	Green	Infrastructure	Innovation	SMEs	Green	Infrastructure
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Decentralized governance (Y/N)	-2.185	1.791*	0.499	-0.664	-4.440	1.295	-0.131	-2.956
	(2.813)	(0.972)	(1.481)	(1.757)	(5.318)	(1.101)	(1.583)	(2.233)
Centralized governance in mono-regions (Y/N)	-	-	-	-	-26.47***	-0.899	-19.21***	-30.54***
	-	-	-	-	(5.805)	(1.732)	(2.754)	(3.880)
EU budget per capita (1,000 EUR)	-69.54*	0.691	-29.60***	-7.746	-63.08*	1.065	-28.48***	-9.722
	(35.82)	(3.436)	(10.07)	(6.808)	(35.57)	(3.539)	(9.612)	(6.550)
Share big projects (> 50 Million EUR)	-9.098***	0.0282	-5.935***	0.125***	-11.14***	0.0269	-7.706***	0.123***
	(2.396)	(0.0188)	(1.081)	(0.0386)	(3.223)	(0.0186)	(1.065)	(0.0383)
Change in EU budget	0.0113	0.0308	-0.0203	-0.365***	0.000509	0.0258	-0.0282	-0.408***
	(0.0929)	(0.0316)	(0.0598)	(0.122)	(0.122)	(0.0288)	(0.0605)	(0.149)
Concentration index (share budget in area j)	0.0765	-0.455***	0.0274	-0.398**	0.0771	-0.458***	0.0249	-0.343**
	(0.0495)	(0.148)	(0.0184)	(0.201)	(0.0520)	(0.128)	(0.0191)	(0.172)
Share pop. with tertiary education (2013-15)	-0.196	-0.0717	-0.498*	-1.156***	-0.104	-0.0579	-0.489*	-1.193***
	(0.242)	(0.0711)	(0.291)	(0.341)	(0.269)	(0.0747)	(0.295)	(0.378)
Unemployment rate (2013-15)	-0.251	0.0432	0.391*	0.439*	-0.454	0.0343	0.381*	0.380
	(0.290)	(0.0997)	(0.227)	(0.233)	(0.491)	(0.103)	(0.228)	(0.245)
Investment growth (2013-15)	0.0357	-0.0366	-0.122	0.124*	0.0434	-0.0337	-0.112	0.324**
	(0.0914)	(0.0540)	(0.143)	(0.0744)	(0.134)	(0.0523)	(0.143)	(0.143)
GDP negative effect of Covid-19 (Y/N)	5.322	2.112	3.682	13.72***	6.633	2.456*	4.231	16.92***
	(5.236)	(1.590)	(5.084)	(5.035)	(7.139)	(1.378)	(5.216)	(6.039)
Log pseudolikelihood	-70.79				-68.22			
Joint significance	0.0000				0.0000			
Pseudo R2	0.5487				0.5807			
Goodness-of-fit test (p-value)	0.540				0.138			

Source: Own elaboration. Note: Number of observations = 162. Country-cluster robust standard errors in parentheses. Significance level: *** p<0.01, ** p<0.05, * p<0.1. Regression includes geographical groups.

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