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A Study on its Main Drivers of Adoption at the Regional Level

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Cross-Border Cooperation via the EGTC – A Study on its Main Drivers of Adoption at the Regional Level

The European Grouping of Territorial Cooperation (EGTC) is a novel European legal form for cross-border, interregional and transnational cooperation, introduced in 2006. So far, the literature on the EGTC is predominantly descriptive in nature, it relies heavily on case studies and mainly inquires of the impact of the EGTC on regional integration. In this paper, we focus on the external factors that influence the adoption of the EGTC at the level of 281 NUTS2 regions in the EU28. Based on transaction costs theory and innovation studies we derive six hypotheses on which structural characteristics contribute to the adoption of an EGTC. Applying logistic regressions and spatial autoregressive models we find that the following characteristics of a NUTS2 region have a positive influence on adopting the EGTC: being a border region, being economically weaker, being form the EU15, having a more innovative RIS and having more absorptive capacity. Based on these findings, we recommend designing programs for local and regional public agents in border regions that are directed at personal meetings and knowledge exchange. They should assist in strengthening capabilities to deal with innovation and improve the absorptive capacities at the local and regional levels resulting in successful and sustainable cross-border cooperation to improve prosperity and well-being.

Keywords: Adoption of Legal Innovations, Cross-border Cooperation, European Grouping of Territorial Cooperation, European Integration, Regional Policy

JEL Classification: C21, C25, H7, K33, O17, O18, O52, R11,

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1. Introduction

Differences in economic and social well-being between rural and urban that are, peripheral and prospering regions are characteristic of EU Member States. Since 2005 it has gained renewed momentum through the accession of the 13 new Member States, most of which are from Eastern Europe. European integration has manifold impacts on regional disparities. On the one hand, it leads to increased convergence between the Member States, while on the other hand, interregional disparities within the Member States grow, too. Cohesion policy has long been an important part of EU policies (Bachtler et al 2017). With the Lisbon Treaty in 2007 the objective of promoting economic, social and territorial cohesion even became constitutional (European Union 2007). Currently, about one-third of the EU budget is used for the Cohesion Policy. In the 2014-2020 period, funding for European Territorial Cooperation (ETC) amounts to about 3% of the Cohesion Policy budget. One of its main objectives is to promote cross-border cooperation (CBC) (EU COM 2019; on CBC studies see Scott 2017).

This points to the "dual impact on border regions" European integration has: "On the one hand, borders were physically dismantled across most of the EU's internal territory (…). On the other hand, border regions have become a fertile ground for territorial co-operation and institutional innovation" (de Sousa 2013, 669). ETC aims at cooperation among public actors from different Member States and different government levels that is national, sub-national, regional and local ones. Yet such multi-level cooperation among actors from different Member States does not only occur in respect to funding by the ECT or other EU programs. A characteristic of border regions is that there is no congruency between the political-administrative structure and the functional scope in the provision of public goods and services due to obstacles created by the border (Pucher/ Stumm/ Schneidewind 2017). Accordingly, by CBC regions might realize economies of scale or scope from the joint production of common goods (Jaansoo 2019) and strengthen der regional innovation system (Asheim/ Isaksen/ Trippl 2019). But for this to happen, adequate governance structures must be available that "support economic activity and economic transactions by protecting property rights, enforcing contracts, and taking collective action to provide physical and organizational infrastructure" (Dixit 2009, 5). Otherwise beneficial policy solutions cannot be realized or only at high transaction costs so that profound "institutional gaps" (van den Broek/Smulders 2014) remain.

The European Grouping for Territorial Cooperation (EGTC) is such a governance innovation. It was implemented in 2006 and amended in 2013 (European Union 2006, 2013). It is a supranational EU-wide legal form for sub-national cooperation that is set up by local, regional

or (sub-) national authorities and public bodies from at least two Member States. An EGTC has an own legal personality with its own budget and the right to sign contracts and hire a staff of its own. Its task is to administer ETC programs and funds or to jointly provide public goods and services cross-border, interregional or transnationally. The main fields of activity are tourism, culture and sports, transport and infrastructure, education and training and entrepreneurship and regional development. Most EGTCs state a rather broad field of activities; only very few are founded to follow a special purpose, such as the EGTC *Hospital de Cerdanya* or the EGTC *EUCOR – The European Campus*. EGTCs are active in 20 Member States, covering about 28% of the EU population (Zillmer et al. 2018, p.103). So far, 69 EGTCs have been registered, which comprise about 988 public actors from different administrative levels (ibid, Annex 2, pp.159ff.). At the end of 2017, there had been another 19 EGTCs in the process of registration, awaiting approval or preparing for the approval process (ibid, Table 12, p.127f.).

While institutional innovations like the EGTC are a prerequisite for successful territorial cooperation, enacting a novel legal form does not guarantee it being adopted by the addressees. As the literature on the diffusion of innovations shows, the dissemination process is influenced by a lot of different structural, contextual and individual factors that work as drivers or obstacles for the dissemination of an innovation (Gallagher/ Rogers 2010; Eckardt/ Okruch 2020a). For each public actor when deciding on whether to participate in an EGTC or not, its incentive structure and its absorptive capacities are the main determining factors. Both aspects are influenced by external as well as internal characteristics of the respective actor. In this paper, we focus on the external factors that have an impact on the adoption of an EGTC. More precisely, our research question is what structural characteristics contribute to the adoption of an EGTC at the NUTS2 regional level.

The EGTC is a kind of multi-purpose legal form when it comes to the types of cross-border, interregional or transnational cooperation that can be carried out by applying it. Accordingly, the determining factors of individual public actors' decision to participate in an EGTC are place-, problem- and time-specific. They reflect not only the general policy issue(s) to be promoted by a particular EGTC, but also micro-policies and personal characteristics of the actors involved. As a consequence, the factors affecting the adoption of an EGTC are quite heterogeneous when looking at the micro-level of single decision-makers. In contrast to that, looking at the external factors at the meso-level allows us to draw more general conclusions on enabling or hindering factors for adopting an EGTC. NUTS2 regions are administrative regions which have generally between 800,000 and 3 million inhabitants. They are the main administrative units for the EU Cohesion Policy (Eurostat 2019). Therefore and due to data

availability, our analysis refers to NUTS2 regions. To answer our research question on which structural characteristics do increase the likelihood of an EGTC to be adopted, we perform logistic regressions. In addition, we apply spatial autoregressive estimations to account for regional spill-overs. The analysis is based on an original dataset for 281 NUTS2 regions in the EU28 in 2015. Following from this, policy recommendations can be given to improve the overall adoption climate for the EGTC as a legal form. In turn, this might have a positive impact on the adoption decision at the micro-level independent of the variety of heterogeneous factors at work there.

This paper contributes to the literature on cross-border cooperation (CBC). The hypotheses to be tested are well-grounded in transaction costs theories and innovation studies. It provides a first econometric analysis of the determinants affecting the adoption of the EGTC as a legal innovation that is aimed at fostering CBC. Finally, it also adds to the emerging literature on cross-border regional systems of innovation.

The structure of the paper is as follows. Section 2 provides a short review of the scarce empirical literature about the adoption of EGTCs, derives the hypotheses to be tested and presents the variables and data. Section 3 discusses the estimation results based on logistic regression and spatial autoregressive models. Section 4 summarizes and concludes.

2. Literature Review, Hypotheses, Variables and Data

2.1 Literature Review

The EGTC as a new legal instrument was implemented in 2006, with the first EGTCs being registered in 2008. Therefore, it comes as no surprise that the first wave of literature was mainly descriptive and/or normative in nature.[2] It mainly describes the legal set up and analyzes the characteristics of the EGTC from a normative point of view (for an overview see Eckardt/ Okruch 2020a). This literature is mostly rooted in legal science resp. political sciences.

Over time, a growing number of reports appeared that analyze the application of the EGTC taking a mainly practical approach. The Committee of the Regions, which runs the register of the EGTCs, issues regular monitoring reports (e.g. Zillmer et al. 2015; 2018; for an overview of former monitoring reports and additional material see COR 2019). In addition, the European Commission issued a number of studies on the application of the EGTC Regulation (European Union 2011, 2018, 2019). The "Cross border review" of the European Union also refers to the

[2] For a comprehensive literature review on adopting innovations including approaches from innovation economics, Law and Economics and political sciences, see Eckardt/Okruch (2020a).

application of the EGTC (European Union 2017, Pucher/ Stumm/ Schneidewind 2017). In addition, EPSON issued a number of in-depth studies of CBC (e.g. EPSON 2018). This body of literature provides first empirical insights into the working of single EGTCs. It also tries to summarize the experiences made with the EGTCs in place. Again, these studies are mainly descriptive in nature.

In the meantime, a number of case studies analyzing single or several EGTCs in more depth have been published. However, their main focus is mostly on the impact of EGTCs in furthering cross-border cooperation (e.g. Medeiros 2013, Balogh/Gyelnik 2016; for a comprehensive literature overview on CBC including the EGTC see Jaansoo 2019)

So far, we are aware of only one empirical study that explicitly focuses on the likelihood of participation in CBC, although it does not explicitly deal with the factors affecting the adoption of an EGTC. Jaansoo (2019, 201-246) provides a logistic regression analysis on drivers of CBC, including the EGTC *inter alia*. It is based on a dataset (n=106) derived from an online survey among subnational governments adjacent to international land borders in Europe carried out in 2016/2017. The hypotheses tested are derived from a comprehensive transaction costs (TC) framework aimed at explaining participation in CBC in general resp., in CBC service provision. The author argues that the likelihood of CBC increases with increasing gains from cooperation and with decreasing TC. The latter is mainly caused by proximity (Boschma 2005), trust and service characteristics. In addition, the availability of financial and human capital resources and an enabling institutional context should also result in a higher likelihood of CBC. The logistic estimations performed show that lower TC resulting from proximity and service characteristics, higher resource endowment, and being from the EU15 significantly increase the likelihood of participating in CBC for subnational governments. When it comes to CBC in service provision, there are indications that gains from CBC due to scale economies might be a driver for CBC of subnational governments.

Eckardt/ Okruch (2020b) empirically analyzes whether the EGTC contributes to reduce barriers to economic integration, in particular in border regions, and to promote territorial cohesion within the EU. They derive 8 hypotheses on differences regarding NUTS2 regions with at least one EGTCs adopted there and those without any EGTCs. Based on a data set of the 281 NUTS2 regions for 2015, they perform t-tests for equality of means, Mann-Whitney U-tests for equality of medians and Chi-square tests for equality of proportions. The results show that NUTS2 regions with at least one EGTC located there have a higher share of regions with land borders. They show a higher share of households living in rural areas, with a lower share of households

in urban areas. They also have a lower employment rate and lower investment in research and development (R&D), but a higher unemployment rate. Their GDP per capita is significantly lower, but the growth rate of GDP per capita is higher (see Table 1A in the Appendix). All in all these findings confirm that EGTCs are located in rather peripheral regions, like border regions, which exhibit economic weaknesses.

However, what we do not know from these results is whether these structural characteristics of a NUTS2 region influence the likelihood of an EGTC being adopted just in such a region. Therefore in the following, we derive six hypotheses to test for the impact of structural characteristics of NUTS2 regions on the adoption of EGTCs.

2.2 Hypotheses

Hypotheses 1 to 3 refer to the three main objectives which should be pursued by the legal form of the EGTC according to the legislator: promoting cross-border cooperation, furthering territorial cohesion and administering EU structural funds. Each hypothesis tests whether a NUTS2 region with certain characteristics has a higher chance of having at least one EGTC being adopted there: that is, being a border region (Hypotheses 1), being economically less developed (Hypotheses 2), or showing a higher share of funding from EU structural programs (Hypotheses 3).

The theoretical underpinning for these hypotheses is the TC framework from the CBC literature as developed by Jaansoo (2019, 39-96). We expect the likelihood of adopting an EGTC to increase, the higher the potential gains from cooperation via an EGTC are, the lower the TC involved, and the better the resource endowment is. In addition, certain institutional characteristics also might have a positive overall impact of adopting an EGTC within a NUTS2 region.

(1) Being a border region

It is undisputed that borders, be them administrative, and thus rather ‘artificial’ ones, or geographical, thus more ‘natural’ ones, cause additional challenges and barriers when it comes to providing public goods and services and economic integration. Not only are the underlying administrative units usually not optimal for a minimum cost provision of public services. A border also sets boundaries for more integrated cooperation due to differences in the respective national public law and the respective national public administration systems. The EGTC is a legal form that directly aims at overcoming such barriers to cooperation for public actors in border regions. Accordingly, the EGTC should provide additional gains in particular for border

regions which otherwise could not be realized. This holds in regard to the provision of collective common goods, to the internalization of externalities, and to the realization of gains from economies of scale and/or scope. Thus, being a border region should increase the chance of having adopted at least one EGTC in a NUTS2 region by providing additional gains from cross-border cooperation.

However, the EGTC is a legal form not only for cross-border cooperation. It aims to promote international cooperation, be it cross-border, interregional or transnational. But while all cooperation involves some amount of TC, nevertheless these are the lower the closer both physically and conceptually partners are, thus, the higher proximity is. In addition, border regions share a number of similar problems that are not present or not that prevalent for regions without borders. This should lower TC in regard to collecting and assessing information, negotiating and monitoring, and thus it should promote cooperation.

According to this reasoning, *hypothesis 1a* states that border regions should have a higher likelihood of at least one EGTC being adopted there compared to regions without any external borders. To see whether this reasoning also holds for natural borders, we also test *hypothesis 1b* which refers to NUTS2 regions that have sea borders, but no international land borders.

(2) Economic development

The potential gains from cooperation are relatively higher for economically weaker regions. Thus, public actors from such regions should benefit relatively more from participating in an EGTC. In addition, the wealthier a region is the higher revenues for public actors should be. This implies that NUTS2 regions with better economic performance should be under less fiscal stress, thus having less need to look for ways of improving their fiscal situation. Accordingly, the chances for EGTCS to be adopted in low-income NUTS2 regions should be higher. Therefore h*ypothesis 2* tests whether the less developed a NUTS2 region is, the higher the chances of an EGTC being adopted there.

(3) Funding from EU structural programs

Besides the indirect gains from operating an EGTC, there also might be direct financial gains involved. The original idea behind the EGTC is to have a legal form for managing EU funds to promote territorial cooperation. The motivation to participate in an EGTC is positively linked to the potential benefits of receiving additional funding from the EU. Moreover, adopting an EGTC by public actors increases the chance of additional external funding, increasing the financial resources available for cooperation. In addition, the higher the sum of EU funding is

in a region, the better the knowledge base on international cooperation. This implies in a learning process, lowering TC for international cooperation, which in turn should increase the likelihood of cooperation via an EGTC. Accordingly, to *hypothesis 3* there should be a positive relationship between the amount of funding a NUTS2 region receives from the EU structural programs and the likelihood of having an EGTC adopted there.

Hypotheses 4 to 6 turn to characteristics of the adopters of an EGTC. They take into consideration that the EGTC is a rather novel legal form whose adoption requires particular characteristics by the public actors. Hypothesis 4 relates to potential advantages of being from the EU15. Hypothesis 5 takes a systems perspective on the innovativeness of a region and its public actors for adopting a novel legal form like the EGTC. Finally, hypothesis 6 refers to the impact of absorptive capacity of the public administration in a NUTS2 region for an EGTC to be adopted.

(4) Being from the EU15

Belonging to an EU Member State that joined the EU before 2005 should decrease TC since the public actors in such NUTS2 regions have more comprehensive knowledge in regard to interregional and cross-border cooperation. They have longer experiences with cooperating with neighboring regions and are thus more familiar with the working of both the EU institutions as well as the institutions of adjacent Member States. In addition, there is more economic proximity regarding the underlying socio-economic framework of a market economy. This all reduces TC for cooperation via an EGTC. In addition, trust is generally higher in the EU15 than in the EU13 which joined after 2004 (Eurofound 2018a; 2018b). Trust plays a prominent role in reducing TC in complex situations with a high degree of information imperfections and uncertainties. This holds also for such novel forms of cooperation like the EGTC. Thus, *hypothesis 4* states that NUTS2 regions from the EU15 should have a higher likelihood of having at least one EGTC being adopted there.

(5) Innovativeness of the regional innovation systems

The EGTC is a rather novel legal instrument for international cooperation by public actors. So far, knowledge about the EGTC is not a public good. Due to its novelty, there are only a few experiences about the projects and types of cooperation for which it works well and the circumstances for which it is best suited. Early adopters have to accept the rather high uncertainty associated with an EGTC and they have to incur higher information costs to gain knowledge about the working mechanisms of founding an EGTC. Applying for participating in an EGTC requires the consent of the competent national authorities. Again, in the early adoption

stage, fulfilling these administrative requirements is associated with additional uncertainty and TC because cost-saving routines have yet to emerge. Accordingly, early adopters should be rather entrepreneurial. Following from the regional innovation system (RIS) approach, innovativeness is a systemic feature, involving well-functioning cooperation among public actors, private companies and research entities; this holds the more so for cross-border RIS (Asheim/ Grillitsch/ Trippl 2015; Isaksen/ Tödtling/ Trippl 2018; Lundquist/ Trippl 2013; Makkonen/ Rohde 2016; Trippl 2010; van den Broek 2018; Zukauskaite 2018). Thus, *hypothesis 5* states that higher overall innovativeness of a NUTS2 region should have a positive impact on adopting an EGTC.

(6) Absorptive capacity of public administration

The novelty associated with the rather new legal form of the EGTC requires public actors adopting it to show a high degree of absorptive capacity that is, the capability of an organization 'to recognize the value of new information, assimilate it, and apply it' (Cohen/ Levinthal 1990, 128). This includes strong motivation as well as dynamic capabilities by the participating public actors to successfully deal with innovations and the related complexities. It refers to both elected politicians and administrative personnel. Accordingly, we test *hypothesis 6* that NUTS2 regions with better absorptive capacity in its public administration will show a higher likelihood of adopting an EGTC.

Finally, we control for the impact of population size and population density. EGTCs are targeted to increase allocative efficiency by reducing the costs for cross-border, interregional or transnational cooperation by public actors from different member states. This inevitably implies that the services are provided for a larger number of people compared to a situation without such cooperation. Therefore the costs of service provision should decline due to economies of scale and/or scope – depending on the service at hand. Thus, with an increase in population size for which public services are provided, the potential gains from economies of scale and/or scope increase, too. Accordingly, we control for the impact of a larger population size on the chance of having at least one EGTC being adopted in a NUTS2 region. However, the costs of providing public services not only depends on the absolute population size but often also on population density. Therefore, we also control for population density.

For the hypotheses, variables and expected signs see Table A2 in the Appendix.

2.3 Variables and Data

To test hypotheses 1 to 6 we perform logistic regression estimations. In addition, to account for regional spill-overs we provide spatial autoregressive models.[3] We use the EU 2016 NUTS2 classification in this paper (Eurostat 2019). Data are from EU sources, they refer to 2015 with the exception of the European Quality of Government Index, which is for 2013.

Our dependent variable is a dummy variable that identifies NUTS2 regions with and without EGTCs located there. Data are provided by the Committee of the Regions (2019). Of the 281 NUTS2 regions for the EU28, three-fifth have no EGTC located there (n = 170) compared to two fifths with at least one EGTC (n = 111). There are 6 Member States where in each NUTS2 region at least one EGTC is adopted, while 14 Member States have both NUTS2 regions with and without EGTCS. 8 Member States have no EGTCs located.

Besides, there are the Member States without any EGTCs. With the exception of Malta, they are all from Northern Europe, like the UK and Ireland, but also Sweden, Finland, the three Baltic States, and Denmark. Regarding the other 20 Member States,

To test hypothesis 1a, we use the variable *Land_border* which is coded 1 if a NUTS2 region shares an administrative border to at least one other member state. To see whether the effect of natural borders is similar to administrative borders we use the variable *Sea_border* which is coded 1 if a NUTS2 region has a maritime border, but no administrative land border to another member state. To test the effect of economic development in hypothesis 2, we use the natural log of GDP per capita. The lower it is in a NUTS2 region the higher the chances of at least one EGTC being adopted there. Therefore we expect a negative coefficient sign. Hypothesis 3 is about the potential benefits the EGTC provides in administering EU programs. Thus, we use the log of the sum of funding from the EU structural programs in a NUTS2 region as a proxy.

To test for the effect of time spent as an EU member in hypothesis 4, we use a EU15_dummy which is coded 1 if a NUTS2 region belongs to a member state which had been a member of the EU already before 2005. Hypothesis 5 assesses the impact of the innovativeness of the RIS at the NUTS2 level for adopting EGTCs. The RIS approach conceptualizes the innovativeness of a region to depend strongly on the cooperation between private enterprises, research institutions, and public actors. Thus, we use the log of total spending for research and development activities per GDP in a NUTS2 region as a proxy for the innovativeness of its RIS. We argue that the more public actors are faced with innovative challenges as indicated by R&D

[3] For more on methodology and discussion of estimations see section 3.

spending, the more likely they are to adopt novel legal forms for cooperation like the EGTC as well.

To test hypothesis 6 on the impact of absorptive capacity of public administration we use the regional version of the European Quality of Government Index (EQI) 2013 (Charron 2013, Charron/ Lapuente 2018). This is a composite index, based on the aggregated perceptions and experiences of about 85,000 citizens on the NUTS2 level, regarding the following three main categories: quality, impartiality, and corruption in delivering public goods and services. The higher the EQI, the more content the population in a NUTS2 region is with the services provided by its public administration. This implies that the public administrations in such regions take a close look at the needs and preferences of the respective population for deciding what services are to be delivered. Over time they adapt to the changing needs and requirements of the region, thus acquiring learning capabilities and problem-solving skills that increase the absorptive capacity to deal with external and internal changes over time. This absorptive capacity then enables public actors to explore novel ways for closing institutional gaps by adopting novel solutions like the EGTC, for example (Jukneviciene 2013; Narula 2004; Uotila/ Harmaakopri/ Melkas 2006).

To control for the impact of population size we use the natural log the population size at the NUTS2 level. In regard to population density, we use the percentage of households living in rural areas respectively living in intermediate areas that is, towns and suburbs.

For definition, measurement and sources of data see Table A3 in the Appendix. Descriptive data are given in Table 1.

[Table 1 about here]

3. Estimation Results and Discussion

3.1 Logistic Regressions

To test our hypotheses, we estimate three logistic regression equations (see Table 2). *Model 1* tests hypotheses 1 to 3, *Model 2* includes variables to test for hypotheses 4 to 6, while *Model 3* also controls for the impact of population size and density.

Regarding hypothesis 1 we find a highly significant positive coefficient for *Land_border* in all three specifications, while *Sea_border* also shows a positive, but not a significant coefficient. Following from this, the likelihood of adopting the EGTC is higher in border regions, thus, principally promoting CBC. In contrast to that, there is no positive effect if a NUTS2 region has a sea border regarding the adoption of the EGTC.

As stated in hypothesis 2, the estimation coefficient of log GDP per capita is negative in all three models. However, it is only significant as long as we do not include variables that account for other characteristics of a NUTS2 region. Thus, having a low GDP per capita positively impacts the adoption of an EGTC.

In regard to administering structural funds by the EGTC, we find a significantly positive coefficient for the proxy *log(SumPayMod)* in *Model 1* as stated in hypothesis 3. However, it changes sign when including additional variables in *Models 2 and 3*.

Hypothesis 4 tests for the impact of trust and long-term experience with international cooperation by using a *EU15_dummy*. As expected NUTS2 regions from the 'old' EU Member States show a significantly higher chance of having at least one EGTC being adopted there.

log(RDpGDP) which is a proxy of the innovativeness of the RIS at the NUTS2 level also has a significantly positive coefficient as stated in hypothesis 5. From this, we conclude that the chances for adopting a novel legal form like the EGTC increases, the more innovative the public sector is in a region.

Hypothesis 6 takes into account the absorptive capacity of the public administration in a given region. We started by hypothesizing a positive relationship. However, our first estimations showed a highly significant negative coefficient estimate when including the *log(EQI)* as a proxy for absorptive capacity. Since we are not aware of any reasonable arguments that account for such a relationship, we modified the hypothesis to test for an inverse U-shape. Accordingly, the hypothesis is that an increase in the absorptive capacity of public administration would increase the chances of having an EGTC adopted in a NUTS2 region only up to a certain point, with a decreasing likelihood thereafter. Therefore, we apply a quadratic specification of *log(EQI)*. *Models 2* and *3* confirm this argument of an inverse U-shaped relationship by showing highly significant coefficients in the hypothesized directions.

The EGTC is a rather young legal instrument which is available only since 2006, while the problems it is intended to solve, are not new. Confronted with the issue of closing institutional gaps for CBC, NUTS2 regions with high absorptive capacity thus will have tried to find solutions already in the years before the EGTC was introduced. In contrast to that, for NUTS2 regions with lower absorptive capacity of public administration, the introduction of the EGTC as a supranational legal form provides a low-cost instrument to support CBC. An illustration that further supports this argument is the fact that there is only one EGTC in a Swedish NUTS2 region, with none in other Scandinavian countries. A reason for this might be the existence of the *Nordic Council*. Since 1955 this transnational parliamentary forum of the countries involved

focusses especially on issues of cooperation and tackling cross border challenges (see for example the *Border Database* in Nordic Council 2019).

[Table 2 about here]

We performed a number of tests with regard to our full *Model 3* to see whether the usual assumptions for logistic regression hold. We excluded the following NUTS2 regions from the analysis because they proved to be influential outliers: BE10 (Brussels), LU00 (Luxembourg and CY00 (Cyprus).

To test for model misspecification like omitted or irrelevant variable we use the *link test* in *STATA*. It provides us with a significant *hat* and a not significant *hatsquare* which indicates that there is no misspecification (Bittman 2019, 130). Multicollinearity does not pose a problem since all simple correlation coefficients are smaller than 0.7. The variance inflation factor (VIF) is lower or around 2 for all variables except for *log(GDPpc)_2015* where it is 5.3 (See Table.A3 and Table.A4 in the Appendix). Since the single correlation coefficients are rather low and the VIF only slightly above 5 we do not change our estimation models. Besides, Bittman argues that a VIF factor of about 10 is still acceptable (Bittman 2019, 132).

Comparing the overall fit of our model we find a clear increase in explanatory power from *Model 1* to *Model 3* when including additional characteristics of the NUTS2 regions regarding the adoption of an EGTC (see *pseudo-R²*, *AIC* and *BIC* values in Table 2). The *estat goodness of fit* test also points to a good fit. In addition, the *classification table* shows that *Model 3* correctly classifies 75% of all observations. It gives a better estimate than using the share of all NUTS2 regions which have at least one EGTC adopted there, which is 40%. This also indicates a good fit of our model.[4]

3.2 Spatial autoregressive estimations

So far, we assumed that there is no autocorrelation among the observations in our sample so that residuals from neighboring NUTS2 regions are not correlated. However, the spatial arrangements of NUTS2 regions are not random. Therefore we use *Moran's test* for spatial dependence to test the null hypothesis that error terms are independent and identically distributed (*i.i.d.*). We define a spatial weighting matrix that takes it into account if NUTS2 regions share a border. Running *Moran's test* results in a highly significant *chi(2) value* (chi(2) = 61.33, p-value = 0.0000). Accordingly, we have to reject the hypothesis that the residuals are *i.i.d*. As a consequence, we run a number of spatial autoregressive models to account for spatial

[4] All statistics are available from the author upon request.

lags of the (in-)dependent variable(s) and of the autocorrelation of the error term. Table A5 in the Appendix reports results for the different equations.

Equation 3 reproduces the results of the logistic regression *Model 3* from above. *Model 4* shows estimates for the linear probability model (LPM) using OLS. Comparing *Model 3* and *4* shows that there are no big differences regarding signs and significance of coefficients. Due to these robust results, we use STATA *spregress* command for estimating the effects of spatial correlation (STATA 2019). To control for the effect that the EGTC is indeed used for CBC and applied by neighboring regions, we estimate a spatial lag model (SLM) which treats the dependent variable as autoregressive (*Model 5)*. Our results show that there is indeed a significant positive effect if a neighboring NUTS2 region has at least one EGTC adopted there, while the signs and level of significance of the other independent variables remain rather robust. In contrast to that *Model 6* (SEM) estimates a spatial error model which considers only the error term to be autoregressive. In this case, again our results remain rather robust with the exception that *Land_border* has no longer a significant impact. *Model 7* (SLEM) takes into account both the dependent variable and the error term to be autoregressive. In contrast to *Model 5* the lagged dependent variable now shows a negative impact on the likelihood of having an EGTC adopted which is rather implausible. Therefore, in *Model 8* (SLEIM) we include spatial lags for the continuous independent variables to account for potential spill-overs from them, too. In this equation, the coefficient of *Land_border* again becomes significant, while the coefficient of the lagged dependent variable and the error term change signs. This indicates that there should be interregional spill-over effects from independent variables that had been caught by the lag of the error term in *Models 6* and *7*. *Model 8* shows a better fit regarding *pseudo R²* and *AIC* when compared to the logistic regression *Model 3*, which does not account for spatial relationships among NUTS2 regions. In the following, we thus compare *Models 3, 4* and *8* for the average marginal effects of the independent variables on the dependent variable (see Table 3).

Models 3 and *4* do not account for spatial spill-overs, therefore the direct impact of the independent variables relating to the respective NUTS2 region equal their total impact. We find a robust direct impact for most of the variables when comparing the coefficient estimates for *Models 3, 4* and *8*. In Model 8, the following variables show also a significant impact on the adoption of an EGTC: *Land_border*, *log(GDPpc)*, *log(SuMPayMod)*, *EU15_dummy*, *log(RDpGDP)* and *log(EQI)*. Accordingly, for hypotheses 1a, 2, 4 and 5 we can reject the null hypothesis of no influence of the respective independent variables. In line with our hypotheses, being a border region, having a low GDP per capita, being from the EU15, and showing higher innovativeness in its RIS increases the likelihood of a NUTS2 region in adopting an EGTC. In

contrast to that, however, we find that the lower the funding a region receives from the EU structural funds, the higher the chance of adopting an EGTC. Without additional information, one can only speculate whether this result is a sign that in such region EGTCs are used to acquire additional EU funding or whether it just shows that regions with a higher inflow of EU funding have already designed better methods for administering these payments. Regarding hypothesis 6 on the absorptive capacity of public administration, the coefficient estimates confirm an inverse U-shaped relationship (see Table 3), with on average a negative impact on adopting an EGTC the higher the absorptive capacity within a region is.

A look at the indirect effects of the independent variables shows that there are significant positive recursive effects form a NUTS2 region having a land border and being from the EU15 in regard to the likelihood of adopting an EGTC. In contrast to that, the better off a neighboring NUTS2 region is as measured by its GDP per capita, the lower the chances that there are public actors that adopt an EGTC for cooperation with adjacent NUTS2 regions. This is in line with our reasoning above that the potential gains from cooperation via the EGTC are the higher the weaker its economic situation is.

All in all, the SAR estimations strengthen the findings of the logistics regression and back our hypotheses, they are also in line with the findings of Jaansoo (2019) which refer to the micro-level (see above).

[Table 3 about here]

4. Conclusions and Outlook

For successful cooperation to take place among public policy actors from different Member States, appropriate legal arrangements must be available. The EGTC is such a supranational EU-wide applicable legal form. From the above analysis, there are some important conclusions to be drawn with respect to how suitable the EGTC is for closing institutional gaps, thus enabling policies for better economic development at the regional level.

There seem to be some structural characteristics at the NUTS2 level at work that facilitate the adoption of the EGTC, irrespective of the different activities it can be used for and regardless of the particularities of the public actors of which it is composed. Being a border region, being economically weaker and being from the EU15 as well as being from a more innovative RIS and having a more absorptive capacity distinctly increases the likelihood of an EGTC being adopted at the NUTS2 level. This implies that at least in the eyes of its members, the EGTC is a useful legal instrument for cooperation among the different Member States.

What conclusion can we draw from that if we look at these enabling factors separately?

For one thing, there is nothing like a 'one-type-fits-all' supranational legal instrument. This holds in regard to different types of cooperation, be it cross-border, interregional and transnational cooperation, but also regarding the activities carried out. Cross-border cooperation seems to be particularly well-suited for applying the EGTC – in contrast to interregional or transnational cooperation. This is in line with TC theory according to which geographic, economic, cultural and social proximity reduces TC and thus increases the likelihood of cooperating via the EGTC. In addition, economically weak regions are more likely to apply the EGTC than richer ones, which again is in line with the TC approach in that potential gains from cooperation are relatively higher for less developed regions. However, for administering structural funds, the EGTC is not the first choice, at least according to our findings. Other institutional arrangements to govern their management are available, probably at lower costs.

For another thing, our findings emphasize insights from innovation studies in that the adoption of a novel legal form like the EGTC requires the adopters to have special capabilities to deal with the accompanying uncertainties and complexities. Public actors situated in the EU15 have long experience in dealing with their counterparts in the other Member States than those from the EU13. If a RIS is more innovative, public actors from such regions have acquired more of the dynamic capabilities necessary in the face of the uncertainties caused by implementing innovations. Finally, public actors in regions with higher absorptive capacity induce the emergence of a better knowledge base to adapt to novel forms of cooperation.

From this we draw the following conclusions:

Regarding the theoretical underpinning of our study, we find that both the TC literature and the innovation systems literature are valuable in explaining the adoption of legal innovations. While TC theory is rather static in nature, the innovation systems approach neglects in some ways cost considerations. Both approaches could benefit from better integration of their main insights.

With respect to the methodology applied, the results show that a quantitative approach to analyze the structural determinants of the adoption of the EGTC leads to some meaningful findings. Spatial autoregressive models enable us to better differentiate between the internal factors from spill-overs from neighboring regions when it comes to the adoption of the EGTC. Nevertheless, valuable further insights are to be expected from carrying out additional surveys among actual or potential adopters of an EGTC regarding the main factors driving their decision to participate or not.

By devising adequate policies the diffusion of a novel legal form like the EGTC can be furthered. The impact of being from the EU15 refers to knowledge about the working of other Member States' public administration and to trust among public actors from the different Member States. Accordingly, programs directed at personal meetings and knowledge exchange should be promoted among public actors along border regions, in particular for the EU13. Furthermore, particular programs that foster skills and increase the respective knowledge bases to increase capabilities to deal with innovation and to improve absorptive capacities should be devised. Particular focus should be given to public actors from the local and regional level since they are the agents most relevant for the successful implementation and working of CBC.

These policy recommendations might assist in the overall adoption climate for the EGTC as a legal form. In turn, this might improve cross-border and interregional cooperation among the EU Member States. As a result, it could back other policies like implementing successful cross-border regional innovation systems which are especially important for reducing differences in economic and social well-being between rural and urban that are, peripheral and prospering regions of EU Member States.

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Tables

Table 1: Descriptive data

Variable	Obs	Mean	Std. Dev.	Min	Max
NUTS2 region with EGTC	278	0.3884892	0.4882858	0	1
Land_border	278	0.4856115	0.5006943	0	1
Sea_border	278	0.3057554	0.4615575	0	1
GDPpc	278	27983.81	17679.66	3900	226200
log(GDPpc)	277	10.07036	0.5822134	8.268732	11.17465
SumPayMod	278	1.05E+08	1.66E+08	0	1.40E+09
log(SumPayyMod)	278	16.33843	4.67251	0	21.06043
EU15_dummy	278	0.7841727	0.412137	0	1
RDpGDP	262	1.594046	1.244885	0.06	10.36
Log(RDpGDP)	262	0.1922105	0.7844118	-2.813411	2.337952
EQI	267	54.30094	17.60158	0	100
log(EQI)	267	3.911634	0.4879317	0	4.60517
Pop	278	1819878	1516458	28916	1.21E+07
log(Pop)	278	14.1186	0.8258649	10.27215	16.30724
DEG3_rural	277	0.3100722	0.1887794	0	0.81
DEG2_inter	277	0.3284477	0.1723814	0	0.82

Source: Own calculation.

Table 2: Logistic regressions

	Model 1	Model 2	Model 3
Land_border	1.190***	1.526***	1.310***
	(0.002)	(0.000)	(0.003)
Sea_border	0.661	0.294	0.296
	(0.111)	(0.560)	(0.572)
log(GDPpc)	-0.540**	-1.057	-0.912
	(0.026)	(0.114)	(0.205)
log(SumPayMod)	0.0694*	-0.0386	-0.0562
	(0.068)	(0.550)	(0.422)
EU15_dummy		2.225***	2.045***
		(0.001)	(0.003)
log(RDpGDP)		0.745**	0.621**
		(0.013)	(0.046)
log(EQI)		19.51***	19.82***
		(0.000)	(0.000)
log(EQI)^2		-3.080***	-3.116***
		(0.000)	(0.000)
log(Pop)			0.398
			(0.115)
DEG3_rural			1.981*
			(0.093)
DEG2_inter			2.680**
			(0.018)
_cons	2.999	-20.44**	-29.16**
	(0.269)	(0.049)	(0.014)
pseudo R^2	0.085	0.238	0.257
AIC	348.8	280.0	278.2
BIC	366.9	311.8	320.5
N	277	253	251

p-values in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source: Own calculation.

Table 3: Direct, indirect and total impact - average marginal effects

	Model 3	Model 4 LPM	Model 5 SLM	Model 6 SEM	Model 7 SLEM	Model 8 SLEIM
Direct						
Land_border	0.2293***	0.2562***	0.1423**	0.0545	0.0326	0.1448**
	(0.002)	(0.001)	(0.047)	(0.496)	(0.683)	0.031
Sea_border	0.0468	0.0700	0.1175	0.0251	0.0391	0.1309
	(0.574)	(0.375)	(0.125)	(0.764)	80.643)	(0.106)
log(GDPpc)	-0.1534	-0.1868	-0.1881*	-0.2592**	-0.2906**	-0.3055***
	(0.200)	(0.108)	(0.077)	(0.024)	(0.011)	(0.003)
log(SumPayMod)	-0.0095	-0.0096	-0.0109	-0.0115	-0.0121	-0.0198**
	(0.419)	(0.314)	(0.267)	(0.276)	(0.245)	(0.031)
EU15_dummy	0.2701***	0.3201***	0.2838***	0.2734**	0.2711**	0.3138***
	(0.000)	(0.001)	(0.005)	(0.036)	(0.046)	(0.000)
log(RDpGDP)	0.1045**	0.1051*	0.0691	0.0594	0.0583	0.0975*
	(0.040)	(0.076)	(0.161)	(0.202)	(0.195)	(0.065)
log(EQI)	-0.7812***	-0.5778***	-0.4629***	-0.4975***	-0.5289***	-0.577***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
log(Pop)	0.067	0.0488	0.0196	0.051	0.0499	0.0431
	(0.109)	(0.254)	(0.605)	(0.184)	(0.191)	(0.257)
DEG3_rural	0.3334*	0.2559	0.0847	0.1884	0.1896	0.1173
	(0.088)	(0.160)	(0.629)	(0.301)	(0.292)	(0.518)
DEG2_inter	0.451**	0.3758**	0.2526	0.2175	0.180	0.2537
	(0.015)	(0.023)	(0.123)	(0.170)	(0.241)	(0.146)
Indirect						
Land_border	0	0	0.1187*	0	-0.0071	0.3602*
			(0.072)		(0.686)	(0.095)
Sea_border	0	0	0.098	0	-0.0085	0.3256
			(0.177)		(0.647)	(0.182)
log(GDPpc)	0	0	-0.1569	0	0.0635*	-1.2515**
			(0.109)		(0.066)	(0.032)
log(SumPayMod)	0	0	-0.0091	0	0.0026	-0.0493
			(0.289)		(0.280)	(0.100)
EU15_dummy	0	0	0.2367**	0	-0.0592	0.7805**
			(0.022)		(0.101)	(0.029)
log(RDpGDP)	0	0	0.0577	0	-0.0127	0.5344
			(0.180)		(0.244)	(0.142)
log(EQI)	0	0	-0.3994***	0	0.1169**	-0.1942
			(0.004)		(0.024)	(0.660)
log(Pop)	0	0	0.0163	0	-0.0109	0.0415
			(0.603)		(0.244)	(0.835)
DEG3_rural	0	0	0.0706	0	-0.0414	-0.4257
			(0.626)		(0.333)	(0.630)
DEG2_inter	0	0	0.2107	0	-0.0393	1.2351

	Model 3	Model 4 LPM	Model 5 SLM	Model 6 SEM	Model 7 SLEM	Model 8 SLEIM
			(0.143)		(0.277)	(0.221)
Total						
Land_border	0.2293***	0.2562***	0.2610*	0.0545	0.0255	0.5050*
	(0.002)	(0.001)	(0.051)	(0.496)	(0.683)	(0.062)
Sea_border	0.0468	0.0700	0.2155	0.0251	0.0306	0.4565
	(0.574)	(0.375)	(0.143)	(0.764)	(0.643)	(0.149)
log(GDPpc)	-0.1534	-0.1868	-0.3450*	-0.2592**	-0.2271**	-1.5571**
	(0.200)	(0.108)	(0.084)	(0.024)	(0.012)	(0.015)
log(SumPayMod)	-0.0095	-0.0096	-0.0200	-0.0115	-0.0095	-0.0692*
	(0.419)	(0.314)	(0.273)	(0.276)	(0.248)	(0.065)
EU15_dummy	0.2701***	0.3201***	0.5205***	0.2734***	0.2119**	1.0943***
	(0.000)	(0.001)	(0.007)	(0.036)	(0.049)	(0.008)
log(RDpGDP)	0.1045**	0.1051*	0.1268	0.0594	0.0456	0.6319
	(0.040)	(0.076)	(0.163)	(0.202)	(0.197)	(0.109)
log(EQI)	-0.7812***	-0.5778***	-0.8623***	-0.4975***	-0.412***	-0.7711
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.106)
log(Pop)	0.0670	0.0488	0.0359	0.051	0.039	0.0846
	(0.109)	(0.254)	(0.603)	(0.184)	(0.192)	(0.696)
DEG3_rural	0.3334*	0.2559	0.1553	0.1884	0.1481	-0.3083
	(0.088)	(0.160)	(0.627)	(0.301)	(0.291)	(0.746)
DEG2_inter	0.451**	0.3758**	0.4632	0.2175	0.1406	1.4887
	(0.015)	(0.023)	(0.125)	(0.170)	(0.244)	(0.172)

p-values in parentheses
$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Source: Own calculation.

Appendix –

Table A1: Test for equality of mean and median

	Valid cases		T-test for equality of mean			Mann-Whitney U-test for equality of median		
	NUTS2 regions with EGTCs	NUTS2 regions without EGTCs	NUTS2 regions with EGTCs	NUTS2 regions without EGTCs		NUTS2 regions with EGTCs	NUTS2 regions without EGTCs	
	N	N	Mean	Mean	Sig. (2-tailed)	Median	Median	Sig. (2-tailed)
GDPpc	111	170	23,497	31,446	neg. ***	22,900	31,350	neg. ***
SumPayMod	111	170	152,554,760	71,645,163	pos. ***	66,794,603	19,633,274	pos. ***
RDpc	97	144	403.55	652.76	neg. ***	213.30	459.85	neg. ***
RDpGDP	97	144	1.3964	1.7045	neg. **	1.1500	1.4900	neg. *
EQI	111	159	47.1221	59.4094	neg.***	47.0491	63.2881	neg.***
Pop	111	170	2,046,258	1,655,209	pos. **	1,477,202	1,441,543	n.s.
DEG3_rural	111	169	34.08	28.81	pos. **	37.00	30.00	pos. **
DEG2_inter	111	169	35.23	31.03	pos. **	32.00	30.00	n.s.
DEG1_urban	111	170	30.72	40.52	neg.***	27.91	34.70	neg. ***
gGDPpc	111	170	2.2087	-0.2906	pos. ***	2.1687	1.7037	pos. ***
UR	111	169	11.8937	7.9320	pos. ***	9.5000	6.5000	pos. ***

1) ***, **, * significant on the 99, 95, 90 percent level

For definition of variables and source of data see Table A3 below.

Source: Eckardt/ Okruch (2020b).

Table A2: Hypotheses, independent variables, and expected sign

Hypotheses	Independent Variable	Sign
Hypothesis 1a: A NUTS2 region that has an **administrative border** has a higher chance of at least one EGTC being adopted there.	Land_border	pos.
Hypothesis 1b: A NUTS2 region which has a **natural border** has a higher chance of at least one EGTC being adopted there.	Sea_border	pos.
Hypothesis 2: The **economically less developed** a NUTS2 region is, the higher the chances of an EGTC being adopted there.	log(GDPpc)	pos.
Hypothesis 3: The **more funding a NUTS2 region receives from the EU structural programs**, the higher the chances of at least one EGTC being adopted there.	log(SumPayMod)	pos.
Hypothesis 4: A NUTS2 region which is **part of a EU15 member state** has a higher chance of at least one EGTC being adopted there.	EU15_dummy	pos.
Hypothesis 5: The **more innovative a regional innovation system** at the NUTS2 level, the higher the chances of at least one EGTC being adopted there.	log(RDpGDP)	pos.
Hypothesis 6: The higher the **absorptive capacity** is in a NUTS2 region, the higher the chances of at least one EGTC being adopted there.	log(EQI)	pos.

Source: Own compilation.

Table A3: Definition and sources of data

Variable	Definition	Source
NUTS2 region with and without EGTC	Dummy variable with 1 = NUTS2 region with at least 1 EGTC in 2015, 0 otherwise	Committee of the Regions (2019)
Land_border	Dummy variable with 1 = NUTS2 region adjacent to a administrative land border, 0 = otherwise	Own compilation following Eurostat (2019)
Sea_border	Dummy variable with 1 = NUTS2 region with sea border 0 = otherwise	Own compilation following Eurostat (2019)
SumPayMod	Continuous variable measuring sum of modeled funding from EU structural programs in 2015, including the following funds: CF. ESF, ERDF, EAFRD	Own calculation based on the dataset "Historic EU payments - regionalised and modelled" retrieved on July 15, 2019 from https://cohesiondata.ec.europa.eu/Other/Historic-EU-payments-regionalised-and-modelled/tc55-7ysv, last updated on April 1, 2019.
log(SumPayMod)	Continuous variable measuring natural log of the sum of modeled funding from EU structural programs in 2015, including the following funds: CF. ESF, ERDF, EAFRD	Own calculation based on the dataset "Historic EU payments - regionalised and modelled" retrieved on July 15, 2019, from https://cohesiondata.ec.europa.eu/Other/Historic-EU-payments-regionalised-and-modelled/tc55-7ysv, last updated on April 1, 2019.
GDPpc	Continuous variable measuring GDP per capita at current market prices in EURO in 2015	Eurostat [nama_10r_2gdp] updated 26.02.2019, download 17.03.2019
log(GDPpc)	Continuous variable measuring natural log of GDP per capita at current market prices in EURO in 2015	Own calculation based on Eurostat [nama_10r_2gdp] updated 26.02.2019, download 17.03.2019
EU15_d	Dummy variable =1, if EU accession of the country before 2005, 0 otherwise	Own compilation.
RDpc	Continuous variable measuring intramural R&D expenditure per capita (Euro) in 2015, for France in 2013, for ITF2 Molise and ITI2 Umbria 2014 data	Eurostat [rd_e_gerdreg], updated 27.11.2019, download 29.11.2019
RDpGDP	Continuous variable measuring intramural R&D expenditure (Euro per GDP) in 2015, for France in 2013, for ITF2 Molise and ITI2 Umbria 2014 data	Eurostat [rd_e_gerdreg], updated 27.11.2019, download 29.11.2019
log(RDpGDP)	Continuous variable measuring natural log of intramural R&D expenditure (Euro per GDP) in 2015, for France in 2013, for ITF2 Molise and ITI2 Umbria 2014 data	Own calculation based on Eurostat [rd_e_gerdreg], updated 27.11.2019, download 29.11.2019
log(EQI)	Continuous variable measuring natural log of the European Quality of Government Index (EQI), 1 … 100 in 2013, a higher number indicates higher quality; since original data for 2013 follow former NUTS2 classification adjustments were made for the 2016 NUTS2 classification where possible, this concerns the following countries FR, HU, IE, PL, UK. For a detailed description see Charron/ Dijkstra/ Lapuente (2015; 2018)	Own calculation based on Regional data for 2013 from eqi_data_long17_v2.xlsx; The QoG EQI Data - Country Level (2010 & 2013 & 2017), https://qog.pol.gu.se/data/datadownloads/qog-eqi-data, download 01.08.2019
Pop	Continuous variable measuring population size in 2015	Eurostat [demo_r_d2jan], updated 18.03.2019, download 18.03.2019
log(Pop)	Continuous variable measuring natural log of population size in 2015	Own calculation based on Eurostat [demo_r_d2jan], updated 18.03.2019, download 18.03.2019
Deg3_rural	Degree of population density: Share of households living in rural areas in % in 2015	Own calculation based on Eurostat [lfst_r_lfsd2hh], updated 18.03.2019, download 18.03.2019

Table A3: continuing

Variable	Definition	Source
Deg2_inter	Degree of population density: Share of households living in towns and suburbs in % in 2015	Own calculation based on Eurostat [lfst_r_lfsd2hh], updated 18.03.2019, download 18.03.2019
Deg1_urban	Degree of population density: Share of households living in urban areas in % in 2015	Own calculation based on Eurostat [lfst_r_lfsd2hh], updated 18.03.2019, download 18.03.2019
UR	Continuous variable measuring unemployment rate in % in 2015	Eurostat [tgs00010], updated 11.03.2019, download 18.03.2019
gGDPpc	Continuous variable measuring growth rate of GDP per capita at current market prices in EURO between 2015 and 2016 in %	Own calculation based on Eurostat [nama_10r_2gdp] updated 26.02.2019, download 17.03.2019 and Eurostat [demo_r_d2jan], updated 18.03.2019, download 18.03.2019

Source: Own compilation.

Table A4: Simple correlation coefficients

	log(GDPpc)	log(SumPayMod)	log(RDpGDP)	log(EQI)	log(Pop)	DEG3_rural	DEG2_inter
log(GDPpc)	1						
log(SumPayMod)	-0.4481	1					
log(RDpGDP)	0.6384	-0.0818	1				
log(EQI)	0.6712	-0.3569	0.4195	1			
log(Pop)	0.0447	0.1226	0.273	-0.1005	1		
DEG3_rural	-0.4164	0.2475	-0.3341	-0.1502	-0.3892	1	
DEG2_inter	0.1635	0.0587	0.172	0.1474	-0.0938	-0.1105	1

Source: Own calculation.

Table A5: Variance inflation factor

Variable	**VIF**	**SQRT-VIF**	**Tolerance**	**R-Squared**
Border	1.16	1.08	0.8648	0.1352
log(GDPpc)	5.33	2.31	0.1876	0.8124
log(SumPayMod)	1.48	1.22	0.6757	0.3243
EU15_dummy	2.57	1.6	0.3894	0.6106
log(RDpGDP)	2.16	1.47	0.4628	0.5372
log(EQI)	1.97	1.4	0.5075	0.4925
log(Pop)	1.42	1.19	0.7057	0.2943
DEG3_rural	1.6	1.27	0.6241	0.3759
DEG2_inter	1.11	1.05	0.8992	0.1008

Source: Own calculation.

Table A5: Estimation results including spatial lags and autocorrelation

	Model 3 (Logit)	Model 4 LPM (OLS) (1)	Model 5 SLM (ML) (2)	Model 6 SEM (ML) (2)	Model 7 SLEM (ML) (2)	Model 8 SLEIM (ML) (2)
Land_border	1.310***	0.256***	0.134**	0.0545	0.0321	0.122**
	(0.003)	(0.001)	(0.048)	(0.496)	(0.683)	(0.033)
Sea_border	0.296	0.0700	0.111	0.0251	0.0385	0.110
	(0.572)	(0.375)	(0.124)	(0.764)	(0.643)	(0.106)
log(GDPpc)	-0.912	-0.187	-0.177*	-0.259**	-0.286**	-0.225**
	(0.205)	(0.108)	(0.077)	(0.024)	(0.011)	(0.013)
log(SumPayMod)	-0.0562	-0.00956	-0.0103	-0.0115	-0.0119	-0.0167**
	(0.422)	(0.314)	(0.267)	(0.276)	(0.245)	(0.032)
EU15_dummy	2.045***	0.320***	0.268***	0.273**	0.267**	0.264***
	(0.003)	(0.001)	(0.005)	(0.036)	(0.046)	(0.001)
log(RDpGDP)	0.621**	0.105*	0.0652	0.0594	0.0574	0.0633
	(0.046)	(0.076)	(0.161)	(0.202)	(0.195)	(0.161)
log(EQI)	19.82***	1.008***	0.778***	0.678***	0.626***	0.766***
	(0.000)	(0.000)	(0.001)	(0.003)	(0.004)	(0.000)
c.log(EQI)#c.log(EQI)	-3.116***	-0.203***	-0.155***	-0.150***	-0.147***	-0.170***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
log(Pop)	0.398	0.0488	0.0184	0.0510	0.0491	0.0404
	(0.115)	(0.254)	(0.605)	(0.184)	(0.191)	(0.251)
DEG3_rural	1.981*	0.256	0.0799	0.188	0.186	0.145
	(0.093)	(0.160)	(0.630)	(0.301)	(0.292)	(0.405)
DEG2_inter	2.680**	0.376**	0.238	0.218	0.177	0.174
	(0.018)	(0.023)	(0.124)	(0.170)	(0.241)	(0.277)
_cons	-29.16**	0.360	0.871	1.740	2.203	1.521
	(0.014)	(0.793)	(0.463)	(0.206)	(0.103)	(0.128)
W						
EGTC_dummy			0.587***		-0.376**	0.847***
			(0.000)		(0.020)	(0.000)
e.EGTC_dummy				0.720***	0.901***	-0.597***
				(0.000)	(0.000)	(0.001)
log(GDPpc)						-0.167
						(0.160)
log(RDpGDP)						0.0993
						(0.270)
log(EQI)						0.448***
						(0.003)
log(Pop)						-0.0223
						(0.727)
DEG3_rural						-0.244
						(0.390)
DEG2_inter						0.206
						(0.538)
var(e.EGTC_dummy)			0.137***	0.133***	0.120***	0.112***
			(0.000)	(0.000)	(0.000)	(0.000)
adj. R^2		0.230				
pseudo R^2	0.257		0.300	0.212	0.169	0.378
AIC	278.2	305.2	253.9	254.6	254.7	248.8
BIC	320.5	347.5	303.3	304.0	307.6	322.9
N	251	251	251	251	251	251

(1) OLS estimation with robust standard errors
(2) Maximum likelihood estimation with robust standard errors
p-values in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source: Own calculation.

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