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ABSTRACT

This paper estimates the impacts of opening of borders and intensity of cross-border cooperation (CBC) on regional growth across European border regions. The difference-in-difference estimations show that the opening of national borders for free movement of people is associated with a 2.7% increase in regional gross value added (GVA) per capita for the border regions of Europe. Using an extension of this estimation based on European Commission-supported CBC projects data for the 2007–13 period (through the INTERREG programme), the results suggest that the doubling of the number of CBC project partners (per 100,000 population) is correlated with an increase of 2.3% in regional GVA per capita. These results confirm the positive economic benefits of European integration by means of CBC. For future research efforts, these findings also encourage the research community to investigate more deeply the channels through which CBC affects the socioeconomic development of border regions.

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INTRODUCTION

Border region studies have been gaining momentum in the last few years, particularly in the regional studies and regional science fields. In their extensive literature review article, Makkonen and Williams (2016) report that the share of ‘border region’ studies within the regional studies literature is on the rise since the 1990s, and this concentration area is now considered as an important branch of regional studies, particularly in Europe and North America. This trend is also accompanied by an increasing interest in connecting the two separate literature streams originating in traditional border studies and regional studies. As a testimony to this, the title of the 2019 Regional Studies Association Conference was ‘Pushing Regions beyond their Borders’. This conference also hosted a special session co-organized by the Association of Borderland Studies to seek ways to ensure more exchange between border studies and regional studies.

The rise of border region studies is being triggered by a series of high-impact political developments, including those related to the United States–Mexico border, the Brexit process in the European Union (EU), and more recently the re-emergence of territorial disputes in South

CONTACT

(Corresponding author)  kb438@cornell.edu

Department of City and Regional Planning, Cornell University, Ithaca, NY, USA.

Asia. On the policy-making side in the EU, the European Commission (EC) has recently been busy with formulating its new Cohesion Policy for 2021–27, and exerting a lot of effort to back up its policy preferences with empirical evidence. When it comes to Europe's border regions, the EC's (2015) cross-border cooperation (CBC) survey, and its 2016 study entitled 'Collecting Solid Evidence to Assess the Needs to be Addressed by INTERREG CBC Programmes' (EC, 2016a) are two pioneering pieces of work as part of its new empirical approach. The data collected and compiled under these two initiatives have already been used in several studies within a very short time after they become available to the scholarly community (Camagni et al., 2019; Capello et al., 2018a; Durand & Decoville, 2020).

The present paper represents an effort to contribute to this fast-developing empirical literature on border regions, albeit from a different angle. The existing empirical work on European border regions and CBC exclusively focus on quantifying the magnitude of border obstacles by using recently available data. This is a well-justified research orientation, particularly at a time when the spirit of open borders is strongly challenged (Votoupalová, 2020). In a way, border studies scholars try to show that the closing of borders would cost a lot not only to national economies in general but also to border regions specifically. However, for the sake of guiding the policy-making processes beyond the open–closed border dichotomy, the research needs to go one step further to explore the channels of impact of open borders on regional economic growth. This paper argues that CBC is one main channel of such an impact, and moves on to test the significance of this impact by using INTERREG-funded CBC projects data from the EC's 2007–13 programming cycle. In doing that, it also makes use of panel data on regional gross value added (GVA) per capita, which is a more robust indicator of economic development compared with population as used in previous similar studies (Brakman et al., 2012; Heider, 2019).

The paper engages with two complementary research questions. The first is: What is the impact of opening of borders (for free movement of people) on European border regions' economic growth? Based on a quasi-experimental evaluation, answering this question will lay the overall foundation for the paper to the extent we find evidence in favour of open borders. However, such a result would not be enough to make a judgment about the intermediary role of CBC in spurring economic growth. To analyse the role of CBC, we will proceed with the second question: What is the impact of intensity of CBC on economic growth for European border regions? Based on the premise that free movement of people is a key facilitator of CBC, this paper's findings would provide a more complete picture of the relationship between open borders, CBC and regional economic growth.

The remainder of the paper is structured as follows. The next section is a general literature review that focuses on the consequences of bordering and the role of CBC in spurring growth in border regions. The following two sections take up the above-mentioned research questions individually. Each of these analytical sections describes their data and model specifications, then discusses the respective empirical results within their own context. The last section consolidates the results and proposes some ideas for future research. As this paper is of interest not only to researchers but also to CBC policy practitioners, readers will probably forgive the deliberate intention here to use non-technical language, particularly when interpreting the empirical results.

BORDERING, CBC AND REGIONAL GROWTH

This paper sits at the intersection of three literature streams. Among the three, the first is the most widely studied focusing on the economic consequences of bordering between neighbouring sovereign states. The second and third streams are part of the European studies literature. One part of the European studies literature deals with the relationship between Europe's

regionalization process and the intensification of CBC across the continent since the Second World War. The other one aims at measuring the contribution of CBC activities to the development of European border regions. This paper tries to relate these areas to each other in order to understand the specific role of CBC as a development policy tool within the overall context of European integration. The review of the first literature stream would guide our paper from a macro-perspective by looking at the overall connection between bordering and development in border regions. The review of the second and third streams is to obtain a grasp of what we know about the role of CBC in defining a causal chain from European integration to local development. Below is a general review of the three literature streams.

There has been a long-time interest in analysing the impact of national borders on regional economic outcomes. Following the formation of new borders across Europe in the aftermath of the First World War, Christaller (1933) observed that border cities could only develop limited hinterlands, which disrupts the orderly arrangement of the urban hierarchy according to his well-known central place theory. Another prominent regional scientist, Losch (1940), applied location theory to the study of the borders in mathematical terms for the first time. He basically assigned an additional distance to borders as he considered borders as an artificial distorting element for trade. Though borders were not the primary interest of Christaller and Losch, their contribution can be considered as an early sign of the relevance of border studies to regional science from the very beginning. In parallel to the growing policy focus on border regions triggered by the post-Second World War regionalism momentum, particularly in Europe, Hansen (1977, 1983) approached the same subject from the standpoint of economic backwardness of border regions. He emphasized the need to develop a policy-relevant theory of border regions. Since then, the quantitative branch of the border region studies has grown with a heavy focus on the EU example, particularly after the establishment of the EU's common market and a common visa regime in the Schengen Area. Besides, the signing and implementation of the North American Free Trade Agreement (NAFTA) intensified the scholarly debates along the same lines, particularly in North America. Coming to today, regarding the geographical focus of existing border region studies, Europe and North America together represent nearly 90% of all academic work (Makkonen & Williams, 2016).

Regional trade has been at the heart of discussions on the economic consequences of borders. As a pioneering study in this field, McCallum (1995) used a gravitational framework model to estimate the impact of the Canada–US border on regional trade patterns. Contrary to many of his contemporaries, he believed that national borders continue to matter despite the trend towards easing trade restrictions at that time. McCallum found that trade between two Canadian provinces is more than 20 times larger than trade between a Canadian province and an equivalent US state. A later study by Anderson and Van Wincoop (2003) challenged this estimation on the grounds of omitted variables bias. By using an extended version of McCallum's gravity equation with the inclusion of new trade barrier variables in addition to physical distance, they founded that national borders reduce trade between industrialized countries only by 20–50%. Despite the huge difference between the two estimates, the consensus that national borders still matter was largely endorsed by the research community (Andersen, 2010; Hillberry & Hummels, 2002; Persyn & Torfs, 2016). New economic geographers joined this conversation by analysing the driving forces of concentration and dispersion of economic activities across borders. In this line of research, Petrakos and Topaloglou (2008) theorized that geography is a key determinant of the level of cross-border trade and investments. They examined the spatial dimension of cross-border economic activities by studying the interaction between neighbouring city groups, and concluded that economic activities tend to concentrate in cross-border regions where geographical distance is moderate between major urban centres. As discussed by Niebuhr (2004), this is related to the formation of new demand linkages originating from locations that can serve large cross-border markets at relatively low transportation

costs. The empirical findings of Niebuhr (2004) and Petrakos and Topaloglou (2008) also supported the idea that Europe's more central border regions benefit more from macro-integration in comparison with its external border regions (bordering non-EU countries). More recently, Brakman et al. (2012) and Heider (2019) also confirmed the spatial heterogeneity of integration effects on population growth. Brakman et al. (2012) found a positive effect of EU enlargement along Europe's integrating borders, particularly for large regions and cities that are located within a 70 km range from national borders. Heider's (2019) results showed differences along the German–Polish and the German–Czech borders. In essence, these results imply that national borders still matter, but more importantly, to what extent it matters is a question of who neighbours whom.

Until the last few years, the literature was dominated by studies that focus on demand-side effects of open borders. However, the recent focus shifted more to the understanding of supply-side effects. This emerging literature received a significant boost right after the compilation of a large cross-border regional data set as part of the EC's (2016a) assessment of the INTERREG-funded CBC programmes. It is now one of the most active areas of empirical research on CBC in Europe. A recent study by Capello et al. (2018a) offers a good summary and discussion of this new research orientation. These authors go back to original cross-border research question regarding the impact of being located along a border. Even though their research question is not new in border region studies, their methodology is very different from the above-mentioned past approaches. They propose a new econometric methodology to measure supply-side border effects including traditional production factors (i.e., labour and capital) and intangible assets such as interpersonal trust and local identity. Besides, this methodology helps them break down the separate effects of physical, institutional and cultural differences across borders (Capello et al., 2018b). Their results suggest that cross-border cultural obstacles are the most critical barrier to European border regions' growth. In a follow-up study on the same topic from a formal institutional viewpoint, Camagni et al. (2019) also argue that legal and administrative barriers still affect the economic growth of European border regions despite the formation of the European Single Market. They estimate that removing legal and administrative barriers would allow European border regions to be 8.7% richer than they presently are. In reaching this conclusion, they mainly discuss the role of border regions' limited access to intermediate goods markets, as well as discontinuities in cross-border knowledge exchanges and transportation links.

To the best of the author's knowledge, previous research efforts have not specifically looked at the impact of the free movement of people on European border regions' growth. Essentially, a visa-free travel regime represents a fairly advanced stage of macro-regional integration beyond free movement of goods and capital. Following Martinez's (1994) borderlands typology, a free-travel regime makes national borders 'integrated' rather than 'interdependent'. While interdependency is mostly confined to economic matters, integration encompasses all aspects of cooperation, including social and environmental spheres. In this regard, both in academia and policy circles, the Schengen agreement is celebrated as a cornerstone of the European construction project, despite the recent political challenge from the refugee crisis (Evrard et al., 2020; Staudt, 2017). Since its effectiveness in 1995, the Schengen agreement grew to include 26 member nations, where more than 400 million people can normally travel without any restriction (Davis & Gift, 2014). The EC's (2015) CBC survey reports that a majority of respondents (53%) in European borderlands have travelled to a neighbouring country in their own cross-border region. In terms of scholarly interest, Votoupalová's (2020) literature review on Schengen-related research highlights that scholars tend to study the EU's Schengen experience mainly from the perspective of its security implications. The same paper mentions that the majority of these publications are case studies, which makes it difficult to draw general conclusions about Schengen. It is also worth noting that the existing large-sample comparative

studies are mostly undertaken to understand the contribution of Schengen to trade across the entire EU (Chen & Novy, 2011; Davis & Gift, 2014). They do not differentiate the impact of Schengen on specific type of regions such as border regions. Therefore, our current level of knowledge is inadequate to understand the relationship between opening of borders for the free movement of people and the economic growth in European border regions.

The second relevant literature strand mentioned above focuses on the contribution of European integration process to the intensification of CBC activities. This contribution has been realized in two complementary ways, one being more top-down and the other bottom-up. Regarding the first, at the EU level, the EC has been providing continuous financial support for CBC activities under its INTERREG programme since 1990 (Organisation for Economic Co-operation and Development (OECD), 2013). According to the latest data from the EU's CBC projects database (i.e., the KEEP database), the INTERREG programme has already funded more than 20,000 projects since its inception (KEEP, 2019). Besides, regarding the EU's soft policy measures, the European Grouping for Territorial Cooperation (EGTC) regulation allows European CBC actors to establish their own cross-border entities with a recognized legal personality under EU law (EC, 2018a). This makes it easier for them to formalize their CBC efforts. More recently, the EC has also been working to launch a new legal tool called the European Cross-Border Mechanism, which would allow CBC players to apply the administrative rules of their neighbouring counties for the sake of managing CBC projects without much legal complexity (EC, 2018b). As for the second channel of influence, which is more bottom-up driven, European local border actors have also been very active since 1950s with the aim of institutionalizing their cross-border relations. Since the establishment of the first *Euroregion* (independent cross-border entity) on the German–Dutch border in 1958, more than 200 independent cross-border entities have become operational across Europe (Association of European Border Regions (AEBR), 2020). As they grew in numbers and capacity, these entities emerged as the EC's new partners in implementing its regional policy measures that have implications on European border regions (Perkmann, 2003).

The positive relationship between the EU's further integration and the scaling-up of CBC activities is a well-supported argument without much controversy (Grix, 2001; Nadalutti & Kallscheuer, 2017; Perkmann & Sum, 2002). Several case studies lend support to the argument that these two processes go hand in hand (Brunet-Jailly, 2004; Casula, 2005; González-Gómez & Gualda, 2020; OECD, 2013; O'Dowd et al., 2004; Sielker, 2016). The fact that INTERREG was elevated into one of the major goals of EU Cohesion Policy in 2007 is in itself a supporting proof that CBC is central to the very existence of the EU (Medeiros, 2018). The new decade's first issue of the *European Planning Studies* journal is a special issue, taking a deep dive into the planning aspects of CBC based on several case studies. Its opening article by Niernaber and Wille (2020) makes the same point by emphasizing that CBC is an important tool to overcome a variety of forms of populist political tendencies in Europe. In support of this argument, Evrard et al. (2020) highlight that the recent temporary reintroduction of border controls in the Schengen Area has disrupted CBC in Europe's internal border regions. To put it in few words, the results from case studies are very supportive of the argument about the positive role of European integration on CBC. Having said that, there are some potential new research avenues in this literature stream. In order to provide a more consistent analytical framework across different cases, new approaches such as game-theoretic models can be incorporated into future studies.

Coming to the third literature strand that we engage with, the contribution of CBC to the development of border regions is an active area of study particularly for policy-making purposes. This literature is situated within a broader body of literature that deals with the outcomes of EU enlargements and Cohesion Policy interventions from the perspective of interregional development disparities and trade (Bachtler & Wren, 2006; Crescenzi & Giua, 2020; Ezcurra et al.,

2007; Fratesi, 2016; Gaspar & Leite, 1995; Kaminski & Ng, 2005; Pellegrini et al., 2013). Acknowledging that the results from this massive literature are far from being consistent, as rightly pointed out by Fratesi and Wishlade (2017), for the purposes of this paper we will only review the studies that relate their findings to border regions. In fact, the current literature on this niche topic is still scarce to understand in what ways CBC leads to developmental outcomes. Nevertheless, this discussion has an increasing policy-relevance especially these days when the EC is busy with formulating its Cohesion Policy for the post-2020 period (Loewen, 2018). Indeed, it would continue to be equally important because the EC's future programming efforts would need inputs from such studies.

Among the first studies along these lines of interest, we can mention Mora et al. (2011) who explore the impact of regional membership in *Euroregions* on the spatial distribution of economic activities across the EU. This study is based on the theory that cross-border neighbourhood effects have a role in explaining regional specialization patterns in the EU. Their findings from a spatial econometric analysis support the fact that *Euroregion*-mediated CBC activities have a quantitative impact on the specialization of economic activities in cross-border regions. A later study by Xheneti et al. (2013) also analyses the connection between CBC and developmental outcomes by looking from the angle of informal entrepreneurial activities. Using qualitative data from interviews in 10 regions, their results show that the informal CBC activities in the EU's central (internal) border regions tend to turn into more substantial forms of entrepreneurial activity with positive economic benefits. A more recent study by Darvas et al. (2019) take up the same subject to understand the value addition that CBC activities bring to border regions. In a regression-based analysis, they use a direct measure of CBC intensity based on actual project implementation records of the INTERREG programme (i.e., the KEEP database). According to their results, CBC projects unlock growth in a much more effective way than the other projects that do not involve cross-border partners. They argue that CBC leads to efficiency gains by means of knowledge spillovers that go beyond the scope and timespan of INTERREG-financed projects.

As one would expect, there have been a lot of efforts on the EC side to analyse the benefits of INTERREG-financed CBC projects. In 2010, the INTERREG III ex-post evaluation study tried to answer the question whether CBC initiatives contribute to the EU's harmonious development. A similar evaluation study was repeated in 2016 for INTERREG's 2007–13 financing term. The two reports mainly confirmed the positive results of INTERREG interventions and came up with recommendations for the next programming period. However, these reports can be considered more as big-picture evaluations rather than pure empirical research. As Bergs (2012) notes, the developmental impacts of CBC have not been empirically examined to a large extent because of data limitations. Berg tried to address this limitation by using survey data from the EC's (2010) ex-post evaluation study. He used a regression model to test the impact of CBC on interregional disparities and integration of markets. This model included a set of explanatory variables that measure the scope and strength of CBC activities based on the INTERREG implementation data. His results implied that the major determinants for cross-border integration are related to a set of factors that are outside the scope of INTERREG programme (e.g., intra-industry trade patterns, monetary union and Schengen). He argued that there is no significant relation between the strength of CBC and regional economic outcomes through the INTERREG channel.

These contradictory results suggest that the jury is still out regarding the strength of a direct link between CBC and regional economic growth. The EC-initiated evaluation studies reveal the positive effects of CBC, whereas large sample comparative studies show mixed results. Besides, when interpreting the findings, drawing a rigid line between INTERREG and other aspects of European integration (e.g., free movement of people) prevents us from seeing the big picture. The EU's Cohesion Policy and its deepening integration efforts essentially

complement and reinforce each other, laying the necessary foundation for enhanced CBC activities. Considering these gaps in the CBC literature, this paper will start by testing whether the EU's macro-regional integration process makes a positive contribution to the development of European border regions. If yes, it will then go on to investigate whether CBC is one of the main channels of such contribution. The next two sections will seek answers to these questions by following a two-stage analysis. This approach helps us connect the missing links between the three literature domains that were briefly reviewed above.

MEASURING THE IMPACT OF OPENING OF NATIONAL BORDERS

This section compares European border regions' economic growth before and after the opening of national borders in order to understand whether they benefit from an open border regime. In doing so, the paper specifically focuses on the actual implementation of the Schengen agreement for each specific border region rather than considering their respective countries' admission to the EU. This would provide a fine-grained observation of the reality of open borders in connection to the CBC because such cooperation depends heavily on direct human-to-human interactions and cross-border travels. Furthermore, if we do not make a distinction between the time of joining the EU and the time of opening of borders, our results will be contaminated because these two events are not necessarily the same. For example, some countries are part of the Schengen Area without being an EU member. The most well-known examples of this category are the member states of the European Free Trade Association (EFTA). Besides, for new EU members, there is a certain time lag between joining the EU and implementing the Schengen agreement in practical terms. In the case of the EU's largest enlargement in 2004, this time lag was more than three years (EU, 2019). In fact, at the time of writing, there are still four EU member states (from the latest three enlargements) that do not belong to the Schengen Area in addition to another two cases of voluntary opt-outs (i.e., pre-Brexit UK and Ireland). This complexity suggests that unless we specify the actual opening of borders for the free movement of people, we will not be able to measure the impact of European integration on border regions precisely. For the reasons mentioned above, when we use the phrase 'opening of borders' in this paper: it specifically refers to the abolition of border controls for people.

Our empirical strategy in this section is based on a difference-in-differences design that compares European border regions' per capita output before and after the opening of borders. However, before talking more about the model specification, it would be good to present further information about the nature and sources of data used in the study. To start, the list of European border regions is obtained from the EC's 'border needs' database, which was developed as part of the EC's (2016a) needs assessment study for the INTERREG-funded CBC programmes. The list has 617 individual NUTS-3 regions (according to the NUTS 2013 classification), which include land and maritime borders. As the second main data source, regional GVA data are sourced from the EC's Urban Data Platform for the 1990–2015 period (Urban Data Platform, 2019). These data are disaggregated to the NUTS-3 level, and all monetary values are deflated to 2005 constant price euros. Total population data are also obtained from the same source, which is based on Eurostat statistics. As the next step, regional per capita GVA data are matched up to the list of border regions, which gives a total of 15,057 observations (for the entire timespan) for 584 individual NUTS-3 regions. Out of the full list of 617 regions, 33 did not match up because consistent GVA data were not available for the border regions of non-EU countries (e.g., Switzerland, Norway and Liechtenstein). These EFTA member states were in the original list despite their non-EU member status simply because they are included under EU-funded CBC programmes.

In the final step of data preparation, the data are coded for the dates of opening of borders for each individual border region (as 'open' or 'not open' regions at a specific year) at the NUTS-3

level. To do that, the actual implementation dates of the Schengen agreement for individual countries are taken into consideration based on the official records (EU, 2019). If a pair of neighbouring countries joined the Schengen Area on different dates, these countries' respective border regions are coded as 'open-border regions' at the later date. To give a specific example, in the case of the France–Italy border, the concerned border regions in both countries are coded as 'open' from 1997 onwards because Italy joined the Schengen Area in 1997, which is two years after the joining of France. For tri-border regions, the first opening instance (when at least two of the three countries join the Schengen Area) is accepted as the indicator of opening. A final adjustment is made to this data set for Denmark, Finland and Sweden because they abolished border controls at internal Nordic borders in 1958 long before the Schengen agreement (Turack, 1968). For the regions located along the internal Nordic borders, the implementation date of the Nordic Passport Union is recognized as the time of opening.

As Capello et al. (2018b) mention, the existence of borders is a quasi-natural experiment in economic geography. When it comes to the opening of borders in Europe, we can treat the timing of opening of a border as an exogenous event because this specific time is determined at a higher political level beyond the direct control of cross-border neighbouring regions. The fact that countries are usually joining the Schengen Area as a group on a same date supports the validity of our exogeneity assumption from a practical perspective. For example, following the EU's largest expansion in 2004, a total of nine countries joined the Schengen Area on the same date in 2007. These countries' possibly different pace of adjustment to the Schengen rules did not accelerate or slow down their membership process. To put it simply, we have the opportunity to design quasi-experimental studies to test the impact of open borders on European border regions. For this purpose, this paper uses a regression formulation of the difference-in-differences approach as our baseline model in the following form:

$$\log(GVA \text{ per capita})_{it} = \beta(\text{open border status})_{it} + \lambda_t + \mu_i + \varepsilon_{it}$$

where the dependent variable is the natural logarithm of regional GVA per capita in region i at time t ; the coefficient β is the estimator for our indicator variable, which is coded open (denoted as 1) from the time of joining the Schengen Area onwards; the coefficient λ captures overall time trends (year fixed effects); the coefficient μ represents regional fixed effects; and ε_{it} is the random error term. Theoretically, we expect a positive effect of the opening of borders on regional GVA per capita for the border regions after accounting for their inherent differences (by including

Table 1. Impact of the opening of borders on regional gross value added (GVA) per capita.

	Model 1 (baseline)	Model 2	Model 3
Coefficient on the 'open border' indicator	0.0269 (0.0092)***	0.0246 (0.0052)***	0.0232 (0.0054)***
R^2 (within the panel units)	0.5905	0.7590	0.8292
Time fixed effects	Overall	Country-specific	Region-specific
Number of observations	15,057		
Number of groups (unique regions)	584		
Average observations per group	25.8 ^a		

Notes: ^aThe panel is not fully balanced since regional GVA data are available for Croatia from 1995 onwards.

The outcome variable is natural-logged GVA per capita in constant 2005 euros.

All models include regional fixed effects (at the NUTS-3 level).

Standard errors are robust and clustered on region.

***Significant at the 99% confidence level.

Source: Author's elaboration.

regional fixed effects). For the sake of explaining the logic of this model without using technical language, we need to mention that the model assumes a non-changing growth trend for European border regions if they did not experience the event of opening of borders with their immediate cross-border neighbours. This is essentially a critical assumption to be checked later (i.e., parallel trends assumption) after discussing the results, which are presented in Table 1. Table 1 also contains the results from two alternative approaches that are basically the extensions of the baseline model. The first alternative model includes county-specific time trends rather than global time trends; and the second alternative includes region-specific time trends rather than the global. As we add country and region-specific time fixed effects, time-variant drivers of economic growth are also indirectly introduced to these models. The results from running these two alternative regressions show that the estimated coefficients on the open border indicator are not statistically different from each other as well as from that of the baseline model. However, the two alternative models do not pass the parallel trends test while it is not the case for the baseline model (to be detailed below). Here, as we control for time trends at a smaller geographical scale, the trends themselves are affected more by the policy shock, which leads to an over-controlling bias and a violation of the parallel trends assumption. For this reason, in this part of our empirical analysis, the findings from the baseline model are preferred over the others.

According to our baseline model estimates, the opening of national borders for free movement of people is associated with nearly 2.7% increase in regional GVA per capita for European border regions. The two alternative models yield more conservative results, but they are not statistically different from the baseline estimation. If we make a comparison with another recent finding in the literature, Camagni et al. (2019) estimate European land border regions' total output loss due to legal and administrative border barriers at 8.7%. However, it is worth mentioning that the two studies are not directly comparable. Camagni et al. (2019) follows a regression-based simulation procedure by using regional gross domestic product (GDP) data from 2008 to 2013. Our paper uses a quasi-experimental design for a larger time span from 1990 to 2015. Besides, in the 2019 paper, the definition of legal and administrative differences is much wider than our definition of border status. To measure legal and administrative differences, it uses data from the EC's (2015) CBC survey where participants were asked about their perception of cross-border differences on different issues. Therefore, the estimated impact for all kinds of perceived legal and administrative differences is expectedly much higher than the individual impact of joining the Schengen Area, which is something confirmed by our results.

As emphasized above, we need to test the validity of parallel trends assumption to be able to make causal claims based on our difference-in-differences model. To do that, we employ a form of event study approach proposed by Cerulli and Ventura (2019). This method starts with generating a series of dummy variables for the lags and leads of each event of opening of borders. These dummy variables then replace our indicator variable in the baseline model in order to estimate the pre- and post-intervention effects. For the parallel trend assumption to hold, we expect the pre-intervention dummies not to be statistically significant. This is simply because it is a sign of no change in economic trends before the borders are opened. However, we expect the post-intervention dummies to be significant and positive in order to confirm the validity of our results. Since our border status indicator turns to 'open' at different times for different regions, we have relatively few cases at extreme time periods before and after opening of borders. Therefore, for the sake of ensuring statistical power for the test, we limit our event study to a 15-period window. This means we use a seven-year period before opening of the borders, and another seven-year period after the opening (Figure 1). If we extend the analysis to more than seven years, the eight-year turns insignificant (results not reported here but they are available upon request), implying that the impact is fading out at a certain point.

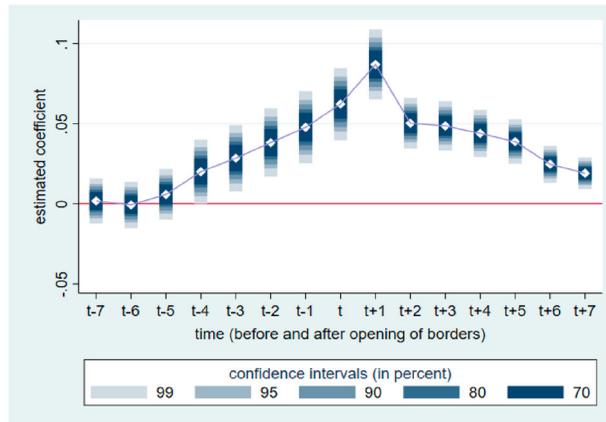


Figure 1. Impact of the lags and leads of opening of borders.

The test results bring out two important points. First, the immediate three years before opening of borders are statistically different than zero at conventionally accepted levels. This is a clear case of an anticipatory effect of opening of borders in the EU case. A positive impact starts well in advance, which is actually not surprising because it normally takes some time for new Schengen countries to start implementing the Schengen agreement after they sign it. As mentioned above, in the case of the EU's 2014 enlargement, the transition time for implementing the agreement lasted almost three years from 2004 to 2007. For the earlier Schengen members, this transition time ranged from two to eight years. Our results are very much in line with the reality on the ground, indicating a three- to four-year anticipatory effect on average. This suggests that the transition periods are characterized by gradual relaxation of border controls on the administrative side. Moreover, it suggests that border actors (including public agencies, businesses and civil society) are proactive in getting themselves ready for the post-Schengen era to make the maximum benefit out of it.

As the second important point from our analysis, the results also confirm the hypothesis of positive impact of opening of borders on regional economic growth. The seven-year period after opening of borders is statistically different from zero with positive estimated coefficients. The positive impact reaches a peak at the first year after opening of borders and continues on a declining trend in the following years. The positive impact apparently fades out over time like any other policy intervention in that nature. Here it is also worth analysing the possible impact of EU membership on top of opening of borders. When our baseline model uses an EU membership indicator (dummy variable) instead of the open border indicator, the estimated coefficient on the EU membership indicator is 0.141 and significant at the 99% confidence level (the results are presented in Table 2). This means that EU membership is associated with a 14.1% increase in regional GVA per capita, which includes not only the impact of open borders but also other direct and indirect benefits coming out of EU membership. To investigate this impact further, if we use a triple differences model in order to differentiate the impact of open borders from that of EU membership, the results show that EU membership is correlated with a 13.7% increase in GVA per capita even for the category of not-yet-open regions for free movement of people (e.g., those along the Romanian–Hungarian border). Therefore, we can conclude that an open border policy makes a sizable economic impact on European border regions only if it is part of a full EU membership process.

Table 2. Impact of European Union membership on regional gross value added (GVA) per capita.

Model 1 (difference-in-differences estimation)	
Coefficient on the 'EU membership' indicator	0.1413 (0.01229)***
R^2 (within the panel units)	0.6324
Model 2 (triple difference-in-differences estimation)	
Coefficient on the 'EU member' with 'not-yet-open border' category	0.1372 (0.01298)***
Coefficient on the 'EU member' with 'open border' category	0.1403 (0.01386)***
Coefficient on the 'non-EU member' with 'open border' category	-0.0325 (0.02173)
R^2 (within the panel units)	0.6329

Notes: The number of observations is 15,057 in both models. The panel is not fully balanced since regional GVA data are available for Croatia from 1995 onwards.

The outcome variable is natural-logged GVA per capita in constant 2005 euros.

Both models include time fixed effects and regional fixed effects (at the NUTS-3 level).

Standard errors are robust and clustered on region.

***Significant at the 99% confidence level.

Source: Author's elaboration.

ANALYSING THE ROLE OF CBC IN REGIONAL GROWTH

Our analysis in the above section has provided empirical evidence for the argument that the opening of borders for free movement of people as part of the EU's deepening regional integration makes a positive contribution to its border regions. Moving from this basis, the next step is to understand the mechanisms by which this macro-integration process affects regional economic growth. Several mechanisms could possibly explain this relationship. To name a few, more integrated cross-border labour markets, increasing cross-border trade and investments, and enhanced knowledge spillovers are among the first to consider. Although all these channels deserve a closer look to understand their unique value addition, our ability to study their individual role is quite limited due to data availability constraints at cross-border regional level.

On the positive side, the project database of the EC's INTERREG programme offers an opportunity to analyse the growth dynamics of border regions by focusing on the role of CBC as a potential channel of impact. We have publicly available data on CBC projects that are stored in the *keep.eu* database (henceforth KEEP). This extensive database is a reliable source that can help us quantify the intensity of CBC across the EU because the INTERREG programme has been actively supporting CBC projects since 1990s. These projects cover a wide spectrum of themes, including entrepreneurship, research and development, natural resources management, capacity-building, as well as hard infrastructure such as transportation and energy (EC, 2016b). Therefore, using a measure of the intensity of CBC based on the available project statistics from the KEEP database is a plausible way to explore the impact of CBC on border regions. By definition, CBC is a wide-encompassing term that includes all forms of institutionalized collaboration between contiguous subnational actors across national borders (Perkmann, 2003). This means that CBC, in and of itself, can be considered as a primary mechanism to explain the impact of the EU's macro-integration process on the economic growth of border regions.

In the KEEP database, the CBC projects data are categorized by the EC's seven-year cycles for programme financing. The latest fully completed INTERREG cycle is for the 2007–13

period, which accordingly marks the beginning of our time frame for the analysis. Using this time frame, we need to quantify the intensity of CBC for all border regions so that we can investigate its role in regional growth. To do so, we use the number of CBC projects partners for each border region (after normalizing by population) as a proxy for CBC intensity because it captures these projects' overall stakeholder mobilization impact on the ground. As mentioned above, we have CBC project statistics for the 2007–13 period as a whole, but not for the individual years within that period. For this reason, in this part of the analysis we are not able to follow the fixed effects model approach of the preceding section anymore. This is simply because we do not know the yearly variation of CBC intensity within individual border regions. As an alternative, we can use a generalized least square (GLS) random effects model, which is a special kind of pooled regression that accounts for serial correlation. Here it is worth noting that the moment we use a random effects model, the need arises to control for potential confounding factors due to omitted variable bias concerns. Considering all these aspects, we define our model in the following form:

$$\log(GVA \text{ per capita})_{it} = \alpha + \beta \log(\text{intensity of CBC})_i + \delta X_i + \lambda_t + \varepsilon_{it}$$

where the outcome variable is the same as in the previous model; i denotes the region; and t denotes the time period. In this model, we are not including the pre-2007 observations since our consistent INTERREG data are available after 2007. We also need to keep in our sample only the regions that have open borders (according to our definition in the previous section) during our reference period because our ultimate aim is to understand the effect of opening of borders on regional growth through the CBC channel. To continue with the components of our model, the coefficient α is a constant in the equation. The coefficient β is the estimator for the natural logarithm of our principal variable of interest, which is the number of CBC project partners per 100,000 population (i.e., intensity of CBC). The term X represents a set of control variables that vary by region. They include the regions' geographical characteristics, traditional growth factors, knowledge-based growth factors, as well as agglomeration economies, cultural assets and country dummies to account for cross-country heterogeneity. These controls are selected in line with the literature findings (Camagni et al., 2019; Capello et al., 2018a; Cuaresma et al., 2014; Hascic & Mackie, 2018; World Bank, 2009). Their data are sourced from the EC's (2016a) border needs database. In our model, time dummies are also included to account for variation across years; and ε_{it} stands for the random error term. Table 3 presents the model results along with additional information on original data sources for the controls. The results show that the doubling of number of CBC project partners per 100,000 population (i.e., an increase of 100% in our measure of CBC intensity) is associated with an increase of nearly 2.3% in regional GVA per capita for European border regions.

We would argue that our estimation captures both the direct and indirect contribution of CBC because these cooperation engagements help border actors establish long-term partnerships that go beyond the duration and scope of individual projects. This point has already been made recently by Darvas et al. (2019) and the EC's (2016b) INTERREG post-evaluation report. However, defining and differentiating these direct and indirect roles would be subject to a separate study in future research. On this matter, possible factors of interest are productivity gains, cross-border investment trends, and population/labour force changes. It is possible that some European entrepreneurs from non-border regions are relocating part of their production facilities to border regions as CBC activities offer them a more conducive environment than before. It is also possible that new growth partnerships are emerging across national borders, where some regions mainly supply capital and know-how while their cross-border neighbours supply relatively low-cost labour. Besides, CBC activities can also give a boost to small-scale cross-border entrepreneurship activities as doing business on the other side of a border becomes

Table 3. Impact of cross-border cooperation (CBC) intensity on regional gross value added (GVA) per capita.

	Estimations	Remarks on the data sources
Intensity of CBC (natural-logged)	0.0226 (0.0100)**	Author's calculation based on INTERREG-financed CBC project statistics from the KEEP database, and regional population statistics from Eurostat
<i>Geographical characteristics:</i>		
Multimodal accessibility index	-0.1908 (0.0661)***	Interregional gap index constructed in EC (2016a) by using ESPON's 2006 data sourced from Spiekermann and Wegener (2006)
Border type	0.0182 (0.0297)	Indicator variable coded as 1 for maritime border regions and 0 for land border regions based on EC's (2016a) classification
<i>Labour/capital-based growth factors</i>		
Employment index	-0.0101 (0.0012)***	Gap index constructed in EC (2016a) by using Eurostat's 2015 employment statistics (to measure productive capacity needs)
Industrial activity index	-0.0047 (0.0016)***	Gap index constructed in EC (2016a) by using Eurostat's 2015 employment statistics
Saving propensity index	0.0007 (0.0007)	Gap index constructed in EC (2016a) based on the European Values Study 2008 results (to measure long-term saving needs)
<i>Knowledge-based growth factors</i>		
Human capital index	-0.0139 (0.0036)***	Gap index constructed in EC (2016a) by using Eurostat's 2011 educational attainment statistics
Patent application index	-0.0001 (0.0001)*	Interregional gap index constructed in EC (2016a) by using Eurostat's 2012 patent application statistics
<i>Additional controls</i>		
Social trust index	-0.0067 (0.0022)***	Gap index constructed in EC (2016a) based on the European Values Study 2008 results
Artificial (built-up) land cover index	0.0071 (0.0013)***	Index constructed in EC (2016a) by using Eurostat's 2006 land-cover statistics (included as a proxy for urbanization rate to capture agglomeration economies since built-up land dominates urban landscapes)
R ² (overall)	0.8823	
Number of observations	3769	
Number of groups (unique regions)	421	

Notes: The outcome variable is natural-logged GVA per capita in constant 2005 euros.

The regression includes country dummies and year dummies.

Numbers are estimated coefficients; numbers within parentheses are estimated standard errors.

Standard errors are robust and clustered on region.

* $p < 0.10$; ** < 0.05 ; *** < 0.01 (using two-tailed p -values).

Source: Author's elaboration.

easier. These are just some ideas to think about as part of a future research agenda. As new data become available from INTERREG's 2014–20 implementation, as well as from further efforts of cross-border data compilation, we can seek more precise answers to such questions.

It would also be an important contribution to the literature if we can integrate the two steps of our empirical investigation into a single model, subject to the availability of annual data at the cross-border regional level in the future. When possible, this would allow us to make better informed decisions about using fixed effects, random effects or cross-sectional models when analysing the impact of open borders and CBC on regional growth.

CONCLUSIONS

Border regions hold a special place in the study of European integration. These regions have their own challenges and opportunities that are often inherited from their unique histories. For the purposes of empirical investigation, the institutionalization of an EU-level CBC policy offers an opportunity to study the consequences of European integration from the perspective of border regions. With this aim in mind, this paper is structured around the following basic argument: A deepening macro-integration leads to more intense CBC, which in turn contributes to the further development of border regions.

Our literature review reveals that the first part this argument (i.e., the relationship between macro-integration and CBC) is already well supported by findings from several case studies across Europe. However, the second part of our argument remains understudied to a large extent. We also notice that the issue of European integration is often taken up as a story of EU enlargements, which limits our ability to establish causal relationships between macro-integration and local development. For this reason, we start our analysis with an exclusive focus on the specific events of opening of borders for free movement of people as they mark a critical step towards facilitating more CBC. Once the significance of the relationship between macro-integration and regional growth is tested, we move on to the second part of the analysis, where CBC comes into play as a possible driver of growth for border regions.

The econometric results in this paper provide support in favour of our argument. For European border regions, the instances of opening of borders explain a 2.7% increase in regional GVA per capita. Most importantly, this impact is largely facilitated by a country's membership process in the EU. According to our results, even before joining the Schengen Area in practical terms, European border regions start experiencing significant positive economic returns from their respective country's EU membership process. This means a country's membership in the EU itself has huge spillover effects on the economic development of border regions, which is an exciting area of further research to define and explain what these spillover effects are. Furthermore, we have evidence to believe that CBC intensity has a significant role in facilitating economic growth for border regions. In future studies, adding relevant controls from the second part of our empirical analysis into the difference-in-differences model would strengthen our confidence in these estimations. However, the current data limitations at cross-border regional level hinder our ability to do so. As of today, the only compiled sources of CBC data are the EC's (2016a) border needs database and the KEEP database (covering INTERREG-financed CBC projects). In both databases, due to the nature of the CBC programmes' seven-year implementation cycle, the data are not detailed down to individual years.

Our results have possible implications for policy-making in the EU. Our findings suggest that the impact of INTERREG-supported CBC activities goes beyond the scope of one-off projects. The impact is not limited to a few project actors at an individual level but extends to more institutions across borders. In order to unpack this proposition a bit more, it would be useful to use a cost-benefit analysis framework in future research. We know that CBC is difficult in the first place due to the existing administrative and cultural differences across national borders (Sousa, 2013). In other words, in the case of CBC, initial cooperation costs are higher than those of single-nation cooperation engagements. From a public policy viewpoint, what INTERREG is doing is basically lowering these entry costs, making the first engagement less costly. Once such cooperation is formed on a mutually beneficial basis, there is a good possibility that it moves on without external support at a certain point. In the course of time, these long-lasting relations can lead to further positive outcomes on a more stable development path by means of knowledge spillovers, cross-border investments, as well as productivity and efficiency gains. These are some possible mechanisms to explain the role of CBC in regional

growth. Our future research would shed more light on understanding the channels through which CBC contributes to the development of border regions.

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ORCID

Kadir Basboga  <http://orcid.org/0000-0001-8701-2714>

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