Analysis of the economic impacts of border-related measures taken by Member States in the fight against COVID-19

Final Report

Roberta Capello, Andrea Caragliu
September 2022

EUROPEAN COMMISSION

Directorate-General for Regional and Urban Policy
Directorate D – European Territorial Cooperation, Macro-regions, Interreg and Programme Implementation I
Unit D.2 – Interreg, Cross-Border Cooperation, Internal Borders

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Politecnico di Milano

Directorate-General for Regional and Urban Policy

2022

EN

Manuscript completed in September 2022

1st edition

Luxembourg: Publications Office of the European Union, 2022

PDF ISBN 978-92-76-61605-4 doi: 10.2776/973169 KN-08-22-344-EN-N

Table of Contents

List of abbreviations **7**

List of Figures **8**

List of Tables **9**

1. Setting the scene **10**

2. A methodology for measuring the impacts of partial closure measures preventing the diffusion of the virus **12**

3. Impacts of partial closures on border regions **14**

3.1. Results at European level 15

3.2 Results at NUTS3 level 16

3.3 Results by regional typologies 20

3.3.1 GDP losses due to partial closures by regional typologies 21
3.3.2 Manufacturing employment loss due to partial closures by regional typologies 22
3.3.3 Service employment loss due to partial closures by regional typologies . 23

4. A methodology for measuring the impacts of full closure measures preventing the diffusion of the virus **24**

5. Impacts of full closures on border regions **27**

6. Conclusions and policy implications **30**

References **32**

Technical Appendix **34**

A.1 Additional details on the methodology used to simulate the impact of partial closures **34**

A.2 Additional details on the methodology used to simulate the impact of full closures **61**

List of abbreviations

Acronym	Meaning
CBRs	**Cross-Border Regions**
CEECs	**Central and Eastern European Countries: all countries joining the EU since 2004**
COVID-19	**Coronavirus disease**
ESPON	**European Observation Network for Territorial Development and Cohesion**
EU	**European Union**
EU14	**Countries joining the EU prior to the 2004 wave of enlargement**
EUROSTAT	**Statistical office of the European Union**
MAN	**MASST at NUTS3**
MASST	**MAcroeconomic, Sectoral, Social, Territorial model**
MOT	**Mission Opérationnelle Transfrontalière**
NACE	**EU statistical classification of economic activities**
NUTS	**Nomenclature of territorial units for statistics**

List of Figures

Figure 1. Structure of the simulation procedure for partial closure measures 13

Figure 2. Share of NUTS3 GDP loss as a result of partial closures 17

Figure 3. Share of NUTS3 manufacturing employment loss as the result of partial closures 18

Figure 4. Share of NUTS3 service employment loss as the result of partial closures 19

Figure 5. Structure of the simulation procedure for full-fledged stay at home measures.....24

Figure 6. Share of NUTS3 GDP loss as a result of full closures (March – June 2020).....28

List of Tables

Table 1. GDP, manufacturing and service employment losses in Europe.....15
Table 2. Definition of agglomerated, urban, and rural regions.....21
Table 3. CBRs' GDP losses due to partial closure by regional typologies.....22
Table 4. Manufacturing employment loss due to partial closure by regional typologies23
Table 5. Service employment loss due to partial closure by regional typologies 24
Table 6. Assumptions for regional forecasts of GDP growth to December 2020 26
Table 7. GDP loss in Europe (March – June 2020).....27
Table 8. CBRs' GDP loss due to full closure by regional typologies (March – June 2020)29

1. Setting the scene

In Spring 2020, Europe has been severely hit, not as a first destination, but certainly with the most dramatic impact, by the first wave of COVID-19. While the exact origin of the virus as well as the identification of the first known case are a matter of dispute at the time this report is being drafted (WHO, 2022; Roberts et al., 2021; Felter, 2021), medical evidence suggests that Europe initially faced the hardest consequences. The virus circulated rapidly and its tragic consequences in terms of surges in mortality rates became very early clear.

This crisis prompted a rapid reaction by national authorities, who, first in Italy (9th March 2020), then in the rest of the EU, closed inter- and intra-national borders, and even citizens' urban mobility, while also prohibiting, with a few notable exceptions such as Sweden, public gatherings (Piccoli et al., 2020). In many cases, production plants in non-indispensable manufacturing activities were also temporarily closed, and a ban on all public gatherings was issued.

A prior MOT-commissioned study (Peyrony et al., 2021) provides a detailed account of the bilateral border closures following the "*Guidelines concerning the exercise of the free movement of workers during COVID-19 outbreak*" issued by the European Commission on 30 March 2020 and the "*Guidelines on EU Emergency Assistance in Cross-Border Cooperation in Healthcare related to the COVID-19 crisis*" adopted on 3 April 2020. The report documents a detailed and precise mosaic of restrictions to the free movement of people and freight, against treaties such as the Schengen agreement, signed in 1985 with the aim to abolish border controls in Europe.

The present report focuses in particular on areas mostly depending on cross-national economies, and therefore directly affected by policies limiting cross-Country movements, i.e. Cross-Border Regions (henceforth, CBRs). However, Spring 2020 witnessed a nearly **unprecedented dramatic example of an almost perfectly symmetric shock to European Countries**. The negative impulse to EU economies can be considered as fully exogenous, holding the theory explaining the emergence of COVID-19 as a consequence of a species spillover true. Its diffusion caused **a nearly universal reaction translating in plant closures, ban on public gatherings and events, and border controls that caused a severe macroeconomic downturn in all EU countries, with no exception, hitting almost all major components of aggregate income** (i.e. consumption, investment, exports, and imports). The only exception was represented by a major surge in public expenditure almost everywhere in Europe (Carraro et al., 2022), with the aim to react to the medical emergency and support with extra public budget the increased need for healthcare

financing on the one hand, and counterbalance negative labor market outcomes due to forced plant closures, on the other hand.

Because of the symmetric nature of the Spring 2020 closures, the authors of the present report simulated, in the absence of official EUROSTAT statistics at regional level, the costs of COVID-related closures in Spring 2020, taking both the border increase and the macroeconomic measures into account (Capello and Caragliu, 2021a; see also Section 4). In fact, **within this rather dramatic framework, border closures represent only a part of the whole story, the core of which is the diffusion of contagion-preventing measures to the macroeconomic sphere**.

In the aftermath of the first wave of closures, when in Summer 2020 many hoped that COVID-19 would be gone soon and for good (Middleton et al., 2020), early estimates of the severity of the economic damages caused by major closures suggested that the costs would be dire. Early assessments suggest a likely contraction of World GDP by a range between 3 per cent (IMF: Gopinath, 2020) and 5.2 per cent (World Bank, 2020).

The severity of the economic downturn caused some seriously questioning of the opportunity to renew such extreme measures in face of further waves of the pandemic. In fact, **subsequent lockdowns were in many ways much milder and were more unevenly distributed in the European territory**. For border regions, **this meant a less universal, or, in other words less stringent set of closures that did cause economic losses, which cannot nevertheless be directly compared to the universal measures described above**.

This report aims at providing an **assessment of the economic losses caused by both total and partial closure measures taken to limit the diffusion of the virus, the former between March and summer 2020, the latter after summer 2020**. Because of their nature, these costs are expected to be highest for border areas. More importantly, they are conceptually to be treated differently, **in that the macroeconomic factors characterising the universal closure are in the case of the partial closure not part of the story**. In fact, consumption resumed in Fall 2020 and took off in early 2021, prompting an early rebound that allowed most European countries to recover 60 to 70 per cent of GDP missed in 2020.

The present report therefore presents results on two main outcomes:

- **losses in terms of missed GDP and employment growth due to partial measures, net of the macroeconomic factors** that influenced the magnitude of losses to the Spring 2020 lockdowns;

- **losses in terms of missed GDP growth due to full measures, including the macroeconomic factors** that influenced the magnitude of losses during Spring 2020 lockdowns.

The rest of the report is organized as follows. Section 2 briefly introduces the method used to simulate losses due to partial measures; Section 3 illustrates the results of these simulations. In Section 4 we introduce the methodology for simulating the costs of full closures at NUTS2 level, and the way these will be brought to the NUTS3 level (baseline geography for Cross-Border Regions).[1] Results of these simulations are presented in Section 5. Lastly, Section 6 concludes and discusses possible policy implications stemming from our overall findings.

2. A methodology for measuring the impacts of partial closure measures preventing the diffusion of the virus

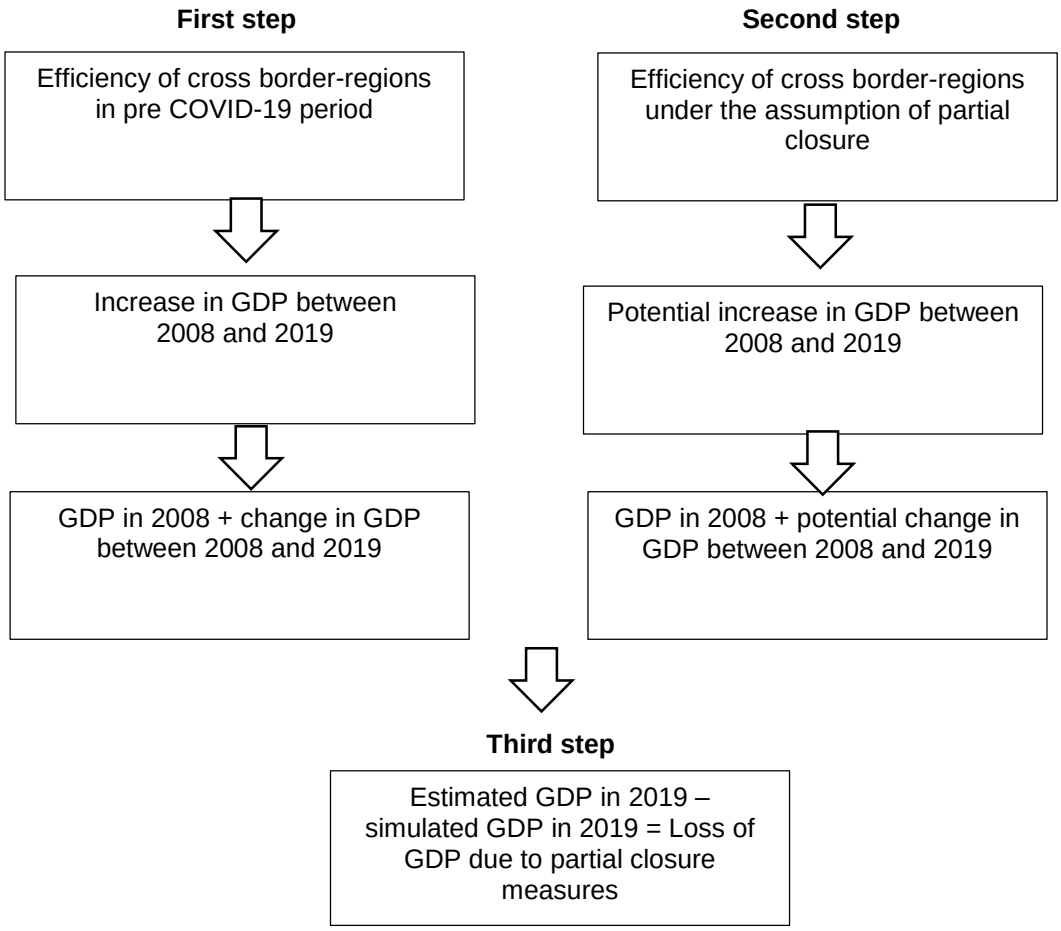
The methodology adopted to quantify the effects of partial closure measures preventing the diffusion of the virus finds its origin in Capello et al. (2018), specifically applied to the assessment of the impact of legal and administrative barriers in Camagni et al. (2017; 2019) and Caragliu (2022). Before presenting our main analyses, it is here important to lay down the main steps undertaken.

The method follows three steps (Figure 1):

1. we first estimate the efficiency of border-regions in a pre COVID-19 period, leading to an increase in GDP between 2008 and 2019, and obtaining the GDP at 2019 once the increase is summed up to GDP of 2008 (first step);
2. we then simulate what GDP would have been, if border regions would be higher as happened with the partial closures measures (second step);
3. lastly, we calculate the difference between the estimated GDP and the simulated one. This difference represents the **loss of GDP** due to the due to introduction of border control measures. The same procedure is applied to measure losses in **employment in manufacturing and services** (third step).

[1] Both in the case of partial and total closures, methods are described in details in the Technical Appendices (A.1 ad A.2, respectively) to this report.

Figure 1. Structure of the simulation procedure for partial closure measures



Source: Camagni et al. (2019), Authors' elaboration

Partial measures affected different types of barriers among countries. Legal and administrative barriers were drastically increased to contrast the free movement of people and goods, to limit contagions, and to keep track of the virus infections. Peyrony et al. (2021) has also vastly documented the spatial distribution of the increases in legal and administrative barriers being erected between Country couples in the wake of the pandemic. Border closures have been associated with a rise in the burden of paperwork associated with moving people and freight across borders. While a comprehensive account of all such measures goes beyond the scope of this report, it is important here to point at the guidelines for safe travelling in COVID-19 by the European Commission, first issued on 13 October 2020, and subsequently updated on 1 February 2021, 14 June 2021, and 25 January 2022. Until a few months before this report is being written, for instance, most EU Countries adopted the mandatory request of a green certificate, often with the additional request of the negative result of a recent antigenic COVID-19 test, to allow within Europe international travel.

Another type of barrier that was worsened by the partial measures, and by the presence of the virus, was trust among countries, in many cases for the different attitudes and partial

restriction measures adopted. The worsening of such barrier complicated the way people living across international borders within CBRs could cross international borders. Early evidence suggests that the erection of partial measures to contrast the diffusion of COVID-19 within CBRs has caused a significant decrease in the stock of bilateral trust (Haist and Novotný, 2022) in all its forms. It has increased trade costs (Xing and Zhu, 2018), complicated the diffusion of knowledge (Guiso et al., 2009), and limited firm cooperation (Bloom et al., 2012).

Lastly, partial restrictions for fighting the diffusion of COVID-19 also simply meant that the Schengen treaty has been repeatedly suspended by individual countries in a patchy way across the whole continent.

Our simulation lies on the increase in these three barriers, namely:

- Legal and administrative barriers;
- Bilateral trust;
- Schengen barriers.

The simulation is made as follows. For legal and administrative barriers and bilateral trust, measured in a continuous way, we raise each region's level of the barrier to the maximum level observed in all EU NUTS3 regions. For the Schengen barrier, instead, we switch a dichotomous variable off, implying that we simulate a universal dropping of the Schengen treaty.

3. Impacts of partial closures on border regions

This section will present the main findings of the analyses carried out following the methodology illustrated in Section 2. To this aim, we proceed as follows. Section 3.1 presents the aggregate results of the analyses, looking at the general picture of the losses induced by partial measures to contrast the diffusion of COVID. Section 3.2 will provide a regional breakdown of the GDP, manufacturing employment, and service employment losses. Lastly, Section 3.3 will discuss such losses in terms of the regional typologies within border regions and non-border regions.

3.1. Results at European level

Aggregate losses caused by partial COVID-19 restrictions for all Europe are shown in Table 1.

Table 1. GDP, manufacturing and service employment losses in Europe

Source of loss	Absolute loss	% EU27	% border regions
GDP	-12,419,969,936.17 €	-1.08	-2.44
	[-13,268,969,936.17€,-11,570,969,936€]	[-1.15,-1.01]	[-2.61,-2.27]
Manufacturing employment	-16,997	-0.60	-1.25
	[-16,999,-16,995]	[-0.61,-0.59]	[-1.27,-1.23]
Service employment	-1,786	-0.01	-0.03
	[-2,329,-1,243]	[-0.013,-0.008]	[-0.04, -0.02]

Source: Authors' elaborations

Note: 95% confidence intervals reported

Table 1 highlights a rather relevant role played by partial COVID-19 closures through the increase in barriers in CBRs in the aftermath of the first (European) wave of the pandemic. All in all, our method suggests a **GDP loss of 12 billion Euros in CBRs**. This represents roughly **1 per cent of the EU27's overall GDP, and 2.5 per cent of CBRs' GDP**. In fact, the method identifies losses for NUTS3 regions located in CBRs, which are only a subset of all NUTS3 regions. For each assessed loss, we also present a confidence interval, which suggests the boundaries of an ideal area defining the intensity of the loss with a given (chosen) probability. In our case, confidence intervals are based on a 95 per cent confidence level. The precision of the estimates is reflected in **relatively narrow intervals, ranging from 11 to 13 billion Euros in aggregate terms**; **from 1 to 1.15 per cent in EU27 percentage terms; and from 2.3 to 2.6 in CBRs percentage terms**.

Table 1 also presents the same findings for the expected losses in manufacturing and service employment. All in all, **partial closure could wipe out as many as 17,000 manufacturing jobs and 1,800 service jobs in the border regions area**. This is the equivalent of 0.6 per cent of the manufacturing workforce and 0.01 per cent of the service jobs. Thus, our findings hint at a more severe impact in terms of manufacturing employment, which may be due to the role as manufacturing powerhouse played by many CBRs, especially those located in the Central and Eastern Europe area. One can also speculate on this result interpreting it to the capacities of services to continue their activities online,

something much more complicated (and in some situations impossible) for manufacturing activities. As for confidence intervals, the interval around manufacturing estimates is way narrower than the second interval, built around service employment assessments, reflecting a relatively lower level of statistical significance in the estimates.

While aggregate results provide a general and informative picture of the extent of the losses, it is now worth focusing on their spatial dispersion.

3.2 Results at NUTS3 level

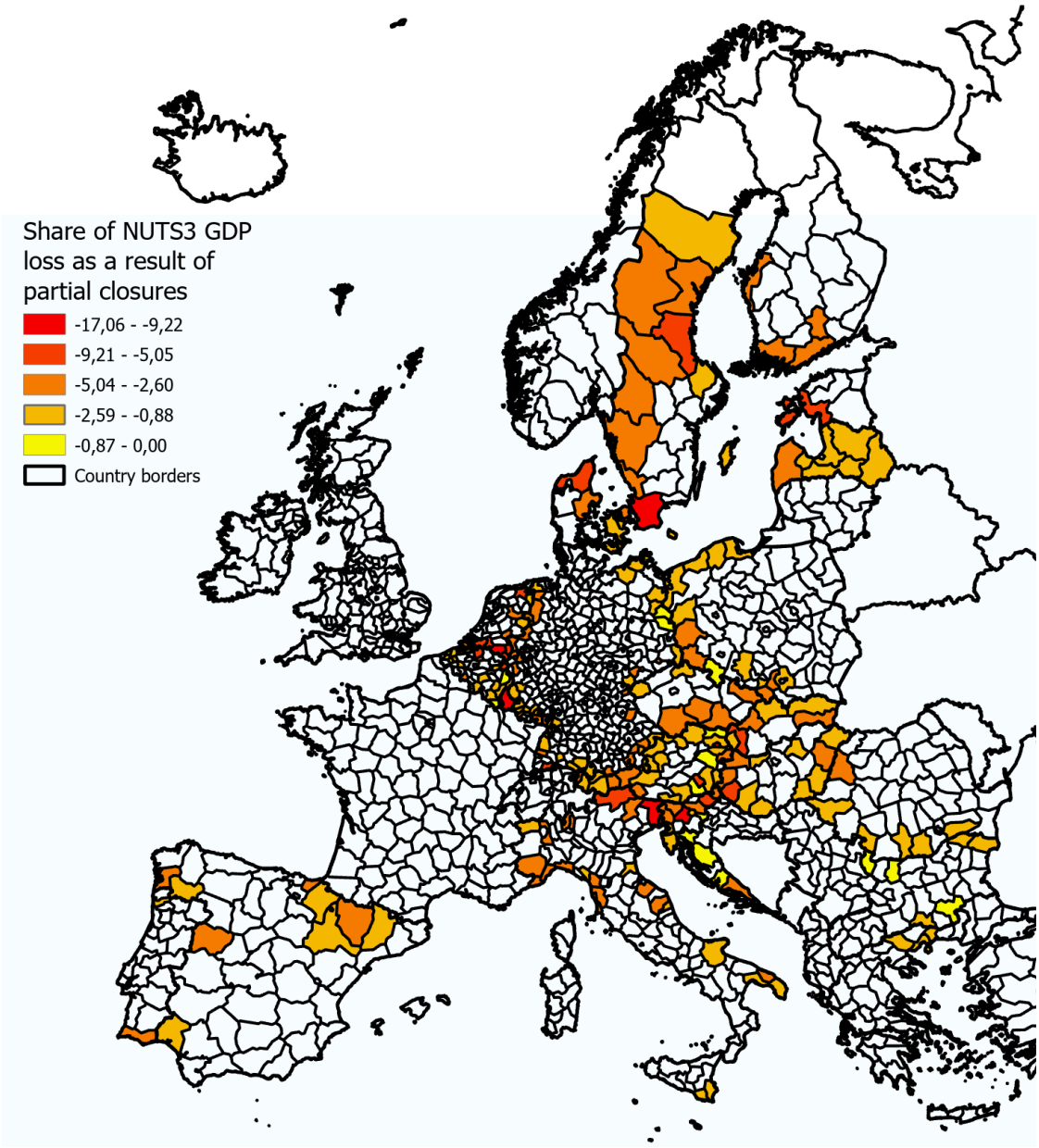
Figures 2, 3, and 4 show the spatial distribution (at NUTS3 areas) of GDP, manufacturing employment, and service employment losses stemming from our analyses. Across all figures, darker colors imply higher losses.[2]

Figure 2 documents CBR's GDP losses as a share of total European GDP as the result of partial closure. Darker colors tend to concentrate in the Northern part of the continent, and appear rather evenly distributed between the Eastern and the Western part of the EU27. Spatial patterns also suggest a concentration of losses in non-urban areas, with a few notable exceptions (such as the NUTS3 region of Malmö in Sweden, or the Grand-Duché of Luxembourg).

This result goes hand in hand with manufacturing employment losses (Figure 3). Again, **the major losses seem to be concentrated in second- and third-tier urban and rural areas**, suggesting the relevance of raising partial barriers in the effectiveness of manufacturing activities. For both GDP and manufacturing employment losses, **land border regions seem to suffer more in both absolute and relative terms with respect to maritime border regions.** This could probably be due to the different nature of such areas: whereas land borders can effectively hamper by policy the free movement of freight and people across borders, thereby causing relevant losses, cross-border travel across the sea is by its very nature more complicated in the first place, and regulated so that restrictions bite less seriously.

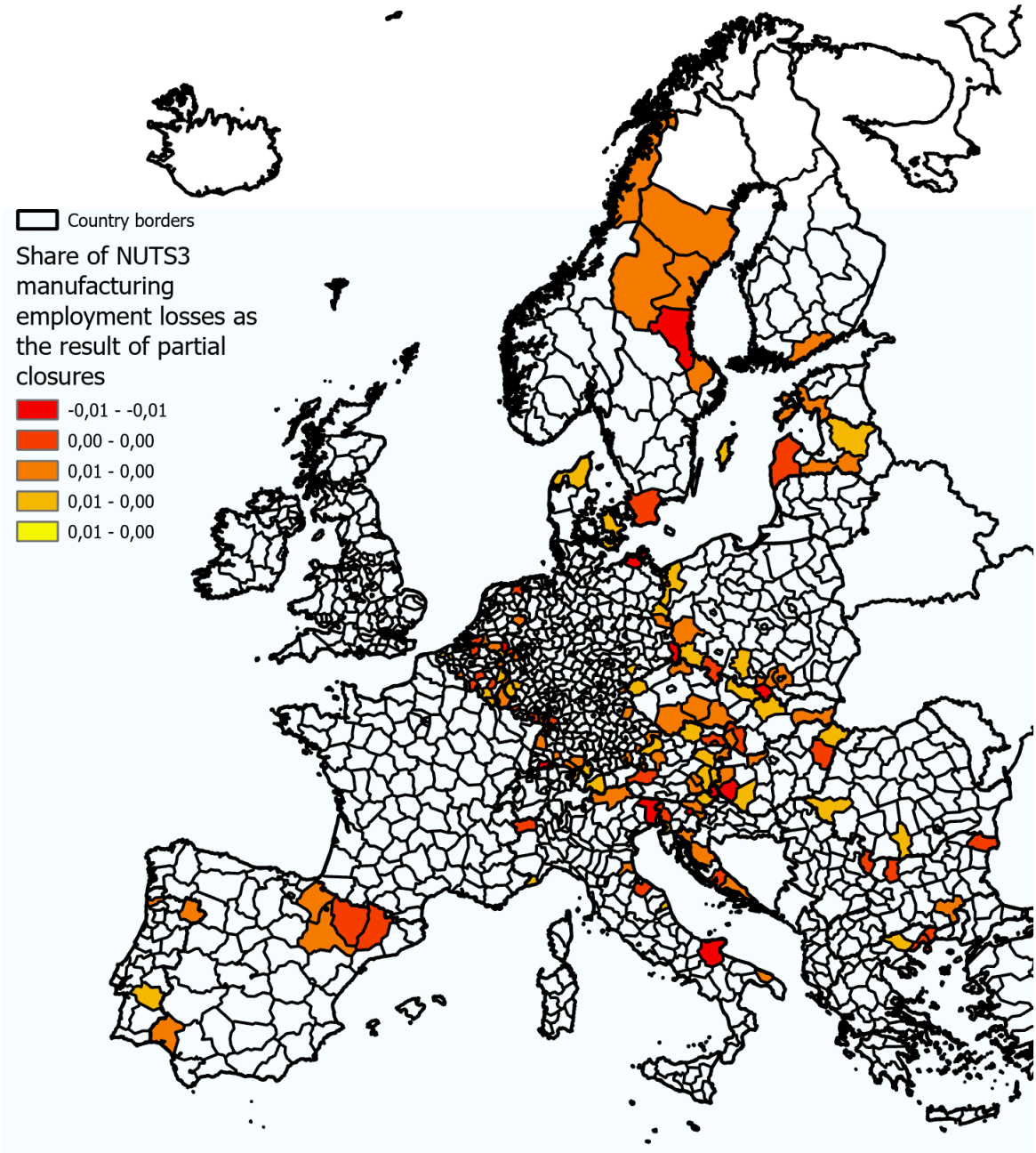
[2] The white color in CBRs indicates the lack of data in the estimate procedures that does not allow to calculate the GDP loss.

Figure 2. Share of NUTS3 GDP loss as a result of partial closures



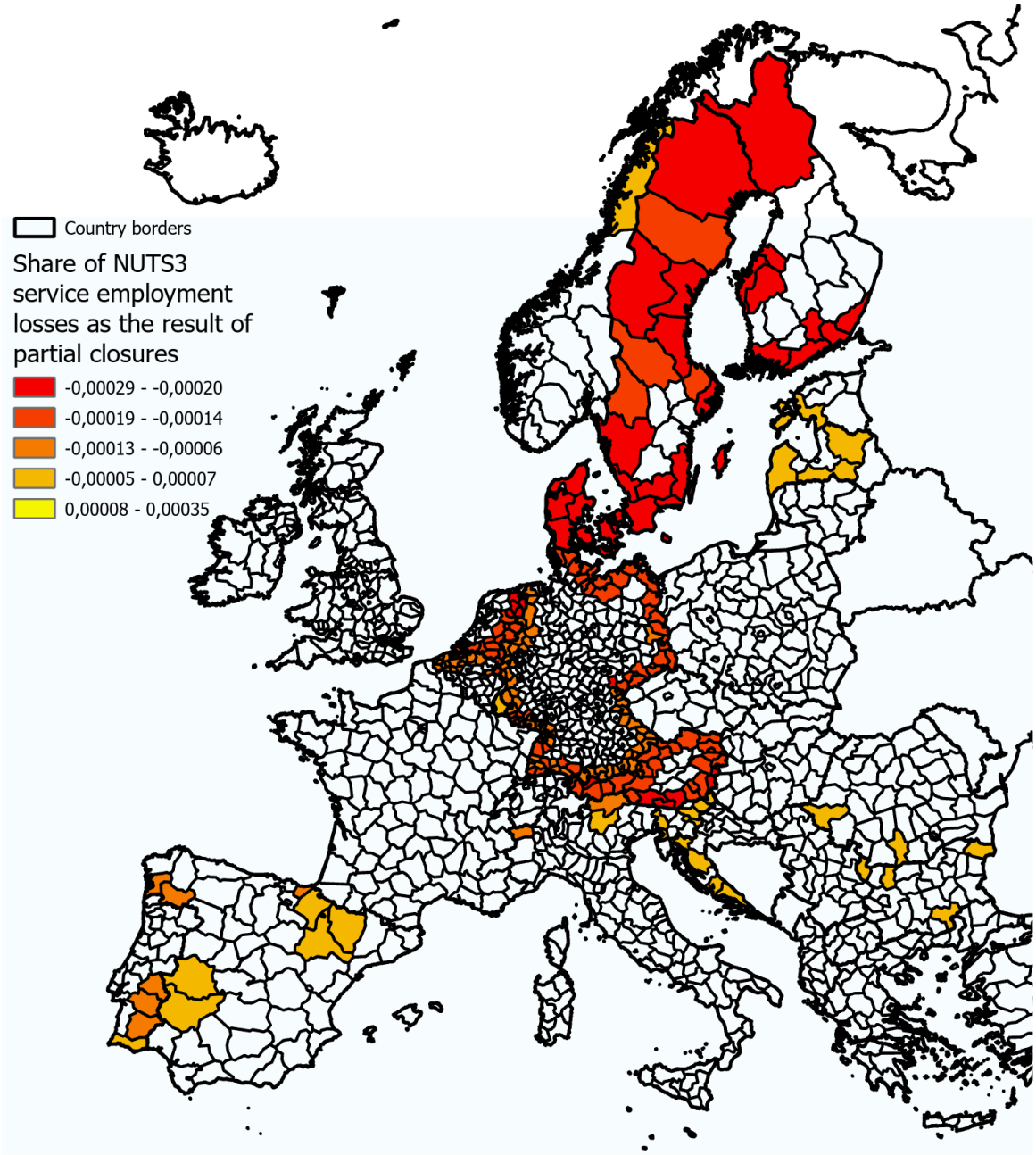
Source: Authors'elaboration

Figure 3. Share of NUTS3 manufacturing employment loss as the result of partial closures



Source: Authors'elaboration

Figure 4. Share of NUTS3 service employment loss as the result of partial closures



Source: Authors'elaboration

Lastly, Figure 4 shows the spatial distribution of service employment losses. While their overall level remains substantially lower with respect to losses in manufacturing employment, their spatial distribution is much more concentrated in Northern Europe, with regions located in Denmark, Sweden, and Finland most directly involved.

Since services concentrate in urban areas (Goodall, 1972), **cities appear much more affected by service employment losses** with respect to the other outcomes described above. Border regions located in Germany and Austria also appear rather severely affected, again taking the lower aggregate negative impact of less severe restrictions on service activities into account.

To reach beyond a qualitative intuition-based reading of the maps in Figures 2-4, Section 3.3 breaks down overall losses by regional typologies, with the aim to strengthen the interpretation of region-specific findings discussed in Section 3.2.

3.3 Results by regional typologies

This section presents overall GDP, manufacturing employment, and service employment losses broken down by four regional typologies:

- agglomerated regions vs. non-agglomerated regions;
- land border regions vs. maritime regions;
- EU14 regions VS CEECs regions.

Each assessment is provided for the three outcomes analyzed in this report.

The rationale for the choice of these four typologies is as follows. The first typology seeks to identify whether losses have been most severe in urban areas or in rural ones. To this aim, we employ the regional classification of NUTS3 areas as agglomerated, urban, or rural first presented in the ESPON 1.1.1 Project Final Report, and resumed in Capello et al. (2015). The classification is reported in Table 2 below, which shows that areas are allocated a class depending on a combination of population and density indicators.

In particular, we first deal with a breakdown of results by agglomerated border regions, vs. non-agglomerated ones. The rationale of this first approach is to verify whether losses tend to concentrate in urban areas.

The second classification relate to types of borders. In fact, this report focuses on losses due to restrictive measures enacted in all border regions, irrespective of whether borders are land or maritime ones. For a subset of NUTS3 areas, the two may actually coexist, in that some areas can join multiple cooperation programmes on both land and sea.[3]

[3] As this report is being written, 459 NUTS3 regions belong to a land Cross-Border region and 201 to a maritime Cross-Border region. A relatively small number of NUTS3 regions (43) belongs to both maritime and land CBRs.

Table 2. Definition of agglomerated, urban, and rural regions

Typology of region	Quantitative criteria for its definition
Agglomerated regions	With a centre of more than 300.000 inhabitants and a population density more than 300 inhabitants/km sq or a population density between 150 and 300 inhabitants/km sq.
Urban regions	With a centre between 150.000 and 300.000 inhabitants and a population density between 150 and 300 inhabitants/km sq (or a smaller population density—between 100 and 150 inhabitants/km with a bigger centre (more than 300.000) or a population density between 100 and 150 inhabitants/km sq.
Rural regions	With a population density less than 100/km sq and a centre more than 125.000 inhabitants or a population density less than 100/km sq with a centre less than 125.000.

Source: Capello et al. (2015)

Lastly, we deal with a classification of aggregate losses into those accruing to CBRs located in Countries joining the EU prior to 2004 vs. those joining the EU in the last three waves of enlargement. The rationale of this last classification is to verify whether regions belonging to Countries with a long history of centralized planning suffer more or less from the losses induced by partial restrictions.

3.3.1 GDP losses due to partial closures by regional typologies

Table 3 shows results for GDP losses in border regions by regional typologies.

The Table highlights the following main messages:

- in absolute terms, we find evidence of **a relatively evenly spread loss of GDP in agglomerated regions and non-agglomerated ones**. However, given that the latter represent a substantial share of the EU's CBRs, losses in percentage terms turn out to be substantially larger for rural areas and regions hosting second- and third-tier cities;

- taking the uneven distribution of GDP production, and therefore looking at percentage losses for all remaining classifications, we find **no substantial difference between land border regions vs. maritime ones, and EU14 regions**

vs. CEECs regions. Across all these classes, losses oscillate around two and a half a percentage points of regional GDP.

Table 3. CBRs' GDP losses due to partial closure by regional typologies

Typology	Loss of GDP	GDP loss as a share of CBRs' GDP
Agglomerated	-5,871,258,515.28	-1.53%
Non-agglomerated	-6,548,711,420.89	-5.47%
Land border	-8,919,796,590.52	-2.19%
Maritime border	-3,725,990,980.85	-2.70%
Region located in EU14	-11,177,972,942.55	-2.36%
Region in CEECs	-1,241,996,993.62	-2.39%

3.3.2 Manufacturing employment loss due to partial closures by regional typologies

Table 4 illustrates the losses in manufacturing employment due to partial restrictions described in Section 2.

Manufacturing jobs seem to suffer more evenly from losses, probably due to the wider diffusion of plants in both urban and rural areas, and both located directly on borders or off from them. According to the latest EUROSTAT data, **in border regions manufacturing jobs represent roughly 20 per cent of the total workforce in non-urban areas against 18 per cent in urban areas; 20 per cent in land border regions vs. all other regions; and 16 per cent of the workforce in maritime regions against 21 in all other region.** A slight prevalence instead is found for border regions located in CEECs (25 per cent) against 18 per cent in regions located in the EU14. These figures provide therefore a picture of spatially diffused exposure of losses.

Table 4. Manufacturing employment loss due to partial closure by regional typologies

Typology	Loss of manufacturing employment	Manufacturing employment loss as a share of CBRs' manufacturing employment
Agglomerated	-4,787	-0.45%
Non-agglomerated	-12,210	-0.58%
Land border	-14,905	-0.55%
Maritime border	-2,766	-0.47%
Region located in EU14	-9,220	-0.48%
Region in CEECs	-8,014	-0.62%

3.3.3 Service employment loss due to partial closures by regional typologies

Table 5 shows service employment losses in border regions by regional typologies.

The table suggests the following main findings:

- unlike manufacturing, service jobs tend to be concentrated in cities. I**n border regions, service jobs represent roughly 73 per cent of the total workforce, but while this figure drops to 70 per cent in rural areas, it peaks to almost 80 per cent in agglomerated regions**. Therefore, losses appear more concentrated in agglomerated regions versus non-agglomerated ones;

- in terms of border location, **maritime border regions bear a substantially higher cost in terms of service employment with respect to land ones**;

- lastly, the fact that **EU14 regions are more specialized in service jobs probably exposes this area more directly to the losses caused by partial measures with respect to regions located in CEECs**.

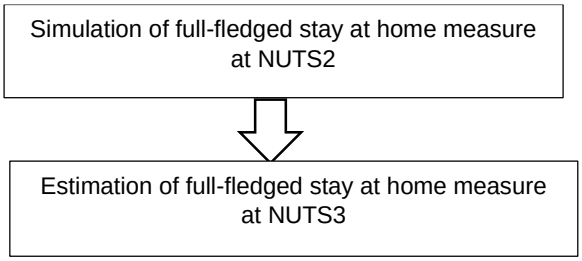
Table 5. Service employment loss due to partial closure by regional typologies

Typology	Loss of service employment	Service employment loss as a share of CBRs' service employment
Agglomerated	-961	-0.19%
Non-agglomerated	-825	-0.14%
Land border	-806	-0.09%
Maritime border	-1,255	-0.41%
Region located in EU14	-1,261	-0.45%
Region in CEECs	-525	-0.37%

4. A methodology for measuring the impacts of full closure measures preventing the diffusion of the virus

For this stage of the assessment exercise, we will make use of a methodology to capture the loss of a full-fledged stay-at-home measures. The methodology is divided in two steps. In the first step, we simulate the 2020 GDP through a forecasting model able to obtain GDP, employment and service at NUTS2 level. In a second step, we estimate the NUTS3 GDP from the simulated NUTS2 one, as summarised in Figure 5.

Figure 5. Structure of the simulation procedure for full-fledged stay at home measures



Source: Authors' elaboration

The first step is necessary since insufficient data exists at regional level for 2020, when the major restrictions took place. We therefore have to rely on the simulation of GDP in 2020 through a methodology already applied by the authors in the ESPON project "*CE FLOWS – Spatial dynamics and integrated territorial development scenarios for the functional area of Central Europe*".[4] In particular, simulations are obtained by applying a forecasting regional macro-econometric growth model, called MASST (presented in its fourth version in Capello and Caragliu, 2021a), built to simulate regional growth scenarios in the medium and long-run (typically, over a 15–20 years' time horizon). Thanks to the estimation of the structural relations among economic variables, the model is able to project such relationship in the future on the basis of assumptions on the macroeconomic and territorial conditions of the economy.

In the case of the full-fledged closures, 2018 data are projected into 2020 based on assumptions that hold for the period of total closure (March – June 2020). The assumptions regard both the macroeconomic variables (e.g. interest rate, inflation rate) and the regional ones (e.g. level of trust, innovation rate, industrial growth), among which also those on increased barriers due to total closure. In particular, for this simulation, two major barriers are assumed to drastically increase, namely the decrease of trust among Countries due to different exposure to the germ (the sudden closure of the Brenner Pass with Italy decided by the Austrian Government in that period is a clear example in this respect) and the drastic weakening of input-output relationships due to total closures. For the sake of this project, we verified the consistency of the assumptions related to barriers in Table 6 with the fine-grained evidence collected in Peyrony et al. (2021). The specific assumptions on macroeconomic and regional variables made in the simulation exercise are presented in Table 6.

In a second step, we estimated NUTS3 GDP from NUTS2 simulated data. For this step, we took advantage of an exercise already applied in an ESPON project, and published in Camagni and Capello (2011). NUTS3 GDP is obtained by explaining the difference between NUTS2 GDP growth and NUTS3 GDP growth (called in the literature a shift, *s*) as a function of local context conditions. Such a difference *s* is added to the growth of GDP at NUTS2 level, so to obtain NUTS3 GDP growth, as follows (Eq. 1):

$$\Delta \boldsymbol{GDP}_{\boldsymbol{NUTS3}} = \Delta \boldsymbol{GDP}_{\boldsymbol{NUTS2}} + \boldsymbol{s} \quad (1)$$

[4] The reliability of the simulation is witnessed by its publication in an international journal (Capello and Caragliu, 2021).

Once the NUTS3 GDP growth rates are obtained, we calculate the loss of GDP for CBRs.

Table 6. Assumptions for regional forecasts of GDP growth to December 2020

Variables	Assumptions
Macro factors	
Debt/GDP	General relaxing of Maastricht rules, proportional to starting levels
Interest rate	Low interest rates
Inflation rate	Nil across all Europe
Deficit/GDP	Relaxed Maastricht rules
GDP growth US-JP-BRIC	Major GDP contraction in US and Japan; milder contraction in BRIC Countries
FDIs	Major contraction of FDIs w.r.t. the period before the COVID lockdown
Consumption levels	Contraction of consumption levels everywhere
Investment	Contraction of investment levels everywhere
Regional factors	
Industrial specialization	Major contraction in all activities, other than agriculture and public administration w.r.t. the period before the COVID lockdown
Death rate	Surge everywhere, especially in most affected areas
Innovation	No major change
Border variables	
Trust among countries	Contraction of trust levels everywhere
Regional Input/Output relations	Decrease in the intensity of I/O relations everywhere

Legend: trends of variables in the table are meant w.r.t. the period before the COVID lockdown

Source: Capello and Caragliu (2021b)

5. Impacts of full closures on border regions

This Section presents the findings of our simulations based on the methodology introduced in Section 4. Findings represent the loss of GDP due to both the increase in barriers and the deep worsening of the macroeconomic conditions that total closures created.

We first illustrate aggregate results for the whole EU27; next, we scale down to the NUTS3 level; lastly, we break down overall findings into various regional typologies. Throughout this section, impacts of full closures on border regions are presented only for GDP, in the absence of underlying employment COVID impacts simulated with the MASST model.

Aggregate results are presented in Table 7, along with the classical confidence intervals at 95% level.

Table 7. GDP loss in Europe (March – June 2020)

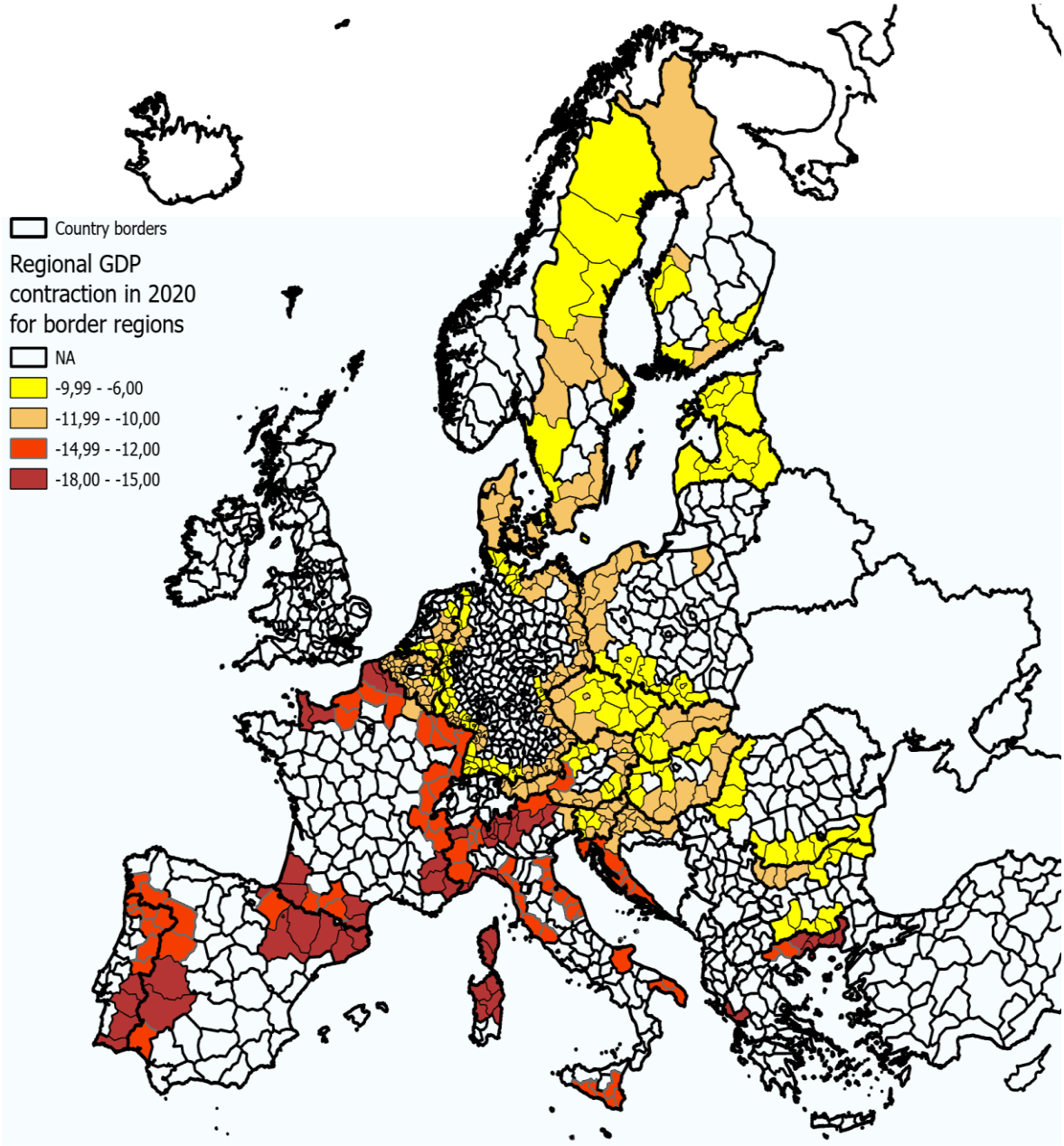
Absolute loss	% EU27	% border regions
-51,117,350,000 €	-4.44	-10.04
[-89,461,270,000€, -9,068,400,000€]	[-7.78, -0.79]	[-17.58, -1.78]

Due to the symmetric and universal nature of closures in order regions in the wake of the first lockdown period, losses are roughly five times as large as those due to partial closures. All in all, border regions lost about 10 per cent of their potential GDP in 2020, and about 4.5 per cent of EU27 GDP (Table 1).[5]

Regional (NUTS3 level) results are shown in Figure 6, which first of all suggests the existence of rather substantial Country effects in the losses caused by full closures. A South-West vs. a North-East divide emerges. Losses are in fact highest in areas most severely affected by early lockdowns, like Italy, Spain and France, while Countries in the North and the East, where the lockdown was less severe, turn out to be less affected.

[5] The confidence interval appears rather broad, ranging from 1 to 17 per cent of border regions' GDP, signalling a risk of estimate error. However, given the aggregate EUROSTAT figures available at Country level, the extreme estimated impacts that would represent a mistake of our estimates appear rather implausible.

Figure 6. Share of NUTS3 GDP loss as a result of full closures (March – June 2020)



Our findings also present spatial asymmetries. For instance, the borders between Italy and Austria or the border between Germany and France present two rather opposing pictures; areas whose exposure to the germ was earlier and more severe clearly tend to suffer the most. Macroeconomic effects play a substantial role in driving these results. All the Western CBRs of Eastern countries tend to suffer the most from the decrease in input-output relations with Western countries (mainly Germany). North-Eastern Italian CBRs, whose economy benefits from tourism from Austria, suffer more than Austrian regions losing Italian activity. By the same token, losses are high for manufacturing regions like Veneto, whose foreign direct investments concentrate in CEECs.

Within Countries, differences exist in the impact of total closures, suggesting that such differences are only partly due to the different regional exposure to macroeconomic effects of closures, and instead mainly obtained through border effects.

Future analyses should ideally cross-check these estimates exploiting future availability of regional (NUTS3-level) data.[6]

Table 8 shows the breakdown of the previous results by regional typologies.

Table 8. CBRs' GDP loss due to full closure by regional typologies (March – June 2020)

Typology	Loss of GDP	GDP loss as a share of CBRs' GDP
Agglomerated	-24,607,330,000	-9.46%
Non-agglomerated	-26,510,020,000	-10.20%
Land border	-38,427,860,000	-9.61%
Maritime border	-15,010,660,000	-10.72%
Region located in EU14	-44,923,550,000	-9.98%
Region in CEECs	-6,193,794,000	-9.37%

The main result emerging from reading Table 8 is associated with the relatively spatially even diffusion of losses across all typologies. While trade and cross-border mobility become more complicated as a result of border closures, forcing border areas to reroute towards channels internal to the Country, in 2020 macroeconomic factors did play the lion's share in causing aggregate GDP contraction. As a result, losses appear slightly higher for:

- rural areas with respect to urban ones, which could be interpreted as the result of cities being able to cope more efficiectly due to their nature of large markets (Fujita, 2012);
- maritime regions with respect to land ones, probably due to the fact that land borders are by defiition more permeable, and more complicated to control and seal, with respect to sea ones;

[6] The first data appearing on 2020 Country-level statistics seem to suggest that our NUTS2 simulations performed with the MASST4 model seem to overestimate the overall GDP contraction in 2020, due to the rebound of macroeconomic factors (most importantly, consumption) at the end of 2020, which was not taken into consideration in our simulation.

- EU14 regions with respect iterim CEECs ones, arguably due to the more severe impact of the COVID-19 pandemic in the Western part of the continent during the first wave in 2020.[7]

6. Conclusions and policy implications

The Final Report documented a rather relevant role played even by partial restrictions in causing losses in terms of GDP, manufacturing, and service employment in European CBRs. All in all, our simulations suggest that partial measures may cause a decrease of around 1 per cent of EU's GDP, a decrease by 0.6 per cent of the manufacturing workforce, and a decline by 0.01 per cent of service employment. In the long run, this may engender substantial losses in terms of potential levels of welfare for EU citizens. **These costs are roughly twice as large for EU CBRs, which suffer most directly because of their higher dependency on intercountry cooperation**.

The Report also complemented these analyses by showing results of measuring losses due to the Spring 2020 lockdowns, obtained with simulations through the MASST model at NUTS2 level, and allocated to NUTS3 regions in our sample by means of the MAN (MASST at NUTS3) model. These analyses suggest that losses to COVID-19 restrictions, which encompass both more severe restrictions in terms of border closures, as well as macroeconomic factors, are an order of magnitude larger than the losses induced by partial closures. **All in all, border regions lost about 10 per cent of their potential GDP in 2020.** Despite a certain degree of uncertainty about the estimates,[8] in magnitude terms our results appear in line with recent EUROSTAT figures now available at Country level.

Despite the lack of regional statistics for both 2020 and 2021, and even taking the random component of all estimates into account, our results appear in line with the mounting evidence that is becoming available at Country level. For future reference, results could be usefully compared against the backdrop of real NUTS2- and NUTS3-level statistics, for both checking the methodology's statistical degree of approximation, as well as for better helping evidence-based policy design.

In terms of policy suggestions, while this report does not deal with the cost of removing barriers and/or avoiding partial resitrictions, it does hint at a rather relevant cost caused by the latter, and highlights substantial gains stemming from policies favoring full labor and

[7] Mortality has in fact initially surged most rapidly in Italy, Spain, France, and Belgium.

[8] As expressed by the confidence intervals in the Tables.

freight mobility, and the complete removal of remaining barriers in terms of trust, Schengen treaty, and administrative differences.

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Technical Appendix

A.1 Additional details on the methodology used to simulate the impact of partial closures

The method syhtnetically summarized in Section 2 of this report has been first presented in Capello et al. (2018a), and subsequently exploited in several applications (Capello et al., 2018b, where the overall border effect is broken down into its building blocks; Capello et al., 2018c, where the method is amended so as to also encompass border effects acting on external regional assets; and Capello et al., 2018d, where the approach is employed to simulate the regional costs of Brexit before it actually took place).

More recently, the method has been specifically applied to the measurement of the costs stemming from administrative barriers persisting among EU regions (Camagni et al., 2019; Caragliu, 2022). This last approach is applied for the measurement of the costs of partial barriers discussed in this report.

While Section 3 provided a snapshot of the main findings, we here present the full set of estimates underlying tables and maps in Section 3. Before presenting them, though, it is here worth reminding the table showing the data used in the regressions whose results are going to be discussed here (Table A.1).

Type of variable	Types of economic outcome / resource / barriers	Indicator	Source of raw data	Data processing	Time availability (NUTS3 level)
Economic outcomes	GDP growth	Growth of nominal regional GDP	EUROSTAT	Possible adjustment for inflation	2003-2020
	Manufacturing employment growth	Growth of manufacturing employment	ARDECO/EUROSTAT	-	2003-2020
	Service employment growth	Growth of service employment	ARDECO/EUROSTAT	-	2003-2020
	Tourist overnights stays evolution	Growth of nights spent in regional facilities	EUROSTAT	-	2000-2019 (with gaps)[9]
	Trust	Percentage of people	EVS	Micro (Individual)	2008-2009

[9] Data only available at NUTS2 level.

Determinants of economic performance		answering they trust others "A lot-" or "Enough" to the European Values Study question "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?"		data, aggregated at NUTS3 level	
	Cultural heritage	Number of museums per 1,000 inhabitants	ESPON	-	2008
	Human capital	Percentage pop. with tertiary degree	EUROSTAT	-	
	Manufacturing activity	Gross value added in manufacturing activities over total regional value added	EUROSTAT	-	2003-2020
	Agglomeration economies	Population density	EUROSTAT	-	
	Regional quality of governance	Regional score in the Regional Quality of Government Index	University of Gothenburg	-	2010; 2013; 201710
	Public safety	Number of recorded crimes per 1,000 inhabitants	EUROSTAT	-	2008-2010
	Degree of innovation	Trademark applications to the EPO per 1m inhabitants	EUROSTAT elaboration on EPO data		2000-2015
	Market potential	Percentage of GVA in manufacturing in neighbouring areas	EUROSTAT	Spatial lag of manufacturing specialization	2003-2020
	Financial capital flows	Propensity to save in	EVS	Spatial lag of propensity to	2008-2009

[10] Data only available at NUTS1/NUTS2 level.

		neighbouring areas		save in NUTS3 regions	
	Local labor market	Employment rate	EUROSTAT	-	2003-202011
	International partnerships	Number of Framework Programme co-participations	CORDIS	Count of FP7 project collaborations	2007-2013
Intangible cross-border barriers	Bilateral trust	Perc. replies to question "Generally speaking, would you agree or disagree that most people can be trusted?"	Flash Eurobarometer 422	Micro (Individual) data, aggregated at NUTS3 level	2015, 2020
	Schengen barriers	Dummy variable, =1 if Cross-Border Regions involve NUTS3 areas not members of the Schengen Treaty	Authors' elaboration	-	2022
	Legal and administrative barriers	Perc. replies to question "Thinking about the cooperation between Country X and Country Y, to what extent are legal or administrative differences a problem"	Flash Eurobarometer 422	Micro (Individual) data, aggregated at NUTS3 level	2015, 2020

Table A.1. List of data used for assessing the impact of intangible barriers on CBRs

Source: Authors'elaboration.

In what follows, we provide the full battery of estimates. Each table presents results for each regional asset, with the first block showing the impact of barriers on the 2008-2019 growth rate of regional GDP growth; the second on the 2008-2019 regional manufacturing employment growth; and the third on the 2008-2019 regional service employment growth. Significant border effects are highlighted in yellow, and the estimated standardized coefficients are employed in the simulations leading to the projections discussed in Section 3.

[11] Data only available at NUTS2 level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008-2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.775****	0.776****	0.775****	0.775****	0.776****										
	(8.97)	(8.91)	(8.92)	(8.86)	(8.91)										
rural	0.032	0.030	0.033	0.028	0.030	0.225****	0.223****	0.226****	0.221****	0.223****	-0.008	-0.005	-0.004	0.002	-0.005
	(1.08)	(1.07)	(1.17)	(1.02)	(1.07)	(5.54)	(5.39)	(5.48)	(5.30)	(5.39)	(-0.20)	(-0.11)	(-0.10)	(0.04)	(-0.11)
urban	0.004	0.003	0.005	0.001	0.002	0.130****	0.129****	0.132****	0.127****	0.129****	-0.015	-0.012	-0.011	-0.005	-0.012
	(0.15)	(0.09)	(0.20)	(0.03)	(0.08)	(3.94)	(3.84)	(3.94)	(3.74)	(3.84)	(-0.43)	(-0.34)	(-0.32)	(-0.16)	(-0.36)
Dummy overall border, final version (June 24, 2016)	0.003	0.006	0.001	0.008	0.013	0.024	0.026	0.021	0.028	0.026	-0.009	-0.015	-0.016	-0.023	-0.002
	(0.12)	(0.26)	(0.06)	(0.38)	(0.49)	(0.77)	(0.76)	(0.60)	(0.81)	(0.73)	(-0.32)	(-0.48)	(-0.50)	(-0.71)	(-0.06)
Population density	0.079***	0.080***	0.082***	0.080***	0.081***	-0.095***	-0.094**	-0.093**	-0.095**	-0.094**	0.010	0.008	0.008	0.011	0.009
	(2.03)	(1.99)	(2.03)	(1.97)	(2.01)	(-1.97)	(-1.92)	(-1.90)	(-1.94)	(-1.92)	(0.32)	(0.25)	(0.26)	(0.33)	(0.27)
agglomeration_border		-0.006	0.027	-0.019	-0.589*		-0.004	0.034	-0.018	0.032		0.013	0.019	0.056*	-1.149*
		(-0.20)	(0.58)	(-0.67)	(-1.44)		(-0.14)	(0.71)	(-0.47)	(0.04)		(0.41)	(0.37)	(1.61)	(-1.31)
agglom			-0.040					-0.045					-0.008		

eration_border_biltrust															
			(-0.91)					(-1.08)					(-0.18)		
agglomeration_border_legal				0.022					0.022					-0.072****	
				(0.81)					(0.55)					(-2.66)	
agglomeration_border_schengen					0.582*					-0.036					1.159*
					(1.43)					(-0.04)					(1.32)
lmanemp_2008						0.070	0.070	0.071	0.070	0.070					
						(1.18)	(1.18)	(1.18)	(1.17)	(1.18)					
lseremp_2008											0.223****	0.222****	0.222****	0.225****	0.223****
											(6.06)	(6.00)	(6.00)	(6.12)	(6.06)
Constant term	****	****	****	****	****	*	*	*	*	*	*	*	*	*	*
	(-9.56)	(-9.52)	(-9.54)	(-9.50)	(-9.52)	(-1.53)	(-1.51)	(-1.47)	(-1.57)	(-1.50)	(1.49)	(1.48)	(1.49)	(1.62)	(1.37)
Observations	846	846	846	846	846	847	847	847	847	847	847	847	847	847	847
Adjusted R^2	0.589	0.588	0.588	0.588	0.588	0.415	0.414	0.414	0.414	0.413	0.450	0.450	0.449	0.453	0.450

Table A.1. Border effects on agglomeration economies

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008-2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.702****	0.700****	0.701****	0.700****	0.700****										
	(9.61)	(9.57)	(9.58)	(9.55)	(9.57)										
rural	-0.046**	-0.047**	-0.047**	-0.047**	-0.047**	0.224****	0.224****	0.224****	0.226****	0.225****	-0.012	-0.012	-0.012	-0.021	-0.012
	(-1.69)	(-1.75)	(-1.76)	(-1.72)	(-1.75)	(6.03)	(6.04)	(6.03)	(6.08)	(6.04)	(-0.27)	(-0.27)	(-0.27)	(-0.48)	(-0.27)
urban	-0.058***	-0.057***	-0.056***	-0.057***	-0.057***	0.143****	0.143****	0.143****	0.144****	0.143****	-0.036	-0.035	-0.035	-0.042*	-0.035
	(-2.39)	(-2.45)	(-2.41)	(-2.42)	(-2.45)	(4.56)	(4.55)	(4.55)	(4.58)	(4.55)	(-1.08)	(-1.06)	(-1.07)	(-1.29)	(-1.06)
Dummy overall border, final version (June 24, 2016)	0.002	0.079**	0.080**	0.078**	0.085**	0.024	-0.005	-0.004	0.000	0.001	-0.008	0.032	0.032	0.001	0.031
	(0.09)	(1.88)	(1.91)	(1.87)	(1.96)	(0.87)	(-0.14)	(-0.12)	(0.00)	(0.04)	(-0.27)	(0.83)	(0.83)	(0.02)	(0.76)
Number of monuments	0.185***	0.233***	0.232***	0.233***	0.235***	0.083****	0.064***	0.063***	0.063***	0.065***	0.033	0.058**	0.058**	0.063**	0.058**
	(2.42)	(2.53)	(2.51)	(2.52)	(2.54)	(2.95)	(2.16)	(2.13)	(2.12)	(2.19)	(0.99)	(1.79)	(1.79)	(1.94)	(1.78)
monuments_b		-0.119***	-0.102**	-0.118***	-0.338***		0.046*	0.059*	0.027	-0.207		-0.063**	-0.064*	0.048	-0.026

order															
		(-2.07)	(-1.67)	(-2.07)	(-2.28)		(1.36)	(1.52)	(0.62)	(-0.83)		(-1.71)	(-1.59)	(1.20)	(-0.06)
monuments_border_biltrust_cont			-0.033**					-0.024					0.002		
			(-1.66)					(-0.87)					(0.08)		
monuments_border_legal				-0.001					0.023					-0.132****	
				(-0.05)					(0.74)					(-4.55)	
monuments_border_schengen					0.217**					0.251					-0.037
					(1.80)					(1.02)					(-0.09)
lmanemp_2008						0.018	0.018	0.018	0.018	0.018					
						(0.34)	(0.35)	(0.34)	(0.35)	(0.35)					
lseremp_2008											0.126****	0.126****	0.126****	0.124****	0.126****
											(3.42)	(3.45)	(3.45)	(3.36)	(3.44)
Constant term	****	****	****	****	****						****	****	****	****	****
	(-10.17)	(-10.21)	(-10.21)	(-10.18)	(-10.21)	(-1.00)	(-0.78)	(-0.78)	(-0.83)	(-0.83)	(2.99)	(2.73)	(2.74)	(3.06)	(2.72)
Observations	963	963	963	963	963	978	978	978	978	978	978	978	978	978	978
Adjusted R^2	0.609	0.615	0.616	0.615	0.615	0.425	0.425	0.425	0.425	0.425	0.358	0.359	0.359	0.367	0.359

Table A.2. Border effects on cultural heritage

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008-2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.772****	0.772****	0.772****	0.772****	0.771****										
	(10.11)	(10.10)	(10.09)	(10.10)	(10.10)										
rural	0.018	0.017	0.017	0.018	0.018	0.255****	0.254****	0.252****	0.253****	0.256****	-0.010	-0.010	-0.010	0.003	-0.007
	(0.75)	(0.72)	(0.71)	(0.72)	(0.76)	(6.88)	(6.83)	(6.80)	(6.78)	(6.89)	(-0.24)	(-0.23)	(-0.22)	(0.06)	(-0.16)
urban	-0.022	-0.023	-0.023	-0.023	-0.024	0.159****	0.157****	0.158****	0.156****	0.156****	-0.035	-0.034	-0.034	-0.029	-0.035
	(-1.10)	(-1.15)	(-1.14)	(-1.15)	(-1.16)	(5.07)	(4.97)	(5.00)	(4.96)	(4.96)	(-1.07)	(-1.04)	(-1.05)	(-0.91)	(-1.06)
Dummy overall border, final version (June 24, 2016)	0.005	-0.023	-0.022	-0.023	-0.013	0.026	-0.032	-0.027	-0.030	-0.011	-0.009	0.005	0.005	-0.018	0.034
	(0.19)	(-0.38)	(-0.37)	(-0.38)	(-0.20)	(0.91)	(-0.56)	(-0.48)	(-0.52)	(-0.19)	(-0.31)	(0.08)	(0.07)	(-0.28)	(0.50)
share_isced56_real	0.089*	0.080	0.079	0.081	0.084*	0.112**	0.092*	0.088	0.088	0.100*	-0.164***	-0.159***	-0.158***	-0.108*	-0.148**
	(1.47)	(1.26)	(1.25)	(1.24)	(1.32)	(1.66)	(1.33)	(1.28)	(1.26)	(1.45)	(-2.23)	(-2.07)	(-2.06)	(-1.39)	(-1.91)
hc_border		0.033	0.036	0.034	-0.109		0.070	0.095*	0.063	-0.242		-0.017	-0.021	0.077	-0.443**
		(0.63)	(0.69)	(0.63)	(-0.68)		(1.16)	(1.58)	(0.99)	(-1.08)		(-0.28)	(-0.33)	(1.28)	(-1.76)

hc_border_biltrust_cont			-0.006					-0.058**					0.009		
			(-0.34)					(-1.88)					(0.35)		
hc_border_legal				-0.002					0.011					-0.154****	
				(-0.15)					(0.37)					(-6.74)	
hc_border_schengen					0.136					0.299*					0.409**
					(1.12)					(1.43)					(1.80)
lmanemp_2008						0.037	0.038	0.038	0.038	0.037					
						(0.73)	(0.75)	(0.76)	(0.76)	(0.73)					
lsemp_2008											0.157****	0.157****	0.157****	0.165****	0.156****
											(4.44)	(4.45)	(4.44)	(4.74)	(4.43)
Constant term	****	****	****	****	****	**	*	*	*	*	****	****	****	****	****
	(-10.66)	(-10.54)	(-10.53)	(-10.54)	(-10.53)	(-1.88)	(-1.49)	(-1.45)	(-1.52)	(-1.62)	(3.17)	(2.90)	(2.90)	(3.06)	(2.70)
Observations	970	970	970	970	970	985	985	985	985	985	985	985	985	985	985
Adjusted R^2	0.587	0.587	0.587	0.587	0.587	0.422	0.422	0.424	0.421	0.422	0.361	0.360	0.360	0.377	0.361

Table A.3. Border effects on human capital

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008-2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.435****	0.436****	0.441****	0.433****	0.436****										
	(7.49)	(7.39)	(7.44)	(7.43)	(7.38)										
rural	0.021	0.022*	0.020	0.026*	0.022*	0.247****	0.248****	0.248****	0.248****	0.250****	0.001	0.001	0.003	0.001	0.000
	(1.16)	(1.36)	(1.24)	(1.59)	(1.34)	(6.69)	(6.74)	(6.72)	(6.73)	(6.76)	(0.01)	(0.01)	(0.06)	(0.03)	(0.01)
urban	0.020	0.020	0.020	0.022*	0.020	0.156****	0.156****	0.156****	0.156****	0.155****	-0.021	-0.021	-0.021	-0.020	-0.021
	(1.17)	(1.19)	(1.22)	(1.31)	(1.19)	(4.94)	(4.93)	(4.93)	(4.93)	(4.92)	(-0.64)	(-0.64)	(-0.65)	(-0.63)	(-0.63)
Dummy overall border, final version (June 24, 2016)	-0.007	-0.014	-0.011	-0.020	-0.014	0.025	0.013	0.014	0.013	0.012	-0.010	-0.010	-0.013	-0.011	-0.009
	(-0.51)	(-0.60)	(-0.46)	(-0.87)	(-0.59)	(0.88)	(0.45)	(0.45)	(0.44)	(0.41)	(-0.33)	(-0.30)	(-0.41)	(-0.33)	(-0.30)
TM applications to the EPO per mil. pop.	0.559****	0.541****	0.538****	0.544****	0.541****	0.015	-0.011	-0.012	-0.011	-0.012	0.108****	0.108***	0.110***	0.109***	0.108***
	(4.75)	(3.15)	(3.13)	(3.16)	(3.15)	(0.60)	(-0.39)	(-0.40)	(-0.38)	(-0.41)	(3.19)	(2.51)	(2.53)	(2.51)	(2.51)
inn_border		0.029	0.039	0.102	-1.181		0.045**	0.046***	0.049**	6.643		0.000	-0.009	0.013	-1.178
		(0.26)	(0.35)	(1.00)	(-0.90)		(1.74)	(1.97)	(1.80)	(0.82)		(0.00)	(-0.28)	(0.26)	(-0.41)

inn_border_biltrust_cont			-0.048					-0.005					0.043*		
			(-1.19)					(-0.11)					(1.30)		
inn_border_legal				-0.111****					-0.007					-0.020	
				(-6.02)					(-0.28)					(-0.63)	
inn_border_schengen					1.210					-6.598					1.178
					(0.95)					(-0.81)					(0.41)
lmanemp_2008						0.039	0.038	0.038	0.038	0.039					
						(0.72)	(0.70)	(0.70)	(0.70)	(0.72)					
lseremp_2008											0.077**	0.077**	0.073**	0.077**	0.077**
											(1.89)	(1.88)	(1.77)	(1.87)	(1.88)
Constant	****	****	****	****	****	*	*	*	*	*	****	****	****	****	****
	(-8.99)	(-8.83)	(-8.87)	(-8.81)	(-8.82)	(-1.47)	(-1.46)	(-1.47)	(-1.45)	(-1.47)	(3.63)	(3.62)	(3.60)	(3.65)	(3.62)
Observations	968	968	968	968	968	983	983	983	983	983	983	983	983	983	983
Adjusted R^2	0.782	0.782	0.783	0.789	0.782	0.421	0.421	0.420	0.421	0.421	0.364	0.363	0.363	0.363	0.363

Table A.4. Border effects on innovation

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable		*2008-2019 regional GDP growth*				*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.784****	0.785****	0.785****	0.785****	0.785****										
	(9.83)	(9.82)	(9.83)	(9.78)	(9.81)										
rural	0.010	0.011	0.009	0.011	0.011	0.250****	0.253****	0.252****	0.257****	0.253****	0.005	0.004	0.005	0.004	0.006
	(0.43)	(0.47)	(0.40)	(0.47)	(0.50)	(6.79)	(6.90)	(6.88)	(7.07)	(6.90)	(0.11)	(0.10)	(0.11)	(0.09)	(0.14)
urban	-0.029*	-0.029*	-0.028*	-0.029*	-0.029*	0.160****	0.160****	0.160****	0.164****	0.160****	-0.023	-0.023	-0.023	-0.025	-0.024
	(-1.43)	(-1.42)	(-1.40)	(-1.41)	(-1.44)	(5.07)	(5.07)	(5.07)	(5.24)	(5.07)	(-0.71)	(-0.71)	(-0.71)	(-0.77)	(-0.73)
Dummy overall border, final version (June 24, 2016)	0.006	-0.115	-0.128	-0.115	-0.104	0.022	-0.350***	-0.358***	-0.342***	-0.344**	-0.010	0.009	0.011	0.000	0.038
	(0.25)	(-0.68)	(-0.75)	(-0.68)	(-0.61)	(0.77)	(-1.98)	(-2.04)	(-1.96)	(-1.93)	(-0.35)	(0.05)	(0.06)	(0.00)	(0.19)
Employed/pop. between 15 and 64	-0.022	-0.037	-0.037	-0.037	-0.035	0.040*	-0.005	-0.006	-0.003	-0.005	0.039*	0.042	0.042	0.039	0.045
	(-0.91)	(-1.08)	(-1.08)	(-1.08)	(-1.03)	(1.62)	(-0.18)	(-0.18)	(-0.10)	(-0.15)	(1.43)	(1.11)	(1.11)	(1.03)	(1.19)
lll_border		0.125	0.155	0.125	0.069		0.382***	0.405***	0.342**	0.349*		-0.020	-0.024	0.022	-0.168

		(0.69)	(0.83)	(0.70)	(0.36)		(2.14)	(2.28)	(1.94)	(1.52)		(-0.11)	(-0.12)	(0.12)	(-0.65)
lll_border_biltrust_cont			-0.038**					-0.031							
			(-1.70)					(-0.86)							
lll_border_legal				0.000					0.092****					-0.097****	
				(0.00)					(2.93)					(-3.13)	
lll_border_schengen					0.048					0.028					0.127
					(0.98)					(0.22)					(1.05)
lmanemp_2008						0.038	0.039	0.039	0.038	0.039					
						(0.77)	(0.79)	(0.79)	(0.77)	(0.79)					
lseremp_2008											0.136****	0.136****	0.136****	0.144****	0.135****
											(3.87)	(3.87)	(3.86)	(4.11)	(3.86)
lll_border_biltrust													0.005		
													(0.17)		
Constant	****	****	****	****	****	***			*		*			*	
	(-10.56)	(-10.61)	(-10.63)	(-10.63)	(-10.61)	(-2.18)	(-0.89)	(-0.86)	(-1.50)	(-0.92)	(1.31)	(1.06)	(1.04)	(1.52)	(0.92)
Observations	970	970	970	970	970	985	985	985	985	985	985	985	985	985	985
Adjusted R^2	0.587	0.587	0.587	0.586	0.586	0.421	0.423	0.423	0.428	0.422	0.358	0.358	0.357	0.363	0.358

Table A.5. Border effects on local labor markets

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008-2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.795****	0.794****	0.794****	0.794****	0.794****										
	(10.02)	(10.05)	(10.06)	(10.02)	(10.05)										
rural	0.024	0.025	0.024	0.025	0.025	0.226****	0.224****	0.224****	0.223****	0.214****	-0.000	-0.001	-0.001	0.003	0.000
	(1.02)	(1.05)	(1.02)	(1.05)	(1.08)	(6.00)	(5.96)	(5.95)	(5.95)	(5.69)	(-0.00)	(-0.02)	(-0.02)	(0.07)	(0.01)
urban	-0.009	-0.008	-0.008	-0.008	-0.008	0.137****	0.136****	0.136****	0.139****	0.130****	-0.033	-0.033	-0.033	-0.035	-0.033
	(-0.44)	(-0.41)	(-0.39)	(-0.39)	(-0.41)	(4.25)	(4.24)	(4.25)	(4.37)	(4.04)	(-1.01)	(-1.03)	(-1.03)	(-1.08)	(-1.03)
Dummy overall border, final version (June 24, 2016)	0.002	-0.076*	-0.073	-0.076*	-0.075*	0.024	0.117*	0.119*	0.114*	0.062	-0.007	0.054	0.053	0.057	0.055
	(0.09)	(-1.34)	(-1.28)	(-1.34)	(-1.32)	(0.87)	(1.59)	(1.62)	(1.57)	(0.78)	(-0.22)	(0.69)	(0.68)	(0.74)	(0.71)
Manufacturing specialisation	-0.119****	-0.145****	-0.145****	-0.145****	-0.146****	0.078***	0.109****	0.109****	0.110****	0.115****	0.035	0.055	0.055	0.056	0.053
	(-4.82)	(-4.32)	(-4.33)	(-4.32)	(-4.36)	(2.47)	(2.87)	(2.86)	(2.89)	(2.99)	(1.07)	(1.23)	(1.23)	(1.25)	(1.19)
manufacturing_border		0.090**	0.104***	0.087**	0.024		-0.107*	-0.096*	-0.140**	-0.106*		-0.070	-0.074	-0.036	-0.197*

	(1.90)	(2.23)	(1.80)	(0.37)		(-1.47)	(-1.30)	(-1.91)	(-1.45)		(-0.83)	(-0.87)	(-0.43)	(-1.53)
manufacturing_border_biltrust		-0.034**					-0.028					0.011		
		(-1.89)					(-1.05)					(0.38)		
manufacturing_border_legal			0.009					0.096****					-0.101****	
			(0.47)					(3.58)					(-3.61)	
manufacturing_border_schengen				0.070**										0.135*
				(1.68)										(1.32)
lmanemp_2008					0.005	0.006	0.006	0.003	-0.007					
					(0.09)	(0.11)	(0.11)	(0.06)	(-0.13)					
monuments_border_schengen									0.086****					
									(2.75)					
lsemp_2008										0.143****	0.144****	0.144****	0.151****	0.144****
										(4.09)	(4.13)	(4.12)	(4.36)	(4.14)
Constant	****	****	****	****	****	**	**	**	****	*	***	**	**	***	**
	(-10.66)	(-10.70)	(-10.72)	(-10.72)	(-10.70)	(-1.75)	(-1.92)	(-1.83)	(-2.67)	(-1.35)	(2.17)	(1.89)	(1.84)	(2.39)	(1.83)
Observations	969	969	969	969	969	984	984	984	984	977	984	984	984	984	984
Adjusted R^2	0.598	0.598	0.599	0.598	0.598	0.423	0.424	0.424	0.429	0.428	0.358	0.358	0.357	0.364	0.358

Table A.6. Border effects on manufacturing

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008-2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.559****	0.559****	0.559****	0.559****	0.558****										
	(9.01)	(9.01)	(9.03)	(9.02)	(9.02)										
rural	0.031*	0.030*	0.029	0.030*	0.031*	0.243****	0.244****	0.242****	0.247****	0.244****	0.001	0.001	0.001	0.001	0.003
	(1.34)	(1.34)	(1.26)	(1.33)	(1.38)	(6.54)	(6.54)	(6.51)	(6.69)	(6.55)	(0.02)	(0.03)	(0.03)	(0.02)	(0.07)
urban	0.014	0.013	0.014	0.013	0.013	0.152****	0.152****	0.152****	0.156****	0.151****	-0.026	-0.025	-0.025	-0.028	-0.025
	(0.69)	(0.66)	(0.67)	(0.66)	(0.64)	(4.77)	(4.75)	(4.75)	(4.95)	(4.75)	(-0.81)	(-0.76)	(-0.76)	(-0.87)	(-0.78)
Dummy overall border, final version (June 24, 2016)	0.006	0.174***	0.191***	0.175***	0.161***	0.024	0.188	0.202	0.148	0.180	-0.007	-0.318*	-0.317*	-0.275	-0.339*
	(0.29)	(2.30)	(2.38)	(2.34)	(2.10)	(0.87)	(0.90)	(0.95)	(0.73)	(0.86)	(-0.25)	(-1.29)	(-1.29)	(-1.12)	(-1.34)
(count) id	0.416****	0.417****	0.416****	0.417****	0.417****	-0.003	-0.003	-0.003	-0.003	-0.003	0.038	0.037	0.037	0.035	0.038
	(3.03)	(3.03)	(3.03)	(3.03)	(3.04)	(-0.11)	(-0.11)	(-0.12)	(-0.11)	(-0.10)	(1.24)	(1.22)	(1.22)	(1.17)	(1.25)
partner_border		-0.169***	-0.171***	-0.169***	-0.225****		-0.164	-0.165	-0.154	-0.196		0.312	0.312	0.303	0.220
		(-2.05)	(-1.99)	(-2.06)	(-2.64)		(-0.79)	(-0.78)	(-0.77)	(-0.89)		(1.28)	(1.28)	(1.25)	(0.77)

partner_border_biltrust_cont			-0.031***					-0.028					-0.001		
			(-1.99)					(-0.79)					(-0.04)		
partner_border_legal				-0.001					0.088****					-0.099****	
				(-0.05)					(2.86)					(-3.21)	
partner_border_schengen					0.074*					0.042					0.122
					(1.44)					(0.38)					(1.17)
lmanemp_2008						0.043	0.044	0.043	0.043	0.044					
						(0.84)	(0.85)	(0.84)	(0.84)	(0.85)					
lsemp_2008											0.121****	0.123****	0.123****	0.131****	0.123****
											(3.11)	(3.17)	(3.17)	(3.39)	(3.17)
Constant	****	****	****	****	****	*	*	*	***	*	****	****	****	****	****
	(-10.41)	(-10.42)	(-10.44)	(-10.40)	(-10.43)	(-1.46)	(-1.50)	(-1.46)	(-2.23)	(-1.53)	(3.00)	(3.02)	(3.01)	(3.50)	(2.95)
Observations	970	970	970	970	970	985	985	985	985	985	985	985	985	985	985
Adjusted R^2	0.699	0.699	0.699	0.699	0.699	0.420	0.419	0.419	0.424	0.419	0.358	0.358	0.358	0.364	0.359

Table A.7. Border effects on scientific cooperation

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008-2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.779****	0.778****	0.777****	0.778****	0.778****										
	(9.82)	(9.78)	(9.74)	(9.78)	(9.78)										
rural	0.009	0.009	0.009	0.008	0.010	0.240****	0.240****	0.240****	0.241****	0.241****	0.010	0.010	0.009	0.024	0.014
	(0.40)	(0.39)	(0.38)	(0.35)	(0.44)	(6.54)	(6.53)	(6.53)	(6.52)	(6.53)	(0.23)	(0.21)	(0.19)	(0.54)	(0.32)
urban	-0.024	-0.025	-0.025	-0.026	-0.025	0.152****	0.152****	0.152****	0.152****	0.152****	-0.028	-0.030	-0.030	-0.021	-0.029
	(-1.18)	(-1.24)	(-1.24)	(-1.26)	(-1.23)	(4.94)	(4.90)	(4.90)	(4.90)	(4.90)	(-0.84)	(-0.88)	(-0.90)	(-0.62)	(-0.86)
Dummy overall border, final version (June 24, 2016)	0.013	0.011	0.011	0.010	0.019	0.013	0.012	0.012	0.014	0.016	-0.002	-0.005	-0.007	0.016	0.020
	(0.55)	(0.45)	(0.45)	(0.37)	(0.60)	(0.47)	(0.42)	(0.42)	(0.51)	(0.55)	(-0.08)	(-0.15)	(-0.21)	(0.54)	(0.53)
EQI index	-0.263****	-0.274****	-0.273****	-0.272****	-0.271****	0.280****	0.272****	0.273****	0.270****	0.274****	0.085	0.069	0.076	0.046	0.079
	(-3.14)	(-3.17)	(-3.14)	(-3.16)	(-3.14)	(3.61)	(3.50)	(3.51)	(3.46)	(3.52)	(0.87)	(0.66)	(0.73)	(0.44)	(0.78)
qog_border		0.020	0.017	0.016	0.058*		0.013	0.012	0.019	0.035		0.028	-0.002	0.077**	0.157***
		(0.81)	(0.60)	(0.67)	(1.61)		(0.36)	(0.30)	(0.49)	(0.40)		(0.62)	(-0.04)	(1.71)	(2.20)

qog_border_biltrust_cont			0.006					0.002					0.052*		
			(0.35)					(0.05)					(1.62)		
qog_border_legal				0.014					-0.019					-0.168****	
				(0.58)					(-0.57)					(-4.66)	
qog_border_schengen					-0.045					-0.026					-0.156**
					(-0.88)					(-0.31)					(-1.85)
lmanemp_2008						0.032	0.032	0.032	0.032	0.032					
						(0.64)	(0.64)	(0.63)	(0.63)	(0.64)					
lsemp_2008											0.137****	0.136****	0.133****	0.144****	0.138****
											(3.70)	(3.67)	(3.55)	(3.96)	(3.74)
Constant	****	****	****	****	****	***	***	***	***	***	***	***	***	****	***
	(-10.46)	(-10.44)	(-10.41)	(-10.44)	(-10.43)	(-2.47)	(-2.50)	(-2.51)	(-2.25)	(-2.50)	(2.21)	(2.18)	(2.16)	(3.07)	(2.20)
Observations	945	945	945	945	945	959	959	959	959	959	959	959	959	959	959
Adjusted R^2	0.594	0.594	0.594	0.594	0.594	0.432	0.431	0.430	0.431	0.430	0.300	0.299	0.300	0.312	0.301

Table A.8. Border effects on regional governance

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008--2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.785****	0.785****	0.783****	0.783****	0.785****										
	(9.82)	(9.81)	(9.82)	(9.81)	(9.81)										
rural	0.013	0.013	0.009	0.008	0.014	0.244****	0.242****	0.248****	0.256****	0.244****	0.002	0.003	0.000	-0.002	0.006
	(0.54)	(0.55)	(0.38)	(0.34)	(0.59)	(6.65)	(6.59)	(6.74)	(7.07)	(6.66)	(0.04)	(0.08)	(0.01)	(-0.05)	(0.14)
urban	-0.024	-0.023	-0.025	-0.028*	-0.024	0.154****	0.153****	0.156****	0.165****	0.152****	-0.024	-0.024	-0.025	-0.028	-0.025
	(-1.15)	(-1.14)	(-1.21)	(-1.33)	(-1.16)	(4.92)	(4.88)	(5.00)	(5.32)	(4.85)	(-0.76)	(-0.73)	(-0.77)	(-0.87)	(-0.76)
Dummy overall border, final version (June 24, 2016)	0.002	-0.001	0.003	0.006	0.004	0.023	0.050**	0.044*	0.032	0.063***	-0.013	-0.025	-0.022	-0.017	-0.011
	(0.07)	(-0.02)	(0.14)	(0.24)	(0.15)	(0.82)	(1.68)	(1.45)	(1.06)	(2.07)	(-0.46)	(-0.74)	(-0.66)	(-0.53)	(-0.32)
Crime rate per 100,000 pop.	0.047**	0.044**	0.043**	0.045**	0.044**	0.031	0.074**	0.075**	0.071**	0.075**	0.131***	0.113***	0.113***	0.115***	0.114***
	(1.85)	(1.74)	(1.72)	(1.80)	(1.76)	(0.80)	(1.85)	(1.86)	(1.75)	(1.87)	(2.22)	(2.54)	(2.55)	(2.57)	(2.54)
saf_border		0.007	0.013*	0.010	-0.644*		-0.078***	-0.087***	-0.088***	-1.954***		0.032	0.037	0.036	-2.060****
		(0.70)	(1.45)	(1.19)	(-1.58)		(-2.41)	(-2.55)	(-2.56)	(-2.30)		(0.60)	(0.67)	(0.69)	(-2.78)
saf_bor			-0.024**					0.038					-0.018		

der_biltrust_cont			(-1.74)					(1.20)					(-0.77)		
saf_border_legal				-0.034***					0.094****					-0.037*	
				(-2.35)					(2.61)					(-1.55)	
saf_border_schengen					0.650*					1.875***					2.090****
					(1.60)					(2.21)					(2.85)
lmanemp_2008						0.046	0.045	0.048	0.054	0.045					
						(0.92)	(0.89)	(0.96)	(1.07)	(0.91)					
lsalemp_2008											0.151****	0.153****	0.151****	0.150****	0.153****
											(4.44)	(4.49)	(4.44)	(4.42)	(4.52)
Constant	****	****	****	****	****	*	**	**	**	**	****	****	****	****	***
	(-10.43)	(-10.42)	(-10.43)	(-10.43)	(-10.42)	(-1.50)	(-1.65)	(-1.70)	(-1.83)	(-1.76)	(2.62)	(2.65)	(2.66)	(2.71)	(2.51)
Observations	970	970	970	970	970	985	985	985	985	985	985	985	985	985	985
Adjusted R^2	0.587	0.587	0.587	0.587	0.587	0.420	0.423	0.424	0.430	0.425	0.365	0.365	0.365	0.365	0.367

Table A.9. Border effects on public safety

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008--2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.783****	0.782****	0.782****	0.783****	0.782****										
	(9.88)	(9.86)	(9.88)	(9.84)	(9.86)										
rural	0.013	0.013	0.011	0.013	0.013	0.243****	0.244****	0.243****	0.247****	0.245****	-0.001	-0.001	-0.001	-0.001	0.001
	(0.55)	(0.55)	(0.47)	(0.55)	(0.58)	(6.64)	(6.67)	(6.64)	(6.80)	(6.68)	(-0.02)	(-0.01)	(-0.01)	(-0.02)	(0.01)
urban	-0.025	-0.025	-0.025	-0.026	-0.026	0.153****	0.152****	0.153****	0.157****	0.152****	-0.030	-0.029	-0.029	-0.032	-0.030
	(-1.24)	(-1.24)	(-1.23)	(-1.24)	(-1.26)	(4.87)	(4.86)	(4.86)	(5.04)	(4.85)	(-0.91)	(-0.90)	(-0.90)	(-1.00)	(-0.92)
Dummy overall border, final version (June 24, 2016)	0.004	0.018	0.040	0.019	0.036	0.025	0.484*	0.502*	0.458*	0.506*	-0.007	-0.277	-0.277	-0.246	-0.241
	(0.16)	(0.11)	(0.25)	(0.12)	(0.23)	(0.87)	(1.40)	(1.44)	(1.35)	(1.48)	(-0.25)	(-0.69)	(-0.69)	(-0.61)	(-0.57)
Spatial lags of EVS (thrift)	-0.028**	-0.027	-0.027	-0.027	-0.026	0.021	0.048	0.048	0.047	0.050*	0.042*	0.025	0.025	0.027	0.028
	(-1.88)	(-1.22)	(-1.22)	(-1.22)	(-1.16)	(0.74)	(1.28)	(1.28)	(1.25)	(1.33)	(1.34)	(0.63)	(0.63)	(0.66)	(0.70)
lagsav_border		-0.014	-0.019	-0.014	-0.084		-0.461*	-0.464*	-0.463*	-0.544*		0.270	0.270	0.275	0.132
		(-0.09)	(-0.12)	(-0.09)	(-0.49)		(-1.34)	(-1.34)	(-1.37)	(-1.51)		(0.67)	(0.68)	(0.69)	(0.28)

lagsav_border_biltrust_cont			-0.035**					-0.028					0.000		
			(-1.75)					(-0.80)					(0.00)		
lagsav_border_legal				-0.004					0.085****					-0.106****	
				(-0.19)					(2.77)					(-3.49)	
lagsav_border_schengen					0.055					0.066					0.110
					(1.18)					(0.57)					(0.96)
lmanemp_2008						0.041	0.041	0.041	0.041	0.041					
						(0.81)	(0.82)	(0.82)	(0.81)	(0.82)					
lseremp_2008											0.139****	0.140****	0.140****	0.147****	0.140****
											(4.03)	(4.07)	(4.06)	(4.30)	(4.06)
Constant	****	****	****	****	****	*	**	**	***	**					
	(-10.73)	(-10.90)	(-10.92)	(-10.91)	(-10.91)	(-1.38)	(-1.74)	(-1.73)	(-2.01)	(-1.80)	(0.28)	(0.59)	(0.59)	(0.83)	(0.50)
Observations	970	970	970	970	970	985	985	985	985	985	985	985	985	985	985
Adjusted R^2	0.587	0.587	0.587	0.586	0.586	0.420	0.421	0.421	0.425	0.420	0.359	0.358	0.358	0.365	0.358

Table A.10. Border effects on financial capital flows

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008--2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.782****	0.783****	0.782****	0.782****	0.783****										
	(9.84)	(9.84)	(9.85)	(9.82)	(9.83)										
rural	0.012	0.012	0.011	0.012	0.013	0.243****	0.243****	0.242****	0.242****	0.243****	-0.000	0.001	0.001	0.002	0.002
	(0.51)	(0.54)	(0.47)	(0.51)	(0.55)	(6.59)	(6.62)	(6.60)	(6.59)	(6.62)	(-0.00)	(0.02)	(0.02)	(0.04)	(0.04)
urban	-0.027*	-0.027*	-0.026	-0.028*	-0.027*	0.151****	0.150****	0.151****	0.149****	0.150****	-0.028	-0.029	-0.029	-0.028	-0.030
	(-1.29)	(-1.30)	(-1.28)	(-1.34)	(-1.31)	(4.76)	(4.74)	(4.74)	(4.68)	(4.74)	(-0.87)	(-0.88)	(-0.88)	(-0.85)	(-0.90)
Dummy overall border, final version (June 24, 2016)	0.005	0.217**	0.227**	0.190	0.200*	0.025	0.233	0.240	0.173	0.230	-0.008	0.298*	0.299*	0.323*	0.238
	(0.21)	(1.67)	(1.74)	(1.10)	(1.48)	(0.88)	(1.01)	(1.04)	(0.75)	(0.97)	(-0.25)	(1.34)	(1.34)	(1.39)	(1.03)
People can be trusted/ can't be too careful	0.013	0.033	0.033	0.030	0.031	0.022	0.042	0.041	0.036	0.041	-0.026	0.003	0.003	0.006	-0.002
	(0.54)	(1.03)	(1.03)	(0.87)	(0.96)	(0.65)	(0.98)	(0.97)	(0.83)	(0.96)	(-0.72)	(0.07)	(0.07)	(0.13)	(-0.05)
border_		-0.215**	-0.209**	-0.201*	-0.194*		-0.211	-0.206	-0.178	-0.207		-0.309*	-0.308*	-0.323*	-0.240

trust															
		(-1.69)	(-1.65)	(-1.41)	(-1.43)		(-0.89)	(-0.87)	(-0.77)	(-0.85)		(-1.35)	(-1.34)	(-1.40)	(-1.00)
border_trust_bil trust_cont			-0.033**					-0.024					-0.005		
			(-1.75)					(-0.67)					(-0.19)		
Border* trust * legal borders				0.019					0.040					-0.017	
				(0.36)					(0.80)					(-0.30)	
Border* trust * Schengen					-0.011					-0.002					-0.039
					(-0.63)					(-0.05)					(-1.02)
lmanemp_2008						0.044	0.044	0.043	0.044	0.044					
						(0.89)	(0.90)	(0.89)	(0.89)	(0.90)					
lsemp_2008											0.139****	0.139****	0.139****	0.140****	0.139****
											(4.02)	(4.03)	(4.02)	(4.05)	(4.02)
Constant	****	****	****	****	****	*	**	**	**	**	***	*	*	*	*
	(-10.08)	(-9.98)	(-10.00)	(-9.92)	(-9.96)	(-1.60)	(-1.86)	(-1.83)	(-1.79)	(-1.84)	(2.28)	(1.41)	(1.41)	(1.38)	(1.48)
Observations	969	969	969	969	969	984	984	984	984	984	984	984	984	984	984
Adjusted R^2	0.587	0.587	0.587	0.586	0.586	0.420	0.420	0.420	0.420	0.419	0.357	0.358	0.357	0.357	0.358

Table A.11. Border effects on trust

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Dep. variable	*2008--2019 regional GDP growth*					*2008-2019 regional manufacturing employment growth*					*2008-2019 regional service employment growth*				
Log of total 2008 value added	0.782****	0.781****	0.781****	0.781****	0.781****										
	(9.88)	(9.85)	(9.86)	(9.82)	(9.84)										
rural	0.013	0.012	0.010	0.012	0.013	0.242****	0.242****	0.241****	0.246****	0.242****	-0.002	-0.001	-0.001	-0.002	0.000
	(0.56)	(0.54)	(0.45)	(0.53)	(0.56)	(6.64)	(6.66)	(6.63)	(6.80)	(6.67)	(-0.05)	(-0.03)	(-0.03)	(-0.04)	(0.01)
urban	-0.025	-0.026	-0.026	-0.026	-0.026	0.152****	0.150****	0.151****	0.155****	0.150****	-0.030	-0.029	-0.029	-0.033	-0.030
	(-1.23)	(-1.26)	(-1.26)	(-1.27)	(-1.28)	(4.86)	(4.80)	(4.79)	(4.99)	(4.79)	(-0.93)	(-0.90)	(-0.90)	(-1.01)	(-0.92)
Dummy overall border, final version (June 24, 2016)	0.004	0.146	0.167	0.149	0.135	0.024	0.506**	0.519**	0.462**	0.498**	-0.008	-0.182	-0.181	-0.135	-0.209
	(0.17)	(0.91)	(1.05)	(0.94)	(0.82)	(0.86)	(1.89)	(1.92)	(1.76)	(1.85)	(-0.26)	(-0.59)	(-0.59)	(-0.44)	(-0.67)
Spatial lags of manufacturing specialisation	-0.014	-0.003	-0.003	-0.003	-0.004	0.035	0.070**	0.070**	0.069**	0.070**	0.044*	0.031	0.031	0.032	0.029
	(-0.93)	(-0.14)	(-0.14)	(-0.13)	(-0.16)	(1.16)	(1.83)	(1.82)	(1.81)	(1.81)	(1.40)	(0.79)	(0.79)	(0.80)	(0.75)
lagman		-0.143	-0.146	-0.144	-0.177		-0.484**	-0.484**	-0.470**	-0.508**		0.175	0.175	0.162	0.093

_border															
		(-0.82)	(-0.83)	(-0.83)	(-1.07)		(-1.80)	(-1.79)	(-1.78)	(-1.84)		(0.57)	(0.57)	(0.53)	(0.28)
lagman_border_biltrust_cont			-0.037**					-0.027					-0.001		
			(-1.86)					(-0.78)					(-0.05)		
lagman_border_legal				-0.006					0.087****					-0.100****	
				(-0.28)					(2.83)					(-3.23)	
lagman_border_schengen					0.048					0.035					0.117
					(1.04)					(0.32)					(1.13)
lmanemp_2008						0.040	0.040	0.040	0.040	0.040					
						(0.81)	(0.81)	(0.80)	(0.80)	(0.81)					
lseremp_2008											0.140****	0.141****	0.141****	0.147****	0.141****
											(4.05)	(4.09)	(4.09)	(4.30)	(4.10)
Constant term	****	****	****	****	****	**	***	***	****	***					
	(-10.64)	(-10.85)	(-10.87)	(-10.87)	(-10.85)	(-1.78)	(-2.32)	(-2.29)	(-2.67)	(-2.32)	(0.55)	(0.73)	(0.73)	(1.03)	(0.73)
Observations	970	970	970	970	970	985	985	985	985	985	985	985	985	985	985
Adjusted R^2	0.586	0.586	0.587	0.586	0.586	0.421	0.422	0.422	0.426	0.422	0.359	0.358	0.357	0.364	0.358

Table A.12. Border effects on market potential

*Standardized beta coefficients; t statistics in parentheses. * p < 0.20, ** p < 0.10, *** p < 0.05, **** p < 0.01*

A.2 Additional details on the methodology used to simulate the impact of full closures

This second technical appedix provides more details on the MASST model that was used to simulate future scenarios based on the full closures enacted during Spring 2020.[12]

The MASST model is a macroeconometric regional growth model built to simulate long-run regional growth rates for European regions. The label encompasses the building blocks it is is made of, namely Macroeconomic, Sectoral, Social and Territorial. In the MASST model, regional performance is explained both by macroeconomic features, that we use to model the national and global side, and by regional competitiveness factors, which are instead used to capture the supply side, with the sectoral, social, and territorial aspects of each region. The regional dimension is modelled taking into account two groups of factors:

- territorial capital, which encompasses tangible and intangible assets representing a region's growth potential;
- territorial complexity, capturing region-specific assets and synergies causing regional growth, including differentiated territorial patterns of innovation, regional urban structure, agglomeration economies, and structural urban dynamics.

The model runs across two stages:

- In an estimation stage, structural relations between explanatory and dependent variables in various national and regional equations are estimated over a long run time span through a set of equations included in the model;
- In the simulation stage, instead, estimated coefficients are employed for simulating likely future growth patterns (usually, over a 15-20 years' horizon), and given an internally coherent sets of assumptions forming regional growth scenarios.

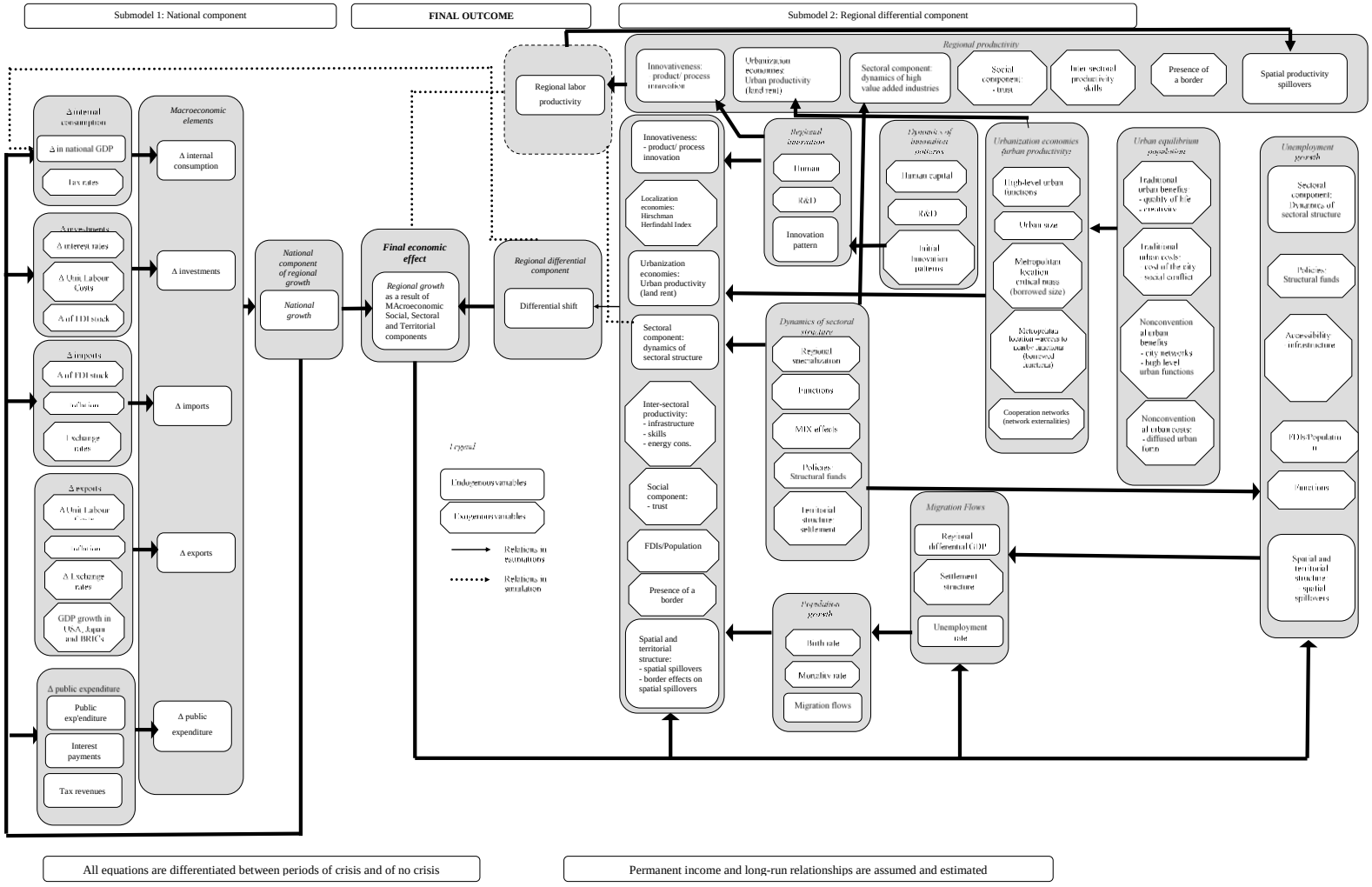
The model merges national and regional growth-enhancing factors by explaining regional growth (ΔY_r) as a decomposition between a national growth rate (ΔY_n) and a regional differential shift (s) (Capello, 2007; Eq. A1):

$$\Delta \boldsymbol{Y_r} = \Delta \boldsymbol{Y_N} + s;\ \boldsymbol{r} \in \boldsymbol{N} \qquad \text{A.1}$$

The regional differential shift *s* lies at the core of the logical flowchart of the MASST4 model (Figure A.1). On the left-hand side, macroeconomic factors explain national GDP growth rates, while on the right-hand side endogenous regional equation explain the regional differential shift.

[12] The interested reader is referred to Capello and Caragliu (2021a) for a thorough scientific discussion of the structure of the fourth version of the model employed in our simulations, and to Capello and Caragliu (2021b) for details on the simulations of the costs of COVID closures.

Figure A.1. Logical flowchart of the MASST4 model



Source: Capello and Caragliu (2021a)

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KN-08-22-344-EN-N

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