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The Economic Effect of the EU Eastern Enlargement in 2004 on Border Regions in the Old Member States*

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Abstract

The paper evaluates the impact of the EU Eastern enlargement 2004 on the economic performance of border regions located at the frontier to the new member states in the East. These regions were assumed to be particularly affected by the enlargement because of their geographic proximity to the new member states. Effects are identified by applying a synthetic control method that generates the counterfactual situation, i.e. the hypothetical economic performance of the border regions had the EU Eastern enlargement not taken place. Results show that, overall, the EU Eastern enlargement 2004 had no statistically significant effect on the economic performance of border regions. However, when considering each border region individually, it becomes evident that heterogeneous treatment effects are at play: While the German border regions have predominantly profited from the EU enlargement, for the Italian region, the effect is negative. This heterogeneity seems to be driven by differences in the initial state of regional development as well as in regional import volumes.

Keywords: EU Enlargement, Border Regions, Economic Integration, Synthetic Control Method

JEL Classification: F15, R10, R11

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1 Introduction

About a decade ago, in May 2004, eight Eastern European countries (namely Czech Republic, Estonia, Hungary, Latvia, Poland, Slovakia and Slovenia) have joined the European Union in the hitherto largest expansion. This enlargement led to a significant increase in market size, yet it differed from previous enlargement rounds, as the wealth gap between old and new member states was more distinct. The gross national income per capita (measured in purchasing power parities) of the new member states, for instance, amounted to merely 40% of the old member states, i.e. the EU-15 (Baas and Brücker, 2010). Because of the large discrepancy in wages and socioeconomic conditions, the enlargement was accompanied by both hopes and fears about the effects of full integration particularly in regions located at the frontier to the new member states. These concerns were fueled by the presumption that the specific geographic position of border regions made them focal points in the integration process (European Commission, 2001; Niebuhr and Stiller, 2002).

In economic theory, this is taken up in the classic trade and location theories as well as in the New Economic Geography (NEG), assuming that border regions experience more drastic changes in market access than more central regions due to their sheer geographical proximity to the new member states (e.g. Krugman, 1991; Krugman and Venables, 1990; Hanson, 2005; Bosker and Garretsen, 2010). While advocates of the enlargement viewed the border location as an advantage, arguing that the privileged access to the markets in the new member states constitutes an incentive for firms to locate in these regions, opponents feared an increased (price) competition from foreign firms on domestic markets entailing a depression of wages and increasing unemployment (e.g. Niebuhr, 2008; Lafourcade and Paluzie, 2011).

Most empirical studies addressing the economic consequences of the EU Eastern enlargement 2004 provide a rather clear picture, suggesting an overall positive enlargement effect on income levels and economic growth rates (Epstein and Jacoby, 2014). However, the works almost exclusively focus on EU-wide impacts or on economic effects on the country-level in both old and new member states (e.g. Baas and Brücker, 2010); Elsener, 2013b and 2013a). Few address the peculiarities of border regions, even though they were assumed to be especially affected by the integration effects (European Commission, 2001; Resmini, 2003; Niebuhr and Stiller, 2002; Brakman *et al.*, 2006). The few studies that do emphasize on the effects on border regions mainly assess the immediate effects of integration (Braakmann and Vogel, 2010). Yet, border regions might face pronounced adjustment pressures in the short-run due to decreasing transaction costs and strong external effects. Therefore, it is crucial to investigate the performance of

these regions for a sufficient time period to draw valid conclusions about the effects of the EU Eastern enlargement. This paper adds to the existing literature on the economic effects of the EU Eastern enlargement in 2004 in two ways: First, it explicitly focuses on the economic effect (i.e. changes in regional GDP) on former EU external border regions in Germany, Austria and Italy. Second, by choosing a relative long time-period (i.e. 22 years), the paper accounts for the dynamics in the years prior and past to the EU enlargement that may act as confounders of the treatment effect.

In order to identify the effects the EU enlargement had on the regional GDP of border regions in the old member states, the paper applies a synthetic control method (SCM) developed by Abadie and Gardeazabal (2003) and Abadie *et al.* (2010, 2014). This method enables the creation of a credible counterfactual scenario that would be difficult in standard panel regression analysis because of omitted variable bias. Precisely, the SCM compares the economic development of the border regions in the aftermath of the EU enlargement with synthetically generated controls, representing the counterfactual scenario, i.e. the economic performance of border regions had the EU enlargement not taken place. The SCM is very suitable for the assessment of the economic impact of the EU 2004 enlargement on border regions, because of the small number of treated units. Out of all 186 EU-15 regions (NUTS2), merely seven German regions, five Austrian regions and one Italian region share a border with the new Eastern European member states. The SCM is also more transparent than the standard regression design, because it explicitly reveals the relative contribution of each control unit to the counterfactual of interest as well as the similarities between the border regions and their respective synthetic control group in terms of pre-intervention outcomes and other predictors of post-intervention outcomes (Abadie *et al.*, 2010). The method has been successfully applied in similar studies on the effects of trade liberalization and economic integration on the country-level (for example Billmeier and Nannicini, 2013; Campos *et al.*, 2014). At the aggregate level (i.e. when considering all border regions together) no statistically significant enlargement effect can be observed. Yet, when assessing the enlargement effect for each border region individually, it becomes evident that at the regional-level, the EU Eastern enlargement had an effect on the regional GDP of individual border regions: While several German border regions benefited from the enlargement, the Italian border region seems to be negatively affected by the enlargement. These results suggest that regions adjust differently to the institutional changes evoked by the enlargement. When looking at the factors that potentially drive the heterogeneous integration effects, the initial state of regional economic development and the regional import volume seem to impact the extent to which border regions benefit from the EU Eastern enlargement 2004.

The remainder of the paper is structured as follows: the next section provides an overview over the economic theory addressing the effects of economic integration on border regions and outlines the main features of the EU Eastern Enlargement 2004. Section 3 introduces the synthetic control method (SCM) and describes the sample and data as well as the estimation strategy. The results from the empirical analysis are provided in Section 4. The paper closes with a critical discussion of the main results and their consequences for regions located at the border to the new member states (Section 5).

2 The Impact of Economic Integration for Border Regions

2.1 Economic Theory

In the literature, the effect of economic and political integration on the economic performance of border regions is still not conclusively assessed (Niebuhr and Stiller, 2002). It is neither clear whether regions located at the border to newly integrated countries have been particularly affected by the integration process, nor whether the potential effect is positive or negative. As Petrakos and Topaloglou (2008) have put it, it is unclear whether border regions turn from barriers to bridges in the integration process and inherently benefit from cross-border trade, or whether they are they just corridors for trade flows, without gaining from integration.

In economic theory, the spatial effect of economic integration, i.e. a decline of cross-border transportation costs, has traditionally been assessed under classic trade and location theories. In trade theory, spatial effects of integration emerge as a result of intra-country factor reallocation, whereby regions with inherently better access to the new markets such as port cities and border regions are assumed to profit from an increase in international trade flows (Rausch, 1991; Niebuhr and Stiller, 2002). Hence, border regions may attract export firms, profiting from reduced transportation costs. This argument is closely linked to classic location theories, presuming that the location decision of firms is determined by the size of the market they can serve. As borders constitute barriers in market access, regions along the border are less attractive location sites for firms. Reversing the argument, economic integration and free movement of goods, services, capital and labor alters the position of border regions and increases the accessible market area, i.e. the market potential of border regions. As a consequence, border regions may gain in attractiveness due to privileged access to the newly integrated markets.

Building on these early location theories, the New Economic Geography (NEG) introduced by Krugman in his seminal core-periphery model (1991) and refined by Krugman and Venables

(1990, 1993) explains regional disparities in economic activities by endogenous location decisions of firms and workers (Camagni and Capello, 2011; Niebuhr and Stiller, 2002). Integration processes and changes in market access affect the relative strength of centrifugal forces, entailing an uneven distribution of economic activities within the integrating countries. In an application of the NEG model, Brühlhardt *et al.* (2004) and Crozet and Koenig (2004) trace explicitly what happens to domestic spatial distribution of economic activities when cross-border transaction costs decrease in the course of economic integration. Their theoretical models predict that *ceteris paribus*, regions with inherently less costly access to foreign markets such as border regions realize the largest gains from economic integration. While Brühlhardt *et al.* (2004) attribute this to a concentration of human capital in border regions, Crozet and Koenig (2004) predict that trade liberalization drives domestic firms to regions close to the border, unless competition is too strong. Overall, border regions, which are endowed with a relative better access to the markets in the newly integrated countries, should profit from economic integration due to the emergence of new economic opportunities in the new markets (Braakmann and Vogel, 2010; Niebuhr, 2008; Brühlhardt *et al.*, 2004).

Even though the theoretical models suggest that trade liberalization and economic integration reveal a positive effect for border regions at the frontier to the new member states, it would also be plausible to find no or a negative effect. Hence, regions located at the former EU external border are conceived as peripheral, low opportunity areas, hosting less advanced local economies (Petraikos and Topaloglou, 2008). On average, they perform worse in terms of GDP and income levels than metropolitan and core regions. Furthermore, they are characterized by a lower population density and, in turn, lacking any agglomeration economies. Therefore, they may not have been affected from the EU enlargement at all, as trade of goods and services and migration takes place between national hubs (Bathelt *et al.*, 2004). Moreover, the economic integration also entails an increased competition from foreign firms on the domestic market, potentially reducing the attractiveness of border regions as production sites (Niebuhr, 2008). Thus, border regions may face pressures due to a potential dislocation of local firms, difficulties to compete in low-tech sectors and labor immigration, as a consequence of the economic integration (Topaloglou *et al.*, 2006). This suggests that border regions do not particularly profit from economic integration. The arguments brought in for a positive or negative effect of the EU Eastern enlargement for border regions in the old member states are listed in Table 1.

Empirically, the effects of economic integration on border regions are not conclusively assessed, yet. Niebuhr and Stiller (2002) provide a comprehensive overview of earlier works, examining the effect of economic integration on border regions for the European as well as North

Table 1: Advantages and Disadvantages of Border Location in the Course of Economic Integration

Positive Effects	Negative Effects
-Privileged access to new markets	-Increased (price) competition
-Incentive for firms to locate in region	-Reduction of the attractiveness of border regions
-Exploitation of economies of scale	-Difficulties of firms to compete in low-tech sectors
-Trade creation due to lower transaction costs	-Loss of protection for firms in peripheral areas
-Better performance of regional firms due to increased competition	-Depression of wages
-Concentration of human capital	-Increased unemployment

American context. Recent works that particular emphasis on the integration effects on border regions include Brakman *et al.* (2012), who find a positive effect of economic integration on the population in border regions in the EU, and Redding and Sturm (2008), who find that West German cities located close to the inner German border experienced a decline in population as well as an economic downward trend, once the border was established. The only study that focuses explicitly on the effects of the EU Eastern enlargement in 2004 on border regions is the work by Braakmann and Vogel (2010). They show that especially small service firms located in German NUTS 1 border regions profited from the EU Eastern enlargement, while large firms did not profit, at least in the years immediately after the EU Eastern enlargement. Similar to Braakmann and Vogel (2010), this paper focuses on the economic impact of the EU Eastern enlargement in 2004 on border regions.

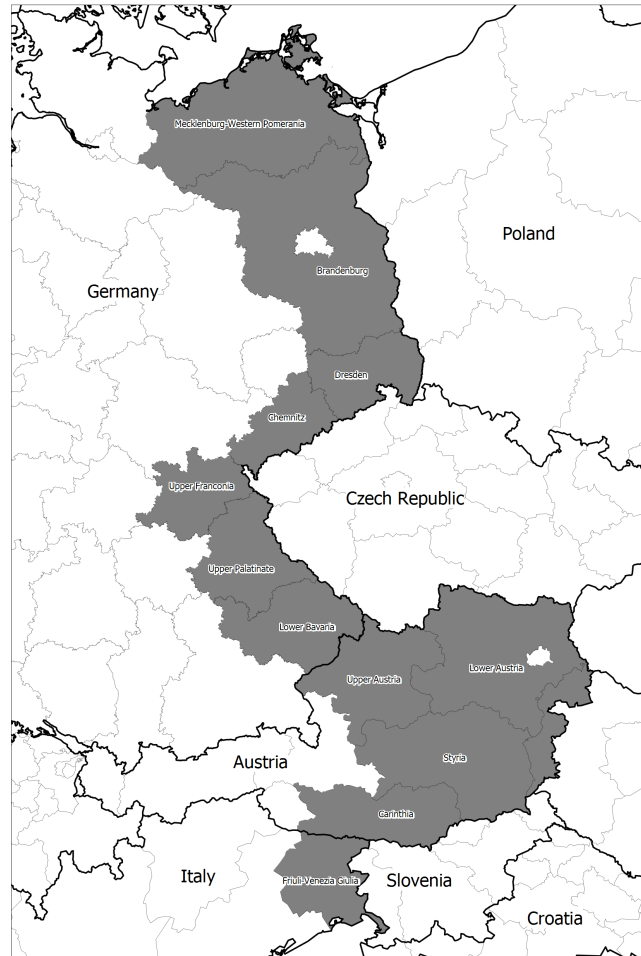
2.2 The EU Eastern Enlargement 2004 as an Exogenous Reform

To assess the impact of economic and political integration on border regions, the paper evaluates the impact of the EU Eastern enlargement in 2004 on the economic performance of border regions in the old member states. Figure 1 displays the 13 border regions (NUTS 2) under consideration, namely the seven Germany regions Mecklenburg-West Pomerania, Brandenburg, Dresden, Chemnitz, Upper Franconia, Upper Palatinate, and Lower Bavaria, the five Austrian regions Upper Austria, Lower Austria, Burgenland, Styria, and Carinthia, and the Italian region of Friuli-Venezia Giulia.¹ According to economic theory, these regions may have been particularly affected by the institutional changes resulting from the EU Eastern enlargement due to their geographic proximity to the new member states.

Overall, the economic and political integration of the eight Eastern European countries in 2004 was the final step in a long integration process, initiated in the early 1990s that had led to a

¹The German regions of Mecklenburg-West Pomerania, Brandenburg, Dresden, and Chemnitz are located in the former East Germany.

Figure 1: NUTS 2 Regions at the Frontier to the New Member States (Treatment Group)



gradual trade liberalization and implementation of EU legislations. Yet, the EU Eastern enlargement in 2004 exceeded earlier trade agreements that merely dealt with the reduction of tariffs. Hence, the accession of the new member states and the implementation of the *aquis communautaire* and the *multiple recognition principle* led to the adoption of a common legal framework, the reduction of institutional and administrative disparities and legal barriers, as well as to the removal of formal non-tariff barriers to cross-border economic interaction like technical regulations. The effects of these institutional changes were only visible in May 2004, despite the fact that the economic integration of the new member states has been long planned. It is therefore plausible to conceive the EU Eastern enlargement as an external shock, particularly for regions located directly at the border to the new member states. As these regions were exogenously selected into the treatment group because of geographic location and because their selection into the treatment group is stable over time, the EU Eastern enlargement may

be conceived as a natural experiment, despite the presence of anticipation effects.

3 Research Design

3.1 The Synthetic Control Method

The empirical analysis is based on a synthetic control method (SCM). This method compares the economic performance of regions located at the former EU external border with synthetically created control groups, approximating the counterfactual situation, i.e. the economic performance of these region had the EU Eastern enlargement not taken place. The counterfactual (i.e. synthetic control group) is generated as a combination of regions located in the old member states (EU-15) which share similar characteristics and are shaped by the same structural process than the respective border regions prior to the EU 2004 enlargement, but which are not located at the border to the new member states. Borrowing from the statistical matching literature, these regions are referred to as the *donor pool* (Abadie *et al.*, 2014). By comparing outcomes between the unit representing the case of interest and otherwise similar but unaffected units, the research design can be conceived as a treatment-control design.

The individual *synthetic controls* for each of the 13 border regions are created as weighted averages of all regions included in the *donor pool* with weight coefficients that sum up to one (Abadie and Gardeazabal, 2003 and Abadie *et al.*, 2010, 2014). Weights are selected by an algorithm based on the similarity of the respective *donor pool* regions to the border regions before the enlargement with respect to both relevant predictors of the outcome variable and past realizations of the outcome variable. Formally, the synthetic control can be represented by a $(J \times 1)$ vector of weights $W = (w_2, \dots, w_{J+1})'$, with $0 \leq w_j \leq 1$ for $j = 2, \dots, J$ regions and $w_2 + \dots + w_{J+1} = 1$ (Abadie *et al.*, 2010, 2014). The value for the vector of weights W is chosen so that the characteristics of distinct border regions are best approximated by the characteristics of the synthetic control. This is, the difference between a $k \times 1$ vector X_1 , that contains the values of the of the pre-enlargement characteristics of one distinct border region, and X_0 , a $k \times J$ matrix containing the values of the same variables for the regions in the *donor pool*, should be minimized.²

The intuition behind the SCM is straightforward and comparable to the statistical matching approach. This is, only units that are similar in both observed and unobserved determinants

²Thus, W^* is chosen as the value of W that minimizes $\sum_{m=1}^k v(X_{1m} - X_{0m}w)^2$, where v_m is a weight that reflects the relative importance that is assigned to m -th variable when narrowing the discrepancy between X_1 and X_0W (Abadie *et al.*, 2014).

of the outcome of interest should produce similar trajectories of the outcome variable over extended periods of time (Abadie *et al.*, 2010 and 2014). When both the unit representing the case of interest and the synthetic control group behave similarly over an extended period of time, prior to the intervention, any discrepancy of outcome variables following the intervention may be interpreted as a result of the intervention itself (Abadie *et al.*, 2010 and 2014). For the SCM to work, two identification assumptions must hold: First, the choice of pre-treatment characteristics should include variables that can approximate the path of the treated region, and second, the regions used to create the synthetic control, i.e. the *donor pool*, should not be affected by the treatment (Campos *et al.*, 2014). While the first assumption can easily be tested by correlating the set of potential factors that have frequently been identified in the literature as affecting the regional economic performance with the outcome variable, the second assumption may be more difficult, because the EU enlargement undeniably also affects other regions. Yet, the focus of this paper is explicitly on the marginal effect the EU Eastern enlargement had on border region. As the border location is exogenously given, the distinction between the treatment group (i.e. border regions) and control group (i.e. non-border regions) is justified.³

Compared to a panel regression design, the SCM profits from controlling for unobserved, time-variant factors that potentially drive the economic performance of border regions. Furthermore, it makes explicit both the relative contribution of each control unit to the counterfactual of interest and the similarities between the border regions and their synthetic control (Abadie *et al.*, 2010 and 2014). It is, therefore, more transparent than the usual panel regression design.

3.2 Data and Variables

The analysis is based on empirical data of 186 EU-15 regions (NUTS2) for the years 1990 to 2012.⁴ The time-frame is chosen to include a sufficient pre-intervention period, i.e. 14-years before the EU Eastern enlargement 2004. The post-intervention period encompasses eight years. The selection of the time period is mainly driven by data availability. The 13 regions located at the border to the new member states constitute the treated units, while the remaining regions constitute the *donor pool*. The identification of the *donor pool* (i.e. the selection of regions that may constitute potential controls) is highly important: If comparison units are not sufficiently similar to the regions representing the case of interest, then any differences in outcomes between these two sets merely reflect disparities in their characteristics, but do not

³To account for potential spill-over effects, in an alternative estimation, regions that constitute next-to-neighbors to the border regions were excluded from the *donor pool*. Results do not change significantly, except for the East German regions for which next-to-neighbors constitute important control regions.

⁴For the eight NUTS 2 regions located in the former East Germany, only data from 1991 onward is available.

reveal any valid conclusion about the effect of the EU enlargement (see Abadie *et al.*, 2014). Therefore, regions with geographic peculiarities are *a priori* excluded from the donor pool. This applies to the French oversea departments, the Spanish regions of Ceuta and Melilla, as well as to insular regions in France (Corsica), Spain (Balearics and Canaries), Portugal (Azores and Madeira), and Finland (Åland). Moreover, the Dutch region of Flevoland and all Greek regions are also excluded, because of a lack of data availability.

The dependent variable is the regional GDP per capita in billions of euro in 2005 prices. The data are obtained from the Cambridge Econometrics' European Regional Database (2015), a highly disaggregated regional dataset. For the pre-intervention characteristics, a standard set of economic growth predictor that has frequently been identified in the literature as affecting regional growth is used (e.g. Cuaresma-Crespo *et al.*, 2014). The set includes the regional employment rate, the relative strength of the regional financial and agricultural sector, the regional innovativeness, and the regional income level. Furthermore, for three years (1980, 1990 and 2000) the pre-enlargement regional GDP per capita is included as further predictor to account for inertia and path-dependency in the regional economic development.⁵ Data on these variables is also obtained from the Cambridge Econometrics European Regional Database as well as from the Eurostat Regional Database (2015). An overview over the predictor variables included in the model is given in Table A.1 in the Appendix. Table 2 reports the correlation coefficients of the various confounding variables with the outcome variable, i.e. the regional GDP per capita. As the depicted results reveal, regional GDP per capita correlates highest with regional average hourly wages. In contrast, regional employment and innovativeness do not correlate particularly high with the regional GDP per capita. Still, they constitute plausible predictors of the level of economic development within a region (e.g. Cuaresma-Crespo *et al.*, 2014).

Table 2: Predictors of Regional Economic Performance ^a

Predictors of Regional Economic Performance	Correlation Coefficient
Employment Rate	.44
Patent Intensity	.39
GVA Agriculture	.40
GVA Finance	.61
Hourly Wage	.83

^a Table entries denote correlation coefficients between the various demerminants and the regional GDP per capita.

⁵For the four East German regions, the pre-enlargement GDP per capita is only considered for the years 1991 and 2000.

3.3 Estimation Strategy

Having identified the *synthetic controls*, i.e. the hypothetical economic performance of the border region had the EU enlargement not taken place, the synthetic control estimator of the effect of the treatment is easy to obtain. Hence, it is given as the comparison of post-enlargement outcome of interest (i.e. the regional GDP) between the distinct border region and its synthetic control. Given that Y_{jt}^I denotes the outcome observed for unit j at time t if unit j is exposed to the intervention, and Y_{jt}^N denotes the outcome observed for region j at time t in the absence of the intervention for units $j=1, \dots, J+1$ and time period $t=1, \dots, t$, the effect of interest is the following:

$$\Delta = Y_{jt}^I - Y_{jt}^N$$

Thereby, the model for untreated outcomes Y_{jt}^N is given as:

$$Y_{jt}^N = \delta_t + \theta_t Z_j + \lambda_t \mu_j + \epsilon_{jt},$$

where δ_t is an unobserved (common) time effect, Z_j are the observed pre-enlargement covariates, μ_j are permanent unobserved variables, and ϵ_{jt} are unobserved transitory shocks at the unit level with zero mean. The basic idea of the synthetic control method is to reweight the control group so that the *synthetic control* matches Z_j and (some) pre-enlargement Y_{jt} of the treated unit, so that as a result, μ_j is automatically matched. The identification of the *synthetic control* and the estimation of the treatment effect (i.e. the EU enlargement 2004) is conducted using the freely available *synth* package for Stata, developed and made available by Abadie *et al.* (2014).

The model is estimated separately for each of the 13 border regions. This allows evaluating the impact of the EU Eastern enlargement on each border region individually and identifying whether the effects are homogeneous across all border regions or whether heterogeneous effects are at play. Subsequently, an aggregated treatment effect is generated. This is done by weighting the effects of the individual border regions by the size of their labor force to account for differences in size.⁶

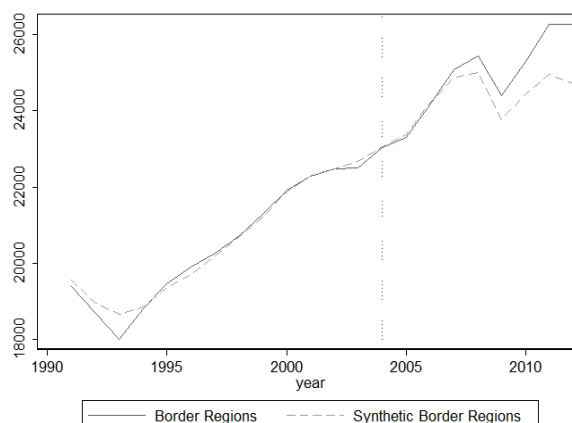
⁶Results are similar when weighting the border regions by their regional economic performance in terms of GDP.

4 The Economic Impact of the EU 2004 Enlargement

4.1 Aggregated Effect

In the following, in a first step, the overall effect of the EU Eastern enlargement, i.e. the effect of the EU Eastern enlargement when taking all border regions together, is reported. Figure 2 depicts the weighted average of the regional GDP per capita of all 13 border regions together for the years from 1991 to 2012 as well as the corresponding *synthetic control*, representing the counterfactual, i.e. the assumed development of the region had the EU enlargement not taken place. Both series are generated as weighted average of all border regions and their corresponding *synthetic controls*. Weights correspond to the size of the regional labor force, measured by the number of employees. This allows accounting for the size of the region and their relative contribution to the average of all border regions.

Figure 2: Trends in Regional GDP per Capita: Border Regions (Weighted Average) vs. Synthetic Control



As the graph reveals, no immediate effect of the EU Eastern enlargement can be observed. Instead, the two series show a similar trend in the years after the EU Eastern enlargement in 2004. Only from 2007 onward, the aggregate of all border regions shows a slightly better economic performance than its corresponding *synthetic control*. This suggests that in the medium-run, the border regions have experienced a more favorable development in the years after the EU Eastern enlargement than they would have in the counterfactual situation, i.e. when the enlargement had not taken place. However, the effect is quite small and cannot be traced back directly to the enlargement, pointing towards a negligible effect of the EU Eastern enlargement on the economic performance of border regions in the old member states.

The difference in short- and medium-run adjustment also becomes evident when looking at

the magnitude of the effect listed in Table 3. The table entries denote the difference (in %) in GDP per capita between the weighted average of all border regions and the corresponding *synthetic control* in the years after the EU Eastern enlargement. The first column shows the magnitude of changes for the first four years after the EU enlargement (i.e. the average for the years 2004-2008).⁷ The values show that in the short-run, the enlargement effect is quite small, amounting to 0.42%. The second column reports the difference in GDP per capita between the two series for the whole post-accession period. For this period, the effect is slightly higher and amounts to 2.17%.

Table 3: Difference between Border Region and Synthetic Control GDP

	Difference in post-enlargement average GDP per capita (in %) between Border Region and Synthetic Control	
	Average effect 4 years after Eastern Enlargement	Average effect 8 years after Eastern Enlargement
	Aggregate	0.42
Burgenland	-1.47	0.06
Lower Austria	-2.78	-0.87
Carinthia	1.69	3.58
Styria	1.88	2.98
Upper Austria	0.59	1.84
Lower Bavaria	2.95	7.65
Upper Palatinate	2.81	6.21
Upper Franconia	-0.35	3.70
Brandenburg	-2.84	-1.02
Mecklenburg-Western Pomerania	-2.52	0.30
Dresden	5.80	4.49
Chemnitz	7.02	9.12
Friuli-Venezia Giulia	-5.79	-8.73

The relative small magnitude of the effect indicates that, overall, the enlargement did not have a significant effect on the economic performance of border regions. To examine the statistical significance of the estimated enlargement effect, following the suggestion of Campos *et al.* (2014), a difference-in-difference model is estimated. This allows examining the level of statistical significance of the differential between the actual and synthetic series. Precisely, the difference-in-difference model estimates the statistical significance of the differential between the average difference between the actual economic performance of the border regions and their corresponding synthetic controls prior to the enlargement, and their average difference in the post-enlargement period. Table 4 (first line) reports the result of the corresponding difference-in-difference estimator. It becomes evident that for the weighted average of all border regions, the estimated difference-in-difference coefficient is not statistically significant. This implies that on average (i.e. when taking all border regions together), border regions do not reveal a significant higher GDP per capita after the EU enlargement than they would have, had the EU

⁷This threshold is chosen to exclude the effects of the European economic and financial crisis that presumably hit regions differently and may bias the results.

enlargement not taken place. Thus, in contrast to popular concerns, the enlargement did not comprehensively weaken the economic performance of border regions. However, the enlargement neither led to a comprehensive strengthening of border regions, as it may have been assumed from economic theory. At least in the course of the EU Eastern enlargement 2004, on average, no significant economic effect can be found.

Table 4: Difference-in-difference estimate of EU Eastern enlargement ^a

	GDP per capita (in 2005 Euro)	
	DiD estimate Std. error	R-square N
Aggregate	597.97 808.12	.718 44
Burgenland	-121.50 (986.84)	.650 46
Lower Austria	-317.65 (937.34)	.0696 46
Carinthia	921.99 (981.44)	0.690 46
Styria	869.52 (1197.11)	0.667 46
Upper Austria	1106.98 (1097.08)	0.721 46
Lower Bavaria	2352.17** (1021.81)	0.659 46
Upper Palatinate	1970.64* (1193.13)	0.644 46
Upper Franconia	625.92 (801.56)	0.646 46
Brandenburg	359.95 (671.63)	0.688 44
Mecklenburg-Western Pomerania	212.28 (588.81)	0.695 44
Dresden	610.09 730.51	0.713 44
Chemnitz	1983.59*** (684.59)	0.735 44
Friuli-Venezia Giulia	-2500.00** (1072.16)	0.472 46

^a Table entries denote the statistical significance of the difference between the average difference before the enlargement (between the border region and its synthetic control) and the average difference after the enlargement (between the border regions and its synthetic control). Results are presented for each region and for the weighted average. Robust standard errors are reported. Inference: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.2 Regional Effects

Having examined the effect of the EU enlargement for the weighted average of all 13 border regions, in the following, the focus is laid on the individual regions. The graphs in Figure 3 display the actual economic development of the 13 border regions and their corresponding synthetic controls between 1990 and 2012, i.e. 14 years before and eight years after the EU

2004 Eastern enlargement.⁸ In the graphs, the synthetic control represents the counterfactual situation, i.e. the hypothetical regional economic growth trajectory in the absence of the EU Eastern enlargement.

The graphs show that for none of the 13 border regions a clear-cut enlargement effect can be observed immediately after the EU Eastern enlargement in 2004. However, in the medium-run, the border regions seem to be differently affected by the EU Eastern enlargement. While all regions have continued their positive growth path after the EU Eastern enlargement, not in every region, the economic performance exceeded the economic performance of the *synthetic control*, i.e. the situation had the EU Eastern enlargement not taken place. The German border regions seem to profit from the EU Eastern enlargement, as their actual economic development is better than that of their respective synthetic counterparts. This is especially the case for the German border regions of Lower Bavaria, Upper Palatinate and Upper Franconia, located in the federal state of Bavaria, but also for Chemnitz, located in the former East of Germany.

Yet, in these regions, the effect does not occur immediately after the enlargement. Instead, for the Bavarian regions, it only becomes visible from 2008 onward, while for the two former East German regions of Dresden and Chemnitz, the effect is already visible in 2000, i.e. four years prior to the enlargement. These results may either point towards the presence of distinct anticipation or adjustment effects, inhibiting an immediate economic effect of the EU Eastern enlargement in 2004, or to the existence of region-specific confounding factors influencing the dissimilar trends in the two series. These potential confounding factors will be further examined in the subsequent section. For the remaining German border regions in the former East (i.e. Brandenburg and Mecklenburg-Western Pomerania) as well as for the German region Upper Franconia, located in Bavaria, no significant effect can be observed. The same is true for the five Austrian border regions. While the Austrian regions of Carinthia and Styria reveal a slightly positive effect from 2006 onward, for the remaining three regions, no significant effect can be observed. In the Italian region of Friuli-Venezia Giulia, constituting the only Italian region that shares a border with the new member states, a negative effect can be observed. Hence, when comparing the trend in GDP per capita of Friuli-Venezia with its synthetic counterpart, the regional economic performance is less favorable than it would have been, had the enlargement not taken place.

When looking at the magnitude of the effects listed in Table 3, it becomes evident that the effects are larger in the long-run than in the short-run. Hence, the average difference (in %) between the actual GDP per capita of the individual border regions and their respective *synthetic control* is

⁸For the four East German regions, the time-series only commences in 1991 due to data availability.

larger when considering the whole post-enlargement period than it is when only considering the average in the four years immediately after the enlargement. The largest positive enlargement effects can be found for the German regions of Chemnitz and Dresden, located in the federal state of Saxony in the former East of Germany, as well as for the German border regions of Lower Bavaria and Upper Palatinate, located in the in the federal state of Bavaria. The largest negative effect can be observed for the Italian region of Friuli-Venezia Giulia. As it becomes evident from the results in Table 4, the enlargement effects (i.e. the difference between the actual development and the counterfactual) are only statistically significant for the German regions of Lower Bavaria, Upper Palatinate and Chemnitz, as well as for the Italian region of Friuli-Venezia Giulia, while for the remaining border regions, no statistically significant enlargement effect can be found.

These results confirm the findings of the preceding subsection, namely that on average, no effect of the EU Eastern enlargement in 2004 on the economic performance of border regions in the old member states can be observed. Yet, the heterogeneous regional findings suggest that regions respond differently to the changes in market access and that it is not possible to draw any general conclusions about the effects of the EU Eastern enlargement for the economic performance of regions located at the border to the new member states.

4.3 Explanatory Factors for Heterogeneous Treatment Effects

The results outlined above show that the effects of the EU Eastern enlargement are not homogeneous, but vary across regions. This evokes the question why some regions benefit from the enlargement, while others do not profit, or even experience negative enlargement effects. This section aims to shed light on possible reasons behind the differential payoff of the EU Eastern enlargement 2004 for border regions and to disentangle potential mechanisms through which the EU Eastern enlargement evokes a favorable economic performance of border regions.

To shed light in the specific mechanisms that may drive the differentiated payoffs from economic integration of border regions, a simple linear panel regression model with region and year fixed effects is estimated for the set of border regions in the post-enlargement period. Thereby, the dependent variable is the percentage difference between the actual GDP per capita of the border regions and their estimated synthetic counterparts. Of course, this outcome variable suffers from being merely an estimate itself. Yet, it is the best indicator that approximates the extent to which a region has actually been affected from the EU Eastern enlargement. Formally, the regression model can be presented as follows:

$$Y_{jt} = \beta_0 + \beta_k X_{k,jt} + \gamma_{j-1} E_{j-1} + \sigma_{t-1} T_{t-1} + \mu_{jt},$$

where Y_{jt} is the percentage difference between the actual and synthetic time series for region j at time t , β_0 is the unknown intercept, $X_{k,jt}$ is a set of k observed explanatory variables, β_k is the corresponding coefficient for the k -th variables, E_{j-1} are $j-1$ dummy variables for the treatment regions, γ_{j-1} are the coefficients for the region dummies, T_{t-1} are $t-1$ dummy variables for the years in the post-enlargement period, σ_{t-1} are the coefficients for the time dummies, and μ_{jt} is the error term.

Overall, three sets of potential explanatory factors for the differential enlargement effects across regions are included. The first set contains factors that capture the initial state of the region's economic development, measured by the regional employment rate and the industrial share on the regional GVA. These factors take up the assumption that regions encompassing a higher level of economic development may be better able to exploit the effects of trade liberalization and economic integration (see Rodriguez-Pose, 2012; Petrakos and Topaloglou, 2008). The second set includes the regional trade volume, measured via regional import and export volumes in the manufacturing sector. It accounts for the fact that regions with inherently higher trade volumes may gain more from the process of economic integration. The third set reflects the regional innovation potential, measured by the share of human resources in science and technology. It accounts for the fact that regions with a higher innovation potential may be better equipped to absorb new ideas, fueled by free movement of labor (see Ventura, 2005). Data on all explanatory variables is obtained from the Eurostat Regional Database.

Table 5 depicts the regression coefficients for three different specifications. As it becomes evident from the reported estimates, the regional economic performance and the regional import volume correlate statistically significantly with higher positive enlargement effects. In contrast, the share of human resources as well as the level of regional export volumes are not correlated with the magnitude of the enlargement effect in a statistically significant way. Of course, these results merely report associations and should not be interpreted in any causal way. Yet, they provide first insights on potential factors influencing the extent to which border regions have profited from changes in market access following the EU Eastern enlargement 2004.

Table 5: Explanatory Factors of the Economic Performance Payoff of EU Eastern Enlargement on Border Regions in the Old Member States ^a

	Specification 1	Specification 2	Specification 3
Employment Rate	47.177** (19.720)	51.358** (20.269)	47.270** (21.024)
Regional Industry	60.702** (27.794)	59.169** (28.828)	56.711* (29.360)
Import Volume		0.001* (0.000)	0.001* (0.000)
Export Volume		-0.001 (0.000)	-0.001 (0.000)
Human Resources in Science and Technology			0.120 (0.162)
Region FE	yes	yes	yes
Year FE	yes	yes	yes
Observations	104	104	103
R-squared	0.51	0.53	0.53

^a Table entries denote regression coefficients of with region and year fixed-effects. Standard errors in parantheses. Dependent variable: Percentage difference between the actual and the synthetic series of per capita GDP for each border region and each year after the EU Eastern enlargement 2004. Inference: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5 Discussion and Conclusion

The paper examined the impact of the EU Eastern enlargement in 2004 on the economic performance of border regions located at the former EU-external border in Austria, Germany and Italy. It did so by applying a synthetic control method (SCM) that allows contrasting the economic performance of these border regions before and after the EU enlargement with the counterfactual situation, i.e. their economic performance had the EU enlargement not taken place. Results revealed that on average, i.e. when taking all border regions together, immediately after the EU Eastern enlargement 2004, no effect can be observed. In the medium-run, the effect of the EU Eastern enlargement is slightly positive, but it is not statistically significant. This result suggests that in contrast to popular concerns fearing an economic downturn due to increased (price) competition, on average, the EU Eastern enlargement did not negatively impact the economic performance of border regions. Yet, in contrast to the expectations formulated in economic theories on the spatial effects on economic integration, on average, border regions did not benefit from their geographic position at the frontier to the new member states, either.

When evaluating the enlargement effects for individual border regions, it becomes evident that the EU Eastern enlargement did not affect all border regions in the same way. Instead, border regions seem to respond differently to changes in their market access. While the German border regions of Chemnitz, Lower Bavaria and Upper Palatinate show a significantly better performance than they would have in the absence of the enlargement, the Italian border region

of Friuli-Venezia Giulia reveals a significantly poorer performance than it would have, had the enlargement not taken place. For the Austrian and the remaining German border regions, no statistically significant effect can be observed.

Given these heterogeneous results, the paper shows that border regions have responded differently to changes in market access entailed by the EU Eastern enlargement. When looking at potential reasons behind the differential economic performance following the EU Eastern enlargement, it becomes evident that the initial state of regional economic development as well as the regional trade volume positively correlate with enlargement effects. This is in line with other recent empirical works on the benefits of trade liberalization and economic integration on the country-level, suggesting that economically advanced countries and countries that are better integrated into global trade flows gain most from trade liberalization and economic integration (e.g. Campos *et al.*, 2014; Rodriguez-Pose, 2012).

Even though the results provide new insights into the causal effect of the EU Eastern enlargement on the economic performance of regions located at the former EU external border, some caveats have to be noted. First, the synthetic controls do not perfectly match the border regions in the years prior to the enlargement, pointing towards potential measurement errors in the calculation of the *synthetic controls*. This remains present when adjusting the *donor pool* to alternative compositions, i.e. excluding regions that constitute next-to-neighbors to the treatment regions to account for spatial spillover effects, or excluding all EU-internal border regions to account for some inherent border-specific effects. In an extension of the paper, it may be desirable to include more potential predictors of regional economic performance when estimating the synthetic controls. Second, the external validity of the results may be limited, given that only the EU 2004 enlargement is taken into consideration. To draw more general conclusions about the effects of economic integration on border regions, it might also be fruitful to extend the analysis to previous enlargement rounds. Despite these potential caveats, the paper still provides a first attempt to empirically evaluate the effects of the economic and political integration in the EU on the economic performance of border regions in the incumbent member states.

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A Appendix

Table A.1: Variables, Measures and Data Sources ^a

Variable	Measure	Data Source
GDP	GDP per capita (in Billion Euro) at 2005 prices	CERD
Employment Rate	Share of employees at the regional active population	CERD
Financial Sector	Share of financial sector on regional gross value added	CERD
Agricultural Sector	Share of agricultural sector on regional gross value added	CERD
Wage Level	Average regional hourly wage (in Million Euro) at 2005 prices	CERD
Patent Intensity	Number of patents reportet to EPO per 1000 employees	Eurostat

^a CERD = Cambridge Econometric Regional Database (2015); Eurostat = Eurostat Regional Database (2015).

Figure 3: Economic Performance of Border Regions and their Synthetic Controls 1990-2012

