Out of the Dark into the Light? Impact of EU Eastern Enlargements on Development of Border Municipalities

Preliminary version

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Borders constitute market barriers that hamper the development in the surrounding regions. In the location theory of Lösch (1944), a firm settles down where it can best serve demand for its goods, while facing costs that are proportional to the distance. If a firm settles near a border and wants to access the market in the other country, it faces additional costs to access part of its market that stem from the tariff and non-tariff trade barriers. A profit maximalizing firm would therefore prefer to settle further inward within its own country to avoid these costs. Consequently, only firms that require a small market would remain in the border region thus making the area near the border peripheral within its country. As this presents less opportunities to work, an extension of the model of Helpman et al. (1995) by Redding and Sturm (2008) predicts that a border region should therefore exhibit a lower equilibrium number of workers.

The empirical evidence seems to support the negative impact of borders. In a general case, Brülhart et al. (2019) use nighttime lights data to show that roads in majority of border areas in the world are darker, when compared to their counterparts located further inward. Redding and Sturm (2008) take advantage of the division of Germany to see how a new border can influence areas around it. Using population growth as a proxy of

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changes in economic activity, they find that West German cities located in the vicinity of the new border declined in comparison to cities located further inward. In the same experimental setting, Ahlfeldt et al. (2015) find that the construction of the Berlin wall lead to reallocation of economic activity as the city blocks located near the wall had a lower growth of population density as well as wages and land prices in comparison to the ones located further away. In both cases the impact declines rapidly with distance from the new border. Similarly, Nagy (2018) assess an earlier formation of new borders. They indicate that the loss of territory of Hungary following the First World War reduced urbanization in the Hungarian counties close to the new borders. Although Japan and Korea are separated by sea, Nakajima (2008) apply the distance from Busan as a proxy for the border to evaluate the impact of the end of the Japanese colonial rule over Korea on the population growth of Japanese cities. Their results indicate that the decline of Japanese border cities can be attributed to the loss of market potential in Korea.[1] Borders may matter also on intra-national level. Yang et al. (2022) exploit the creation of a new border within the Sichuan province as the city of Chongqing being granted a city-level province status. As a result of subsequent competition between Chongqing and Sichuan, which included also a 60% increase in tolls on the major highway connecting the two provinces, counties on both sides of the border experienced a lower population growth rate relative to the counties further from the new border. Likewise, Hoffstadt (2022) find that the implementation of federalism reform in the former Yugoslavia resulted in a lower population growth in cities that were cut off from the nearest town with 5000 inhabitants and more by the new borders between the federal units. Once trade liberalization occurs, the border regions could benefit from it the most. The reason is that by moving there firms can benefit from a better access to foreign demand. Consequently, a region that was once peripheral within its own country could become the centre of an integrated market. However, in the model of Redding and Sturm (2008), as in other New Economic Geography models, the result depends on the interplay between agglomeration and dispersion effects. On one hand, firms would want to remain located near large markets (home market effect) as well as consumers would want to live near to large markets (love of variety). On the

[1] Nakajima (2008) measure market potential of a city A as the sum of the number of inhabitants of all other cities weighted by the inverse distance to city A.

other hand, a less crowded market (in the border area) is more attractive for firms to settle in (competition effect) and the cheaper prices of commodities for consumers (cost of living effect). If the former agglomeration effects dominate, firms and consumers would prefer to stay in the centre located further inland, while the opposite holds if the latter diffusion effects prevail. Importantly, Niebuhr et al. (2002) mention that the overall outcome may depend also on the abundance of mobile production factors. They further note that another important aspect is the sectoral structure of the border areas - if firms on both sides of the border are vertically linked, the economic activity could concentrate in these areas.

Indeed, a reduction of tariffs can help border regions of countries concerned by trade liberalization. Brülhart et al. (2019) find that a decrease in tariffs reduces the difference in night-time lights emitted between the border and inner regions. Analogous results can be found by looking at distinct cases of trade liberalization. As a result of a reduction of tariffs in the US-Mexican bilateral trade, apparel industry relocated from more central regions in Mexico to its border regions (Hanson, 1996b). On the other side of the border, the US cities experienced an increase in employment (Hanson, 1996a, 2001). Moreover, Hanson (1996a) notes that the cities on the US side of the frontier began to specialize in production of parts and components for the Mexican assembly plants. Brülhart et al. (2018) shows that after the fall of the iron curtain, the Austrian cities near the eastern border experienced an increase of employment as well as wages when compared cities located further from the border.

The size of the trade shock, whether upon creating new borders or abolishing them, differs with the size of the city located in the border region. Smaller cities respond more strongly to it than larger ones (Redding and Sturm, 2008; Wassmann, 2016; Brülhart et al., 2018; Yang et al., 2022). The provided explanation is that while larger cities are more self-sufficient, smaller ones are more open to trade and thus more susceptible to exogenous shocks. Another explanation is offered by Wassmann (2016), who note that large cities (in their case Vienna and Berlin) are driven more by global economic shocks rather than the local ones. Moreover, Hanson (2001) also finds that the increase in US-Mexico trade had a positive impact on different industries in small and large cities - transport services in the former and manufacturing in the latter.

Another quasi-experiment that enables the analysis of trade liberalization on the border regions is the widening dimension of economic integration within the European Union. This refers to the enlargement process of the EU from the original six to the pcurrent 27 member states. The accession of a country to the EU provides thus an initial shock in terms of trade liberalization that may intensify with time as the EU itself is evolving and differs across each cohort of new countries, as each cohort enters into an EU that is more integrated. These changes may lead to a reduction in cross-border transaction costs, resulting in an increase in movement of capital, goods and labour. As Petrakos et al. (2008) note this shock can turn borders from barriers that separate the two sides into bridges that connect the border regions or tunnels that bypass them. Otherwise put, the shock stemming from the EU integration can help the border regions to catch-up, but could also reinforce the existing divergence.

Table 1 displays the, to the best of our knowledge, previous studies that examined the impact of EU enlargements on regions affected by the integration of borders. Previous literature on the impact of EU enlargements chose a similar approach as the studies examining the impact of other quasi-experiments. That is, they compare the development in border regions or cities affected by EU enlargements to regions or cities further away from the border using difference in differences or synthetic control method. Brakman et al. (2012) evaluate the impact of multiple EU enlargements. They find that the border regions tend to benefit from EU enlargements, but the impact is not strong enough to counteract their peripheral status. In other words, despite of the positive impact of the EU enlargement, border regions are still falling behind their interior counterparts. Due to the difficulties with finding data that go far enough into the past to evaluate previous enlargements, others (Wassmann, 2016; Mitze and Breidenbach, 2018; Brülhart et al., 2019; Heider, 2019; Gouveia et al., 2020; Kapanadze, 2021) concentrate mainly on the recent eastern enlargements. Their findings show that the areas located near the borders affected by these enlargements in general profit from the integration of the border they are located close to into the EU. Yet, as a border between each pair of countries has its specificities, several papers look at a more detailed level of individual borders to exploit their uniquenesses. That is, each border is different in terms its physical geography, differences between

the countries it seperates and economic structure of the border regions. By taking this into account, Mitze and Breidenbach (2018) and Heider (2019) find that (Former East) German regions and cities located near the 2004 enlargement borders (especially near the borders with Poland) are the main beneficiaries of that enlargement. Mitze and Breidenbach (2018) note that a possible explanation is that they benefited from the proximity to the large Polish market as well as the possibility of having ties established before the fall of the iron curtain due to East Germany's part of the eastern block. Wassmann (2016) find mixed results as regions that it took more time for the impact of the enlargement to demonstrate in regions that were rural and at the same time economic weaker at the time of the enlargement than their economically stronger counterparts. Furthermore, the effect is stronger in regions with higher employment rates, more developed infrastructure and a higher share of manufacturing. Kapanadze (2022) concentrate on the impact of the 2004 EU enlargement on cities that were divided by a border before the EU accession. They find that once the intercity borders were opened, economic activity (proxied by the nighttime light data) increased in the proximity of the pre-division city centres. Moreover, the impact is stronger following the accession to the Schengen area in 2008 than after the EU accession itself. An interpretation of this is that free movement of people spurs agglomeration in the border cities more than free movement of goods.

There are several caveats associated with the analysis of the impact of EU enlargements on border regions, mostly associated with the model specification and choice of the treatment and control groups. The pre-dominant analysed research question at hand is the whether the border regions have benefited from EU enlargements more than regions that are further inward (Heider, 2019) or any other regions (Brakman et al., 2012; Wassmann, 2016; Mitze and Breidenbach, 2018; Gouveia et al., 2020; Kapanadze, 2021).[2] Such formulation, however, violates the Stable Unit Treatment Value Assumption (SUTVA), which states two conditions: control group is not affected by the treatment and there are now spillovers between the control and treatment groups. The first part is breached as the control group also benefits from the EU integration - either from the same enlargement as the treatment

[2] An exception here is Brülhart et al. (2019), who use the distance from the border as the variable of interest instead of seperating the sample into treatment and control groups.

	Enlargements	Spatial unit	Dependent variable	Method	Treatment	Control	Result
Brakman et al. (2012)	All	Cities and regions (EU28)	Pop growth	DiD	75 km from borders	Rest of the sample	+
	2004 & 2007	Cities and regions (EU28)	Pop Growth	DiD	75 km from borders	Rest of the sample	+
Wassmann (2016)	2004	NUTS2 (EU-15)	GDP pc	SCM	Border adjacency	Rest of the sample	H
Mitze and Breidenbach (2018)	2004	NUTS3 (EU-28)	GDP pc	IDiD	Border adjacency	Rest of the sample	H
Brülhart et al. (2019)	2004 & 2007	Grids (NMS)	Nighttime light	DiD (continuous treatment)	200 km from borders	200 km from borders	+
Heider (2019)	2004	cities (Bavaria, DD, west PL)	Pop growth	DiD	30 and 40 minutes from borders	rest of the sample	H
Gouveia et al. (2020)	2004, 2007 & 2013	NUTS3 (EU28)	Pop growth	DiD	Border regions (EU definition)	Rest of the sample	+
Kapanadze (2021)	2004	NUTS2 (E8)	GDP pc	SCM	Border adjacency	Rest of the sample	+
Kapanadze (2022)	2004	Grids	Nighttime light	DiD (continuous treatment)	Divided cities	Divided cities	+
Bachtrögler-Unger et al. (2022)	2004	LAU2 (CZ, DE, PL)	Nighttime light	DiD (continuous treatment)	Border municipalities	Border municipalities	+

Table 1: Overview of previous studies examining the impact of EU integration on the development of border regions. **Note:** + - significantly positive effect, - - significantly negative effect, o - insignificant effect, H - heterogeneity in effects. The continuous treatment in Brülhart et al. (2019) and Kapanadze (2022) refers to the use of distance as treatment intensity, while in Bachtrögler-Unger et al. (2022) it is the reception of EU funds.

or from the deepening of the integration process of the previous enlargements. Hence, the results can be regarded as the lower bound estimates of the impact of EU integration on border regions.

The second SUTVA requirement of no spillovers between treatment and control groups cannot be ruled out. In other words, the benefits of EU integration experienced by the border regions could be also felt in their neighbouring regions through production linkages or spillovers. An alternative is to have in the control group regions that are located in countries unaffected by EU integration. For instance, Kapanadze (2021) use regions of countries that acceded later into the EU (Bulgaria, Romania and Croatia) as well as one non-EU country (Norway) in the donor pool to create the synthetic counterfactuals of the 2004 enlargement regions.[3] Yet this approach creates another problem of being able to compute only the short term effects of the 2004 enlargements as accession of Bulgaria an Romania in 2007 limits the post-treatment period to 2004-2006. Furthermore, this does not fully eliminate the problem, as Bulgaria and Romania could have had anticipation effects present. Also Norway, although not being part of the EU, is part of the European Free Trade Association (and also the European Economic Area), could have been also a beneficiary of the 2004 enlargement.

Furthermore, there is a problem with the optimal choice of a spatial unit for observations. When using NUTS regions, it is possible to have a relatively large variety of variables at disposal as either dependent or covariates. However, the NUTS regions are defined, beside administrative divisions of a country, by the population size in order to be comparable. As population density is higher in the EU15, the NUTS regions are also relatively smaller in the EU15 countries. Consequently, a border region might go further inward in the new member states than in the EU15. Using municipalities or cities as spatial units of interest allows for more flexibility in defining the border region, which could be also defined in a symmetric way. Due to the lack of economic data on this level of spatial units,Brakman et al. (2012) and Heider (2019) resorted to the use of population growth rates as proxies of economic development. The use of population data is easier when concentrating on

[3]Kapanadze (2021) actually conduct a two step procedure: in the first step they compute the synthetic counterfactuals for the NUTS2 regions of the new member states and then compares the results between border regions and interior regions using difference in differences.

one country or a few borders, but it is more difficult when evaluating the impact for all countries affected by an enlargement. The reason is that the latter case does not offer a possibility to use population data on annual basis and thus it might be more difficult to differentiate between the EU enlargement shock and other potential shocks.

More recent studies (Brülhart et al., 2019; Kapanadze, 2022; Bachtrögler-Unger et al., 2022) opted for the use of night-time lights data as a proxy for economic development, when looking at border areas. The nighttime light was stems from the Operational Linescan System of the U.S. Air Force Defense Meteorological Satellite Program (DMSP-OLS) using six different satellites for the 1992-2013 time period for $1km^2$ grid areas. Each grid is assigned a digital number ranging from 0 to 63. As the primary objective of the data gathered by the satellites was to serve U.S. airforce pilots and not to gather data on nighttime lights, the dataset has several caveats. Notably, the values of the pixels are top-coded and blurred. Furthermore, the fact that the data stem from different satellites influences the temporal consistency of the data Gibson et al. (2020). However, as the nighttime lights data remain an important source of data source that allows to analyse a long time period with granular data, several algorithms have been developed to improve the quality of the data. For instance, in addressing the issue of temporal consistency Li et al. (2013) recommend using a calibration algorithm, while Chen and Nordhaus (2011) suggest that including the time fixed effects as well as satellite fixed effects helps to solve the issue. This allows the application of a granular dataset that is available for a relatively long time period on a yearly basis.

In this paper we therefore use the DMSP-OLS stable lights dataset (Elvidge et al., 1997) to evaluate the impact of the 2004 and 2007 enlargements on the LAU2 municipalities on both sides of the borders affected by the enlargements. We compare the development in the municipalities located within 25 km of borders affected by the 2004 and 2007 enlargements to the ones located near the external borders of the EU. [4] The control treatment groups are displayed on **??** . To do that, we employ a staggered difference in differences design using the Callaway and Sant'Anna (2021). Our dependent variable is the

[4]We are aware that this violates the SUTVA conditions in the same way as the previous literature has breached them. We are currently working on a control group that should do better in satisfying them.

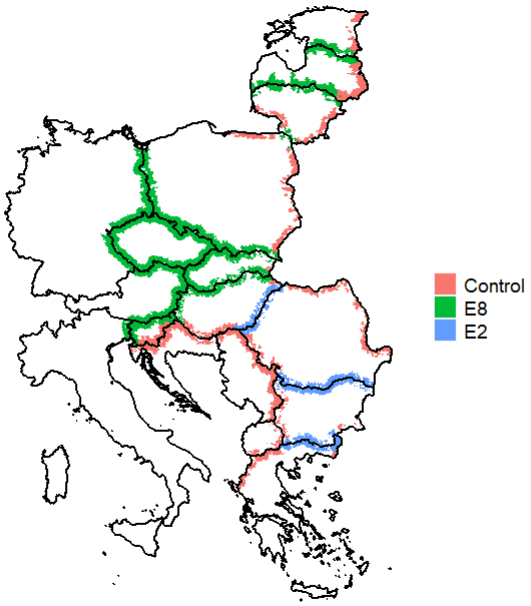

Figure 1: Overview of treatment and control groups for the Eastern enlargement.s Note: Treatment group is comprised of municipalities located within 25 kilometers of a border affected by the 2004 or 2007 EU enlargement, while control group is comprised of municipalities located within 25km of other borders that in this time period were not exposed to an EU enlargement.

growth of total nighttime lights in LAU2 municipalities over three year periods (1992-1994, 1995-1997, 1998-2000, 2001-2003, 2004-2006, 2007-2009, 2010-2013) to limit the volatility of the data.[5]. We also include satellite and year fixed effects.

Figure 2 depicts our preliminary result. It shows that the municipalities in the proximity of borders that were affected by either of the two enlargements did not experience a significantly different economic development than the ones located near the external borders of the EU. Notice on Figure 3, once we split the treatment group in to municipalities on the New member states and EU15 sides of the borders, we can observe that the municipalities on the EU15 side of the 2004 enlargement benefited from the enlargement. On the other hand, the results for the new member states side of the border remains insignificant. The reason might be that agglomeration forces accelerate after the enlargement process. This could be in line with the previous literature, for instance Camagni et al. (2020), that observes divergence in the new member states after the enlargements. The results for the 2007 enlargement group are insignificant on both sides of the border.

[5]We are planning to use yearly data instead in the future

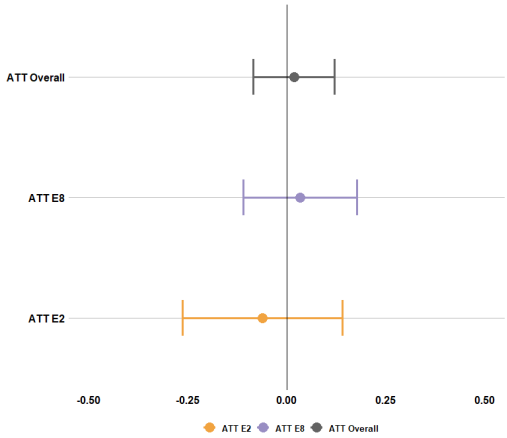

Figure 2: Overall result. Note: ATT Overall denotes the overall treatment effect, while ATT E8 and ATT E2 denote the average treatment effects for the municipalities located near the borders affected by the 2004 and 2007 enlargements, respectively.

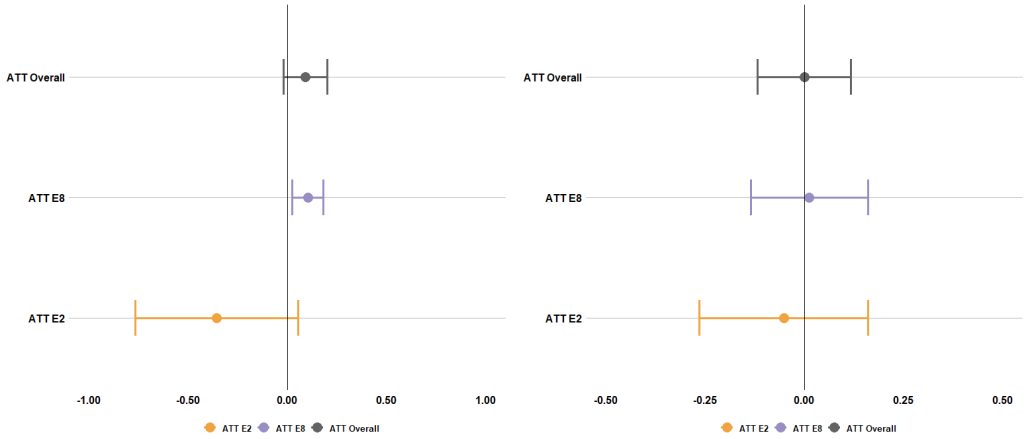

Figure 3: Comparison of results. Note: Left figure shows the impact for the municipalities located near the borders affected by enlargements located in the EU15, while the right figure shows the impact for the municipalities located near the borders affected by enlargements located in the new member states. ATT Overall denotes the overall treatment effect, while ATT E8 and ATT E2 denote the average treatment effects for the municipalities located near the borders affected by the 2004 and 2007 enlargements, respectively.

In order to confirm these results, we plan to extend the model to include market potential in the model following Nakajima (2008) and Yang et al. (2022). Lastly, we also plan to look at the impact for individual borders to be able to observe how much heterogeneity is in the results.

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