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What kind of region reaps the benefits of a currency union?

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Abstract

What is the economic impact of joining a currency union? Is this impact heterogeneous across regions? And how does it change in case of a recession? We answer these questions by investigating the economic impact of joining the euro area for the latecomers, i.e., the countries that adopted the euro after 2002. Differently from previous literature, we use NUTS-2 regions as units of analysis. This novelty allows us to investigate the theoretical predictions of a currency union impact at a more appropriate geographical level. Using a counterfactual approach based on the recently developed kernel balancing estimator, we estimate the overall as well as the disaggregated impact of joining the euro area. We find that the adoption of the euro brought about a small positive effect, which was, however, dampened by the Great Recession. Individual regional estimates suggest heterogeneous returns with benefits accruing mostly to core regions.

Keywords: euro area, accession countries, regional data, kernel balancing estimator

JEL classification: C23, F33, R11

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1 Introduction

At a time of sizable adverse shocks affecting the global economy, such as the Covid-19 pandemic or the Great Recession, monetary policy gains popularity rekindling the unending debate on the pros and cons of being part of a currency union. In general, the benefits of joining a currency union concern enhanced cost-effectiveness and reduced risk of doing business. Furthermore, strengthening the Member States' competitiveness on a global scale eliminates exchange rate risk and reduces the weight of interests for countries with a large public debt. On the other hand, the most considerable price to pay is the loss of complete sovereignty in monetary policy decisions. Thus, Member States can no longer resort to currency appreciation or depreciation to handle asymmetric external shocks, for example, by devaluing their currencies to slow imports and encourage exports. This negative effect is reinforced by the presence of wage rigidity and weak labor mobility, which are generally features of euro area countries. What is more, in case of limited economic integration, monetary policies within a currency area will be ineffective and unsuitable for dealing with the countries' heterogeneity. According to the optimal currency area (OCA) theory, first developed by Mundell (1961), asymmetric negative shocks stress this issue. For instance, the European sovereign debt crisis produced winners and losers at the country level and even more at the regional level due to the lack of similarity of economic structure and synchronization of the economic cycles that make centralized monetary policy decisions unsuitable for everyone. Although countries joining the euro might presume to reach symmetry of business cycles with monetary integration,[1] this process could result in either tighter or looser correlations of national and regional business cycles. Albeit regions are not directly affected by monetary policy decisions, participation in the euro area indirectly impacts regions' competitiveness. According to Hallet (2004), the initial static integration effects of the euro, as the reduction of trade costs, may differ across regions and lead to dynamic integration effects on growth, employment, welfare, and thus changing the spatial structure of production.

[1]For example, according to the 'Lucas critique', joining a currency union can be seen as a policy shock that changes the agents' economic expectations.

The neo-classical theory highlights the advantages of a currency union for peripheral regions, as it enhances the convergence process by attracting more investments (Barro and Sala-i Martin 1992)[2]. This is to be achieved via the compensation of the localization disincentive with wage differentials. Frankel and Rose (1998) refine the neo-classical framework and propose the endogeneity of the OCA criteria, affirming that a country can satisfy such criteria ex-post rather than ex-ante. In fact, they suggest that joining a currency area leads to more trade, increasing the degree of business cycle synchronicity and boosting net welfare (Rose and Van Wincoop 2001).

On the contrary, according to the new economic geography (NEG) theory, economic integration favors the concentration of activities in core areas and, therefore, it does not lead to synchronized business cycles. When firms produce more efficiently, and workers enjoy higher welfare by being close to large markets, which are those where more firms and workers locate: this engenders a cumulative causation process which increases regional differences (Puga 2002). Therefore, in compliance with the NEG theory, regions more open to trade and with better access to new markets, such as port cities and border regions, should experience more significant gains from adopting a single currency[3].

In Europe, the economic integration process started with the Single Market, and the euro adoption can be considered an accelerator for this process. Thus, if an increase or a decrease was observed in regional disparities after the set-up of the Single Market, we expect that the currency union accelerates this dynamic[4]. As reported by Capello et al. (2018), many studies demonstrate that the Eastern enlargement of the EU increased intra-national disparities in favor of metropolitan and core areas. Therefore, we expect that the Eastern enlargement of the euro area will reinforce such a trend.

[2]Solow (1956) and Swan (1956)show that under a certain assumption income differentials across countries disappear in the long run. However, Barro et al. (1995) demonstrate that in case of heterogeneous structural characteristics regions do not necessarily converge on the same equilibrium.

[3]McKinnon (1963) was the first to put forward the importance of the high degree of openness to reap the advantages of an OCA.

[4]The expected advantages of central European regions to attract production factors from the periphery were discussed during the Maastricht Treaty negotiations. This led to introducing the European Structural and Cohesion Funds, which target the least developed European Union regions.

In line with NEG predictions, Bayoumi and Eichengreen (1993) argue that Economic and Monetary Union (EMU) would disadvantage the least developed regions, with the benefits accruing to the most developed core areas. Fingleton et al. (2015) highlight the importance of the regional aspect in the context of an OCA: national economies are considered merely as aggregates of their constituent regional and sub-regional components. So, while countries might meet the OCA conditions, their regions might not, and vice versa[5].

Given the importance of this topic, recent literature considers core-periphery patterns in evaluating the economic effect on a country of joining a currency union. Nevertheless, it surprisingly ignores the regional dimension of integration and convergence[6]. Our paper seeks to fill this gap in the literature.

In light of the substantial heterogeneity across European regions, it is crucial to assess the detailed economic impact of joining a currency union and how it changes during a crisis period given the limitation on the use of monetary policy. Our paper aims at estimating the regional economic impact of joining the euro for latecomer eastern countries[7]. Choosing these countries has many advantages for identifying an adequate control group in a counterfactual approach. In fact, this allows comparison with countries with a similar economic and cultural structure, all in transition from preceding centrally planned regime, which belong to the European Single Market and which all previously suffered the shock due to the creation of the euro area, even without belonging to it. Although eastern countries are generally considered as peripheral, the use of the regional level allows splitting these areas into core and peripheral regions[8]. We then try to answer questions like: which

[5]Mundell (1961) highlights that an OCA could be several states, regions of several states, or regions inside a single state.

[6]The regional dimension was also 'forgotten' by governments when deciding whether to join the euro area. Fingleton et al. (2015) affirm that there are three potential explanations for this: OCA theory was ignored, modified, or cast aside. In the first case, in favor of the political project; in the second case thinking of an 'endogeneity' version (Frankel and Rose 1998 states that potential member countries did not have to meet certain optimal conditions ex-ante but would instead form an OCA ex-post); in the last case because the 1990s theory focused on the neoclassical determinants rather than on the business cycle.

[7]We consider regions at NUTS-2 level and adopt the NUTS 2013 regional classification. The NUTS classification (Nomenclature of Territorial Units for Statistics) is a system for classifying the economic territory of the EU.

[8]Figure A1 in Appendix A maps core and peripheral eastern areas, where core regions are those with a high level of urbanization.

regions gained from joining the euro area? Do economic crises make these gains vanish?

Our analysis concerns the regions belonging to the 5 eastern European countries which joined the euro between 2007 and 2015[9]. There are two important novelties in the paper:

1. We are the first to our knowledge to use a counterfactual approach to investigate the regional impact of joining the euro area by using NUTS-2 regions as unit of analysis. All previous studies have used country-level data (see, among others Fernández and Garcia-Perea 2015; Puzzello and Gomis-Porqueras 2018; Gabriel and Pessoa 2020). This is a crucial step forward as it allows us to evaluate the spatial heterogeneity of the impact, improving the estimate accuracy and better investigate the theoretical predictions related to the currency union impact on local economies;

2. The use of the kernel balancing (KB) approach introduced by Hazlett and Xu (2018). This is a counterfactual method which improves on the Synthetic Control Method (SCM) (Abadie and Gardeazabal 2003, Abadie et al. 2010) by adopting a more sophisticated reweighing algorithm and explicitly allowing the analysis of multiple treated units. KB estimates the counterfactual scenario, i.e., what would have happened to the latecomer eastern European countries – Estonia (1 region), Latvia (1 region), Lithuania (1 region), Slovenia (2 regions), and Slovakia (4 regions) - if they had not joined the euro area. Then it measures the effect as the difference between the factual and counterfactual situation. Our panel dataset covers all NUTS-2 regions belonging to eastern European countries in all years from 1993 (two years after eastern European countries became independent from the Communist Bloc) to 2015.

Overall, we find that the adoption of the euro brought about a positive effect, which was, however, dampened by the Great Recession. The individual regional

[9]We do not consider Malta and Cyprus as they have specific features that are difficult to recreate using a counterfactual approach. They are islands in the Mediterranean Sea and have historical and economic features quite different from the eastern European countries, which make up the core of our analysis. However, in Appendix F1, we report the analysis concerning Malta and Cyprus.

estimates show heterogeneous returns from joining the currency union, also within a single country. The real 'winner' is the Bratislava region in Slovakia, which garnered great advantage from joining the euro area, also during the economic crisis. This finding is in line with NEG predictions, as the Bratislava region is the only 'core' area: among the treated units, it is the only urban region bordering on EU-15[10], and it is the wealthiest region. On the contrary, Eastern Slovakia registered a slight loss, while the other two Slovak regions did not gain nor lose, being a 'periphery' not only in Europe but also inside their country. Slovenian regions had not gained from the euro before the crisis and registered consistent losses afterward. Baltic countries recovered losses experienced during the Great Recession, but only Lithuania obtained a gain.

The rest of the paper is organized as follows. Section 2 presents the literature review, while the following section summarizes the history of the EU and EMU in eastern Europe. Sections 4 and 5 describe the data and the methodology, and Section 6 discusses the results and presents robustness tests. Section 7 concludes.

2 Literature review

Previous studies on the causal impact of joining the euro are carried out at the country level and mostly concern the early adopters. In this review, we first consider studies on the early-adopters and then articles on the late-adopter countries. Puzzello and Gomis-Porqueras (2018) use the SCM to provide estimates of the effect of the euro on the income per capita of six early adopters before the global financial and Eurozone crises took place. They find that Belgium, France, Germany, and Italy have lost from adopting the euro. In contrast, both the Netherlands and Ireland are better off after euro adoption. Moreover, they establish that trade is the main channel through which currency unions increase income growth. Gabriel and Pessoa (2020) also consider trade one of the main channels even though they state that only Germany and Ireland obtain net trade benefits. Besides, they

[10] 15 was the number of Member States in the EU before the accession of ten candidate countries on 1 May 2004. The EU15 comprised the following 15 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

extend the Puzzello and Gomis-Porqueras (2018) analysis to the twelve Member States which joined the euro before 2002, showing a substantial economic gain only for Ireland. Verstegen et al. (2017) used a similar approach to investigate the benefits of real GDP per capita from participation in the EMU. Their estimates suggest that, until the Great Recession, all countries, except for Italy, gained from being in the EMU, while, during the crisis, several Member States suffered losses from joining the euro. This impact is substantial and even statistically significant for Greece, Italy, and Spain. A similar evaluation strategy was used by Fernández and Garcia-Perea (2015) who find that the euro area did not produce the expected permanent increase in GDP per capita. Their estimates suggest that peripheral countries (Spain, Greece, and Ireland) registered positive and significant gains up to the debt crisis, except Italy and Portugal. In contrast, central European countries (the Netherlands, Germany, and Austria) did not seem to obtain any gains or losses. A different approach is used by Drake and Mills (2010) who decompose the euro area GDP into a trend and a cyclical component. They find that the adoption of the euro reduced the trend rate of growth of the Eurozone economies, both during the Maastricht nominal convergence phase and during the period from 2001 to 2005. Giannone et al. (2010) adopt a Bayesian Model Averaging approach to evaluate the EMU growth path, based on the past distribution and conditioning of external developments. Their results show that the euro area's average growth from 1999 to 2006 was slightly lower than what they would have expected. Country differences are small and come from different degrees of competitiveness, real interest rates, and other economic characteristics. Another significant contribution that underlines the heterogeneity of the impact is the study by Fingleton et al. (2015). They investigate the vulnerability and resilience of regions in the Eurozone to economic shocks, such as the Great Recession. Using predictions based on dynamic spatial panel models, they find a considerable difference between peripheral regions that suffered the most during the crisis period, and central regions, that are more resilient.

Concerning late-adopters, we have only two studies. Backé et al. (2018) adopt a qualitative approach to investigate the economic impact of the enlargement of the euro area to include Central, Eastern, and South-Eastern Europe (CESEE) Member States. They suggest that joining the euro area has not had a damp-

ening effect on Slovakia or the Baltic countries (Estonia, Latvia, and Lithuania). Slovenia went through a more extended boom-bust cycle, with a second recession in 2012-13, before pursuing a dynamic growth path. The results of Slovakia are also confirmed by Žúdel and Melioris (2016), who, using the SCM, quantify a gain approximately equal to 10% in terms of GDP per capita from joining the euro.

3 Euro in central and eastern Europe

In 1989, the Cold War between the capitalist Western Bloc and the communist Eastern Bloc was concluded, and the USSR's influence over communist Europe started to collapse. A new process of independence began between 1990 and 1992 in a perspective of European integration that saw a key step in 2004 with the EU enlargement to most eastern European countries. On 1 May 2004, Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia, and Slovakia joined the European Union (EU), while Romania and Bulgaria joined the EU three years later. Excluding Malta and Cyprus, all countries come from a historical path driven by the socialist system. Moreover, as shown by Artis et al. (2006), the eastern European countries are really similar to each other. They are poorer than EU-15, rural, small in size – except for Poland – relative to EU-15, with a lesser efficient national and regional innovation systems (Kravtsova and Radosevic 2012). Besides, they all experienced a more or less deep recession during the transition from the preceding centrally planned regime, then followed by an expansionary path. Despite similarities, they achieved different transition levels in terms of economic development, institutions, the stability of democracy, and civil society development. For example, Artis et al. (2006) observe that Slovakia was the most progressive country in central Europe at the beginning of the 2000s, while Slovenia, Cyprus, and Malta did not perform well in economic terms. The economic differences within CESEE countries were even more remarkable than those across countries.

The EU integration process with the EU 2004 enlargement is strictly connected with euro adoption. The elimination of cross-border barriers to the free movement of goods, services, capital, and people cannot be complete when each member state has its own currency, some with floating exchange rates (see European Commis-

sion, 1990)[11]. Nevertheless, for eastern European countries, the actual national sovereignty was a delicate issue after independence from the USSR. As highlighted by Ágh (2017), the euro accession is viewed as a confirmation of their national sovereignty, which protects them against potential Russian aggression. On the other hand, eastern countries have only recently obtained national sovereignty and might be unwilling to give up monetary policy independence. As of December 2020, Bulgaria, Romania, and Croatia have expressed their willingness to join the euro area[12].

While joining the euro might represent an opportunity to close the large economic gap between the euro area countries and those in the eastern Europe, it requires careful economic preparation. According to Artis et al. (2006), the euro area monetary policy would be ill-adapted to the needs of most eastern countries, with a counter-indication to EMU participation.

The monetary unification process seems to continue slowly towards the east of Europe. While Slovenia, Slovakia, and the Baltic countries joined the EMU, other eastern countries have a purely pessimistic approach like the Czech Republic according to Rozmahel et al. (2013). Poland's statements regarding the euro might be considered careful regarding the current state of Maastricht criteria' fulfillment. These criteria involve: a high degree of price stability (average inflation over one year before the examination not more than 1.5 percentage points above the rate of the three best-performing EU countries), a sound fiscal situation (public deficit below 3 percent of GDP), converged long-term interest rates (long-term interest rate not more than 2 percentage points above the rate of the three best-performing EU countries in terms of price stability), and exchange rate stability (participation in the ERM II for two years without severe tensions). ERM II mimics the euro area conditions, thereby helping non-euro area Member States prepare for satisfying such criteria. By following ERM II, countries accept to limit their monetary policy; in fact, they cannot move the exchange rate. As can be observed from Ta-

[11]Dabrowski (2019) remarks the marginal political influence over EU policy decisions of countries that decide to remain outside the European Monetary Union (EMU).

[12]Bulgaria and Croatia sent a letter of intention respectively in July 2018 and in July 2019 regarding ERM II participation, and in July 2020 the ERM II parties agreed to include the Bulgaria lev and the Croatian kuna in the ERM II mechanism. According to the National Plan to Changeover to the Euro, Romania has scheduled 2024 as the date for euro adoption. As of December 2020, Romanian is not part of ERM II.

ble 1, Estonia, Latvia, Lithuania, Slovenia, and Slovakia started participating in ERM II between 2004 and 2005, while they joined the euro between 2007 and 2015. While the Baltic countries adopted the euro after a long period from entrance in ERM II, the exchange rate of their currencies with respect to the euro remained unvaried, also during the Great Recession. This is why we consider entrance in ERM II as the beginning of the 'euro treatment' .

Table 1: Eastern European countries

Country	UE	ERM II	EMU	NUMBER OF NUTS-2
TREATED				
Slovakia	2004	2005	2009	4
Slovenia	2004	2004	2007	2
Estonia	2004	2004	2011	1
Lithuania	2004	2004	2015	1
Latvia	2004	2005	2014	1
Total				9
CONTROLS				
Bulgaria	2004	-	-	6
Poland	2004	-	-	16
Czeck Republic	2004	-	-	8
Romania	2004	-	-	8
Hungaria	2004	-	-	7
Total				45

4 Data and Sample

In this study we consider as treated the regions belonging to latecomer countries that adopted the euro after 2002. As shown in Figure 1, we consider only the eastern European countries, i.e., Estonia (1 region), Latvia (1 region), Lithuania (1 region), Slovenia (2 regions), and Slovakia (4 regions), for a total of 9 treated regions. Our initial donor pool - the set of potential comparison units - includes all regions belonging to the EU countries that have not adopted the euro. We then restrict the donor pool to only eastern EU countries that are not in the euro area, i.e., Bulgaria (6 regions), Czech Republic (8 regions), Hungary (7 regions), Poland (16

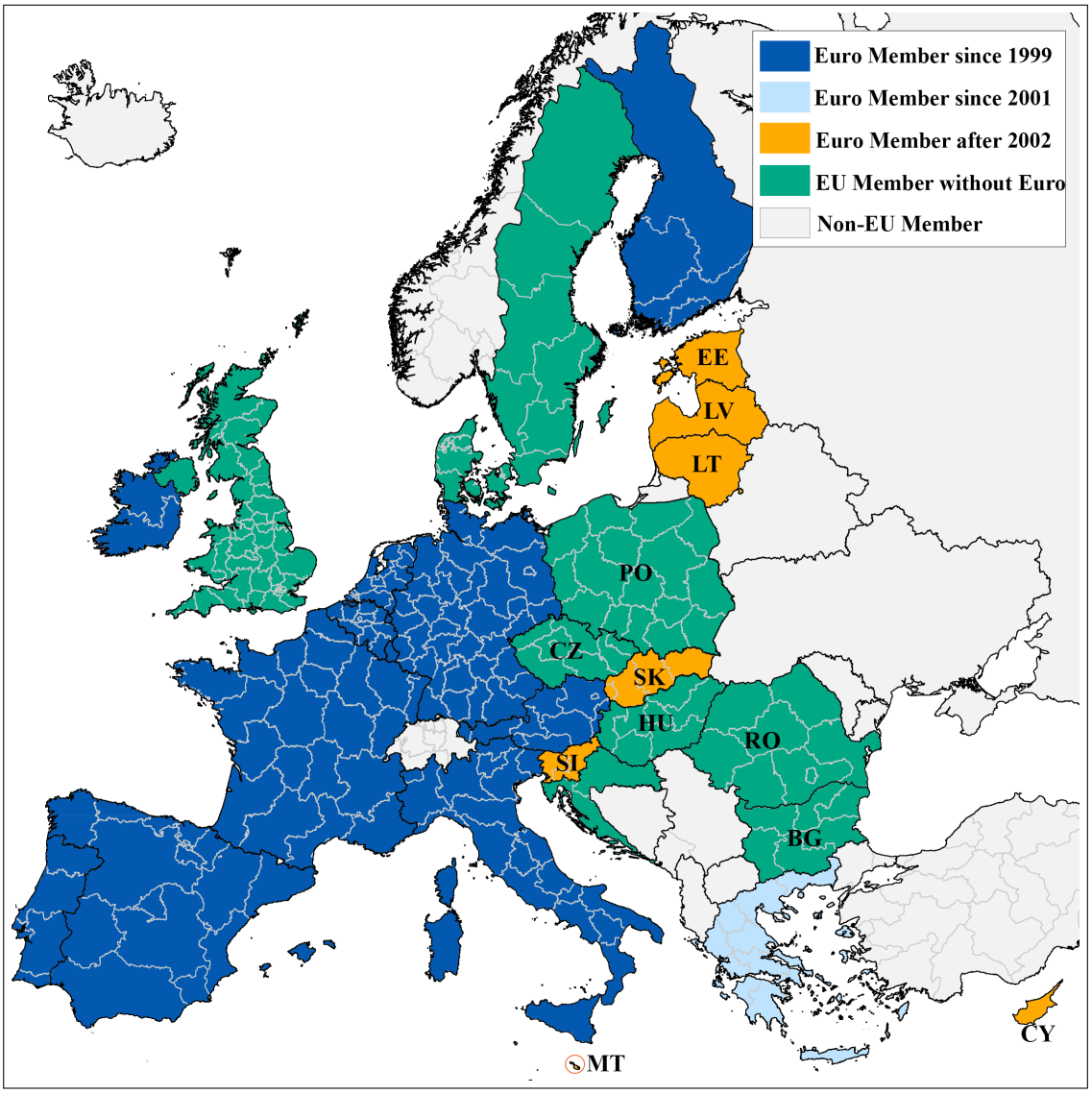


Figure 1: Political map of Europe showing the European countries that joined the euro (NUTS-2 level) by data of entry

Notes: The map shows the situation in 2015. At that time, the UK was still a member of the EU. Croatia joined the EU in 2013.

regions), and Romania (8 regions), for a total of 45 regions[13]. We exclude Croatia as it joined the EU only in 2013. All the countries considered, both treated and control, have experienced a similar historical path (see Section 3). This allows us to build a counterfactual scenario that mimics what would have happened to the regions treated in the absence of treatment. As suggested by Abadie et al. (2015), because comparison units have to approximate the counterfactual situation, it is important to restrict the donor pool to units with outcomes that are thought to be driven by the same structural process as for the treated units and that were not subject to different structural shocks affecting the outcome variable during the sample period of the study. In our empirical analysis, the Great Recession hit all eastern countries in the ex-post period; therefore, we assume that the recession represented a common negative shock which affected eastern EU Member States similarly[14].

The eastern EU countries joined ERM II – here considered as the actual treatment – between 2004 and 2005, allowing for a pre-treatment period which ranges from 11 to 12 years. In particular, Slovenia, Estonia, and Lithuania entered ERM II in 2004, and Latvia and Slovakia in 2005. Our main data source is the Cambridge Econometrics' European Regional Database from 1993 to 2015, which consists of a wide range of economic and demographic indicators for the EU countries at the NUTS-2 level. The analysis also relies on data from Eurostat, PBL Netherlands Environmental Assessment Agency[15] - a trade database (Thissen et al. 2013) that determines interregional trade among 256 NUTS-2 regions and 59 sector categories from 2000 to 2010 - and the European Quality of Government Index (EQI) [16] -

[13]Baltic countries, i.e., Estonia, Latvia, and Lithuania, are classified by one NUTS-2 region. Nevertheless, even for them, the use of the level NUTS-2 as the unit of analysis is important because using regions in the donor pool instead of countries makes it possible to create a more credible counterfactual scenario.

[14]Alessi et al. (2019) show that heterogeneous resilience at the crisis across EU countries, even though, in the short-run, the economic impact was similar for the majority of eastern countries, except for Poland that bounced back promptly from the negative shock. Another potential difference across eastern regions is the per capita amount of funds received from the European Union (EU) regional policy. However, EU regional policy financial support is inversely proportional to the level of wealth. Therefore, as we control for GDP per capita in our analysis, we are implicitly controlling for differences across regions due to the EU regional policy funds.

[15]PBL Netherlands Environmental Assessment Agency is the national institute for strategic policy analysis in the fields of the environment, nature, and spatial planning.

[16]We thank Andres Rodríguez-Pose for providing us with these data.

that concerns citizen-based perception and experience with respect to corruption, quality and impartiality in terms of education, public health care and law enforcement (Charron et al. 2014)[17]. To capture the economic impact, we use the GDP per capita adjusted at Purchasing Power Standard (PPS). To identify the exogenous predictors of the economy, we follow the literature (Abadie et al. 2015) and control for: population, total hours worked per employee, employment rate on active population, compensation of employees, labor productivity, share of gross value added (GVA) on the primary sector, the share of GVA on the tertiary sector, the share of old (65+) population, the share of foreigners, trade openness, trade balance, and EQI[18].

5 Methodology

To estimate the effect of joining the euro for the Eastern European Area on the GDP per capita, we use the KB estimator proposed by Hazlett and Xu (2018). This is a general reweighing approach to the causal inference which builds upon the SCM, developed by Abadie and Gardeazabal (2003) and Abadie et al. (2010), enabling us to estimate the treatment effect in the presence of few treated units. The idea behind KB is that in a difference-in-differences setting with one or few treated units, it is possible to construct, transparently, a 'synthetic' counterfactual unit that can better mimic what would have happened to the units treated in the absence of treatment. The 'synthetic' unit is built as a weighted average of control units whose pre-treatment characteristics closely match that of treated units. Therefore, the treatment effect in each post-treatment period ($t > T_0$) is given by the difference between the observed outcomes for the treated regions and the 'synthetic' control unit. Considering the whole Eastern Euro Area, the average

[17]Weak institutional capacity is perceived as the key inhibitor in many lagging regions, so the EQI is a direct determinant of economic growth (Rodríguez-Pose and Garcilazo 2015).

[18]Concerning trade, there are no data at the NUTS-2 level for Bulgaria, Romania, or Slovenia. We impute the missing regional data by allocating the national trade figure on the basis of the GVA in manufacturing. Concerning EQI, as data at the NUTS-2 level are not available for Slovenia, we attribute the country value to both regions.

treatment effect for each post-treatment period (ATT_t) is equal to:

$$\widehat{ATT_t} = \frac{1}{N_{tr}} \sum_{G_i=1} Y_{it} - \sum_{G_i=0} w_i Y_{it}, \qquad T_0 < t \leq T,$$

where N_{tr} = number of treated (in our case the 9 regions that join the euro), G_i is the group indicator that is equal to 1 if i lies in the treated group, and equal to 0 if i lies in the control group, and Y_{it} is the outcome variable of unit i at time t, w_i is the control weight. The w_i are chosen s.t.

$$\frac{1}{N_{tr}} \sum_{G_i=1} \phi(Y_{i,pre}) = \sum_{G_i=0} w_i \phi(Y_{i,pre}),$$

and $\sum_{G_i=0} w_i = 1$; $w_i > 0$ for all i in the control group. $Y_{i,pre}$ [19] must be made equal for the treated and control regions, not only in the average trajectory but also on the higher-order representation of the pre-treatment history $\phi(Y_{i,pre})$. This allows us to eliminate the bias in the ATT estimates, ensuring that the control regions that are more similar to the treated regions in their trajectories receive higher weights[20]. To choose $\phi()$ and then determine weights, a kernel-based approach is used. The basis of this approach consists in kernels, i.e., functions that assess similarity for each covariate and pre-treatment outcome between unit i and each other unit. $\phi(Y_{i,pre})$ can be represented as simply K_i, or in matrix form Y^{pre} as K. K_i has the form $[k(Y_i, Y_1), k(Y_i, Y_2), ..., k(Y_i, Y_N)]$, where N are the number of observations and $k(Y_i, Y_j)$ is a function that measures similarity between unit i and unit j. Given that an exact balance on all N dimensions of K is typically infeasible, we seek an approximate balance. The basic idea is to minimize the (worst-case) bias due to this approximation: (1) take the eigenvectors of K based on singular value decomposition (SVD), and (2) achieve balance on the first P eigenvectors, leaving those whose eigenvalues rank $P + 1$ to N unbalanced, where

[19] For the sake of brevity, $Y_{i,pre}$ includes pre-treatment outcomes as well as pre-treatment covariates

[20] Matching not only on the average but on all distribution of the trajectories is very important overall when, for example, a control group that varies wildly around a flat line could be well mean balanced to a treated group that has all 'flat' trajectories. Yet, the treated and control groups would look very different on features such as variance or volatility. If these features later come to have a large directional impact on the outcome, this imbalance can generate bias.

(3) the value of P is chosen to minimize the 'worst-case' bias that could arise due to remaining imbalances. As using this procedure makes it difficult to find a set of weights that reduce the imbalance between treated and control groups, it may be necessary, before reweighing, to subtract from the original outcome variable of each unit the average outcome in the pre-treatment period, ensuring mean zero outcomes in the pre-treatment period. While making feasible weights easier to find, this comes at the cost of an invariance assumption.

The heterogeneous estimated effect for each eastern European region ($\widehat{\theta_{it}}$) is equal to

$$\widehat{\theta_{it}} = Y_{it} - \sum_{G_i=0} w_i Y_{it}, \qquad T_0 < t \leq T.$$

The KB offers additional advantages over SCM by:

1. reducing user-discretion (it does not require one to specify which pre-treatment outcomes or covariates or their higher-order interactions to be matched on, thus minimizing the negative effects of research degrees of freedom);

2. accommodating for several treated units;

3. achieving balance on the high-order 'trajectory' of pre-treatment outcomes rather than their period-wise average (KB procedure ensures that the weighted control group is similar to the treated with respect to average values before the treatment, but also for high order features, such as 'volatility', 'variance' or 'curviness').

6 Results

Figure 2 shows the trends of the average GDP per capita in PPS of the eastern European countries that joined the euro (dark line) and its synthetic counterpart (dashed line), i.e., the weighted average GDP per capita in PPS of control units, based on the KB approach. The horizontal axis represents the time in years, while the vertical axis represents the GDP per capita in PPS. We consider 2004 as the beginning of treatment (grey vertical line), as it is the year in which the majority of treated countries entered ERM II (KB does not allow accommodating for different

treatment years in a single run). However, when we analyze the heterogeneous effects, we use the different ERM II entrance years as 'treatment start', as shown in Figure 3. The 'synthetic' eastern euro area resembles the pre-treatment characteristics of the eastern euro area, suggesting that it is a valid counterfactual. Indeed, the pre-treatment fit observed between treated and synthetic eastern euro area in Figure 2 is very good and it is bolstered by the high degree of covariate balancing reported in Table 2. This table displays the mean values between the treatment and control groups in the pre-treatment covariates before and after reweighting via KB. We find that the adoption of the euro brought about a positive effect on the whole period considered. However, after the onset of the financial crisis (the dashed vertical line), we observe a reduction of the eastern euro area economic gain.[21] This finding suggests that, in general, for the eastern euro area the positive effects of being in a currency union outweighed the economic costs despite the time of crisis.

Nevertheless, it is difficult to argue that with the accession of eastern European countries to the euro area, the conditions for an OCA (homogeneity, i.e., economic similarities, or at least flexibility on the labor market) were satisfied for all regions. Therefore, we might expect that the treatment impact is not homogeneous across areas. So, despite the positive average impact, some regions might have been damaged by joining the euro area. To identify the impact heterogeneity, we analyze each treated NUTS-2 region and report all individual analyses in Figure 3. After the beginning of the financial crisis, we observe a reduction of the positive impact of adopting the euro or an increased negative impact, which is temporary for some regions and permanent for others. Both Slovenian regions suffer from joining the euro area, with losses that increase after the crisis. On the contrary, Slovak regions suffer little from the crisis. Overall, the Slovakian region of Bratislava experienced an economic gain from joining the euro also during the crisis. Bratislava is the only 'core' region among the treated units, as it is the only urban region bordering on EU-15, and it is by far the wealthiest region. Concerning the Baltic countries, while they entered ERM II between 2004 and 2005, they adopted the euro

[21] In Table 3, one can observe the overall average treatment effect and the treatment effect at the middle of the crisis and in the last observed year for the eastern euro area and for every single region which joined the euro.

only between 2011 and 2015. Such a long time span might suggest that the euro had a more moderate impact on them than on countries that managed a quicker adoption. Although it took them a few years to meet all Maastricht conditions, the Baltic countries always satisfied the exchange rate stability criteria also in the crisis period. This choice led to an internal devaluation via austerity measures and nominal wage reduction to restore competitiveness and reorient their production to new markets (Kuokštis 2011). This was possible for the so-called 'Baltic flexibility,' allowing them to quickly recover in the early 2010s after being harshly hit by the Great Recession (Kahanec et al. 2016). However, there are differences between the three countries. According to Kuokštis (2011), Latvia responded in a less flexible way to changes in economic conditions than Estonia and Lithuania and faced the most significant difficulties. Our findings confirm this: Latvia is the Baltic country that suffered the most from the onset of the crisis. Nevertheless, in the early 2010s, it quickly recovered most of the economic losses. Lithuania obtained a positive effect when entering the ERM II, then experienced a loss during the early crisis period, but after it quickly bounced back. Estonia did not gain or lose, except at the beginning of the Great Recession, where we observe a moderate loss. It is likely that these outcomes have been amplified by the EU's political choice to focus on growth cores in response to the Great Recession (see Pike et al. 2016).

Overall, our results are in line with the NEG theory and reinforce the importance of considering regions' heterogeneity. When there is no exchange rate risk, the regional economic and productive structure is critical to enhancing growth and resilience to adverse shocks. Regions with better access to new markets, such as port cities and border regions, are assumed to profit from economic integration. This prediction is confirmed by the Bratislava region, which is the only urban region in our sample that shares a border with early-adopter euro countries, as shown in Table 4. Moreover, regions with high openness to trade (e.g., Bratislava) are also the regions that benefited the most from the single currency, in line with McKinnon (1963) prediction. On the contrary, as shown in Figure 4, some of the regions with low openness to trade (mainly the Slovenian regions) experience substantial losses in terms of per capita GDP.

Table 2: Covariate balancing

	Treated	Unbalanced controls	Kernel balanced controls
Labor productivity	6.59	5.21	6.97
Annual hours worked per employee	2,083.14	1,979.20	2,073.87
Share of GVA in services	65.96%	58.70%	64.39%
Share of GVA in agriculture	4.43%	7.13%	3.61%
Employment on active population	88.64%	89.74%	94.47%
Compensation of employee (Millions of €)	5,240.29	3,438.37	4,800.45
Share of foreigners	4.19%	1.02%	1.63%
EQI index	-0.73	-0.88	-0.59
Trade openness	1.17	1.14	1.32
Trade balance	-0.06	-0.06	-0.02
Share of 65+ population	13.60%	14.21%	14.11%
Population (ln)	14.18	14.39	14.44

Notes: The columns represent the average value of the treated regions, control regions, and control region after a kernel balancing procedure for each covariate in the row.
Labor productivity, hours worked per employee, share of GVA in services and in agriculture, compensation per employee, and population (ln) are averaged for the 1993-2003 period. EQI index is averaged for the 1996-2003 period. The EU average is 0; negative value are below the EU average, positive value are above the EU average. In pre-treatment period the smallest EU value was -3.32 while the biggest value was 2.71. Trade openness and trade balance are averaged for the 2000-2003 period. For the share of 65+ population 2003 is considered. For the share of foreigners 2001 is considered.
Labor productivity is the ratio between the total Gross Value Added (the net result of output valued at basic prices less intermediate consumption valued at purchasers' prices deflated to 2005 constant price in euros)and the total hours worked. The share of GVA in service (agriculture) is the ratio between the Gross Value Added (GVA) in service (agriculture) and the total GVA. Employment of the active population is the ratio between the number of employees (workplace-based measure) on the number of employed and unemployed people (household-based measure), economically inactive. Compensation of employees consists of wages and salaries, and employers' social contributions. Current price compensation of employees is deflated to 2005 constant price in euros. Trade openness is the ratio between exports plus imports on the GDP. Trade balance is the ratio between exports minus imports on the GDP.

Table 3: Treatment effects in different times

	ATT	TE 2009	TE 2015
Bratislava Region	€9,603.93	€8,928.43	€13,254.06
Western Slovakia	€2,571.21	€2,056.31	€2,558.72
Central Slovakia	€873.41	€741.46	€1,088.59
Eastern Slovakia	€184.50	€-214.28	€-23.25
Latvia	€-920.73	€-2,161.55	€-1,176.67
Estonia	€-674.87	€-2,343.97	€-1,193.15
Lithuania	€1,560.03	€-278.79	€2,761.17
Eastern Slovenia	€-2,127.40	€-1,917.79	€-4,212.93
Western Slovenia	€-4,659.40	€-4,784.79	€-4,212.93
Eastern Euro Area	€910.23	€442.92	€741.36

Notes: The first column indicates the average treatment effect for the whole post-treatment period. The second and the third columns indicate the treatment effect for 2009 and 2015, respectively.

Table 4: Eastern euro regions' characteristics

NUTS2	NAME	EURO BORDER	URBANIZATION
EE00	Estonia	-	Intermediate
LT00	Lithuania	-	Intermediate
LV00	Latvia	-	Urban
SI03	Eastern Slovenia	AT21, AT22	Rural
SI04	Western Slovenia	AT22, ITH4	Intermediate
SK01	Bratislava Region	AT11, AT12	Urban
SK02	Western Slovakia	AT12	Intermediate
SK03	Central Slovakia	-	Intermediate
SK04	Eastern Slovakia	-	Intermediate

Notes: Data on urbanization are taken from Jonard et al. (2009a). The regions are classified in 3 classes (rural, intermediate, and urban) on the basis of the share of population living in rural communes or located in urban centers as developed in the OECD methodology.

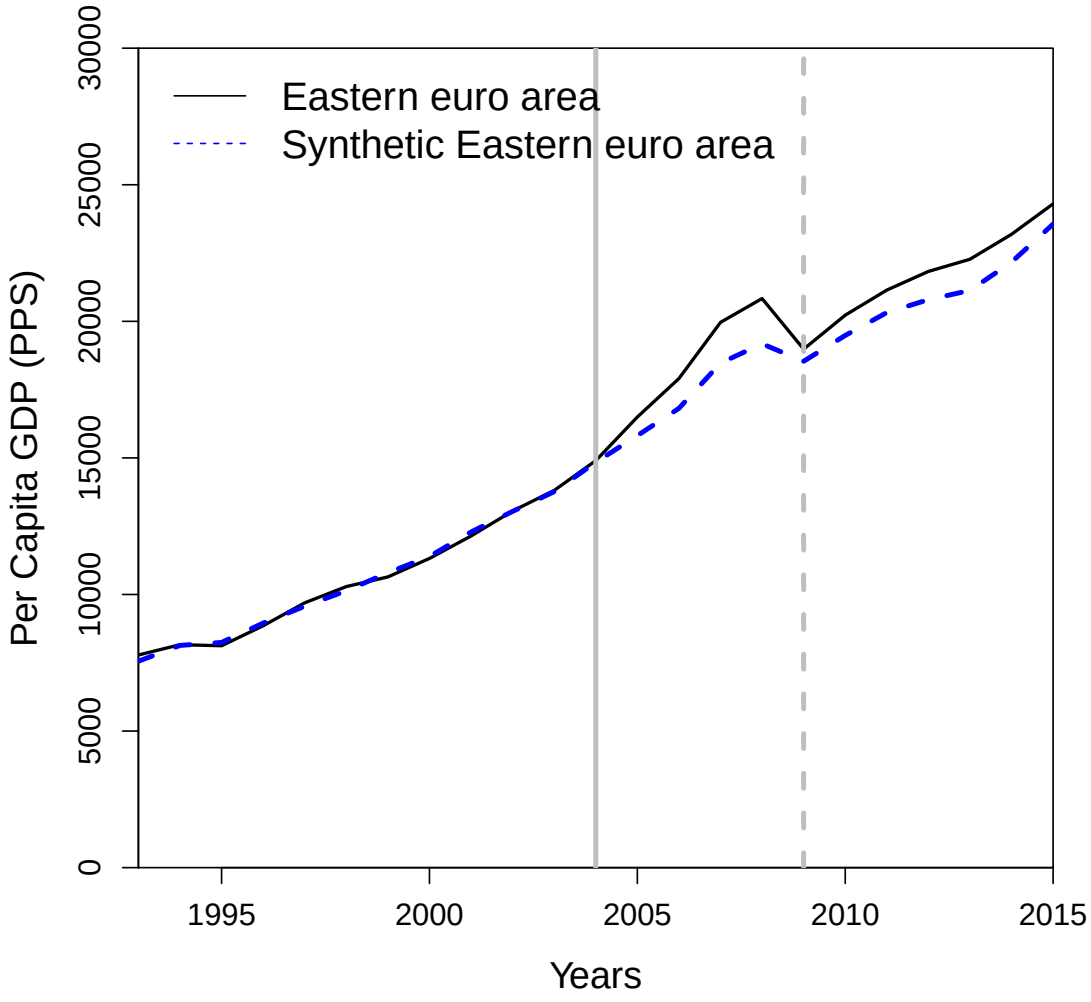
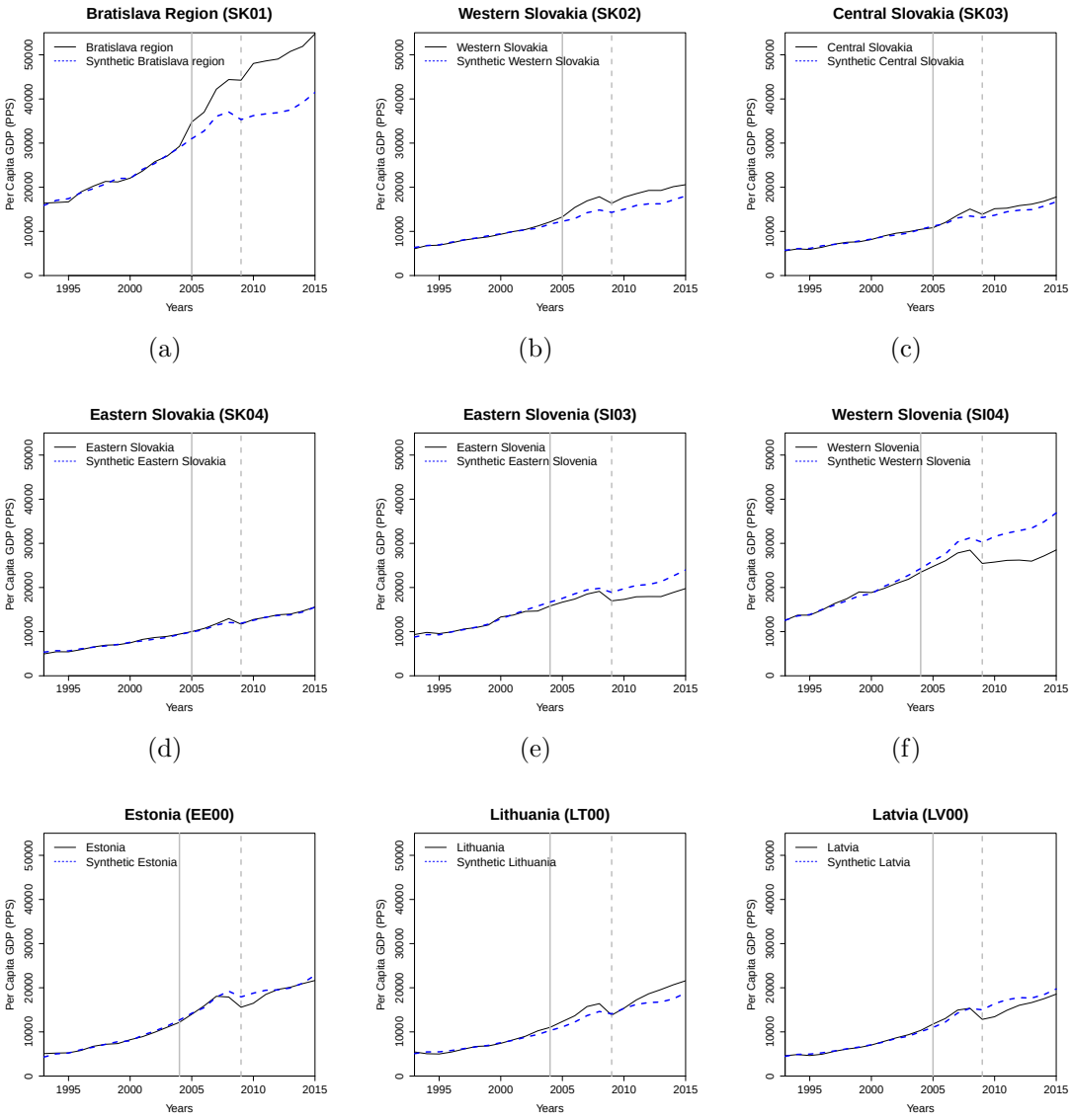


Figure 2: Trends in GDP per capita: eastern euro area and synthetic eastern euro area



(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Figure 3: Trends in GDP per capita (NUTS-2 level)

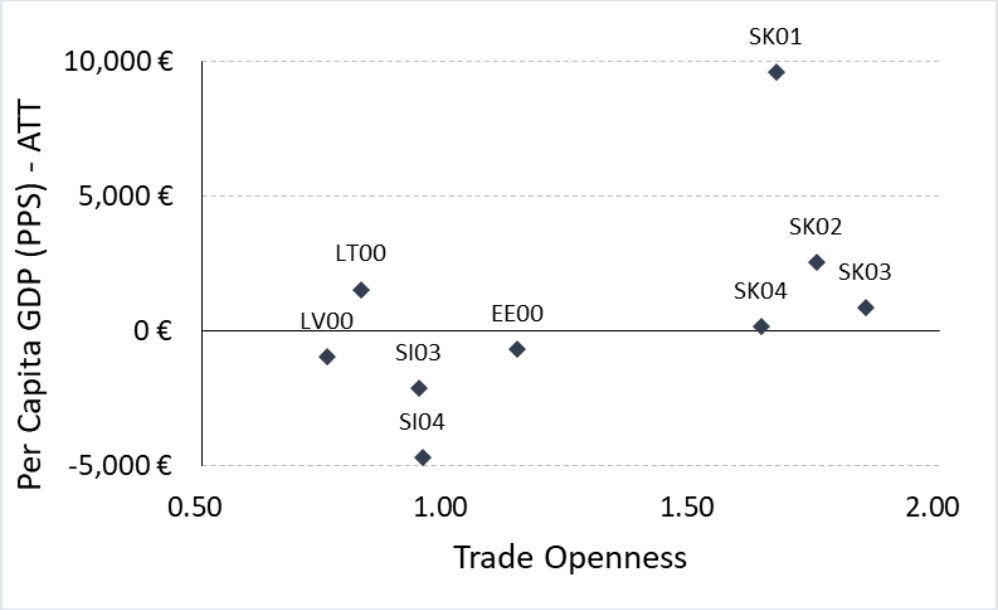


Figure 4: Trade openness in eastern euro regions in 2003

6.1 Placebo in-space

Following Abadie et al. (2010), we run in-space placebo tests to evaluate the statistical significance of the estimates. The in-space placebo test reassigns the treatment (euro accession) artificially to every potential control region in the donor pool, i.e., regions not in the euro area, creating a distribution of placebo effects. If the treated region's trend dominates placebo distribution trends, there is a likely statistically significant effect. On the contrary, if sizable estimate effects on control regions are similar or larger, the statistical significance disappears. We repeat the process for each of the nine treated regions. Figure 5 depicts the gaps for treated (black line) and controls (grey lines). This test suggests that our estimates are statistically significant for the Bratislava region, Western Slovakia, the Slovenian regions, and Lithuania, as shown in Figure 3[22].

[22]There is an unusually large treatment effect for some control regions. This is a common situation in SCM literature, and it is due to an imperfect pre-treatment fit of the 'synthetic' placebo regions. The regions with a bad fit are usually removed because considered not useful to evaluate the statistical significance of the estimates. We exclude from the donor pool regions with a pre-treatment Mean Squared Prediction Error (MSPE) of more than 5 times the MSPE of each treated region, so regions for which the approach used is ill-suited.

In appendix C, we report an alternative statistical significance test first proposed by Abadie et al. (2015). This test generally confirms the aforementioned results.

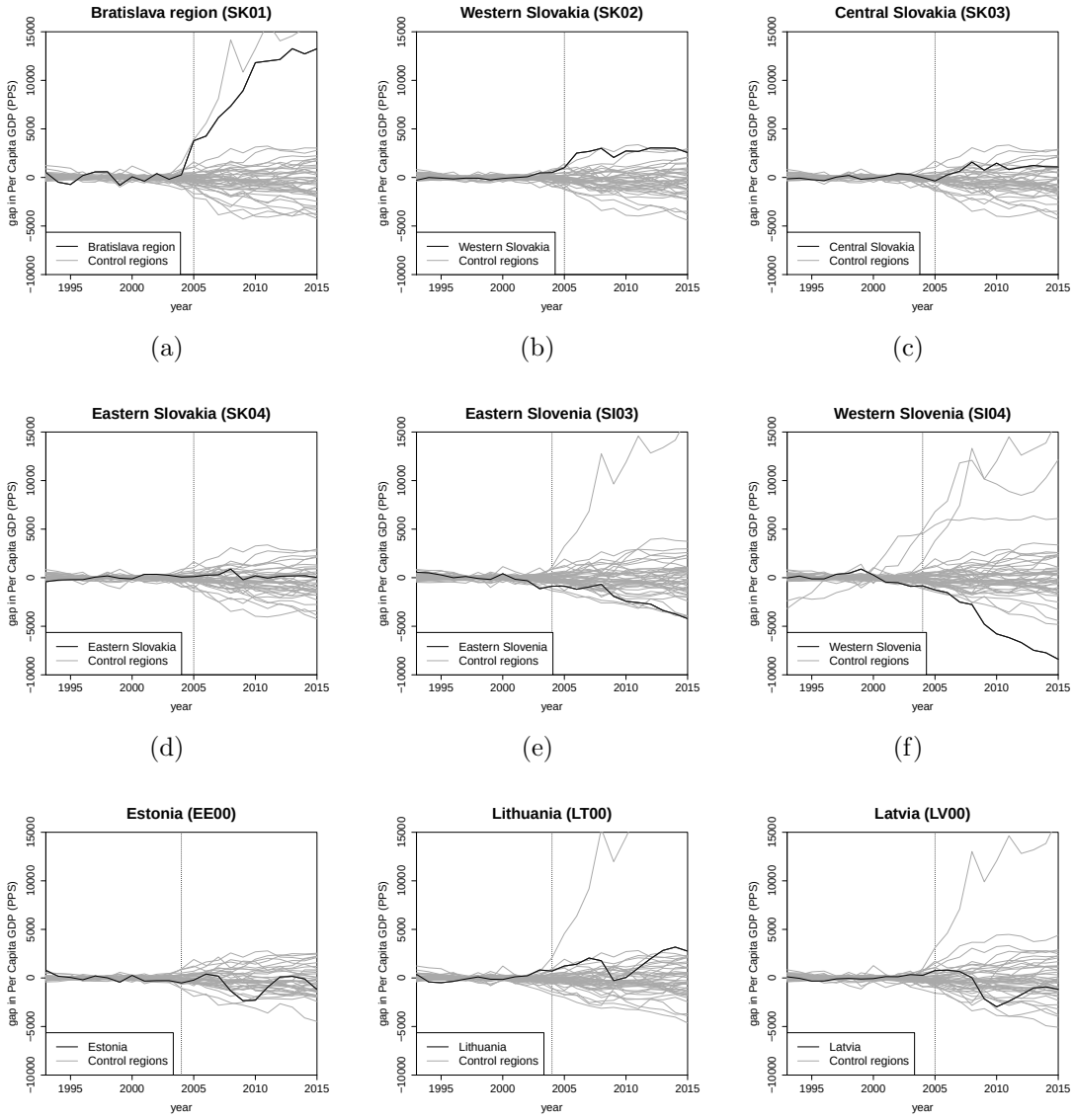


Figure 5: In-space placebo: gap in GDP per capita at NUTS-2 level.

Notes: In Panel (a) there are 43 regions plus Bratislava region; in panel (b) there are 40 regions plus Western Slovakia; in panel (c) there are 39 regions plus Central Slovakia; in panel (d) there are 45 regions plus Eastern Slovakia; in panel (e) there are 43 regions plus Eastern Slovenia; in panel (f) there are 43 regions plus Western Slovenia; in panel (g) there are 37 regions plus Estonia; in panel (h) there are 43 regions plus Lithuania; in panel (i) there are 42 regions plus Latvia.

6.2 Robustness check

The sensitivity of the per capita GDP estimates was tested by changing:

1. The donor pool.
   We propose a leave-one-out analysis, i.e., we re-run the KB, excluding from the sample one-at-a-time each of the regions that contribute to the counterfactual. The findings are shown in Figure 6. It emerges that no particular donor region is driving our main findings. Only the results of Estonia and Western Slovenia seem to be less robust.
   We then restrict the donor pool of each treated region to regions having the same level of urbanization (rural, intermediate, or urban). The results are reported in Figure 7. The figure depicts the synthetic region (dashed blue line) as well as the synthetic region built with a restricted donor pool in terms of urbanization (dashed green line). The results are similar to the main analysis, except for the Bratislava region and Latvia, where the effects become even larger (even if with the opposite sign), for Slovenian regions where the effect is positive before crisis, and for Estonia where it is positive for the entire post-treatment period.[23]
   Lastly, as all of our treated regions joined the EU in 2004, we exclude from the donor pool the Bulgarian and Romanian regions, which joined the EU in 2007. The results corroborate our main findings, even though Eastern Slovenia has a smaller negative effect, and Latvia a positive effect, as shown in Appendix D1.

2. The algorithm to assess weights. We use Mean Balancing (MB), a procedure developed by Hazlett and Xu (2018) that seeks balance on the first P principal components of the characteristics, where P is chosen automatically by a method that minimizes the worst-case bias, and Synthetic Control Method (see Abadie et al. 2010, and Abadie et al. 2015 for more details). The findings shown in Appendix E1 and E2 largely support the main analysis, except for Estonia, where the main analysis showed a negative effect

[23] The results are slightly different from the main analysis, but the worst pre-treatment fit can justify this.

during the beginning of the crisis, while the MB and SCM showed a positive effect.

3. The covariates. We add tertiary education to the set of variables. The effects remain unchanged except for Estonia, as shown in Figure 7, where we observe the synthetic trends in the presence (dashed red line) and in the absence (dashed blue line) of the education variable.

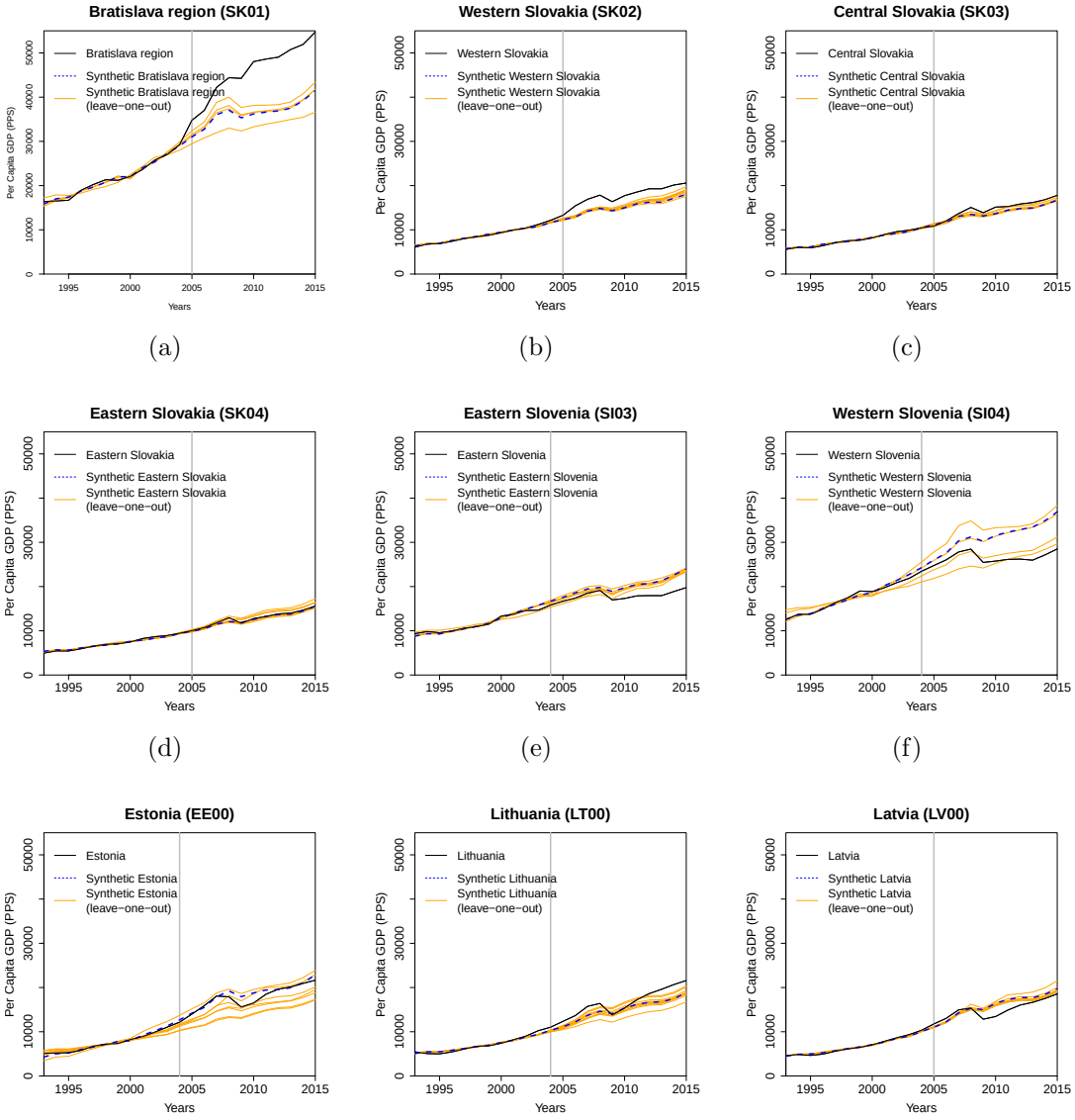


Figure 6: Leave-one-out procedure (NUTS-2 level)

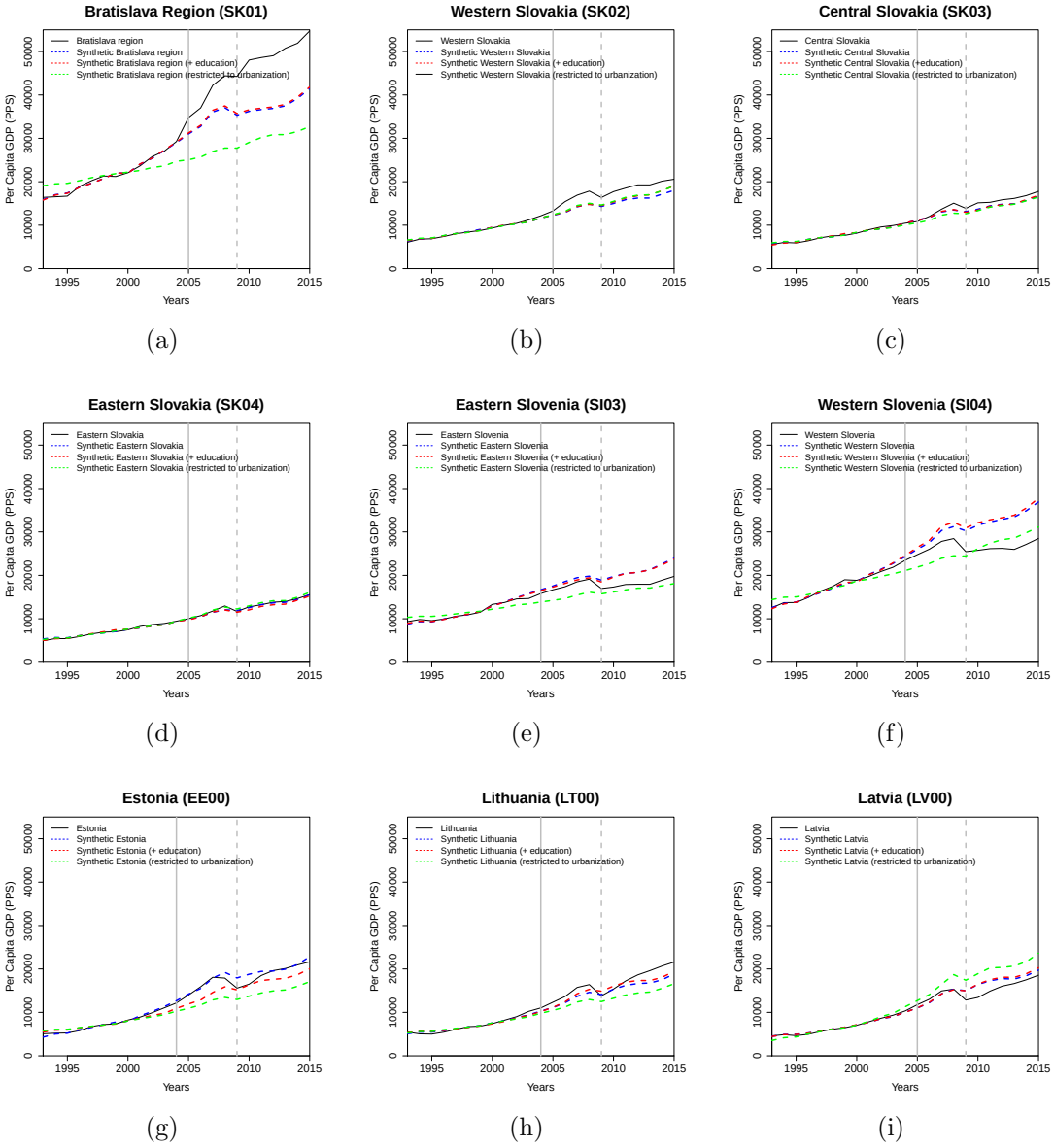


Figure 7: Robustness checks: added variable and restricted donor pool on urbanization degree

Notes: Data on education are taken from Eurostat. Eurostat issues data on tertiary education for every NUTS2 region in our dataset, except for two Slovenian regions. So, we attribute the national percentage of 15-64 people obtaining tertiary education to both regions.

7 Conclusion

With the end of the Cold War and the collapse of the communist Eastern Bloc, several eastern European countries initiated an integration process with the rest of Europe, which culminated with the EU enlargement between 2004 and 2007 to 27 Member States. Simultaneously, some eastern European countries (Slovakia, Slovenia, and the Baltic countries) also decided to join the euro area. These countries entered the ERM II immediately before the Great Recession, so they could not use monetary policy to address the crisis. In this context, the crisis undoubtedly represented a considerable shock to this integration model (Becker et al. 2010). Stiglitz (2017) argues that the shock caused by the 2007–08 financial collapse cast new doubts about the ability of the currency union to properly operate in the presence of regional economic diversities. Indeed, regions' different characteristics can determine a positive or negative effect of the euro on the economy, bringing winner and loser regions often inside the same country, and the overall net effect can be undetermined. In this case, do 'one-size-fits-all' policies represent the best possible solution? A common monetary policy could be sub-optimal, and appropriate differentiated policies could be more advantageous, particularly when a recession hits and the loss of monetary independence may prove to be costly.

In our paper, we adopt a novel counterfactual approach to estimate the economic impact of adopting the euro for the latecomers and the individual regional effects of currency union participation. Our findings show, on average, a positive effect, which is, however, dampened by the Great Recession. Moreover, individual estimates exhibit highly heterogeneous returns. Given that the real convergence that helps optimality of the currency union was not fostered automatically by the monetary union for all regions (Coudert et al. 2020), it is necessary to revive the catching-up process. 'One-size-fits-all' policies, such as national fiscal policies, can be inefficient, and specific place-based policies that consider the economic characteristics of each region should be preferred. The solution of having greater mobility in wages to adjust asymmetric shocks within a country is often not feasible, and internal migration is costly. A more promising approach would be to support regional growth via customized regional and social policies aimed at enhancing welfare in the long run (Hallet 2004).

The strengthening of place-based policies has been pursued over time by the EU, which has increasingly used the European Structural and Cohesion Funds to facilitate regional integration processes and bear the Single Market costs for lagging regions. Our work results indicate that this is the right direction: monetary integration may require long convergence times for the weaker areas, and in the meantime, increase inequalities, which must be addressed with policies geared towards the resources and skills of the lagging areas. The growing acknowledgment of the region's role as a key spatial unit is important to strengthen competitiveness that could take action when the exchange rate and monetary policies could not.

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Appendix

A Map on urbanization by region

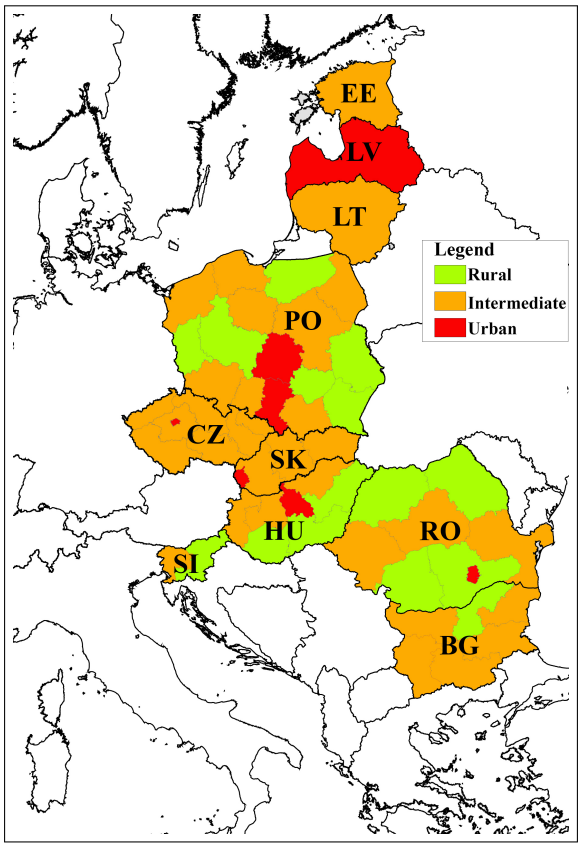


Figure A1: Level of urbanization in the Eastern Euro Area by NUTS-2 level. Source: Elaboration of data by Jonard et al. (2009b)

B Kernel balancing weights

Table B1: Kernel balancing weights

	EE00	LT00	SI03	SI04	LV00	SK01	SK02	SK03	SK04
BG31	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BG32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BG33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BG34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BG41	0.04	0.25	0.00	0.00	0.48	0.00	0.00	0.00	0.00
BG42	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CZ01	0.29	0.00	0.05	0.05	0.01	0.58	0.00	0.02	0.00
CZ02	0.00	0.00	0.05	0.05	0.00	0.00	0.01	0.00	0.00
CZ03	0.00	0.00	0.31	0.31	0.00	0.00	0.00	0.00	0.00
CZ04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.17
CZ05	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00
CZ06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CZ07	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.05	0.00
CZ08	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.20	0.00
HU10	0.10	0.01	0.21	0.21	0.00	0.12	0.00	0.00	0.02
HU21	0.00	0.14	0.10	0.10	0.00	0.00	0.00	0.00	0.00
HU22	0.00	0.03	0.28	0.28	0.00	0.16	0.00	0.00	0.00
HU23	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
HU31	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
HU32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
HU33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PL11	0.00	0.04	0.00	0.00	0.00	0.00	0.17	0.01	0.00
PL12	0.01	0.05	0.00	0.00	0.12	0.14	0.00	0.00	0.00
PL21	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.01	0.01
PL22	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.08
PL31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PL32	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.09	0.00
PL33	0.00	0.00	0.00	0.00	0.11	0.00	0.30	0.00	0.00
PL34	0.00	0.00	0.00	0.00	0.05	0.00	0.10	0.23	0.00
PL41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
PL42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.26
PL43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
PL51	0.00	0.01	0.00	0.00	0.03	0.00	0.00	0.00	0.00
PL52	0.00	0.00	0.01	0.01	0.09	0.00	0.00	0.00	0.00
PL61	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
PL62	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34
PL63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
RO11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RO12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RO21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RO22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RO31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RO32	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
RO41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RO42	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00

C RMSPE

We follow Abadie et al. (2015) and compare the ratios between the post-treatment Root Mean Squared Prediction Error (RMSPE) and the pre-treatment RMSPE, separately for each region treated. The RMSPE measures the magnitude of the gap between the treated and 'synthetic' unit. In case of significant statistical impact, we expect a large numerator, i.e., a large gap in the post-treatment, and a small denominator, i.e., an almost perfect fit in the pre-treatment, for the treated. On the contrary, we do not expect any effect on the control regions, i.e., the ratio's small value. This means that the effect is statistically significant if the treated RMSPE ratio is larger than the distribution of the ratios for the controls. Table C1 shows the RMSPE ratios and the associated p-values. The smallest p-values ($\leq$ 0.15) are observed for both Slovenian regions, the Bratislava region, and Western Slovakia.

Table C1: Post-treatment RMSPE/Pre-treatment RMSPE and p-value

	EEOO	LT00	LV00	SI03	SI04	SK01	SK02	SK03	SK04
p-value	0.80	0.46	0.30	0.43	0.15	0.15	0.13	0.48	0.95
TR	3.37	5.13	7.93	5.36	11.22	9.29	7.63	4.71	1.46
BG31	4.38	4.11	4.96	4.67	4.03	4.18	3.52	3.51	3.57
BG32	12.67	13.89	9.73	12.15	11.43	8.83	8.87	8.85	8.86
BG33	5.69	5.76	4.95	5.68	2.29	2.97	5.30	5.28	5.26
BG34	2.44	2.58	2.50	2.51	2.47	3.15	2.78	2.84	2.80
BG41	3.85	4.07	9.98	2.62	2.48	3.10	2.51	2.55	2.54
BG42	3.94	3.90	8.28	3.81	3.96	4.43	7.44	7.65	7.96
CZ01	5.10	4.18	3.87	4.38	5.45	3.70	2.98	3.30	3.30
CZ02	3.82	6.97	4.00	7.19	4.31	2.66	2.56	2.60	2.55
CZ03	12.72	3.10	2.53	3.46	2.89	2.50	1.46	2.45	2.39
CZ04	1.35	5.03	7.86	5.59	7.34	5.47	5.51	5.47	5.31
CZ05	6.88	4.30	7.15	3.96	4.51	6.73	5.00	8.12	7.74
CZ06	10.74	6.87	12.72	10.85	10.63	13.17	6.85	13.87	13.90
CZ07	9.45	8.87	8.26	9.01	9.88	8.60	8.31	8.10	8.02
CZ08	10.90	11.01	5.83	11.95	12.74	2.31	1.60	1.75	2.27
HU10	3.46	2.36	4.53	2.88	2.39	3.69	0.79	0.83	0.81
HU21	2.51	2.87	1.87	2.55	2.55	1.22	1.30	2.93	2.93
HU22	6.07	5.27	2.99	1.69	2.62	4.94	2.59	3.35	3.24
HU23	4.93	5.04	3.28	4.54	6.02	4.97	2.88	4.46	3.20
HU31	4.37	2.51	3.86	2.50	2.50	4.83	4.12	4.16	4.19
HU32	4.74	6.19	8.80	6.04	5.27	6.38	7.36	6.04	5.96
HU33	2.20	2.16	2.25	2.22	2.22	2.31	2.37	2.35	2.37
PL11	5.81	7.50	6.09	3.97	3.64	5.30	5.52	5.44	5.29
PL12	4.81	4.08	3.60	4.96	5.24	2.39	3.18	3.14	3.08
PL21	4.48	4.31	1.82	2.10	5.59	1.94	3.05	2.78	3.17
PL22	9.83	2.96	18.93	2.80	3.61	9.73	1.96	6.36	6.55
PL31	4.44	3.33	1.94	2.12	3.97	2.23	1.59	1.62	1.63
PL32	4.79	6.60	8.22	8.65	7.73	6.96	7.11	7.99	5.84
PL33	3.10	3.88	7.18	3.25	4.30	5.10	5.03	3.61	4.99
PL34	3.80	5.17	4.38	10.54	4.49	6.18	5.58	5.76	3.26
PL41	7.12	6.30	6.19	7.14	6.56	4.53	5.17	5.34	5.39
PL42	4.98	4.95	2.47	2.47	2.53	2.32	2.92	2.22	2.20
PL43	3.35	2.41	3.08	6.68	3.97	1.98	2.74	3.74	2.82
PL51	36.14	26.97	28.49	26.53	27.08	17.23	20.82	28.83	20.76
PL52	3.06	1.78	2.88	2.75	2.70	0.86	2.39	2.33	1.65
PL61	7.52	8.51	7.58	9.56	9.56	4.58	5.41	5.88	5.91
PL62	11.73	5.97	3.16	4.19	4.84	2.78	3.70	3.53	3.17
PL63	17.98	11.07	33.43	22.49	21.03	9.73	9.66	19.62	19.62
RO11	7.64	3.46	3.80	4.25	4.41	3.30	3.06	3.14	3.25
RO12	4.88	5.04	10.84	4.89	4.66	11.53	1.07	1.13	1.26
RO21	7.96	8.13	7.28	8.17	8.14	5.24	6.25	6.25	6.26
RO22	2.15	2.15	4.26	2.19	2.63	7.48	4.24	5.19	6.00
RO31	2.67	3.70	4.24	3.29	14.12	7.21	5.67	3.36	3.35
RO32	30.72	33.12	19.29	23.24	25.71	11.15	11.83	10.64	10.23
RO41	8.41	7.36	5.92	7.90	10.17	4.89	4.53	3.74	3.70
RO42	10.42	10.69	8.02	11.06	11.06	6.19	6.51	6.47	6.53

D Restricted donor pool to 2004 EU accession regions

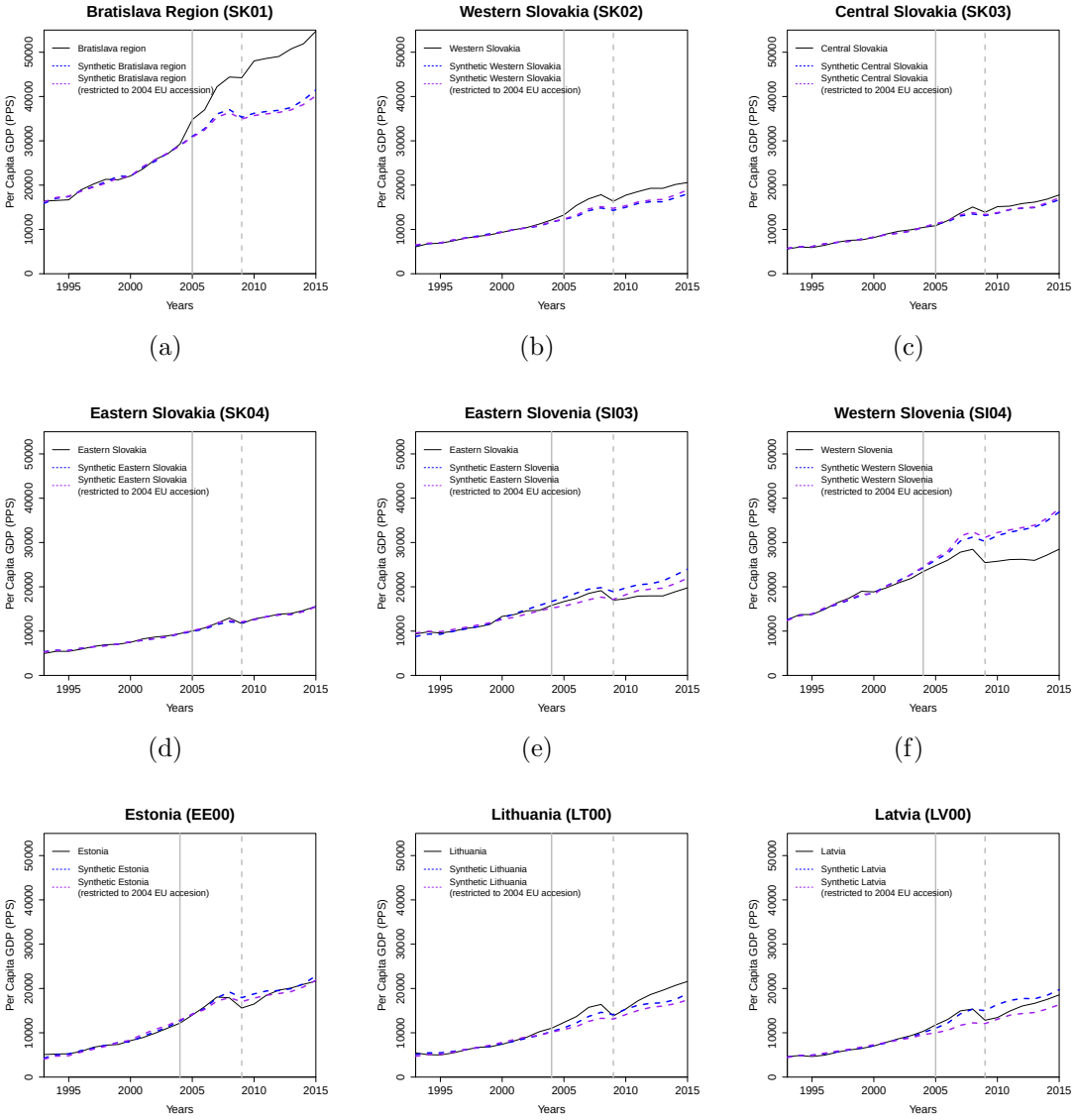


Figure D1: Robustness checks: restricted donor pool on 2004 EU accession regions

E Alternative algorithms

E.1 Synthetic Control Method

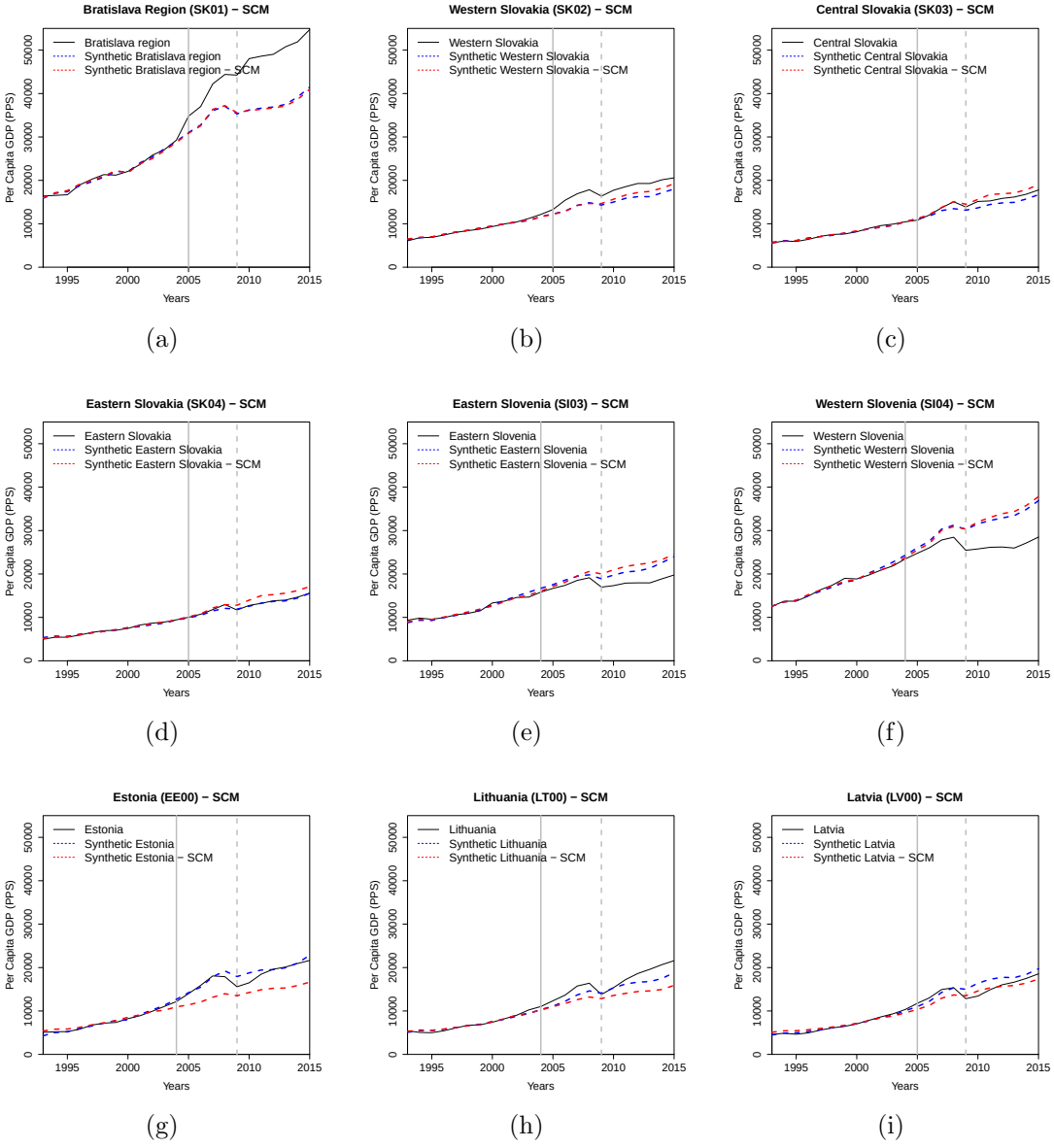
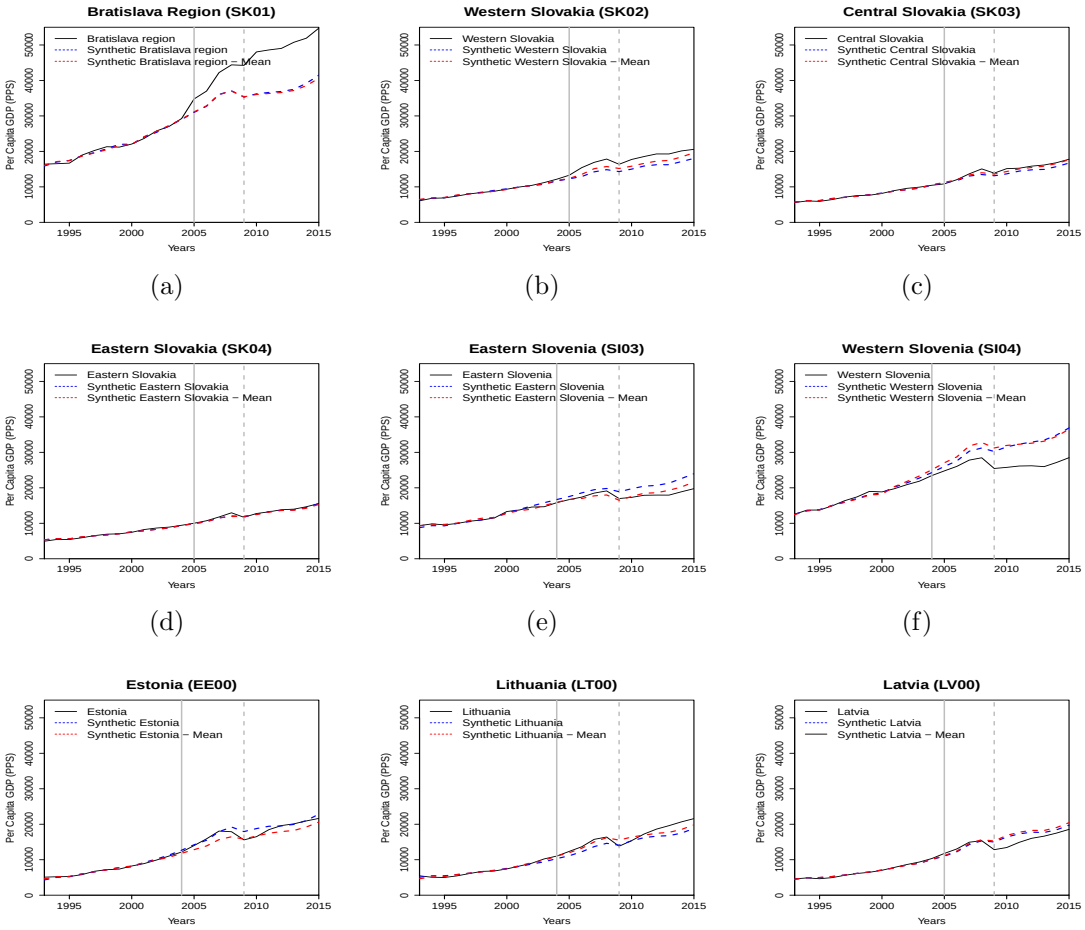


Figure E1: Synthetic Control Method

E.2 Mean Balancing



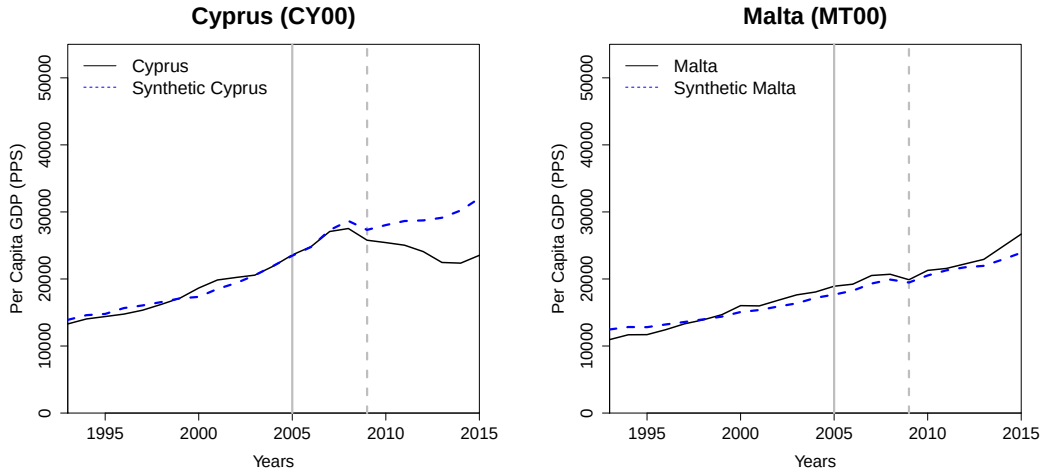
(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Figure E2: Mean Balancing

F Cyprus and Malta



(a) (b)

Figure F1: Cyprus and Malta trends' in GDP per capita (NUTS-2 level)