ESTIMATING THE BENEFITS OF EU MEMBERSHIP FOR CENTRAL AND EASTERN EUROPEAN COUNTRIES USING SYNTHETIC CONTROL METHOD

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Abstract

Benefits of the European Union membership have been receiving a lot of attention in the current political climate. With some countries still planning to join the Union and others already leaving (the United Kingdom), good quality empirical research is key to an informed political debate. Such analysis is, however, scarce (particularly for Central and Eastern European countries), mainly due to the challenges that traditional statistical methods face in providing reliable causal estimates for these questions, especially in absence of good counterfactuals. Synthetic Control Method used in this thesis attempts to overcome the issue by constructing synthetic counterfactuals for Central and Eastern European countries from the most similar economies outside of the Union. This, in turn, allows for more reliable causal estimates of the benefits of the latter. According to the results of the analysis, the Baltic States might have benefited the most from EU membership, both before and after the financial crisis. Czech Republic followed a similar path but with somewhat lower overall positive impacts, as the income convergence theory would predict. Poland also experienced some benefits but only during and after the financial crisis (mainly by avoiding it). Bulgaria and Romania, on the other hand, did not show any significant EU membership effects, and neither did Hungary. Croatia was the only country to demonstrate negative impact. These results are also supplemented by a deeper analysis of the main causes that gave rise to such differences, and policy recommendation for the future.

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1. Introduction

With the Brexit referendum and various populist parties coming to the European political scene, advantages and disadvantages of European Union membership have been widely discussed lately. While some countries, especially from the Western Balkans, still aspire to join, others have started doubting whether the expected benefits of membership have indeed materialized. Depending on what one reads or whom one listens to, the narratives can be very different. One common aspect they usually share, however, is the lack of credible empirical research to confirm their statements. Its absence does not stem from disinterest of researchers but rather from the challenges that common statistical methods face in providing credible impact estimates of such a complicated phenomenon as the European Union. Causality is one of the main concerns. With good counterfactuals rarely available to tell us what would have happened had the countries not joined the EU, it is hard to provide robust estimates of the benefits of this Union. While some attempts have been made for Old Member States, Central and Eastern European countries (CEEC) have rarely been included in those studies due to data limitations, despite the fact that they would probably benefit the most from such estimations judging from the current political climate in the region. CEEC also bear the most resemblance to the candidate countries in the Western Balkans, giving the latter a chance to learn from their respective experiences.

While this thesis does not pretend to completely solve the credibility issue as proving true causal effect of the membership would require having a perfect counterfactual rarely found in practice, the synthetic control method (SCM) used in this analysis will nevertheless bring us closer to the latter by constructing the best possible synthetic counterfactual from the combination of countries most closely resembling the analyzed ones in their pre-accession periods. It will do so for nine Central and Eastern European countries (Hungary, Poland, Czech

Republic, Lithuania, Latvia, Estonia, Bulgaria, Romania and Croatia)[1] in an attempt to close the information gap observed there. The effects will be estimated on GDP per capita levels.

A similar exercise was done by Campos et al. (2014) for a number of old and new member states but their analysis period ends in 2008 and, therefore, does not include the financial crisis which proved to be devastating for some countries and not so much for the others, bringing to light the actual progress and quality of the European integration. Martinovic (2015) extended the same analysis until 2010, thus taking into account the crisis, but only for Latvia. This thesis will, therefore, extend on both these analysis as well as provide new estimates for Bulgaria, Romania and Croatia that have not yet been subject to such research.

The thesis is organized as follows. The first chapter presents the reader with an overview of the Fifth enlargement and possible channels of EU benefits for CEEC, followed by literature review of the previous attempts to estimate the impact of the Union in Chapter 2. Chapter 3 will discuss the logic behind the synthetic control method as well as its requirements and limitations, and Chapter 4 will provide all the necessary information about the data and sample used in this analysis. Empirical results and discussion can be found in Chapter 5. Chapter 6 concludes and provides some policy recommendations.

[1] Slovakia and Slovenia were excluded from the analysis due to the difficulty of separating Euro adoption effects from EU membership as these countries adopted the single currency soon after the EU accession (Slovakia adopted it two years later than Slovenia, in 2009, but Žúdel & Melioris (2016) estimates that the anticipation effects started already in 2006 for this country).

2. Accession Road and Membership Benefits

The majority of Central and Eastern European countries began their roads towards the European Union as early as the beginning of the 1990s. Starting from Europe agreements (similar to today's Stabilisation and Association Agreements in the Western Balkans) from 1990; EU's definition of Copenhagen (accession) criteria in 1993[2]; membership applications in 1994-1996; accession negotiations from 1998 (2000 for Latvia and Lithuania) to 2003; and accession in 2004 for the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia. Bulgaria and Romania followed the same road, concluding their accession negotiations in 2004 and joining in 2007. Croatia started the process last, signing the Stabilisation and Association Agreement in 2001, applying for the membership in 2003, opening negotiations in 2005 and joining the Union in 2013 (Goetz, 2005; Lejour et al., 2008).

The Eastern enlargement was quite different from the previous ones both in size and development levels of the new members. While some worries about different priorities, strains on the EU budget and strong migration flows arose among the old member states, enthusiasm in Central and Eastern European countries was high, waiting for both political and economic benefits (Lejour et al., 2009). Expectations for the latter were especially high since, in accordance with the neoclassical growth theory, countries with lower initial capital stock are expected to grow faster than capital-rich countries (catching-up convergence) (Böwer & Turrini, 2010).

Growth benefits from EU membership had the potential to manifest through several channels. First of all, while Europe agreements had already abolished majority of the tariffs, trade was expected to further increase because of the accession to the Single Market and resulting reduction in administrative barriers; lessening of technical barriers through mutual

[2] See European Commission (2016)

recognition, harmonization of rules and minimum requirements; and lower trade risks that could further incentivize trade flows to the East (Lejour et al., 2001).

Adoption of the four freedoms should also facilitate free flow of labor, capital and goods, exposing the new economies to significant competition. Competition, in turn, can be expected to improve the efficiency of resource allocation, decrease costs and promote innovation, all leading to increased competitiveness of the economies and higher flows of foreign direct investment (FDI) which might be further motivated by larger returns on capital in CEEC (Balcerowicz, 2007; Nowak, 2007).

Another factor with potential to strongly increase FDI was the environment of more stability and security that the EU membership entailed. To qualify for EU accession new members needed to fulfill Copenhagen criteria proving that they had institutions guaranteeing democracy and the rule of law; functioning market economy able to withstand competition and market forces; and administrative and institutional capacities to implement the acquis (European Commission, 2016). After entering the Union, they were also subject to European law, its enforcement by the European Court of Justice and EU-wide economic policy coordination. All of these reasons had the potential to increase investors' confidence and promote FDI flows to the new members.

Apart from sending positive signs to investors, EU-wide economic policy coordination and all the national structural reforms required to implement both prior and after the accession aimed at creating fundamentals for strong and resilient economies able to enjoy sustainable growth in the long run.

Lastly, all new countries were expected to highly benefit from EU structural funds due to low initial income levels compared to the rest of the Union. If correctly directed towards innovation, R&D, entrepreneurship and quality of human capital, they could further increase the potential for growth in NMS (Belka, 2013).

3. Literature Review on EU Membership Effects

Most of the literature on the effects of regional integration dates back to 1990s and employs either neoclassical (Solow) or endogenous growth theories. In the former per capita long-term growth can only be driven by exogenous rate of technological change meaning that the only impact any economic policy, including integration, might have is on temporary higher growth rates leading up to a new steady state; in other words - level rather than scale effect on economic growth. Endogenous growth theory, on the other hand, envisions the possibility for integration to contribute to the long-term growth as well by producing constantly higher growth rates (scale effect) (Mann, 2015; Crespo-Cuaresma et al., 2008). There is no clear consensus in the empirical literature on the superiority of either of these two underlying theories.

First empirical papers to tackle this question were cross-country studies comparing EU members with non-EU countries of similar development in search for global growth benefits from being part of the EU. Landau (1995), who analyzed data for 1950-1990, did not find any such growth bonus after comparing EU countries to other similar OECD members. Neither did De Melo et al. (1992).

More studies using panel data then followed, allowing researchers to ask questions about the EU members themselves and if they had benefited from such membership (Crespo-Cuaresma et al., 2008). Henrekson et al. (1997) reported positive and significant effect of European economic integration on long term growth (bonus on annual GDP growth of 0.6 to 0.8 percentage points) after studying 22 OECD countries from 1975 to 1990. The author, however, did not find any difference between European Community (EC) and European Free Trade Association (EFTA) memberships, and his results were not completely robust with respect to changes in model specifications. Vanhoudt (1999), who published his study shortly after (on 23 OECD countries, for 1950-1990), was once again unable to find any long-run growth bonus associated with EU membership (contrary to Henrekson et al.).

Badinger (2005) was also interested in a similar question but was not completely satisfied with the measurements of EU integration that the previous papers used (dummy variables, length of the membership, trade shares, market expansion, etc.), so he suggested one that would account for both GATT liberalization and European integration, include all the relevant steps of integration and take into account their continuous implementation (more details in Badinger, 2005, p. 57). Using this measurement and analyzing panel data of 15 EU countries from 1950 to 2000, the author was unable to find any permanent growth effects either, but the level effect was found to be considerable – income per capita in the analyzed countries would have been one-fifth lower today in the absence of EU integration. Crespo-Cuaresma et al. (2008) also concentrated on 15 EU member states (using panel data for 1961-1998) and actually found positive and asymmetric (benefiting less developed countries more) impact of the length of EU membership on long-term economic growth. Dreyer and Schmid (2017) also confirmed the long-term growth bonus of the EU membership after analyzing EU-28 and EFTA countries from 1999 to 2013.

Apart from the last paper, all the others focused their analysis solely on the old members states (OMS) due to longer and better time series available there. However, what interests us the most from the existing literature are the few more recent papers that also include new member states (NMS) into their analysis. Mann (2015), for example, concentrated her research of EU membership effects explicitly on NMS from Central and Eastern Europe. Using Solow growth model, share of trade with the rest of the EU as a proxy for common market effects and analyzing data from 1995 to 2010, she was able to show small but significant medium-run European integration growth bonus for these countries, robust to different model specifications. These results are in line with the conclusions of Rapacki and Próchniak (2009) who produced a similar analysis (for the period of 1996-2007) and found that EU enlargement had positive effect on the growth of CEEC and their convergence to the EU-15. Böwer and Turrini (2010) confirm these findings, adding that EU membership had stronger growth effects "for those NMS with relatively low initial income levels, weak institutional quality and lower degrees of financial development. EU accession seems to have had a fast-track convergence effect particularly on the economic laggards among the NMS" (Böwer & Turrini, 2010, p.183).

All the papers discussed above provided aggregated results for the EU membership impact. Individual country effects, however, might be as (if not more) interesting for policy analysis and future decision-making. There is only a limited number of papers that attempted such analysis, e.g. Breuss (2001, 2009), Lejour et al. (2001, 2008), Campos et al. (2014) and Martinovic (2015). Contrary to previous papers that used growth regressions, Breuss (2001) ran simulations with a world macro model to analyze impacts of the fifth enlargement on the old member states and at that point still candidate countries Czech Republic, Hungary and Poland, for whom he predicted ten times higher gains that for the existing EU members. He calculated that Hungary's and Poland's real GDP would increase by 8-9% over a ten-year period (counting from 2001, even before the planned accession); for Czech Republic the number was around 5-6%. Old member states would only benefit by around 0.5% of GDP on average over six years. In 2009 Breuss produced another similar simulation for Romania and Bulgaria, predicting even twenty times higher accession benefits for these countries compared to the incumbents and average annual growth effect of 0.6%, or cumulative 9 percentage points by 2020 (Breuss, 2009).

Lejour et al. (2001) also ran a similar simulation where Hungary was leading again (similar to Breuss (2001)), with an expected enlargement benefit of 12% higher GDP per capita in the long run. CEEC average effect was estimated at 8%. Benefits for Croatia were also quantified by the same authors in 2008, predicting up to 9% higher GDP but conditional on significant institutional improvement (Lejour et al., 2008).

Contrary to these four papers that mostly engaged in ex-ante analysis and predictions, Campos et al. (2014) produced ex-post estimations of the individual EU membership effects on its members. Authors of this paper were quite concerned with causality issues not being addressed properly by the existing methods and papers on the impact of the union and thus proposed to use a relatively new approach to alleviate this problem - employ the synthetic control method (SCM) to construct a reliable counterfactual that would allow them to infer causality with more certainty. This method was first introduced by Abadie and Gardeazabal (2003) and will be used in this paper as well (please refer to the methodological part for a full description). Its basic idea is letting an algorithm construct a synthetic counterfactual that best resembles the treated unit before the intervention. That means relying on a combination of various unaffected units rather than any of them in particular (the latter was seen as a major drawback of comparative studies by the authors of the model (Abadie et al., 2015)). To produce this analysis Campos et al. (2014) use 30 non-EU countries[3] that serve as a donor pool for the construction of synthetic counterfactuals that best mimic the economic development of EU entrants[4] before their respective EU accessions. Using these synthetic economies authors then derive EU membership effects on GDP per capita and labor productivity for countries in question, concluding that there is strong evidence of positive overall pay-offs from such membership, even despite considerable heterogeneity across countries. Results show that only Greece might have had been better off not joining the EU, but the rest benefited by 12% higher per capita incomes, on average.

Another paper that uses SCM to assess EU membership effect for an individual country (Latvia) is written by Martinovic (2015). He expands the analysis performed by Campos et al.

[3]Argentina, Australia, Belarus, Brazil, Canada, Chile, China, Hong Kong, Colombia, Croatia, Egypt, Indonesia, Iceland, Israel, Japan, Korea, Morocco, Mexico, Macedonia, Malaysia, New Zealand, Philippines, Russia, Singapore, Switzerland, Thailand, Tunisia, Turkey, Ukraine, and Uruguay.

[4] Countries that joined in 1973, 1980s, 1995 and 2004. 2007 enlargement is not used due to its short post-intervention period. Malta and Cyprus are not included due to their small size and resulting difficulty to construct a reliable counterfactual.

(2014) for this country using a longer time frame that now also includes the financial crisis. This is the main reason for getting different results compared to Campos et al. (2014), in author's opinion. While the former only analyzed pre-crisis period and found very strong EU membership effects for Latvia, the later discovered a big change in direction around the financial crisis, claiming that Latvia would have performed much better during and after that period had it not been a member of the European Union. To perform this analysis, he used a smaller donor pool of 18 countries[5], mainly comprised of European countries that are non-EU members, accompanied by other former states of the Soviet Union. The period of analysis was from 1992 to 2010.

This thesis is going to use the same methodology as the last two papers, both expanding on their analysis and providing new estimates for Bulgaria, Romania and Croatia that have not yet been subject to such studies. The next chapter will present the synthetic control method in more details, discussing the logic behind it, requirements and inference possibilities.

[5] European non-EU countries (Albania, Belarus, Iceland, Macedonia, Moldova, Norway, Russia, Switzerland, Ukraine) and the remaining former states of the Soviet Union (Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan).

4. Methodology

This thesis will use the synthetic control method to estimate the causal effects of EU membership on Central and Eastern European Countries. This method allows the researcher to construct a synthetic counterfactual for countries of interest as a weighted average of control economies that best mimic the economic development of the analyzed countries before their EU accessions. Resulting synthetic economies are then compared to the performance of the actual countries in question (after the interventions) to estimate the effect of the membership.

As already mentioned before, this method was first introduced by Abadie and Gardeazabal (2003) in their famous paper about the economic consequences of terrorist activity in the Basque Country (Spain). The authors then expanded the application of this method to estimations of the impact of California's Tobacco Control Program on tobacco consumption (Abadie et al., 2010) and German reunification impact on West Germany's economy (Abadie et al., 2015). Often cited Billmeier and Nannicini (2013) also used synthetic control to investigate the effects of economic liberalization on incomes.

4.1 Description of the model

Suppose we have J + 1 countries. Only the first one is exposed to the intervention (EU membership); remaining J countries comprise the pool of potential controls, or donor pool. T_0 is the number of pre-intervention periods ($1 \leq T_0 < T$). Y_{it} will indicate the observed value of the outcome of interest for country $i = 1, \ldots, J+1$, at time $t = 1, \ldots, T$. Specifically, Y_{it}^N is the outcome that would be observed for country i at time t without the intervention; and Y_{it}^I - the outcome that would be observed for country i at time t if exposed to the intervention in periods from $T_0 + 1$ to T. The effect of intervention for country i at time t is, thus, $\alpha_{it} = Y_{it}^I - Y_{it}^N$. Y_{it}^I is observed, so only Y_{it}^N needs to be estimated. This is exactly the goal of the synthetic control method – to construct a control group that would provide a reasonable estimate for this missing potential outcome (Abadie et al., 2010, 2011).

Let's assume that Y_{it}^N is given by a factor model $Y_{it}^N = \delta_t + \theta_t Z_i + \lambda_t \mu_i + \varepsilon_{it}$, where δ_t is unknown common factor with constant factor loadings across countries, Z_i is a (r ×1) vector of observed covariates unaffected by the intervention, θ_t is a (1 × r) vector of unknown parameters, λ_t is a (1×F) vector of unobserved common factors, μ_i is a (F×1) vector of unknown factor loadings, and ε_{it} represents unobserved transitory shocks with mean zero for all *i* (Abadie et al., 2010).

Abadie et al. (2010) show that if one chooses a vector of weights W*= $(w_2^*, \ldots, w_{J+1}^*)$' (where weights are nonnegative and their sum equals to one)[6] so that

$$\sum_{j=2}^{J+1} w_j^* Y_{j1} = Y_{11}, \qquad \sum_{j=2}^{J+1} w_j^* Y_{j2} = Y_{12}, \qquad \ldots,$$

$$\sum_{j=2}^{J+1} w_j^* Y_{jT_0} = Y_{1T_0}, \qquad \text{and} \qquad \sum_{j=2}^{J+1} w_j^* \mathbf{Z}_j = \mathbf{Z}_1.$$

,

then $\sum_{j=2}^{J+1} w_j^* Y_{jt}$ will more and more closely approximate Y_{1t}^N as the number of pre-intervention periods increases. This means that $\widehat{\alpha}_{1t} = Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}$ in periods T_0+1, … , T.

This equation, however, only holds if (Y_{11}, . . . , Y_{1To} , Z'_1) belongs to the convex hull of [(Y_{21}, . . . , Y_{2To} , Z'_2), . . . , (Y_{J+11},. . . , Y_{J+1To} , Z'_{J+1})]. In practice it often does not, so synthetic control region should be chosen to let the equation hold at least approximately. For cases when the values of the treated unit are far from the mentioned convex hall, it might be impossible for the equation to hold even approximately and the synthetic control method should not be used then (Abadie et al., 2010).

6 Negative weights or weights larger than one are also possible, but at the cost of extrapolating outside of support of the data for the donor pool (Abadie et al., 2015).

To find W* weights that allow the equation to hold approximately, Abadie et al. (2015) suggest picking ones that allow for the closest resemblance between characteristics of the treated unit and the ones of the synthetic control. For that lets define a (J x 1) vector of weights W where each different W corresponds to a particular weighted average of control units and, therefore, different synthetic control. We will also need a (k x 1) vector X_1 containing values of pre-treatment characteristics of the treated unit (ones that we want to resemble); and a (k x J) matrix X_0 with the same values for the countries in the donor pool. Both may also include pre-intervention values of the outcome variable to control for unobserved common factors with varying effects over time (different from traditional difference-in-differences model which restrict the effects of unobserved confounders to be constant in time in order to subsequently eliminate them by taking time differences) (Abadie et al., 2010).

The next step is to select the synthetic control W* that minimizes the distance between X_1 and X_0W $\|X_1 - X_0W\|_V = \sqrt{(X_1 - X_0W)'V(X_1 - X_0W)}$, where V is some (k x k) symmetric and positive semidefinite matrix. Introduction of V allows to assign larger weights to pre-treatment variables that have higher predictive power on the outcome. An optimal choice is the one that results in the lowest mean square error of the synthetic control estimator, or the expectation of $(Y_1 - Y_0W^*)'(Y_1 - Y_0W^*)$ (Abadie et al., 2011).

This can be achieved in various ways: V can either be chosen according to some previous knowledge about the relative importance of each predictor or by a more data-driven approach (suggested by Abadie et al. (2003, 2010)) where V that minimizes the mean square prediction error (MSPE) of the outcome variable over some set of pre-intervention periods is selected. A third option also exists for samples with large number of pre-intervention periods - to divide them into an initial training and a subsequent validation periods (more details in Abadie et al. (2010)). This option, however, is not suitable for the current analysis due to a relatively short pre-intervention period.

Summing up all the steps described above, the synthetic control algorithm estimates the missing counterfactual as a weighted average of the outcomes of potential controls from the donor pool, with weights chosen to best match the pre-intervention characteristics of the treated country. The effect of the intervention is then calculated by simply taking the difference between the post-intervention outcomes of the treated country and those of its synthetic control,

$$Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}.$$

(t – post-intervention period; t > T_0).

4.2 Requirements

There are some conditions that need to be satisfied for this model to work well. To begin with, the outcome variable should not be highly volatile as the intervention effect might be hard to distinguish then.[7] When it comes to the construction of the donor pool itself, first of all, other countries exposed to similar interventions have to be discarded. Then the ones that experienced large idiosyncratic shocks to the outcome of interest in the studied period should also be left out if such shocks would have not affected the treated country in the absence of the intervention. Finally, it is important for the donor pool to be comprised of countries with characteristics similar to the treated unit in order to avoid interpolation biases (an event when synthetic control seems like a good match because large discrepancies between its characteristics and the ones of the treated unit are averaged away) (Abadie, 2012). Including only similar countries into the donor pool will also help to avoid overfitting which "arises when the characteristics of the unit affected by the intervention or event of interest are artificially matched by combining idiosyncratic variations in a large sample of unaffected units" (Abadie et al., 2015, p.500).

[7] The volatility is not a problem, however, if it is generated by the common factors affecting both the donor pool and the treated unit. The key is to choose a synthetic control comprised of countries that resemble the treated one in factors determining the outcome variable.

There should also be no anticipation effects, that is no impact of interventions prior to their implementation (otherwise it is better to backdate the intervention date (Abadie et al., 2010). Interference between units, or spill-over effects, ought to be avoided as well. Their presence will not completely invalidate the results but might bias them upwards or downwards depending on the nature of the intervention. Convex hall condition (explained in the description of the model) should also hold, meaning that characteristics of the treated country need to fall in the convex set of characteristics of the donor pool. It is not crucial, however, if some of the characteristics cannot be perfectly approximated as long as the synthetic control tracks the trajectory of the pre-treatment outcome variable well enough. A significant problem only arises if the outcome variable itself cannot be matched as then hardly any weighted average of the donor pool countries can reproduce its trajectory well. A potential solution in those cases is to use the growth rates of the outcome variable instead of levels. Finally, longer pre-intervention period will always increase the credibility of the synthetic control estimate by reducing the possible overfitting bias (Abadie, 2012). Concluding, only when (most of) these conditions are satisfied can the synthetic control method provide us with a good counterfactual and a resulting reliable causal estimate of the treatment effect.

4.3 Inference

Statistical inference is one of the main challenges of the synthetic control method and comparative studies in general. Due to small-sample nature of the data, lack of randomization and other similar characteristics, traditional tools of statistical inference are hard to implement in these cases (Abadie et al., 2015). Standard errors that are often used in regression-based comparative case studies are one way to overcome the problem. They are, however, more suitable for individual (micro) data analysis as they test uncertainty about aggregate data. When aggregate data itself is used (as in most SCM cases and in this thesis), we are not worried about its representativeness anymore but rather about the control group’s ability to closely reproduce the unobserved counterfactual of the treated unit – the outcome that would have occurred had the latter not received the treatment (Abadie et al., 2010).

In order to address this issue, authors of the synthetic control method suggest several new ways of inference for comparative studies (applicable for both individual and aggregate data). The main ones consist in running in-time and in-space placebos. In-time placebo means applying different dates of the intervention and looking at the resulting impact estimates. If false dates also produce large effects, this could seriously undermine the credibility of the original estimate. This test is more feasible with longer pre-intervention periods. In-space placebo does not have such restrictions and consists in applying the treatment to all the donor pool units instead of choosing different intervention dates. Credibility of the original result is high if no other unit shows similar or larger effects. Even p-values can be estimated here to express the probability of obtaining similar or larger effect when randomly reassigning the intervention in the data set[8] (Abadie et al., 2015). Obtaining a statistically significant p-value, however, requires a somewhat larger donor pool which is not always feasible in these studies.

Smaller pools (as well as shorter pre-intervention periods) also entail risks of high sensitivity of the results to minor changes in the model specification. So-called Leave-One-Out tests are one good way to check if the results are not excessively driven by any particular country (by leaving out one by one those countries that received significant weight in the synthetic control). Other tests can also include adding further predictor variables to the model or building synthetic control on similar data from different sources. This thesis is going to use all of the above-mentioned tests apart from in-time placebos due to short pre-intervention period of analysis.

[88] This can be achieved by estimating in-space placebos for all units in the donor pool and calculating the fraction of the effects equal to or larger than the one of the treated unit.

5. Data and Sample

In this study I will estimate the effects of EU membership on nine new member states (NMS) from Central and Eastern Europe: Hungary, Poland, Czech Republic, Lithuania, Latvia, Estonia, Bulgaria, Romania and Croatia. [9]

Following synthetic control method (SCM) literature on similar topics (Abadie et al., 2015; Campos et al., 2014; Martinovic, 2015; etc.), real GDP per capita is chosen as the outcome variable. The measure is Purchasing Power Parity (PPP)-adjusted and measured in constant 2011 international dollars.[10] Pre-intervention characteristics also reflect the standard set of economic growth predictors used in these papers: investment rate, industry value added, openness of the economy, inflation rate, government consumption, household consumption, tertiary school enrollment and age dependency ratio (please see Table 2 in the Appendix A for full description and sources). All variables are averaged for the pre-treatment period in accordance with synthetic control methodology;[11] outcome variable average for the same period is also added to control for unobserved common factors. All the data is extracted from IMF, World Bank (WB) and PENN World Tables databases.[12]

The analysis will be based on annual country-level panel data with a maximum length of 1990–2017 (sometimes shorter depending on the source of the outcome variable as WB data ends in 2016 while IMF - in 2017; and the exact country of analysis (Estonia, for example, only has its GDP per capita time series starting from 1993, Lithuania -1995, etc.).[13] Such short time series result from the nature of the analyzed countries (Soviet past, newly established

[9] Slovakia and Slovenia were excluded from the analysis due to the difficulty of separating Euro adoption effects from EU membership as these countries adopted the single currency soon after the EU accession (Slovakia adopted it two years later than Slovenia, in 2009, but Žúdel & Melioris (2016) estimates that the anticipation effects started already in 2006 for this country).
[10] Two possible sources: IMF and World Bank databases. GDP per capita from PENN World Table will also be used but only for robustness tests due to short post-treatment availability (ends in 2014).
[11] Expect for inflation which is averaged for the period from 1996 to intervention year to exclude the hyperinflation periods some of the countries faced in the beginning of the 1990s.
[12] World Economic Outlook Database 2018 (IMF), World Development Indicators (World Bank), PENN World Table 9.0
[13] Refer to Table 3 in Appendix A for data availability details.

democracies) where pre-1990s data is either unreliable or does not exist at all. Selecting one year before the respective accessions as the intervention year[14], this leaves us with 8 to 13 pre-intervention and 14-15 post-intervention years[15] for 2004 accession countries; 16 pre-intervention and 11-12 post-intervention years for 2007 accession countries Romania and Bulgaria; and 20 pre-intervention and 5-6 post-intervention years for 2013 accession country Croatia. [16]

While the relatively short Croatian experience in the EU might not yet be enough to see the full effect of the membership, the other countries have already accumulated somewhat longer time series being part of the EU, allowing for the synthetic control method to produce more reliable results. While this still might not be ideal, the length of the post-intervention period is actually not the main concern in this analysis. Authors of the synthetic control method themselves have stated that a decade long period is enough to see the full consequences of German reunification (Abadie et al., 2015). EU membership is, of course, a different economic event but, nevertheless, bears some resemblance to the former. As for the other two existing papers that also employ this method for EU integration impact analysis, Campos et al. (2014) uses only five post-treatment years for Eastern enlargement countries (eleven if accounting for anticipation effects) and Martinovic (2015) – eight years for Latvia.

The larger concern here is the length of the pre-intervention period. It is quite short compared to other papers that used the same method and mostly analyzed old member states where longer time series are available. This is one of the main reasons why NMS are not a popular subject of similar analyses even though it would arguably be much more useful in the current political situation and future enlargements. In my view, however, because the length of

[14] In order to account for anticipation effects as these decisions are usually known to the economic agents before the actual signing. Intervention year could be set even earlier as in Campos et al. (2014) but this would further decrease the already short pre-treatment period.
[15] Depending on whether IMF or World bank data on outcome variable is used.
[16] Somewhat later starts might also occur due to the optimization problems (inability to match well due to strong volatility in the outcome variable of the treated unit in the beginning of its time series in the early 1990s).

the pre-EU accession period (contrary to post-accession) cannot be extended with the passage of time and probably neither with a better availability of pre-1990s data, there is no point of postponing this analysis solely on the grounds of short pre-intervention time span. The attention should rather be focused on searching for ways to mitigate the problem.

Limited pre-treatment period is usually seen problematic because of possible overfitting (situation where the match is constructed by combining idiosyncratic variations in a large sample of unaffected units). While such match might reproduce the trajectory of the outcome variable of the treated unit very well in the pre-intervention period, same might not hold afterwards (Abadie, 2012). One way to decrease the threat of overfitting is by running various robustness tests on the results (this study will employ a number of them). Another way is by restricting the donor pool only to units with characteristics similar to the treated unit (Abadie et al., 2015). This is why my original donor pool will consist only of countries with relatively similar recent history and background to that of the Central and Eastern Europe. Complying with other SCM requirements for the donor pool as well (not adding any countries exposed to the same intervention or its spillover effects), I end up with a pool of 12 potential donor countries: Albania, Armenia, Belarus, Bosnia and Herzegovina, Georgia, Macedonia, Moldova, Montenegro, Russia, Serbia, Ukraine and Turkey. Other European countries that are not part of the EU, namely Iceland, Switzerland and Norway, were excluded from the original sample due to substantial differences in income per capita and possible EU spillovers either through European Free Trade Association (EFTA) for Switzerland or European Economic Area (EEA) for Iceland and Norway.[17]

[17] This donor pool is somewhat more narrow than one used by Martinovic (2015) because of the exclusion of Iceland, Switzerland, Norway and five former Soviet Union states (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) that are believed to either be too different or might have been exposed to different shocks than the countries of our analysis (both violating SCM requirements). It is also much smaller than the one used by Campos et al. (2014) which, in addition to EU neighboring countries, also included OECD, Mediterranean and newly industrialized economies.

This restriction, however, might be relaxed if the convex hall condition is not satisfied (characteristics of the treated unit do not fall in the convex set of characteristics of the donor pool). As explained before, this is especially problematic if the outcome variable itself is the outlier. In current analysis this is the case for Hungary and Czech Republic which were already richer than the donor pool (in terms of GDP per capita) in the pre-accession period. Estonia and Croatia were also on the border of the convex hall (see Tables 4-7 in Appendix A for convex hall details). Two possible solutions are available in this case: either use growth rates of GDP per capita instead of levels or expand the donor pool (Abadie, 2012). Both are going to be employed in this analysis and the best one (based on the length of pre-treatment period and the goodness of fit in terms of MSPE) chosen for each case. Three countries that were previously left out can serve as additional donor countries for the second method. Here the priority of first inclusion is given to Iceland because of closer per capita income levels to CEEC than the other two and possibly less EU spillovers than in case of Switzerland which is surrounded by EU members (compared to the island economy of Iceland).[18] Norway is seen as the least suitable candidate because of its natural resource-based economy (also discarded by Campos et al. (2014)).

Next chapter will present the detailed analysis and results for each of the nine countries. Every case will first describe the construction of the synthetic control and country-specific limitations, followed by the estimation of EU membership impact and finally robustness tests to ensure the credibility of the estimate. Implications of all these results and policy recommendation will follow in the subsequent chapters.

[18] Even though theoretically Switzerland should be less tied to the EU as it is only EFTA member compared to EEA membership of Iceland, its strong bilateral relationship with EU (that closely resembles EEA benefits) puts this assumption into question.

6. Results

6.1 Lithuania

Lithuania's GDP per capita time series only start from 1995. While, unfortunately, this decreases the length of possible analysis, it nevertheless allows me to include most of the potential donor countries into the pool (as some of them also have missing data problems in the beginning of the 1990s). Using World Bank outcome variable data for 1995-2016, the algorithm constructs a synthetic control that follows actual Lithuania's GDP per capita path reasonably well before the EU accession, but diverges quite significantly afterwards, pointing to a substantial effect of the intervention. Figure 1 below illustrates this situation: continuous line represents Lithuania's actual per capita GDP and the dashed one – that of the estimated synthetic counterfactual. Vertical line marks the intervention year.

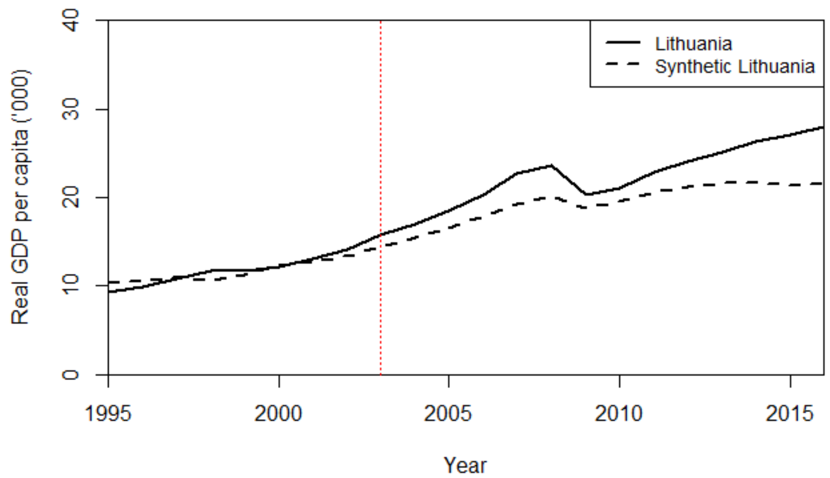

Figure 1 Trends in per Capita GDP: Lithuania versus Synthetic Lithuania

Out of the 11 countries in the donor pool (only Montenegro is not added as its GDP per capita data starts from 1997) three countries received significant weights in the synthetic control: Russia - 0.66, Bosnia and Herzegovina - 0.22 and Turkey - 0.11 (Table 8 in Appendix

B). Synthetic control matches Lithuania relatively well in terms of almost all predictor variables except for trade and government consumption to a lesser extent (Appendix B).

Comparison with the synthetic control evidences strong impact from EU membership on Lithuania's income per capita. Lithuania outperforms its counterfactual throughout the entire period of EU membership, even despite a strong fall during the financial crisis. The gap becomes even wider in the recent years.[19] Expressing the result in dollar terms, Lithuania's per capita GDP would on average have been about 3,000 USD lower each year, or approximately 20% of the 2003 baseline level, had it not joined the EU. These results are broadly in line with those of Campos et al. (2014) who also estimated very high EU accession impacts for Lithuania, indeed second highest among all 17 analyzed members in their first ten years of accession.[20]

In order to evaluate the credibility of these results, series of robustness test will be performed, including:

- recalculating the synthetic control with outcome variable data from other sources (which can both add extra years and slightly differ in the same ones);
- including Croatia into the donor pool (and restricting the analysis to 2012, before Croatia joined the EU) as it has very similar pretreatment characteristics to Lithuania (and other countries of this analysis);
- performing the Leave-One-Out exercises;
- running in-space placebo tests.[21]

[19] The difference from 2015 might also be associated with some effects of Euro adoption.
[20] Campos et al. (2014) estimated that the percentage difference in post-treatment average GDP per capita between actual and synthetic Lithuania is 28% while my estimate is smaller, around 16%, when recalculated according to the technique used in that paper. The divergence might be the result of different analysis periods: our post-intervention period stems from 2003 to 2016, while theirs – from 1998 (accounting for anticipation effects) to 2008. Their donor pool is also much wider and pre-intervention period is shorter.
[21] Running in-time placebos is infeasible in this case due to short pre-treatment period.

Results for the first test can be found in Appendix C. Synthetic control built with outcome variable data from IMF provides exactly the same result (analysis for 1995-2017) and the one with PENN data (which starts from 1990 and ends in 2014) also collaborates the story showing even stronger overall EU impact due to high anticipation effects (pre-treatment fit, however, is not as good as before).

Second test that includes Croatia into the donor pool (Appendix D) also confirms my conclusion. When added to the mix, Croatia gets a significant weight in the new synthetic control (0.534) which makes the overall fit (measured in pre-intervention RMSPE) between actual and synthetic Lithuania even better than before. This brings more certainty to the estimate of intervention effect which is very similar to the original one in this case – on average 3,200 USD higher GDP per capita each year (now for 2003-2012).

Results of the next test, Leave-One-Out exercise, can be found in Appendix E. They show that excluding either Turkey or Bosnia and Herzegovina barely changes the results while leaving Russia out (which had the main weight in the synthetic control) brings some differences, but the gap between the two series only widens, pointing to a possibly even bigger EU membership effect than estimated.

Lastly, I run in-space placebo tests assigning the treatment to countries in the donor pool. As they were not actually exposed to the treatment, ideally their placebo effects will be smaller than the estimates for Lithuania. Abadie et al., (2015) suggest estimating and ranking these effects using a ratio of post-intervention to pre-intervention root mean squared prediction errors (RMSPE). These errors measure the gap in the outcome variable between the treated country and its synthetic control. Using the ratio of post- to pre-intervention RMSPE is seen as more informative than just post- intervention RMSPE because it also takes into account the pre-intervention fit between the treated unit and the synthetic control. If the latter is not good, even a large post-treatment effect (expressed in post-intervention RMSPE) will not be credible.

In Appendix F we can see that unfortunately Lithuania's estimated effect comes only fourth after Belarus[22], Macedonia and Ukraine. It is still higher than that of eight countries in the donor pool but prevent us from claiming completely robust results. After taking a closer examination, it appears that the results for a number of control countries were driven more by better pre-intervention fits that stronger post-intervention effects. When Lithuania's original synthetic control is changed for the one that includes Croatia and produces a much better pre-intervention fit as described in the robustness test above (and the placebo test is adjusted accordingly so that Croatia is now included into the donor pool of each country that receives a the test and the analysis is restricted until 2012), the problem seems to be somewhat mitigated and Lithuania actually comes second after Belarus, this way strengthening the robustness of the results until 2012 even though still not fully proving it.

Overall, SCM analysis found strong and persistent EU membership effects for Lithuania, robust to most of the tests performed (especially for the benefits accumulated up to 2012).

6.2 Latvia

Analysis for Latvia resembles very closely the one done for Lithuania. Same source outcome variable is used (World Bank), equal time period (1995-2016)[23] and same eleven countries in the donor pool as well. The synthetic counterfactual based on Russia (0.588), Belarus (0.216) and Bosnia and Herzegovina (0.196) resembles the actual Latvia quite well in terms of all predictor variables (Appendix B) and follows it quite closely during the pre-accession period (see Figure 2). The divergence starts around the intervention year. Actual

[22] While Belarus actually shows lower intervention effects (post-treatment RMSPE) than Lithuania, because of a much better fit between synthetic control and actual Belarus (very low pre-treatment RMSPE, 0.14 versus 0.6 in Lithuanian case), the ratio of the two results in a very high number.

[23] GPD per capita data for Latvia starts from 1992 in IMF database. Unfortunately, no good match could be found optimizing for any period prior to 1995. As same time series start from 1995 in World Bank database and give the possibility to include more control variables because of better data availability there, the decision was made to use WB database instead of IMF.

Latvia performs much better than its counterfactual in the years leading up to the financial crisis, falls but stays on the same level as the counterfactual during the turbulent years and then outperforms it again starting from 2012. The situation is quite similar to Lithuania's case, although with a somewhat lower overall impact of the membership. In dollar terms it is 1,550 USD higher average GDP per capita each year (or 11% of the 2003 baseline level) that can be attributed to the EU membership.[24]

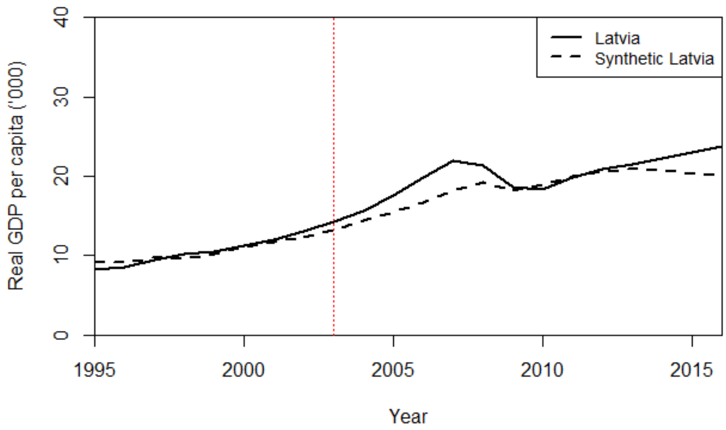

Figure 2 Trends in per Capita GDP: Latvia versus Synthetic Latvia

Although significantly smaller, this result goes in the same direction as the one produced by Campos et al. (2014)[25] who actually claimed that Latvia benefited the most from the EU membership out of all 17 analyzed members in their first ten years of accession. As for the results shown by Martinovic (2015), they coincide with mine up until the financial crisis but then diverge as his actual Latvia falls significantly below the counterfactual while mine does not. The period of his analysis ends shortly after, in 2010, so no further comparison is possible.

[24] The difference from 2014 might also be associated with some effects of the Euro adoption.
[25] 32% difference in post-treatment average GDP per capita between actual and synthetic Latvia compared to my 8.5% when recalculated according to the technique used in that paper. As mentioned before, such difference might stem from different periods of analysis and donor pools.

In order to evaluate the credibility of these results the same robustness tests will be performed as in the case of Lithuania. Recalculated synthetic controls with outcome variable from different sources can be found in Appendix C. Synthetic control built with IMF outcome variable data tells us almost exactly the same story as the original one (analysis for 1995-2017). The one with PENN data (for 1990-2014) also confirms the pattern of the results even though with noticeably lower pre-intervention fit (possibly due to strong anticipation effects).

The test of including Croatia into the donor pool also works in favor of the original results. Even though Croatia gets a significant weight (0.338) in the new synthetic control which also displays somewhat better fit with the actual Latvia than the original one, results seem to be quite robust to this change and the overall patterns (until 2012) remain relatively similar. Some difference is only observed in the period before the financial crisis where EU membership impact is even larger than previously estimated (Appendix D).

Results of the Leave-One-Out tests can be found in Appendix E. It is visible that excluding either Belarus or Bosnia and Herzegovina does not cause any change, while leaving out Russia has an effect, but it only further increases EU membership effect.

Lastly, Latvia did not perform as good as Lithuania in the placebo tests, even after including Croatia into the donor pool. It comes seventh out of twelve in the original ranking (see Appendix F), both due to lower than Lithuania's impact estimate and not a perfect pre-treatment fit. When the pre-treatment fit between actual and synthetic Latvia is slightly improved by adding Croatia to the mix (and limiting the analysis to 2012), Latvia moves up to the third place, now only staying behind Belarus and Macedonia. While considered as a significant improvement, it still does not allow us to claim completely robust results in relation to this test.

Overall, while somewhat lower than in the case of Lithuania, EU's impact on Latvia nevertheless seems to be significant and long-lasting as well. Confirmed by most of the robustness tests apart from placebo studies, the results look relatively strong. They are in line with the analysis produced by Campos et al. (2014) for Latvia but contradict Martinovic (2015) in his statement that the country would have been better off outside the EU during the financial crisis. My results show that it would not have been much better or worse off during those years but has been benefiting significantly throughout the rest of its membership period.

6.3 Estonia

Due to Estonia's higher average pre-accession income per capita compared to both Lithuania and Latvia, it is very hard to construct a good synthetic control out of the existing donor pool where only Russia has comparable pre-treatment income levels. The latter alone is not enough for a good match either as it differs from Estonia both on some other predictor variables and the path of its GDP per capita development. As Estonia finds itself on the border of the convex hall (almost outside of the characteristics of the donor pool; see Appendix A), we try to remedy this first by using the growth rate of GDP per capita as the dependent variable (but are unsuccessful in obtaining a better fit) and then by extending the donor pool to include Iceland and Switzerland.[26] Iceland's addition is enough to significantly improve the pre-treatment fit between the actual and synthetic Estonia, seen in Figure 3. Synthetic control is now built from World Bank GDP per capita data for 1995-2016[27] and employs a donor pool of 12 countries (only excluding Montenegro whose outcome variable data starts in 1997). The optimal combination includes Bosnia and Herzegovina (0.4), Iceland (0.33) and Belarus (0.27). It matches Estonia very well on pre-treatment GDP per capita, investment, industry share and age dependency ratio. Matching on tertiary education as well as household and government consumption is slightly worse; and trade is the most problematic one as Estonia's trade

[26] Reasons for this decision are summarized in the "Data and Sample" part of the thesis.

[27] GPD per capita data for Estonia starts from 1993 in IMF database. Unfortunately, no good match was achieved there, even including Iceland and Switzerland, so World Bank data from 1995 is used instead.

indicator falls out of the convex hall of the entire donor pool. Such issue is not, however, crucial as long as it is not the outcome variable, and the overall matching is still good.

This seems to be our case, at least up until 2001, as synthetic Estonia follows the income path of the actual one very closely until that year (first graph of Figure 3). The divergence starts sooner than expected and signals stronger anticipation effects than already accounted for by 2003 intervention year. Backdating the accession to 2001 solves this problem[28], increasing the accession benefits even further than in the first graph. In dollar terms they now mean 4,240 USD higher average GDP per capita each year (or 25% of the 2001 baseline level). More modest estimates from the first graph (only accounting for one year of anticipation effects) are 3,110 USD or 16% of the 2003 baseline level, respectively. Both graphs show that Estonia significantly outperformed its counterfactual in the years leading up to the financial crisis, then suffered a significant fall (but not enough as to drop below the synthetic control) and shorty after started outperforming it again.

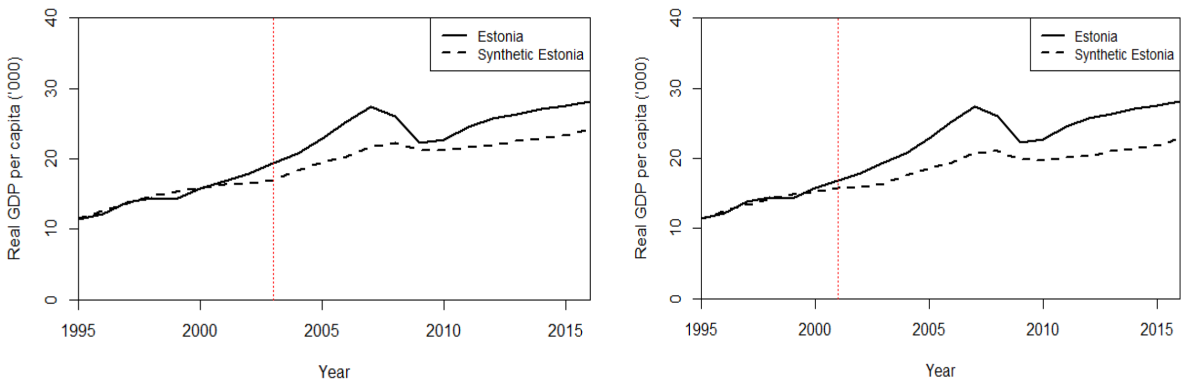

Figure 3 Trends in per Capita GDP: Estonia versus Synthetic Estonia (2003 and 2001 intervention year, respectively)

The results, especially the ones with longer anticipation effects included, strongly resemble those of Campos et al. (2014) who estimated 24% difference in post-treatment average GDP per capita between actual and synthetic Estonia. Adjusting my result to their

[28] Synthetic control is now comprised of Bosnia and Herzegovina (0.39), Iceland (0.34), Belarus (0.14) and Moldova (0.14).

estimation technique, I get 21% for the case with longer anticipation (and 15% for the more conservative one) even despite the differences in the donor pool and period of analysis between the two papers.

As the already limited pre-treatment period becomes even shorter using an earlier intervention year, robustness tests are even more important to ensure that the results are not suffering from overfitting and can indeed be trusted. To start with, recalculated synthetic control with outcome variable data from IMF for 1993-2017 confirms the results for both intervention years and the one with PENN data for 1990-2014 shows an even stronger EU accession effect for both cases. While the latter is surprising seeing as basically the same countries are used to form this counterfactual, it only tells us that the original results might be underestimated but not the other way around (Appendix C). Adding Croatia to the donor pool instead of Iceland (and restricting the analysis to 2012) also significantly helps to prove the reliability of the results (Appendix D). When added, Croatia gets a very high weight in the new synthetic control (0.953), which itself shows a relatively good fit with actual Estonia in the pre-accession period, and in post-accession years acts in line with to the pattern observed above (treatment year is 2003). In dollar terms the impact is 4,000 USD higher average GDP per capita each year (or 20% of the 2003 baseline level), even if only until 2012. This result falls in the range provided by the two previous estimates.

Leave-One-Out tests also mostly confirm the story (Appendix E). Excluding Belarus does not change the result at all while leaving out Bosnia and Herzegovina only somewhat decreases the overall impact. The biggest change is observed leaving out Iceland (lower accession impact) but the fit between the synthetic and actual Estonia is this case is very poor (which was exactly the reason to add Iceland in the first place), so these results should be interpreted with caution.

Lastly, placebo studies do not fully confirm the results (Appendix F). Estonia is either fourth in the ranking or third if we account for longer anticipation effects. When the case with Croatia in the donor pool is considered, Estonia moves up to the second place, just below the already familiar Belarus leading these tests. While this is a good result in itself, it nevertheless does not allow me to claim full robustness of the estimated EU membership effect.

Apart from checking the robustness of the results, we should also address a possible inflation of the EU effect estimate by another intervention - Euro adoption - that followed in 2011. Contrary to Latvia and Lithuania where it could only affect very short periods of analysis in the end (as it was adopted in 2014 and 2015, respectively), around five years could be possibly affected in the case of Estonia. While I am not going to engage in the full analysis of Euro effect on Estonia in this thesis (as it requires a different approach, donor pool, etc.), there is one exercise I can conduct to investigate the size of the problem and spillovers from one intervention to the other. It consists of creating a synthetic control from a donor pool of only Latvia and Lithuania (until 2014)[29] so as to see if the earlier Euro introduction in Estonia resulted in some significant GDP per capita differences between the three countries.[30] If not, there would be no reason to think that my estimate for Estonia's EU membership effect is significantly overstated because it actually follows a similar trend as the other two Baltic countries (especially Lithuania) which did not introduce the Euro that early. This method, however, only applies to the estimations until 2014, leaving the last two years of analysis subject to the potential bias. The results of the exercise are visible in Figure 4. The outcome variable is growth rate of GDP per capita instead of level as Lithuania and Latvia do not provide a sufficiently good basis for a counterfactual similar to actual Estonia in terms of income per

[29] As after 2014 Latvia would be subject to the same intervention, disqualifying it from the donor pool.

[30] Even though for a different purpose, a similar exercise was also produced by Janota (2015) who came up with the same result as I did.

capita levels.[31] Data is from the World Bank for 1996-2014 and the weights are distributed as follows: Latvia – 0.716, Lithuania - 0.284. Although the match is not always perfect, synthetic control nevertheless follows Estonia's per capita growth rate pattern quite well in the pre-euro adoption period. There is also no significant divergence in the four years after the intervention, pointing to no immediate Euro adoption effect for Estonia and allowing for more confidence in my EU impact estimate for this country until 2014.

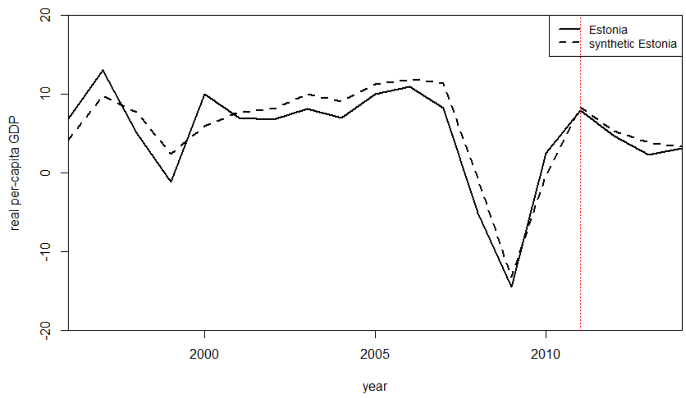

Figure 4 Estonia versus Synthetic Estonia (built from Lithuania and Latvia only)

Summarizing, the analysis of EU accession effects for Estonia using SCM brings me to similar conclusions as with the other two Baltic countries: the impact on this decision seems to be large and persistent over time. While it is slightly more challenging to prove than in the previous two cases due to Estonia's higher pre-accession income per capita and resulting difficulty to form a good counterfactual from the existing pool, addition of Iceland helps significantly. Overall, even though there is some uncertainty about the exact estimate of the accession impact (depending on the chosen intervention year), most of the different model specifications and robustness tests nevertheless confirm the overall existence of a significant effect. It is especially robust until 2011, before the euro was introduced, as the latter also has the potential to affect income per capita levels. Comparison of Estonia's GDP per capita growth

[31] These countries are, however, very similar to Estonia on a lot of other aspects, so using growth rates instead of levels does not constitute a major drawback.

rates with those of the other two Baltic countries for 2011-2014 helped to investigate this concern and brought more robustness to the estimated EU membership impact at least until 2014.

6.4 Romania

The synthetic counterfactual for Romania is constructed from Turkey (0.52), Albania (0.267), Russia (0.168) and Belarus (0.045). It resembles actual Romania very well on pre-treatment income per capita and investment, and slightly poorer on the other predictor variables. Biggest divergences are seen in terms of matching on trade and age dependency ratio (Appendix B). This would not, however, pose a significant problem as long as the overall fit is good. Outcome variable data from IMF is used and the period of analysis is 1992-2017 (2006 being the intervention year). [32] This allows for inclusion of nine countries into the donor pool leaving out Bosnia and Herzegovina, Serbia and Montenegro whose outcome variable data starts a few years later.

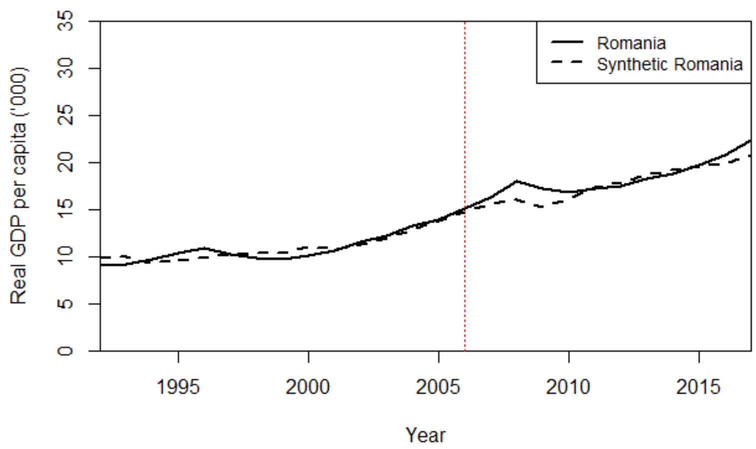

Figure 5 Trends in per Capita GDP: Romania versus Synthetic Romania

[32] IMF GDP per capita data for Romania starts in 1990 but due to most of control variables only having this information from 1992, the latter is chosen as the beginning of the period to increase the size of the donor pool

The new counterfactual is able to follow actual Romania's GDP per capita path relatively well in the pre-treatment period (Figure 5), increasing the reliability of post-accession impact estimations. These, in turn, are very modest as there is almost no divergence between the actual and synthetic Romania after the EU accession. Some difference is only visible in the first few years but is then quickly followed by convergence of the two series up until 2015. The last two years again see some modest distance between the two lines but only time will tell if it persists. Owing to the fact that this is the first time SCM is applied to estimating the EU membership impact for Romania, no comparisons can be made with respect to similar papers. These results do, however, contradict Breuss (2009) predictions of much higher impacts.

As there is no significant impact to test, some of the robustness tests will be forgone, for example placebo studies. Adding Croatia to the donor pool did not significantly improve the fit either, so the resulting synthetic control is omitted as well. Most of the remaining tests confirm the previous result: synthetic control constructed with outcome variable data from World Bank database for 1990-2016 tells exactly the same story of almost no impact (Appendix C); and Leave-One-Out tests show that the results are not sensitive to exclusion of any particular country of the four that received significant weights in the original construction (Appendix E). Only the synthetic control built on PENN outcome variable data diverges from the previous results, indeed showing a significant intervention effect (Appendix C). It gives the highest weight to Bosnia and Herzegovina which was previously not used in the cases of IMF and WB analysis due to missing outcome data in the beginning of the 1990s in these databases.[33] However, even shortening the analysis period for the latter two cases so as to include Bosnia and Herzegovina into the mix gives exactly the same results of no impact as

[33] Even though it was available in PENN dataset from 1990, these time series are not directly substitutable due to different specifications, so Bosnia and Herzegovina is only included into analysis with World Bank data from 1994 and IMF - from 1996.

before. This limits the possibilities of proving that PENN data based synthetic control was not a result of interpolation bias or overfitting and can indeed be trusted.

Overall, it seems that EU accession did not have a significant effect on Romania's income per capita levels apart from the first few years of membership. The last two years of analysis give a slight indication that it might be changing but only time will tell. As for the rest of the period, most of the robustness tests confirm the conclusion of no significant impact from the EU membership.

6.5 Bulgaria

The fit between synthetic and actual Bulgaria is even better than in the case of Romania, and the EU effect is even lower, practically non-existent (Figure 6). Synthetic control for Bulgaria is built on the same data, period and donor pool as for Romania (GDP per capita from IMF for 1992-2017; 2006 as the intervention year; nine countries in the donor pool). The optimal combination is formed by Russia (0.342), Macedonia (0.294), Belarus (0.221), Moldova (0.1) and Turkey (0.04); and resembles the actual Bulgarian economy quite well on all of the predictor variables apart from inflation (which is much higher for actual than synthetic Bulgaria but did not receive any significant weight in the synthetic control, so does not cause many problems) (Appendix B).

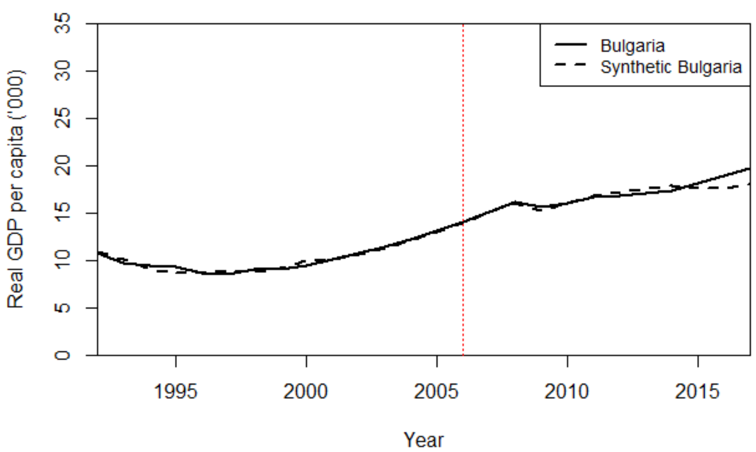

Figure 6 Trends in per Capita GDP: Bulgaria versus Synthetic Bulgaria

Looking at the intervention effect, the only divergence between the two lines throughout the entire observed period is in the last two years (similar to Romania) but otherwise they follow each other perfectly, strongly suggesting no EU membership effect at least until 2015. This is again the first time SCM is applied to estimate EU membership effect for Bulgaria, so no comparison to similar papers is possible. As for Breuss (2009), the results are again contradictory.

Same as in the case of Romania, placebo tests and addition of Croatia to the donor pool are forgone (former due to the lack of significant effect to test; latter due to lack of substantial improvement in the model fit). As for the remaining tests, synthetic counterfactual built on the outcome data from PENN database for 1990-2014 tells us exactly the same story of no EU membership effect as before; and the one with World Bank data even points to some negative impacts (Appendix C). Support for both of these conclusions can actually be found in Leave-One-Out tests: two of them (excluding Russia and Macedonia from the pool) show the same negative effects as synthetic control built on WB data; and the other two (without Belarus and Moldova) show no impact at all as in the case with PENN data (Appendix E).

With no possibility to fully prove either of the two conclusions I will limit myself to forming a bound around the true effect of EU membership for Bulgaria, saying it is either close to non-existent or even slightly negative. What we can do with more certainly is rule out any strong positive impacts of such intervention, at least until 2015.

6.6 Croatia

Croatia's case is similar to the Estonian one in the sense that no good synthetic control is possible to build from the existing donor pool because of barely satisfied convex hall condition for the outcome variable. Only Russia had similar pre-treatment income per capita levels but alone is not enough to formulate a good counterfactual. Changing the outcome variable to growth rate of GDP per capita did not help much but adding Iceland to the donor pool did. It left us with twelve countries (excluding only Montenegro). The new synthetic control is based on World Bank GDP per capita for 1995-2016 (2012 as the intervention year) and consists of Iceland (0.357), Bosnia and Herzegovina (0.225), Armenia (0.173) and Albania (0.118). It is very similar to actual Croatia in terms of all predictor variables apart from household consumption (Appendix B), and follows Croatia's GDP per capita path very well throughout the entire pre-treatment period. Right after the EU accession the two start diverging and a negative treatment effect is observed as synthetic control outperforms the actual Croatia. Expressing this in dollar terms, Croatia witnessed 1,850 USD lower average GDP per capita each year (or 9% of the 2012 baseline level) from 2012 to 2016 as a result of EU membership. As this is the first time SCM research is done for Croatia, no comparisons to other papers are possible. This result does, however, contradicts Lejour et al. (2008) prediction of relatively high impact.

As not all the previously used tests can be reproduced for Croatia (PENN data is too short to show any real impact as it only runs until 2014; and test of including Croatia into the donor pool is obviously not relevant here), only three robustness tests will be used: synthetic control based on the outcome variable data from IMF, Leave-One-Out tests and placebo studies.

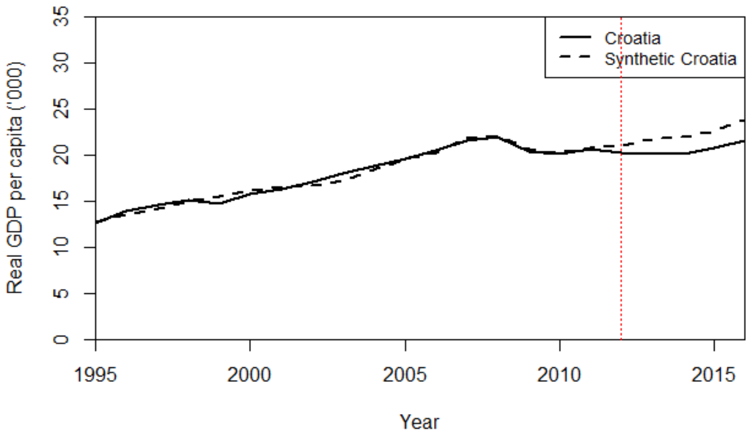

Figure 7 Trends in per Capita GDP: Croatia versus Synthetic Croatia

All of them confirm the negative membership impact. Synthetic control based on outcome variable data from IMF for 1992-2017 tells exactly the same story as before (Appendix C). Leave-One-Out tests excluding Bosnia and Herzegovina, Albania and Armenia do not change the results at all while the one for Iceland does but only further increasing the negative impact estimate. It is, however, unreliable as the pre-treatment fit is very bad (which was the reason to include Iceland into the pool in the first place) (Appendix E). Finally, placebo tests also confirm the negative result as Croatia is the first in the list of post- to pre-treatment RMSPE ratios (Appendix F).

Summing up, Croatia is the first of the six analyzed countries to show robust negative impact of the EU accession during its first five years of membership – result that is confirmed by all robustness tests performed.

6.7 Hungary

Contrary to Estonia and Croatia whose pre-accession GDP per capita levels were just on the border of the convex hall of income levels of the donor countries, Hungarian ones are actually completely outside of these boundaries and it is, therefore, not surprising that no good synthetic control was possible to construct out of the original donor pool. Adding Iceland significantly helped the situation.

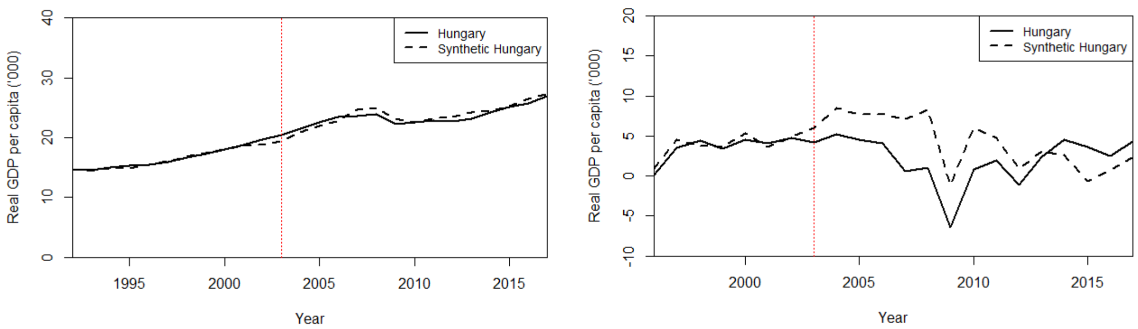

Figure 8 Trends in per Capita GDP and growth rate of per Capita GDP: Hungary versus Synthetic Hungary

Synthetic control is now built from IMF GDP per capita data for 1992-2017 and a donor pool of 10 countries (excluding Bosnia and Herzegovina, Montenegro and Serbia due to missing outcome variable data in the early 1990s). It is based on a combination of Armenia (0.476), Iceland (0.465) and Russia (0.05); and matches Hungary very well on pre-accession income per capita, investment, industry share and government consumption. Household consumption, tertiary education, inflation and age dependency ratio are matched slightly worse and trade again faces the main discrepancies (Appendix B). Yet we can see from the first graph of Figure 8 that synthetic Hungary matched the actual one in terms of GDP per capita very well in the pre-intervention period meaning that these divergences do not cause any substantial problems. The match is also good in the post-intervention period. While the former is desirable and means good fit between synthetic and actual Hungary, the latter just points to no significant effect of EU membership for the country.

This result is also confirmed by robustness tests using WB outcome variable data for 1991-2016 (Appendix C); and by Leave-One-Out test excluding Armenia from the donor pool (one excluding Iceland has very bad pre-intervention fit so cannot be trusted) (Appendix E). Like in the analysis for Romania and Bulgaria, placebo tests were not performed due to lack to impact to prove; and including Croatia into the donor pool did not improve the pre-intervention fit, leaving us with only two robustness tests described above.

In the second graph of Figure 8 another possible solution for cases when outcome variable falls out of the convex hall is employed – changing it from levels of GDP per capita to growth rates. Contrary to the previous case, the algorithm now searches for a combination of countries that would resemble well Hungary's pre-accession GDP per capita growth rate, not its level. It is, therefore, not that surprising that the new synthetic control is formed from different countries and shows different results than before. This donor pool does not include Iceland but again only concentrates on the original set of countries. Synthetic control is built on IMF outcome variable data for 1996-2017[34] and consists of Belarus (0.4), Macedonia (0.25), Moldova (0.18) and Russia (0.07). Interestingly enough, synthetic Hungary outperforms the actual one throughout most of the period of analysis, until 2013 that is, when the roles change. Quantifying this result, Hungary experienced on average 4.3 percentage points lower GDP per capita growth rate each year due to EU membership, even after taking into account the positive impact of the last several years.

Reliability of this result is checked by running the placebo test which strongly confirms the latter as Hungary leads the ranking with strong RMSPE ratio difference from the rest of the countries (Appendix F). All four Leave-One-Out tests also support the overall conclusion of significant negative effects later followed by several years of positive impact of EU membership (Appendix E), and so does the synthetic control built on the WB outcome variable data instead of IMF (Appendix C).

Summarizing, we do not find any significant EU membership effects for Hungary when looking at the income per capita levels (even after expanding the donor pool to Iceland to satisfy the convex hall condition). However, after changing the outcome variable to the growth rate of GDP per capita and using the original more conservative donor pool again, significant negative effects of EU membership on GDP growth rates are observed until 2013, followed by a change to positive ones afterwards. Results are robust to different tests performed.

They are, however contradicting the conclusion of Campos et al. (2014) who actually found some significant positive EU membership effects for Hungary, both on GDP per capita levels and growth rates, using the same methodology.[35] Both Breuss (2001) and Lejour et al. (2001), using different a method, also predicted much higher gains for Hungary.

[34] Though IMF has data on growth rate of GDP per capita since 1991, a relatively good synthetic control is only possible to build starting from 1996.

[35] As already mentioned before, these differences might come both from much larger (and less similar in terms of characteristics) donor pool that Campos et al. (2014) used and a shorter time period analyzed (especially pre-treatment as 1998 is chosen as the intervention year to account for anticipation effects). Both of these factors have

6.8 Czech Republic

Pre-accession GDP per capita of Czech Republic is even higher than that of Hungary or any other previously analyzed country (Appendix A, Tables 4 and 5). Changing outcome variable to growth rates instead of levels did not help in building a good synthetic control, and neither did adding Iceland to the donor pool. When Switzerland was included instead, it greatly improved model fit. Synthetic control is now built on IMF GDP per capita data for 1995-2017 and a donor pool of ten countries (excluding Bosnia and Herzegovina, Montenegro and Serbia due to missing outcome variable data). Russia (0.35), Moldova (0.34) and Switzerland (0.315) receive the main weights. This new counterfactual matches Czech Republic very well on pre-accession income per capita, trade and government consumption; and slightly worse on the rest, with inflation and tertiary enrollment witnessing the highest differences (Appendix B). Despite these discrepancies, pre-treatment fit between actual and synthetic Czech Republic is very good (Figure 9). Some significant divergence is then observed after the EU accession, pointing to positive effects of the membership. Actual Czech Republic outperforms the synthetic one throughout most of the period, with the difference increasing even further in the recent years. In dollar terms, country's per capita GDP would on average have been about 1,800 USD lower each year, or approximately 8% of the 2003 baseline level, had it not joined the EU.

the potential to decrease the reliability of the impact estimate, and because our analysis was attempting to mitigate both of them, it is not that surprising that we reach different conclusions in the end.

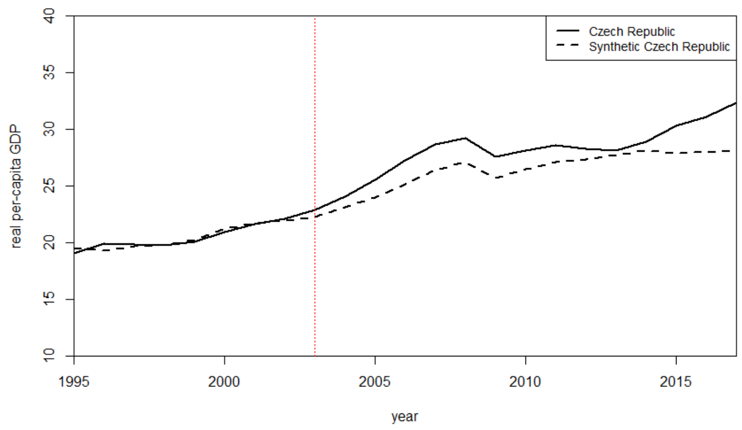

Figure 9 Trends in per Capita GDP: Czech Republic versus Synthetic Czech Republic

This result is very similar to the one proposed by Campos et al. (2014) despite all the differences in approaches discussed above;[36] and does not contradict Breuss's (2001) predictions either. Lastly, it is also in line with the income convergence theory that predicts lower gains to initially richer countries. Not surprisingly, thus, the effects are smaller than in the Baltic cases.

Results of the robustness tests are mixes for Czech Republic. As the estimate is much smaller than in previous cases of positive effects, it is harder to prove with placebo tests. Not surprisingly, thus, Czech Republic only comes fourth in the ranking, preventing us from claiming completely robust results (Appendix F). Other tests are more supportive of the result: synthetic control built on World Bank outcome variable data shows exactly the same effect and Leave-One-Out tests that exclude Russia and Moldova from the donor pool also collaborate the story. Only excluding Switzerland provides different results but the fit between synthetic and actual economy is very bad, so this conclusion is not reliable (Appendix C; E). Other tests using PENN outcome variable data or including Croatia into the donor pool provided a very bad fit so were excluded from the analysis.

[36] Campos et al. (2014) estimated that the percentage difference in post-treatment average GDP per capita between actual and synthetic Czech Republic is 5.6%. Adjusting our calculation to their estimation technique), I get 6.8% difference.

Summarizing, Czech Republic seems to have benefited from the European Union membership throughout the entire period (even after much richer Switzerland is included into the donor pool and gets a significant weight in the synthetic control). These results are more modest than in the case of the Baltic countries (in accordance with income convergence theory) but are still robust to most of the tests apart from placebo studies. The latter, however, prevents us from claiming full reliability of the estimate.

6.9 Poland

Even though Poland's pre-accession income per capita levels are within the convex hall of characteristics of the original donor pool (Appendix A, Tables A and B), still no good match was achieved within these boundaries. Changing the outcome variable to growths rates of GDP per capita did not help either, only including Iceland did. The resulting synthetic Poland is built from IMF GDP per capita data for 1995-2017[37] and ten countries in the donor pool (excluding Bosnia and Herzegovina, Montenegro and Serbia due to missing outcome variable data). Armenia (0.46) and Iceland (0.35) receive the main weights, followed by Belarus (0.1) and Georgia (0.1).

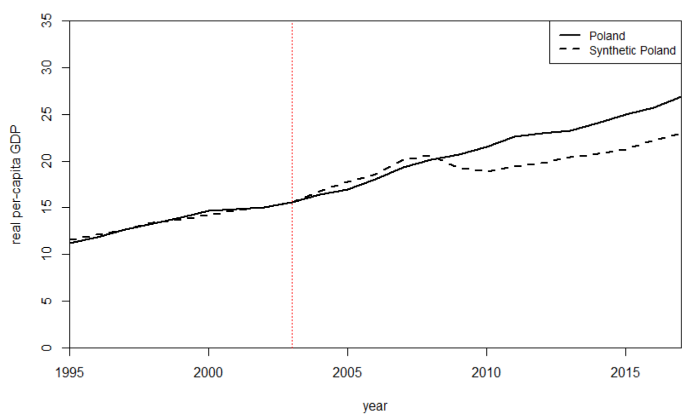

Figure 10 Trends in per Capita GDP: Poland versus Synthetic Poland

[37] Though IMF has data on Poland's GDP per capita since 1990, a good synthetic control was only possible to build starting from 1995.

Synthetic control follows GDP per capita path of the actual Poland very well during the pre-accession period and diverged only after the financial crisis (Figure 10). While this still means positive overall EU membership effects, they are not immediate. Poland does not seem to have benefited from being part of the EU in the first five years of its membership, when the global economy was booming, but the benefits might have revealed themselves later on, in more difficult times. Expressing these benefits in dollar terms, Poland has experienced 1,650 USD higher average GDP per capita each year (or 11% of the 2003 baseline level) than its synthetic counterfactual. If we only look at the average post-crisis effects, they are 2,730 USD or 18% of the baseline level, respectively.

The first result is similar to the one proposed by Campos et al. (2014).[38] What is interesting, however, is that they found most of the positive effects before the financial crisis while I encountered them only afterwards. As their analysis ends in 2008, the last period cannot be compared well. My result is also broadly in line with Breuss (2001) predictions.

Most of the robustness tests also support this result. Synthetic control built on WB outcome variable data for 1994-2016 tells the same story[39] (Appendix C). Leave-One-Out tests show that the result in not sensitive to exclusion of Armenia but changes if Iceland is left out (Appendix E). This is not surprising as the donor pool without Iceland could not produce a good synthetic control in the first place and results became more reliable only after adding the latter. Including Croatia into the original donor pool instead of Iceland (and restricting the analysis to 2012) also confirms my conclusion. In this case Croatia receives a very high weight (0.8) and the resulting analysis shows a very similar trend of significant membership effects only after the financial crisis (Appendix D). Finally, placebo tests are supportive but not fully affirmative of the result as Poland is second in the ranking after the already usual Belarus.

[38] They found 6% difference in post-treatment average GDP per capita between actual and synthetic Poland while I found 8.5%.
[39] Analysis of PENN data did not produce a good enough synthetic control for this comparison.

Overall, similar to a number of already analyzed countries, EU membership of Poland can be attributed with some significantly positive effects. Contrary to the other cases, however, they only start after the financial crisis. These results are robust to most of the tests performed.

7. Discussion and Policy Implications

This chapter presents the summary of the main findings and their implications. While the quantitate results from the previous chapter are already quite useful on their own, they are still not enough for good policy decisions if not accompanied by further examination of the causes. Therefore, an attempt is made here to position these results in a wider context of the respective economies and see if we can find logical explanations for them. If successful, broader policy conclusions can be drawn.

Table 1 Summary of the results

	Outcome variable	**Donor pool**	**Estimated EU effect**			**Comparison to Campos et al.. (2014)**
			overall	**before crisis**	**after crisis**	
Lithuania	GDP p/c	original	positive	positive	Positive	same direction
Latvia	GDP p/c	original	positive	positive	Positive	same direction
Estonia	GDP p/c	extended	positive	positive	Positive	same direction
Romania	GDP p/c	original	neutral	slightly positive	Neutral	-
Bulgaria	GDP p/c	original	neutral	neutral	Neutral	-
Croatia	GDP p/c	extended	negative	-	Negative	-
Hungary	GDP p/c	extended	neutral	neutral	Neutral	opposite direction
Hungary	g/r of GDP p/c	original	inconclusive*	negative	neg/pos*	mostly opposite dir.
Czech Republic	GDP p/c	extended	Positive	positive	Positive	same direction
Poland	GDP p/c	extended	Positive	neutral	Positive	same direction

* negative until 2013; positive afterwards

Table 1 provides the main conclusions of the study. The analysis has indicated the three Baltic countries as the main beneficiaries of the European Union membership.[40] They seem to have continuously outperformed their synthetic controls, both before and after the financial crisis. Even when the latter hit them very hard,[41] income per capita levels did not fall below those of the synthetic controls. This result does not come as a surprise as these countries are

[40] Robust to most of the tests apart from placebo studies that still give them support but not full confirmation.
[41] Lithuania's GDP contracted by 14.8%, Estonia's by 14.7% and Latvia's by 14.3% in 2009. Unemployment rose to 13.8%, 13.5% and 17.5% in the same year, respectively. Source: Eurostat.

often praised for their model European integration road and fast convergence. Starting off from a very difficult economic situation in the early 1990s but with strong will to leave the Soviet past behind and rejoin the West, they were consistent in implementing difficult but much needed reforms to modernize their economies and qualify for EU membership.

The accession in 2004 gave a good indication of their progress to investors and the three countries experienced a strong economic boom in the following years, fueled by foreign direct investment, strong net capital inflows, rapid credit growth, rising wages and increasing current account deficit. Not surprisingly, such growth was unsustainable and left the countries vulnerable to the financial crisis of 2008.[42] This event, however, was another stepping stone in the Baltic success story. Without the possibility to stimulate the economies through external adjustment,[43] they had to turn to harsh internal devaluation measures that included significant cuts to public spending, public sector salaries and pensions; higher taxes; and further liberalization of labor and product markets. This fiscal adjustment of a size hardly seen in the EU before allowed the countries to start growing again already in the next one to two years. The growth period that followed and continues today is now seen as significantly more sustainable compared to the pre-crisis period (European Commission, 2018e, 2018f, 2018g).

The Baltic story is a good case study for future EU entrants, especially those with initial income levels much lower than the EU average. EU membership can bring significant long-term benefits to such countries but only if they implement all the necessary reforms and transform their economies well. If the transformation is unfinished and reforms stagnate after accession – perhaps not even maliciously but possibly just driven by good moods in the global

[42] Fixed exchange rate is also said to have contributed to accumulation of imbalances as it prevented the appreciation of nominal exchange rate (shock observer in these situations) and instead contributed to rising inflation – the only channel able to absorb the real appreciation of the national currency (Todorov, 2013).
[43] All three countries had their currencies pegged to the euro. Currency devaluation would have meant both the loss of investor confidence (leading to higher borrowing costs) and sacrifice of the progress made on the way to the Euro adoption as this would have violated the stable exchange rate condition that needed to be satisfied for two years prior to the changeover. Most private sector and household loans were already euro-denominated as well so a devaluation could have had a disastrous effect (Staehr, 2013).

economy as in the Baltic case - benefits from EU membership might be very short-lived and unsustainable, exposing all the remaining vulnerabilities in face of the next crisis. So, while positive EU effects exist and are there to be exploited, they are not a panacea and have to go hand in hand with continuous national solutions.

Poland is a good example of this. It is not completely unexpected that the results of this analysis indicate significant positive EU effects for the country only after the financial crisis[44]. Poland ran much more prudent macroeconomic policies in the years leading up to the crisis, therefore avoiding excessive growth rates and resulting accumulation of imbalances that were visible in the Baltics. The country's inflation volatility, output gap and current account deficit were among the lowest in the New Member States. Its banking sector was sound, with strong macroprudential rules and low exposure to the kind of financial assets that triggered the global crisis. A floating exchange rate regime is also said to have contributed to the stability of the economy by acting as a shock absorber.[45] All these reasons, together with strong fundamentals, relatively flexible labor market, low indebtedness (mostly due to good financial system supervision) and supportive policies during the crisis itself (e.g. strong public investment) allowed Poland to avoid the disastrous effects of the global turmoil. It was the only EU country in 2009 to register positive GDP growth and one that had the highest cumulative growth rates for 2008-2011 among all EU members (Belka, 2013).

Knowing that, it is easier to understand why we do not witness a significant difference between actual and synthetic Poland in the pre-crisis period but only find it afterwards. As Poland already had a substantial investor confidence in the years leading up to EU accession due to good transition policies, strong growth, OECD membership and so on,[46] EU accession did not bring as many immediate benefits as in case of the Baltic countries. Due to sound post-

[44] The results were again robust to most of the tests performed apart from placebo studies that still support them but do not give full confirmation.
[45] Appreciating in the boom period (decreasing inflationary pressures) and depreciating during the financial crisis.
[46] See Belka (2013) for more details.

accession economic policies the growth rates were also not excessive throughout the economic boom of 2004-2007. The main differences came after, when the entire world plunged into the financial crisis but Poland did not. Of course, this cannot be attributed just to the effects of the EU membership due to all the factors discussed above, but we have to remember that most of them, to larger or smaller extent, were shaped by the EU recommendations, its accession requirements and acquis communautaire that the country needed to implement throughout the 1990s and early 2000s (Belka, 2013, p.58). Poland probably just did a much better job than the rest of the NMS, and continued on the good path after the accession as well - the key to sustained EU membership benefits mentioned before.

Cases of the Baltic States and Poland present two very different examples of positive EU membership effects, showing how important national actions are as well. However, any kind of positive effects should not just be taken for granted. Stories of Hungary, Romania, Bulgaria and Croatia are good example of that. While Hungary and Croatia might be slightly different from the other two in terms of higher initial GDP per capita and predicted lower convergence pace, Romania and Bulgaria had all the potential to follow if not Poland’s then at least the Baltic example of EU integration. The conducted analysis, however, did not find any significant membership effects for these two countries.

This result does not come as a complete shock as there were a lot of voices saying Romania and Bulgaria were not ready for the accession in 2007 just. Recently even The European Court of Auditors (ECA) revealed that it was actually against the accession in 2007 saying the countries needed more time to prepare so that the European money could be absorbed correctly (Gotev, 2016). As the report was published only in July 2006, however, the political decision was already taken and the accession went through. Nevertheless, even inside the Union, these two countries still faced special monitoring by the Cooperation and Verification Mechanism (CVM) to safeguard reform process after accession, mainly in terms of rule of law, judicial system, corruption and organized crime – something completely new compared to previous rounds of enlargement. This monitoring, however, did not prove to be very successful and even today, eleven years after the accession, the two countries still face serious problems in these areas. Resistance of the political class is seen as the main obstacle to successful reforms. EU recommendations are frequently implemented half-heartedly, with long delays and significant loopholes. Even if successful in decreasing corruption in some areas, they usually result in the latter capturing some other parts of the political system. Even some successfully established institutions in the pre-accession period (like National Anticorruption Directorate in Romania) failed to fully take off due to lack of support from the national governments in their integration into the broader political scene. Dimitrova (2015) reports that CVM was the most effective when actual sanctions were applied by suspending funding or linking CVM reports to the accession to Schengen area. [47] The European Union, however, is not based on such principles - as evident in the ongoing argument with Hungary and Poland – and cannot constantly rely on punishments if some members do not want to implement reforms.

This situation prevents the two countries from reaping the full benefits of EU membership as foreign investors are not too keen to invest in countries with high corruption, a lagging rule of law and problematic judiciary system (Dimitrova, 2015). The European Court of Auditors was also seemingly right about the inability of these countries to correctly absorb EU funds. Hunya (2017) writes that due to lacking institutional capacity and wide-spread corruption, EU Cohesion funds that Romania used in 2007-2013 amounted only to 1.5% of cumulative GDP, one of the lowest shares among the NMS.

Post-accession economic policy was also not too conducive to achieve high and sustainable EU benefits. Similar to the Baltic States, unsustainable high growth and lax policies

[47] Funding from the Instrument for Structural Policies for Pre-Accession (IPSA) was cut for Bulgaria in 2008 (Dimitrova, 2015)

before the crisis left the countries vulnerable to the financial turmoil. Contrary to the Baltic story, however, the crisis lessons were not learned well, at least by Romania, where austerity measures imposed by IMF brought some years of sustainable growth just to be followed by another political cycle and expansionary pro-cyclical fiscal policy that started from 2015. Large number of structural reforms agreed with IMF were left pending and commitment to the Medium-Term Objective of EU Stability and Growth Pact – broken (Hunya, 2017). These developments might again lead the country to a strong crash in the next crisis. As for Bulgaria, its current fiscal situation is in a much better shape but the convergence with the rest of the EU has slowed down and real income differences with some of the country's peers are increasing -the fact that strongly calls for the implementation of much needed and long delayed structural reforms (European Commission, 2018a). Having understood this, the SCM results of no significant EU membership effect for these two countries do not seem that unexpected anymore even if they contradict the predictions of other academics discussed before.

Examples of Romania and Bulgaria are especially relevant in the case of the next Balkan enlargement. The European Court of Auditors sees the same high corruption, lagging rule of law and questionable EU funds absorption patterns in these candidate countries and this time plans to publish relevant reports well in advance of accession dates to avoid any rushed decisions (Gotev, 2016). So, while Romania and Bulgaria might have gotten lucky having caught the last moments of the good EU enlargement mood, their example has probably taught the EU a lesson that might now be applied to the Western Balkans as well, possibly further delaying their accessions.

The remaining three countries (Czech Republic, Hungary and Croatia) joined the EU with much higher pre-accession income levels and were thus predicted to have somewhat lower growth rates than the rest, in line with income convergence theory. Despite this fact substantial EU benefits were still possible and Czech Republic might be a proof of that. Summarizing its catching-up experience, European Commission (2018c) states that country's convergence process, based both on sound economy policy that fostered foreign and domestic investment, and significant support from the EU structural funds, was successful and went in line with what was expected of it. Synthetic control analysis also broadly supports that, indicating gains from EU membership both in pre- and post-crisis periods that are somewhat lower than in the case of the Baltics, as predicted by the theory.[48]

Contrary to Czech Republic, Hungary did not use all the membership benefits it was predicted to collect based on its initial income level. SCM results of no tangible EU benefits for this country are in line with the prevailing opinion[49] that questionable post-accession domestic economic policy choices - which resulted in twin deficits - significantly undermined country's growth potential at the time and its convergence rate, which, as the European Commission puts it, has been lower than that of its regional peers even after adjusting for differences in initial positions (European Commission, 2018d). Addressing it in terms of GDP per capita, Figure 11 in Appendix G shows that while Hungary started in the third place in 1995, by 2016 it had fallen to the seventh position among CEEC. During the period of 2004-2014 it was also significantly downgraded in the S&P long-term rating - the only one among its peers who, on the contrary, steadily climbed the ranking. Even Romania and Bulgaria appeared higher than Hungary in 2014 in this ranking (Figure 12 in Appendix G). Not surprisingly, thus, synthetic control results show no significant difference between the actual and synthetic Hungary in terms of GDP per capita levels, and mostly negative gap in GDP per capita growth rates.[50] The change in direction of the latter from 2013, however, is a good sign and is also corroborated by the Europeans Commission's latest report stating that country's growth potential is gradually recovering and the economy is on a more sustainable track now,

[48] The results were again robust to most of the tests apart from placebo studies.
[49] See European Commission (2018d), Jedlicka et al. (2014), Salgo (n.d.), Shaleva (2007).
[50] Confirmed by all robustness tests.

even though the fiscal loosening is somewhat worrisome again (European Commission, 2018d).

While Hungary's case is not directly relevant to the potential Balkan newcomers as their initial income levels are not as high, it nevertheless is a good example of how bad economic policy choices even in a country with strong fundamentals can prevent it from enjoying the full benefits of the Union. It is also a good reminder for the rest of the members that everything is reversible and those benefits should not be taken for granted.

Lastly, Croatia was the only country to show negative results from EU membership.[51] To begin with, while having similar GDP per capita levels to those of Hungary when the latter joined the Union, Croatia was different from the rest of the NMS in that it went through a war in the 1990s, damaging its underlying economic structures and institutions – hence the longer road to the European membership (further complicated by disputes over the collaboration with the International Criminal Tribunal for the former Yugoslavia) (Lejour et al., 2008). Interestingly, even though not being a member in the years leading up to the financial crisis, Croatia found itself in a situation closely resembling that of the Baltic states: high unsustainable growth fueled by strong capital inflows and foreign direct investment directed to non-tradable sectors, high import growth and increasing unit labor costs. Like the Baltic states, pegged currency could not act as a shock absorber and the cost competitiveness and export performance were deteriorating, increasing current account deficit to unsustainable levels by 2008 (European Commission, 2015). All of this resulted in a very hard landing when the global financial crisis came. Differently from the Baltics, however, but more similar to Romania and Bulgaria, Croatia did not take this time to fundamentally reform the economy. As a result, it faced one of the longest and deepest recessions in Europe, lasting for six years. Amidst that recession country joined the EU in 2013. Modest growth resumed only two years after, in 2015.

[51] Confirmed by all robustness tests.

Unfortunately, even today Croatia still faces much of the same problems as before the crisis and not many successful structural reforms have been implemented since the accession. While the negative output gap seems to have closed in 2017, the growth potential is still much lower compared to the rest of the catching-up economies and is constrained by very low labor activity rate, low total factor productivity and restrictive business environment (European Commission, 2018b). As the European Commission put it in 2015, "the Croatian economy does not seem to have engaged in the significant process of capital and labor reallocation required to unwind internal and external imbalances and return to growth" (European Commission, 2015, p.6). After three years, the latest report from the Commission comes to very similar conclusions (European Commission, 2018b). It is, therefore, understandable that the synthetic control analysis showed negative income gap between Croatia and its synthetic control after the EU accession.

The case of Croatia might also be quite interesting for the Balkan countries because of the shared history. Once again, this example tells us how (non)implementation of EU recommendations and structural reforms makes itself most visible during the difficult times. While Poland avoided the recession by timely implementation and the Baltics fell into the trap but quickly learned from their mistakes, Croatia followed the road of Bulgaria and Romania and remains highly vulnerable to the next crisis in addition to having reaped almost no visible benefits from the EU membership so far.

Summarizing, qualitative analysis in this chapter provided us with some good insights into the possible reasons for obtaining the results that we did. It also helped to increase their credibility as none of the estimations turned out to be unexpected and indeed went in line with the opinions of other policy experts presented above. This deeper investigation was especially useful for Poland whose results were not fully confirmed by placebo tests at first but were subsequently strengthened in this chapter by pointing out that it was the only country to avoid the financial crisis – a development at least partly attributed to positive EU membership effects. Credibility of the results for the Baltics and Czech Republic (that were also constrained by the same test) was improved as well by the relevant analysis that helped to understand their respective paths. Estimations for other countries did not necessarily require such improvement as they were already confirmed by all the other robustness tests. Nevertheless, an additional validation is always useful and these results also fell in line with the implications of the broader policy analysis.

8. Conclusion

Benefits of the EU membership have received a lot of attention lately. With some countries still wanting to join the Union and others contemplating - or even actually leaving as in the case of the United Kingdom - this topic has been widely discussed. It has not, however, been as widely researched and is in critical need of actual empirical facts to substantiate the political discourse. The main obstacle for such analysis is the lack of good counterfactuals that would allow us to predict what would have happened had these countries not joined the EU in the first place. While limited estimates exist for Old Member States, New Member States from Central and Eastern Europe have so far mostly been left out even from those studies due to bad data quality and availability, even though their examples can be very beneficial for the future enlargements such as the Balkan one. The aim of this thesis was, therefore, to quantify the impact of the EU membership for nine Central and Eastern European countries using synthetic control method (SCM) that allows the researcher to construct a synthetic counterfactual from the most similar countries that did not join the Union and this way establish the causal effect of the latter.

The results of the analysis by and large confirm most of the expectations and predictions of the policy experts concerning these particular countries. From the new members with lower initial income levels, the Baltic States seem to have benefited the most, both in pre- and post-crisis periods, even if the former was mostly driven by unsustainable growth and resulted in a strong crash. Poland was much more prudent and therefore reaped the main EU benefits during and after the financial crisis as it managed to avoid the recession altogether. As for the initially higher income economies, it looks like Czech Republic has benefited as well, even though with somewhat lower EU benefits than in the previous cases, as the income convergence theory would predict.

There were also countries that did not use the full potential of the EU membership. Hungary is a good example, mainly due to some of its controversial post-accession economic policy choices. SCM analysis did not find any significant EU benefits for this country on the income per capita levels and even some negative ones on its growth rates. Bulgaria and Romania also did not have any substantial effects to show but this time the problems might lie not so much in the economic policy choices as in the more fundamental issues that have not been solved even eleven years after the accession. Lastly, Croatia was the only member to show negative membership effects as it joined the Union amidst the country's deep recession and has not yet been able to solve the underlying problems that brought such a profound crisis in the first place. The main obstacle that still prevents all three of these countries (Romania, Bulgaria and Croatia) from enjoying the full benefits of the membership seems to be the lack of political will to reform – something indispensable for success, as this analysis has demonstrated.

8.1 Policy recommendations

SCM analysis showed that EU accession in itself is not a magic bullet and will not bring all the answers. Future entrants have to realize that the reforms should not end with the accession if one wants to enjoy continuous membership benefits. This applies as much to the initially higher income countries as it does to the lower income ones.

Talking more specifically about the potential Western Balkan enlargement, these countries should avoid the paths taken by their neighbors Romania, Bulgaria and Croatia. All these countries were neither fully prepared when they joined nor did they embrace the required transformation after the accession and even after the financial crisis. The Baltic states (also similar to the Western Balkans in low pre-accession income levels) are a better example to follow. Even though the reform agenda was not fully finished in time for accession there either, the financial crisis gave a strong impetus to conclude it, putting the countries on a better and more sustainable path. Poland's example is an even better one as it shows the EU in its full effect. The main objective of all these EU regulations and structural reforms that the countries are asked to implement is to build modern robust economies with a sustainable growth path. By avoiding the financial crisis, Poland showed exactly that and has continued its strong growth ever since. It is, therefore, important for the Western Balkan countries to realize that all their difficult pre-accession roads will not pay off as much as they expect, even if they manage to join the EU, as long as the homework is not done. While they might enjoy some good years with strong capital inflows as most of the NMS did, future crises will quickly reverse all of that if the economy is not robust enough to withstand them.

The same applies to some members already in the EU. SCM analysis confirmed the predictions of many that countries that were not ready to join will not fully benefit from the EU membership. Eleven years later Romania and Bulgaria did not prove them wrong. Croatia is on a similar path. It is, therefore, high time for some changes in these countries, especially now that the global economy is booming and there is room for the remaining structural reforms to be implemented successfully.

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Appendix A: Data description

Table 2 Variable description and sources

Variable	Description	Source*
GDPpc_IMF	GDP per capita, PPP (constant 2011 international $)	IMF
GDPpc_WB	GDP per capita, PPP (constant 2011 international $)	WB
GDPpc_Penn	Expenditure-side real GDP at chained PPPs (in mil. 2011US$) / Population (in millions)	PENN
h_cons	Share of household consumption at current PPPs	PENN
gov_cons	Share of government consumption at current PPPs	PENN
Investment	Share of gross capital formation at current PPPs	PENN
Industry	Industry, value added (% of GDP)	WB
Trade	Trade (% of GDP)	WB
Tertiary	School enrollment, tertiary (% gross)	WB
age_dependecy_r	Age dependency ratio (% of working-age population)	WB
infl_cpi	Inflation, consumer prices (annual %)	WB

* World Economic Outlook Database 2018 (IMF); World Development Indicators (World Bank), Penn World Table 9.0

Table 3 Data availability

	GDPpc_IMF	GDPPC_WB	GDPpc_Penn	h_cons	gov_cons	investment	industry	trade	tertiary	age_dep__r	inflation
Lithuania	1995-2017	1995-2016	1990-2014	1990-2014	1990-2014	1990-2014	1995-2016	1995-2016	1990-2016	1990-2016	1993-2016
Latvia	1992-2017	1995-2016	1990-2014	1990-2014	1990-2014	1990-2014	1995-2016	1995-2016	1990-2015	1990-2016	1992-2016
Estonia	1993-2017	1995-2016	1990-2014	1990-2014	1990-2014	1990-2014	1995-2016	1995-2016	1990-2015	1990-2016	1993-2016
Romania	1990-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1990-2016	1990-2016	1991-2016
Bulgaria	1990-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016
Croatia	1992-2017	1995-2016	1990-2014	1990-2014	1990-2014	1990-2014	1995-2016	1995-2016	1990-2016	1990-2016	1990-2016
Hungary	1990-2017	1991-2016	1990-2014	1990-2014	1990-2014	1990-2014	1995-2016	1991-2016	1990-2016	1990-2016	1990-2016
Czech Republic	1995-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1993-2016	1990-2016	1990-2015	1990-2016	1994-2016
Poland	1990-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1995-2016	1990-2016	1990-2016	1990-2016	1990-2016
Albania	1990-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1990-2016	1990-2016	1992-2016
Armenia	1992-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1990-2016	1990-2016	1994-2016
Belarus	1990-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1990-2016	1990-2016	1993-2016
Bosnia&Herzegovina	1996-2017	1994-2016	1990-2014	1990-2014	1990-2014	1990-2014	1994-2016	1994-2016	2000-2002	1990-2016	2006-2016
Georgia	1991-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1991-2016	1990-2016	1995-2016
Macedonia, FYR	1992-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1990-2015	1990-2016	1994-2015
Moldova	1992-2017	1995-2016	1990-2014	1990-2014	1990-2014	1990-2014	1995-2016	1995-2016	1990-2015	1990-2016	1995-2016
Montenegro	2000-2017	1997-2016	1990-2014	1990-2014	1990-2014	1990-2014	2000-2016	2000-2016	2001-2010	1990-2016	2006-2016
Russia	1990-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1990-2016	1990-2016	1993-2016
Serbia	1997-2017	1995-2016	1990-2014	1990-2014	1990-2014	1990-2014	1995-2016	1995-2016	2001-2016	1990-2016	1995-2016
Turkey	1990-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1990-2015	1990-2016	1990-2016
Ukraine	1991-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1990-2014	1990-2016	1993-2016
Iceland	1990-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1997-2016	1990-2016	1990-2015	1990-2016	1990-2016
Switzerland	1990-2017	1990-2016	1990-2014	1990-2014	1990-2014	1990-2014	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016

Table 4 Variable averages for treated countries

	GDPpc_IMF	GDPPC_WB	GDPpc_Penn	h_cons	gov_cons	investment	industry	trade	tertiary	age_dep__r	inflation
Czech Republic	20.413	19.704	20.217	48.066	29.633	23.293	38.407	83.049	22.144	46.584	6.627
Estonia	13.434	14.549	10.996	52.908	32.059	20.451	29.092	138.942	38.688	50.454	22.472
Hungary	16.414	16.342	14.275	55.365	29.611	18.023	31.388	90.521	25.788	48.280	18.917
Latvia	9.836	10.404	10.771	55.445	30.471	15.985	28.264	84.266	37.494	50.652	41.187
Lithuania	11.550	11.603	10.548	58.857	32.345	12.691	30.361	89.969	37.558	51.276	56.403
Poland	12.072	12.181	11.170	57.111	24.998	17.547	33.677	49.401	35.900	50.002	65.150
Bulgaria	10.368	9.336	9.798	51.135	31.864	10.937	30.837	87.289	38.635	48.252	120.175
Romania	10.746	11.126	7.447	59.288	24.445	18.262	39.090	62.143	22.101	48.420	86.887
Croatia	16.756	17.742	14.912	59.796	22.858	22.334	29.129	77.707	36.088	48.302	132.383

Table 5 Donor pool variable averages (until 2002)

	GDPpc_IMF	GDPPC_WB	GDPpc_Penn	h_cons	gov_cons	investment	industry	trade	tertiary	age_dep__r	inflation
Albania	4.33	4.60	4.20	80.34	22.55	10.76	22.60	54.30	12.20	61.69	38.11
Armenia	2.52	2.70	3.33	64.62	37.18	13.21	36.89	85.50	26.83	57.39	399.42
Belarus	7.12	7.10	9.09	43.80	36.39	18.18	40.70	120.22	48.46	49.80	487.61
Bosnia&Herzegov	5.86	4.77	3.30	106.44	35.33	22.23	27.17	105.90	22.31	45.46	
Georgia	3.11	3.60	4.10	72.77	32.26	12.23	23.35	77.79	40.38	54.28	30.78
Macedonia, FYR	8.46	8.27	7.23	64.67	26.73	13.57	32.18	80.90	19.60	49.74	17.79
Moldova	2.72	2.45	2.80	56.11	40.51	13.34	25.55	123.49	31.38	53.18	19.77
Montenegro	10.25	10.53	7.42	61.59	28.67	18.23	24.07	94.53	17.37	49.81	
Russia	14.86	14.80	12.72	44.63	28.67	22.38	40.23	58.23	51.28	47.99	161.37
Serbia	8.00	8.03	6.29	67.84	28.89	15.78	32.54	42.03	36.71	50.76	57.47
Turkey	12.08	12.67	10.77	64.04	13.83	18.59	31.53	41.00	20.20	61.55	71.28
Ukraine	6.10	6.20	6.42	47.36	33.96	18.03	40.57	82.82	46.54	48.12	617.33
min	2.52	2.45	2.80	43.80	13.83	10.76	22.60	41.00	12.20	45.46	17.79
max	14.86	14.80	12.72	106.44	40.51	22.38	40.70	123.49	51.28	61.69	617.33

Table 6 Donor pool variable averages (until 2005)

	GDPpc_IMF	GDPPC_WB	GDPpc_Penn	h_cons	gov_cons	investment	industry	trade	tertiary	age_dep__r	inflation
Albania	4.78	5.10	4.49	78.43	22.99	13.96	22.92	56.75	13.67	60.44	30.31
Armenia	2.99	3.08	3.54	67.72	32.38	14.08	38.00	83.79	28.97	56.25	300.59
Belarus	7.68	7.67	9.18	46.72	33.57	18.20	40.79	122.37	51.51	48.78	379.46
Bosnia&Herzegov	6.40	5.51	3.85	103.16	34.00	22.14	26.56	106.63	22.31	45.52	
Georgia	3.38	3.76	4.10	72.70	28.66	13.92	23.91	78.41	41.20	53.84	23.72
Macedonia, FYR	8.66	8.41	7.40	66.03	26.38	14.14	30.77	80.59	21.17	49.04	13.42
Moldova	2.80	2.62	2.74	62.31	35.35	13.70	23.87	127.65	32.18	50.99	17.64
Montenegro	10.69	10.79	7.69	60.25	30.88	17.24	22.97	94.32	18.79	49.81	
Russia	15.47	15.42	12.69	45.78	28.07	21.17	39.37	58.09	55.03	46.80	126.99
Serbia	8.65	8.63	6.73	67.47	28.91	16.75	31.97	49.71	39.64	50.69	45.17
Turkey	12.55	13.13	10.92	64.87	14.34	18.18	31.00	42.01	22.61	60.36	60.79
Ukraine	6.31	6.31	6.42	50.41	31.04	17.51	39.38	87.92	50.36	47.39	477.01
min	2.80	2.62	2.74	45.78	14.34	13.70	22.92	42.01	13.67	45.52	13.42
max	15.47	15.42	12.69	103.16	35.35	22.14	40.79	127.65	55.03	60.44	477.01

Table 7 Donor pool variable averages (until 2011)

	GDPpc_IMF	GDPPC_WB	GDPpc_Penn	h_cons	gov_cons	investment	industry	trade	tertiary	age_dep__r	inflation
Albania	5.90	6.25	5.45	75.99	22.62	18.49	24.21	62.48	19.88	57.72	22.12
Armenia	4.09	4.10	4.40	71.88	28.12	15.00	38.49	77.87	34.48	53.36	202.37
Belarus	9.64	9.64	10.54	50.18	30.59	19.00	41.30	123.92	57.91	46.77	265.11
Bosnia&Herzegov	7.50	6.84	5.07	97.25	32.50	21.86	26.82	99.44	22.31	44.88	3.42
Georgia	4.23	4.48	4.72	72.81	27.03	13.73	23.70	80.82	38.11	52.46	18.04
Macedonia, FYR	9.46	9.08	8.27	66.50	26.78	16.17	28.88	86.27	24.67	47.37	9.97
Moldova	3.09	3.03	2.91	70.23	31.48	13.72	21.22	128.19	34.59	47.23	14.52
Montenegro	12.18	12.05	9.04	60.71	30.89	18.58	21.71	105.31	29.56	49.42	3.93
Russia	17.49	17.45	14.42	47.45	26.66	19.89	38.27	56.18	59.73	44.76	90.03
Serbia	10.05	9.98	7.94	67.44	28.47	18.20	30.85	60.34	44.74	49.83	32.51
Turkey	13.83	14.43	12.28	64.56	15.63	19.04	30.49	43.73	29.83	58.23	46.49
Ukraine	6.90	6.80	7.09	55.08	28.33	16.28	37.48	90.84	58.82	46.18	330.60
min	3.09	3.03	2.91	47.45	15.63	13.72	21.22	43.73	19.88	44.76	3.42
max	17.49	17.45	14.42	97.25	32.50	21.86	41.30	128.19	59.73	58.23	330.60

Appendix B: Description of synthetic controls

Table 8 Country weights

	Lithuania	Latvia	Estonia	Romania	Bulgaria	Croatia	Hungary (levels)	Hungary (growth)	Czech Republic	Poland
Albania	0	0	0	0.267	0.002	0.118	0	0.1	0	0
Armenia	0	0	0	0	0	0.173	0.476	0	0	0.458
Belarus	0	0.216	0.269	0.045	0.221	0	0.003	0.401	0	0.09
Bosnia and Herzegovina	0.223	0.196	0.399	-	-	0.225	-	-	-	-
Georgia	0	0	0	0	0.001	0.01	0	0	0	0.09
Macedonia, FYR	0	0	0	0	0.294	0.014	0	0.249	0	0
Moldova	0	0	0	0	0.1	0.007	0.009	0.184	0.338	0
Montenegro	-	-	-	-	-	-	-	-	-	-
Russia	0.661	0.588	0	0.168	0.342	0.01	0.047	0.07	0.346	0
Serbia	0	0	0	-	-	0.01	-	-	-	-
Turkey	0.116	0	0	0.52	0.039	0.07	0	0	0	0
Ukraine	0	0	0	0	0	0.006	0	0	0	0
Iceland*			0.331			0.357	0.465			0.345
Switzerland*									0.315	

* extended donor pool

Table 9 Predictor averages and weights (v) in the synthetic control

Lithuania

```
                          Treated  Synthetic      v.weights
 h_cons                    58.617     57.923      0.12
 investment                13.399     16.285      0
 gov_cons                  34.462     28.244      0.003
 industry                  30.361     34.043      0.001
 trade                     89.969     67.379      0.011
 tertiary                  42.759     42.311      0
 age_dependency_r          51.441     47.817      0
 special.GDPpc_WB.1995.2002 11.603    11.529      0.865
```

Latvia

	Treated	Synthetic	v.weights
h_cons	55.203	55.008	0.053
investment	15.188	16.049	0
gov_cons	33.092	31.141	0.002
industry	28.264	35.385	0.003
trade	84.266	81.413	0.072
tertiary	45.472	46.037	0.008
age_dependency_r	50.171	46.839	0
special.GDPpc_WB.1995.2002	10.404	10.364	0.862

Estonia

	Treated	Synthetic	v.weights
h_cons	53.851	63.870	0
investment	20.299	20.265	0.11
gov_cons	34.203	27.097	0
industry	29.092	30.453	0
trade	138.942	98.928	0
tertiary	47.672	36.490	0
age_dependency_r	49.585	49.431	0
special.GDPpc_WB.1995.2002	14.549	14.554	0.889

Romania

	Treated	Synthetic	v.weights
h_cons	59.459	64.860	0.002
investment	17.439	17.116	0.567
gov_cons	25.097	20.127	0.046
industry	37.889	29.462	0
trade	65.161	54.830	0.001
tertiary	23.971	27.988	0.25
age_dependency_r	47.921	56.920	0.002
special.infl_cpi.1996.2005	43.730	37.254	0.001
special.GDPpc_IMF.1992.2005	10.768	10.794	0.131

Bulgaria

	Treated	Synthetic	v.weights
h_cons	51.998	55.765	0.021
investment	11.384	16.511	0
gov_cons	30.818	28.792	0.001
industry	28.603	34.166	0.009
trade	88.863	89.096	0.166
tertiary	40.073	41.032	0.084
age_dependency_r	47.934	48.474	0.053
special.infl_cpi.1996.2005	123.826	31.439	0.003
special.GDPpc_IMF.1992.2005	10.090	10.078	0.665

Croatia

	Treated	Synthetic	v.weights
h_cons	59.747	69.822	0
investment	24.525	22.611	0
gov_cons	22.885	22.890	0.069
industry	29.129	28.170	0
trade	77.707	77.517	0.002
tertiary	39.870	39.920	0.03
age_dependency_r	48.879	50.977	0
special.GDPpc_WB.1995.2011	17.742	17.742	0.898

Hungary (GDP per capita levels)

	Treated	Synthetic	v.weights
h_cons	55.529	62.277	0.001
investment	18.208	19.122	0.038
gov_cons	30.138	27.438	0.017
industry	31.388	31.311	0.211
trade	93.453	76.412	0
tertiary	27.822	33.888	0.004
age_dependency_r	47.745	55.621	0
special.infl_cpi.1996.2002	12.878	6.804	0.001
special.GDPpc_IMF.1992.2002	16.474	16.338	0.727

Hungary (GDP per capita growth rate)

	Treated	Synthetic	v.weights
h_cons	55.081	58.736	0.073
investment	19.520	14.317	0.056
gov_cons	29.469	30.528	0
industry	31.531	31.443	0.484
trade	112.073	102.564	0.262
tertiary	33.370	36.884	0
age_dependency_r	46.996	49.879	0
special.infl_cpi.1996.2002	12.878	50.588	0.069
special.imfgr.1996.2002	3.570	3.816	0.056

Czech Republic

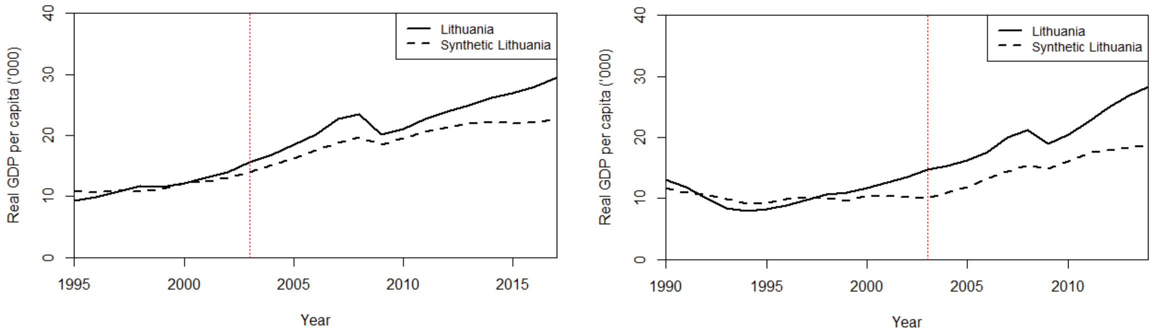
	Treated	Synthetic	v.weights
h_cons	50.161	56.176	0
investment	25.091	18.793	0.007
gov_cons	27.508	25.478	0.038
industry	38.311	30.228	0
trade	88.810	89.855	0.017
tertiary	25.913	39.812	0.001
age_dependency_r	44.300	48.561	0
special.infl_cpi.1996.2002	5.787	18.015	0.009
special.GDPpc_IMF.1995.2002	20.413	20.411	0.929

Poland

	Treated	Synthetic	v.weights
h_cons	57.813	67.228	0
investment	18.459	18.311	0.034
gov_cons	24.417	24.683	0.01
industry	33.677	31.291	0.001
trade	53.763	77.044	0
tertiary	44.116	36.835	0
age_dependency_r	47.945	55.042	0
special.infl_cpi.1996.2002	10.193	15.875	0.001
special.GDPpc_IMF.1995.2002	13.424	13.435	0.954

Appendix C: Outcome variable data from other sources

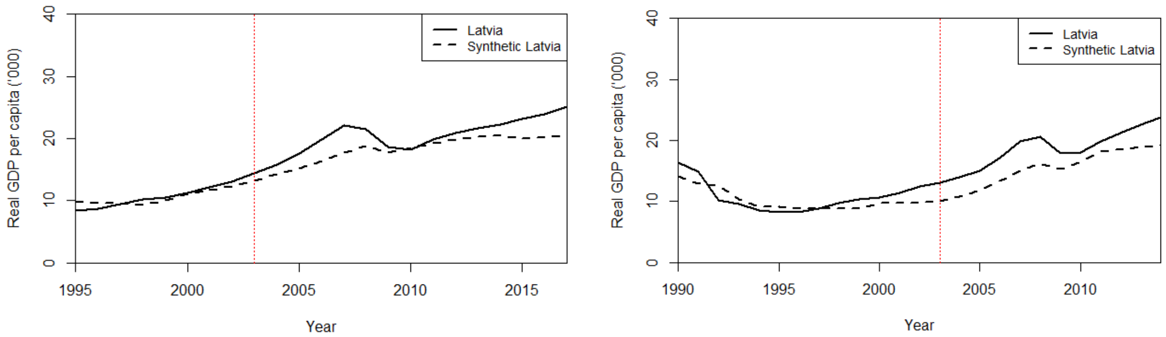
Lithuania



(1) Source: IMF. Country weights: Russia - 0.539, Turkey - 0.229, Belarus - 0.139, Albania - 0.08

(2) Source: PENN World Table 9.0. Country weights: Turkey -0.589, Montenegro –0.242, Russia -0.142

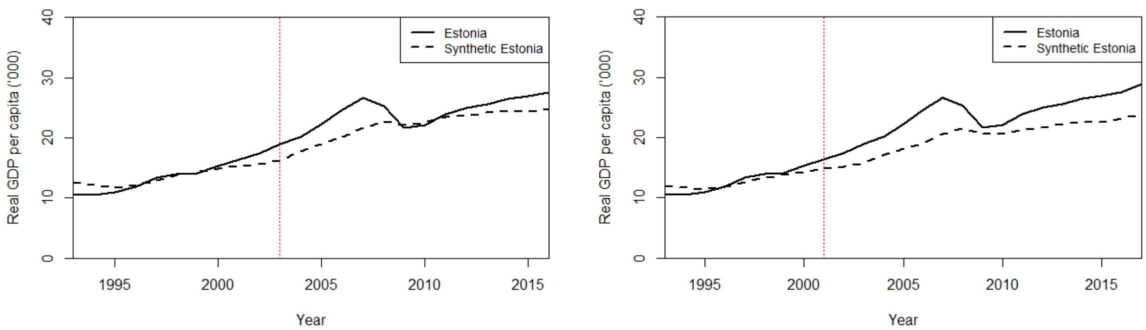
Latvia



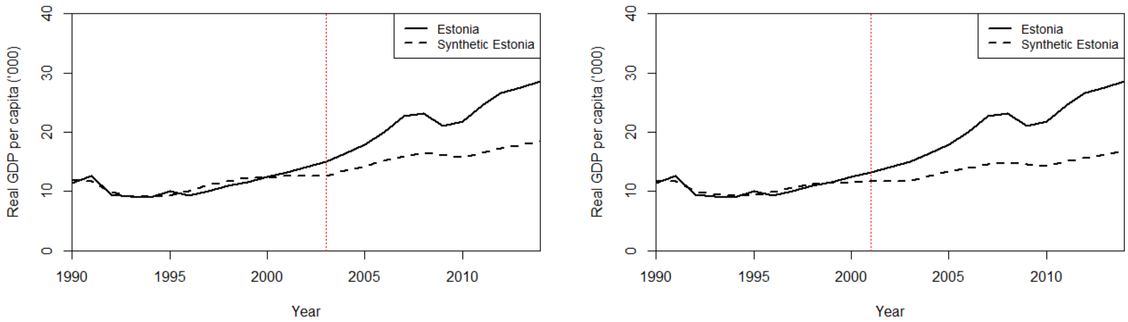
(1) Source: IMF. Country weights: Russia- 0.655; Albania -0.344.

(2) Source: PENN World Table 9.0. Country weights: Montenegro – 0.396, Russia -0.396, Turkey -0.207.

Estonia

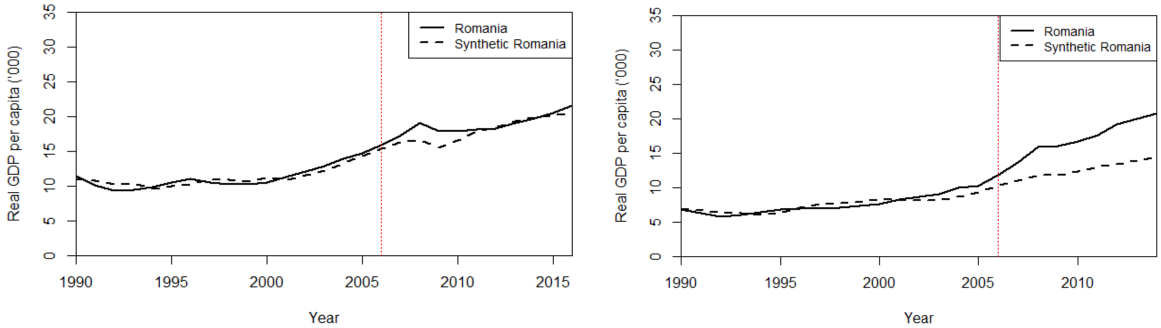


Source: IMF. Country weights: (1) Belarus - 0.728, Iceland - 0.272; (2) Belarus - 0.466, Iceland -0.296, Armenia – 0.193, Moldova – 0.04



Source: PENN Country weights: (1) Bosnia and Herzegovina – 0.343, Iceland -0.209, Belarus -0.195, Georgia - 0.152, Moldova - 0.082. (2) Moldova – 0.4, Belarus – 0.172, Bosnia and Herzegovina – 0.165, Iceland – 0.209.

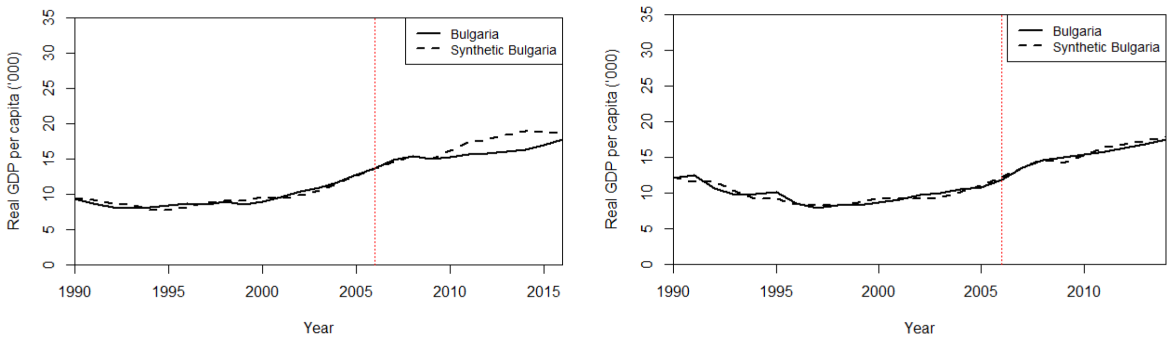
Romania



(1) Source: World Bank. Country weights: Turkey – 0.582, Armenia – 0.175, Russia -0.141, Belarus – 0.103

(2) Source: PENN World Table 9.0. Country weights: Bosnia and Herzegovina – 0.303, Macedonia – 0.291, Turkey – 0.254, Russia – 0.057

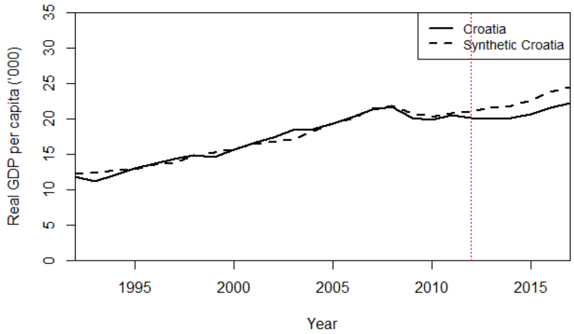
Bulgaria



(1) Source: World Bank. Country weights: Belarus - 0.571, Turkey – 0.358, Georgia - 0.680

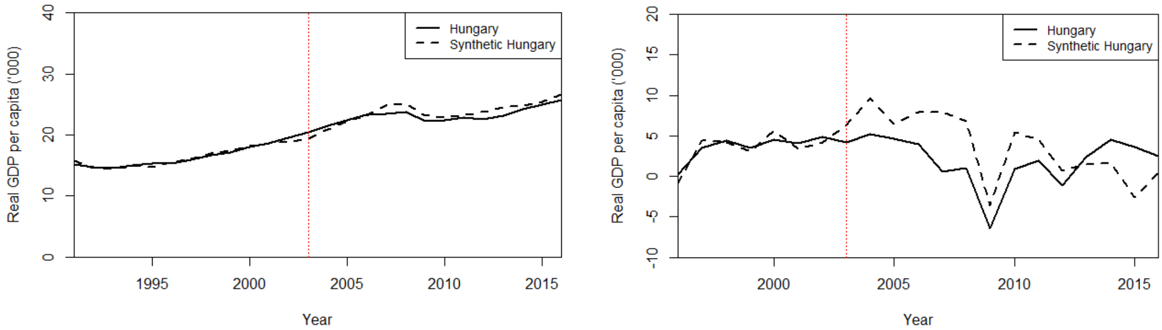
(2) Source: PENN World Table 9.0. Country weights: Macedonia – 0.441, Russia – 0.367, Turkey – 0.108

Croatia



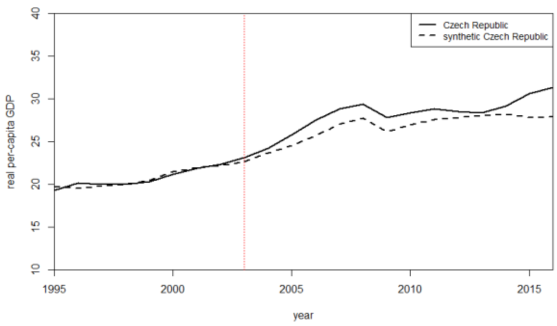
Source: IMF. Country weights: Iceland – 0.387, Albania – 0.349, Armenia – 0.264

Hungary



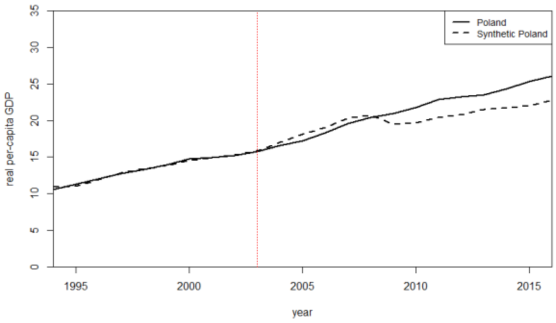
Source: World Bank. (1) GDP per capita levels. Country weights: Iceland – 0.474, Armenia – 0.435, Belarus – 0.07. (2) GDP per capita growth rate. Country weights: Belarus – 0.389, Macedonia - 0.361, Ukraine - 0.249.

Czech Republic



Source: World Bank. Country weights: Russia – 0.37, Moldova – 0.32, Switzerland – 0.3

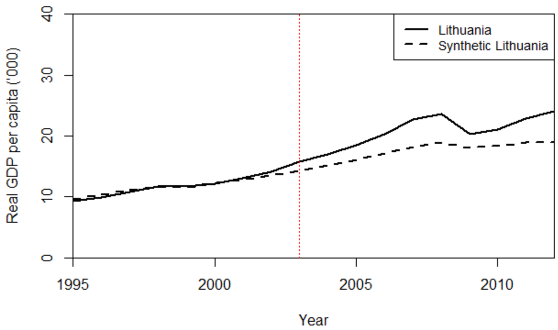
Poland



Source: World Bank. Country weights: Bosnia and Herzegovina –0.43, Russia – 0.24, Iceland – 0.2, Turkey –0.14

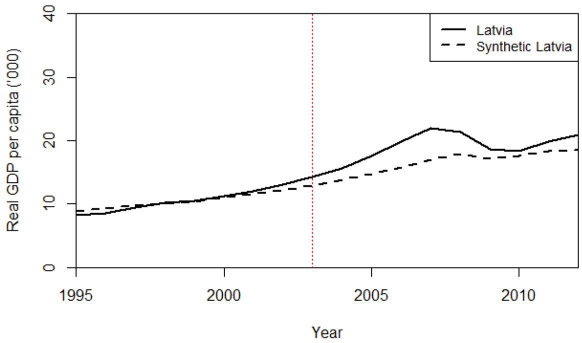
Appendix D: Extended donor pool (Croatia added)

Lithuania



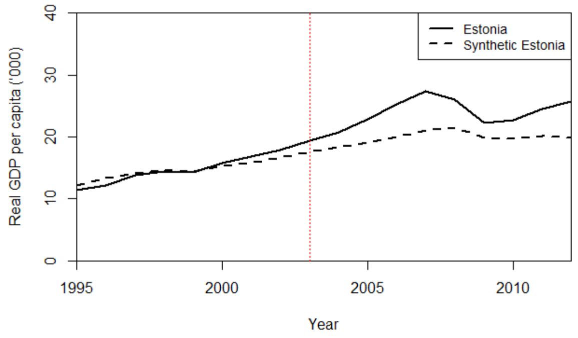
Country weights: Turkey -0.589, Croatia -0.534, Belarus - 0.307, Bosnia and Herzegovina – 0.082, Russia - 0.076.

Latvia



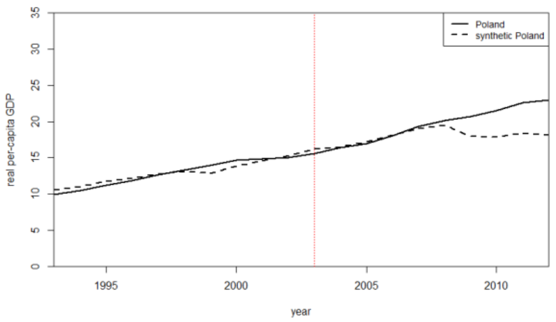
Country weights: Croatia - 0.338, Belarus - 0.343, Russia - 0.157, Albania – 0.151.

Estonia



Country weights: Croatia – 0.953, Bosnia and Herzegovina – 0.047.

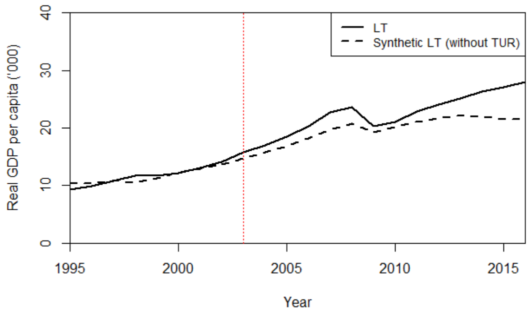
Poland

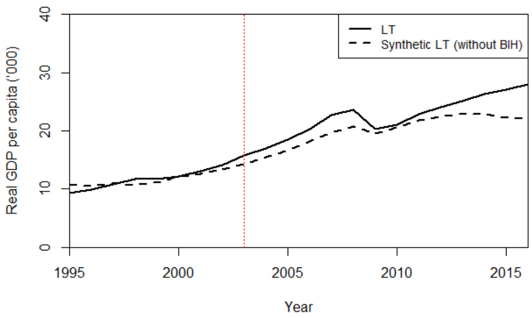


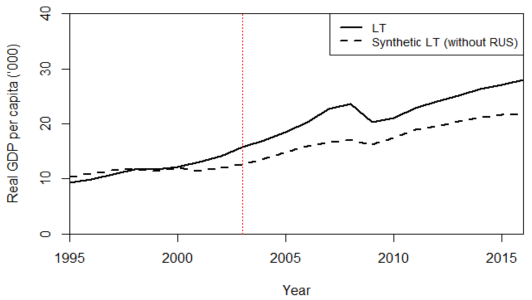
Country weights: Croatia – 0.79, Ukraine – 0.15, Turkey – 0.04.

Appendix E: Leave-One-Out tests

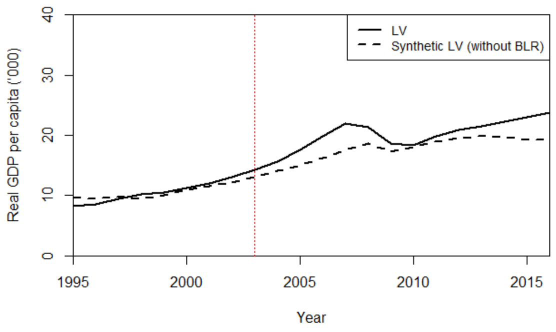
Lithuania (excluding Turkey, Bosnia and Herzegovina, and Russia)

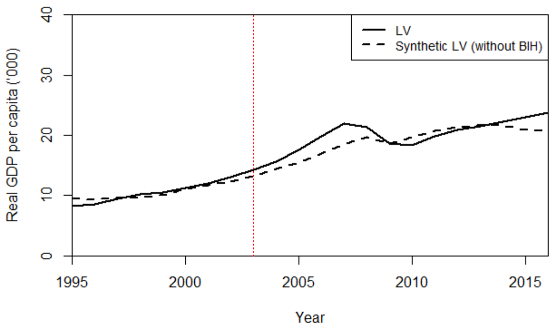


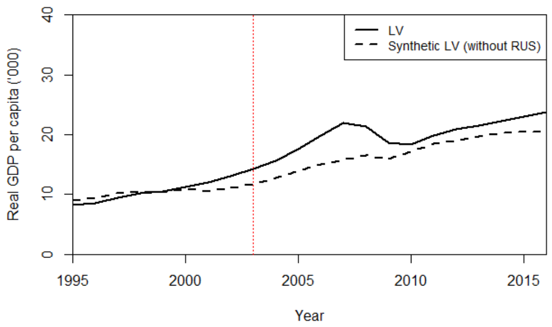




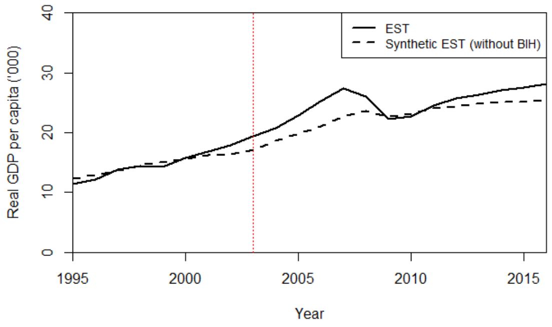
Latvia (excluding Belarus, Bosnia and Herzegovina, and Russia)

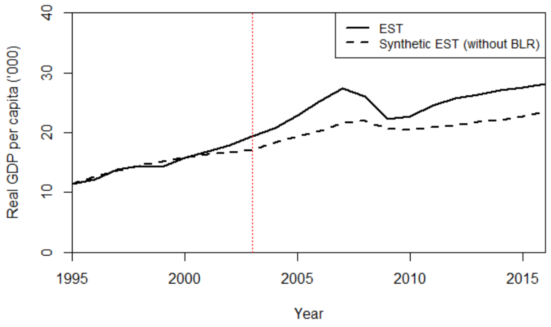


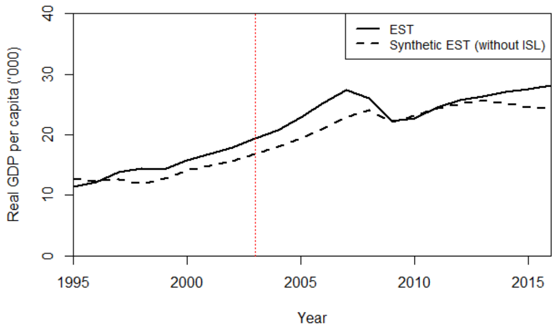




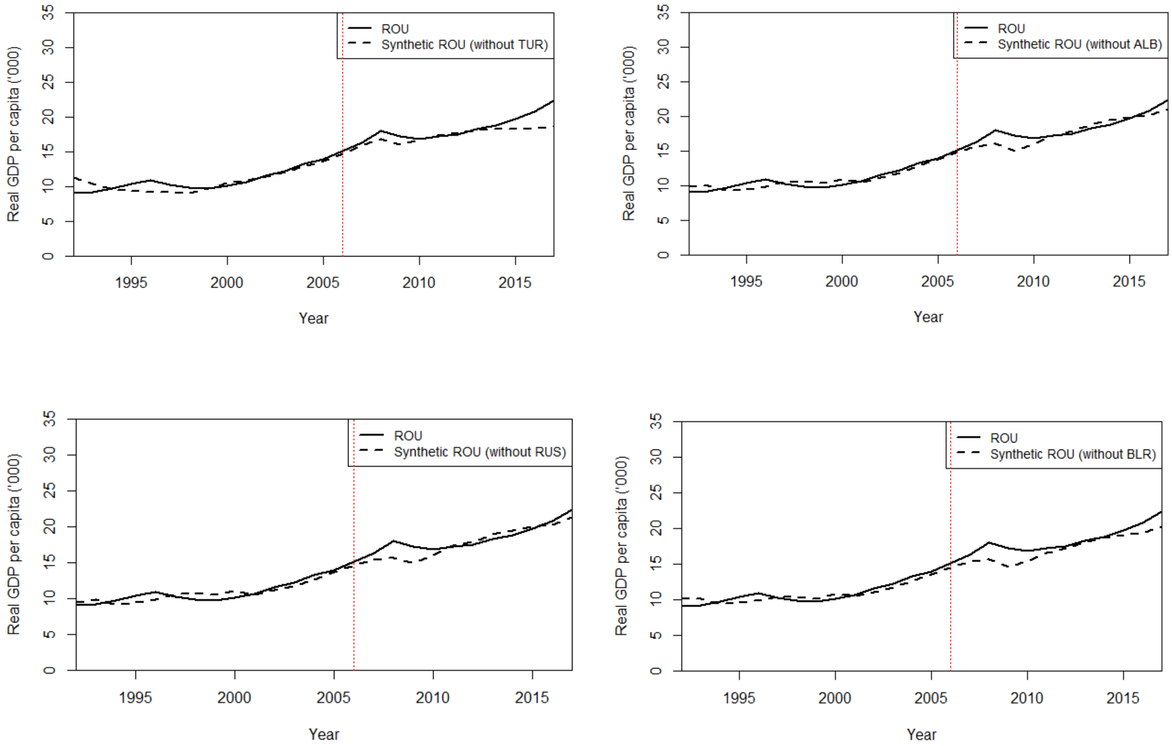
Estonia (excluding Bosnia and Herzegovina, Belarus and Iceland)



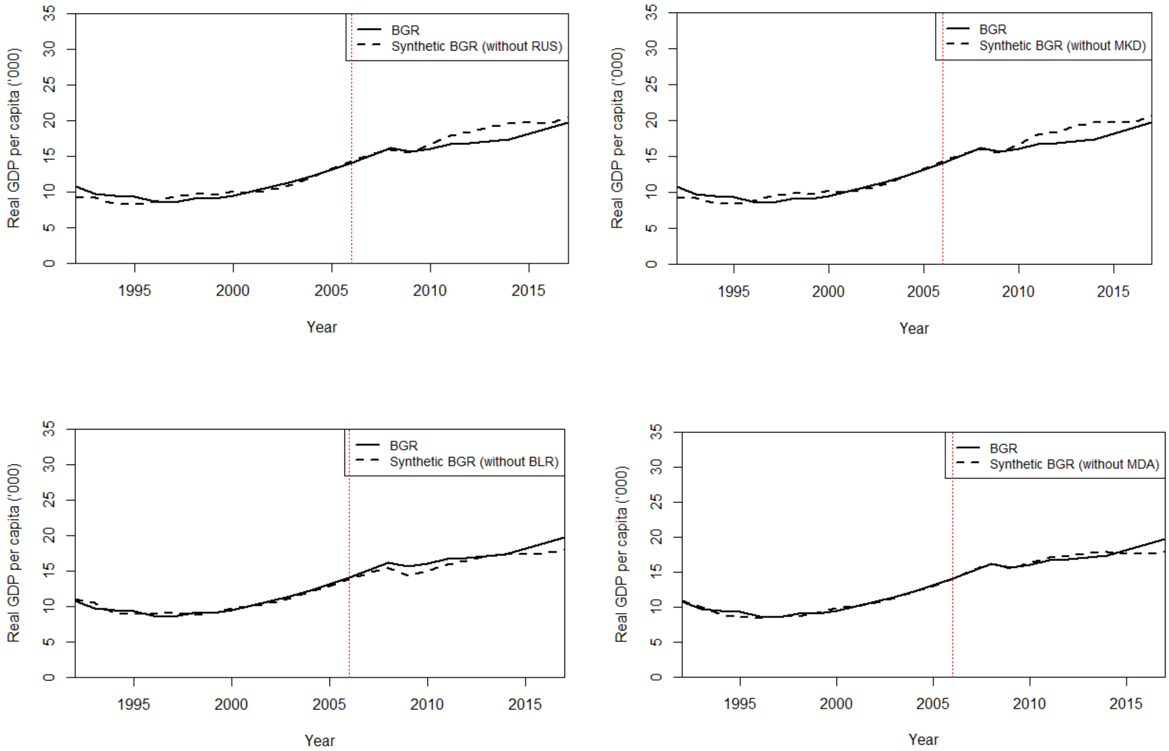




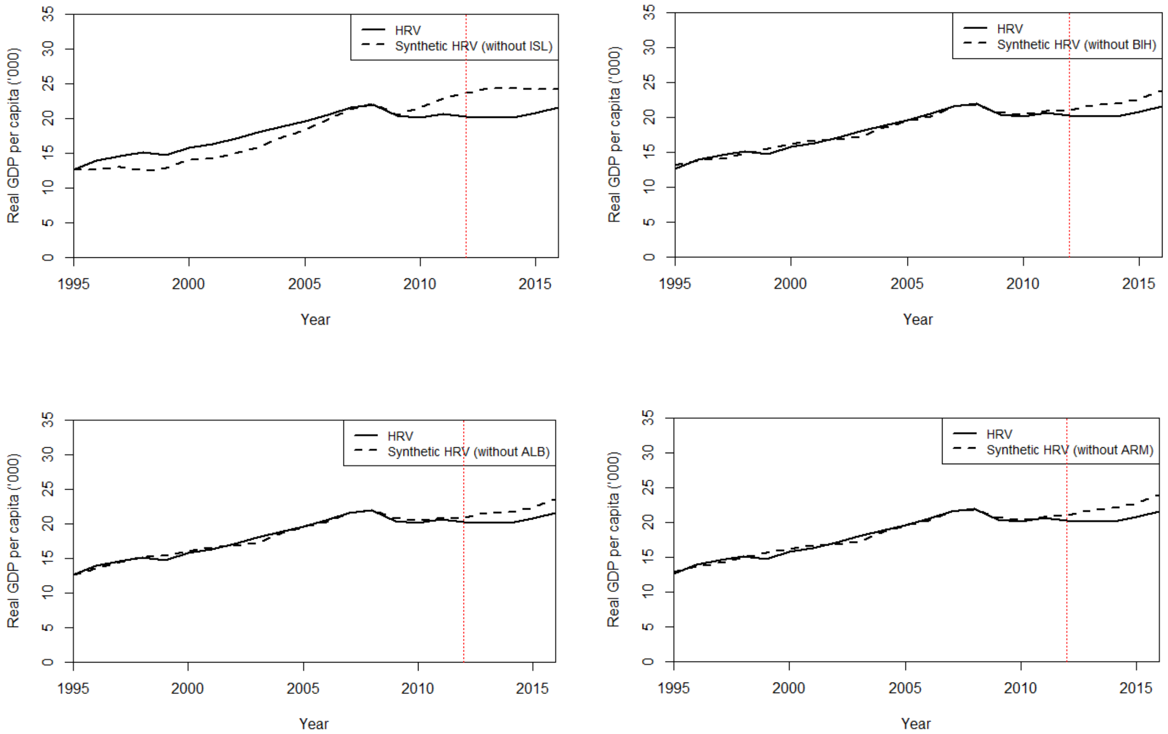
Romania (excluding Turkey, Albania, Russia and Belarus)



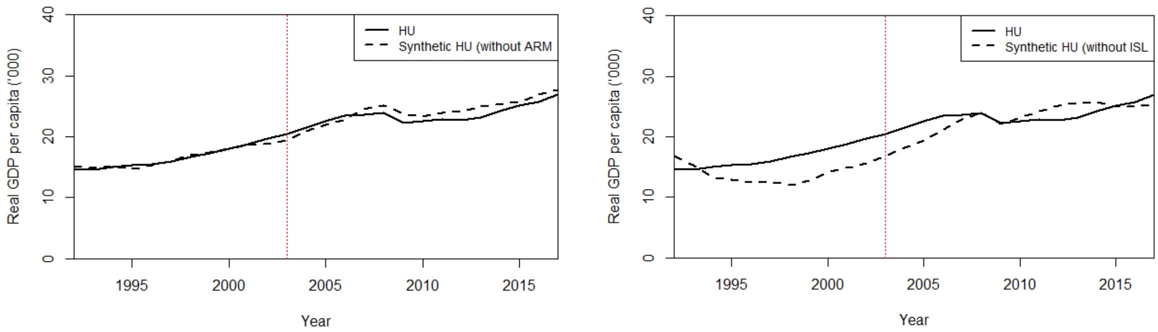
Bulgaria (excluding Russia, Macedonia, Belarus and Moldova)



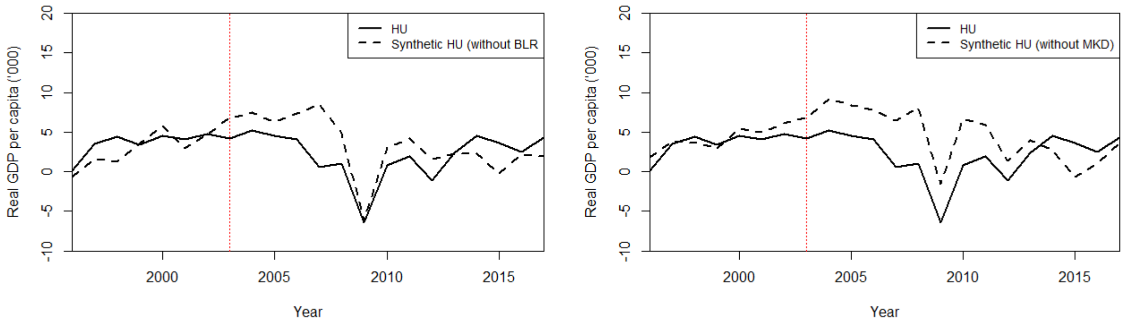
Croatia (excluding Iceland, Bosnia and Herzegovina, Albania and Armenia)

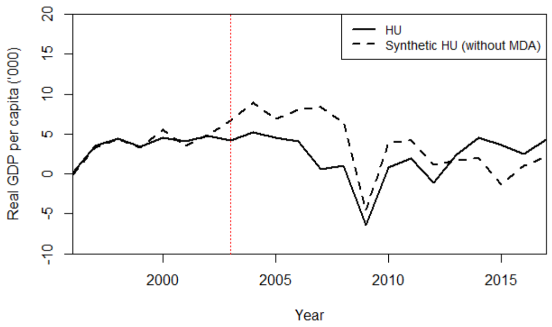


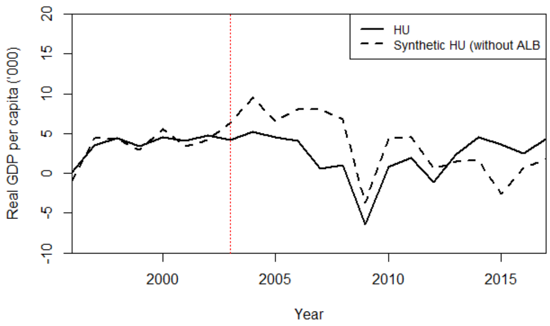
Hungary, GDP per capita in levels (excluding Armenia and Iceland)



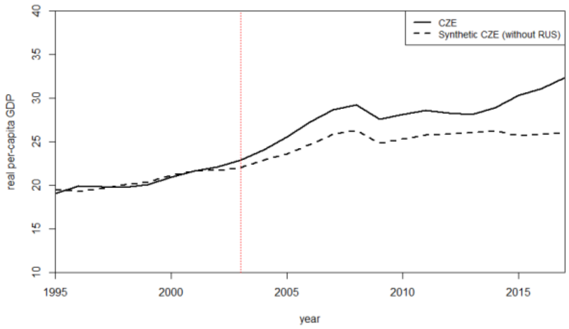
GDP per capita growth rate (Belarus, Macedonia, Moldova, Albania)

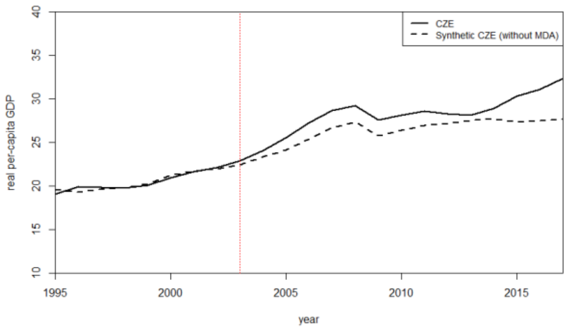


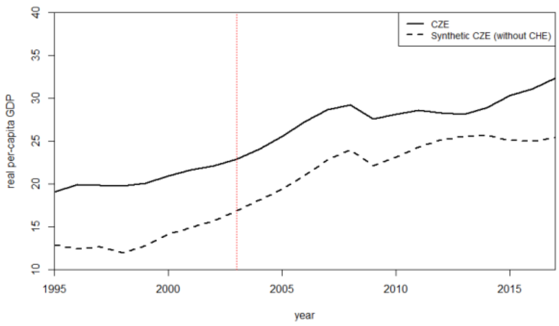




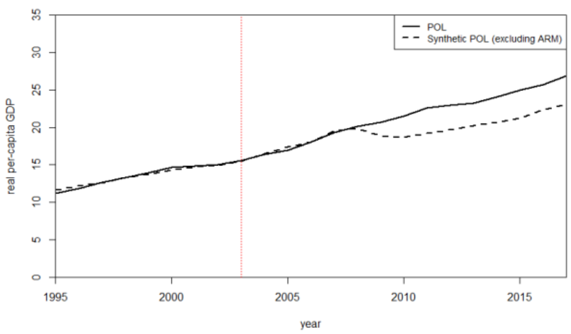
Czech Republic (excluding Russia, Moldova and Switzerland)

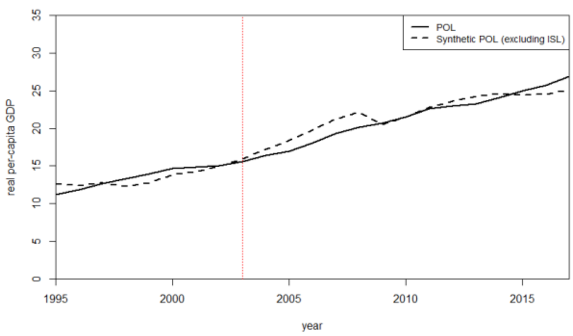






Poland (excluding Armenia and Iceland)

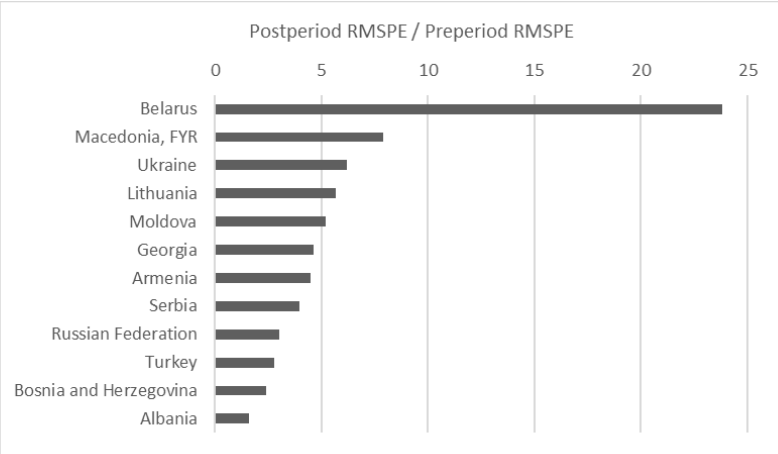




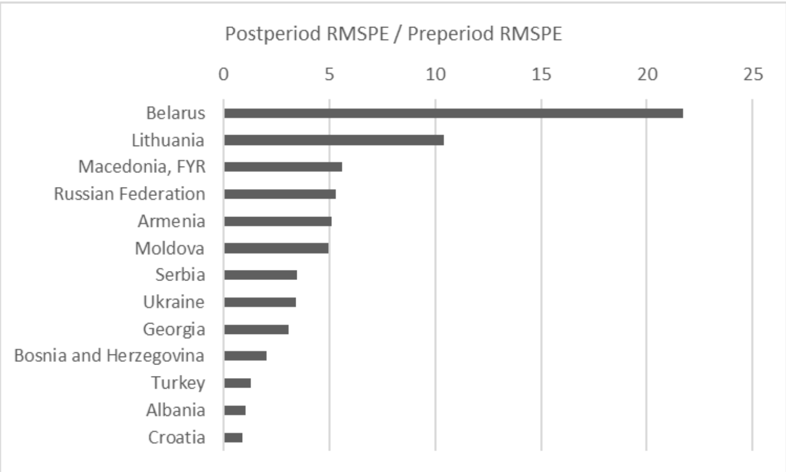
Appendix F: Ratio of Post-intervention to Pre-intervention RMSPE

Lithuania

- Original donor pool

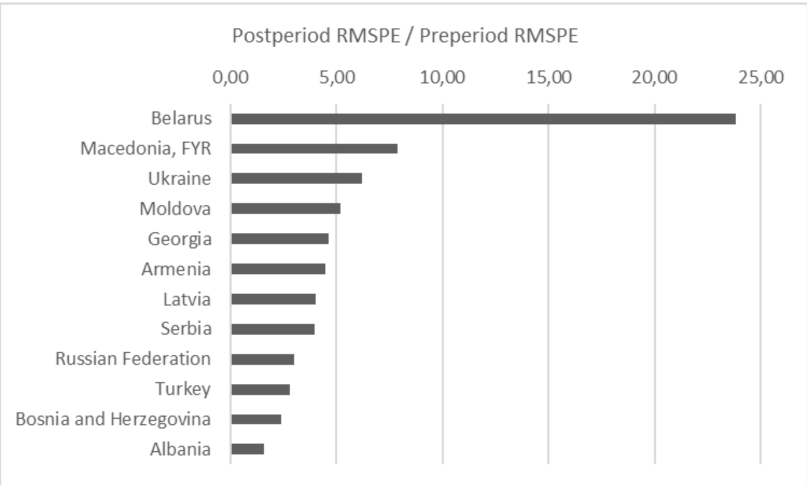


- Donor pool with Croatia

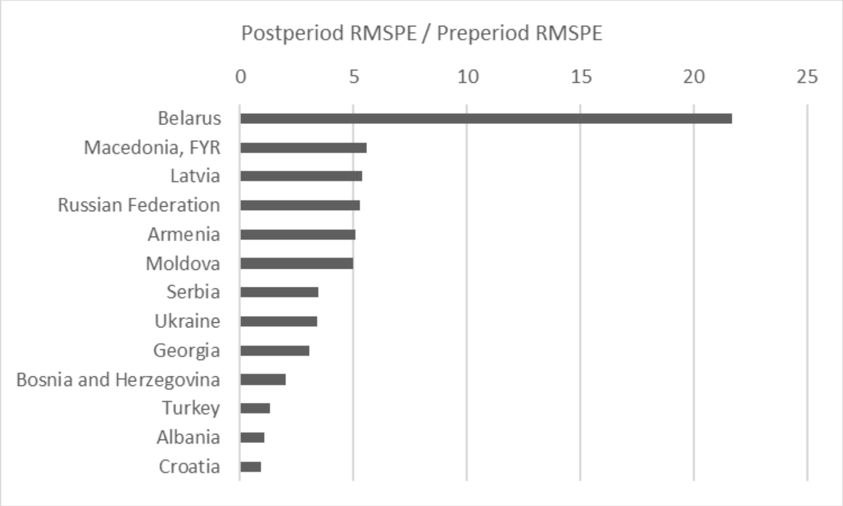


Latvia

- Original donor pool

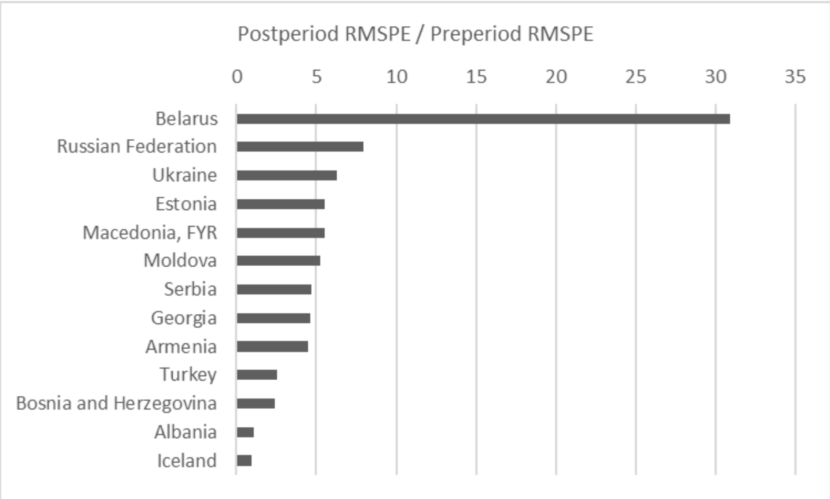


- Donor pool with Croatia

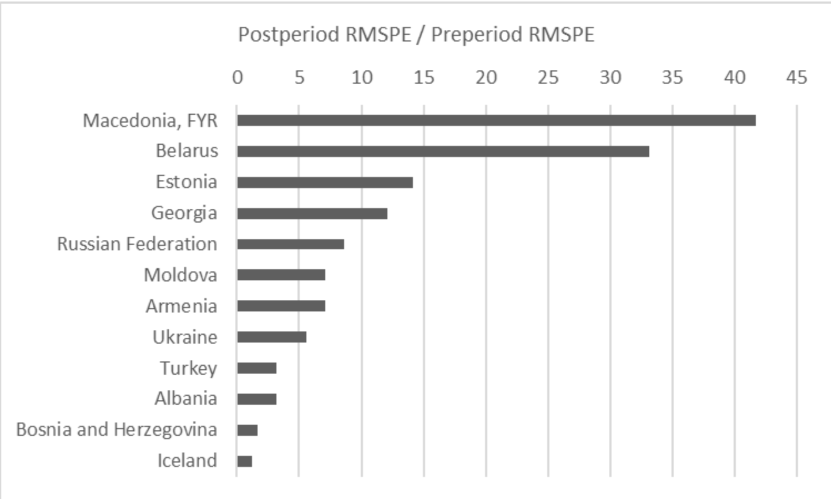


Estonia

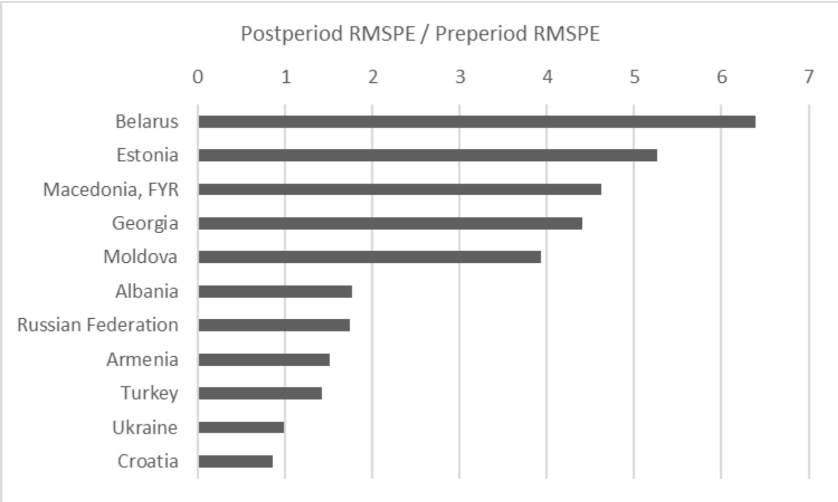
- Original donor pool + Iceland



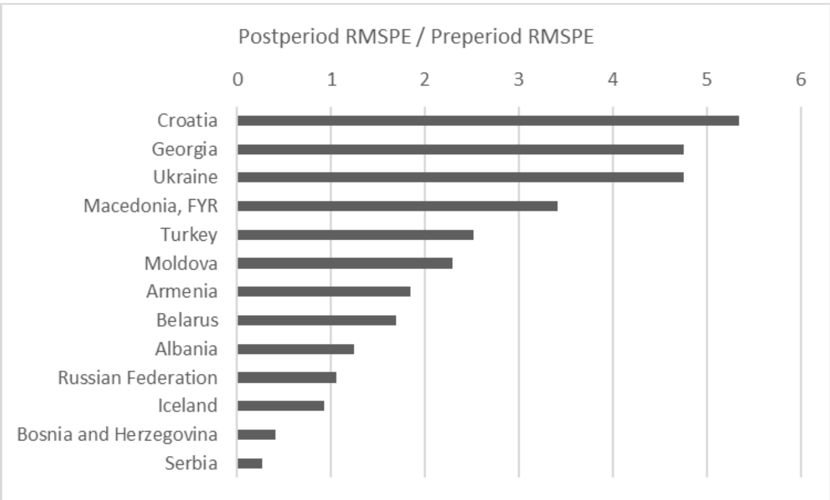
- Original donor pool + Iceland + earlier intervention year



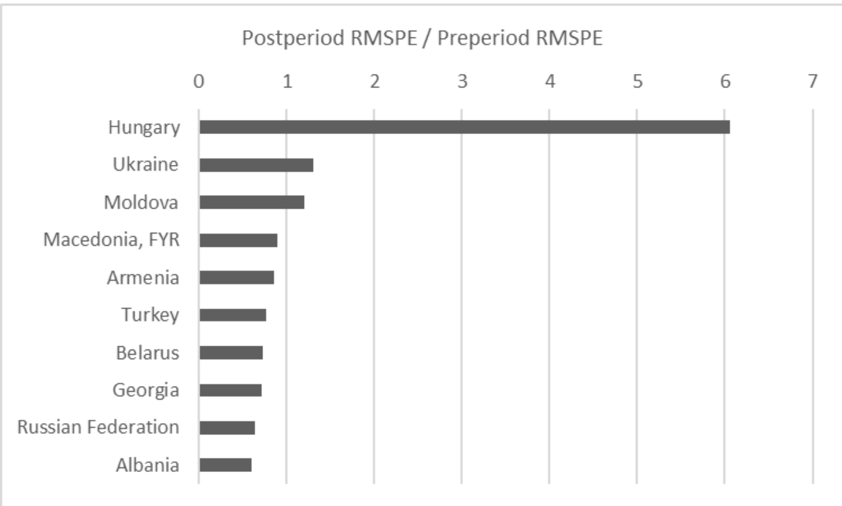
- Donor pool with Croatia (without Iceland; analysis until 2012)



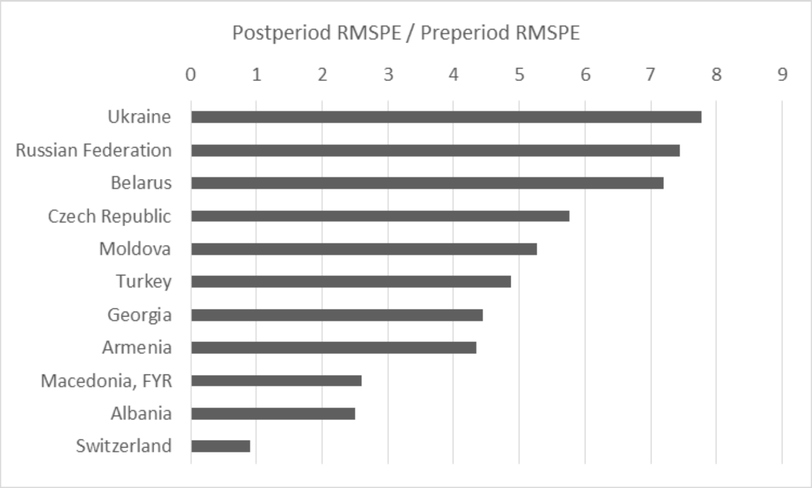
Croatia



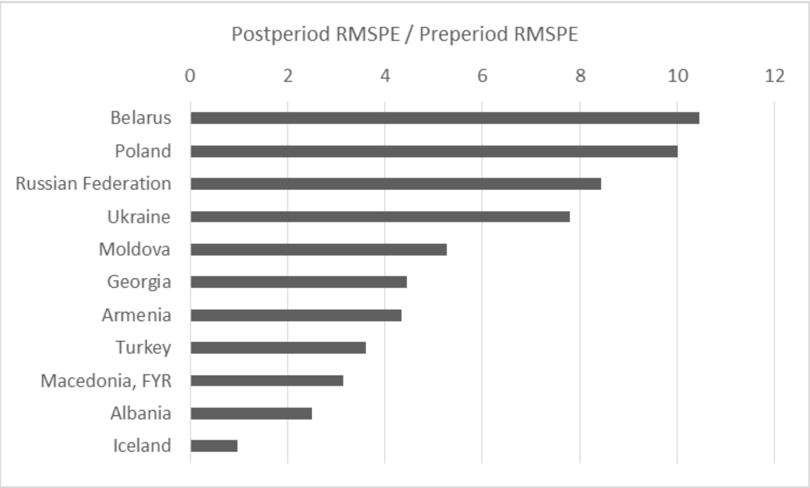
Hungary. Outcome variable – growth rate of GDP per capita



Czech Republic



Poland



Appendix G: Additional figures

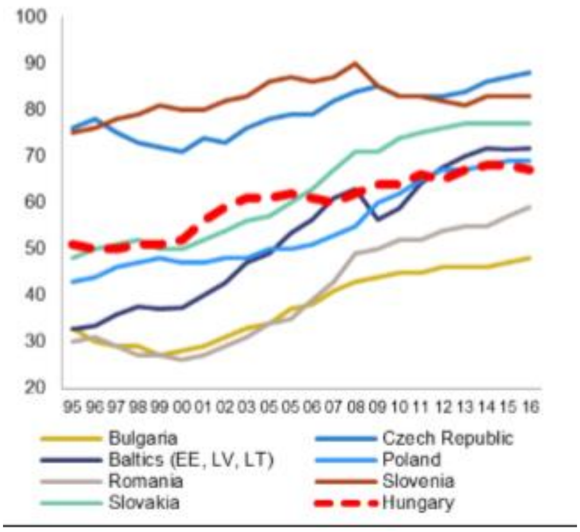


Figure 11 GDP per capita based on PPP (% of EU average). Source: European Commission (2018d)

	Jan 2004	Apr 2014
AAA	1-10 (AT,DK, FI, FR, IE, DE, NL, SW, LX, GB)	1-6 (DK, FI, DE, SW, LX, GB)
AA+	11-12 (BE,ES)	7-8 (NL, AT)
AA	13-14 (IT,PT)	9-10 (FR,BE)
AA-		11-12 (**CZ**,EE)
A+	15-16 (SI,GR)	
A	17-18 (MT,CY)	13 (**SK**)
A-	19-21 (**CZ**,**HU**, EE)	14-15 (**PL**, SI)
BBB+	22-24 (**PL**,LV, LT)	16-18 (IE, LV, MT)
BBB	25 (**SK**)	19-21 (IT, BG, LT)
BBB-	26 (HR)	22 (ES)
BB+	27 (BG)	23 (RO)
BB	28 (RO)	24-26 (**HU**,PT,HR)
BB-		
B+		
B		
B-		27-28 (CY,GR)

Source: Bloomberg, Erste Group Research

Figure 12 Long-term sovereign rating by S&P. Source: Jedlička, Kotian, and Münz (2014).