Fiscal governance in the Eurozone: How effective is the Stability and Growth Pact limiting public debt?

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14th November 2012

Abstract

The public debt crisis in the Eurozone continues to hold Europe and the World captive. Will the Euro and the fiscal mechanism of the Eurozone survive? And how about the effectiveness of this Stability and Growth Pact–did the members generally fail to comply with the fiscal rules, or, does the Eurozone need a more member–specific solution? In this article, we examine whether and how the Stability and Growth Pact influenced the development of public debt in the Eurozone countries. Our synthetic control-analysis reveals that the mechanism effectively reduced public debt in the donor countries of the EU, while many recipient countries–including Greece, Portugal and Italy–could increase their public debt by membership. This suggests that a more sophisticated fiscal mechanism is required for overcoming free-riding and moral hazard in particular recipient countries.

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The public debt crisis in the Eurozone continues to hold Europe and the World captive. Scholars and practitioners call the effectiveness of fiscal governance in the Eurozone - which is defined by the Stability and Growth Pact (SGP) among the 27 member states of the European Union (EU) - more and more into question. The pact's excessive deficit procedure defines a mechanism which should sanction countries whose government deficit exceeds 3% and debt 60% of GDP. Ever since Germany's chancellor Gerhard Schröder and France's president Jacques Chirac successfully watered down compliance with the SGP in the beginning of the 2000s, skepticism about free-riding and moral hazard is growing against the Eurozone. De Grauwe (2008, 7) for example claims that "This problem will exist as long as the nation-states maintain their sovereignty over spending and taxation, and as long as sthose who decide about spending are made accountable before a national electorate.". In spite of similar deficit and debt developments in other OECD countries, such as Japan, the United States and the United Kingdom, this skepticism againstfiscal governance in the Eurozone has been nourished by the Greek's disastrous debt record.

One problem is that the Eurozone differs from other currency zones because the Euro is a "*currency without a state*"[1] which is currently creating mistrust in the financial markets due to the inability of the members to effectively coordinate their fiscal policies. With the introduction of the Euro in 1999 these members are "sharing" credibility in a common currency zone with the effect that some could enormously raise their expenditures, in particular during the economic crisis in 2007, without reforming the structural

[1]Economist Intelligence Unit (2011, 4)

reasons for their debt. Because of the large variation in the members' fiscal policy-making interests, which range from a German price stability to an Italian inflationary policy, private investors consequently treat the Eurozone members differently than Japan, the United States and the United Kingdom (Economist Intelligence Unit 2011).

In our view, there is little theory and even less empirical evidence in this debate on the effectiveness of the Eurozone mechanism and the impact of the introduction of the Euro on public debt. Looking at the current level of public debt in the Eurozone, a common argument is that the structural contradiction of the Eurozone system has been created by the introduction of a monetary union without a fiscal union. Because the SGP imposes only little or weak common restrictions in making individual fiscal polices, the overall impression is that this system promotes incentives for prodigal member countries to excessively increase public debt at the expense of more frugal countries. However, what matters from a scientific point of view is the trajectory of the members' public debt record over time and the impact of the introduction of the Euro as a "policy shock" in 1999. Although it is often concluded that the SGP fails to constrain government spending and debt (e.g. Hallett and Hougaard Jensen 2012), this effect, despite being often interpreted and cited, has seldom been identified and measured empirically.

On closer inspection, arguments on the ineffectiveness of the Eurozone mechanism rely on either data about violations of the budget deficit criteria or a quick inspection of the current level of public debt in the Eurozone. A typical conclusion from this perspective is that there is a causal effect of joining the Eurozone, i.e., the Eurozone countries accumulate more debt.

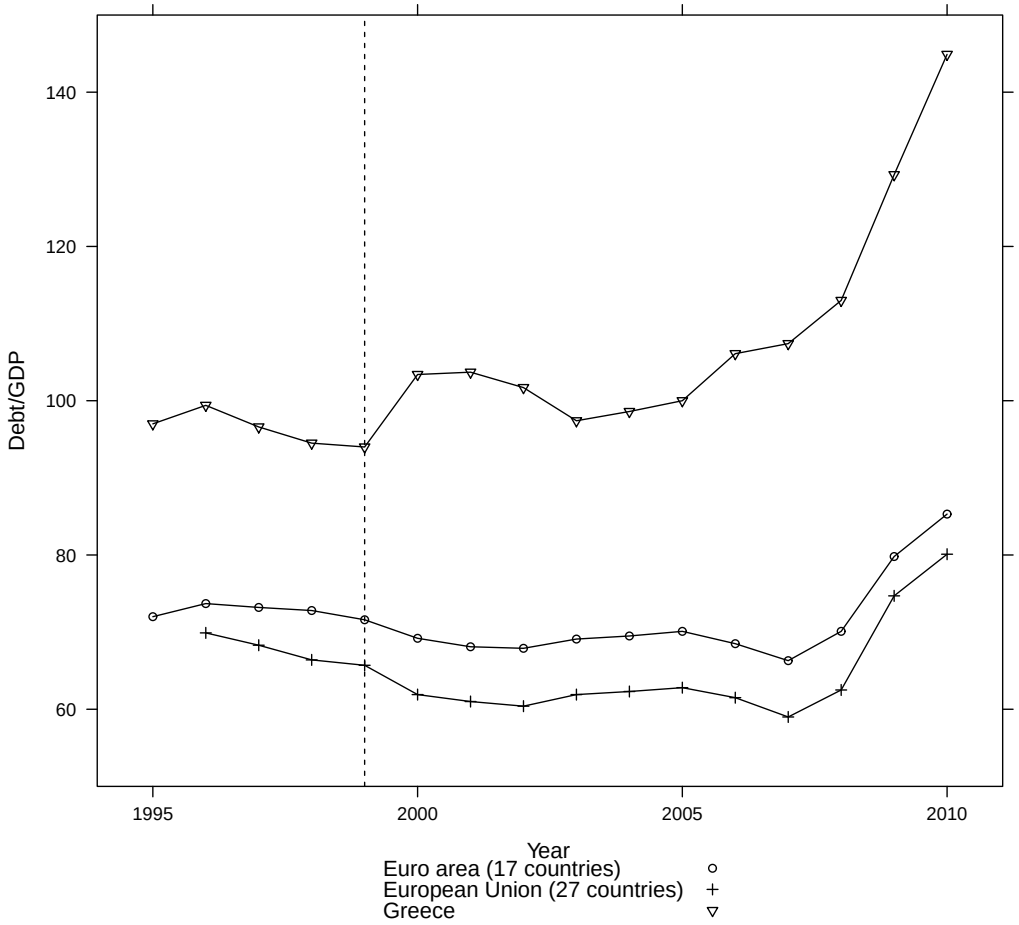


Figure 1: Time series plot of the debt/GDP ratio for selected aggregates

However, a comparison of levels of public debt and the causal effect should not be confused. For example, the graph in Figure 1 shows the time series of the debt/GDP ratio for the 27 EU member states, and the 17 members of the Eurozone as well as for Greece since 1995.

Compared to the EU as a whole, the 17 Eurozone members show a higher average of debt-GDP ratio. However, the levels of public debt in the Eurozone were higher throughout the whole period, therefore already before the

Eurozone was established with the introduction of the Euro in 1999. Obviously, the development of the averages is rather parallel. Insofar, it might be misleading to attribute the current level of public debt in the Eurozone to the introduction of the Euro. In order to assess causality we need to ask whether the level of public debt in the Eurozone members would have been different *if they had kept their national currencies*.

To answer this question, we argue that a more comparative evaluation over time and across countries is needed for an evaluation of the effectiveness of the SGP on public debt in the Eurozone. We accordingly propose to apply a quasi-experimental research design that examines the constraining effect of the SGP and thus its effectiveness to prevent from free-ridging and moral hazard in making debt in the Eurozone. We use the synthetic control method developed by Abadie et al. (2010) to calculate specific membership effects and to provide a more solid empirical basis for an evaluation of the working of the Eurozone system.[2] Key is the estimation of the development of public debt in the Eurozone for a scenario without the introduction of the Euro and comparison to the actual development. Estimating this counterfactual will better allow us to identify the effect of Eurozone membership on public debt. We believe that this insight is particularly important for understanding the SGP and reforming the mechanism in the future.

Our analysis surprisingly reveals that on aggregate for the original members of the Eurozone (including Greece) the effect is significant. In other words, the aggregate level of public debt in the Eurozone countries would be higher without the Euro. Overall, the mechanism of the Eurozone accord-

[2]A similar approach has been taken by Maier (2012).

ingly seems to work better than is commonly perceived. On closer inspection, we find that this effect is mainly caused by a lower public debt in the richer donor countries from Middle and Northern Europe, while the evidence on the poorer recipient Southern European countries is mixed. In most of these countries, the level of public debt would indeed be lower without the Euro, while Ireland and Spain reveal a more promising development. This suggests that a reform is needed with a more sophisticated mechanism, which specifically targets the reasons and incentives of specific countries with high public debt and record for non-complying with the existing mechanism.

The Euro as a policy shock - ex ante and ex post development

On 1 January 1999, the Euro was launched and became the currency of the Eurozone members. From this day onwards, the stock of public debt of the members was converted to Euros and newly debt issued in Euros exclusively. This means that the Eurozone members lost the authority over their monetary policy (Hallerberg 2002). Introducing the Euro can thus be seen as a policy experiment, which changed the conditions for the members of the Eurozone. In the beginning, the credibility of many Eurozone countries increased by signing the SGP with the effect that they received historically low interest rates for governmental bonds until recently. The former high inflation (mainly Southern recipient) countries quickly converged to interest rate levels which formerly only low inflation countries like Germany enjoyed.

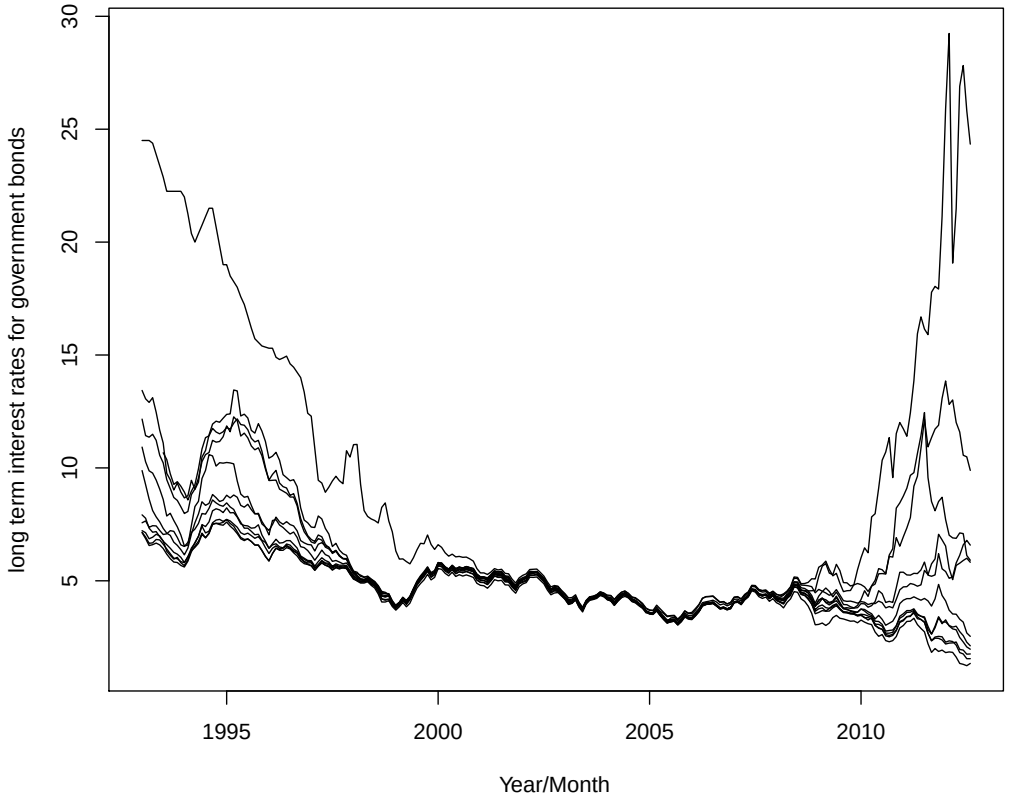


Figure 2: Time series plot of the long term interest rates for government bonds in the Euro 11 (Monthly data). Source: ECB

Countries like Greece, Portugal or Spain thus benefited from the (initial) promise to follow the "German price stability-primacy" by relative high trust of financial actors into the SGP. This development is visible from the time series plot of the long term interest rates for government bonds in the Eurozone (11 countries) provided in Figure 2.

One can easily see the convergence in interest rates starting in the end of the 1990s and divergence from 2007 onwards. As a credible ex ante control mechanism, the SGP initially reduced variation in the ex post mechanism of

interest rates. However, the fact that money was relatively cheap supposedly triggered higher public expenditure and thus higher levels of public debt in the following years (Baumgarten and Klodt 2010). Similarly, Bernoth et al. (2004) have shown that Eurozone member states had to pay lower default risk premia after joining the Eurozone. However, Hallerberg and Wolff (2008) demonstrate that this is only true if institutions are neglected. As a functioning coordination of fiscal and macroeconomic policies has not been achieved yet, this again increased divergence among Eurozone members. A common suspicion is that some governments firstly profited from the others more restrictive spending by lower interest rates, and secondly took excessive debt in the hope that they will be bailed out by their fellow members who want to sustain the common currency. The response of the fellow members may however depend on the question whether other members have voluntarily failed to comply with the rules.

Today, countries like Greece, Italy and Portugal are confronted with similar interest rates than before entering the Eurozone. For other countries like Finland, Germany and the Netherlands, the level of interest rates hardly changed. All of this seems to indicate that the confidence in the effectiveness of a common ex ante control mechanism of the Eurozone is disappearing due to a moral hazard problem, created by externalities through the adoption of the Euro. Note that is not easy to assess the extent of this problem as risk premia are found to respond positively to increases in public debt within the Eurozone (Schuknecht et al. 2008). There is no doubt that almost all countries - whether they belong to the Eurozone, EU or OECD group of states - increased their public debt in the vein of the 2007 economic crisis. The more

interesting question however is whether the SGP as the Eurozone's control mechanism generally failed or whether only some countries took advantage of their early credibility gains without reforming the structural reasons for their debt, which led to a similar divergence in interest rates than before introducing the Euro.

The consequences for countries like Greece, Portugal, and Ireland are crucial, since they came under control of the Troika[3]. While these countries need to make enormous reform efforts under the supervision of the Troika, the more recent development in the larger countries Italy and Spain is increasing the worries about the future of the Euro. These countries have a higher impact on the Euro and suffer from increasing interest rates, which threaten their ability to generate money for re-financing their public debt from private banks and borrowers. Although their interest rates are still lower than before entering the Eurozone, they have the power to demand for more support by the European Central Bank, which is already intervening into the financial market by (indirectly) buying governmental bonds of the countries in trouble. Furthermore, the EU adopted the European Financial Stability Facility and the European Stability Mechanism - a development that is raising serious concerns in countries like Germany, which is financing the largest part of these activities. This enters into a vivid debate about fiscal governance in the Eurozone and the ways how to reform the Eurozone mechanism.

[3]The Troika consists of the European Commission, the European Central Bank and the International Monetary Fund.

Fiscal governance in the Eurozone - but how?

The introduction of a common currency in 11 European countries in 1999 was a politically and historically important event which fundamentally changed the conditions for the Eurozone members and their relationship to the other non-members of the EU. Today, 17 countries adopted the Euro as the common currency and the other 10 outsiders remain co-decision makers about (any reform of) the system. The Delors report (Delors 1989) defined the blueprint for the institutional setup, which was to a large degree inspired by the theory of optimum currency areas to tackle the problems of a Monetary Union without a Fiscal Union (Mundell 1961; McKinnon 1963; Kenen 1969; Grauwe 1999; Silva and Tenreyro 2010). The result is a double strategy to deal with differences among all countries and macroeconomic imbalances within the Eurozone.

Firstly, the system of structural funds was strengthened to mitigate differences in economic development between the countries[4]. The overarching goal of the *European Social Fund* (ESF), the *European Regional Development Fund* (ERDF), and the newly created *Cohesion Fund* (CF) was harmonized. For example, the so called objective 1 is to foster economic convergence by reducing regional imbalances. This is important as higher equality of economic development leads to a better synchronization of business cycles and potentially reduces the need for highly asymmetric fiscal policies. Regions whose GDP is below 75% of the EU average are eligible for funding by the ERDF. This includes most parts of Greece, Portugal, and Ireland, as well

[4]This includes all EU member states, not only those who have already adopted the Euro.

as large parts of Spain and Italy in the funding period 2000-2006. All EU member states whose gross national income is below 90% of the EU average are eligible for funding by the CF, including Portugal, Spain and Greece in the 2000-2013 period.

Secondly, mainly due to the insistence of Germany, the SGP became an agreement among the 27 EU member states to maintain the stability of the Euro [5]. Based on Articles 121 and 126 of the Treaty on the Functioning of the EU, it consists of fiscal monitoring of members by the European Commission and the Council, and the issuing of a yearly recommendation for policy actions to ensure a full compliance with the SGP also in the medium-term. If a member state breaches the SGP's outlined criteria, the surveillance and request for corrective action will intensify through the declaration of an Excessive Deficit Procedure; and if these corrective actions continue to remain absent after multiple warnings, the member country can ultimately be issued economic sanctions.

The purpose of the SGP was to ensure that fiscal discipline would be maintained and enforced in the Eurozone. Each member state is required to run fiscal policies within the limits on government deficit spending (at most 3% of GDP); and in case of having a debt level above 60% it should each year be declining towards a level below. As outlined by the "preventive arm" regulation, all Eurozone members report their compliance by submitting regular

[5]The pact was outlined by a resolution and two council regulations in July 1997. The first regulation "on the strengthening of the surveillance of budgetary positions and the surveillance and coordination of economic policies", known as the "preventive arm", entered into force 1 July 1998. The second regulation "on speeding up and clarifying the implementation of the excessive deficit procedure", known as the "dissuasive arm", entered into force 1 January 1999.

"stability programmes", whilst non-Eurozone members submit "convergence programmes". Since the reform of the SGP in 2005, these programmes also include the *Medium-Term budgetary Objectives* of each member state, and the measures foreseen to attain the objectives of the programme. They are submitted to the Council and the European Commission with an outline for four years,which is updated annually. If a member does not comply with the deficit and debt limit, the "Excessive Deficit Procedure" is initiated along with a deadline to comply.

In the early 2000s this mechanism came under fire both practically and theoretically when Germany and France pressured the European Commission not to pursue their deficits under the Excessive Deficit Procedure. A reform of the SGP followed in 2005 which was seen as the "original sin" for the credibility of the Eurozone (Heipertz and Verdun 2010). When the economic crisis hit Europe in 2007, the system got into more strain. The developments in countries like Greece, Portugal and Ireland undermined the trust of markets in the sustainability of both public debt in the Eurozone and the Euro as a currency. This is seen as proof that the SGP had not fulfilled its purpose. For example, Hallett and Hougaard Jensen (2012, 646) claim that the SGP has failed because it was widely ignored by the Eurozone members. Schuknecht et al. (2011, 5) also conclude that "[t]he sovereign debt crisis in the euro area is a symptom of policy failures and deficiencies in-among other things-fiscal policy coordination." The result is a debate about fiscal governance in the Eurozone, including disputes about the European Central Bank's policies.

In this debate, there is almost consensus about the ineffectiveness of the

second part of the strategy, which intends to cope with macroeconomic imbalances in a currency zone of independent and sovereign states with different monetary and fiscal preferences by the SGP. For example, Ioannou and Stracca (2011) analyze the effect of the SGP on the primary balance[6] of states. Using a difference-in-differences approach to model the behavior of the primary balance of Eurozone member, they do not find a significant effect of the SGP. De Grauwe (2008, 7) claims that "it can be concluded that the SGP is a fragile institutional construction that is unlikely to lead to its objective". He attributes this effect to the accountability problem inherent in the setup. Hallerberg et al. (2009, 178) conclude that "the data suggest that the process for fiscal consolidation that started with the Maastricht Treaty was rather unsuccessful." Heipertz and Verdun (2010, 113) critically stress that the proof of the pudding was in the eating. As most scholars in this debate, they equate the effective working of the SGP with countries strictly obeying the rules. However, a violation of the rules by some members does not necessarily imply that the SGP does not effectively constrain governmental spending. To measure the effectiveness of the SGP we propose to apply the synthetic control-method for the analysis of public debt which focuses on the counterfactual of Eurozone non-membership.

Measuring the effects of Eurozone membership

From a methodological viewpoint, we conceive the introduction of a common currency together with the SGP as a policy shock for the members of the

[6]The primary balance is the overall government balance without gross interest payments for outstanding government liabilities (Escolano 2010, 1).

Eurozone which is very similar to a treatment in an experiment. While the SGP is also binding for the non-Eurozone members, the latter have a completely different incentive structure. Beetsma and Uhlig (1999) have argued that pacts like the SGP are only credible in monetary unions, because this will lead governments to internalize the effects of their debt policies on the common inflation rate. They show theoretically that governments in a monetary union should prefer compliance with the stability pact over fiscal autonomy, as this enables them to collect the long-term benefits of monetary union. The expected effect of the SGP is thus conditional on adopting the Euro.

We exploit this fact to estimate the impact of the SGP on the debt/GDP ratio of the Eurozone countries. The standard framework for assessing policy effects is the Neyman[7] framework (Imbens and Wooldridge 2009). In general, two approaches for empirical research are possible: A case based (qualitative) approach where one applies counterfactual reasoning on an individual case or a regression based approach, where on uses other cases to identify the counterfactual (Fearon 1991).

For the latter kind of research design, the difference in differences method has been the standard method for assessing such effects in observational data for quite some time. The major challenge for this method is to identify an adequate control unit (Angrist and Pischke 2009). We therefore apply the synthetic control method developed by Abadie et al. (2010) based on work by Abadie and Gardeazabal (2003), which generalizes the difference

[7]This approach is sometimes also called Neyman-Rubin or Potential Outcomes framework of causality. See also Pearl (2009) or Morgan and Winship (2007) for an elaboration.

in differences method, and offers an elegant way to model a counterfactual outcome. The method takes a middle ground between the case study design and the regression designby providing a way to conduct quantitative case studies (Abadie et al. 2010).

The synthetic control method has been developed to evaluate the effects of policy changes. Abadie et al. (2010) for example measure the effect of the introduction of California's tobacco control program on the consumption of cigarettes. Abadie et al. (2012) analyze the effect of German reunification on West Germany's GDP. The approach is also rooted in the ideas of the Neyman framework of causality. Crucial in this framework is the notion that a causal effect is the difference between the outcome we observe after a treatment by a shock or intervention in relation to the outcome we would have observed *without* the treatment (counterfactual). The *effect* is then simply the difference between the counterfactual and the observed value (Shadish et al. 2002, 5). Formally we can write this as

$$\alpha_i = Y_i^I - Y_i^N$$

where Y denotes the outcome and i indexes the unit. If a unit has received the treatment we indicate the state with a superscript I. In case of non-treatment, we indicate the state with superscript N. Note that it is logically impossible to observe both states at the same time. This provides the hardest challenge for the estimation of causal effects.

The key for estimating a causal effect is thus to construct a counterfactual outcome as a benchmark in our quasi-experimental setting. Quasi-

experimental means that the situation resembles an experiment without random assignment (see for example Shadish et al. 2002, 13). Accordingly, we conceive the introduction of the Euro as a treatment, albeit one which countries select themselves into. We identify the shock with the start of the third stage of the monetary union on 01 January 1999 where the exchange rates between the Eurozone members were fixed once and for all, and the interest rates which countries had to pay for government bonds were no longer determined individually. All electronic financial transactions within the Eurozone were carried out in Euro from 1999 onwards. In addition, countries had to comply with the Maastricht convergence criteria and the SGP. Although we decided for the year 1999 as the year which constitutes the treatment period in our study and not the year 2002 when the Euro paper money was introduced, we will check the robustness of this decision later on.

The general idea of the synthetic control model is simple and our description of the intuition closely follows Abadie et al. (2010, 494f.). First, a time series of the dependent variable of interest is given for a unit we may call 1. This unit could be a region, a country or an aggregate such as a group of countries. In our case the debt/GDP ratio is the variable of interest. A requirement is that the time series comprises both some pre-treatment periods, indicated as periods 1 to T_0 and some post treatment periods $T_0 + 1$ to T, where $1 < T_0 < T$. T_0 is the period in which the shock or intervention (the treatment) takes place.

Second, we choose a convex combination of J untreated units (i.e., countries that did not introduce the Euro) indexed from $2, \ldots, J + 1$ which minimizes the difference between the actual time series and the convex com-

bination for the pre-treatment period. This is called the synthetic control group.

Third, under the assumption that the treatment does not affect the outcome prior to the intervention or any of the other units, the difference between the actual outcome and the extrapolation of the time series for the synthetic control group approximates the causal effect of the policy intervention on the dependent variable.

More formally, we denote the effect of the intervention for unit i at time $t \in \{1, \ldots, T\}$ as

$$\alpha_{it} = Y_{it}^{I} - Y_{it}^{N}$$

where the superscripts denote treatment (I) and no-treatment (N). The ultimate goal is to estimate α_{it}. Note that the effect we are interested in also has a temporal dimension. Let D_{it} be an indicator variable which denotes the treatment status of unit i in period $t \in \{1, \ldots, T\}$. Then it must be that

$$Y_{it} = Y_{it}^{N} + \alpha_{it} D_{it}$$

Now realize that Y_{it}^{I} is given. Thus, in order to estimate α_{it} we need to estimate Y_{it}^{N}. We model Y_{it}^{N} using a factor model where

$$Y_{it}^{N} = \delta_t + \theta_t Z_i + \lambda_t \mu_i + \epsilon_{it}$$

where δ_t is a time dependent common factor with constant factor loadings across units, Z_i is a $(r \times 1)$ vector of observed covariates which are not affected by the intervention. θ_t is a $(1 \times r)$ vector of unknown parameters. λ_t denotes

a $(1 \times F)$ vector of unobserved common factors and μ_i denotes an $(F \times 1)$ vector of unknown factor loadings. The ϵ_{it} are transitory shocks (with zero mean) at the unit level. They are unobserved.

The goal is now to estimate a $(J \times 1)$ vector of weights $\mathbf{W} = (w_2, \ldots, w_{J+1})$ according to

$$\sum_{j=2}^{J+1} w_j Y_{jt} = \delta_t + \theta_t \sum_{j=2}^{J+1} w_j Z_j + \sum_{j=2}^{J+1} w_j \mu_j \sum_{j=2}^{J+1} w_j \epsilon_{jt}$$

such that the difference between the actual and the synthetic outcome is minimized. Then it can be shown that

$$\hat{\alpha}_{1t} = Y_{1t} - \sum_{j=2}^{J} w_j^* Y_{jt} \tag{1}$$

is a consistent estimator of the effect α_{it} for the periods $t \in \{T_0 + 1, \ldots, T\}$ (Abadie et al. 2010).

Our dependent variable is the population weighted average of the Debt/GDP ratio for 11 out of 12 of the original Euro members[8] (Euro 11) for the years 1980-2010. Due to problems with data availability we had to drop Luxembourg[9]. As the population weight of Luxembourg in the period of interest lies between of 0.0013 and 0.0016 this is not distorting the calculations too much, despite the relatively low values the Debt/GDP ratio usually assumes in Luxembourg. In fact, the potential bias would rather increase the effect we find. Thus, using the Euro 11 aggregation of the Debt/GDP data would

[8]The original members are: Finland, Ireland, Belgium, the Netherlands, Luxembourg, France, Germany, Austria, Italy, Spain, Portugal, and Greece.

[9]Data for Luxembourg are only available from 1995 onwards, which is a problem in many comparative evaluations, see for example the 2006 ECOFIN report on Public Finances in the EU (ECOFIN 2006)

slightly underestimate the actual effect making it a conservative approach. Technically, Greece joined the Eurozone only in 2001. However, Greece was already preparing for joining the Eurozone and its exchange rate was tied to the Euro from 1999 to 2001 which constitutes effectively the same treatment which the other members received (Batzoglu et al. 2011). Because the consequences for the actions of the Greek government were similar to the ones of the other members faced, we add Greece for assessing the overall effects already from 1999 onwards.

We use the data of Reinhart and Rogoff (2010) which offers the most comprehensive time series of public debt data for the period of interest (1980-2010). For calculating the average Debt/GDP ratio of the Euro 11 countries we use their population weighted average. The population data are taken from the World Bank database. The procedure of aggregating the treated units is in line with the suggestions of Abadie et al. (2010, 494) and Abadie et al. (2012). In effect we thus analyze an average treatment effect (ATE)[10], not an individual treatment effect, where

$$ATE = E[\alpha_{it}]$$

is the expectation of the effect across units and time periods.

In a second step, we will distinguish two Eurozone groups of interest, donor and recipient countries, before we assess Greece as an individual unit. The recipient countries are those countries within the Euro 11 who benefit the most from the structural funds. They are Greece, Portugal, Italy,

[10]See for example Angrist and Pischke (2009, chapter 3) for an elaboration on average treatment effects and their estimation.

Variable	Source	Minimum	Maximum	Mean
Population (65+)	OECD	3.869	23.013	13.154
Population (0-14)	OECD	13.06	44.14	20.50
GDP (US$, millions)	OECD	2739	14447100	1144047
Openness[a]	OECD	0.1227	3.1955	0.7274
Tax revenue/GDP	OECD	8.807	49.725	25.359
Unemployment (%)	World Bank	0.600	31.200	8.161
CO_2 emissions (tons/capita)	World Bank	0.0468	30.2806	5.4286
inflation (consumer prices)	World Bank	-9.601	5.809	11749.640
Type of Political System	DPI	0	2	
Years left in current term	DPI	0	7	
Executive Party orientation	DPI	0	3	
Unified Government	DPI	0	1	
Legislative election in year t	DPI	0	1	
Plurality System	DPI	0	1	
Proportional Representation	DPI	0	1	
Political Constraints	DPI	1	18	

Table 1: Variables used to construct the counterfactual Euro 11 and their sources

[a]Own calculation based on OECD data. We used the standard definition of (exports + imports)/GDP

Ireland, and Spain. The rest of the Euro 11 countries constitute the donor countries. This group comprises of Germany, the Netherlands, Belgium, Finland, France, and Austria. This is an important distinction because the discussion about fiscal governance also centers around expanding this fiscal mechanism to cope with the problems at stake. We take a closer look on recipient countries and Greece to inspect variation in this group.

We use the same political and economic variables to model the synthetic Euro 11, donor and recipient countries as well as Greece. Political variables are widely used for the theoretical and empirical explanation of public debt (see for example Hallerberg et al. 2009). For this purpose, we rely on data from the 2010 update of the world bank database of political institu-

tions (DPI)[11] which provides a comprehensive collection of variables that are important in this literature like the ideological position of the government. Briefly summarized, leftist governments should *ceteris paribus* be more likely to run budget deficits (Alesina and Tabellini 1990). The variable we use codes the positions from leftist (0) to rightist (3). Electoral competition should matter due to political business cycles. Governments are expected to increase deficits before an election in order to improve economic performance for the sake of reelection (Persson and Tabellini 2000; Battaglini 2011). We thus include two variables to capture this effect. We include a dummy variable which is one in case that the year is an election year and have another variable which codes the years which are left in the current term. The number of veto players is important as more veto players make it harder to change the structure of the budget or the trajectory of public debt (Tsebelis and Chang 2004; Bräuninger 2005). We thus include the political constraints variable, which captures the number of veto players. In addition we use a dummy variable indicating unified government to capture this effect too. Finally, (Hallerberg et al. 2009) highlight institutional aspects, like mandatory debt ceilings and strong finance ministers both of which should reduce the likelihood of excessive deficits. We include the type of the political system, as (Persson and Tabellini 2003) shown that presidential regimes have smaller governments. The mechanism is mediated by the electoral system, so we include variables for proportional representation and plurality rules, which code the different types of systems.

[11]For details see Beck et al. (2010). The coding of the `system` and `checks` variables in the dataset is according to Keefer and Stasavage (2003)

The economic variables are taken from the OECD and the World Bank databases. Table 1 gives an overview of the variables we used and their source. Our economic variables comprise the percentage of children and retired people as a proxi for spending demands. The GDP measures economic power, because stronger countries might have higher chances of acquiring debt. More open countries potentially face stronger asymmetric shocks, which might increase the need for fiscal measures to stabilize the country. The tax revenue is the complement of public debt in the sense that all public expenditure has to be financed by taxes or debt and its importance has been highlighted in Romer and Romer (2010). Higher taxes should ceteris paribus reduce the need for running deficits. Unemployment potentially increases the levels of debt due to higher benefit payments and the fact that unemployment is usually higher during recessions, which should go hand in hand with increasing deficits. Because countries with high levels of debt might be tempted to print money in order to finance the debt, the resulting inflation should help to predict the level of debt. We also included the lag of the debt/GDP ratio. This is important as the level of debt in a given year is not independent from the level of debt in the year before. We usually do not observe extreme jumps or reversals in the levels of debt as changes in the level of debt are due to changes in the primary balance.

For the following applications we selected for each analysis those variables from the set of available variables which produced the best fit between the actual development of the Debt/GDP ratio and its counterpart in the pretreatment period as is suggested in Abadie et al. (2010). We thereby had to restrict the countries available to construct the synthetic counterfactual to

Country	Weight	Country	Weight
United States	0.292	Denmark	0
Canada	0.173	Iceland	0.205
Mexico	0	Korea	0.047
United Kingdom	0	Japan	0.206
Sweden	0	Australia	0
Norway	0.076	New Zealand	0

Table 2: Country weights for synthetic control unit

12 countries. Table 2 shows these countries and their weight in the synthetic control group. Note that not only the countries receive a specific weight in any of the synthetic control studies, but also the variables.

Restrictions were necessary due to problems in data availability and concerns about the similarity and thus the comparability of countries. In addition, only EU member states that have not adopted the Euro are available for the synthetic control unit, as the other member states are subject to the same treatment whose effect we seek to measure. The twelve remaining countries are either EU member states or OECD member states or both. From this pool of countries, only the United States, Canada, Norway, Iceland, Korea, and Japan are used with a significant weight. The weight of the United States is the largest being followed by Japan and Iceland on position two and three[12]. Table 3 gives an overview of the size of several independent variables for the synthetic control group and the actual values. For reasons of comparison the sample mean is shown in the last column. At least for the variables with a significantly high weight, the values of the synthetic control group are closer to the true value than the sample mean. We are thus con-

[12]See also the dotplot of weights for all analyzes in the appendix

	Treated	Synthetic[a]	Sample Mean[b]
Population 65 and over as % population	14.44	11.74	11.86
Population under 15 as % population	17.98	21.68	22.72
Years in current term	1.75	1.63	1.61
Ideological position of executive	1.88	1.55	1.84
Unified government	0.10	0.11	0.35
Legislative election	0.28	0.34	0.32
Plurality rule	0.68	0.72	0.67
Proportional representation	0.80	0.54	0.69
Checks	5.02	4.34	3.99
GDP (US $, current prices, current PPPs, millions)	871235.47	2257304.89	924396.54
Tax revenue (excluding social security) as % GDP	23.52	24.16	27.73
CO_2 emissions (metric tons per capita)	8.54	12.64	10.01
Inflation, consumer prices (annual %)	3.35	6.15	9.11
Unemployment, total (% of total labor force)	10.83	5.48	6.05
Openness	0.53	0.42	0.51
lag of Debt/GDP	48.60	48.99	46.27

Table 3: Comparison of values for independent variables (Euro 11)

[a]Countries weighted by population
[b]All countries are weighted equal

fident that the projections which we obtain from using the synthetic control method are better than simply using the mean.

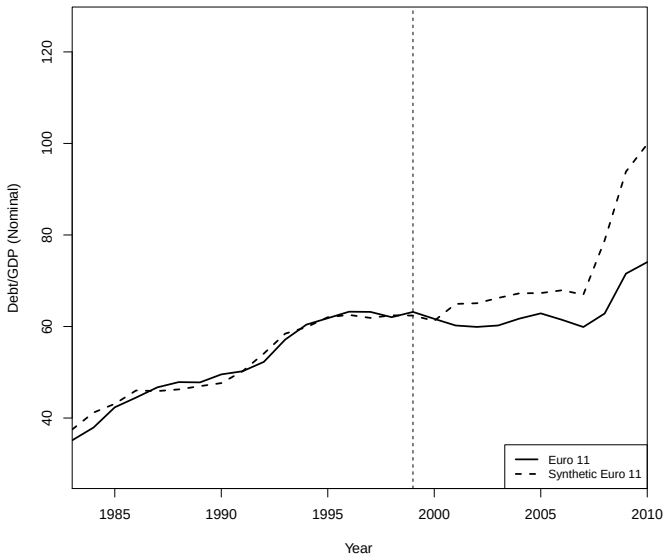
According to table 3, the values between the Euro 11 of the treated column are similar to those of the synthetic control group with weighted averages of the country values. Of particular importance is a similarity of values for those variables who have the highest weight in the determination of the dependent variable. These weights are shown in table 4 in the Appendix. Tax revenue is the variable with the highest weight (0.51), followed by the lag of public debt (0.21). From the set of other variables, most political variables have significantly higher weights than the economic variables for most of which the weights are much smaller than 0.01.

As the synthetic control method is a rather new method some points deserve clarification. Firstly, our sample selection. One could argue that the Stability and Growth Pact is binding for all EU member states, so they should face the same treatment. However, our argument is that the introduction of the Euro constitutes a policy shock which affects the working of the SGP. So effectively only the Eurozone members were treated. Secondly, the synthetic control method operates on a pure data basis. Theoretically, any variable which might help to construct the counterfactual could be used. We have used only variables which are theoretically justifiable. However, we do not claim that there is an underlying general theory of public debt making in OECD countries. The weights used for the construction of the counterfactual are not equivalent to regression coefficients.

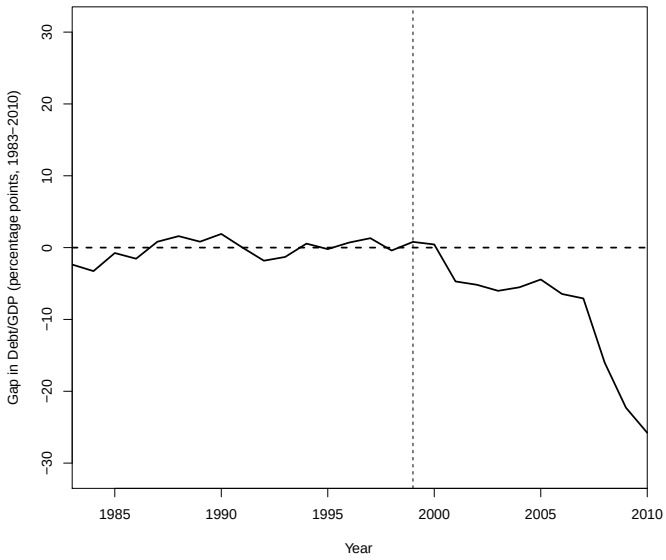
Results

The results of the synthetic control analysis for the Euro 11 are plotted in Figure 3a. The solid line shows the time series of the debt/GDP ratio for the Euro 11 group of countries. The dashed line shows the synthetic approximation (prior to 1999) and its extrapolation from 2000 onwards. The curve for the synthetic control unit matches the actual development of the Debt/GDP ratio in the pre-treatment period closely. This makes us confident that the extrapolation beyond the treatment period is a close approximation to the counterfactual we aim to measure.

In the year 2000 the two curves start to diverge. The curve for the synthetic control unit lies constantly *above* the actual curve and the difference is increasing over time. We thus predict that the average treatment effect of joining the Euro is *negative*, i.e., the levels of public debt are actually *lower* than they would have otherwise been. The effect is persistent and seems to be rather accelerating than to be leveling out. Figure 3b shows the development of the difference between the two curves over time. A potential problem has to be discussed here, namely that of self-selection of countries into the Eurozone. Could it be that the results are driven by a selection of the best performing countries into Eurozone membership? We think this is very unlikely, given that most countries did not comply with the regulations upon the start of their membership in the Eurozone. Several countries (e.g., Belgium, Italy, Greece) also did not meet the 60% rule. Moreover, a couple of non-Euro states are persistently performing better in the sense of the SGP than many Euro states do.



(a)



(b)

Figure 3: Results for the comparison of the Euro 11 group of states and its Synthetic counterpart (1983-2011)

The difference increases up to 16 percentage points in 2010. However, the data from 2007 onwards have to be treated with care, as the economic crisis constitutes an asymmetric shock which affected the budgets of all countries. In consequence, the confidence in the accuracy of the counterfactual from 2007 onwards is lower than for the period 2000-2007. Nevertheless, the trend in the period of study is clear. While the maximum difference before the introduction of the Euro in 1999 is 2.96 percentage points (in 1984) the maximum difference between the two curves is 27.77 percentage points in 2010. Even in 2007 the gap is already 8.59 percentage points.

Over time, the average effect is 2.52 percentage points per year. At first sight, this does not seem much, but it actually is. If we convert this result into monetary units we see that on average the Euro 11 countries would have increased the level of public debt by USD 45 billion (Euro 36 billion[13]) more *per year*. The combined debt in the Euro 11 in 2010 would thus have exceeded the actual level by approximately 397 billion Euros, which is more than the 2010 level of Greece's total public debt (Euro 357 billion). If we use the year 2007 as the relevant year for calculating the average effect in order to circumvent the potential problems of asymmetric shocks caused by the crisis, we still expect a yearly difference of Euro 17.1 billion.

Our result clearly contradicts the common claim that the SGP did not serve well to effectively constrain government spending. While we observe multiple violations of the SGP rules by many Eurozone members following

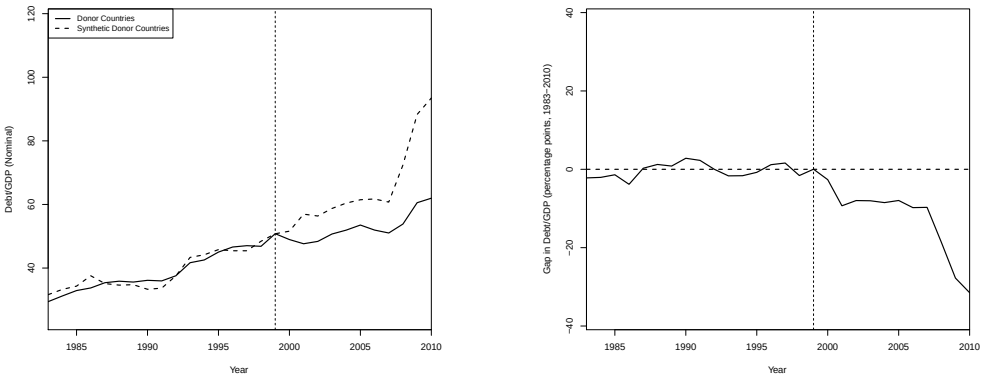
[13]calculation is based on the average GDP of the Eurozone for the years 2000-2010. The conversion of Dollar units to Euro units is based on the average USD/Euro exchange rate for 2010 as reported by the US Internal Revenue Service `http://www.irs.gov/Individuals/International-Taxpayers/Yearly-Average-Currency-Exchange-Rates`

the "original sin" of France and Germany, we find that the provisions still did reduce debt development in the aggregate. In the end, the debt/GDP ratio aggregated for the Euro 11 would have been higher as consequence of a negative treatment effect. Admittedly, this effect may be lower than originally intended by the authors of the SGP, but the actual effects of the constraints are substantial. The SGP thus seems to be an effective ex ante mechanism that reduced the overall levels of public debt in the Eurozone.

However, as Hallerberg et al. (2009) have demonstrated, the aggregate view might mask individual differences. Close inspection of the development of the debt/GDP ratio within the original Eurozone members is given in Figure 13 (in the appendix) revealing that there is considerable variation in the development of the Debt/GDP ratio between the countries. We therefore disaggregate the analysis by splitting the Euro 11 into two subsamples and repeating the analysis. On the one hand, we analyze the development of a group which are *donor* countries with respect to financial transfer payments by the EU structural funds. This group comprises of Germany, the Netherlands, Belgium, France, Finland, and Austria. The second group are *recipient* countries with respect to transfers by structural funds[14] and comprises of Portugal, Italy, Ireland, Greece, and Spain. For both groups of countries we again aggregate the debt/GDP ratio using population weights.

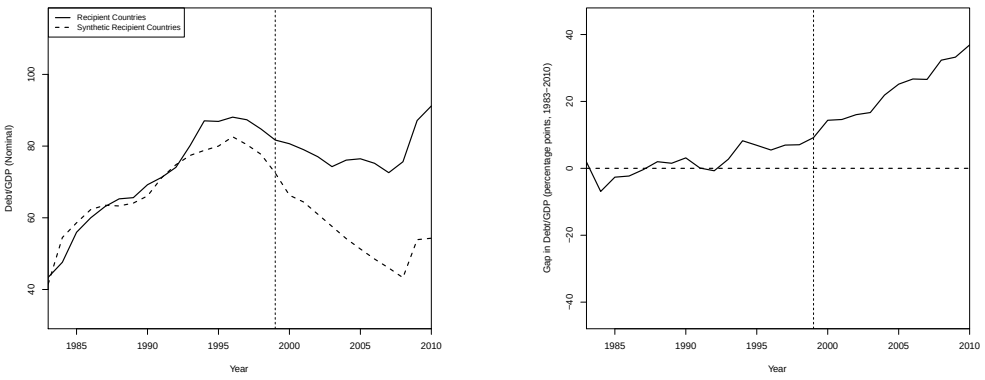
Figures 4a and 4b show the results of the analysis for the donor countries. A striking finding is that the synthetic control group shows again *higher* Debt/GDP ratios for the synthetic control unit. That is, we find a negative

[14]Sometimes the group of countries is also referred to as PIGS or PIIGS, which we reject due to its pejorative connotation.



(a) (b)

Figure 4: Results for the comparison of the donor countries and their synthetic counterpart (1983-2010)



(a) (b)

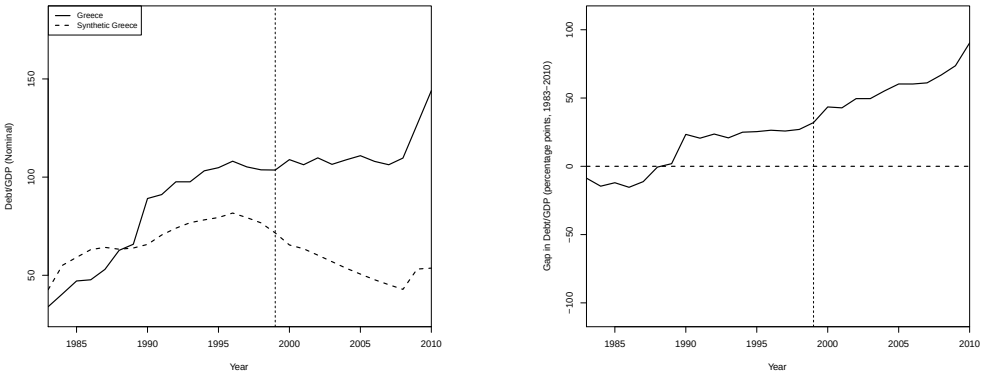
Figure 5: Results for the comparison of the recipient countries and their synthetic counterpart (1983-2010)

effect on the debt/GDP ratio for the donor countries. As far as free-riding, moral hazard and other problems are concerned the SGP seems to constrain these governments effectively. And after all those countries are not directly punished by the markets with higher interest rates.

The picture is quite different for the recipient countries. Figure 5a and

5b show our estimates. The general fit of the synthetic control group is not as good as in the case of the donor countries. The reason for this is, that Ireland, Italy and Greece had already quite high levels of public debt in the pre-treatment period (especially in the beginning and mid 1990s). Thus, it is harder to find a convex combination of non-treated countries in our sample which could closely approximate the pre-treatment curve. Inspecting the curve we find that the general trend in the pre-treatment period until 2007 is slightly negative for the recipient countries. However, the general pattern reveals that in the case of the recipient countries the treatment effect is positive. Without the introduction of the Euro their debt/GDP ratio would be lower than it actually is. Apparently, the SGP hardly works in those countries which did not reduce their debt as they would have done without the introduction of the Euro. This finding supports the impression on free-riding effects by countries which benefited from lower interest rates in the beginning.

But what about the role of Greece? Is this country driving the results of the recipient group? To answer these questions we disaggregate the analysis even more. The figures 6a and 6b show the results for Greece. Unsurprisingly, the fit of the actual development of Greece's debt/GDP ratio and the counterfactual is rather poor. The problem in modeling a single country's development lies in the exceptional pattern of Greece's long term public debt, which is illustrated by Figure 7. The ratio is quite low until the beginning of the 1980s. It starts to accelerate dramatically when Greece entered the EU in 1981. The debt kept on piling up until the end of the 1990s. Since then it is relatively stable with several minor ups and downs until the economic crisis



(a) (b)

Figure 6: Results for the comparison of Greece and its synthetic counterpart (1983-2010)

hit in 2007. The development of debt in the 1980s and early 1990s is very exceptional and therefore difficult to model as a convex combination of other countries whose debt dynamics are more moderate. But it also questions the notion of Greece's levels of debt being caused by joining the Eurozone. The pattern rather suggests that Greece's debt exploded when Greece joined the EU in 1981.

If, despite the relatively poor fit, one takes the results at face value one would conclude that the effect for Greece was positive. However, the fact that the gap between Greece and its synthetic counterpart is widening after the treatment should not be overestimated. Canada has a very high weight in the synthetic control group. It is thus mainly the result of Canada's negative trend in the development of debt in the early 2000s.

Looking at the development of the other four countries in this recipient group (Ireland, Portugal, Italy, Spain) the results provide different pictures.

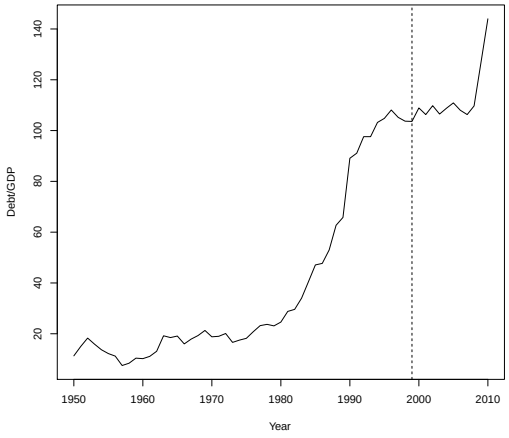


Figure 7: Greece's Debt GDP Ratio 1950-2010

The fit in the case of Spain and Portugal is very good. The one of Ireland and Italy is again not too convincing. While we see a negative treatment effect for Spain, and less clear, but potentially for Ireland, we find a positive treatment effect for Italy and Portugal (similar to Greece). This may indicate that a free-riding problem is not only present but also moral hazard does exist in particular for the latter group of countries. As not all countries are equally affected, we conclude that the SGP also works to some degree for some recipient countries. However, to increase compliance in the Eurozone of a large country like Italy, a more sophisticated mechanism would be needed. While smaller countries like Greece, Ireland and Portugal are supervised by the Troika, larger countries seem to have the power to escape from sanctions.

How confident can we be in the predictions of the method? How robust are our findings? There are two general ways to check the robustness of the results. One way is to compare the effect within each case by shifting the treatment periods and compare the size and direction of the estimated effects

with the effects obtained by setting the real treatment period, a so called placebo study (Abadie et al. 2012, 16f). We ran the synthetic control study for the Euro 11 countries and varied the treatment from 1988 to 2001. We thus effectively check if we find a significant effect for an arbitrary treatment year. We would conclude that our findings are non-substantial, if we found a comparable effect for all or most of those placebo studies. For every treatment year up to 1997 the gap between the actual and counterfactual outcome is *positive*, indicating that we would expect a higher debt GDP ratio than the one observed. This effect turns negative in 1998, albeit not as clear as compared to the treatment effect we estimate for 1999. This strongly suggests that the method indeed captures the unique effect of the SGP in 1999. This also rules out the possibility, that the driving force behind our findings is actually compliance with the Maastricht criteria. Figures 18 – 21 in the appendix show the results of our robustness checks for selected years.

An alternative way to check the robustness of the results in a cross-sectional setting by comparing the effects obtained from using the real treatment period but applying the method to untreated units. This type of analysis is used by Abadie et al. (2010) in their study of the effects of the Californian Tobacco Control Program on tobacco consumption. We accordingly estimated the effects of a hypothetical treatment in 1999 for a couple of OECD countries. For the United States, the United Kingdom, Japan, Korea, and Turkey the effect is positive. For Mexico and Canada the effect is sometimes positive and sometimes negative. For Chile it is negative, too. This shows that while the method would estimate significant effects for other countries, the effects are in most cases opposite to our finding for the Euro

11. The effect for the Euro 11 is different from the effects of other states which raises confidence with our results.

Conclusions

The high levels of public debt in many of the Eurozone countries is seen as the major threat for the survival of the Euro. But where should Europe and the Euro go from here? Do we need a complete makeover of the institutional framework to ensure the survival of the Euro? Or is it impossible to overcome the shortcomings of the SGP by the current reforms to manage the levels of public debt in some countries? To answer these questions we have used the synthetic control method developed by Abadie et al. (2010) to estimate the effect of joining the Eurozone on the development of public debt.

This method conceives the introduction of the Euro as a policy shock to the Eurozone members, which committed to apply the Maastricht criteria of the SGP. With the joining of the Eurozone, some members profited from their promise to follow the German model of the SGP by historically modest interest rates for governmental bonds. As an ex ante control mechanism, the SGP accordingly increased credibility of former high inflation countries. During the economic crisis in 2007, the common currency therefore facilitated to overcome the crisis by increasing expenditures without reforming the spending.

We checked the robustness of our findings in several ways. The tests reveal that our finding that the aggregated level of public debt in the Eurozone would have increased much more than it actually did if the countries

had not joined the Eurozone is not an artifact of the data. On average the governments of the 12 original members of the Eurozone would have accumulated another Euro 36 billion in public debt every year since the introduction of the Euro. By 2010 the accumulated effect was bigger than the absolute level of Greece's total debt in 2010. This result draws another picture on the effectiveness of the SGP on constraining government spending. Overall we conclude that the effectiveness of this mechanism is much higher than is usually claimed in the literature.

On closer inspection we find that this effect was stronger for the donor states (Germany, France, Netherlands, Belgium, Finland, Austria). We have shown that their debt/GDP ratios are lower than one would expect. In the EU, donor countries transfer money to recipient countries to overcome structural imbalances. For the recipient countries, our findings are mixed (Portugal, Italy, Ireland, Greece, Spain). According to our estimates, in some of the recipient countries the debt/GDP ratio would have grown less strongly without the Euro. We conclude that a free-riding and moral hazard problems exist but they hardly exist in all recipient countries. Countries like Ireland and Spain did quite well under the mechanism, while a more sophisticated mechanism is needed to overcome moral hazard in recipient countries, which have ignored the SGP.

We believe that our findings do not exclusively apply to the Eurozone. A look at the German system of fiscal transfers between the federal states (Länderfinanzausgleich) shows that persistent differences exist between the donor and recipient states in what concerns their public finances. Some states systematically accumulate more debt than others and changes in the status of

recipients and donors are almost non-existent. In other words, introducing an overall system of fiscal transfers might not help, although the German example shows that Europe in the end might be able to live with some differences in the development of public debt. Whether a debt brake will help in Europe and Germany will be answered by the future development.

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A Appendix

Variable weights for Euro 11

variable	weight
Population 65+	0.0013
Population 0-14	0.0058
years in current term	0.0465
executive position	0.0197
divided government	0.0308
legislative election in year t+1	0.0150
plurality	0.0709
proportional representation	0.0055
checks	0.0577
GDP	0.0000
Tax Revenue	0.5198
CO2 emissions	0.0001
Inflation (consumer prices)	0.0085
Unemployment	0.0049
openness	0.0000
lag Debt/GDP	0.2136

Table 4: Variable weights for Synthetic Euro 11

Country weights in synthetic control studies

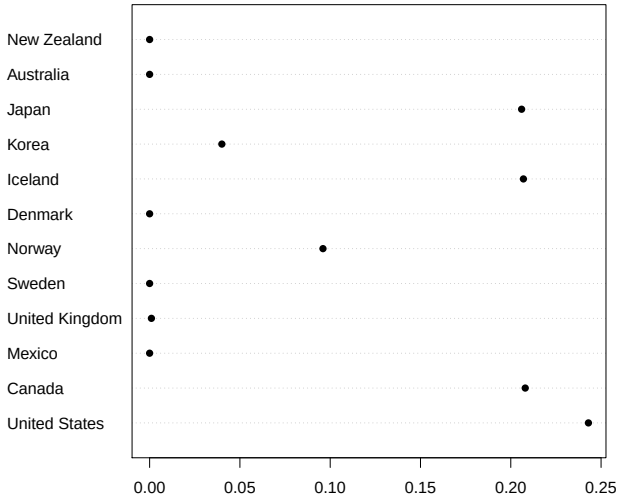

Figure 8: Weights of countries in synthetic control group for Euro 11

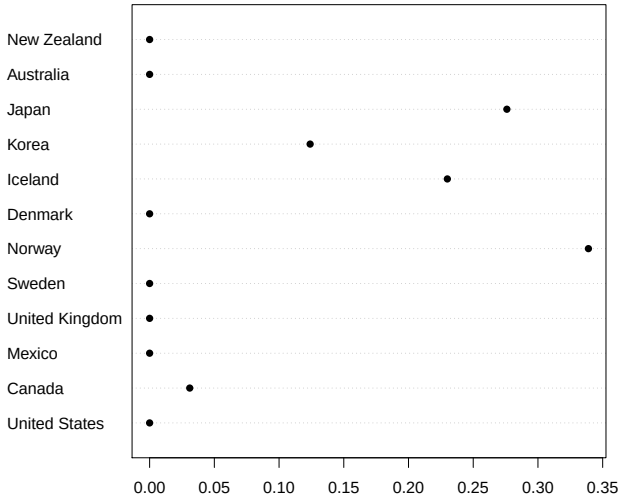

Figure 9: Weights of countries in synthetic control group for donor countries

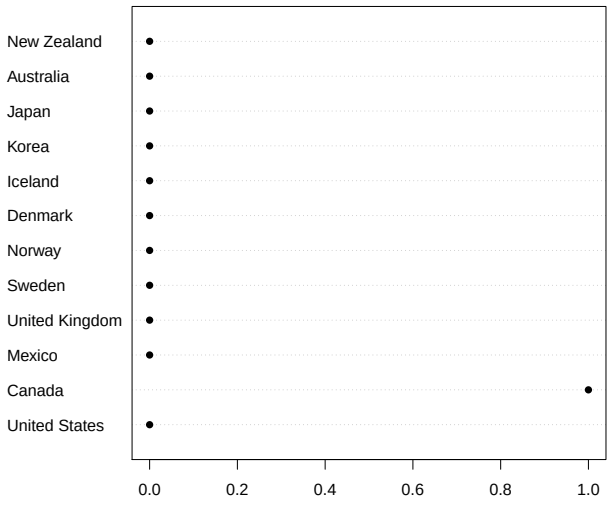

Figure 10: Weights of countries in synthetic control group for recipient countries

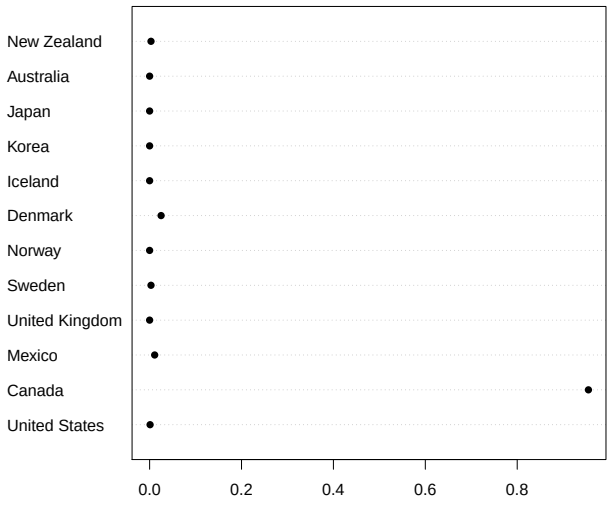

Figure 11: Weights of countries in synthetic control group for Greece

Time series of debt/GDP ratio

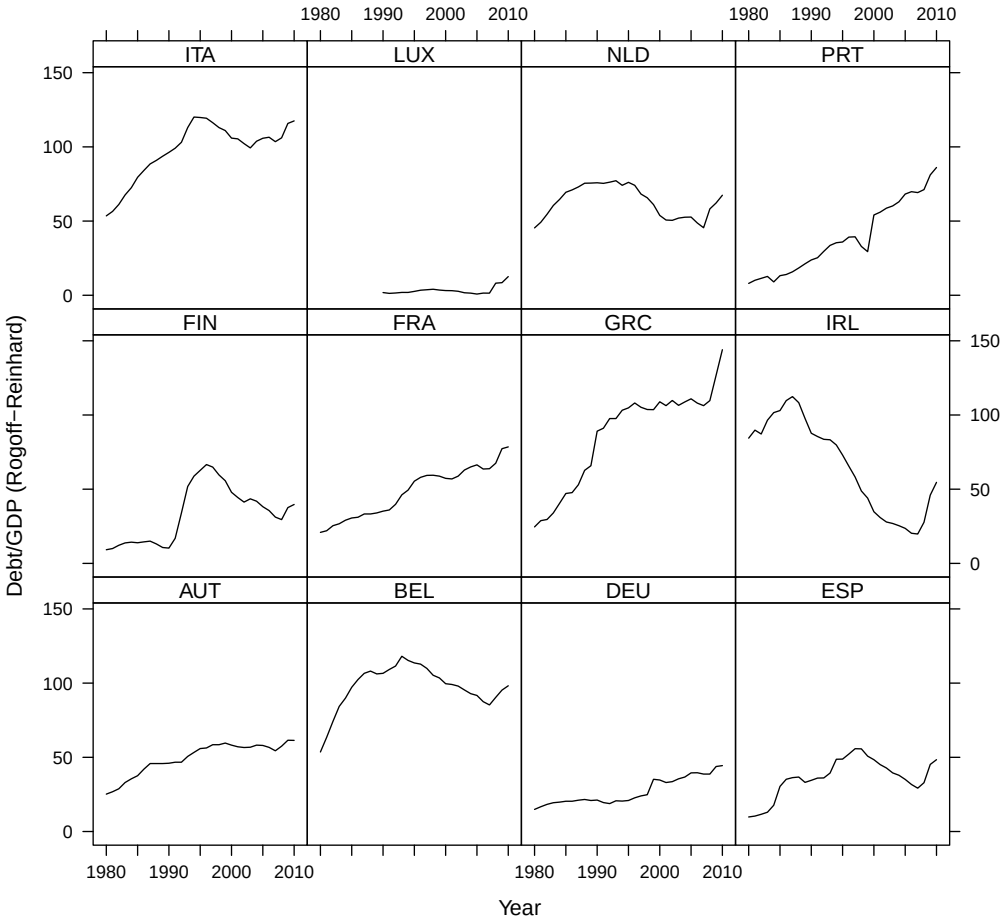

Figure 12: Time series of Debt/GDP ratio for EA-12 (1980-2010)
source: Reinhart and Rogoff (2010), Luxembourg data taken from EUROSTAT

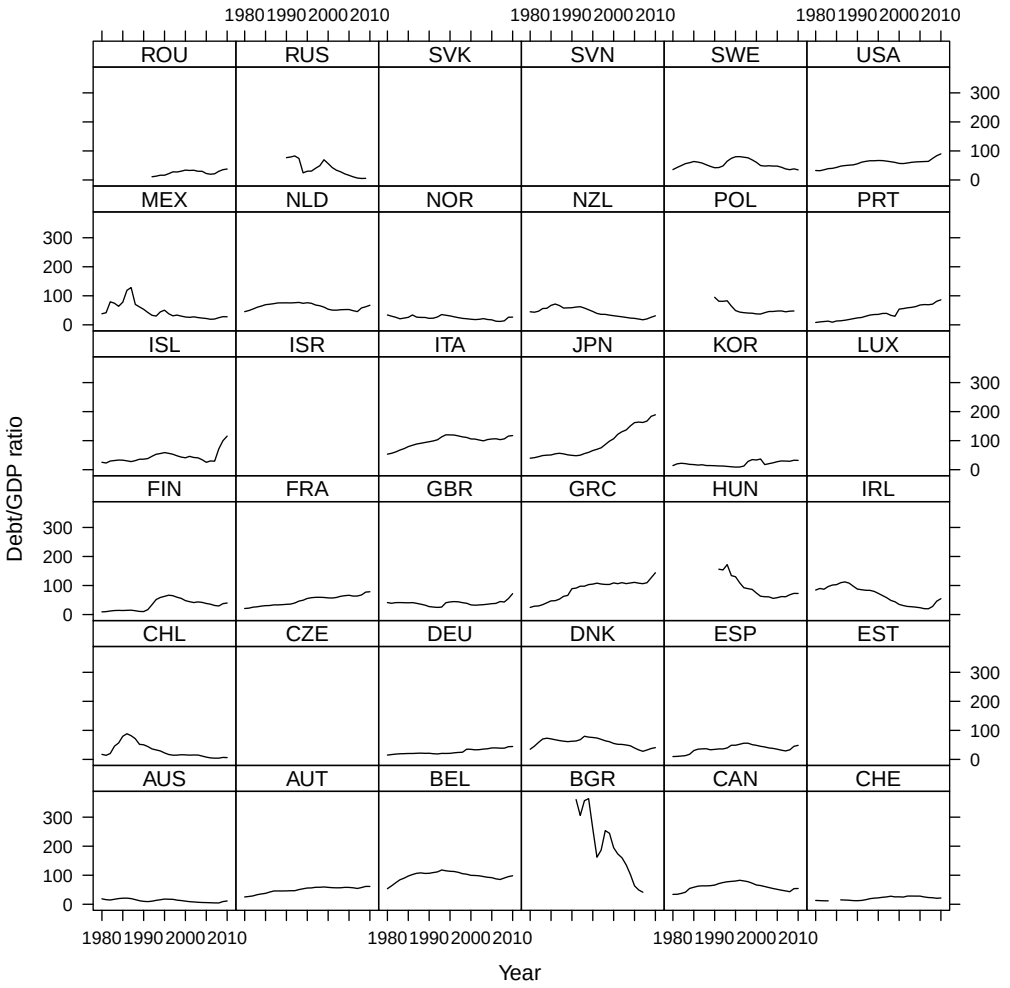

Figure 13: Time series of Debt/GDP ratio for OECD and major European countries (1980-2010)

Plots of Synthetic Control Analyzes for Individual Countries

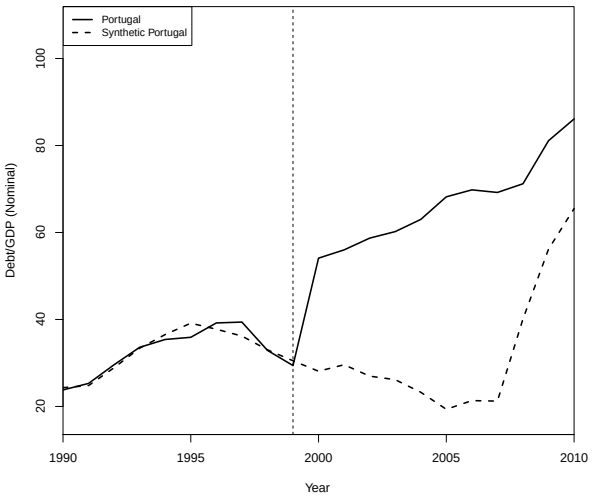

Figure 14: Results for the comparison of Portugal and its synthetic counterpart (1983-2010)

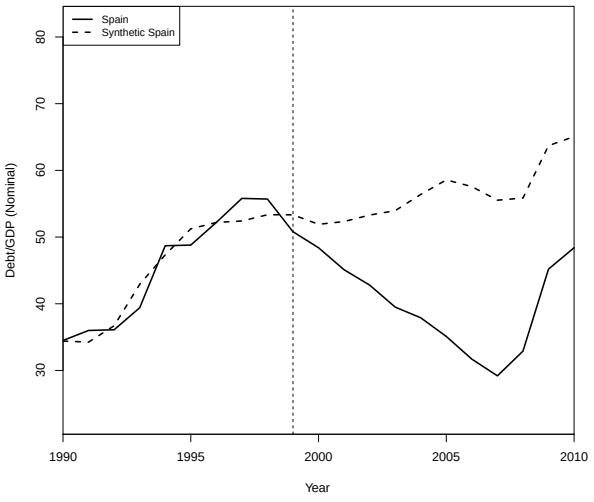

Figure 15: Results for the comparison of Spain and its synthetic counterpart (1990-2010)

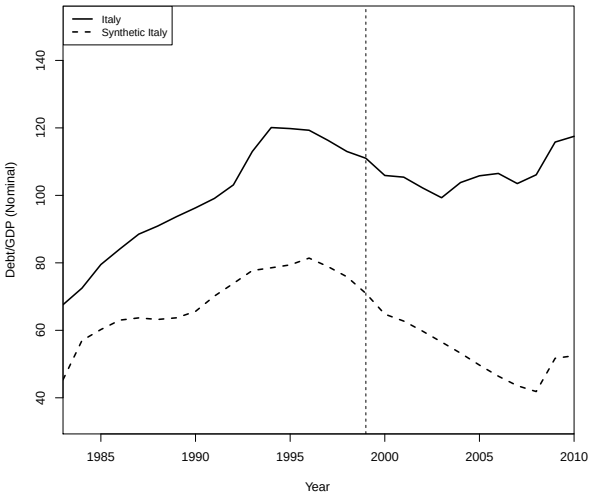

Figure 16: Results for the comparison of Italy and its synthetic counterpart (1983-2010)

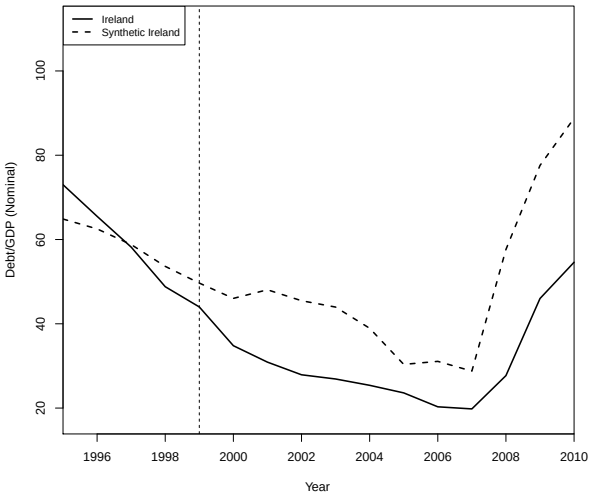

Figure 17: Results for the comparison of Ireland and its synthetic counterpart (1995-2010)

Robustness checks

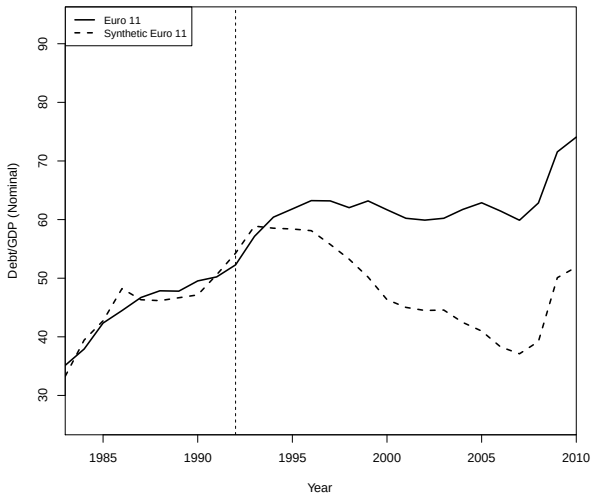

Figure 18: Results for the Euro 11 using 1992 as the treatment period

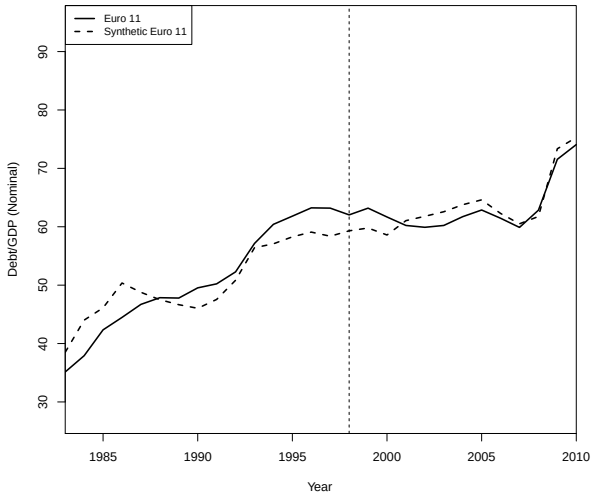

Figure 19: Results for the Euro 11 using 1998 as the treatment period

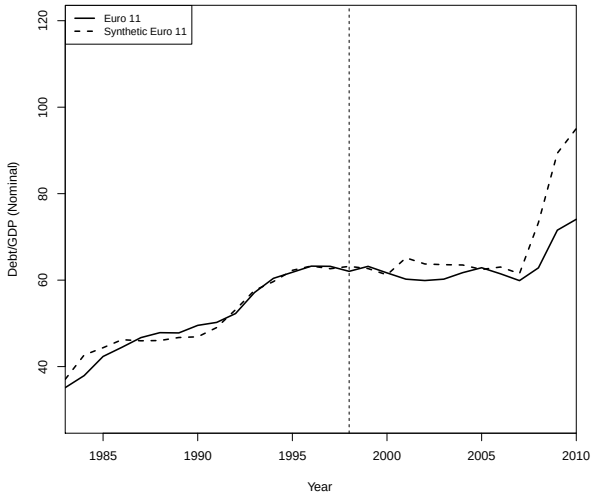

Figure 20: Results for the Euro 11 using 2000 as the treatment period

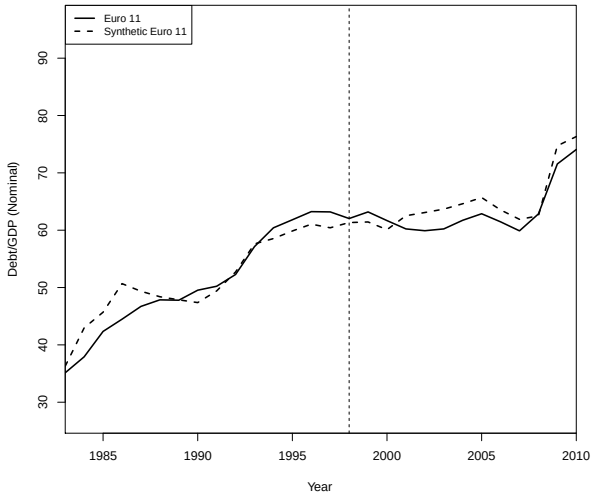

Figure 21: Results for the Euro 11 using 2001 as the treatment period