Estimating the Impact of the Economic and Monetary Union on National Income Inequality: A Synthetic Counterfactual Analysis

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Preliminary Draft

Abstract

Critics of globalization often point to economic integration as a culprit behind growing income disparities in developed economies. In Europe, it is indeed quite common for public opinions and national politicians to blame economic insecurity and rising inequality on deeper integration within the European Union (EU), and especially on the euro. There is however no empirical research that clearly identifies the euro as the cause of the recent increase in income inequality. The dearth of empirical evidence as to the effect of EMU on countries income or income distribution stems from a major problem that policy analysis in social science suffers from, i.e. the missing countrerfactual.The synthetic control method (SCM) developed by Abadie and Gardeazabal (2003) offers a bridge between qualitative and quantitative methodologies, as it provides a systematic way to choose comparison units in comparative case studies. Using the synthetic counterfactual methodology, I estimate what would have happened to income inequality in euro-area countries, had these countries not switched to the single currency. In most countries, especially in Spain, Greece, Ireland, Luxembourg, and the Netherlands, income inequality would have been higher without the euro, while inequality would have been lower in Germany, Portugal, and Finland.

- *Keywords*: income inequality, European Union, EMU, synthetic counterfactual approach
- *JEL Codes*: R11, O52, E65

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1 Introduction

The Great Recession and the subsequent European sovereign debt crisis have stimulated new debates about the costs and benefits of belonging to the Economic and Monetary Union (EMU). The consensus among international economics scholars is that economic integration brings various gains associated with higher average incomes and welfare because specialization based on comparative advantage leads to a more efficient resource allocation. Scholars also acknowledge that trade leads to economic restructuring and permanent income losses for certain social groups. Traditional trade theory however concludes that the benefits from trade liberalization outweigh its costs, and that losers within each nation can be compensated through redistributive policies.

Public opinions however tend to be skeptical about these net benefits, notably because of the lack of redistribution of these gains from trade (Verdier (2004)) and of growing income disparities in most OECD countries (OECD (2011)). In Europe, it is indeed quite common for the public opinion and national politicians to blame feelings of economic insecurity on deeper integration within the European Union (EU), and especially on the euro. For instance, the main reason for a no vote by French citizens on the 2005 European Constitution included concerns about loss of jobs (31%), "too much unemployment" (26%) (Commission (2005)). Furthermore, support for the common currency has eroded since its introduction. While in 2002 65% of people surveyed in the 12 euro area countries were "happy [..] that the euro ha[d] become [their] currency"[1], only 57% of the respondents in 2015 were supportive of a European economic and monetary union with a single currency[2]. More recently, abandon of the euro and even exit from the EU has been advocated by many populist candidates in European national elections- Marine Le Pen in France, Beppe Grillo in Italy, Geert Wilders in the Netherlands among others - as the remedy for their electorates' economic problems and anxiety.

Figure 1 here

Is the euro really to blame for these rising income inequalities? The economic analysis of the impact of trade and economic integration on income inequality is often based on the Stolper Samuelson Theorem. With trade, export price increases and price of imports decreases, leading to changes in the demand for factors and thus to changes in income distribution. A skilled labor-abundant country would have a comparative advantage in producing and exporting

[1]Eurobarometer 2002

[2]Eurobarometer 83, July 2015.

skilled labor-intensive goods. This increase in the production of skilled labor-intensive goods would increase the demand for skilled, thus raising the income of skilled workers. The country's specialization would decrease the demand for unskilled labor, thus causing a fall in unskilled labor's income. Trade would then increase income inequality. In a country abundant in unskilled labor, however, trade would increase the demand for unskilled labor and decrease the demand for skilled labor, thus causing a decrease in the income gap between both groups of workers. While the empirical relevance of the Stolper Samuelson Theorem has been questioned by the rise in income inequality in developing countries, it is interesting to note that, between 1992 and 2009, among the 12 countries who adopted the euro in 1999 and 2001, income inequality decreased in peripheral countries - Spain, Portugal, Greece, and Ireland (Figure 1).

EU scholars have also argued that EMU may affect income distribution through macroeconomic channels. EMU, through a common monetary policy and fiscal policies constrained by the Stability and Growth Pact (SGP), deprives member states of independent national macroeconomic policies to deal with idiosyncratic shocks. Bertola (2010) suggests that, in an integrated market environment where competitive devaluations are no longer an option, market competitiveness concerns as well as fiscal constraints of the SGP have pushed euro-area countries to adopt less generous social and redistributive policies.

Despite the vast literature on EMU and its possible impact on trade, little empirical attention has been paid to the implications of EMU for income inequality. This dearth of empirical evidence stems from a major problem that policy analysis suffers from in social sciences: the missing counterfactual, or the difficulty in identifying a satisfactory benchmark. Researchers would then typically have to choose between conducting a comparative case study or using large-sample quantitative methods which allow for the use of traditional statistical inference tools. Difference-in-difference analysis and randomized control trials are often used in microeconomic research papers as an alternative to a counterfactual analysis, but are not very useful to study macroeconomic policies (such as a currency devaluation, or debt default) or event (such as Brexit).This article intents to fill up this gap by using a relatively new empirical methodology called the synthetic control method to estimate the impact of the adoption of the euro on income inequality in euro-area countries. The synthetic control method (SCM) developed by Abadie and Gardeazabal (2003) offers a bridge between qualitative and quantitative methodologies, as it provides a systematic way to choose comparison units in comparative case studies (Abadie et al. (2015)).Instead of comparing the outcome in countries subjected to a specific policy (the "treatment") and other countries that were not, the synthetic control methodology is based on the construction of a counterfactual group which is obtained as a weighted combination of non-treated countries (called the donor pool). These non-treated countries are chosen to match as closely as possible the pre-treatment characteristics of the treated country. The identification assumption of the synthetic control method is that if the synthetic control unit provides a good approximation of the outcome for the treated unit in the pre-treatment period, then any subsequent difference between the treated and control units can be attributed to the effect of the intervention (policy) on the outcome.

The goal of this paper is to exploit the binary dimension of the euro adoption with this relatively new synthetic control methodology to answer the following research question: would income inequality in EMU countries have been higher or lower than its current levels, had these countries not adopted the euro as their currency? While this empirical technique has been recently applied to study the impact of various facets of the European integration and of a major European political event, this paper constitutes, to my knowledge, the first analysis of the impact of EMU, and more specifically of its third stage (the introduction of the euro) on income inequality within euro-area countries. The synthetic counterfactual methodology allows us The analysis presented in this paper focuses on the 12 countries who adopted the euro in 1999 or 2001 (for Greece). Newer members[3] of the euro area could not be included in the analysis presented here because the post-treatment period would have been too short to be meaningful.

The main results of the paper are as follows. In most countries, income inequality would have been higher without the adoption of the single currency. The counterfactual analysis however leads to some substantial heterogeneity among countries.The impact of the euro on inequality is found more substantial in Greece, Ireland, Spain, Luxembourg, and the Netherlands. Germany, Portugal, and Finland would have enjoyed lower levels of income inequality, had they not adopted the euro. For many countries, I find evidence of anticipation effects, as the path of actual income inequality series and the counterfactual series start diverging in 1997, with the implementation of the convergence criteria.

The remainder of the paper is organized as follows. Section 2 presents the synthetic counterfactual methodology. Section 3 presents the data and summarizes the baseline results, while Section 4 presents and discusses various robustness checks, notably to address possible anticipation effects. Section 5 concludes and discusses directions for future research.

[3]Slovenia, Cyprus, Malta, Slovakia, Estonia, Latvia, and Lithuania

2 The Synthetic Control Method

2.1 Methodology

Instead of comparing the outcome in countries subjected to a specific policy (the "treatment") and other countries that were not, the synthetic control methodology is based on the construction of a counterfactual group which is obtained as a weighted combination of non-treated countries (called the donor pool). The advantage of building this counterfactual unit is that "the pre-intervention characteristics of the treated unit can often be much more accurately approximated by a combination of untreated units than by any single untreated unit" (Abadie et al. (2015)). These non-treated countries are chosen to match as closely as possible the pre-treatment characteristics of the treated country. The choice of the pre-treatment characteristics should include variables that can approximate the path of the treated country, but should not include variables that anticipate the effects of the intervention. The identification assumption of the synthetic control method is that if the synthetic control unit provides a good approximation of the outcome for the treated unit in the pre-treatment period, then any subsequent difference between the treated and control units can be attributed to the effect of the intervention (policy) on the outcome.

Suppose that we observe $J+1$ units (countries, regions, states, etc) in periods $1, 2, ...T$. Unit 1 is exposed to a treatment during periods $T_0+1, ...T$ with $1 < T_0 < T$, while there are J potential comparison (control) units, indexed as $2, ..., J+1$. These units constitute the donor pool. We assume that the treatment has no effect during the pre-intervention period $1, .., T_0$. SCM allows us to measure the effect of the treatment on some post-intervention outcome.
Let Y_{it}^N be the outcome that would be observed for unit i at time t in the absence of treatment, and let Y_{it}^I be the outcome that would be observed for unit i at time t if unit i is exposed to the treatment in periods T_0+1 to T. Let α_{1t} be the effect of the treatment for unit 1 at time t, where $\alpha_{1t} = Y_{1t}^I - Y_{1t}^N$. Since only Y_{1t}^I is observed, α_{1t} can only be measured if we can estimate Y_{1t}^N. Abadie et al. (2010) propose to estimate the treatment effect α_{1t} by modelling the outcome Y_{it}^N as given by the following factor model:

$$Y_{it}^N = \delta_t + X_i\theta_t + \lambda_t\mu_i + \epsilon_{it} \tag{1}$$

where δ_t is an unobserved common time-dependent factor, X_{it} is a vector of observed covariates that are not affected by the intervention, θ_t is a vector of unknown parameters, λ_t is a vector of unknown common factors, μ_i is a vector of unknown factor loadings, and ϵ_{it} are unobserved transitory shocks.

Often X_{it} and pre-treatment Y_{it} of treated unit 1 can be more accurately approximated by a combination of untreated units than by any single untreated unit. While both difference-in-difference estimation and SCM exploit differences in treated and untreated units to assess the effects of the intervention, SCM does not assign the same weigh to all untreated units. Synthetic controls are defined as weighted average of the non-treated units in the donor pool. Let $W = (w_2, ..., w_{J+1})$ be a vector of weights, with $w_j \geq 0$ for $j = 2, ..., J+1$, and $w_2 + ... + w_{J+1} = 1$. Each value of W represents a potential synthetic control. The weights assigned to each non-treated country in the synthetic controls are chosen so that these synthetic controls minimize the difference between the values predicted by the model (the counterfactual) and the values actually observed. Following Abadie and Gardeazabal (2003) and Abadie et al. (2010), the weights are chosen to minimize the root mean square predictor error (RMSPE) over the pre-treatment period:

$$RMSPE = \left(\frac{1}{T_0} \sum_{t=1}^{T_0} \left(Y_{1t} - \sum_{j=2}^{J+1} w_j Y_{jt} \right)^2 \right)^{1/2} \tag{2}$$

Then, the treatment effect for $T_0 < t < T$ can be estimated as:

$$\hat{\alpha}_{1t} = Y_{1t} - \sum_{j=2}^{J+1} w_j Y_{jt} \tag{3}$$

2.2 The Synthetic Control Method and EU Scholarship

The synthetic control methodology has been recently applied to study the impact of various facets of the European integration and of a major European political event. Campos et al. (2014) estimate the effects of EU membership on the countries per capita income and labor productivity. Their analysis focuses on the 1973, 1981, 1986, 1995 and 2004 enlargements. The donor pool includes the remaining 11 non-EU members OECD countries and 24 additional middle-income countries. They find that in the absence of the European Union (i.e. without economic and political integration) per capita income in EU member countries would have been on average 12% lower. This average however hides substantial disparities across countries. The benefits from EU membership (measured for 10 years of treatment) are higher for the 1986 enlargement countries (Spain and Portugal) and for the 2004 Central and Eastern European enlargement. EU membership has only been detrimental to per capita income in Greece, where per capita GDP would have been 17% higher, had Greece not joined the EU in 1981. Unlike Campos et al. (2014), my analysis does not really face any issue of intertemporal comparisons, as all but one country included in the study adopted the euro in 1999. However, like for other stages of the EU economic integration process, anticipation effects might occur, as countries needed to satisfy certain criteria before becoming EU or EMU members.

Saia (2014) applies SCM to the impact of the euro on trade flows. More specifically, using the example of the United Kingdom, the paper assesses what would have happened to trade flows between Euro area member countries and non-member countries, had the latter adopted the common currency. Using bilateral trade data over the 1980-2012 period for the UK and the 10 first countries to adopt the euro starting in 1999, the author finds that overall trade flows between the UK and Euro area countries would have been 13% higher if the UK had adopted the euro. Gains in trade would have been larger with Finland, France, Italy, Spain, and Portugal. Using the same methodology, Saia also finds that the adoption of the euro has fostered trade among EMU member countries (increase in trade flows that ranges from 28% to 53%), as well as trade flows among members and non-member countries. This technique has also been applied to the analysis of country-specific event. While Abadie and Gardeazabal (2003) study the economic effect of conflict and terrorism on the Basque country, Abadie et al. (2015) analyze the impact of the German reunification on West Germany′s per capita income. Using data for the 1960-2003 period and 16 OECD countries in their donor pool, they find that over the 13 years that followed the German reunification, West Germany′s GDP per capita would have been $1,600 higher each year, had the reunification not taken place.

3 EMU and inequality: A counterfactual analysis

After an overview of the data, I present the synthetic counterfactuals constructed with the SCM technique (Section 3.2), before assessing the significance of these results with some placebo tests (Section 3.3).

3.1 Data and Sample

To estimate the impact of the euro on national income inequality with the SCM technique described in section 2.1, I use annual country-level panel data for the 1992-2009 period. The analysis starts in 1992 because it is the first year for which Gini Index data are available for all countries included in the donor pool (notably for some Central and Eastern European countries). While the period studied does not expand beyond 2009 mostly for lack of more recent consistent income inequality data, this also guarantees that our results are not affected by the recent sovereign debt crisis. The pre-treatment period covers 1992 to 1998 for all the countries that adopted the euro in 1999 (year of the treatment), with the exception of Greece who joined the euro area in 2001. Because the pre-treatment period is rather short, I do not divide the pre-treatment period into a training period and a validation period (as is done for instance in Abadie et al. (2015)).

The donor pool used to construct the synthetic controls includes 24 countries: 8 EU countries that are not member of the euro area, 9 other OECD countries, as well as 7 emerging countries. The complete list is available in Appendix B. While limiting the donor pool to other EU countries would have allowed to isolate the impact of the euro on income inequality from the overall effect of EU integration, this limited pool of countries does not generate satisfying synthetic controls for Greece, Portugal, and Spain. Campos et al. (2014) and Bower and Turrini (2010) also use large pool of countries (including non-OECD countries) to study the impact of EU accession on per capita income and economic growth. Table 1 displays the weights of each control country for each of the 12 EMU countries studied in this paper. These weights indicate that each synthetic counterfactual unit is built on a very different combination of donor pool countries. Five donor countries are used in the computation of at least five synthetic counterfactual units: Bulgaria, Denmark, Norway, Poland, and the United Kingdom. Others account for a large fraction of a specific counterfactual. For instance, Sweden is given a weight of 0.903 to construct the synthetic Finland, Norway a weight of 0.948 for synthetic Luxembourg, while the UK accounts for 78.8% of the synthetic Ireland. Only China and Hungary obtain zero weights. Moreover, the synthetic units of 7 countries give non-zero weights to non-OECD countries. The results presented below are robust to changes in the donor pool (such as excluding non-OECD countries).

Table 1 here

The outcome variable, $Y_{j,t}$, is the level of income inequality. Income inequality is proxied by the Gini index, computed on income net of taxes and transfers. The set of pre-treatment characteristics, X, includes predictors of income inequality. This list of covariates is based on Atkinson and Brandolini (2006)'s literature review of the determinants of income inequality, and includes log per capita GDP and squared log per capita GDP (to test of the Kuznets' curve hypothesis), percentage of employment in agriculture, share of government spending in GDP, national inflation rate, national unemployment rate, a measure of trade openness and a measure of human capital. These predictor variables are averaged over the pre-treatment period (1992 to 1998) and are augmented by adding three years of lagged Gini index (1992, 1995, and 1998). A complete list of the variables used in the analysis, along with the data sources are available in Appendix A.

3.2 Baseline Results

Figure 2 displays the income inequality trajectory for the 12 EMU countries and their synthetic counterparts. Two series are plotted in each subfigure: the continuous line shows the actual Gini coefficient for a given country, while the dashed line shows the estimated counterfactual Gini index for the same country. The results are mixed in terms of how closely the counterfactual units match the treated countries in the pre-treatment period, as well as in terms of the estimated effect of the euro on income inequality in the EMU countries. First, the synthetic units reproduce very well the trajectory of income inequality for Finland, France, Greece, Italy, Luxembourg, the Netherlands, and Spain, and to a lesser extent for Ireland and Portugal. The fit is much less satisfactory for Austria, Belgium, and Germany.

Second, the estimated effect of the euro on income inequality for any country is captured in Figure 2 as the difference between the actual Gini index and the Gini index for the counterfactual unit. For most countries, income inequality would have been higher without the adoption of the common currency. Table 2 presents the differences between the actual levels of income inequality and the levels predicted by the synthetic counterfactuals for each country, in percentage terms, 5 and 10 years following the adoption of the euro. On average, after 5 years, income inequality would have been 2.6% higher without the euro, and 3.2% higher after 10 years. The results suggest that income inequality would have been substantially higher in Greece, Ireland, the Netherlands, and Spain without the euro. The benefits from the euro materialized rather quickly in Greece, Ireland, the Netherlands, and Luxembourg, while they occurred later in Spain (especially after 2003). In few countries, notably at the periphery (Greece, and Ireland), as well as in Luxembourg, the drop in inequality was halted or reversed during the global recession of 2001-2002. In the case of Luxembourg, the initial benefits from the euro adoption are offset by a rise in inequality between 2003 and 2005. This increase in inequality was the result of a loss of income of the middle class: while a minority "were able to keep the benefits from 1995 to 2004", for the majority, income fell back to its 1995 level (dAmbrosio and Barazzetta (2014), p.15).

Figure 2 here

Table 2 here

In three countries, namely Finland, Germany, and Portugal, income inequality would have been lower without the euro. Unlike the other peripheral countries where income inequality started to fall following the adoption of the common currency, the trajectory of inequality in Portugal and its synthetic counterpart only start to diverge in 2003, with actual inequality initially increasing between 2003 and 2004 before falling dramatically. The rise in Portugal's inequality was triggered by a recession in 2003 and rising unemployment rate between 2001 and 2007 (from 4% to almost 8%), leaving the Portuguese economy even more out of sync with the rest of the euro area (Blanchard (2007)). However, after 2004, income inequality dropped dramatically below its 1992 level. In the case of Finland, income inequality started to rise in the 1990s as the economy started to recover from the severe 1992 recession. The rise in unemployment during the recession meant that median income and inequality fell. However, during the recovery, "the rising tide did not lift all the boats in a same way" (Blomgren et al. (2012)) and the rise of capital income share in total households' income (see Figure 3), led to a more rapid increase in income for upper-middle class households, and thus to an increase in inequality (Riihel et al. (2002)). The rising importance of capital income, combined with cyclical and structural changes in the labor market (such as the growth of irregular employment, part-time and temporary jobs) is also responsible for the rise in inequality observed in Germany (Schmid and Stein (2013)).

For the seven countries for which we obtain a good fit, the actual and the synthetic Gini index series are reasonably close and move together until 1997-1998 (and 1999 for Greece), when they start to diverge. This suggests that the impact of the single currency was anticipated. For most countries, the anticipation coincided with the establishment of the Stability and Growth Pact and the implementation of its preventive rules. In the case of Greece who adopted the euro in 2001, the anticipation coincided with the euro's debut in the other 11 countries.

Figure 3 here

3.3 Placebo Tests

To evaluate the credibility of the results presented in Section 3.2, I conduct placebo studies where the treatment (here adoption of the euro) is iteratively reassigned to all non-euro area countries included in the donor pool. EMU countries are then shifted into the donor pool. If the placebo studies performed with the same synthetic control methodology generate effects on income inequality of the same magnitude as these found for EMU countries, then our analysis would not provide any robust evidence that EMU has had any particular impact on income inequality in euro area countries. Figure 4 displays the results of the placebo tests. Each graph reports the differences, in terms of Gini index, between the treated EMU country and its synthetic control (orange thick line), as well as the same differences for all other countries (placebos in gray lines). In the post-treatment period, the estimated gap is large relative to the gaps for the donor countries for 8 of the 12 EMU countries included on our analysis, namely for Austria, Finland, Greece, Ireland, Italy, Luxembourg, the Netherlands, and Spain. The placebo tests confirm that income inequality would have been lower in Finland and Portugal without the euro, while the results are weaker for Germany.

Another way to assess the validity of our placebo test is to look at the ratio of post/pre-treatment root mean squared prediction error (RMSPE), which measures the magnitude of the gap between the Gini index of a country and its synthetic counterpart before and after the treatment. A sizeable post-treatment RMSPE is not indicative of a significant effect of the intervention if the synthetic control does not closely reproduce the outcome of interest prior to the intervention, i.e. if the pre-treatment RMSPE is also large (Abadie et al. (2015)). However, if the post-treatment RMSPE is large relative to the pre-treatment RMSPE, we can conclude that the estimated effect is significant with respect to the placebo tests. Figure 5 reports the ratios between the post-1999 RMSPE and the pre-1999 RMSPE for the 12 EMU countries and the non-EMU countries included in the donor pool. In Figure 5 only five EMU countries stand out with higher than average RMSPE: the Netherlands, Luxembourg, Spain, France and Italy, all countries where income inequality would have been higher without the euro.

Figure 4 here

Figure 5 here

4 Robustness checks

In this section, I present alternative ways to test the robustness of the results discussed in Section 3. The first alternative consists on reassigning the treatment (adoption of the euro) to a year other than 1999. This type of falsification exercise, also known as as "in-time placebos" (Abadie et al. (2015)), is used to check for possible anticipation effects. The synthetic counterfactual methodology is based on the premise that the treatment effects are not anticipated, that is, that they start at the date assigned for the treatment (1999 in our case). Anticipation effects might reduce the relevance of the official date of the adoption of the common currency has the beginning of the treatment, and the SCM estimates would only provide lower-bound estimates for the true effects of the treatment. In Figure 2, there would be no anticipation if the actual Gini and the synthetic Gini lines for each country started to diverge only in 1999. While there is indeed no anticipation of the effects in the case of Luxembourg, the actual and synthetic Gini lines start to diverge few years prior to 1999 for mosts countries, especially for Finland, Greece, Ireland, the Netherlands, and Spain[4]

In the case of the EMU, anticipation effects might be expected because the monetary union was achieved in several steps that span over several years: from the signature of the Maastricht Treaty in 1993 to the introduction of the single currency in 1999. The Maastricht Treaty specified the entry conditions, called the convergence criteria. These five convergence criteria were laid out in the 1997 Stability and Growth Pact (SGP) and were designed to ensure that fiscal discipline would be maintained by countries candidates to the EMU, so as to facilitate macroeconomic policy coordination. Decision on euro-area membership was made in 1998. Figures 6 and 7 confirm that countries had already made some macroeconomic adjustment prior to 1999, as national inflation rates and long-term interest rates had converged by the end of 1997.

Figure 6 here

Figure 7 here

To test for anticipation effect, I rerun the model with the assumption that the treatment started with the implementation of the Stability and Growth Pact. Figure 8 displays the results of this "in-time placebo"study. The synthetic Finland and Spain almost exactly reproduce the evolution of income inequality in these two countries for the 1992-1997 period,

[4]Here I focus only on the countries for which I identify a sizeable impact of EMU on income inequality.

and start to diverge in 1997 and not 1999. For few other countries, notably Belgium, France, Greece, and the the Netherlands, the divergence between the counterfactual income inequality series and the actual income inequality series start diverging even before 1997, in 1996. The perceivable effects of this 1997 placebo test therefore confirm that, for some countries, there were undoubtedly some anticipation effects.

Figure 8 here

5 Conclusion

This article intents to fill up a gap in the literature on EMU by estimating the impact of the adoption of the euro on income inequality in Euro area countries. Using the synthetic counterfactual methodology, I estimate what would have happened to income inequality in the countries that adopted the euro in 1999 and 2001, had these countries not switched to the single currency. In most countries, income inequality would have been higher without the adoption of the single currency. The counterfactual analysis however leads to some substantial heterogeneity among countries.The impact of the euro on inequality is found more substantial in Greece, Ireland, Spain, Luxembourg, and the Netherlands. Germany, Portugal, and Finland would have enjoyed lower levels of income inequality, had they not adopted the euro. For many countries, I find evidence of anticipation effects, as the path of actual income inequality series and the counterfactual series start diverging in 1997, with the implementation of the convergence criteria.

Consequently, while the deepening of the EU integration process has coincided with a rise in income inequality in many European countries, the adoption of the euro should not be blamed for this recent development. Technological progress (automation)and the resulting increase in skill premium, as well as changes in labor institutions (such as lower unionization rate, reduction in the minimum wage relative to the median wage) have contributed more to this rise in income inequality than globalization and EMU in Europe (Dabla-Norris et al. (2015)). It is therefore unlikely that leaving the euro, as populist candidates such as Marine Le Pen have promised will help improve the economic outcome of their electorate.

References

Abadie, A., A. Diamond, and J. Hainmueller (2010). Synthetic control methods for comparative case studies: Estimating the effect of californias tobacco control program. *Journal of*

American Statistical Association 105, 493505.

Abadie, A., A. Diamond, and J. Hainmueller (2015, April). Comparative politics and the synthetic control method. *American Journal of Political Science 59*(2), 495510.

Abadie, A. and J. Gardeazabal (2003). The economic costs of conflict: A case study of the basque country. *American Economic Review 93*, 113132.

Atkinson, A. and A. Brandolini (2006). *Mobility and Inequality*, Chapter The Panel-of-Countries Approach to Explaining Income Inequality: An Interdisciplinary Research Agenda, pp. 400–448. Stanford, CA: Stanford University Press.

Bertola, G. (2010, September). Inequality, integration, and policy:issues and evidence from emu. *Journal of Economic Inequality 8*(3), 345–365.

Blanchard, O. (2007). Adjustment within the euro. the difficult case of portugal. *Portuguese Economic Journal 6*, 1–21.

Blomgren, J., H. Hiilamo, O. Kangas, and M. Niemel (2012). Growing inequalities and their impacts in finland. Technical report, Gini Growing Inequalities' Impacts.

Bower, U. and A. Turrini (2010). Eu accession: A road to fast-track convergence? *Comparative Economic Studies 52*, 181–205.

Campos, N. F., F. Coricelli, and L. Moretti (2014, April). Economic growth and political integration: Estimating the benefits from membership in the european union using the synthetic counterfactuals method. IZA Discussion Paper Series, Number 8162.

Commission, E. (2005). The european constitution : post-referendum in france. Eurobarometer 171, European Commission.

Dabla-Norris, E., K. Kochhar, N. Suphaphiphat, F. Ricka, and E. Tsounta (2015, June). Causes and consequences of income inequality: A global perspective. IMF Staff Discussion Notes *SDN*/15/13, International Monetary Fund.

dAmbrosio, C. and M. Barazzetta (2014). Income distribution and inequality in luxembourg and the neighbouring countries, 1995-2013. available online at http://*www.csl.lu*.

OECD (2011). Divided we stand: Why inequality keeps rising. Technical report, OECD.

Riihel, M., R. Sukkstrm, I. Suoniemi, and M. Tuomala (2002). Recent trends in income inequality in finland. Labour Institute For Economic Research Working Papers, number 183.

Saia, A. (2014). Choosing the open sea: The cost to the uk of staying out of the euro. available at https://*sites.google.com/site/asaia*9585/.

Schmid, K. and U. Stein (2013, September). Explaining rising income inequality in germany, 1991-2010. Macroeconomic Policy Institute, Study #32.

Verdier, T. (2004, October). Socially responsible trade integration: A political economy perspective. CEPR Discussion Paper No. 4699.

6 Figures and Tables

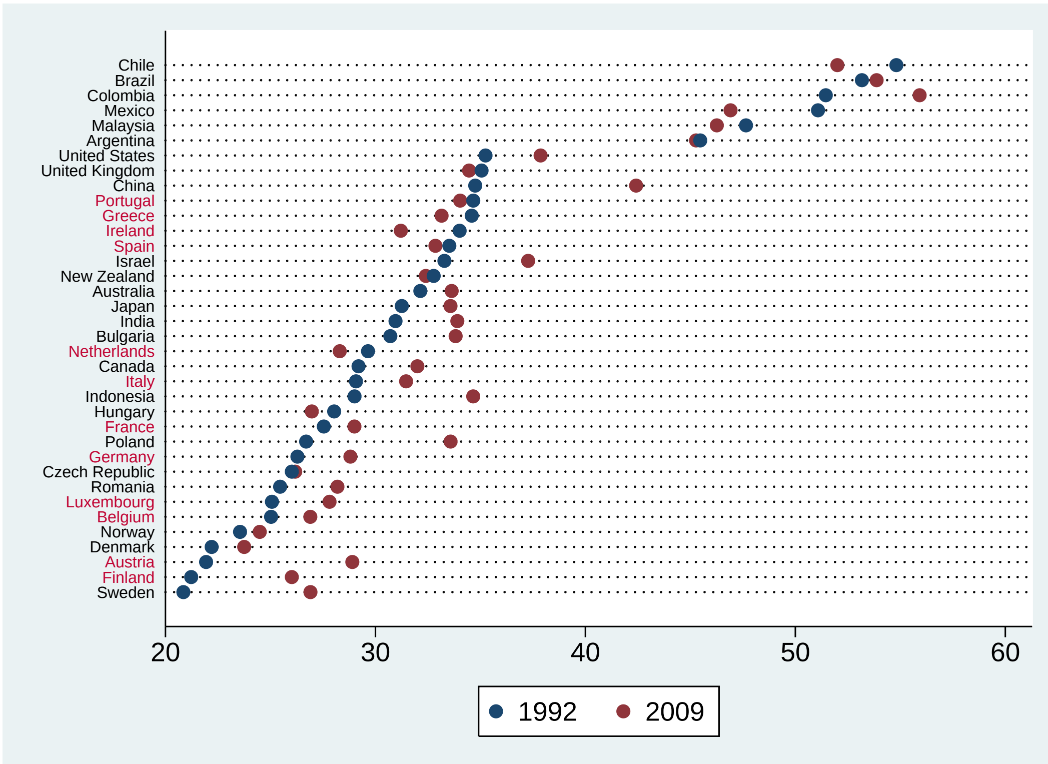
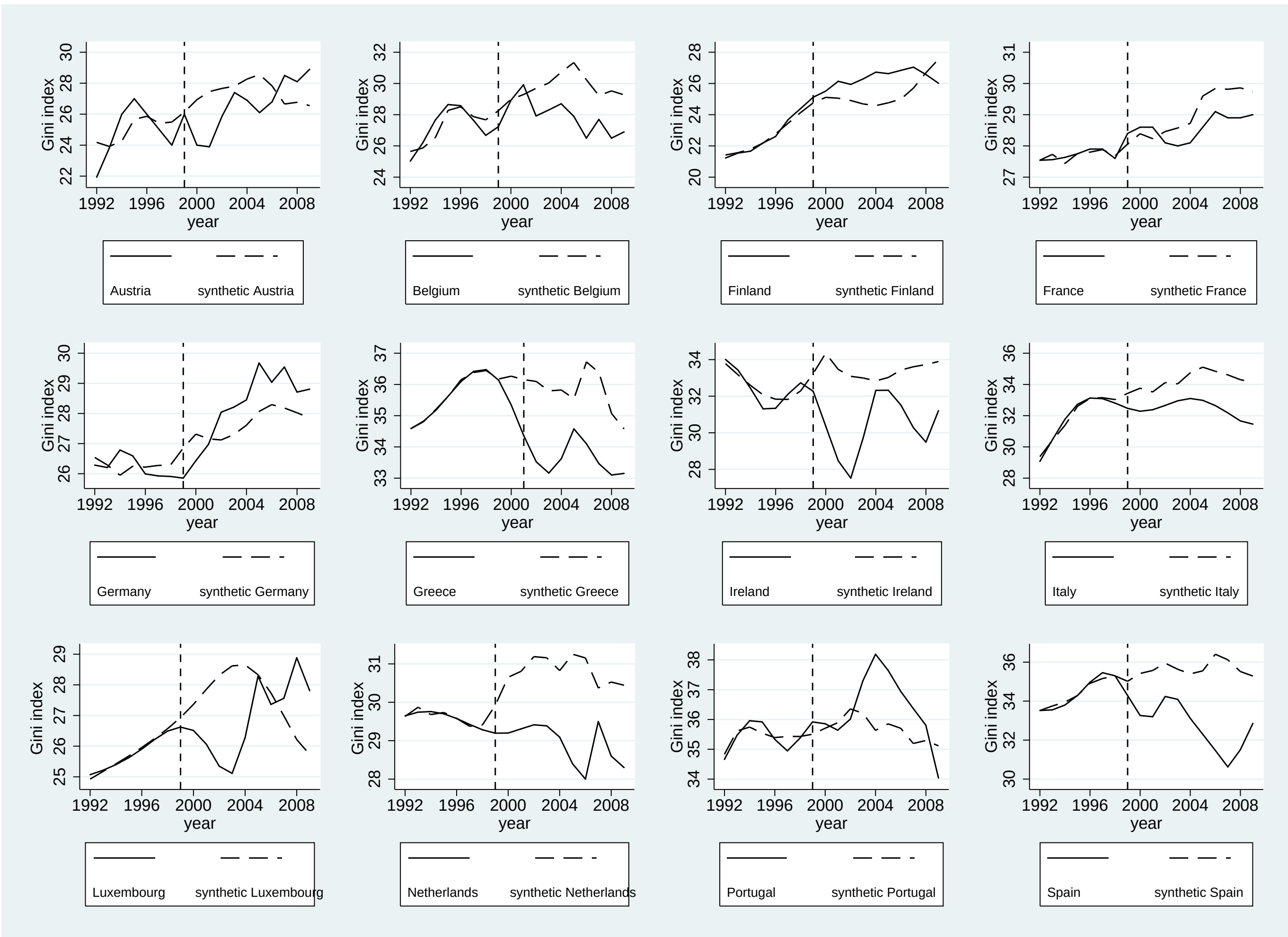


Figure 1: Gini Coefficients: 1992 and 2009

Note: EMU countries are labelled in red.

Figure 2: Trends in income inequality: EMU countries vs. their synthetic counterparts



Two series are plotted in each subfigure: the continuous line shows the actual Gini coefficient for a given country, while the dashed line shows the estimated counterfactual Gini index for the same country.

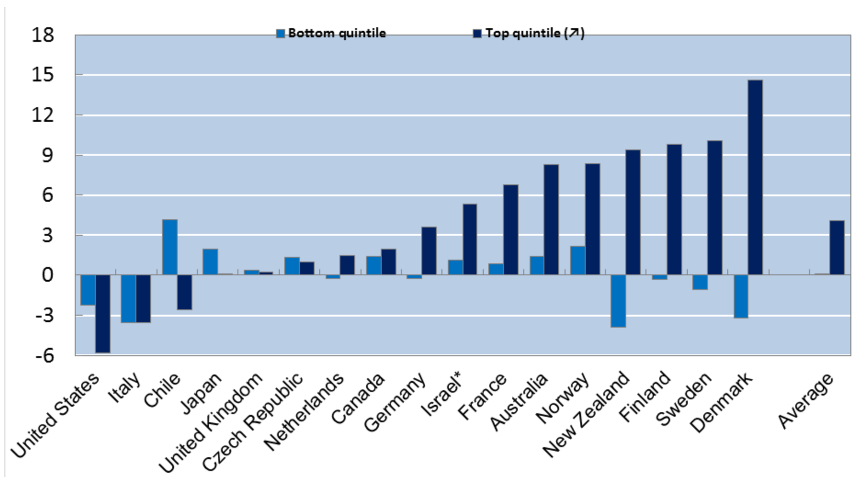
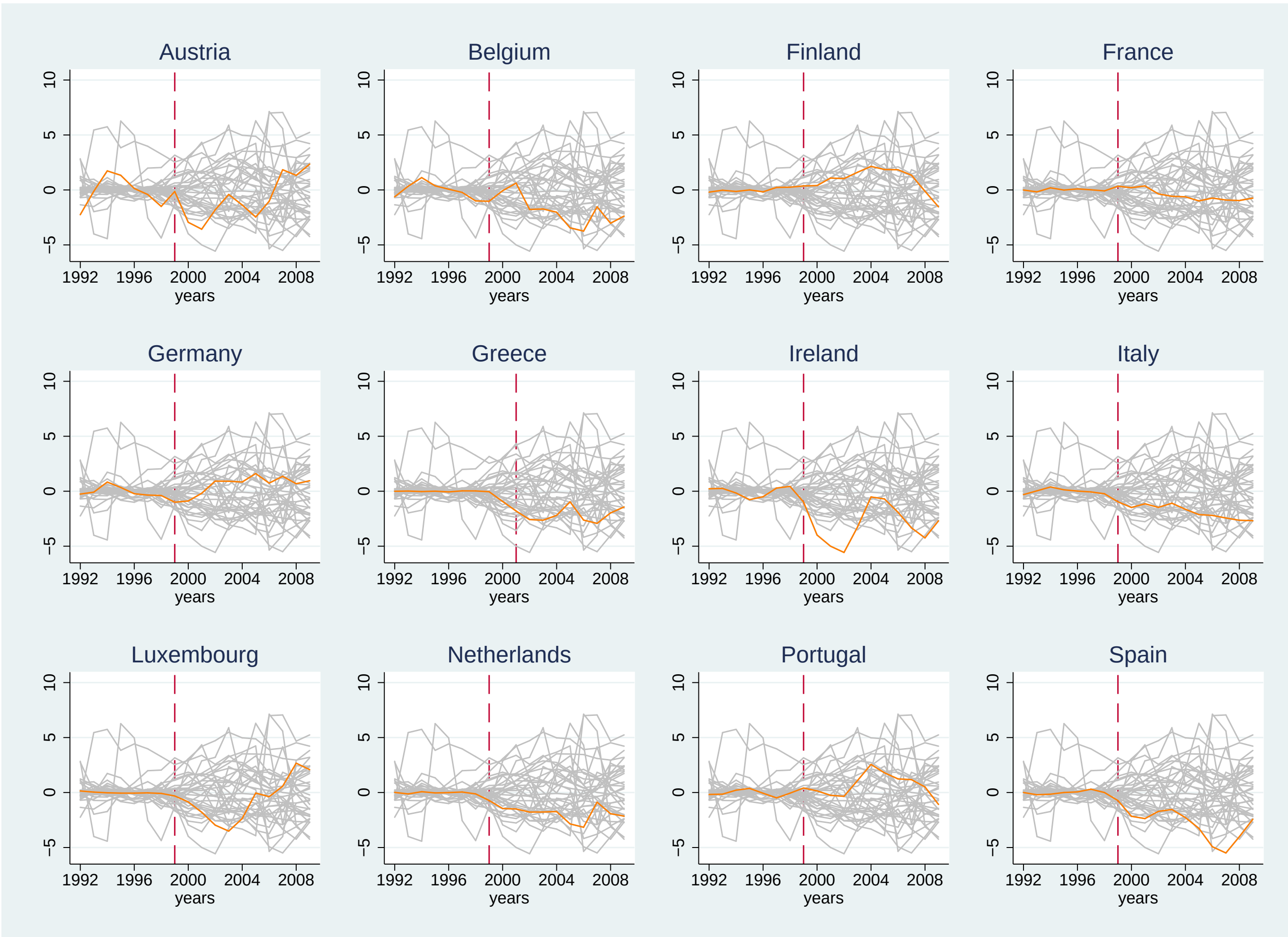


Figure 3: Percentage-point changes in the shares of capital income in total household income, mid-1980s to late 2000s

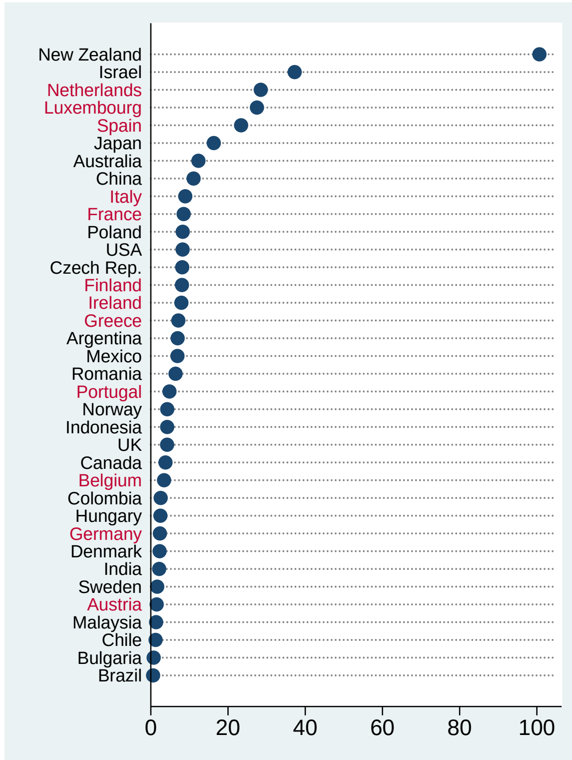
Source: OECD (2011)

Figure 4: Placebo-treated countries vs. EMU countries



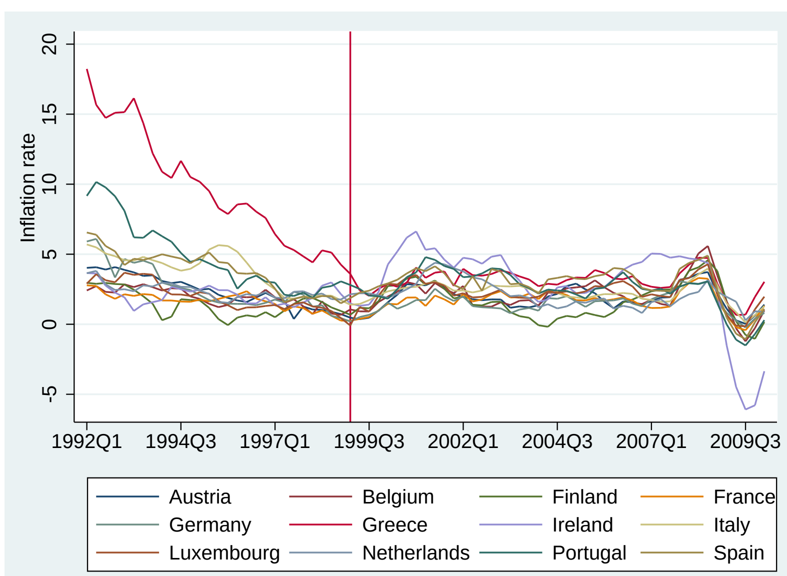
The graph reports the differences, in terms of Gini index, between the treated EMU countries and their synthetic control (orange thick line), as well as the same differences for all other countries (placebos in gray lines).

Figure 5: Post-treatment RMSPE/Pre-treatment RMSPE ratio



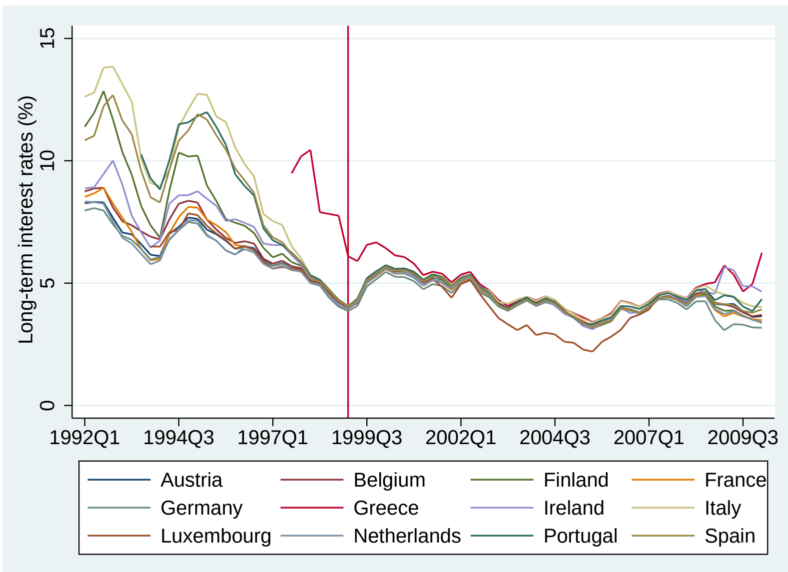
Note: EMU countries are labelled in red.

Figure 6: National Inflation Rates



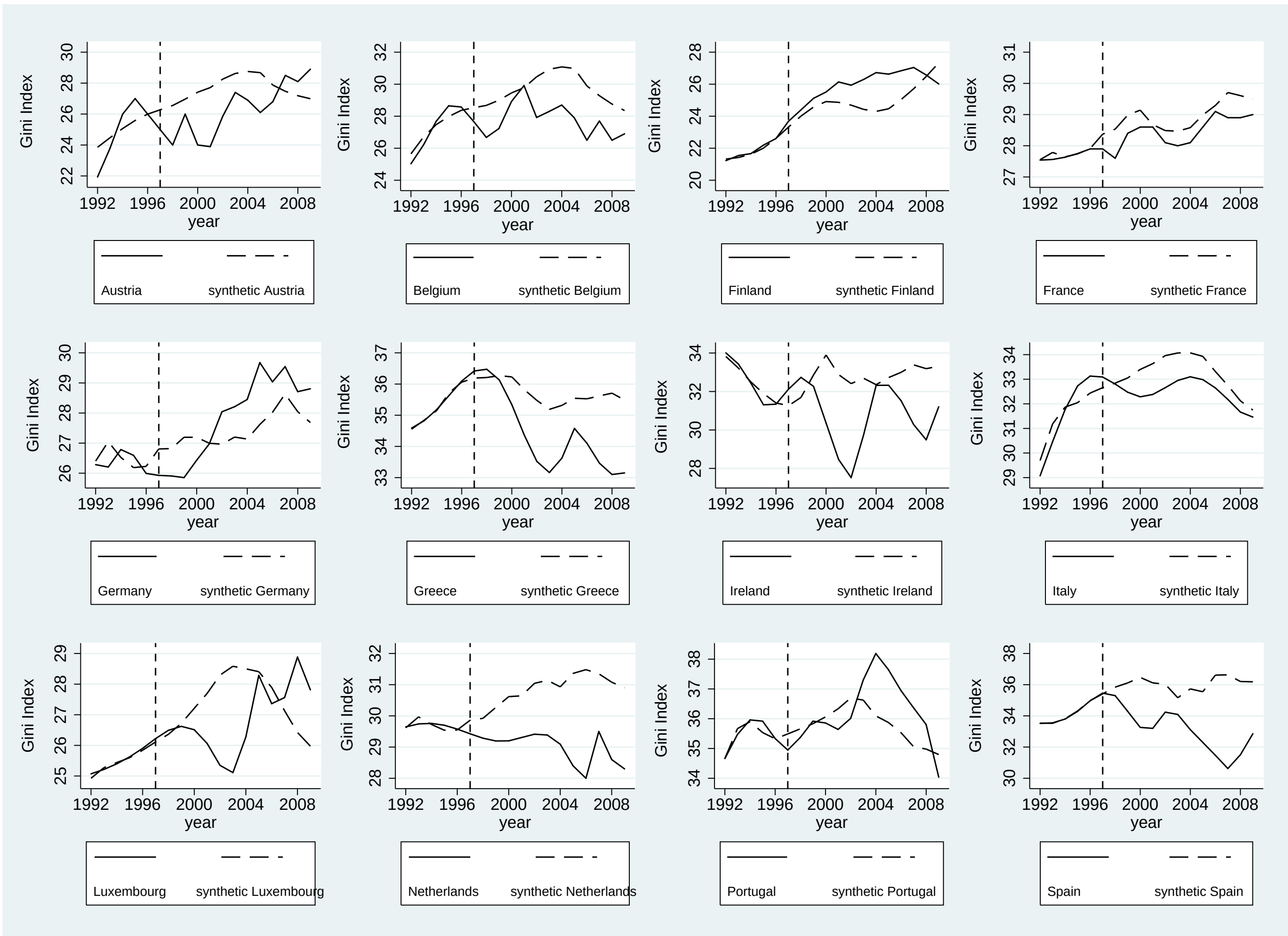
Red line= 1999Q1
Source: OECD MEI database

Figure 7: Long-term Interest Rates



Red line= 1999Q1
Source: OECD MEI database

Figure 8: In-time placebo: treatment year=1997



Two series are plotted in each subfigure: the continuous line shows the actual Gini coefficient for a given country, while the dashed line shows the estimated counterfactual Gini index for the same country.

Table 1: Country weights in the synthetic controls

	EMU countries											
Donor pool:	Austria	Belgium	Finland	France	German	Greece	Ireland	Italy	Lux	Netherl	Portugal	Spain
Argentina	0	0	0	0	0	0	0	0	0	0	0	0.052
Australia	0	0	0	0.016	0	0	0	0	0	0	0	0
Brazil	0	0	0	0	0	0.001	0	0	0	0	0	0
Bulgaria	0.096	0.103	0	0.034	0.034	0	0	0.029	0	0.034	0.006	0
Canada	0	0	0	0	0	0.275	0.183	0	0	0	0	0.461
Chile	0	0	0	0	0	0	0	0	0	0	0.158	0
China	0	0	0	0	0	0	0	0	0	0	0	0
Colombia	0	0	0	0	0	0	0	0.138	0	0	0	0
Czech Rep.	0	0	0	0	0	0	0	0	0	0.307	0.291	0
Denmark	0.015	0.159	0	0.482	0.409	0	0.013	0.263	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0	0	0	0
India	0	0	0	0	0	0	0.017	0	0	0	0	0
Indonesia	0	0	0	0.07	0.09	0	0	0.02	0	0	0	0
Israel	0	0.042	0	0	0	0	0	0	0	0	0	0
Japan	0	0	0	0	0	0	0	0	0	0	0	0.049
Malaysia	0	0	0	0	0	0	0	0	0.057	0	0	0
Mexico	0	0	0	0	0	0.334	0	0	0	0	0	0.111
New Zealand	0	0	0	0	0	0	0	0	0	0	0.275	0
Norway	0.667	0.318	0	0	0.223	0.254	0	0	0.943	0.224	0	0.018
Poland	0.096	0.377	0.097	0.087	0	0	0	0.516	0	0	0.013	0
Romania	0	0	0	0	0	0.136	0	0	0	0	0	0.084
Sweden	0.126	0	0.903	0	0	0	0	0	0	0	0	0
UK	0	0	0	0.153	0.244	0	0.788	0.034	0	0.217	0	0
USA	0	0	0	0.158	0	0	0	0	0	0.219	0.257	0.225

Table 2: Treatment Size

DIFFERENCE (%) in post-treatment Gini index between Synthetic and Actual Gini index		
after 5 years (2004)	after 10 years (2009)	
Austria	5.08	*-8.126*
Belgium	7.04	8.82
Finland	*-8.02933*	5.90
France	2.21	2.55
German	*-2.951247*	*-3.3169*
Greece	6.53	4.30
Ireland	1.61	8.61
Italy	4.96	8.50
Luxembourg	9.03	*-7.4899*
Netherlands	5.95	7.58
Portugal	*-6.693035*	3.17
Spain	6.88	7.39

Differences are measured relative to the actual Gini index values. A positive percentage implies that income inequality would have been larger without the euro.

A Data definitions and sources

- Gini Index: Gini Index based on disposable income, post taxes and transfers. Source: OECD Income and Distribution dataset and World Bank Development Indicators database.
- Per capita GDP: real per capita GDP, 2010 constant P.P.P. U.S. dollars. Source: OECD Main Economic Indication Publication and World Bank Development Indicators database.
- Employment in agriculture: percentage of employment in agriculture. Sources: OECD Short-Term Labour Market Statistics and World Bank Development Indicators database.
- Government spending: central government spending as a percentage of GDP. Sources: OECD Main Economic Indication Publication and World Bank Development Indicators database.
- Inflation rate: CPI-based inflation rate. Sources: OECD Main Economic Indication Publication and World Bank Development Indicators database.
- Trade openness: Sum of Exports and Imports as a percentage of GDP. Source: Penn World Table 8.1 item Human Capital: Index of human capital per person, based on

years of schooling (Barro/Lee, 2012) and returns to education (Psacharopoulos, 1994). Source: Penn World Table 8.1

- Unemployment rate: percentage of the labor force who is unemployed. Sources: OECD Population and Labour Force dataset and World Bank Development Indicators database.

B List of countries included in donor pool

- Other EU countries: Bulgaria, Czech Republic, Hungary, Poland, Romania, Sweden, and the United Kingdom. Cyprus, Estonia, Latvia, Lithuania, Slovenia, and Slovakia are not included because they joined the EMU after 2001. Croatia is not included for lack of comparable Gini index data between 1989 and 1998.
- Other OECD countries: Australia, Canada, Chile, Israel, Japan, New Zealand, Norway, and the United States.
- Other countries: Brazil , China, Colombia, India, and Malaysia.