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THE COST OF FISCAL AUSTERITY: A SYNTHETIC CONTROL APPROACH

Abstract

Purpose: This paper analyses economic and social impact of fiscal austerity policies on economic growth and income distribution. In response to the European public debt crisis, austerity measures were implemented in 2010 to decrease the budget deficit and avoid the default of the government debt, but have also caused negative effects on the whole economy.

Methodology: In order to evaluate the effectiveness of fiscal austerity, the synthetic control method (SCM) is applied by creating a synthetic counterfactual from European countries. Greece is used as an example to assess the impact of the aforementioned policy due to having experienced fiscal consolidation to a much larger extent than other crisis-affected countries.

Results: Fiscal austerity causes a decline in real GDP per capita compared to its pre-austerity level. Additionally, it results in higher unemployment and a more unequal distribution of income in the initial years following the treatment.

Conclusion: The objective of fiscal austerity, i.e. the reduction of the debt-to-GDP ratio, is frequently not achieved due to negative effects of these measures on GDP. Fiscal austerity may occasionally be unavoidable, but even in these cases, deliberate measure-taking is required to prevent the increase in unemployment and income inequality, as witnessed after the global financial crisis.

Keywords*:* Debt crisis, European countries, fiscal austerity, income inequality

1. Introduction

In order to balance the state budget, the practice of fiscal austerity is defined by a decrease in government spending and/or an increase in taxation, which typically takes place during times of crisis. Regarding the application of fiscal austerity measures, their efficacy, as well as their repercussions, there is no agreement in the political and scientific community. Lowering state spending and raising tax revenues is assumed to reduce the budget deficit, restore investor confidence, and promote long-term economic recovery (Anderson, 2010). However, fiscal austerity measures have historically not reduced the budget deficit due to decreased output and tax revenue (Okeke et al., 2021).

The main goal of this paper is to analyse the empirical impact of fiscal austerity on economic growth, while also considering its effects on some variables that affect the social status of citizens. It is believed that tightening the state's budget primarily affects the lowest socioeconomic groups, thereby widening the income gap (Campoy-Muñoz et al., 2022). Government spending cuts cause the labour income share to contract, which causes income to be redistributed away from the working class. Additionally, since these measures are typically implemented during recessions, they also affect unemployment, directly through the loss of jobs in the public sector and indirectly through a decline in private-sector employment. Upon examining the historical fiscal austerity measures, it can be inferred that the primary focus of these measures was on increasing regressive taxation and cutting social expenditures, which served as the impetus for the rise in both unemployment and inequality. Mattei (2022) views fiscal austerity as a logical political agenda to protect capitalism since it increases worker precariousness and dependence on the market.

The example of the 2008 global financial crisis often illustrates the failure of fiscal austerity policies. Due to the crisis, most EU members implemented fiscal austerity measures to balance their budgets and prevent sovereign debt default (Ray et al., 2020). However, compared to other EU members, Greece had to implement far more austerity measures during the crisis. This was due to an austerity programme imposed by the EU and the European Central Bank, which aimed to bring Greece's finances under control in exchange for bailouts (Economides et al., 2021). The programme included a tax reform, a pension reform, and pay cuts in the public sector. In relation to the tax reform, the administration was expected to present a fresh strategy aimed at enhancing revenue collection, curbing capital flight, and combating tax evasion. According to the IMF (2013), it was observed that no substantial progress has been made towards curbing tax evasion, and both the wealthy and the self-employed are still not paying their required taxes. To make matters worse, the value-added tax (VAT), which is a more regressive way of collecting taxes, was raised by 10 percentage points, putting a burden on low-income households. This programme led to a reduction in public spending and an increase in taxes, which affected the public employees of Greece. Greece's deficit has significantly reduced since then. However, the nation's austerity programme in 2010 had only sporadic positive effects on the economy. This is because the financial situation was not significantly impacted by the austerity measures, as the nation had already experienced a deficiency in aggregate demand. To escape the austerity trap, it is crucial to increase exports to potentially offset the decline in aggregate demand (Stiglitz, 2014). However, Greece's export performance has been poor, and the country has been carrying a massive current account deficit, which exceeds 10% of the GDP (Pagoulatos, 2018). The Greek economy shrank by 25% in 7 years, with unemployment above 20%. Austerity failed to achieve sustainable debt, and a 2015 referendum rejected the second bailout due to its negative impact on the public (Ifanti et al., 2013).

In this paper, the synthetic control method is employed to examine the effects of fiscal austerity on real GDP per capita, unemployment, and inequality. This approach allows for testing the causal relationship between the variables. Considering the severity of the measures, the effects of fiscal austerity are investigated using Greece as an example. Since the fiscal austerity measures started to be implemented in 2010, when the first Economic Adjustment Programme (EAP) was approved, 2010 is considered the year of treatment. Changes in real GDP per capita, unemployment, and income inequality are examined from 1995 to 2018.

The remainder of the paper is structured as follows. Section 2 provides a literature review on the relationship between fiscal consolidation and economic and social variables of interest. Section 3 brings the methodology and the used data. The results are presented and discussed in Section 4. Finally, the main conclusions of the research are provided in Section 5.

2. Literature review

The 2008 crisis reignited the long-running controversy about the efficiency of fiscal multipliers and the impact of fiscal austerity on GDP, and scholars still disagree on that matter. They divide between those who consider that fiscal austerity harms the economy (Blanchard & Cottarelli, 2010; Blanchard & Leigh, 2013; Alexiou & Nellis, 2016; Brinca et al., 2020) and those who claim that fiscal austerity can have expansionary effects (Giavazzi & Pagano,

1990; Alesina & Ardagna, 2010; Mirdala, 2016; Alesina et al., 2015; 2019), mainly when based on spending cuts.

A variety of empirical research supports the neoclassical theory. Giavazzi and Pagano (1990) demonstrate a positive correlation between fiscal consolidation and an increase in private consumption. Alesina and Perotti (1997) discovered that there is occasionally a connection between fiscal consolidation and rapid output growth, mainly when the consolidation is carried out by reducing government spending instead of raising taxes. Further research, such as Alesina and Ardagna's (2010) paper, has confirmed these findings by analysing larger samples of countries and years.

The economic impacts of budgetary reforms in OECD economies are examined by Alesina et al. (2015). They show that fiscal consolidation based on spending has relatively low economic costs, whereas consolidation based on taxes has far higher costs. Jordà and Taylor (2015) use a counterfactual analysis of the effects of the UK government's transition to austerity measures, which took place in 2010. They demonstrate that austerity is always detrimental to growth, particularly in times of recession. In a downturn, fiscal consolidation amounting to 1% of GDP measures a four per cent loss of real GDP over five years, as opposed to just one per cent in a boom. Similar conclusions are drawn by House et al. (2019), who claim that counterfactuals demonstrate that removing austerity would have significantly decreased output losses in Europe. Moreover, in the wake of the crisis, several European nations experienced an increase in debt-to-GDP ratios due to endogenous decreases in GDP and tax income caused by contractionary austerity shocks.

Using the synthetic control method, Rayl (2020) shows that GDP per capita in Greece, Spain, and Italy would have been higher if fiscal consolidation measures had not been implemented. Similarly, using the same method, Revuelta (2021) examines the effects of the EAPs in Greece and finds that their implementation has had a negative impact of 35.3% of the country's GDP per capita.

Within the framework of fiscal austerity, most research focuses on how the policy mix and economic output interact. However, only a few have examined how these budgetary adjustments affect unemployment and income distribution. In contrast to neoclassical perspectives, it asserts that austerity causes output loss and raises long-term unemployment, which sets off an economic hysteresis effect (Alexiou & Nellis, 2016). The IMF (2014) examined specific cases where policy actions were meant to lower budget deficits. They show that reducing the budget deficit had increased unemployment and caused domestic demand to contract for both kinds of adjustment instruments, tax-based instruments and spending-based instruments. Using counterfactual simulations, Lama and Medina (2019) demonstrate that improving the fiscal balance might come at the cost of a higher unemployment rate.

The relation between unemployment and the impact of fiscal austerity on income inequality is quite strong. Woo et al. (2013) point out that the unemployment channel accounts for roughly 15-20% of increases in income inequality. Research demonstrates that spending-based adjustments have a significant and negative impact on the labour share of national income and increase income disparities, mainly because they cause long-lasting unemployment (Okeke et al., 2021), whereby the impact on the labour's share of national income is more significant than that on capital income (Ball et al., 2013).

3. Methodology and data

The synthetic control method (SCM) enables the evaluation of the effect of an intervention that affects one unit, which can be, for example, a region or a country. The synthetic control method is a generalisation of the difference-in-differences model that shows what would have happened if an intervention or policy had not occurred. Essentially, the SCM proposes that a group of units is a more reliable "imitation" for the unit receiving the treatment than any unit by itself. The SCM is an innovative way to detect causality, presented first in the work of Abadie and Gardeazabal (2003). It has several benefits: 1) prevents endogeneity bias; 2) useful for small samples, and 3) produces more accurate results compared to standard regression (Abadie et al., 2010; Abadie, 2020).

The SCM searches for a set of control unit weights w_j such that:

$$Y_{1,\,t<T_0} = \sum_{j=2}^{J+1} w_j * Y_{j,\,t<T_0}. \quad (1)$$

There are outcome variables (real GDP per capita, unemployment rate and GINI) for a treated unit (Greece) and J control units (27 European coun-

tries). The outcome variable in country i at time t is $Y_{i,t}$; $i = 1$ is the treated unit; $i = 2,3,\ldots, J+1$ are the control units; T_0 refers to the treatment year (fiscal austerity measures in 2010); the time periods where $t < T_0$ are 'pre-treatment' (1995-2009), and $t \geq T_0$ is 'post-treatment' (2010-2018).

During the pre-treatment period, the treated unit is equivalent to the weighted total of the control units. But since it is often not possible to obtain a precise match, the following equation is used instead (Abadie and L'hour, 2021):

$$Y_{1,\, t<T_0} \approx \sum_{j=2}^{J+1} w_j * Y_{j,\, t<T_0}, \tag{2}$$

such that the mean squared error prior to treatment is minimised:

$$w_j = \min_{w} \sqrt{\frac{1}{T_0}\sum_{t=1}^{T_0}\left(Y_{1,t} - \sum_{j=2}^{J+1} w_j Y_{j,t}\right)^2}\,^{1}. \tag{3}$$

By averaging pre-intervention results of chosen donor states, the SCM constructs a "synthetic" counterfactual region. A pool of possible candidates is used to pick the donor countries that come together to generate synthetic control. The choice of donor countries and weights is determined by predictor variables that impact the result.[1] The resulting synthetic is a control for the affected region after policy adoption and closely resembles the outcome of the affected region before policy enactment.

Using the w_j weights, the causal effect is estimated such that:

$$Y_{1,t\geq T_0} = Y^N_{1,\, t\geq T_0} + \alpha_{1,t}. \tag{4}$$

The fundamental problem of causal inference is that $Y^N_{1,\, t\geq T_0}$ cannot be observed, thus the weighted control units are used instead. The difference between the treated time series and the weighted average of control units which represents the treatment's effect, also known as the causal effect, can be written as (Abadie et al., 2010):

$$\alpha_{1,t} = Y_{1,t\geq T_0} - Y^N_{1,\, t\geq T_0}. \tag{5}$$

For the approach to be used effectively, three assumptions must be valid. First, for every year during the pre-treatment period that was utilised to generate synthetic control, the policy change only affects the treated country. Second, the policy change has an effect only when it is implemented. In other words, the treatment is not anticipated and does not cause an effect before the year of implementation. Third, a fixed combination of donor states can approximately represent the counterfactual outcome for the treated country. This means that in order to prevent any potential interpolation bias, the values of the variables used to construct the weights must be comparable between the donor pool countries and the affected country. The values of the treated country cannot be outside any linear combination of the values from the donor pool countries. The assumptions of the model are explained in the following paragraphs.

Given that in this paper we want to examine the impact of fiscal austerity on real GDP per capita, unemployment and inequality, it is necessary to construct three models. In order to be able to observe the causality in all three models, to begin with, it is necessary to select a country that has introduced fiscal austerity measures to a greater extent than the other countries that make up the donor pool[2] (McClelland and Gault, 2017). In the selection of the treated unit, the methodology according to Rayl (2020) was employed, where the degree of strength of fiscal austerity is determined from IMF data in such a way that the average increase and decrease of the budget deficit in the period from 2010-2013, but also the percentage year-to-year increase in the government structural balance, are observed (presented in Table 1). It can be concluded that Greece and Spain experienced heavy austerity measures, but Greece faced these measures to a much larger extent.

1 Thus, different predictor variables imply different selection of weights and countries in the "synthetic" counterfactual country.

2 The donor pool is constructed out of potential candidates that combine to form synthetic control.

Table 1 Evaluating the magnitude of fiscal austerity in European countries, 2010-2013

Type of Austerity	Definition	Countries
No Austerity	> 0 avg, no more than 1% increase in YTY GSB[3] in any year during 2010 - 2013	Denmark, Estonia, Finland, Norway, Sweden, Switzerland
Very Light Austerity	> 0.5, no more than 2% increase in YTY GSB in any year during 2010 - 2013	Austria, Belgium, Germany, Luxembourg, Malta
Light Austerity	> 0.85, no more than 2.5% increase in YTY GSB in any year during 2010 - 2013	Croatia, France, Netherlands, Poland, Slovenia
Moderate Austerity	> 0.85 avg GSB (% GDP)	Czech Republic, Island, Ireland, Italy, Latvia, Lithuania, Portugal, Romania, Slovak Republic, United Kingdom
Heavy Austerity (Treatment)	>2 avg, greater than 4% increase in YTY GSB in a year during 2010 - 2013	Greece, Spain

Source: International Monetary Fund, World Economic Outlook Database, October 2019
General Government Structural Balance

This paper uses Greece as the treated unit, and the year 2010 as the year of the intervention, which is related to the introduction of the first Economic Adjustment Programme[4]. The idea of the synthetic control method is to construct a "synthetic" Greece based on averaging the predictor variables of the countries from the donor pool. Therefore, the first step is the selection of predictor variables, i.e. variables that influence outcomes in countries from the donor pool both before and after treatment.

Table 2 presents the selected predictor variables, as well as the variables of interest. Different predictor variables are used in the three models. The lagged values of the outcome variables from 1998, 2002, and 2009 are included, as the lagged outcome variable is one potentially significant predictor of the outcome variable. It addresses the problem of omitting important predictor effects since it includes the impacts of all predictor variables, regardless of whether the analyst collects them. Indeed, according to Athey and Imbens (2006), it is customary to include the lagged outcome variable for a few pretreatment years, since other predictor variables are rarely significant. In implementing the synthetic control method, it is necessary to define a pretreatment period, i.e. a period before the intervention over which the predictors will be averaged and a post-treatment period, i.e. a period in which the effect of the intervention will be examined. In this paper, the pre-treatment period refers to the period from 1995 to 2009, while the post-treatment period refers to the period from 2010 to 2018. The next step is the choice of countries for the so-called donor pool. In order to acquire values for the donor pool countries that are comparable to those for Greece, EU countries are selected in the donor pool. Ideally, units that have not been the subject of treatment should be included in the donor pool. Given that all EU countries introduced certain fiscal austerity measures during the financial crisis, the goal is to exclude those countries where these measures were more pronounced. Accordingly, all EU countries are included in the donor pool, with the exception of Spain. Since the assumption that the treatment was present only in Greece is not entirely satisfied, this could cause the effect to be relatively underestimated in Greece, which is not as concerning as an overestimation of the effect, but it is still important to consider this when analysing the results.

Furthermore, each country is assigned a certain share in the "synthetic" control group with the aim that it closely matches Greece in the pre-treatment period. In the period of intervention, an alternative scenario can be seen, i.e. what would have happened if fiscal austerity measures had not been introduced. Thus, the causal effect can be determined as the difference between Greece and "synthetic" Greece.

3 Year-to-year change in the general government structural balance.

4 See Revuelta (2021).

Table 2 Description of variables

Outcome variables	
gdppcap (Model 1, M1)	GDP per capita, based on purchasing power parity (PPP) (in constant 2011 international dollars)
unem (Model 2, M2)	Unemployment rate
ginim (Model 3, M3)	The Gini index on market income—sometimes referred to as a pre-tax Gini index—measures inequality in income without considering the effect of taxes and social spending already in place in a country. It is shown on a scale from 0 to 100%.
Predictor variables	
popg (M1)	Population growth (annual %)
inv (M3)	Net investment in government nonfinancial assets (% GDP) includes fixed assets, inventories, valuables, and non-produced assets. Nonfinancial assets are stores of value and provide benefits either through their use in the production of goods and services or in the form of property income and holding gains. Net investment in nonfinancial assets also includes consumption of fixed capital.
gdppcap (M2, M3)	GDP per capita based on purchasing power parity (PPP)
terenr (M2)	School enrolment, tertiary (% gross)
ind (M1, M2)	Industry, value added (% of GDP)
agr (M1, M2)	Agriculture, value added (% of GDP)
debtgdp (M1, M3)	General government gross debt (% of GDP)
trade (M2)	Trade (% of GDP); the sum of exports and imports of goods and services measured as a share of gross domestic product
unem (M3)	Unemployment rate

Note: All variables are gathered from the World Bank Database; except for the variable Ginim, which is gathered from the Standardized World Income Inequality Database.
Source: World Bank Database, Standardized World Income Inequality Database

To ensure that the findings are not the result of pure chance, placebo tests are employed (in-space and in-time placebo). In order to conduct the in-space placebo test, the synthetic control approach is applied to untreated countries to quantify a degree to which the impact size in untreated countries deviates from the effect found for treated countries. There is reason to question the significance of the estimations for the treated unit if impacts of comparable magnitudes are frequently detected. It can be claimed that there is strong evidence of a significant impact of fiscal austerity on Greece's economic and social variables if placebo testing reveals that the difference between the synthetic outcome and the actual outcome is unusually large for Greece in comparison to other nations. Throughout the course of the treatment year, in-time placebo tests are also conducted. To further verify that the outcomes are not the product of pure chance, the intervention should be reassigned to years when there was none (Chen & Yan, 2023).

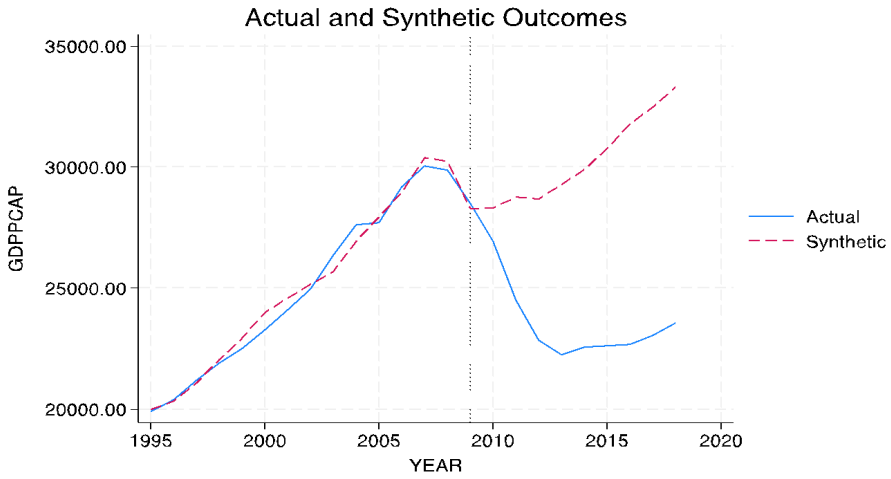
4. Results and discussion

Estimating the impact of fiscal austerity in Greece requires determining the optimal counterfactual.

Synthetic control weights and the optimal counterfactual composition have been optimised using the process outlined in the preceding section. The STATA18 synth2 package was used to perform the estimations.

Three models were constructed. The first model refers to the impact of fiscal austerity on real GDP per capita. Predictor variables used in the first model are popg, debtgdp, agr, ind and lagged outcome variables for 1998, 2002 and 2009. In constructing the counterfactual, the following shares were allocated to the countries: Hungary 47.1%, Iceland 20.2%, Latvia 11.3%, Belgium 11%, Luxembourg 6.5%, and Lithuania 4%. The result of our baseline specifications is given in Figure 1. In the pre-treatment period, real GDP per capita in "synthetic" Greece adequately captures the dynamics of real GDP per capita in Greece (R-squared = 0.98). This allows for a more certain interpretation of the outcomes produced by the synthetic control method. The difference between the real GDP per capita of Greece and "synthetic" Greece between 2010 and 2018 was used to quantify the effect of the introduction of fiscal austerity measures. Although the EAP measures were introduced in 2010, the effect was already visible in 2009, which can be explained by the possible anticipation of such measures and the slowdown of the economy. The method showed a negative effect of fiscal austerity measures on real GDP per capita in Greece. The red (dashed) line indicates what real GDP per capita in Greece would have been if fiscal austerity measures had not been introduced. As can be seen, real GDP per capita would then be significantly higher, on average (through the post-treatment period) 6,916.96 international dollars. This finding supports the heterodox view of fiscal austerity presented in Section 2.

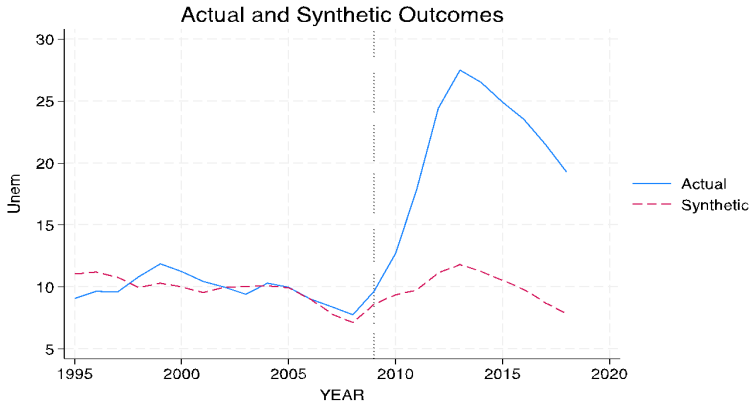
Figure 1 The effect of EAP on real GDP per capita (gdppcap) in Greece



Source: Authors' calculations

The second model shows the impact of fiscal austerity on the unemployment rate (see Figure 2). Predictor variables included in the model are gdppcap, terenr, agr, ind, trade and lagged values of the dependent variable (same as in the first model). In this model, "synthetic" Greece is constructed from France (41.3%), Portugal (22.8%), Poland (19.2%), and Italy (16.6%). In this model, the influence of the effect can also be seen since 2009; however, the synthetic version does not match the actual values for Greece (prior to the treatment) as precisely as in Model 1. The validity of the model will be demonstrated by the placebo tests conducted in the following stage. Figure 2 shows that Greece has significantly higher unemployment rates compared to "synthetic" Greece, which is in line with the scientific literature. The average treatment effect, estimated in the post-treatment period, is 12 percentage points. The effect itself is most pronounced in 2013 (15.68 percentage points) and thereafter it starts to decrease gradually.

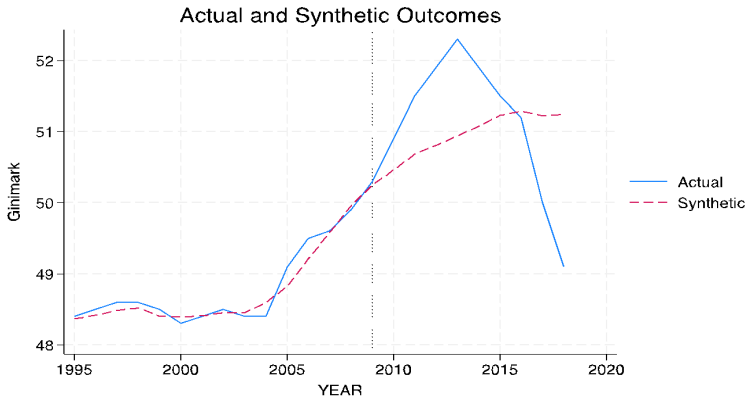
Figure 2 The effect of EAP on the unemployment rate (unem) in Greece



Source: Authors' calculations

The impact of the introduction of the Economic Adjustment Programme on income inequality (measured by the Gini index before taxes and transfers) is examined by the third model, and it is shown in Figure 3. Predictor variables included in this model are unem, gdppcap, debtgdp and inv, and lagged values of the dependent variable. "Synthetic" Greece is constructed from Sweden (47.3%), Austria (27.3%), Portugal (23.6%), and Ireland (1.6%), and it closely resembles the actual values for Greece prior to the treatment (R-Squared = 0.95). The impact of fiscal austerity on income inequality varies in comparison to the impact on real GDP per capita and the unemployment rate. Namely, at the beginning of the post-treatment period, income inequality in Greece is higher than in "synthetic" Greece, and the peak was reached in 2013, when the Gini index in Greece was 1.357 percentage points higher than it would have been if Greece had not started the EAP. However, after 2017, the effect turns negative, i.e. the Gini index in Greece is 1.1 percentage points lower in 2017, and 2.02 percentage points lower in 2018 than it would have been if Greece had not introduced fiscal austerity measures. Thus, from the aspect of income inequality, fiscal austerity initially increased income inequality, and later it resulted in the reduction of income disparities. Thus, the level of inequality in Greece was lower compared to that of "synthetic" Greece. Fiscal austerity is expected to increase income inequality, while the opposite effect can be explained by the reduction of public debt and the indirect effect it has on income distribution (see Hager, 2016).

Figure 3 The effect of EAP on income inequality (ginim) in Greece

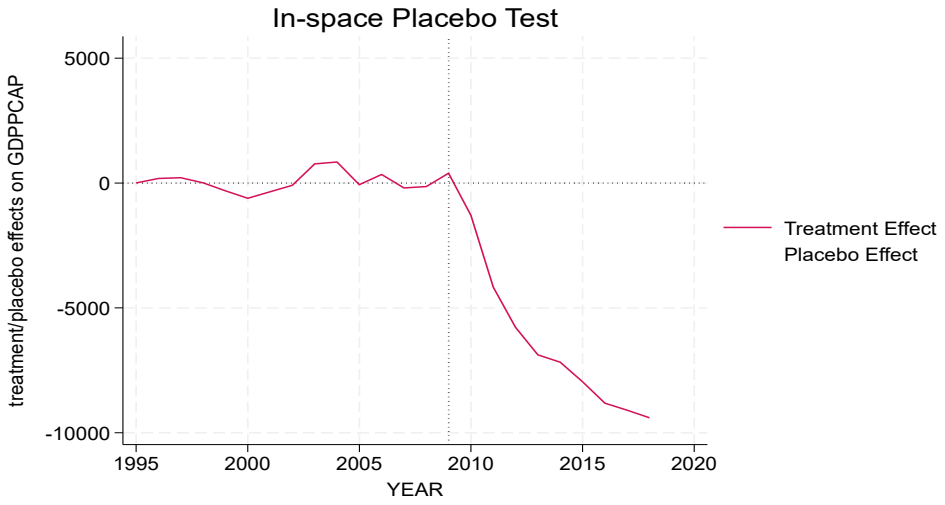


Source: Authors' calculations

To test the reliability of the synthetic control method results, two types of placebo tests were conducted – in-space placebo and in-time placebo. The results of these tests are displayed in the paragraphs that follow.

First, an in-space placebo test was performed to analyse the significance of the estimates. The test requires that all of the donor countries are subject to the 2010 intervention.[5] Figures 4, 5 and 6 show the results of the placebo test for the three models, respectively, by graphing the distribution of placebo effects. The mean squared prediction error (MSPE) and the p-value derived from the placebo test provide detailed information on the robustness of the model, as can be seen in Figure 4. In the first model, the expected impact for Greece differed markedly from the estimates of the placebo tests for the countries in the donor pool. The red line shows the impact on Greece, whereas the grey lines illustrate the effects when the treatment is applied to different donor pool countries. Greece's influence can be deemed significant if the red line falls below the grey lines during the post-treatment period. This is because, in comparison to the placebo countries, Greece encounters the greatest negative effect from the treatment. Since that is the case in Figure 4, the effect was caused by the EAP in Greece, as opposed to a common shock that the EU suffered as a result of the financial crisis and a deep recession. The results indicate that Greece has the largest MSPE ratio among all donor countries, with a general p-value of $1/16^{6} = 0.0625$ (significant at the 10% level). Additionally, the pointwise p-values (two-sided and left-sided) present that for most post-treatment years the effects are significant at the 10% level.

Figure 4 Robustness of results for Model 1 – placebo gaps in control countries



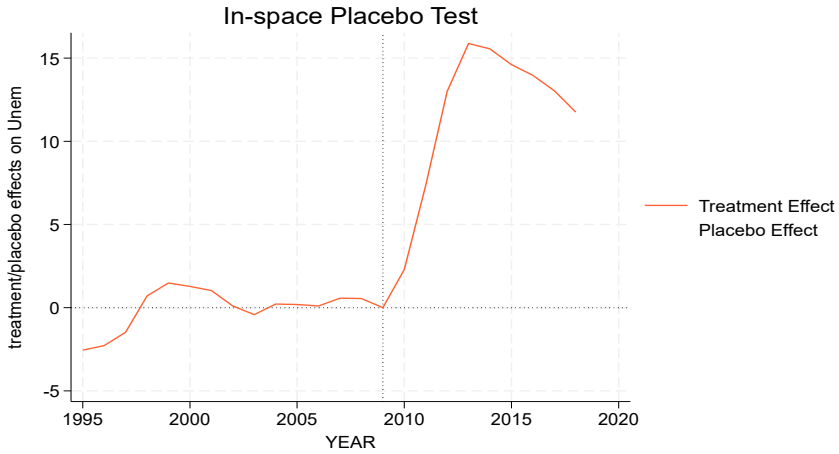
Note: The red line represents Greece, while the grey lines show other countries from the donor pool with a pre-treatment MSPE two times larger than the treated unit.
Source: Authors' calculations

In the second model, the placebo test yields an overall p-value of 0.05, while the pointwise p-values (either two-sided or right-sided) are significant at 5% for all post-treatment years. Figure 5 illustrates how Greece's effect on unemployment differs significantly from other countries included in the placebo test. The red line in this figure indicates that the effect on Greece is the most significant as the red line is above the grey lines. In other words, Greece's unemployment rate increased more than that of any other donor country as a result of the fiscal austerity measures. Therefore, we can validate the accuracy of this model.

5 This analysis excludes those with a pre-treatment MSPE two times larger than that of the treated unit (option (unit cutoff(2)).

6 Number 16 is calculated by extracting the number of units with a pre-treatment MSPE two times larger than that of the treated unit (which are 8 units) from the total number of donor states (24).

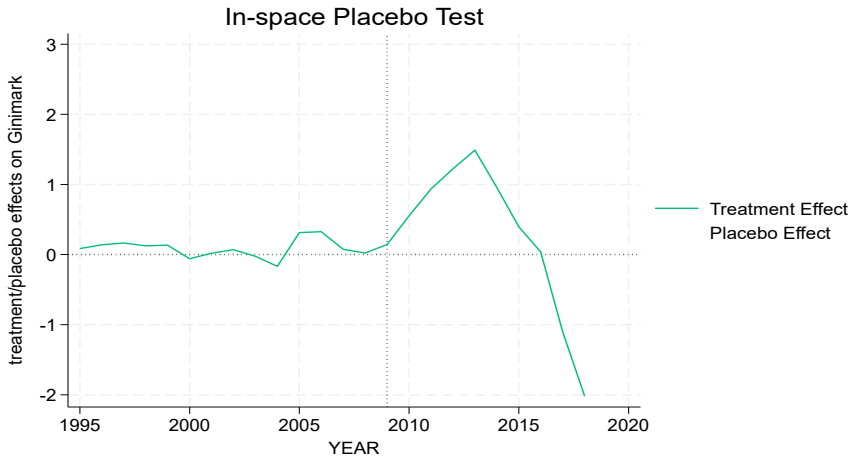
Figure 5 Robustness of results for Model 2 – placebo gaps in control countries



Note: The red line represents Greece, while the grey lines show other countries from the donor pool with a pre-treatment MSPE two times larger than the treated unit.
Source: Authors' calculations

Figure 6 presents the placebo test results for the third model. The figure shows that the outcome for Greece does not significantly differ from the estimates of the placebo tests for the donor pool nations. This can also be confirmed by the overall p-value of 0.5[7], as well as by the pointwise p-values that are not significant at the common levels of significance. The outcome shows that the 2010 treatment impact is not specific to Greece; hence, it is not possible to link it to the implementation of EAPs with certainty.

Figure 6 Robustness of results for Model 3 – placebo gaps in control countries

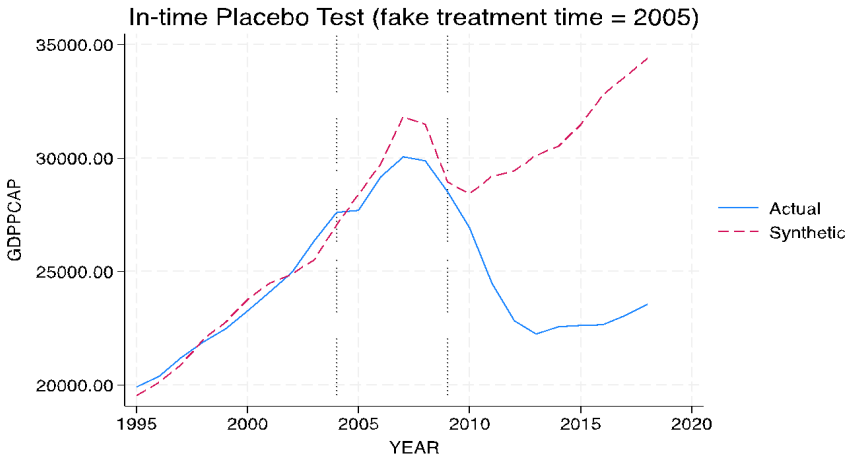


Note: The green line represents Greece, while the grey lines show other countries from the donor pool with a pre-treatment MSPE two times larger than the treated unit.
Source: Authors' calculations

7 There are a total of 22 units with a pre-treatment MSPE two times larger than the treated unit; therefore, the p-value is calculated as ½.

Secondly, to further test the robustness of the results, an in-time placebo test was conducted. We use the synthetic control approach to establish an alternative intervention year for the treatment; rather than 2010, we consider the treatment to begin in 2005, five years prior to the first actual implementation of EAPs.

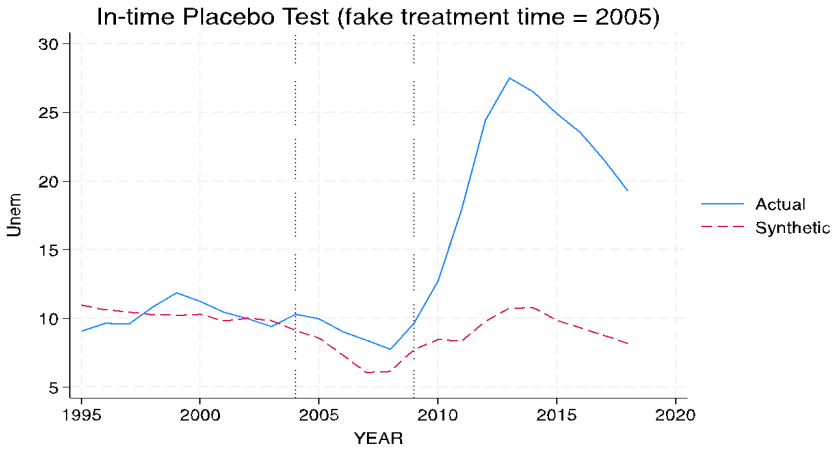
Figure 7 Robustness of results for Model 1 – in-time placebo test (treatment year = 2005)



Source: Authors' calculations

In the first (see Figure 7) and the second model (see Figure 8), the EAP effect became apparent in 2010. Thus, the results of the first two models are robust. Figures 7 and 8 illustrate that, even when a different treatment year is selected, the impact of the treatment is most evident from 2010 onward. This indicates that there is no bias in these models regarding the treatment year. Therefore, the effect shown by the synthetic control method can be considered a consequence of the implementation of EAPs in 2010.

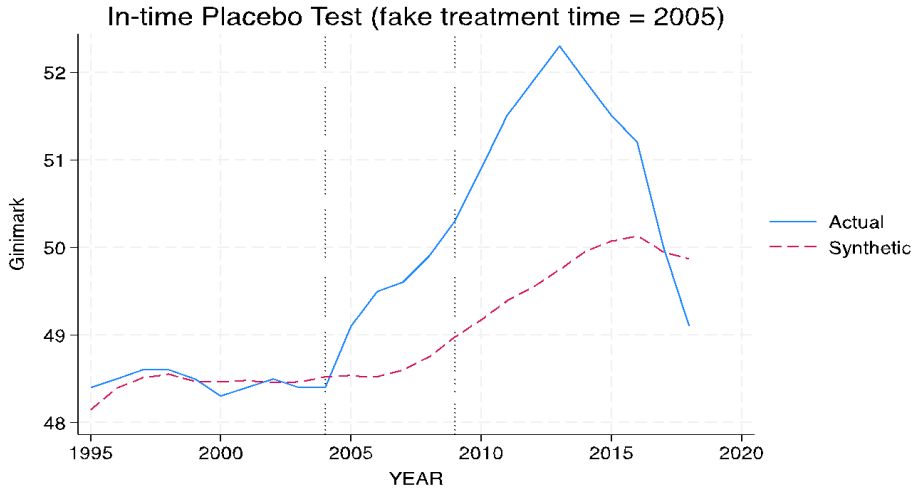
Figure 8 Robustness of results for Model 2 – in-time placebo test (treatment year = 2005)



Source: Authors' calculations

However, the in-time placebo test result of Model 3 indicates that the model is not robust, given that the effect appears to have begun in 2004 (see Figure 9). As a result, the effect determined by the synthetic approach cannot solely be attributed to Greece's fiscal austerity measures.

Figure 9 Robustness of results for Model 3 – in-time placebo test (treatment year = 2005)



Source: Authors' calculations

The in-time placebo test reassigns the treatment to start in a year during the pre-treatment period. If the placebo estimate significantly differs from the actual pre-treatment, the robustness of the model is questionable. While Models 1 and 2 can be considered robust, the third model is biased due to the discrepancy between the actual treatment year and the year when the effect occurred in the in-time placebo test.

Furthermore, reasons for decreasing GDP per capita in Greece are external (a financial crisis), but also internal, i.e. orientation towards tourism, which is related to structural weaknesses of the economy and relative incompatibility with the structure of developed countries, low resilience, low productivity and a low level of competitiveness. The methodology used in this paper enables the identification of the causal effect of "fiscal austerity", given that the donor pool includes European countries which were also affected by the financial crisis. The main cause of the decline was observed uniquely in all countries, whereby internal factors are to a greater or lesser extent represented at least in one or more EU member states used in the donor pool. For instance, low productivity and a low level of competitiveness were also observed in Portugal, Croatia, Romania, etc. Therefore, with this method, the effects of the introduction of EAP measures and their causality with respect to GDP, unemployment and inequality can be determined quite precisely, abstracting to a greater extent the influence of other factors relevant to the phenomenon itself.

5. Conclusion

In this paper, the effect of fiscal austerity measures introduced in 2010 in Greece on the variables of real GDP per capita, unemployment rate and income inequality, is evaluated using the synthetic control method. The causal effect is estimated by creating a counterfactual from a group of European countries, which depicts Greece as closely as possible in the years prior to the intervention. In the post-treatment period, the difference between the synthetically created Greece and the actual Greece can be observed, which shows the effect of the intervention. The period in which the movement of the variables is observed is from 1995 to 2018.

The paper shows that the fiscal austerity measures introduced during the global financial crisis in Greece had a negative impact on the movement of real GDP per capita, which is 42.7% lower in Greece

in 2018 in comparison to the real GDP per capita of the "synthetic" Greece. Precisely, in the post-intervention period (from 2010 to 2018), real GDP per capita is on average 6,916.96 international dollars lower than it would have been if fiscal austerity measures had not been introduced. As for the unemployment rate, the average treatment effect after the intervention is 12 percentage points. The unemployment rate in 2018 in Greece is 61.54% higher when compared to the "synthetic" Greece. It should be emphasised that since 2013 the effect has been decreasing.

The findings are not consistent when it comes to how fiscal austerity affects income inequality. First, the implementation of EAPs causes Greece's Gini coefficient to rise relative to the "synthetic Greece"; subsequently, the Gini coefficient decreases, and since the beginning of 2016, Greece's inequality has decreased relative to what it would have been in the absence of fiscal austerity measures. Still, the results may only be partially interpreted since the robustness of the third model was not verified by the in-time and the in-space placebo test.

It can be concluded that fiscal austerity in Greece reduced real GDP per capita and caused an increase in the unemployment rate. Because fiscal austerity measures were linked to the global financial crisis, this work is limited in that it is impossible to determine whether fiscal austerity is always harmful (the heterodox perspective) or only problematic when implemented during recessions (the Keynesian view). This research, however, confirmed the statements of those who criticised the strict austerity policy in Greece. The empirical results of this paper are in line with the findings of Jordà and Taylor (2015) and House et al. (2019) (see Section 2), which suggest that fiscal consolidation is detrimental to economic growth. Considering the effect on unemployment, this paper is consistent with Lama and Medina (2019), who also examine a rise in the unemployment rate due to fiscal austerity. Since the aforementioned papers examine the effects of fiscal austerity in different countries, this enables a comprehensive view of the consequences of such policies. Rayl (2020), Revuelta (2021) and Alogoskoufis (2019), who also concentrate on the case of Greece, likewise conclude that the 2010 strategy in Greece came at a significant cost in terms of a reduction in output and employment. The strong fiscal adjustments required from Greece had depressing effects by sinking domestic demand and thereby lowering real GDP per capita while exaggerating unemployment. As a consequence, Greece's economy was unable to grow or achieve fiscal sustainability, which led to a vicious cycle.

The obtained results also bring policy implications. In all instances, the findings of our research indicate that the potential distributional effects of fiscal austerity should be weighed against its benefits. Governments are frequently able to introduce tax increases or spending reductions so that the overall impact on distribution is minimised. It is crucial to pay attention to how fiscal policy affects inequality, especially now that it is rising and could be a cause of social unrest. When evaluating the causal effects of comprehensive policies, the synthetic control method has the advantage of being able to resolve the endogeneity issue. Its limitation, however, is that it depends on several assumptions, some of which are challenging to verify. One example of these assumptions in this paper is that the policy was not anticipated and only implemented in the observed country. Future research could consider different methods in addition to the synthetic approach to further evaluate the consequences of fiscal austerity.

References

1. Abadie, A. (2020). Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects. *Journal of Economic Literature*, *59*(2), 391-245. https://www.doi.org/10.1257/jel.20191450
2. Abadie, A. & Gardeazabal, J. (2003). The Economic Costs of Conflict: A Case Study of the Basque Country. *The American Economic Review*, *93*(1), 113-132. https://doi.org/10.1257/000282803321455188
3. Abadie, A. & L'hour, J. (2021). A Penalized Synthetic Control Estimator for Disaggregated Data. *Journal of the American Statistical Association*, *116*(536), 1817-1834. https://doi.org/10.1080/01621459.2021.1971535
4. Abadie, A., Diamond, A. & Hainmueller, J. (2010). Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program. *Journal of the American Statistical Association*, *105*(490), 493-505. https://doi.org/10.1198/jasa.2009.ap08746
5. Alesina, A. & Ardagna, S. (2010). Large Changes in Fiscal Policy: Taxes versus Spending. *Tax Policy and Economics*, *24*(1), 35-68. https://doi.org/10.1086/649828
6. Alesina, A. & Perotti, R. (1997). Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects. *IMF Economic Review*, *44*(2), 210-248. https://doi.org/10.2307/3867543
7. Alesina, A., Favero, C. & Giavazzi, F. (2015). The output effect of fiscal consolidation plans. *Journal of International Economics*, *96*(S1), S19-S42. https://doi.org/10.1016/j.jinteco.2014.11.003
8. Alesina, A., Favero, C. & Giavazzi, F. (2019). Effects of austerity: expenditure- and tax- based approaches. *Journal of Economic Perspectives*, *33*(2), 141-162. https://doi.org/10.1257/jep.33.2.141
9. Alexiou, C. & Nellis, J. G. (2016). A post-mortem of austerity: The Greek experience. *Economic Issues*, *21*(2), 1-32.
10. Alogoskoufis, G. (2019). *Greece and the Euro: A Mundellian Tragedy* (GreeSE Paper No. 136). London: London School of Economics and Political Science.
11. Anderson, B. (2010). Restoring Fiscal Sustainability: Lessons for the Public Sector. *Public Policy Review*, *6*(4), 611-624.
12. Athey, S. & Imbens, G. W. (2006). Identification and Inference in Nonlinear Difference-in-Difference Models. *Econometrica*, *74*(2), 431-497. https://doi.org/10.1111/j.1468-0262.2006.00668.x
13. Ball, L. M., Furceri, D., Leigh, D. & Loungani, P. (2013). *The Distributional Effects of Fiscal Consolidation* (IMF Working Paper No. 13/151). Washington, DC: International Monetary Fund. https://doi.org/10.5089/9781475551945.001
14. Blanchard, O. & Cottarelli, C. (2010). *Ten commandments for fiscal adjustment in advanced economies*. VoxEU 28. https://voxeu.org/article/ten-commandments-fiscal-adjustment-advanced-economies
15. Blanchard, O. J. & Leigh, D. (2013). *Growth forecast errors and fiscal multipliers* (NBER Working Paper No. w18779). Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w18779
16. Brinca, P., Ferreira, M., Franco, F., Holter, H. & Malafry, L. (2020). Fiscal consolidation programs and income inequality. *International Economic Review*, *62*(1), 405-460. https://doi.org/10.1111/iere.12482
17. Campoy-Muñoz, P., Cardenete, M. A., De Miguel-Vélez, F. J. & Pérez-Mayo, J. (2022). How does fiscal austerity impact on poverty and inequality? The Spanish case. *Economia Politica: Journal of Analytical and Institutional Economics*, *39*(3), 715-737. https://doi.org/10.1007/s40888-021-00253-5
18. Chen, Q. & Yan, G. (2023). A mixed placebo test for synthetic control method. *Economics Letters*, *224*, 111004. https://doi.org/10.1016/j.econlet.2023.111004
19. Economides, G., Papageorgiou, D. & Philippopoulos, A. (2021). Austerity, Assistance and Institutions: Lessons from the Greek Sovereign Debt Crisis. *Open Economies Review*, *32*, 435-478. https://doi.org/10.1007/s11079-020-09613-3

20. Giavazzi, F. & Pagano, M. (1990). *Can severe fiscal contractions be expansionary? Tales of two small European countries* (NBER Working Paper No. 3372). Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w3372
21. Hager, S. B. (2016). *Public Debt, Inequality, and Power: The Making of a Modern Debt State.* University of California Press. https://doi.org/10.1525/luminos.14
22. House, C. L., Proebsting, C. & Tesar, L. L. (2019). Austerity in the aftermath of the Great Recession. *Journal of Monetary Economics*, *115*, 37-63. https://doi.org/10.1016/j.jmoneco.2019.05.004
23. Ifanti, A. A., Argyriou, A. A., Kalofonou F. H. & Kalofonos, H. P. (2013). Financial crisis and austerity measures in Greece: Their impact on health promotion policies and public health care. *Health Policy*, *113*(1-2), 8-12. https://doi.org/10.1016/j.healthpol.2013.05.017
24. IMF (2013). *Greece: 2013 Article IV Consultation Concluding Statement of the IMF Mission*. http://www.imf.org/external/np/ms/2013/050313.htm
25. IMF (2014). *Fiscal Policy and Income Inequality* (IMF Policy Paper No. 40). Washington, DC: International Monetary Fund. https://doi.org/10.5089/9781498343671.007
26. Jordà, Ò. & Taylor, A. M. (2015). The Time for Austerity: Estimating the Average Treatment Effect of Fiscal Policy. *Economic Journal*, *126*(590), 219-255. https://doi.org/10.1111/ecoj.12332
27. Lama, R. & Medina, J. P. (2019). Fiscal Deficits and Unemployment Dynamics: The Role of Productivity Gains and Wage Rigidities. *Review of Economic Dynamics*, *34*, 121-140. https://doi.org/10.1016/j.red.2019.02.007
28. Mattei, C. (2022). *The Capital Order: How Economists Invented Austerity and Paved the Way to Fascism*. University of Chicago Press. https://doi.org/10.7208/chicago/9780226818405.001.0001
29. McClelland, R. & Gault, S. (2017). *The Synthetic Control Method as a Tool to Understand State Policy*. Urban Institute. https://www.urban.org/sites/default/files/publication/89246/the_synthetic_control_method_as_a_tool_0.pdf
30. Mirdala, R. (2016). Effects of fiscal policy shocks in the euro area (lessons learned from fiscal consolidation). *Journal of Advanced Research in Law and Economics*, *7*(8), 2236-2277.
31. Okeke, A., Alexiou, C. & Nellis, J. (2021). Austerity Effects on National Output and Income Inequality: A Systematic Literature Review. *Review of Economics*, *72*(2), 97-148. https://doi.org/10.1515/roe-2021-0012
32. Pagoulatos, G. (2018). *Greece after the Bailouts: Assessment of a Qualified Failure* (GreeSE Paper No. 130). London: London School of Economics and Political Science.
33. Ray, R., Gallagher, K. & Kring, W. (2020). *IMF Austerity Since the Global Financial Crisis: New Data, Same Trend, and Similar Determinants* (GEGI Working Paper No. 11/2020). Boston, MA: Global Development Policy Center.
34. Rayl, N. (2020). *Cost of Austerity: Effect of Fiscal Consolidation in Europe Post 2010*. Available at: https://ssrn.com/abstract=3596470 or http://dx.doi.org/10.2139/ssrn.3596470
35. Revuelta, J. (2021). The Effects of the Economic Adjustment Programmes for Greece: A Quasi-Experimental Approach. *Sustainability*, *13*(9), 4970. https://doi.org/10.3390/su13094970
36. Stiglitz, J. (2014). *Austerity has been an utter disaster for the eurozone*. The Guardian. https://www.theguardian.com/business/2014/oct/01/austerity-eurozone-disaster-joseph-stiglitz
37. Woo, J., Bova, E., Kinda, T. & Zhang, Y. (2013). *Distributional Consequences of Fiscal Consolidation and the Role of Fiscal Policy: What Do the Data Say?* (IMF Working Paper No. 13/195). Washington, DC: International Monetary Fund.