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Estimating the effect of the 2008 financial crisis on GNI in Greece and Iceland: A synthetic control approach

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Abstract:

The purpose of this thesis is to conduct a comparative study in order to estimate the impact of the financial crisis to the GNI of Greece and Iceland. By applying synthetic control matching (a relatively new methodology) the study intends to compare the two countries, thus deducting conclusions about good or bad measures adopted. The results indicate that in both cases the adopted measures were not the optimal ones, since the synthetic counterfactual appear to perform better than the actual Greece and Iceland. Moreover, it is shown that Iceland reacted better to the shock it was exposed. However, different characteristics of the two countries impede the application of Icelandic actions in the Greek case.

Keywords:

Synthetic control matching, treatment effects, Greece, Iceland, comparative studies, financial crisis
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1. Introduction

1.1 Background

Economist Paul Krugman (2009, p. 146) characterized the pre-crisis period as an era of “excessive optimism”. This excessive optimism had as a result the creation and burst of the economy bubble and the subsequent collapse of the banking system. In the autumn of 2008, the crisis peaked with the disintegration of financial behemoths as Lehman Brothers, Merrill-Lynch, or Citigroup (Jones, 2009). From that point it was obvious that this financial crisis would spread around the world, affecting not only the capital market but the “real economy” as well (Korten, 2010).

In 2010, the European Union decided to create a long term strategy for European development, building safeguards in order to ensure stability within the zone, after the catastrophic consequences of the longest recession in the European history (European Commission, 2010a). Although in the past years the situation in Europe has not improved much, policies which were developed can provide some security in case of a new recession. Some examples of such policies is the “Europe 2020” which is meant to ensure a basic standard of living for the European citizens (European Comission, 2013) or the creation of Basel III1 (Annexure, 2010).

The economy as a whole includes countless complicated relations, often making it difficult to identify the actual source of economic problems. Therefore, the large number of contingencies requires thorough analysis from different angles and perspectives. Over the years, researchers have attempted to study these contingencies, in order to identify the most plausible scenarios for how economic crisis evolve over time. Policy makers can use such studies in order to create similar safeguards as the ones of the EU, so that the lessons of the past can be used as tools in the future.

The global financial crisis had devastating consequences for various countries around the globe. In Europe, two of the countries which were intensively hit by crisis, was Greece and Iceland. Although some studies indicate that the nature of the problem in both cases is the banking system (Louzis, Vouldis & Metaxas, 2012; Sigurjonsson & Mixa 2011; Hilmarsson, 2013), the

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1 Basel III is an international regulatory accord that introduced a set of reforms designed to improve the regulation, supervision and risk management within the banking sector (Investopedia, 2016).
reasons of this nearly bankruptcy have their own distinguished characteristics. Moreover, policy makers in Greece and Iceland had different approaches on how they dealt with this situation, which resulted into totally different outcomes. In particular, Greece embraced austerity, which until now has not shown any significantly positive results, while Iceland said “no” to the bankers’ bailout, and over the past years, has seen some signs of improvement.

In the previous years, numerous comparative Greek crisis-themed studies have been conducted. Among their findings, it is suggested that institutional issues such as political corruption and European policy application to the existing local framework was rather ineffective, and therefore the country could not respond properly when it was required (Ladi, 2007; Kickert, 2011). Furthermore, Kickert (2011, p. 816) also mentions that historical institutionalism of southern Europe does not embrace radical changes, something that can impede the changes necessary to address the crisis. Therefore, the typical routine of funding organizations such as IMF, which stipulated impetuous cutoffs, did not achieve the desired results (Kickert, Randma-Liiv & Savi, 2013, p. 22). At the same time, the incompetence of the managers to handle properly their portfolios thwarts the explosion of the non-performing loans, deteriorating the situation further.

Corruption appears to be one of the causes of the crisis also in Iceland, where even during the period of rapid economic growth, the presence of corruption was perceivable by its citizens (Erlingsson, Linde & Öhrvall, 2013, p. 27). And indeed, in a society where cross-ownership and lending and complex business relations are not uncommon, the power of monitoring and regulation enforcement is not hard to be undermined. From a macroeconomic perspective, the floating currency which was used to control the inflation, combined with the accretion of the foreign loans, pushed the economy of Iceland to the edge (Sigurjonsson & Mixa 2011, p. 221; Hilmarsson, 2013, p.10).

1.2 Purpose

The purpose of this thesis is to conduct a comparative study in order to estimate the impact of financial crisis to the GNI of Greece and Iceland. By applying synthetic control matching (a relatively new methodology) the study compares the two countries to their synthetic counterfactual in order to deduct conclusions about good or bad practices adopted.
1.3 Method

All the aforementioned studies of Greece and Iceland attempted to comprehend the reasons why the global collapse affected them to this extent. In particular, many researchers attempted to compare these two countries, in order to provide a reliable explanation for the outcomes of the crisis, mostly by applying qualitative methods. As Abadie, Diamond & Hainmueller (2012) mention there are two main problems with traditional comparative studies. Firstly, they are vague to some degree, since there is no definite and concrete way to choose the comparison units. Additionally, it is often the case that the dataset used disaggregated units, employing methods that can only estimate the uncertainty of the aggregate values.

The synthetic control matching is a methodology based on the traditional differences-in-differences (DiD) method, commonly used in order to calculate the causal effects of a particular treatment in a particular setting, by “contrasting the change in outcomes pre- and post-intervention, for the treatment and control groups” (Kreif, Grieve, Hangartner, Turner, Nikolova & Sutton, 2015, p.1). However, the traditional DiD methodology may have some disadvantages. As Bilge & Galle (2015, p. 104) suggest, it may be the case that the distribution of the treatment as well as the covariates that appear to affect the outcome variable may differ for the pre-period and the post-period. Moreover, according to Robbins, Saunders & Kilmer (2015), this particular method assumes a parallel trend, in the absence of crisis, which is often not realistic nor practical.

Synthetic control method, on the other hand can provide various advantages to the researcher. First of all, it can be very useful in the occasion that the existing methods fail to feasibly address the problem, contributing to the overcoming of problems related with biased findings. Moreover, Fremeth, Holburn & Richter (2013) suggest that if the researcher attempts “manually” to choose a good comparison unit in order to study another one, it may be biased, even in the case where multiple cases are studied and compared.

1.4 Results
Summarizing the findings for both Greece and Iceland, we can say that for these countries the pre-treatment periods of counterfactual and actual units are very close. But in the case of Iceland, the peaks of the actual and the synthetic country differ. As for the post-treatment periods, in both cases GNI of the synthetic control appears to be significantly higher than the actual GNI of both Greece and Iceland, indicating that the policies used by these countries have not been optimal at addressing the crisis. However, as far as it concerns the trajectory of the GNI, Iceland comes closer to the patterns of the synthetic control unit, indicating that they are closer to the economic outcome of the combination of countries creating the synthetic control unit, having similar economic development as Iceland before the crisis.

1.5 Structure

The thesis is structured as follows. The next chapter depicts the importance of comparative studies and how they can be used by various interested parties. The background of the crisis for both countries is set. Moving to the third chapter, the methodology and the data set used are presented along with some descriptive statistics. In the fourth chapter, the results of the study for both counties are presented. In the fifth chapter the results for Greece and Iceland are summarized and compared to each other. Finally, in chapter six a summarization of the results takes place, and their connection to the theoretical framework. At the end, limitations of the study and suggestions for future studies are provided.
2. Theoretical Framework

2.1 The chronicle of financial crisis

There is no doubt that until 2007 the world economy in general was in an upward course. Already in 2006 the first signs started to appear in the US, where the growth of the housing prices was so unprecedented that in some occasions the average home exceeded almost four times what a family could earn (Director MIT, 2012). This general growth has its roots at the beginning of the new millennium, which was marked by the Enron and the dot.com crises, when the US government attempted to create some safeguards and support its economy (Bernanke, 2010, p. 2). As Stiglitz (2011, p. 632) mentions, the US government in the following years attempted to regulate the markets by promoting tax relief for large corporations, in order to stimulate the economy, without, however, any significant results. Consequently, the applied monetary policy and the decrease of the interest rates, resulted into the increase of the consumption and the growth of the aforementioned housing market.

2.1.1 Greece

Meanwhile, Greece was indicating a real growth rate of about 3.5% in comparison with the respective average indications of the rest of the Eurozone, according to IMF (2008). The same organization (IMF) in the following year warned the Greek authorities, after an evaluation within the frameworks of its regulations. Despite the resilience that the country initially showed against the global crisis, depression was at its gates (IMF, 2009). Amongst the reasons bringing Greece to such a state was its high public debt, structural impairments, large public sector, increased prices, and the lack of proper reforms, which would help the country to cope with this threat. By taking a closer look, it was realized that the development of Greece, was mostly based on foreign borrowing and domestic consumption, which led to intense fiscal pressures and external imbalances.

In a wider perspective, this issue was reflected on difference of yield between Greek and German bonds, which was growing while the liquidity in the markets was drying up. In order to tackle this issue, IMF demanded the draft of a viable financial model, within the frameworks of which, a target of a progressive adjustment by 1.5% of GDP per year (starting from 2010)
would be set, to reduce the country’s public debt. However, the “new financial information” which came to light, indicated that the estimates of the Fund, did not reflect the actual picture. According to predictions by the mission team, budget deficit was around 7%, but after a few years it was revealed that the actual percentage exceeded 17.5% of GDP in 2009 and 10.6% of GDP in 2010. At the same time ratio of debt / GDP continuously increased, and therefore it could be difficult to be repaid in the future (The World Bank Group, 2016).

Soon after the victory of the Socialist Party (PASOK) in the elections of October 2009, revisions of budgetary data were held by George Papandreou’s government and presented to the Economic and Financial Affairs (ECOFIN); the results indicated that the actual deficit of the GDP had reached 12.8%, which was a significant difference from the one that had been presented in the previous months. After further adjustments, the country’s debt to GDP was increased to 15.4%, while the public debt rose from 99.6% to 126.8% of GDP (Featherstone, 2011, p. 199). Those events resulted in a tight fiscal adjustment plan which included a large number of severe austerity measures, making Greece the first country in the Eurozone, to have to endure such a program. This situation, as had been expected, had an impact on the Greek bond market, which in less than a year soared from 135 points to 586 (Arghyrou & Tsoukalas, 2011, p. 175). Within the following six months, Fitch downgraded the country from A to A-. This downhill continued into the following month, resulting in a downgrade to BBB+ by S&P as well, while Moody’s accordingly shifted the rating from A1 to A2 (Polychroniou, 2011, p. 3).

The pessimistic surrounding intensified due to potential payment default by the Greek side and with Germany at the same time persistently rejecting the bailout of the country (Ross, 2011, p. p. 178). However, the program of Stability and Development was approved by the European Commission at the beginning of 2010, according to which the deficit should be reduced by 4% within the same year and by 3% in the following two (Hardouvelis, 2011, p. 70). In order to achieve that target the amount of 4.8 billion euros was set to be collected, by increasing the Value Added Tax (VAT) on various goods, freezing the pensions in the public and private sector and reducing the additional bonuses that the employees of the public sector received. Both fiscal targets and the new austerity measures in budgeting, eventually received social acceptance and the market prevailed for the time being (Hardouvelis, 2011, p. 70-72).

In the following months, the long term strategy for European development by the European Union was created in order to build safeguards for its stability and to deal with the longest recession in its history (European Commission, 2010a). Within the frameworks of this strategy, EU in collaboration with the IMF created a support mechanism for member states which were
dealing with financial difficulties. One of the problems of using such mechanism is that they estimated the amount of aid needed and the audit processes, without taking the necessary actions to restore confidence in the market, which resulted in further downgrades by financial institutions. A typical example is the evaluation of Greece at the end of April of 2010, when S&P downgraded Greek bonds to BB (Khalip & Melander, 2011). That in fact meant Greece was “excluded” from international capital markets, which deteriorated the situation further. That reflected on the banking system of Greece, where high uncertainty and the inability of consumers to meet their obligations, had an instant negative impact on it. Consequently, bankruptcy scenarios were brought to the table, which were becoming more and more threatening. Meanwhile, the prime minister of Greece announced, that the country would be financed by the aforementioned support mechanism.

As it was expected, the economy of Greece in the following year continued to shrink further, with its GDP decreasing by about 7%, a rate, which rate was double from the previous year. Accordingly, consumption followed the same pattern while unemployment almost doubled. However, the implementation of the following adjustment program, resulted later in some improvement, and the deficit was reduced to a point lower than the respective indication two years before. Nonetheless, fiscal adjustment measures were inevitable, in order to deal with the continuing negative situation in the markets. A key point in 2011 was the 50% “haircut” of Greek bonds which were converted into new loans, and a bailout amount of €100 billion early in the new year (Gow, 2011).

Within the frameworks of this endeavor, at the beginning of 2012 a new installment was disbursed, this time with the contribution of the European Stability Mechanism (ESM). The price for this particular installment was yet another package of fiscal adjustment measures, which included structural changes and voluntary bond exchange in the private sector, the so-called Private Sector Involvement (PSI). The main target of this program was besides the reduction of the budget deficits and the public debt, to restore the confidence in the markets and increase the competitiveness of the Greek economy.

At that time most of European countries and member states of the EU were at a recovering path, with their economies showing a substantial improvement. However, the situation for Greece was following a different path, including more severe austerity measures and fiscal adjustments.
2.1.2 Iceland

In the autumn of 2008, Iceland found itself in total chaos, when its economy suddenly collapsed. As Danielsson (2008, p.9) mentions, the Icelandic crisis is the “most rapid financial crisis recorded in peacetime”. It took only a few days for the three largest banks in Iceland to crash, very likely as an aftereffect of the collapse of the Lehman Brothers investment bank (Carey, 2009). As a result, numerous companies had to proceed to mass layoffs, while the currency of the country plunged (Mattiasson, 2008). Going a few years back, the rapid development and growth of Iceland made it hard for someone to believe that within the following years, the economy would crash and the lives of more than 300,000 inhabitants would be significantly affected (Fridriksson, 2009). So the question that rises is what happened to it and how the island ended up in this situation.

At beginning of 1990s the main occupation of the inhabitants of Iceland was fishing. Later, a neoliberal economic growth model was adopted, which lead to a vast expansion of the financial sector, also, biotechnology, software development and tourism. Since those sectors grew, a large proportion of the population, shifted from fishery to the service sector (Lang, Thompson & Bennett, 2012, p. 9). For more than a decade, this shift caused a skyrocket growth, making Iceland’s economy comparable with the largest countries not only in the EU, but around the globe, or as Sigurgeirs dóttir & Wade (2015, p. 104) refer to as “the most ‘overbanked’ economy in the world”.

At the beginning of the new millennium some reforms were introduced in the institutional financial framework, based on the neoliberal standards, according to which in the following two years the privatization of the banks occurred (Carey 2009, p. 6). The banks attempted to increase their assets by attracting foreign capital (savings mostly), and by simplifying the process providing lower costs and higher deposit rates at the same time. This strategy yielded largely and contributed significantly to the GDP of the country (Matthiasson, 2008, p. 8). However, when the crisis hit Iceland, its external debt was almost €50 billion, where only a 20% did not correspond to the banking institutions, while the GDP in the previous year lying around € 8.5 billion (Dimitrios, 2013, p. 88).

After the collapse, the three larger banks (Landsbanki, Kaupthing and Glitnir) were dissolved and nationalized, and their assets were acquired by the government. However, this process was proven to be inefficient and therefore the central government decided to proceed to the liquidation of the banking institutions (Viterbo, 2011, p. 217). As a consequence of such action,
the Icelandic state managed to remain consistent with its decision to decline the guaranteeing of the banking loans, since this was not possible financially.

What happened was that Iceland’s Financial Supervisory Authority (FME) created a safety net for the domestic operations of the aforementioned banks using a “good bank-bad bank” model which was initially used in Sweden in the 1992 crisis (Danielsson, 2011). According to this model, they attempted to isolate the toxic from net assets by applying a set of criteria, and thus giving priority to domestic activities rather than to the international ones. This separation was of course problematic, given that both categories included a limited number of suitable quality, hence smaller banks where in a disadvantageous position.

Moreover, FME proceeded to the creation of new banks in order to provide for Icelandic households and businesses, with legislation passed a few days later, according to which priority order was established for the claims. The new banking institutions received the domestic assets and liabilities. As far as the foreign clients were concerned, priority was given to the deposits of foreigners, however, their claims remained at the old banking institutions, as the claims of bondholders (Viterbo, 2011, p. 219). Due to this situation, Icelandic banks were in such position that they were unable to repay their obligations to the foreigners, and therefore many British and Dutch citizens were never repaid for the loss of their savings.

However, the Icelandic government recapitalized the new banks with 7.96 billion euros. This move increased the public debt to more than 70.0% of the Icelandic GNI, which can be considered as a non-manageable amount (Howden, 2012, p. 24). It created a non-functioning banking system that was unable to provide the necessary resources for growth of the economy.

In order to deal with the situation it was facing, Iceland guaranteed for all domestic deposits alone and imposed strict capital controls, in order to prevent further instability of the currency (Viterbo, 2011, p. 228). At the same time Iceland received financial aid from IMF and the Scandinavian countries to fill the gap created by the deficit and to facilitate the recovery of the financial sector. Within the frameworks of the agreement with the IMF, the Icelandic government had to adopt new rules of foreign exchange, in order to prevent the move of the funds abroad (Viterbo, 2011, p. 229). Thus, all export activities and payments of Icelanders abroad were monitored to ensure that no such actions occurred. On the other hand, investments by foreigners were encouraged.

The first review by the IMF was set at the end of October 2009, and if everything would go according to plan, Iceland would receive an additional funding of US$167.5 million (IMF, 2009). At any event, the funding was delayed for several months for various reasons, amongst
which one was the attainment of a deal with Great Britain and the Netherlands, who demanded a compensation of an amount as high as the Iceland’s GDP for their citizens (Viterbo, 2011). In addition, during the review the IMF suggested that the imposed capital controls and the high interest rates were an inevitable necessity. Subsequently, the country would be stabilized and ward off the danger of bankruptcy of businesses and households. In this atmosphere, the social outbreak was great and under the pressure, prime minister Haarde resigned at the beginning of 2009 (Wade, 2009, p. 23). A temporary government was established, while after the elections of 2005, the new prime minister was Johanna Sigurdardottir, of the Social Democratic Alliance (Filmore-Patric, 2013, p.5).

In the August of 2009, under the government of Johanna Sigurdardottir, the so-called Icesave I deal was achieved, according to which the initially inadequate Depositors' and Investors' Guarantee Fund (DIGF) would be able to guarantee for the deposits of the UK and the Netherlands. The amount was set to €3.8 billion deposit guarantees, but the bill was rejected by both the UK and the Netherlands (Valdimarson, 2009). After numerous negotiations, the amount was finally agreed (Icesave II) at €5.5 billion, which was approximately half of the GDP of Iceland, and with an interest rate of 5.5% for the debt of Iceland towards those countries. This agreement caused a significant dissensus amongst the members of the parliament and the resignation of the health minister, while at the same time more than one quarter of the active voters in the country signed a petition so that the president of the country would block the deal. Indeed, the president feared that this situation could cause social disorder and proceeded to a referendum, where 98% of the Icelandic people voted “no” to the Icesave II agreement (Hart-Landsberg, 2013).

The results of the referendum gave rise to further negotiations (Icesave III). This time the reduction of the interest rate and the amount that was achieved, was almost ten times less than the respective amount in the previous deal. However, the decision was not accepted by the people and this led yet to another referendum with negative response (Kollewe, 2011). The persistent refusal of the Iceland to guarantee for the savings of UK and Netherlands, led to its prosecution to the European Free Trade Association (EFTA) (Council of European Union, 2010), which however decided that if Iceland was not able to refund the two countries due to lack of funds and systemic crisis, it does not bare any obligation to do so. EFTA’s decision had a direct impact on Iceland’s rating, which shifted from negative to stable status (Moody’s, 2013).
It is important to stress that the main reason that EFTA’s decision was justifying the posture of Iceland was its small GDP which was around US$12 billion in 2009, and its debt which was at the time 10 times bigger that the GDP. Thus, the amount of US$120 billion, was not considered to be threatening for the European financial system, or any other system that the country would participate in. On the other hand, the repayment of a debt which is 10 times higher than the GDP, it is almost impossible, as it is understood. The balance between those two elements, therefore, were of the essence in this particular occasion (Filmore-Patric, 2013, p.16).

Although the capital controls are still in place, the program with the IMF was completed in the summer of 2011. As Sigurgeirsdóttir & Wade (2015, p. 122) explain, the sustaining of the capital controls serves various interests, for instance it contributes to the stability of the exchange rate, distributes the costs between the inhabitants of Iceland and the foreigners, and keeps the public debt in control due to the simplified fiscal consolidation and the low cost of the budget. In that way the public debt remains sustainable.
3. Method and material

3.1 The Synthetic Control Method

Although Synthetic Control Matching method was established a decade ago, it appears to become widespread over the past 5 years, since different researchers around the world utilized it in order to conduct various types of comparative studies. This method was initially discussed by Abadie and Gardeazabal (2003) who attempted to calculate the impact of a series of terrorist acts which took place at the area of Basque Country (known as Spain-ETA conflict) on the regional economy. In order to do so, they took other areas of Spain which were not exposed on the terrorist acts (which is the shock or alternatively called treatment), and used them to recreate a synthetic “Basque Country” in the absence of the conflict (Abadie, Diamond & Hainmueller, 2012). By doing so, they were able to compare the actual Basque Country and the synthetic one, and thereby were able to estimate the effect. From that point, other researchers became aware that this methodology can be used in various small and large scale comparative studies, giving them the chance to assess the impact of different events.

The methodology which was adopted by Abadie & Gardeazabal (2003) shall be used and, later on, by Abadie, Diamond & Hainmueller (2013), in order to investigate the effect of crisis in Greece and Iceland. In order to do so, the so-called counterfactual will be constructed, which basically is an alternative “if” given different circumstances, commonly in policy evaluation (Pesaran & Smith, 2016, p. 2). Suppose we have a J+1 countries (control units) where only one is exposed to the treatment, while the other J remaining countries are used as the sample, the so-called “donor pool” or “control group”, which is not supposed to be exposed to the treatment\(^2\). There is also a set of T-pretreatment predictors, which determine the association of the synthetic control unit to the treated unit. Those periods can be separated into \(T_0\), which can be determined as the pre-crisis period and \(T_1\), which can be defined as the post-crisis period, where \(T_0+T_1=T\). Summarizing, we have countries \(i=1,\ldots,J+1\), where \(i \in \{1,\ldots,N\}\) and \(t \in \{1,\ldots,T_0\}\), at periods of time \(t=1,\ldots,T\) and we can denote the observed outcome for countries \(i\) at time \(t\) in the absence of crisis, as \(Y_{it}^N\). Supposing that the outcome before the treatment is not affected by the crisis, \(Y_{it}^N = Y_{it}^I\), where \(I\) indicates the outcome given the treatment. Although, that treatments do not always have effects on the pre-intervention period,

\(^2\) In the following sections the possibility of contamination and spillover effects will be discussed.
in the modelling of the present paper, it is assumed that there is no such effect. In this methodology, borrowed from Abadie, Diamond & Hainmueller (2012, p. 495), $Y_{it}^N$ is given by:

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

where $\delta_t$ is an unknown common factor invariant across units, $\theta_t$ a vector of unknown time-relevant parameters, $Z_i$ a vector of unknown covariates, non-affected by the treatment, $\lambda_t$ a vector of unknown common factors, $\mu_i$ a vector of unknown country-specific factor loadings and $\epsilon_{it}$ the error term transitory shocks, having a mean of zero. Moreover, the effect of the treatment for country $i$ at time $t$ is given by $\alpha_{it} = Y_{it}^I - Y_{it}^N$ and we can create an indicator which can be called $D_{it}$, which takes the value of 1, if the country is exposed to the crisis, and the value of zero otherwise. Therefore, we have $Y_{it} = Y_{it}^N + \alpha_{it} D_{it}$.

The predictors can be distinguished into a set of M linear combinations of Y and a set of r covariates which can annotate the response variable Y. Setting k predictors which can be incorporated in a k×1 vector $X_1$ concerning the treated unit and a k×J matrix $X_0$ for our control units. Within this process of inner optimization, there is an attempt to identify the linear combinations of $X_0$ columns which better express $X_1$, in other words to find the donor units’ linear combination which minimizes the difference between the values of the predictors. In the attempt of constructing the absent counterfactual by using the donor pool of countries which are not affected by the crisis, and based on Bilgel & Galle (2015) using the methods of Abadie & Gardeazabal (2003), we suppose that $W$ is a $J+I$ vector containing the weights in such a manner that $0 \leq w_j \leq 1$ for $j = 2,3,...,S + 1$ and $\sum_{j=2}^{S+1} w_j = 1$.

Defining $\bar{Y}_j^k = \sum_{m=1}^{T_0} k_m Y_{jm}$ as the linear combination of pre-intervention values, it is suggested by Abadie et al. (2010, as cited in Bilgel & Galle,2015) that if

$$\sum_{j=2}^{S+1} w_j^* Z_j = Z_1 \quad \sum_{j=2}^{S+1} \bar{Y}_j^k = \bar{Y}_1^k$$
where \( w_j \)'s represents the weight on the \( j \)th country which was not affected by the crisis, then, \( \alpha_{it} \), which denotes the effect of the crisis for the country and is given by \( Y_{it} - \sum_{j=2}^{s+1} w_j Y_{jt} \), is an unbiased estimator of \( \alpha_{it} \). Furthermore, as Kaul, Klößner, Pfeifer & Schieler (2015) denote, the distance between the vector containing the pre-intervention characteristics for the \( X_1 \) affected by crisis countries and the \( X_0 \) non-affected countries, can be measured by the following formula:

\[
||X_1 - X_0 W||_V = \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)}
\]

where \( W \) denotes the weights which are used to create the synthetic control unit, and the non-negative semidefinite diagonal \((k\times k)\) matrix \( V \) represents the weights of the predictors, taking into account that these predictors have different influence on the response variable \( Y \). As already mentioned, the minimization of the distance of the pre-crisis period characteristics, can be expressed as follows:

\[
\min_w \sqrt{(X_1 - X_0 W)' V (X_1 - X_0 W)}
\]

which basically attempts to identify of the sum of the non-negative weights of the control units denoted by \( W \) for given predictor weights \( V \), which is \( W^*(V) \).

At the subsequent step, which is the so-called outer optimization, the identification of the optimal predictor weights takes place. It is where the non-negative diagonal matrix, \( V \) is selected between all the included positive semidefinite diagonal matrices in such way that the mean square prediction error of the variable \( Y \) is minimized for the given pre-intervention periods. It is also important to mention the presence of non-linearity in the relationship of the response and the explanatory variables for \( X_1 \) and \( X_0 \), which may lead to interpolation biases. Following the methodology of Kaul et al. (2015), we denote the subset of the outcome variable \( Y \) as \( Z_1 \) for the treated unit of the aforementioned pre-intervention periods. Moreover, by \( Z_0 \) we denote an analogous matrix for control units, resulting into the formula below:

\[
\min_w (Z_1 - Z_0 W * (V))' (Z_1 W * (V))
\]
3.3 Inference techniques

Indeed, as it was explained above, this particular method can provide quantifiable effects of treatments, when it comes to comparative studies. But how can one tell that the results of this method can be reliable? Abadie & Gardeazabal (2003) introduce the so-called placebo or falsification test, which can be used to deal with such issues. Diamond, & Hainmueller (2012, p. 499) mention that this test can be separated into “in-time placebos” and “in-space placebos”. In the first case, the pre-treatment period is used to check the magnitude of the impact and compare it to the post-period. On the other hand, “in-space placebo” test uses units of the donor pool, reassigning the treatment to each one, thus checking the magnitude of the effect. In a similar way with the former, similar results would indicate that the model does not provide a good fit.

3.4 Data

In order to investigate the effect of the crisis on the Greek and the Icelandic economy, a dataset was assembled containing various financial indicators. The data were collected from the database of the World Bank for the years 2003-2014. The data were crosschecked with other websites, such as the International Monetary Foundation, TradingEconomics.com and the UN database. The software that was used in order to process the data was Stata14. More particularly, the “Synth” package was installed as an add-on Stata, and the “Synth-Runner” to run the falsification tests (for code see Appendix).

Given the fact that both countries investigated belong to the European continent, the sample includes almost all European countries, regardless their participation in the European union or not. Some were excluded from the sample, due to lack of data, which could potentially affect the results of the dataset. Those countries were Andorra, Liechtenstein, Monaco, Montenegro, San Marino and the Vatican. One of the shortcomings of this research is that it is not easy to determine the effect of the crisis in each country with precision, nor it is easy to identify which countries were not affected by it. Moreover, as Billmeier & Nannccini (2013) and Abadie,

3 http://web.stanford.edu/~jhain/synthpage.html
Diamond, & Hainmueller (2012) state, the European continent appears to be the most appealing selection for the donor pool; thus, it is suggested to include countries, which have similar regional characteristics and cultural proximity. At the same time, in order to avoid further contamination of the donor pool, the variables were separated into two categories: the ones which are supposed to be affected by the crisis and the ones which are not.

“European Union” is a dummy variable, which takes the value 1 if the country is a member state, and 0 otherwise. This variable was introduced due to the numerous market regulations which concern the member states of the EU. Beyond the economic union, “Eurozone” variable takes the value of 1 if the country has euro as a currency. It is shown that being a part of Eurozone provides more stability, than having a domestic currency. However, as it was indicated in the case of Iceland, having a domestic currency can provide more flexibility to the country, making it easier to react to great changes and different circumstances. “Population” is not supposed to be affected by crisis and “Education of labor force”, as well. As Sudmant and Hawkey (2000) suggest in the last two decades, the awareness of the importance of higher education has accelerated by the policy makers, since it is suggested that post-secondary education affect significantly the labor market. Here, two variables related to the education are used. That is, the percentage of individuals in the labor force having secondary education, and having tertiary education. Among others the variable “Bribery” was included. This variable refers to the corruption and political/financial scandals, since it can harm the political system, and the economy as whole. Moreover, bribery and corruption often indicate a loose security system and enable the mishandlings on governmental level.

Among the ones that are supposed to be affected by the crisis the dummy variable “IMF” is included showing if the external debt of the country is financed by the institution. “Interest payment” illustrates sums paid by the country in terms of currency, goods/services within a given period of time, including long and short term debt and IMF charges. Beyond this dummy variable, “IMF charges” are included as well, showing the interest charged by IMF. This indicates how the amount paid as debt interest rate can affect the economic welfare of the country.

Furthermore, the variable “Debt reduction” was also included. Although debt relief sounds a good idea, it usually has many consequences in various levels. First of all, it may harm the countries future debt intake, since the lenders will have lost their trust in the country or organization. Moreover, in several occasions, debt restructure (for example, through “bondholder haircut”) can affect directly countries or organizations possessing bonds of this
country. For instance, in the case of Greece in 2011, when the debt was cut by 50% it had very bad consequences to Cyprus, whose economy was downgraded, resulting to deposits levy.

In the same spirit, the variable “Long term external debt” shows the levels of debt of the inhabitants of a country to the non-residents in terms of currency, goods, and services. By long-term it is suggested that the maturity of the debt is longer than a year, and it has the ability to influence more the economy, since it usually concerns higher amounts. It is not unusual for countries or organizations, which rely on long-term loans, to end up paying the interest rate alone, and thus bankrupt, since they are unable to repay the capital.

“Unemployment rate” and “Inflation” are two macroeconomic indicators of great importance when it comes to the formation of GDP or GNI. The former is due to the fact that the unemployed individuals are not contributing to the national income, but they usually receive unemployment benefits. On the other hand, it is suggested that low levels of inflation are correlated with the economic growth and vice versa. “Gross fixed capital formation” variable is a measure to describe the capital accumulation of a given period of time. A country utilizes the capital and the labor in order to produce goods or services, and generally it is assumed that the higher the gross fixed capital formation, the bigger the growth of the economy and the higher the capacity for production.

Variable “Current account balance” illustrates the difference between the savings of a country and the investments, and it is considered to be a very representative indicator for an economy’s health. A positive indication suggests that the country lends to other countries, while a negative that the country borrows from other countries. Finally, the percentage of “Labor force” was used for the active population. It expresses the number of the individuals employed, divided by the population of the country.

Some additional variables were used for the modelling of Iceland, in order to achieve a synthetic unit which matches more closely the pre-treatment period of the actual country. Gross savings (% of GNI), which is a good indication of how healthy a country is, household final consumption expenditure, showing the consumption of its inhabitants, as well as subsidies and other tariffs, which are widely used in economic studies. Moreover, the variable net domestic credit, which corresponds to the sum of net credit to both nonfinancial public and private sector, appeared to contribute to the improvement of the model. Conclusively, the variable EFTA was added, indicating the participation of the country in the EFTA union of not, since according to the existing literature, that was one of the determinant reasons that Iceland was not obliged to pay its debt towards UK and the Netherlands.
As far as it concerns the outcome variable the “Gross National Income” ($GNI_{jt}$ in US dollars, for country $j$ at time $t$) is used as a measurement of economic welfare, since it is more representative than GDP. It shows the actual income of a country, since it is basically an indicator of the output from the individuals and the firms which are found in this country. Amongst their differences is that GDP concerns a specific territory, while GNI represents the value generated by a citizen of one country. Usually GNI and GDP do not differ significantly, but this is not always the case. A typical example is Ireland, where the offices of many foreign companies are situated. In 2011, according to Investopedia (2015), Ireland’s GNI was 20% less than GDP. Since we are interested in the actual measurement which is produced by the citizens, GNI is considered to be more appropriate measurement.

### 3.5 Descriptive Statistics for Greece and Iceland

A significant part at the beginning of this process is to comprehend the basic characteristics of the treatment unit, here Greece. As it was elaborated extensively in the previous section, the selected variables, which include various macroeconomic indicators of Greece, can provide a general illustration.

But the indicators alone, cannot provide an adequate explanation, unless there exists a comparison of it with the average of the donor group. In Table 1, the basic descriptive statistics are presented and more particularly the mean or the mode and the standard deviations of the independent variables. The predictors are presented for Greece and the rest of the European countries.
Table 1 Descriptive statistics, means and standard deviations for Greece

<table>
<thead>
<tr>
<th>PREDICTORS</th>
<th>Control Group</th>
<th>Treatment Unit (Greece)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean/Mode</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>EU</td>
<td>0.68</td>
<td>0.47</td>
<td>1.00</td>
</tr>
<tr>
<td>Eurozone</td>
<td>0.34</td>
<td>0.48</td>
<td>1.00</td>
</tr>
<tr>
<td>GNI</td>
<td>487.93*</td>
<td>815.63*</td>
<td>269.50*</td>
</tr>
<tr>
<td>Unemployment</td>
<td>9.66**</td>
<td>6.34**</td>
<td>14.48**</td>
</tr>
<tr>
<td>Inflation</td>
<td>4.07**</td>
<td>4.66**</td>
<td>2.39**</td>
</tr>
<tr>
<td>Bribery</td>
<td>1.12**</td>
<td>5.11**</td>
<td>0.00****</td>
</tr>
<tr>
<td>Debt reduction</td>
<td>-4.7***</td>
<td>61***</td>
<td>0.00***</td>
</tr>
<tr>
<td>Capital formation</td>
<td>103*</td>
<td>164*</td>
<td>53.8*</td>
</tr>
<tr>
<td>IMF charges</td>
<td>27***</td>
<td>199***</td>
<td>0.00***</td>
</tr>
<tr>
<td>IMF</td>
<td>0.28</td>
<td>0.45</td>
<td>1.00</td>
</tr>
<tr>
<td>Interest payment</td>
<td>36.7***</td>
<td>141***</td>
<td>0.00***</td>
</tr>
<tr>
<td>Population</td>
<td>20***</td>
<td>29.6***</td>
<td>11.1***</td>
</tr>
<tr>
<td>Labor force</td>
<td>0.48**</td>
<td>0.05**</td>
<td>0.46**</td>
</tr>
<tr>
<td>Non-performing loans</td>
<td>6.41*</td>
<td>7.39*</td>
<td>12.87*</td>
</tr>
<tr>
<td>Current account</td>
<td>-1.23</td>
<td>7.95</td>
<td>-7.05</td>
</tr>
<tr>
<td>Long term debt</td>
<td>0.101*</td>
<td>0.66*</td>
<td>0.00*</td>
</tr>
<tr>
<td>Labor w/ second. educ</td>
<td>51.53***</td>
<td>13.54***</td>
<td>42.99**</td>
</tr>
<tr>
<td>Labor w/ terti. educ</td>
<td>27.40***</td>
<td>9.90***</td>
<td>26.19**</td>
</tr>
<tr>
<td>Inter. tourism exp</td>
<td>11*</td>
<td>19*</td>
<td>3.4*</td>
</tr>
</tbody>
</table>

*In billion dollars  
** Percentage  
***In million dollars
Table 2 Descriptive statistics, means and standard deviations for Iceland

<table>
<thead>
<tr>
<th>PREDICTORS</th>
<th>Control Group</th>
<th>Treatment Unit (Iceland)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean/Mode</td>
<td>Mean/Mode</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>SD</td>
<td>SD</td>
</tr>
<tr>
<td>EU</td>
<td>0.68</td>
<td>0.47</td>
<td>1.00</td>
</tr>
<tr>
<td>Eurozone</td>
<td>0.37</td>
<td>0.48</td>
<td>0.00</td>
</tr>
<tr>
<td>EFTA</td>
<td>0.05</td>
<td>0.22</td>
<td>0.00</td>
</tr>
<tr>
<td>GNI</td>
<td>494.32*</td>
<td>812.91*</td>
<td>-481.10*</td>
</tr>
<tr>
<td>Unemployment</td>
<td>9.91**</td>
<td>6.43**</td>
<td>-5.19**</td>
</tr>
<tr>
<td>Inflation</td>
<td>3.99**</td>
<td>4.64**</td>
<td>1.52**</td>
</tr>
<tr>
<td>Bribery</td>
<td>1.12**</td>
<td>5.11**</td>
<td>-1.12**</td>
</tr>
<tr>
<td>Debt reduction</td>
<td>-4.7***</td>
<td>61***</td>
<td>-4.7***</td>
</tr>
<tr>
<td>Capital formulation</td>
<td>105*</td>
<td>163*</td>
<td>-101*</td>
</tr>
<tr>
<td>IMF charges</td>
<td>27***</td>
<td>199***</td>
<td>27***</td>
</tr>
<tr>
<td>IMF</td>
<td>0.28</td>
<td>0.45</td>
<td>0.28</td>
</tr>
<tr>
<td>Interest payment</td>
<td>36.7***</td>
<td>141***</td>
<td>36.7***</td>
</tr>
<tr>
<td>Population</td>
<td>20***</td>
<td>29***</td>
<td>19.69***</td>
</tr>
<tr>
<td>Labor force</td>
<td>48**</td>
<td>5**</td>
<td>11**</td>
</tr>
<tr>
<td>Non-perform loans</td>
<td>6.57*</td>
<td>7.57*</td>
<td>-0.09*</td>
</tr>
<tr>
<td>Current account</td>
<td>-1.21*</td>
<td>7.85*</td>
<td>-6.59*</td>
</tr>
<tr>
<td>Long term debt</td>
<td>0.101*</td>
<td>0.66*</td>
<td>0.101*</td>
</tr>
<tr>
<td>Labor w/ sec. educ</td>
<td>51.68**</td>
<td>13.40**</td>
<td>-36.78**</td>
</tr>
<tr>
<td>Labor w/ tert. educ</td>
<td>27.37**</td>
<td>9.90**</td>
<td>-18.47**</td>
</tr>
<tr>
<td>Gross Savings</td>
<td>231.59*</td>
<td>138.55*</td>
<td>217.95*</td>
</tr>
<tr>
<td>Household consmp</td>
<td>238.51*</td>
<td>138.70*</td>
<td>184.13*</td>
</tr>
<tr>
<td>Inter. Tour. expens</td>
<td>233.32*</td>
<td>134.58*</td>
<td>-225.32*</td>
</tr>
<tr>
<td>Subsidies/transf</td>
<td>191.37*</td>
<td>134.36*</td>
<td>-162.90*</td>
</tr>
<tr>
<td>Tariff rates</td>
<td>31.82*</td>
<td>19.15*</td>
<td>27.32*</td>
</tr>
</tbody>
</table>

*In billion dollars  
** Percentage  
***In million dollars
4. Results

By applying the techniques which were described in the previous chapter, the synthetic control methods were used to evaluate the impact of crisis. Within the frameworks of this paper, two counterfactuals were constructed, the synthetic Greece and synthetic Iceland. The synthetic countries are created as a weighted averages of possible control countries, where the weights assigned to countries by using the aforementioned predictors resemble the treated unit or country before the treatment, where in our occasion is the 2008 crisis. Thus, the estimation of the effect of crisis on the GNI of the treated unit is provided.

By running the data with the proper command on STATA 14, during the pre-treatment period, it is indicated that there are no significant differences of the course of the treated unit and the countries included in the donor pool. That observation can be valid for both Greece and Iceland. Below, the outcome of the synthetic matching is discussed in detail. By applying this methodology, one can use this purely quantitatively methodology can be utilized for a circumstantiated comparison, which facilitates the subsequent qualitative research (Abadie, Diamond & Hainmueller, 2015:503).

Nonetheless, it is important to point out before proceeding to the results for each country individually, that given the impact of crisis on global scale, the presence of a potential spillover effect is practically unavoidable. Therefore, the results should be interpreted with caution, taking into account that those potential effects can influence respectively the counterfactual, for the countries which have been assigned with a weight (Abadie, Diamond & Hainmueller, 2015:504).

4.1 Greece

4.1.1 Results

Based on the variables which were included in the model, the output shows the countries which received weights, or in other words which appear to resemble the treatment unit. As it is indicated, synthetic Greece is an average of Austria (0.276), Portugal (0.245), Ireland (0.172), Belgium (0.162), Italy (0.005), Ukraine (0.05), Malta (0.048), Slovakia (0.036), Russia (0.005) and Poland (0.001). The rest of the European Countries have received a weight of zero. As it
is shown in the table below, most of the pre-crisis features of Greece are similar to the ones of the synthetic Greece, suggesting that on average the chosen variables provide a good comparison with the actual one.

**Table 3 GNI predictor means for Greece**

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Treated</th>
<th>Synthetic</th>
<th>Predictors</th>
<th>Treated</th>
<th>Synthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>1.00</td>
<td>0.95</td>
<td>Labor force</td>
<td>0.45</td>
<td>0.49</td>
</tr>
<tr>
<td>Eurozone</td>
<td>1.00</td>
<td>0.92</td>
<td>Non-perf loans</td>
<td>5.43</td>
<td>4.79</td>
</tr>
<tr>
<td>GNI</td>
<td>274.66</td>
<td>275.02</td>
<td>Cur. account</td>
<td>-10.72</td>
<td>-2.61</td>
</tr>
<tr>
<td>Unemployment</td>
<td>9.30</td>
<td>6.64</td>
<td>Long term</td>
<td>0.00</td>
<td>0.20</td>
</tr>
<tr>
<td>Inflation</td>
<td>3.21</td>
<td>3.54</td>
<td>Population</td>
<td>1.11</td>
<td>11.00</td>
</tr>
<tr>
<td>Bribery</td>
<td>0.00</td>
<td>0.07</td>
<td>Sec. educ</td>
<td>43.31</td>
<td>41.56</td>
</tr>
<tr>
<td>Debt reduction</td>
<td>0.00</td>
<td>0.00</td>
<td>Tert. educ</td>
<td>27.02</td>
<td>26.80</td>
</tr>
<tr>
<td>Capital formation</td>
<td>66.40</td>
<td>66.00</td>
<td>Interest paym.</td>
<td>0.00</td>
<td>2.49</td>
</tr>
<tr>
<td>IMF charges</td>
<td>0.00</td>
<td>5793633.00</td>
<td>IMF (dummy)</td>
<td>0.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Intern. Tourism Exp.</td>
<td>273.30</td>
<td>233.07</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is also important to mention that in order to avoid any effects of the crisis on the results, the variables which are shown in the above table were separated into two groups, the ones that are assumed to remain unaffected by the crisis and the others that are considered to be affected by the crisis. For the unaffected group the predictors are used for all the years which are included in the sample, while for the variables which are affected (e.g. gross fixed capital formulation) 3 year prior to the treatment were used.

Accordingly, and the following graph one can observe that there is an almost perfect alignment between of the actual country and the counterfactual in the pre-treatment period. In the first years after the crisis, the actual and the synthetic unit start to differ slightly with the actual performing a bit better. But around 2010, their course takes separate ways. More particularly, in first part of the post-treatment period, the counterfactual appears to do slightly worse than Greece, but in 2009 start to recover gradually. On the other hand, the Gross National Income of the actual Greece seems to plunge and around 2014 the difference with the counterfactual reaches almost 100 billion. The graph also indicates that in the after crisis period there are points of either rapid recovery or deterioration in both units. In any case, one can easily
distinguish the negative effect of the treatment (or the crisis) to the Gross National Income of Greece.

Assuming that countries which have received weights should follow similar trajectory as the treated unit, in terms of observed and unobserved variables (Abadie et al., 2014 as cited in Bilgel & Galle, 2015:111), it is illustrated that the chosen donor pool provides a good fit. This can be also confirmed by the estimated Root Mean Square Prediction Error, which according to the used model is 1,461,797. The value of the RMSPE remained at the same level, even after including all the 18 variables which were described above, in the model.

As it was mentioned above, in the pre-treatment period the synthetic and the actual Greece are almost perfectly aligned, while after the treatment they start to separate instantly. More particularly, in 2009 the GNI of the synthetic unit remains stable and the actual one decreases. In the following year the synthetic unit starts to improve and at the same time Greece’s GNI continues to plunge by almost 15 billion. In 2011 the counterfactual and the actual unit follow the same pattern, when they decrease. However, the Greek dive is much larger, which in actual numbers is a decrease of about 30 billion of Greece’s GNI. This course continues in 2012, which actual Greece’s GNI decrease of 9 billion, while the counterfactual bounces back. At the last year of observation, both synthetic and actual units appear to stabilize, but as it appears at
the graph above, the gap is vast, which in actual measures translates into about 90 billion euros, about 27% lower than the synthetic one.

4.1.2 Placebo test

As it is shown in the graph below, the gray lines represent the trajectories of the countries in the donor pool, assuming that they were affected by the treatment and the thick line illustrates the gap which is calculated for Greece. As it becomes obvious, the synthetic control provides a quite good fit in the pretreatment period. On the other hand, the calculated gap of the country during the years of study, 2003-2014 is quite large, comparing to most of the countries included in the donor pool. Moreover, as one can see, the trajectory of the placebos in the pre-treatment period and post-treatment differs significantly. Although in the pre-period overall the placebos follow a similar pattern to the unit of interest, in the post-period that is not the case. Such an issue could be a potential problem in terms of the chosen donor pool, such as contamination of spillover effects, but at the same time that does not discard the effect of the shock.

*Figure 2 GNI gaps in Greece compared to donor pool*
At the same time, even in the pre-treatment period, the trajectory of some of the countries included in the donor pool appears to be excessive which may be a problem for our sample. In order to deal with this issue, and ensure that all countries in the donor pool are good controls, some of the countries are excluded. In the following graph, one can see that how the placebo test appears to be, excluding countries with GNI higher than a trillion. That would include France, Germany, Italy, Russian Federation, Spain and UK. As a result, the graph below is significantly improved if compared to the previous one including all the countries in the initial donor pool.

![Figure 3 GNI gaps in Greece compared to donor pool (discarding countries with GNI higher than a trillion)](image)

4.2 Iceland

4.2.1 Results

As it was shown for Greece above, by applying the same principles, dataset and model the counterfactual for Iceland was created. Although in the occasion of Iceland, the effect of crisis occurred sooner that the corresponding effect in Greece. The trajectory of Iceland according to the results suggests that it resembles the countries Moldova (0.358), Cyprus (0.257), Lithuania
(0.215), Estonia (0.1), Latvia (0.066) and Norway (0.004), hence the counterfactual is constructed by the weights which are assigned to those countries. The table below shows that almost half of the variables which represent the synthetic unit do not differ significantly from the actual values of the indicators of the treated unit.

Table 4  GNI predictor means for Iceland

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Treated</th>
<th>Synthetic</th>
<th>Predictors</th>
<th>Treated</th>
<th>Synthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>0.00</td>
<td>0.638</td>
<td>Labor force</td>
<td>0.60</td>
<td>0.46</td>
</tr>
<tr>
<td>Eurozone</td>
<td>0.00</td>
<td>0.22</td>
<td>Non-perf loans</td>
<td>0.97</td>
<td>2.27</td>
</tr>
<tr>
<td>EFTA</td>
<td>1.00</td>
<td>0.004</td>
<td>Gross Savings</td>
<td>76.33</td>
<td>127.32</td>
</tr>
<tr>
<td>GNI</td>
<td>17.33</td>
<td>17.58</td>
<td>Cur. account</td>
<td>-16.89</td>
<td>-10.53</td>
</tr>
<tr>
<td>Unemployment</td>
<td>2.53</td>
<td>5.98</td>
<td>Long term</td>
<td>0.00</td>
<td>1.69</td>
</tr>
<tr>
<td>Inflation</td>
<td>5.24</td>
<td>6.80</td>
<td>Population</td>
<td>315711.9</td>
<td>2524010</td>
</tr>
<tr>
<td>Bribery</td>
<td>0.00</td>
<td>0.00</td>
<td>Sec. educ</td>
<td>36.59</td>
<td>52.87</td>
</tr>
<tr>
<td>Debt reduction</td>
<td>0.00</td>
<td>0.00</td>
<td>Tert. educ</td>
<td>27.78</td>
<td>30.45</td>
</tr>
<tr>
<td>Capital formation</td>
<td>5.75</td>
<td>4.79</td>
<td>Interest paym.</td>
<td>0.00</td>
<td>6808802</td>
</tr>
<tr>
<td>IMF charges</td>
<td>0.00</td>
<td>3087034</td>
<td>IMF (dummy)</td>
<td>1</td>
<td>0.358</td>
</tr>
<tr>
<td>Household consump</td>
<td>254</td>
<td>374.98</td>
<td>Tourism expen.</td>
<td>189.33</td>
<td>194.18</td>
</tr>
<tr>
<td>Net domestic credit</td>
<td>270.66</td>
<td>234.53</td>
<td>Subsidies/Transf</td>
<td>28.67</td>
<td>142.20</td>
</tr>
<tr>
<td>Tariff rates</td>
<td>16.33</td>
<td>27.41</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The same image is shown in the graph which was created to compare the actual and the synthetic Iceland. As it is depicted on the graph below, the synthetic and the actual Iceland appear to match very closely until 2005 in the pre-treatment period. However, in the following two years until the crisis peaked in Iceland, the Gross National Income starts to diverge. Based on the graph and the countries with the same trajectory, the impact of crisis in Iceland appeared about a year earlier than it was supposed to.

In addition, as we can see, the hit that the county took was harder than the one suggested in the synthetic until. However, the course of the recovery in both actual and synthetic units follow a similar pattern, but in any case, in terms of national production and substantial financial resources, an almost 55% lower Gross National Income is if anything, not inconsiderable.
Although at the beginning of the process the same model was applied to both Greece and Iceland, in order to provide a comparable analysis, the model for Iceland was altered, with additional variables. The Greek model resulted to higher Root Mean Square Prediction Error and the fit appear to be ineffective. Nonetheless, with these additional variables, the RMSPE decreased to 0.6228504, which is significantly lower, not only for Iceland, but in comparison with Greece, too.

As it is illustrated in the graph, at the first years of the observations the trajectory of the actual and the counterfactual Iceland match, but even four years before the treatment, they begin to distinguish. In more detail, the trajectory of the actual Iceland appears to be more conservative than the synthetic one. Additionally, as it is shown, the counterfactual and the actual country have different peaks. While synthetic Iceland decrease begins after 2008 which is considered to be the year that the crisis hit the global economy, already in 2008 Iceland’s GNI has fallen to 13 billion in comparison with the previous year, when it was 20 billion. Moreover, until 2009, actual Iceland lost 50% of its GNI ending up in 10 billion. This is caused by two components, first there is a fall in real GNI, but as Iceland has a floating exchange rate this is also due to the Icelandic crown falling against the Euro or Dollar.

Besides the difference of a year between the peaks of actual and synthetic Iceland, they differ significantly in actual numbers, where the actual appears to be lower almost 10 billion than the synthetic. Nonetheless, from 2010 the course of both units follow almost the same pattern, which is a steady but positive trajectory. But in any case, this divergence of 10 billion on
average throughout the years of observation, is characteristic. Thus, in 2014 Iceland’s GNI appears to be 40% lower than the GNI of the counterfactual.

4.2.1 Placebo test

Accordingly, as it was shown in the case of Greece, the graph below shows that in comparison to other countries which were included in the donor pool, the gap estimated for Iceland is considerably larger. In contrast with the respective results of the placebo test for Greece, the outcome for Iceland is somehow different. Although it follows an expected trajectory with the respective gaps, the countries in the donor pool do not behave properly. That is due to the large deviations from the zero gap line which are obvious in the graph below. This is an indication that our model probably does not provide a good fit or that our sample is not the optimal one for the particular study. Following the same principal as with Greece, whereas discarding the same countries with GNIs higher than a trillion, it is possible to create a new graph which may be more representative for the unit of interest.

*Figure 5 GNI gaps in Iceland compared to donor pool (discarding countries with GNI higher than a trillion)*

Thus the figure below shows the corresponding results with the updated donor pool. More particularly, the gaps in the pre-treatment period have been limited significantly, thus contributing to a more representative illustration. Although in the post-treatment period there are still large gaps among the countries included in the donor pool, the result appears to be
significantly improved in comparison to the previous graph. Even though the existence of countries in the sample which exhibit a large effect of the crisis in the post-treatment period can be problematic, it is rather expected in countries which have a quite small GNI.

Figure 6 GNI gaps in Iceland compared to donor pool (discarding countries with GNI higher than a trillion)

5. Discussion

Summarizing the findings for both Greece and Iceland, we can say that for both these countries the pre-treatment periods of counterfactual and actual units come very close. But in the case of Iceland, the peaks of the actual and the synthetic country differ. In the post-treatment periods, the results of the synthetic GNI appear to be significantly higher than the ones of the actual, indicating that both countries could have followed more optimal policies to recover from the crisis.

As far as it concerns the trajectory of the GNI, Iceland comes closer to the patterns of the synthetic unit. According to Harvey (1982, as cited in Coe, Kelly & Yeung, 2007, p. 70), one way to deal with crisis of the economic system is devaluation. Specifically, this process involves
the “destruction of the value of the system”. In that way the process of creating value starts over, and therefore can start to function again. Nonetheless, this process comes always with political, economic and social costs. In Iceland this destruction of the “old” value was inevitable, due to the overloading of the financial sector, and as it was described in the results section for Iceland, the impact on its GNI was much more intense than in the weighted countries. It also important to mention that the within the frameworks of the destruction, Icelanders let their banking system fail.

On the other hand, financial crisis in Greece was dealt with a totally different approach. Here instead of failing the banking system, EU and the Greek government proceeded in the bailout of the Greek banks (Louzis, Vouldis & Metaxas, 2012). As a result, despite the overall recovery path of the synthetic counterfactual after 2010, the actual Greece sinks in debt with its GNI reducing more and more. So does that tell us that the different perspectives of Iceland and Greece in how dealing with the banking system is the key element when addressing the issue of financial crisis?

As it was discussed at the background section, in both countries the problem began in the financial sector and therefore the main focus is there. But this is an oversimplified way of looking at the particular issue, and further examination of the countries’ characteristics is required. Moreover, at the beginning of the new millennium Iceland privatized its banks within the frameworks of neoliberalist standards. The financial institutions attempted to increase their assets by attracting foreign capital (savings mostly), by simplifying the process and providing lower costs and higher deposit rates at the same time (Carey, 2009). In practice, this did not differ significantly from what happened in Greece, but in the case of Greece, the government borrowed extensively in order to increase its GDP, resulting in growth of the banking sector (Louzis, Vouldis & Metaxas, 2012). In Iceland, this growth was based on vast amount of deposits, which allowed them to refrain from large borrowing from abroad. On the other hand, Greece continued to fuel the banking sector, thus increasing the country’s GDP, almost entirely based on borrowing. Due to the fact that in Iceland the problem lied in the foreign deposits and in Greece on banking loans overloading, it is understood that the situation requires different treatments. Nonetheless, some measures used by Iceland can be proven to be very useful; for instance, the good bank/bad bank concept, and indeed it has been used in the private sector. A good example of this was the buyout of the Agricultural Bank of Greece by Piraeus Bank, which integrated its assets and its healthy portfolio, while non-performing loans and its liabilities remained in the “old” bank, which was gradually dissolved. In addition, at the descriptive
statistics part concerning Greece, it was shown that the mean of non-performing loans for the donor pool was 6.41%, while at the same time for Greece the percentage was 12.87%.

Among the factors that differed significantly was unemployment as well. According to the descriptive statistics it is suggested that Iceland’s mean unemployment rate is lower than the one of rest of Europe during the observation years. This means that given the size of its economy, the purchasing power of the consumers is higher. On the other hand, as far as it concerns Greece, the mean unemployment rate for the years of observation is around 15% with a standard deviation of almost 8%. At the same time, the mean value of the rest of the Europe is 5 units lower. What basically happens is that high unemployment deteriorates the purchasing power, which in turn increases the unemployment rate, the current account deficit and has a negative impact on GNI.

Another variable which appeared to be significantly different from the corresponding value of the donor group was gross fixed capital formation. As it was stated in the variables’ description, this measurement describes the accumulation of capital for a given period of time, which is used to generate goods or services. While the average in Europe is around 103 billion dollars, in Greece it is 53 billion, while in Iceland 3 billion. Although the value of Iceland is considered extremely insignificant at European level, for a country with a mean GNI of 13 billion, that is not the case. Moreover, for countries as Iceland which for the past years rely on the service sector and Greece which relies mostly on the tourism industry, a lower mean value than the rest of the Europe is expected.

Finally, the question is what was the role of EU and the Eurozone in the course that the two countries took. Being in both EU and the Eurozone, in the beginning of the new century provided Greece with many benefits. The large funding that Greece received by the third Community Support Framework and the stability that the new currency provided, had a significantly positive effect on the economy, hence its macroeconomic indicators. As it was realized after the crisis, the growth was a result of circulation of funds in the country, rather than actual growth (Staikouras & Wood, 2000 as cited in Liargovas & Repousis, 2012). Besides that, being a member state and participating in the Eurozone, made Greece extremely inflexible. Having a common currency does not allow a country to depreciate it, something that would happen if Greece would sustain the drachma. Moreover, as a member state of the EU, Greece cannot afford to take its decisions solely without the approval of the European Parliament. In other words, Greece has essentially no power over its economy. With Iceland on the other hand,
by preserving its own currency and not being a part of EU, potentially gave the country enough flexibility to move in a different way that Greece did. A good example of this is Iceland’s refusal to repay the deposits of the UK and the Netherlands under the unfavorable conditions of the first two Icesaves. But as it was depicted by Filmore-Patric (2013, p.16), one important factor that had to do with Iceland’s bailout was its participation in EFTA, whose decision favored Iceland.
6. Conclusions

6.1 Summarization of conclusions

By applying synthetic control matching, this thesis aimed to study the effects of the economic crisis on the GNI (Gross National Income) of Greece and Iceland. Indeed, the results indicates that, by adopting proper measures, the two countries could have reached a better outcome. Based on the results, we can distinguish the reasons into two categories: the policies adopted and membership in unions and associations.

In the case of Iceland, drastic actions harmed severely the economy and affected a big part of the population. However, its economy appears to be functioning again, while there is a gradual improvement. In the case of Greece, the initial measures taken were not as harsh as the ones in Iceland. But the prolonged crisis and the continuous austerity measures appear to have harmed its economy and citizens, by far worse than Iceland’s economy.

Another fact that was observed by studying the particular dataset was that, being a member of Eurozone and the European Union, had negative effects on the economic state of Greece if compared to Iceland which was not. On the other hand, being a member of Nordic Countries and EFTA was very helpful for Iceland, since it managed to acquire the resources necessary to overcome the crisis and protect it from the demands of the UK and the Netherlands.

But choosing appropriate models, the dataset managed to provide a quite good fit, with a low RMSPE, something that can be confirmed by the placebo tests for both countries. Although the placebo testing shows that there are countries in the donor pool which were also affected by crisis, that is not the case for most of the units.

Conclusively, taking into account the existing literature, we can say that the results are consistent with most of the studies, but this thesis providing a more objective quantitative perspective. The data indicate that the participation or not in various unions (EU, Eurozone, EFTA) played an important role in the way that the crisis evolved in those countries, besides the policies adopted. That shows that, indeed, despite the fact that the problem in Greece and Iceland started in the banking/financial sector, the crisis evolved under different circumstances. Moreover, it is believed that Greece should follow the same steps as Iceland which managed to
recover from crisis faster than Greece. On the contrary, this study shows that that is not the case, and this could lead to different outcomes.

The interesting part of the research is that although that the gap of the synthetic GNI of Greece is smaller than the one of Iceland for more than 10% (30% and 40% respectively), it depicted often that the performance of Greece is quite poor. Although various studies used in the particular research argue for that fact, in 2014 the numbers suggest that indeed Greece is performing better. Therefore, we could assume that the performance or the perception of the performance is often determined by the trend. In the case of Iceland an increasing trend gives the impression of improvement and quite often that may be the case. On the opposite, in the case of Greece with lower difference in comparison with its counterfactual than Iceland, a downward trend contributes to the perception of further deterioration of the situation.

6.2 Limitations and recommendations for future study

When conducting a macroeconomic study, it is quite common to face problems in data collection. This is because it is not easy to find reliable data for all variables which the researcher would like to include. Accordingly, in this study, a number of units was excluded from the sample due to inconsistency and missing values. Moreover, it not easy to identify countries which are not affected by the crisis. Given the fact that there is no universal way to distinguish the ones which are affected and the ones which are not, there will always be the risk of contamination of the donor pool or spillover effects. Finally, during the period of study, various problems occurred in terms of programming. The synthetic control command for the program used (Stata14) is not an official one, and therefore, due to lack of add-ons or across different operating systems, it may not produce the required results.

Time is of the essence and it is quite difficult to manage all the processes within the given time. In the future, it would be interesting to conduct a respective study with an improved dataset. In the present study, countries of the European continent were chosen to create the donor pool. However, as it was seen in the placebo tests for both countries, but mostly Greece, other countries were affected as well, and this can potentially create problems to the validity of the
study. Hence, a dataset with countries outside the borders of Europe could provide a better donor pool for research. In addition, other variables could be tested, in order to achieve better results with smaller standard error. Therefore, a better analysis could be done, by answering a wider variety of questions.
References


**APPENDIX**

**Code for Synthetic Control Marching**

```stata
/* install the "synth" package*/
ssc install synth, replace all

/* Define the panels */
tset Code Year

/*Get synthetic unit for Greece*/
merge 1:1 Code Year using `keepfile', nogenerate
gen GNI_synch = GNI-effect
ereturn list
di (e(pval_joint_post_t)*e(n_pl)+1)/(e(n_pl)+1)

/*Produce the graph*/
single_treatment_graphs, depvar(GNI) trunit(16) trperiod(2008) effects_ylabels(-100(20)100) effects_ymax(130) effects_ymin(-130)

/*Create a file and reconstruct the initial synthetic control for Iceland */
tempfile keepfile
merge 1:1 Code Year using `keepfile', nogenerate
gen GNI_synch = GNI-effect
ereturn list
di (e(pval_joint_post_t)*e(n_pl)+1)/(e(n_pl)+1)

/*Produce the graph*/
single_treatment_graphs, depvar(GNI) trunit(18) trperiod(2007) effects_ylabels(-100(20)100) effects_ymax