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2013 – The Finnish Divergence

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Abstract

In this paper, we use the synthetic control method to analyze the Finnish economic performance after the onset of the Great Recession. Our main interest is to study the slow recovery from the global downturn that began in 2008. We identify the synthetic control with pre-crisis data (1996–2007). It provides the counterfactual response of the Finnish economy to the crisis in the absence of idiosyncratic shocks that affected Finland but not the synthetic control unit. We find that the Finnish GDP growth closely follows the synthetic control until 2013. After that there is a striking divergence in the economic growth of Finland and the expected economic behavior, as represented by the counterfactual. The divergence between the Finnish GDP and its synthetic control is mainly due to underperforming of the Finnish net exports. The consumption expenditures, on the other hand, outperform the synthetic control unit right after the financial crisis, but starting from 2013, they underperform as well. We find that our results are relatively robust to alternative methodological specifications.

Tiivistelmä

2013 – Kun Suomi jäi jälkeen

Tässä artikkelissa muodostamme synteettisen kontrollin tutkiaksemme Suomen taloudellista kehitystä vuonna 2008 alkaneen finanssikriisin jälkeen ja erityisesti sitä seurannutta poikkeuksellisen hidasta taloudellista toipumista. Muodostamme synteettisen kontrollin käyttäen dataa finanssikriisiä edeltäneeltä ajalta, vuodesta 1996 vuoteen 2007. Synteettinen kontrolli toimii kontrafaktuaalina vastaten kysymykseen siitä, miten Suomen talous olisi kehittynyt kriisin jälkeen ilman sokkeja, jotka koskivat vain Suomea mutta eivät muuta euroaluetta. Synteettisen kontrollin ja Suomen bruttokansantuotteen kehitys vastaavat hyvin toisiaan vuoteen 2013 asti, jonka jälkeen kehitysurat erkanevat nopeasti. Kehitysurien erkaantuminen selittyy pitkälti Suomen nettoviennin heikentymisellä. Kotimainen kulutus taas kasvaa kriisin jälkeen jopa synteettistä kontrollia nopeammin, kunnes vuonna 2013 senkin kasvuvauhti laskee alle synteettisen kontrollin tason. Raportoitujen tulosten ei havaita olevan erityisen herkkiä millekään testatuille muutoksille mallintamiseen liittyvien valintojen suhteen.

Key words: Synthetic control method, Comparative case studies, Great Recession, European debt crisis

Avainsanat: Synteettinen kontrolli, Finanssikriisi, Eurokriisi

JEL: E32, F43, F44

1 Introduction

Business cycles are notoriously difficult to link to their fundamental economic and policy origins. The underlying shocks often have complex propagation mechanisms and there is multiplicity of alternative explanations for the economic crises and upswings. In order to better understand the driving forces, we propose to use a novel approach, *the synthetic control method*, to analyze the origins of economic volatility during the Great Recession. In our work, we focus on the Finnish economy with the aim of understanding why the country with strong positions in the international competitiveness rankings before the crisis ended up performing much worse than similar countries in the 2010s.

Our approach, originally presented by Abadie and Gardeazabal (2003), composes a *synthetic control unit*, or *doppelganger*, to serve as a counterfactual for the Finnish economy. The counterfactual is used to understand the different factors behind economic dynamics, as revealed by the comparisons between the counterfactual and the actual dynamics. Our approach deviates from the traditional comparative case studies which are based on the analysis of economic behavior in other similar countries or regions, and use them as counterfactuals. However, countries are not exactly alike and their number is limited. Thus, we use a weighted average of other countries, that more closely correlates with the Finnish economy than any of the other countries alone. We refer to the set of other countries, or *control units*, as the *donor pool*.[1]

Our strategy is to identify the synthetic control unit for Finland by using data that spans over the period before the crisis, 1996–2007. We consider hereby the estimated synthetic control unit as the closest representation of the Finnish economic dynamics before the crisis, and thereafter we use it to investigate the origins of the exceptional behavior of the Finnish economy. Essentially, our assumption is that the synthetic control unit defines the response of the Finnish economy to the crisis in the absence of idiosyncratic shocks that affected Finland but not the synthetic control unit. On the other hand, the response of the synthetic control unit to the Great Recession represents the expected response of the Finnish economy based on its economic behavior in the preceding period.

Our main contribution is to provide the timing and the proximate causes for the divergence between the Finnish economy and its synthetic control unit. The proximate causes here refer to the deviation of the Finnish economy from its counterpart with respect to changes in net exports, gross fixed capital formation and total expenditure.

We reach several interesting findings. To give a first impression of the results we report the actual and the counterfactual path of the GDP in Figure 1. The first striking feature is how well the Finnish economic growth fits the synthetic control until the year 2013.[2] This feature is encouraging, as it shows that the out-of-sample predictive capability of the synthetic control is rather good in a close interval in which we expect that not much has changed in terms of the Finnish economic dynamics as compared to the synthetic control.

After the first response, there is a strong divergence in the Finnish economy and the synthetic control unit. Thus, while the overall initial response matches with the counterfactual, the divergence marks a deviation from the pre-crisis economic dynamics that the synthetic control embodies.

Our analysis also suggests that the fundamental driving force was the development of the Finnish net exports that declined sharply as compared to the similar countries at the early phases of the crisis. While the larger fall of the export demand in Finland was first compensated in aggregate demand by a stronger consumption demand, the subsequent recovery of the consumption demand in the synthetic control revealed the major gap in the Finnish export performance reflected in the GDP as well. Interestingly, we do not find that the overall investment behavior would have been largely different in Finland as compared to the synthetic control unit.

Our findings build on a few methodological choices. First, it is notable that in contrast to many of the preceding studies using synthetic control method, in this study we are not trying to identify the effects of any particular policy intervention or shock to the Finnish economy, but to quantify the combined effect of several factors that played part in the exceptionally sluggish recovery of the Finnish economy in the aftermath of the financial crisis of 2008 and the Euro crisis that followed. In particular, the deviations of the Finnish economy from its previous

path may yield important insights on the causes of the prolonged Finnish slump.

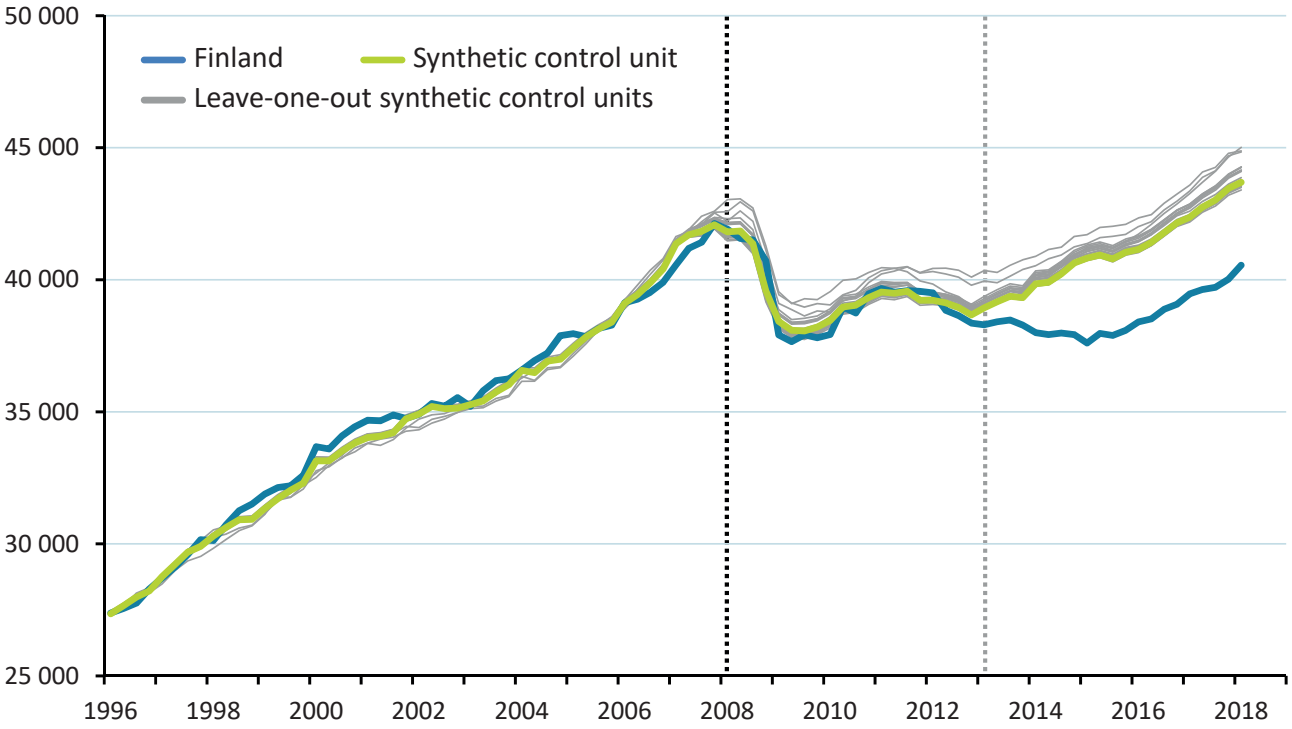
Second, to produce a robust counterfactual, we have used data on the sub-components of the national account in the matching. To be more precise, on top of the real gross domestic product, we used the net exports, the gross fixed capital formation and the final consumption expenditure as additional predictors. To ensure the robustness of our results we also had to make sure that the results are not overly sensitive to changes in any of the individual countries producing the synthetic control unit. To this aim, we repeated the estimation procedure multiple times, each time leaving one country out of the donor pool and assessed the results. The data and the choice of control units is more carefully elaborated in the third section.

This paper is organized as follows. We discuss some technical details on the synthetic control method in Section 2. In Section 3, we report our data. Section 4 reports our results, while Section 5 is devoted to further robustness analysis. Section 6 concludes.

2 Methodology

In the synthetic control literature, the country for which the counterfactual is built is called the *treatment unit*, while the rest of the countries are called *control units*. The control units should be chosen with care, with the particular treatment unit and research question in mind. Essentially, the aim is to find the weights for the control units, such that the weighted average of the aggregate of interest (usually GDP) closely resembles that of the treatment unit. The weights are also restricted to sum to unity and be non-negative. As emphasized in Abadie and Gardeazabal (2003), these restrictions are to prevent the extrapolation outside the support of the data, thus

Figure 1 Gross domestic product per capita, USD (2010)



The blue line illustrates the development of the real GDP per capita in Finland, whereas the green line represents the synthetic control unit using the full donor pool. The grey lines are alternative synthetic control units, each with one country dropped out from the donor pool. Vertical dotted lines represent the end of the estimation period and the first quarter of the year 2013.

Source: OECD, own calculations.

leading to more reliable *post-treatment*, or *out-of-sample*, results compared to a regression where the estimates could obtain arbitrarily large negative or positive values.

The estimation of the weights is carried out using only the data before the event of interest. The period during which the event or policy intervention takes place is often called a *treatment period*. As is typical for the synthetic control literature, we have estimated the weights using yearly aggregate values[3], even though we proceed to examine the quarterly series of interest once the estimated weights are made available. Thus, we have defined the treatment period to be the year 2008. In the exposition of the synthetic control algorithm to follow, the notation follows closely to that of Abadie and Gardeazabal (2003).

The input data for the algorithm consists of the following. The vector $X_1 (Kx1)$ and the matrix $X_0 (KxJ)$ consist of the K predictors of the treatment unit and the J control units, respectively. The predictors may include the main aggregate of interest (GDP) and as already mentioned on top of that in this paper we have chosen the main quantities of the aggregate expenditure equation making up for the GDP. The additional predictors are thus *gross fixed capital formation*, *final consumption expenditure* and *net exports*. To be clear, the predictors always consist of the means or other statistics of the variables from the pre-treatment periods. For generalization of the method to the full time series of predictors see Becker and Klößner (2017, 2018). The vector $Z_1 (Tx1)$ and the matrix $Z_0 (TxJ)$ consist of the time series of the main aggregate of interest (GDP) with T pre-treatment periods for the treatment unit and the J control units, respectively.

Not every predictor is as useful as the other in predicting the aggregate of interest and therefore the diagonal matrix $V(KxK)$ is needed to reflect the relative importance of predictors. As finding not only the optimal vector of weights $W(Jx1)$, but also finding the optimal matrix V is needed, the optimization problem becomes nested with separate inner and outer optimization problems to solve. The inner optimization problem consists of finding the optimal W given the relative importance matrix V (see equation 1).

$$minimize\ W \in \mathcal{W} \quad (X_1 - X_0 W)' V (X_1 - X_0 W), \qquad (1)$$

where $\mathcal{W} = (w_1, \ldots, w_J)'$ subject to $w_1 + \cdots + w_J = 1, w_j \geq 0$. The outer optimization algorithm then deals with finding the optimal value of V as the equation 2 illustrates.

$$minimize\ V \in \mathcal{V} \quad (Z_1 - Z_0 W^*(V))' (Z_1 - Z_0 W^*(V)), \qquad (2)$$

where V is the set of all nonnegative diagonal (KxK) matrices. The optimization is done iterating over the inner and outer optimization problems starting from some initial importance matrix V. To implement the algorithm described, we have used the *Synth* R-package, see Abadie et al. (2011) and R Core Team (2016).

3 Data and the choice of the control countries

Our *target variable* (GDP) is the real gross domestic product per capita and prior to estimation it has been normalized to start from 100 points at the first quarter of 1996 for every country. In other words, all the data has been normalized in a way that one point equals approximately 270 US dollars.[4] The other predictive variables, *gross fixed capital formation*, *final consumption expenditure*[5] and *net exports*, have been estimated from national accounts by using their respective contributions to GDP to obtain real per capita estimates based on our target variable.[6] Thus, on the basis of the aggregate expenditure equation the other predictive variables approximately sum up to 100 points at the first quarter of 1996 for every country. To use the synthetic control method, the normalization of the data is not always necessary, but it often improves both the pre- and post-treatment fit of the synthetic counterfactual leading to more reliable results and it is therefore recommended. All the data used in this study is from the OECD statistical database.

For the synthetic control method to produce useful and reliable counterfactual, the set of control units, also called the *donor pool*, should be chosen with care. The control units should share similar features with the treatment unit, and in economic context, they should be exposed to the same global economic shocks as the treatment unit, depending on the application of course. If the number of different economies subject to different global economic forces is large, the chance of mistaking idio-

syncratic shocks for structural factors rises, making the post-treatment results obtained less reliable. On the other hand, the donor pool should be vast enough for there to be enough different linear combinations available for the algorithm to find weights that fit the data well on the pre-treatment periods.

As the Euro crisis takes place in our post-treatment periods of interest, to avoid mistaking Euro-specific shocks for Finland-specific ones, we first chose to constitute our donor pool of the countries that are both members of the OECD and the European monetary union. We then appended this donor pool with Nordic countries and United Kingdom as their economic development is often compared to that of Finland. Finally, we dropped a few countries with insufficient data on our predictors of interest and chose also to leave Greece out of the donor pool, as the Greek government-debt crisis taking place in the post-treatment periods could destabilize the results.

4 Results

The aggregate dynamics and their sensitivity to the choice of the control countries

In terms of aggregate dynamics, our main finding is that the Finnish economic growth closely resembles the synthetic control until the year 2013. Thereafter there is a striking divergence in the Finnish growth pattern and the synthetic control. This result suggests that overall the early phase of the economic contraction was typical on the basis of the dynamics of the Finnish economy prior to the crisis, whereas after 2013 the economy deviated from the typical behavior, as represented by the synthetic control.

To ensure the robustness of our results we also had to make sure that the results are not overly sensitive to changes in any of the control units alone. To this aim, we repeated the estimation procedure J times, each time leaving one country out of the donor pool. The figure 2 illustrates this procedure. It turned out that the results were highly sensitive to the exceptionally fast recovery of the Irish economy after 2013. The Ireland was dropped from the donor pool and the sensitivity analysis was repeated. The analysis without Ireland showed no signs of high sensitivity to changes in any of the control units alone, even though there were some variation in the accuracy of the synthetic counterfactual during the post- and pretreatment periods (see figure 1). The full and final set of control units with their respective weights can be found from table 1.

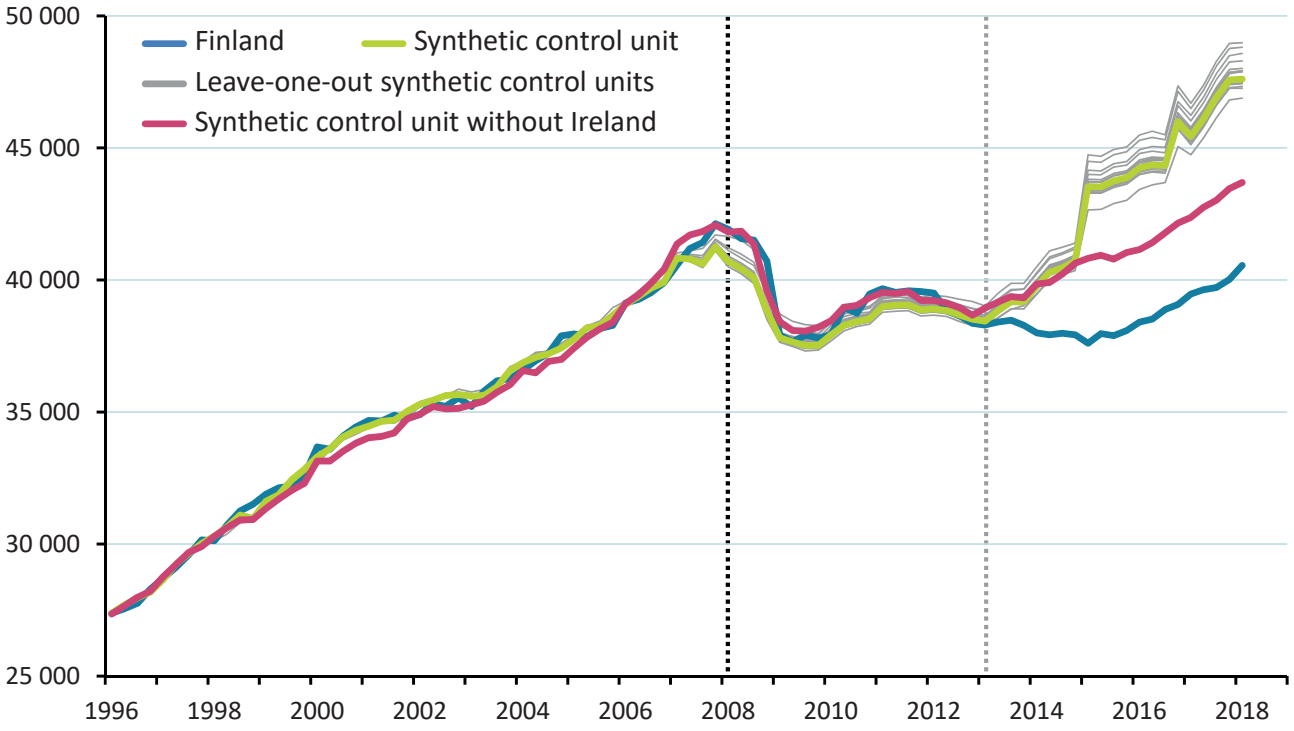
As illustrated, our results are robust to removal of any of the control units and are thus not overly sensitive to changes in the donor pool. Therefore, the synthetic counterfactual and further conclusions obtained should not be overly dependent on any idiosyncratic shocks occurring in the individual countries of the donor pool. It is also evident, that the analysis is not dependent on the treatment period defined, as the paths of the synthetic counterfactual and the treatment unit (Finland) clearly separate only five years after the treatment period. The synthetic counterfactual also provides an excellent fit both before and years after the treatment period, which further suggests the counterfactual to yield reliable results.

Finally, it must be emphasized that the countries chosen by the algorithm are *not* necessarily the ones that most closely resemble the Finnish economy *by themselves*, and no strong conclusions regarding the similarities between the Finnish economy and the individual countries with

Table 1 The final set of control units and their respective weights, %

Country	Weight
Austria	< 1
Belgium	< 1
Czech Republic	< 1
Denmark	< 1
Estonia	15,90
France	< 1
Germany	< 1
Italy	< 1
Lithuania	< 1
Luxembourg	22,10
Netherlands	< 1
Norway	< 1
Portugal	47,30
Slovenia	10,40
Spain	< 1
Sweden	< 1
United Kingdom	< 1

Figure 2 **Gross domestic product per capita, USD (2010)**



Differing from figure 1, here Ireland is kept in the donor pool. The blue line illustrates the development of the real GDP per capita in Finland whereas the green line represents the synthetic control unit including Ireland as one of the control units. The grey lines are alternative synthetic control units, each with one country dropped out from the donor pool and the red one is the alternative synthetic control unit without Ireland. The red line also coincides with the main synthetic control unit used in this study and portrayed with a black solid line in figure 1. Vertical dotted lines represent the end of the estimation period and the first quarter of the year 2013.

Source: OECD, own calculations.

the largest weights should be drawn. The weights are only to establish – in a sense – an *optimal linear combination* of the countries in the donor pool to be used as a counterfactual, and there is not necessarily any interpretation on the weights per se.

The proximate sources of the aggregate pattern

We next analyze the proximate reasons for the divergence of the GDP developments between the synthetic control and the Finnish economy. In particular, we compare the individual items of the balance of resources, i.e. investments, consumption, and the net exports. We notice that in case of each item, the growth patterns are relatively similar in the estimation period 1996–2008, whereas there are altering level of divergence in the items after 2008.

The main features behind the GDP developments become apparent when looking at figures 3–5. They show unambiguously that in terms of the balance of resources items the driving force behind the Finnish growth divergence has been the weak development of the Finnish net exports. The balance between exports and imports declined sharply as compared to the similar countries at the early phases of the crisis. While the larger fall of export demand in Finland was first compensated by stronger consumption demand, the subsequent recovery of the consumption demand of the synthetic control countries revealed the major gap in the Finnish export performance as compared to the synthetic control. The overall

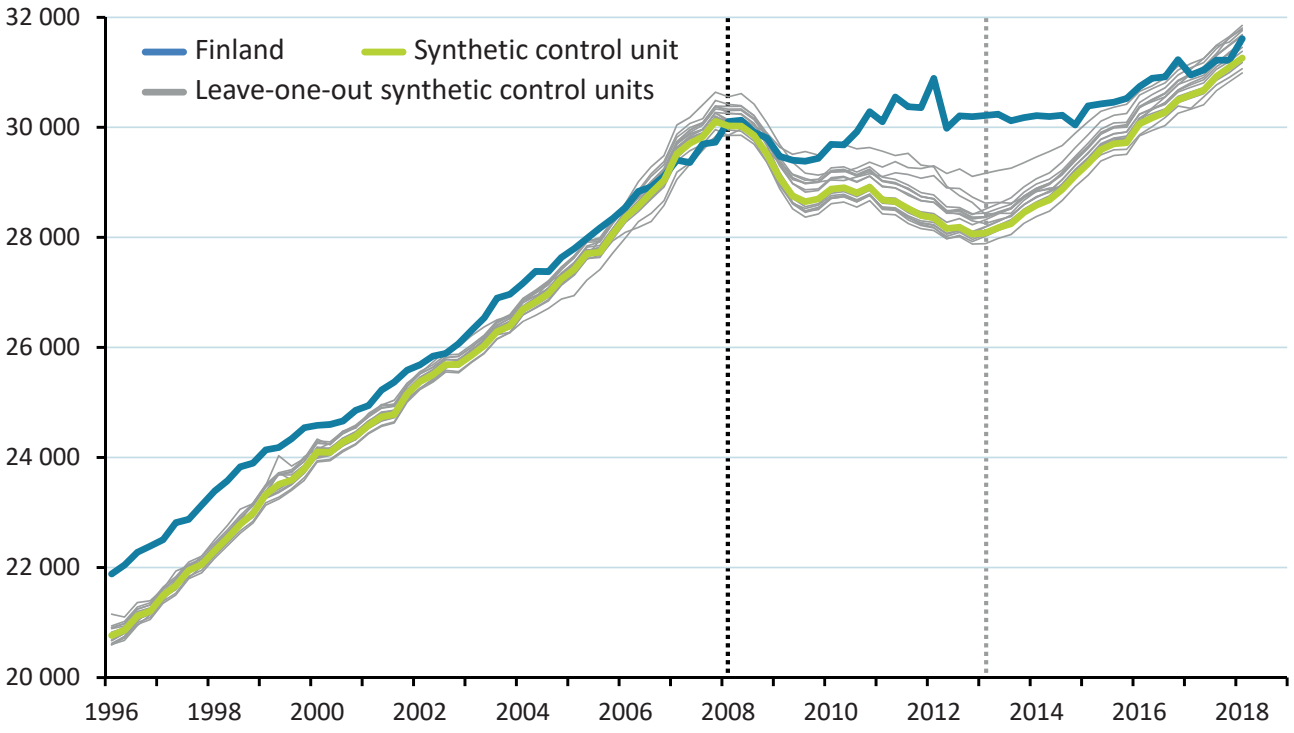
investment behavior seems not to have played a major role in the divergence.

A few details are worth discussing. First, we discuss the divergence between Finland and the synthetic control unit in net exports that is roughly 3000–4000 US dollars per capita[7] or 7–10% of GDP. A large portion of the gap can be explained with the weakening of the Finnish net exports as compared to the year 2008. The collapse of the Nokia cellular phone business is a key explanation. Nokia was a major contributing factor to the strong Finnish export performance prior to the crisis. The direct fall of the value-added contribution of Nokia was roughly 2.5 % of the GDP[8], while after considering a reasonable multiplier the effect is likely to be larger (Kaitila et al. 2018). Otherwise, the gap is likely be due to more general cost competitiveness problems of the Finnish economy that are discussed below in more detail.

On the other hand, roughly half of the emerged gap is explained by the improvement of net exports of the synthetic control. There are two factors in play. First, the control countries may have experienced an improvement in the export competitiveness. Second, given the weak global export demand, part of the improvement may have resulted from the collapse of imports relative to exports. Thus, ultimately the widening of the gap may partly be a result of the gaps in the other items with large share of import content, in particular the consumption demand.

The domestic consumption expenditures in Finland grew at a slightly slower pace than in the synthetic control group until 2008. However, the consumption expenditures in Finland declined less than its synthetic baseline in 2009, and the difference between the Finnish consumption and its synthetic control increased further from 2010 to 2012. Yet in 2013 the synthetic control of con-

Figure 3 Final consumption expenditure per capita, USD (2010)



The blue line illustrates the development of the final consumption expenditure (both public and private consumption) in Finland whereas the green line represents the synthetic control unit using the full donor pool. The grey lines are alternative synthetic control units, each with one country dropped out from the donor pool. Vertical dotted lines represent the end of the estimation period and the first quarter of the year 2013.

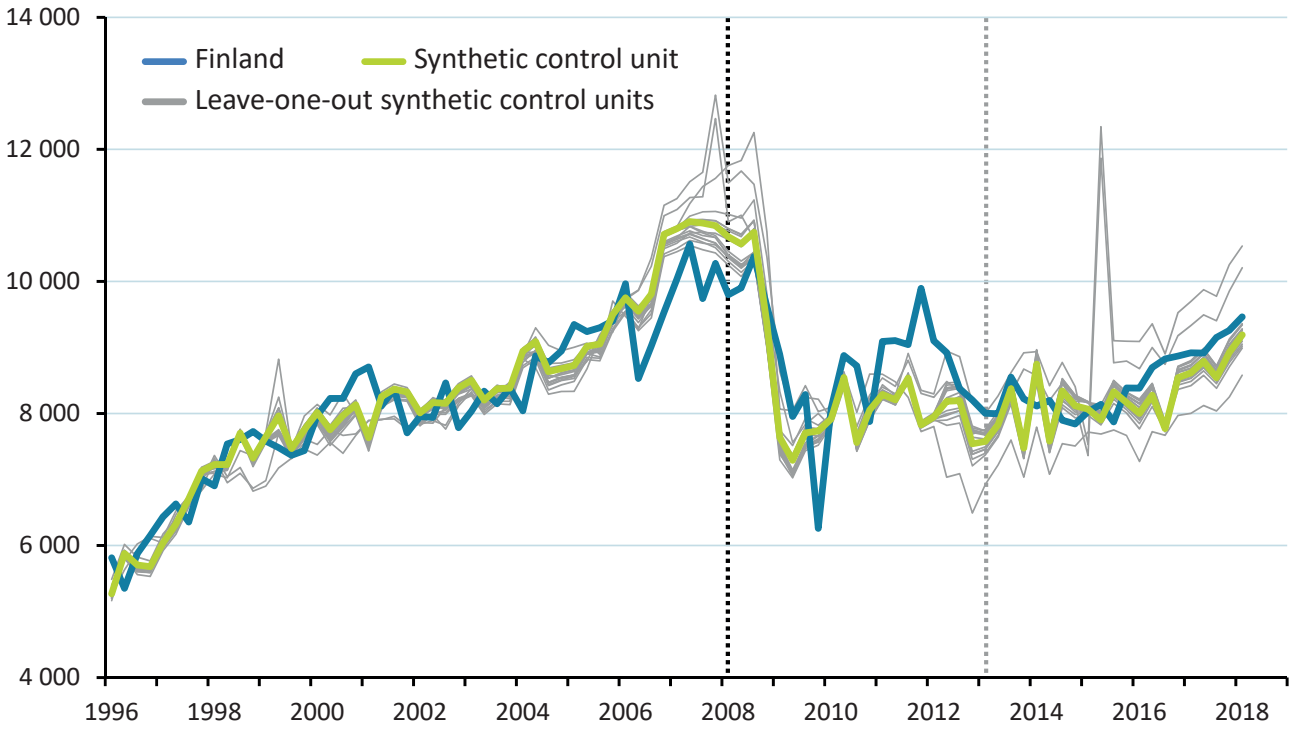
Source: OECD, own calculations.

sumption demand started to recover and the gap started to narrow, and by 2017 the synthetic control had almost reached the level of Finland.

So how can this development, – at first a more positive development in Finnish consumption expenditures but then the narrowing of the gap after 2013 and finally its closing in 2017 –, be explained? We can discuss a few hypotheses. First, despite the shock caused by the financial crisis, the Finnish consumption expenditures were initially helped by substantial pay rises that were implemented across economic sectors in 2008 and 2009. In fact, these pay rises contributed substantially to Finland's loss in price competitiveness at the same time. This development in price competitiveness is well documented and discussed, for instance, by Kajanoja (2015). Nevertheless, the pay rises in 2008–2009 probably only had a short-term positive effect on private consumption till their negative effects, coming for instance from the exports side, started to bite. This would also explain, at least partly, the narrowing gap in consumption expenditures after 2013. The Finnish consumption was also supported by low inflation. In fact, it was private consumption that grew in Finland in 2009–2010 while the volume of public consumption remained quite stable.

The consumption expenditures were also initially, right after the financial crisis struck, supported by slightly looser fiscal policies in Finland as compared to an average country in the EU (see Kaitila et al. 2018). Our donor pool of countries also includes countries that were soon forced to adopt more austerity policies than Finland, which gives support to this hypothesis. On the other hand, also Finland's fiscal policy turned more restrictive from 2011 onwards together with the burst of the European debt crisis. Hence, fiscal policies have prob-

Figure 4 **Gross fixed capital formation per capita, USD (2010)**



The blue line illustrates the development of the gross fixed capital formation in Finland whereas the green line represents the synthetic control unit using the full donor pool. The grey lines are alternative synthetic control units, each with one country dropped out from the donor pool. Vertical dotted lines represent the end of the estimation period and the first quarter of the year 2013.

Source: OECD, own calculations.

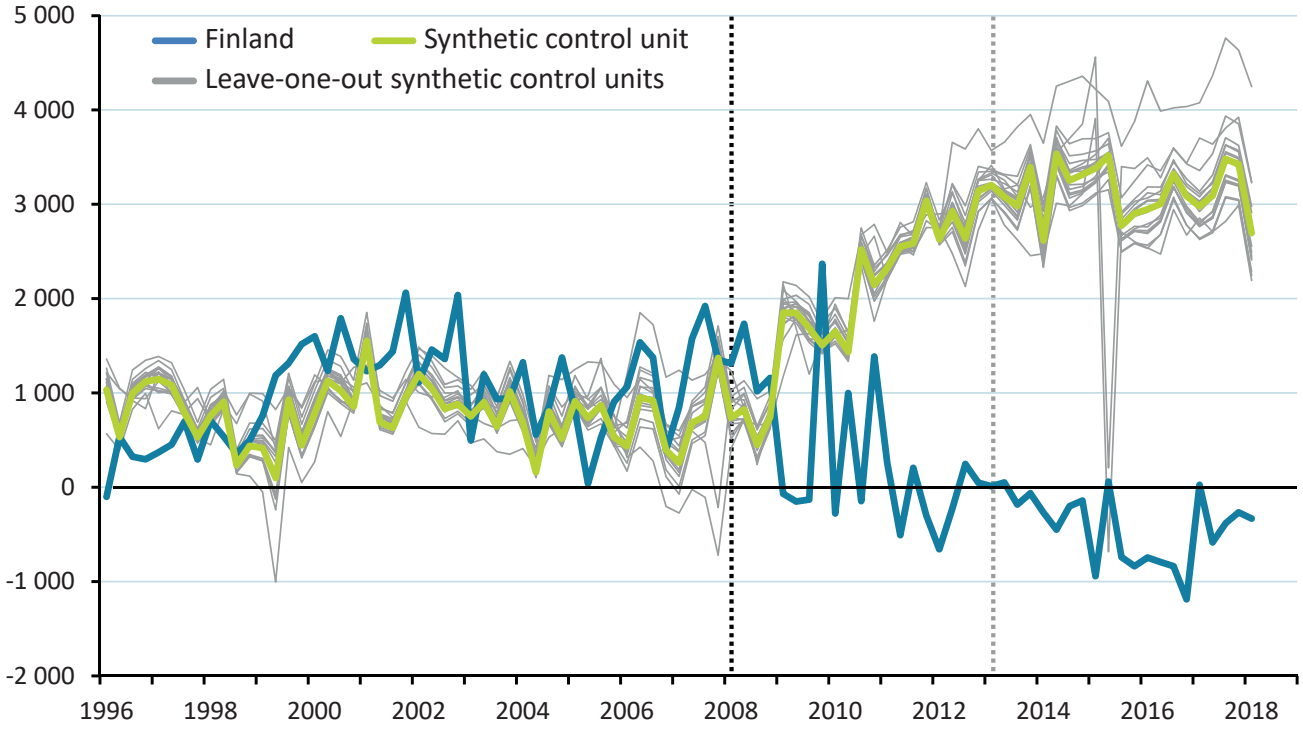
ably contributed to the observed gap between Finnish consumption expenditures and its synthetic control, but other factors have played a role too.

Also, the demographic development may have contributed to the gap. The share of people aged over 65 years started to increase considerably in Finland already since 2011, that is earlier than in most of the European countries. While the incomes of retired persons are tied to income transfers secured by the pension system, this factor has probably alleviated the income shock caused by the financial crisis, and hence contributed positively to Finnish consumption expenditures.

The increases in income transfers should, however, be reflected in assessments of fiscal policy stance: the increased share of pensioners receiving income transfers is at least consistent with the proposition presented above that fiscal policy seems to have been, at least at the beginning of the turbulent period after the financial crisis, looser in Finland as compared to an average country in the EU (one needs to keep in mind here that exact measurement of a fiscal policy stance is a very difficult task). Also, we cannot rule out the possibly that there are even greater differences in fiscal policies in our donating pool of countries in the synthetic control as compared to Finland's.

We can also speculate if the exchange rate or monetary policy have affected the observed gap in consumption expenditures. A counterargument for this is that most of the countries in our synthetic control are euro area countries which share the currency and monetary policy with Finland. It is only Estonia that wasn't in the monetary union in 2008 and that has a significant weight in our control group of countries. Estonia however also joined the monetary union in 2011. Finally, naturally the (idiosyncratic) shock caused by the collapse of Nokia in

Figure 5 **Net exports per capita, USD (2010)**



The blue line illustrates the development of the net exports in Finland whereas the green line represents the synthetic control unit using the full donor pool. The grey lines are alternative synthetic control units, each with one country dropped out from the donor pool. Vertical dotted lines represent the end of the estimation period and the first quarter of the year 2013.

Source: OECD, own calculations.

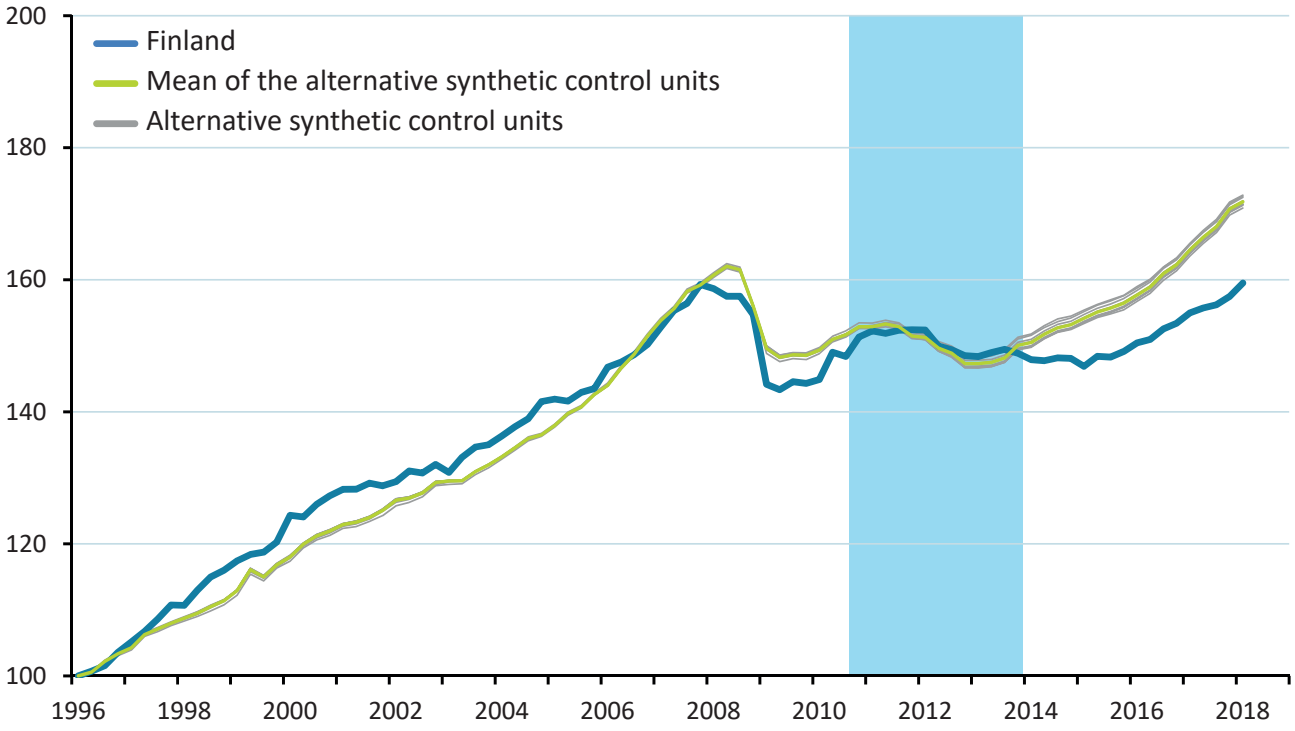
2008–2014 was also reflected in private consumption in Finland. It is, however, difficult to associate this negative shock with the coincident rather positive development in Finnish consumption expenditures as compared to its synthetic baseline.

Interestingly, the gross fixed capital formation per capita in Finland has grown in line with that of the synthetic control group during almost the whole time period analyzed here, starting from 1996. The peak in the synthetic baseline just before the financial crisis was little higher than that in the capital formation in Finland, and on the hand, the capital formation in Finland had a temporary upswing in 2011–2012 which deviates from the synthetic baseline. Nevertheless, besides these, there are basically no differences in developments of capital formation to GDP between Finland and the synthetic control group of countries. The results are also relatively robust to removal of any of the control units (countries) from the donor pool. Having said that, though, it should be acknowledged that we do not take a stand on changes in the structure of investments. For example, there has been a major decline in the GDP share of research and development investments that is not experienced in other countries.

5 Further robustness analysis: Sensitivity to the choice of predictive variables

In the above analysis, we have calculated the synthetic control unit for GDP per capita, using consumption expenditure, gross fixed capital formation and net exports as additional predictors for increased robustness. The

Figure 6 **Gross domestic product, volume (1996Q1 = 100)**



GDP volume and synthetic control based on country specific characteristics. Blue area represents the treatment periods and the grey lines the effect of variation in the treatment period.

Source: OECD, own calculations.

analysis is however dependent of the choice of predictors, target unit (real GDP per capita) and donor pool and to further assess the robustness of our analysis we have constructed an alternative synthetic control unit with more country specific characteristics in mind.

The alternative synthetic control unit is constructed using 12 economic indicators with all the OECD countries in the donor pool.[9] In the alternative analysis we also target the GDP volume without per capita adjustments, although this can be hardly believed to have any effect on the analysis.

It turns out that the synthetic control unit that is built with more country specific characteristics in mind is not able to fit the data as well as the synthetic control unit built above and is more sensitive to the selection of the countries in the donor pool – a change in the donor pool would affect notably the composition of the synthetic control. Other obvious problem in using synthetic control as a counterfactual in our case, is that there is no obvious treatment period. To address this issue, Figure 6 shows the synthetic control units with treatment period varying between the fourth quarter of 2010 and the fourth quarter of 2013. Between these periods, there is only a small variation on the composition of the synthetic control. The set of selected countries stays unaltered with average weights: Slovenia (72%), Portugal (11.9%), Sweden (10.1%), France (2%), Germany (1.5%), Norway (1.4%) and Lithuania (0.9%). The red dashed line in the Figure represents a synthetic GDP with average weights. The resulting path of the synthetic GDP gives us the same information as the baseline specification - the Finnish GDP deviated from its counterparts in 2013 and is approximately 6% below its synthetic counterpart in 2017.

6 Conclusions

In this paper, we propose to use the synthetic control method to analyze the Finnish economic performance after the onset of the Great Recession. Our main interest is to study the slow recovery of the Finnish economy from the global downturn that began in 2008.

Our findings show that the Finnish economic growth has been sluggish as compared to the composition of other countries that most strongly correlated with the Finnish economic dynamics prior to the crisis. The divergence that started in 2013 was mainly due the country's weak export performance. The consumption expenditures, on the other hand, outperformed the synthetic control unit right after the financial crisis, but starting from 2013, they underperformed as well.

All in all, the Finnish experience strikes us as an example of sluggish adjustment to persistent external shocks. The sluggishness has resulted from a combination of uncertainty and inertia caused by the economic structures. The revelation of the persistence of the weak external competitiveness has been gradual, the consumption response has so far mainly been consumption smoothing and the adjustment of prices has been slow. Ultimately, the recovery, however, may necessitate adjustments to the new normal, improvement of the price competitiveness, and investments in the renewal of the Finnish export sector.

Endnotes

[1] Essentially, to produce a synthetic control unit, the target variable (GDP) is matched to those of the control units and the weights are obtained as the restricted linear combination minimizing the sum of squared errors during the estimation period. To discuss the dynamics behind the GDP, the weights obtained are used to assess the developments of a few additional items of aggregate demand as well. The methodology is more closely portrayed in the second section. To name a few examples in the literature regarding the synthetic control method, Abadie and Gardeazabal (2003) and Abadie et al. (2010, 2015) use the method to assess the economic effects of terrorism, tobacco legislation and unification Germany, respectively, and Born et al. (2018) study the economic consequences of the Brexit vote to the British economy, using the synthetic control method. Other applications and improvements to the method include Acemoglu et al. (2016), Becker and Klößner (2018) and Amjad et al. (2018).

[2] The estimation was performed using only the data before the financial crisis of 2008.

[3] Using quarterly values would not change any of the qualitative results or conclusions of our study. Using yearly aggregates for estimation does however seem to improve the fit of the synthetic control for both pre- and post-treatment periods.

[4] Reference period is the year 2010.

[5] Both public and private consumption expenditure.

[6] To be precise, the predictors consist of the means of the predictive variables from the whole estimation period 1996–2007 and from the years 2005–2007. The predictive variables include also the target variable itself.

[7] Reference year 2010.

[8] Based on Nokia's firm-level accounts.

[9] The indicators are: export to GDP, %, in 2008; employment rate, %, in 2008; Gross fixed capital formation to GDP, %, in 2008; average annual population growth, %, in 1996–2008, average share of population over 65, %, in 1996–2008; average industry's share in value added, %, in 1996–2008; average gross fixed capital formation to GDP, %, in 1996–2008; average exports to GDP, %, in 1996–2008; average employment rate, in 1996–2008; average employment rate of women, in 1996–2008; average of at least completed upper secondary, population 25+, total % in 2002–2009; average general government revenue to GDP, %, in 1994–2008.

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