Effects of Hosting the Olympics on GDP Using the Synthetic Control Method

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Abstract

There is often a debate about benefits of hosting a mega event such as the Olympic Games as there is no consensus whether profits outweigh the costs. This paper looks at the countries that hosted the Summer and Winter Games from 1988 to 2010 to see if they benefitted from hosting the Olympics using the synthetic control method developed by Abadie, Diamond, and Hainmueller. The synthetic control method enables us to construct counterfactual countries as if they did not host with similar patterns of GDP to compare the outcomes of the real host countries to the counterfactual ones after hosting. We find that Summer Games mostly have positive effects for the host countries on GDP, whereas Winter Games have mostly negative effects for the host countries on GDP. Placebo tests show that Korea 1988 and Japan 1998 exhibit the biggest significance from hosting the Olympics.

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Keywords: Summer Winter Olympics, GDP indicators, synthetic control method, treatment effects

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1. Introduction

In the past three decades, mega events such as the Olympics, the FIFA World Cup, World Fairs, and regional games "have reached a size that has made them transformative ventures for entire cities, regions, and sometimes whole countries" (Mueller 2015). This paper examines whether hosting the Olympic Games has a sizeable effect on the GDP of the hosting country, focusing on both the Summer and Winter Olympics.

The concept of Olympics has a long history starting with the first ancient Greek Olympics in 776 BCE. Since the first modern Summer Olympics in Athens in the year 1896 and Winter Olympics in 1924, the Games are taking place every four years except for interruptions due to World War I and II (Camille Besse, personal communication May 2016).

The love for mega-events like the Olympic Games is a global phenomenon attracting millions of people, but hosting the event, such as the Olympics, is quite controversial as the ventures of hosting can be negative as well as positive. Recently, more and more residents try to prevent a city from hosting the Olympics. The residents of Munich in November 2013 and the residents of Stockholm in January 2014 both rejected the application of their city to host the 2022 Winter Games. Similarly, in November 2015, the residents of Hamburg voted to withdraw the bid for the 2024 Summer Games. Proponents of the Games were disappointed, since their argument is that the respective regions will receive a positive net benefit when hosting the Olympics due to increased tourism, better infrastructure, lower unemployment, and what is difficult to measure but important for the argument of proponents, the legacy effect. The opponents of the Games argue that hosting results in monetary net loss, mainly due to exuberant government spending on transportation and sports infrastructure, security, and other operational costs.

Since Barcelona, the so-called "poster child of success for hosting the Olympics" (Zimbalist 2015), held the Summer Olympics in 1992, it is one major example for successfully hosting the Olympics. Barcelona government invested large amount of funds in efforts to restructure the city by increasing the amount of roads by 15%, sewage system by 17%, and new green areas and beaches by 78% (Brunet 2005); the funds generated an immediate direct benefit in the amount of $30 million and hosting additionally led to an incredible legacy effect (Levy and Berger 2013, Duran 2005). After Barcelona hosted the Olympics, they experienced the fastest growth in tourism within all European countries (Baade and Matheson 2016). The legacy effect in this case might still function, offsetting all the costs Barcelona had to face to host. However, it is difficult to examine whether this effect is comparable to the Barcelona if they had not hosted the Olympics.

Giesecke and Madden (2007) found that Sydney, Australia hosted in 2000, made a net consumption loss of approximately $2.1 billion due to hosting the Olympics. There is little to no consensus whether hosting the Olympic Games is profitable or not, especially because identifying all the true costs and benefits seems impossible since costs are more a matter of perspective as "Olympic budgets are both political, contentious and notoriously unreliable" (Cashman 2002). Potential host countries want the effect of hosting to seem as profitable as possible and the fear of low public support hinders organizers and politicians from revealing all costs. "Benefits are often equally vague, they are uncosted and their value inflated. After an Olympic Game, there is limited assessment as to whether any proposed benefits have been realised" (Cashman 2002). There is little consensus on which costs and benefits to attribute to the Olympic Games and which do not.

To estimate the true effect of the Olympics, one would need to know how the host country would have developed without hosting the Olympics in order to isolate the treatment effects. The inability to estimate the stage of the country that would exist without the Olympic Games makes it very hard to identify the treatment effect of hosting. What we do not know, for example, is what investments Barcelona would have undertaken without the Olympic Games.

To avoid miscalculations, this paper examines what effect hosting the Olympic Games has on the gross domestic product (GDP) of the hosting country using the synthetic control method. This method, developed by Abadie, Diamond, and Hainmueller (2010) and built on the idea by Abadie and Gardeazabal (2003), allows us to compare the GDP of the host country to a counterfactual not hosting the Olympics. Further, we can conclude whether hosting the Olympics contributed positively, negatively, or indistinctly towards GDP development.

To become a host, the bidders need to go through a procedure that starts ten years before the actual hosting date. The candidature process lasts for three years—it starts with an invitation of the International Olympic Committee (IOC) to the National Olympic Committee (NOC) to declare interest in bidding, then a two-year process consisting of workshops, presentations, and submitting files follows. At the end of this phase, IOC members elect the host city, leaving the elected city with seven years to prepare for the Games. As our data starts in 1980, the Olympics we are looking at are the ones from 1988 to 2010. The Olympic Games take place every four years. Until 1992, Winter and Summer Games took place in the same years, but the IOC decided to implement two-year break between Summer and Winter Games. The next Winter Games was held in 1994 and then again with a four years break for respective to the Summer and Winter Games but two years in between. Table 18 and Table 19 in the Appendix show the hosts, their competing bidders, and the date of announcement for the Summer and Winter Olympic Games.

The remainder of this paper is organized as follows: section 2 reviews existing literature; section 3 contains a brief description of the data; section 4 describes the synthetic control method; section 5 reports the results; section 6 presents the critiques of this paper and we conclude with section 7.

2. Literature Review

Alongside independent studies that evaluate the effect of hosting the Olympic Games, our paper is the first to use the synthetic control method examining the effect of the Olympics on the GDP at a country level. When looking at the literature, no clear pattern of effects of the Olympics can be found. Studies that examine the Olympics effects are either done ex-ante or ex-post, where the ex-ante studies are often more optimistic concluding the host will benefit positively in terms of GDP and unemployment, whereas ex-post studies have found no evidence of a positive effect (Owen 2005). Ex-ante studies are said to be done mainly by proponents of the Games or by commissions who are expected to find a positive result. Undoubtedly, supporters of hosting the Games need positive facts and figures to convince skeptics. Using assumptions and predictions, ex-ante results indicate mainly that hosting the Games is the best instrument for a country to boost their economy.

Comparing input-output models to computable general equilibrium models, as ex-ante and ex-post studies, both studies from Kasimati (2003) and Levy and Berger (2013) state that the different timing of studies leads to different results. Looking at another study, Owen (2005) wrote that ex-post studies have rigorously "failed to find evidence of any economic benefits related to sports teams and facilities"; further, the differences in the results are mainly due to "treating costs as benefits, ignoring opportunity costs, using gross spending instead of net changes, and using multipliers that are too large."

A paper by Miyoshi and Sasaki (2016), which also used the synthetic control method, examined the effect of the 1998 Nagano Winter Olympics on economic and labor market outcomes. But different to our study, the authors were looking at the effects of hosting on the city level, not at the country level. With the synthetic control method, the authors build counterfactual dynamics of various and economic and labor market outcomes of Nagano and compare them to the real data of the outcomes.

This allows them to see how Nagano would have developed without hosting the Olympics. The authors' results indicate a long-term positive effect on the local economy in terms of total GDP, but not on per capita GDP. Effects of production in the construction are only found as short term, but not long-term effect. Positive effects were also found on activity in the service and real estate sector. Baade and Matheson (2016) claim that some documents of the Nagano Winter Olympics in

1998 were burnt in order not to reveal all costs of hosting the Games. Using the synthetic control method still provides the means for Miyoshi and Sasaki to assess the effects of hosting the Olympics on economic and labor market outcomes for their unlisted costs and benefits.

When looking whether the Olympic Games have an effect on exports, Rose and Spiegel used the gravity model of international trade (2009). They find that hosting the Olympics has a positive and permanent effect on national exports. By examining the hosting countries using bidding countries as controls, the authors also find that bidding has a comparably positive effect on trade. The authors use the signaling model to justify their claiming that it is not the hosting that generates the effect but it is the act of bidding that functions as a signal of trade liberalization. The strong export effects are primarily found for the Summer Olympics and they report that the coefficients for the Winter Games are insignificant and small. The authors reasoning for this difference is that the Winter Games have always been overshadowed by the Summer Games and took place in very small cities.

Using the same dataset as Rose and Spiegel (2009) and also the gravity model of international trade. Song (2010) finds similar results supporting Rose and Spiegel's hypothesis that it is more the signal of liberalization to foreign countries that increases exports than hosting.

Maennig and Richter (2012), after examining the study by Rose and Spiegel (2009), explained the findings of Rose and Spiegel by stating that comparing countries such as the "United States, Japan, Germany, Canada, Italy, Spain, and Australia" who all hosted the Olympics to all other nations leads to a selection bias due to different structure between treatment and control group. Further, Maennig and Richter corrected for this bias by using countries that are similar to each other and did not find any significant effect of hosting and bidding for the Games on trade.

Also mentioning the findings by Rose and Spiegel (2009), Baade and Matheson (2016) do not believe that "bidding for the right to throw a three-week party seven years in the future can result in enormous nationwide increases in trade, investment, and income," but it is more the fact that there exists a clear strategy of the IOC on who to choose as bidding countries. Only certain countries are allowed to bid that have already a thriving economy and forecast for the future. If this were the case, results would be biased making the positive finding deceptive. On top of this, by exploring costs and benefits of hosting the Olympic Games, the authors further find that hosting the Olympics mostly results in a "money-losing proposition." Excessive spending starts already when bidding. Chicago, for example, spent between $70 million and $100 million on their unsuccessful bid to host the summer Olympics in 2016. The authors discuss that many studies who do find a positive effect are biased as they fail to account for the substitution effect, hence they do not look at the spending

that would otherwise happen when locals would not spend on the Olympics. They further discuss the spending in infrastructure and claim that some of the spending would have occurred anyway.

Langer, Maennig, and Richter (2015) use propensity score matching to compare host and bidding countries to countries that are similar in their structure but are not bidders. The authors state that covariates between countries which are expected to affect GDP growth and the probability of bidding should be measured before the treatment and should not vary over time. By using nearest neighbor matching, where structural differences between bidders and the other countries are reduced to a minimum, the authors do not find any significant effects of hosting the Olympics on GDP per capita growth even when controlling for lagged effects.

Zimbalist (2015) dispels all beliefs about any positive effect for a nation when hosting the Olympics. The IOC is solely responsible for the Olympic Games and it has become nothing but a financial and corrupt institution, dealing with bribery and ostentation. Further, the author claims that the often mentioned success of the Barcelona Games was a exception. The boost of Barcelona only took place due to a long economic development plan made by the government after Franco's death in 1975. In 1976, Barcelona had already created the General Metropolitan Plan, which led to a bigger boost of their economy than the Olympic Games. Zimbalist does not find a net economic gain for any other host countries. As it is often claimed that Olympics increase the number of tourists, the author states that, against what might be expected, London had fewer tourists than usual when hosting the Summer Games in 2012 and when Australia hosted the Olympics in 2000, Sydney experienced a four-year decrease in numbers of tourists.

Commenting on the findings of Rose and Spiegel (2009) and Song (2010) that hosting increases trade, Zimbalist's book (2015), similar to the paper by Baade and Matheson (2016) and Langer, Maennig, and Richter (2015), shows that hosting the Olympics does not increase trade and concludes that trading partners' decisions are dependent on prices, destinations, taxes, costs and rates of return while no business decides on their trading partner depending on the 17 days Olympics.

3. Data

We use the World Economic Outlook 2016 database provided by the International Monetary Fund (IMF). The database contains macroeconomic data series for member countries. The data is mostly available from 1980 to the present. We focus on the data from 1980 to 2012 from the dataset, as the missing variables were large for the years after 2012. From the IMF dataset, we acquired data on

real GDP in dollars as the dependent variable and investment as a percent of GDP as one of the predictor variables.

Another source of data we use is from the World Bank. We use government expenditure as a percent of GDP, imports as a percent of GDP, and exports as a percent of GDP as the other predictor variables.

Similar to the paper by Abadie, Diamond, and Hainmueller, our year range is 32 years. As we look at different Olympic Games starting from 1988 to 2010, the pre-announcement and post-announcement period differ for each Olympic Game. We obtained the Olympics data by personal communication via e-mail with the Olympics Study Centre and we received data on all the hosts and bidders. From this data, we selected the data on the Olympics events hosted from 1988 to 2010. As for the announcement data, we used the book "Historical Dictionary of the Olympic Movement" by John Grasso, Bill Mallon, and Jeroen Heijmans.

4. Methodology

We decided to use the synthetic control method because, as the literature indicates, it is misleading to compare how much money is spent and earned due to hosting (Owen 2005). Since it seems impossible to identify all true costs and benefits, as Cashman (2002) mentioned, we think that a suitable comparison requires an approach that looks at how the GDP would have developed if the country would not have hosted the Olympic Games.

The basic principle behind the synthetic control method is "to use the control group's outcome to approximate the outcome that would have been observed for the treated group in the absence of treatment" (Abadie Diamond and Hainmueller 2011). This allows us to compare the actual outcome of the host country to the counterfactual outcome that would have evolved if the country would not have hosted the Games.

For each country that hosted, the synthetic control method synthesizes a counterfactual country which is a weighted construction of some countries of the donor pool. The donor pool consists of all countries that have ever taken part in the bidding process of hosting the Olympics between 1980 and 2012.

The synthetic country is constructed in a way such that it is as similar as possible to the host country before the treatment in terms of GDP. To estimate the impact of the games, we will compare the outcome of the host country with the outcome of the synthetic country after the treatment date. We

consider the date of announcement of hosting the Olympic Games as treatment date, as this is the time, where the preparation for the hosting starts. If the pattern of the GDP of the synthetic country is similar to the real country after the treatment, then hosting the Olympics would not have an impact on GDP.

If there is a difference between GDP of the real country and GDP of the synthetic country, we can claim that this difference occurs due to hosting. We can check whether this can be confirmed through synthetic placebo testing. Further explanation of placebo testing is described in section 4.2.

To apply the synthetic control methodology and to identify the impact of it, two conditions need to be fulfilled. The first one is that wining the process for hosting the Olympics has to be exogenous and the second one is to have an available comparative control unit.

We assume winning the bid for hosting as exogenous. Miyoshi and Sasaki (2016) point out that winning the selection for hosting is unexpected and thus exogenous, especially for the inhabitants of the country. Of course, politicians and business people hope for hosting and they might be able to evaluate their chances but all the countries we are looking at in this paper were opposed, which means that no country could be sure of winning the bid before they got announced to do so.

The control unit consists, dependent on the host country, of other countries that did not host the Olympics at the same time as the treated country. To estimate a causal effect, treatment and control country should be similar in terms of GDP before the date of treatment. Starting with the date where the treatment sets in, only the treated country should receive the treatment. However, we do not exclude the countries that hosted an Olympic Game before the treated country from the donor pool because the Olympics takes place every four years and the effect of hosting is not forever. Additionally, we make sure that no country that is included in the weighted counterfactual received a treatment in the same year as the treated country. In 1988 and 1992 Winter and Summer Olympics were hosted in the same year. In 1988, Korea hosted the Summer Olympics and Canada the Winter Olympics. In 1992, Spain hosted the Summer Olympics and France the Winter Olympics. If the synthetic country consists of a country that hosted the Games in the same year as the host country, the condition of an available control unit would not be satisfied and our results would suffer from contaminated weighting of the countries. By checking the predictor balance, we found that neither the synthetic Korea, nor the synthetic Spain consists partly of Canada or France respectively and vice versa, hence only the treated country received the treatment.

The exogeneity of the event and an available control unit allows us to truly identify the effect of hosting the Olympic Games on GDP.

4.1 Empirical Model

We observe $i = 1, \dots, J + 1$ countries, where i is the country subject to treatment, which is hosting the Olympic Games for this paper. J number of countries are all potential controls and our donor pool.

Y_{it} is the outcome that is evaluated for the country i at time t. We have T time periods, $(t = 1,2,..T_0,..T)$. T_0 is the following year of the announcement of the winner of the bidding process to be the host, which we consider the year the treatment goes into effect. We chose to use the following year since the IMF data is end-of-year statistics, while most of the announcement months are in the second half of the year, therefore the most of the discrepancy would be less than 6 months. The pre-treatment periods are from $t = 1$ to $t = T_0 - 1$, and the exogenous treatment is at T_0. The treatment outcome is observed from $t = T_0$ to $t = T$, the post-treatment periods. The Olympics event takes place at either $T_0 + 5$ or $T_0 + 6$, depending each Olympics.

Y_{it}^N is the outcome we would ideally observe for country i at time t without the treatment in order to compare with Y_{it}^H, which is the outcome we observe for country i at time t in the presence of the treatment, the host for the Olympics.

One assumption of this model is that for $t \leq T_0 - 1$, $Y_{it}^N = Y_{it}^H$. This means that the announcement of hosting does not have an effect on the outcome before the date of treatment. This assumption would not be justified if the country was unopposed in the bidding process, hence they knew before the announcement date that they will host, but none of the countries we are examining with our data are unopposed in the bidding process, therefore this problem does not need to be considered.

The observed outcome for host country i at time t is defined by:

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

where D_{it} is a dummy variable that takes value 1 if country i is announced to host at time t and value 0 otherwise. We have $D_{it} = 1$ only if $t \geq T_0$, and $D_{it} = 0$ otherwise $\alpha_{it} = Y_{it}^H - Y_{it}^N$, which is the difference of the outcome when receiving the treatment and the outcome when not receiving the treatment. α_{it} is the treatment effect of hosting the country i at time t has on the GDP.

We want to estimate α_{it} for all $t \geq T_0$ for all host countries. But for our period of interest, $t \geq T_0$, only Y_{it}^H is observed. As it is impossible to observe Y_{it}^N for the post-treatment period, the synthetic control method creates a counterfactual outcome, using data from the donor countries with the weighted average of outcomes, hence the synthetic control as a non-host.

$$Y_{it}^{N} = \eta + \sum_{i \neq j}^{J} w_j Y_{jt} + \varepsilon_{it}, \qquad for\ t < T_0$$

This estimation is used to assign the weights to the different countries of the donor pool. w_j are the coefficients of the outcome of the controls, hence w_j represent the weights distributed across the different countries of the donor pool. $w_j \geq 0$ for all j and $\sum_j^J w_j = 1$. All countries are affected in the same way by the external shocks except for the external shock of announcement to host the Olympics and independent identically distributed shocks.

This estimation is used in the pre-treatment period, where the synthetic control method assigns weights to the countries of the donor pool in a way such that the pattern of the GDP is similar between the counterfactual country and the treated country in the pre-treatment period. Not all countries included in the donor pool have to be included in the weighted countries in the outcome observed without the treatment, Y_{it}^{N}.

To estimate $\alpha_{it} = Y_{it}^{H} - Y_{it}^{N}$, for $t \geq T_0$, we now have:

$$\hat{\alpha}_{it} = Y_{it}^{H} - \left(\eta + \sum_{i \neq j}^{J} w_j Y_{jt} + \varepsilon_{it} \right)$$

where η is the unobserved variable constant across countries; we can estimate the effect of hosting the Olympics on GDP by comparing the outcome of the host country that actually got assigned to host the Olympics with the outcome of the counterfactual country that did not get assigned to host them.

4.2 Validity

To find out whether the obtained results are significant, Abadie, Diamond, and Hainmueller used placebo tests. Placebo tests treat every other country from the donor pool separately as if each got the same treatment and the same time and it then creates a synthetic control for each country. The results of each country from the donor pool, treated as if it hosted as placebos, are then compared to the actual host country.

If the gap of the actual host to the counterfactual and the gaps of the placebo runs are different in the post-treatment periods, we can assume that our method provides us with substantial evidence of an effect of hosting the Olympics. If no difference in the gaps between the treated country to the

synthetic and the placebo runs to the synthetic country can be found, then our estimates do not provide us with significant effects of hosting the Olympics. If the difference of the gap of the actual treated country to its counterfactual is within the upper or lower 5% of the distribution of the differences of the gaps of the other countries from the donor pool to their counterfactuals, "our outcome is significant according to the method of the inference validity test developed by Cavallo et al. (2013)" (Miyoshi and Sasaki, 2016).

We exclude those countries from the placebo graphs where the gap of GDP between the real and synthetic country exceeds 5000 dollars. This excludes few outliers and enables us to see whether hosting had a significant impact or not, similar to what Abadie, Diamond, and Hainmueller (2012) did.

We further need to check whether the root pre-intervention mean squared prediction error (RMSPE) of the treated country is close to 0. The RMSPE from the hosted country is the average of the squared deviations between GDP in the host country and its synthetic country in the pre-announcement period. If it is close to 0, it means that the synthetic country provides a good comparison and there are very few deviations between the host country and its counterfactual.

To see whether our results are robust, we included additional variables in our estimation such as unemployment rate and savings. Specifically for savings, we substituted the savings variable for the investment variable. With several kinds of variations of including the additional variables, the obtained results were all very similar.

5. Results

As the synthetic control method does not provide us with reliable results for the US and China since it is difficult to synthesize US and China, we will not interpret their results, but the results of those are shown in figures 3, 6, and 11 in the appendix. The root mean squared predicted errors (RMSPE) shows to be too great to be considered, as can be seen in tables 3, 6, and 11. It is not surprising that the method for countries such as the US and China does not work, as Abadie, Diamond, and Hainmueller (2014) point out that that the donor pool should consist of countries which should be similar in their structure. The United States and China are unique and incomparable to any other countries since they are currently the two biggest economies in the world.

When examining the effect of hosting the Summer Games in Korea 1988 and the Winter Games in Canada in 1988, we used the year of hosting as the treatment date instead of the announcement of

the hosting date. Since we only have data starting in 1980, the synthetic control method would not have had enough years before treatment period to create the synthetic country when treatment date would be the year of announcement, which was 1981, therefore would only give lead way of 1 year since the start of the data.

	Summer Olympics	Winter Olympics
Positive effects	Korea, 1988 Spain, 1992 Greece, 2004	Norway, 1994
Ambiguous effects	Australia, 2000	
Negative effects		Canada, 1988 France, 1992 Japan, 1998 Italy, 2006 Canada, 2010

Looking at Summer Olympics, Korea, Spain and Greece show positive effects, while Australia shows no effect. Looking at Winter Olympics, Norway is the only country showing positive effects, all other, both of Canadian Olympics, France, Japan and Italy show negative effects. It is striking to see that hosting Winter Olympics mainly results in a negative effect on GDP and hosting the Summer Olympics in a positive effect.

A reason for this could be that the Winter Games have always received less attention from the media and by the society. Winter Games are mostly hosted in cities with an average population number of 400.000 people, whereas Summer Games have been hosted in cities with an average population of about 4.5 million people (Gold and Gold 2010). The most important reaction the countries that were announce to host a mega event should *not* respond to is to tie these events to large-scale urban development and especially should not create cost overruns that result in an oversized infrastructure not suitable for the demands in the post-event period (Mueller, 2015). The risk that the new constructions and infrastructure is not needed after the event is much higher and might result much quicker in lost costs.

As stated previously, in order for our results to be significant, the difference between the gap of the actual treated country to its counterfactual hast to be in the upper or lower 5% of the distribution of the differences in gaps of the countries from the donor pool to their counterfactuals. As our donor pool consist of 25 countries, in order to give us significant results for each country, the black line shown in figures 18 to 27 has to be either the highest or lowest one. The only results that provide us

with evidence of significance are the ones for Korea 1988 (positive) and Japan 1998 (negative). Although the placebo graph shows that Korea appears to have a strong negative effect after about a decade, we think that it is because the control countries (namely Finland and Belgium totaling up to about 0.835 weight) were not affected too much by the Asian Financial Crisis of 1997.

Placebo tests with the actual host are plotted in one graph together with the results of donor countries; figures 18 to 27 show the placebo tests for each host country. The placebo testing works in such a way that it enables us to compare the actual host country compared to the countries in the donor pool as if they hosted, hence called placebo testing. The black line shows the difference between the GDP of the actual treated country to its synthetic country, the dashed line. The grey lines show the differences between the GDP of each country in the donor pool to their synthetic country.

6. Critiques and Limitations

When trying to see how hosting the Olympics affects the investment and the exports of a country, the synthetic control method failed to give us clear pattern of effects on GDP as a result of hosting. As shown in figures and tables 14 to 17, the method did not work to create a synthetic country with a similar investment and export pattern. The method using investments and exports data as dependent variables showed too much noise, as can be seen by the high RMSPE for each of the countries—all in the 100s to 10,000s for the synthetic control method to create similar results. Therefore, we were unable to compare the outcome of the real country to the synthetic country in terms of investments and exports. The investment and export graphs for the other host countries look similar to figure 14 to figure 17 in the way that the investment and export pattern of the real and the synthetic country remarkably fluctuate before the treatment date.

One of the main limitations of this paper is that we used country-level data instead of city-level data. However, the Olympic Games are hosted in one city and not all over the country, therefore it would have been interesting to see how hosting the Olympics affects the city in terms of economic outcomes. Nevertheless, our results are interesting as we can see that although the Olympic Games take place in a smaller region of a country, most effects of hosting can be seen for the whole country. This is important since votes for or against hosting the Olympic Games by a population are only done by the region hosting it and not by the whole country.

Accusations of corruption across institutions of mega-events such as the IOC do not seem to be waning away and this is hard to ignore when conducting a study where exogeneity of winning the bidding is a condition.

Baade and Matheson (2016) wrote that there might be a possibility that the IOC has a strategy of which countries they choose to host. There could indeed be an endogeneity for the selection of candidate countries, but the possible endogeneity of country selection does not influence the exogeneity of winning the bids to host.

Zimbalist (2015) showed evidence that the Australian bid committee bribed to win the elections of hosting, which they did after they offering $50,000 scholarships to the children of the Ugandan and Kenyan members of the IOC. If bribing happened, then the assumption of the exogeneity of winning is not validated. However, we do not think that this does affect our result greatly since even if bribing did happen, no one could have started to prepare for the hosting before the actual announcement date as winning was not official until this date, and it would have been obvious for the population and journalists if officials would have started preparing before knowing whether they would win or not. Thus, it might be that a group of some people knew who would win before the official date, but again, we do not think that this affects this study greatly.

Our assumption about the outcomes of the counterfactual not being affected by the treatment of the treated unit in section 4.1 may be too strong of an assumption. In the recent times, globalization increased interrelations between the countries, therefore could show a bias in our results through spillover effects and feedback. For example, if France was a host, then neighboring touristic countries such as Spain may receive different amount tourists than the usual, as some tourists may relocate their time spent for the holidays to the hosting country or tourists who usually visit the hosting country in their holidays relocate their visit to a non-hosting country. However, we do not think that this affects our results.

The data we used is annual data. Quarterly or monthly data could yield more accurate results since announcing the host is in the middle of the year.

7. Conclusion

The objective of this paper is to find out whether hosting the Olympics affects the development of the GDP of a country. The effect of the Olympics is robust and the main conclusion from this paper is that the development of the GDP can be affected in both ways. More specifically, Summer Games mostly have positive effects while the Winter Games mostly have negative effects and seem to affect the GDP from short-term to at least medium-run. Placebo tests show that Korea and Japan exhibit the biggest significance from the Olympics.

The advantage of this study is that we do not have to fear a selection bias like Langer, Maennig and Richter (2015) and Maennig and Richter (2012) mention. They mention that comparing host and bidding countries to countries that are different in structure in general provides a biased result. In this study we do not face this problem as the synthetic control method enables us to compare the real and the synthetic that are very similar in structure.

The loudest criticism against the Olympics nowadays is that some people fear that the Olympic Games are more about satisfying small groups of interest including the IOC, some politicians, private investors, etc. At least for the Summer Games, that is why it is crucial to see the results of this study, since hosting the Games can also provide the country with a benefit in terms of a positive effect on GDP.

It would be interesting to further find out what components of the GDP are the ones determining these effects in GDP; this will require further research. Especially as we found different results for the Winter and Summer Games, the next step could be to find out what is done differently between Summer and Winter games as well as what the different conditions are that need to be ironed out. The negative effects on the GDP when hosting the Winter Games might be due to a different amount of tourists, consumption or investment, and/or the amount of attraction compared to when hosting the Summer Games. This kind of further research can provide the IOC, hosting cities, and politicians with more essential information.

References

Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. 2010. "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program." *Journal of the American Statistical Association* vol. 105(490): 493–505.

Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. 2011. "Synth: An R Package for Synthetic Control Methods." *Journal of Statistical Software* vol. 42(13): 1-17.

Abadie, Alberto, Alexis Diamond and Jens Hainmueller. 2014. "Comparative Politics and the Synthetic Control Method." *American Journal of Political Science* vol. 59(2): 495-510.

Abadie, Alberto, and Javier Gardeazabal. 2003. "The Economic Cost of Conflict: A Case Study of the Basque Country." *American Economic Review* vol. 93(1): 113-132.

Andrew Zimbalist, "Circus Maximus: The Economic Gamble Behind Hosting the Olympics and the World Cup." Washington: The Brookings Institution, 2015.

Baade, Robert A., and Victor A. Matheson. 2016. "Going for Gold: The Economics of the Olympics." *Journal of Economic Perspectives* vol. 20(2): 201-218.

Besse, Camille. Letter. 2016. "List of all bidders for Olympic Games – REQ033450". Email.

Brunet, Ferran. 2005. "The economic impact of the Barcelona Olympic Games, 1986-2004: Barcelona: the legacy of the Games, 1992-2002." [online article]. Barcelona: Centre d'Estudis Olímpics UAB. [Date of consulted: 20/05/2016] http://olympicstudies.uab.es/pdf/wp084_eng.pdf

Cashman, Richard. 2002. "Impact of the Games on Olympic host cities: university lecture on the Olympics." [online article]. Barcelona: Centre d'Estudis Olímpics/UAB. [Date of consulted: 20/05/2016] http://olympicstudies.uab.es/lectures/web/pdf/cashman.pdf

DuPont, William and Ilan Noy. 2012. "What Happened to Kobe? A Reassessment of the Impact of the 1995 Earthquake in Japan." Working Paper No. 12-4. University of Hawai'i at Manoa. Department of Economics, Working Paper Series.

Duran, Pere. 2002. “The impact of the Olympic Games on tourism: Barcelona: the legacy of the Games 1992-2002.” Barcelona: Centre d’Estudis Olímpics/UAB. [Date of consulted: 20/05/2016]

Giesecke, James, and John Madden. 2007. “The Sydney Olympics, Seven Year On: An Ex-Post Dynamic CGE Assessment.” Centre of Policy Studies Monash University, Working Paper No. G-168.

Gold, John R., and Margaret M. Gold, “Olympic Cities: City Agendas, Planning and the World´s Games, 1896-2016.” Abingdon: Routledge, 2010.

Grasso, John, Bill Mallon and Jeroen Heijmans, “Historical Dictionary of the Olympic Movement.” Lanham: Rowman & Littlefield, 2015.

Kasimati, Evangelia. 2003. “Economic aspects and the Summer Olympics: a review of related research.” *International Journal of Tourism Research* vol. 5(6): 433-444.

Kasimati, Evangelia, and Peter Dawson. 2009. “Assessing the impact of the 2004 Olympic Games on the Greek economy: A small macroeconometric model.” *Economic Modelling* vol. 26(1): 139–146.

Langer, Victoria C. E., Wolfgang Maennig, and Felix J. Richter. 2015. “News shocks in the data: Olympic Games and their macroeconomic effects - Reply.” Hamburg Contemporary Economic Discussions No. 52.

Levy, Ben, and Paul D. Berger. 2013. “On the Financial Advantage of Hosting the Olympics.” *International Journal of Humanities and Social Science* vol. 3(1): 11-20.

Maennig, Wolfgang, and Felix J. Richter. 2012. “Exports and Olympic Games: Is there a Signal Effect?” Journal of Sports Economics, 13(6), 635-641 Hamburg Contemporary Economic Discussions Working Paper No. 42.

Miyoshi, Koyo, and Masaru Sasaki. 2016. “The Long-Term Impacts of the 1998 Nagano Winter Olympic Games on Economic and Labor Market Outcomes.” *Asian Economic Policy Review* vol. 11(1): 43-65.

Müller, Martin. 2015. “The Mega-Event Syndrome: Why So Much Goes Wrong in Mega-Event Planning and What to Do About It.” *Journal of the American Planning Association* vol. 81(1): 6-17

Owen, Jeffrey G. 2005. “Estimating the Cost and Benefit of Hosting Olympic Games: What Can Beijing Expect from Its 2008 Games?” *The Industrial Geographer* vol. 3(1): 1-18.

Rose, Andrew K., and Mark M. Spiegel. 2009. “The Olympic Effect.” NBER Working Paper No. 14854

Song, Wonho. 2010. “Impacts of Olympics on Exports and Tourism.” *Journal of Economic Development* vol. 35(4): 93-110.

"World Economic Outlook Database April 2016." World Economic Outlook Database April 2016. Accessed May 1, 2016. http://www.imf.org/external/pubs/ft/weo/2016/01/weodata/index.aspx.

Appendix

Summer

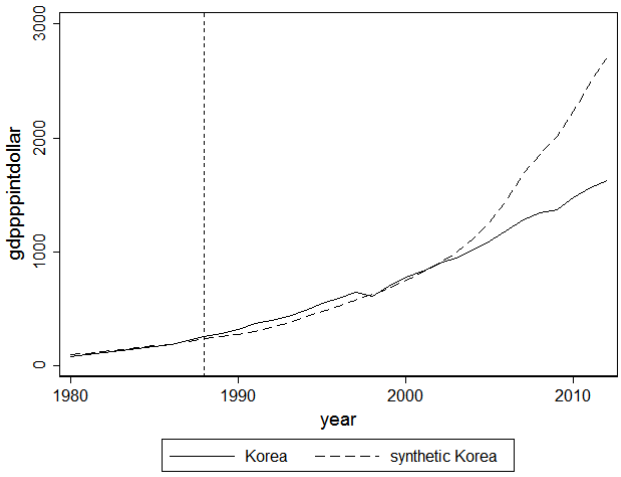

Figure 1: Korea 1988, treatment as hosting

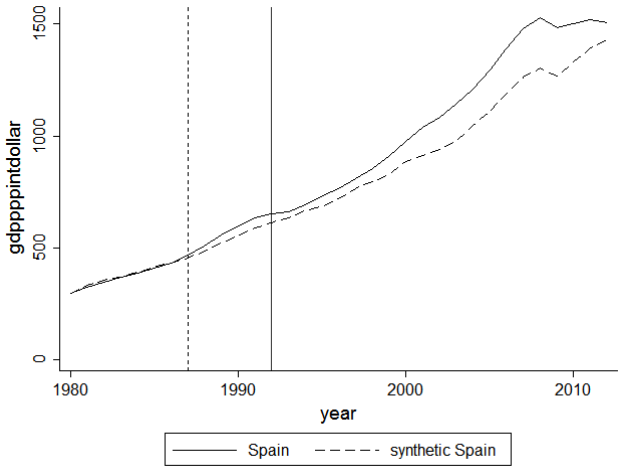

Figure 2: Spain 1992, 1987 as treatment

Table 1—Korea 1988

Variable	*Treated*	*Synthetic*
invest	5178	5086.928
governexpen	1650.688	2717.138
import	4781.337	3551.713
export	5066.069	3413.473
gdppppintdollar(1988)	254.558	240.2985
gdppppintdollar(1984)	151.029	156.9745
gdppppintdollar(1980)	83.261	98.64717
Country		*Weight*
Belgium		0.167
China		0.165
Finland		0.668
RMSPE		9.751854

Table 2—Spain 1992

Variable	*Treated*	*Synthetic*
invest	7846.677	8305.308
governexpen	5419.63	5979.706
import	6997.069	6860.362
export	6749.263	6845.401
gdppppintdollar(1986)	431.081	430.5425
gdppppintdollar(1983)	367.248	366.6681
gdppppintdollar(1980)	296.856	296.3475
Country		*Weight*
Belgium		0.059
Brazil		0.073
France		0.228
Greece		0.354
Mexico		0.179
Turkey		0.106
RMSPE		5.012726

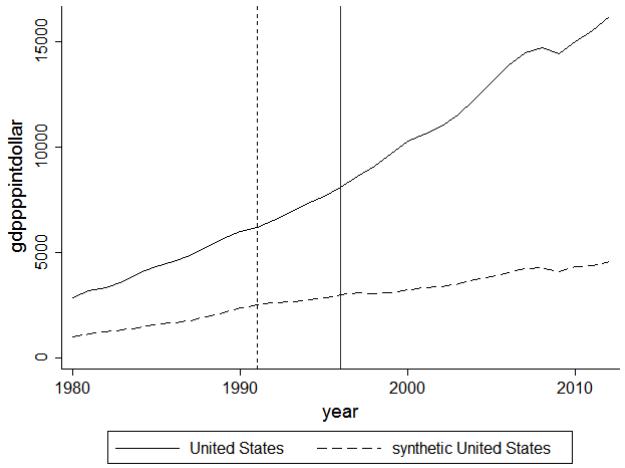

Figure 3: US 1996, 1991 as treatment

Table 3—US 1996

Variable	*Treated*	*Synthetic*
invest	100339.8	48089.07
governexpen	69020.3	22233.2
import	43655.22	16202.33
export	35795.59	19206.61
gdppppintdollar(1990)	5979.575	2359.452
gdppppintdollar(1985)	4346.75	1585.113
gdppppintdollar(1980)	2862.475	996.752
Country		*Weight*
Japan		1
RMSPE		2798.8

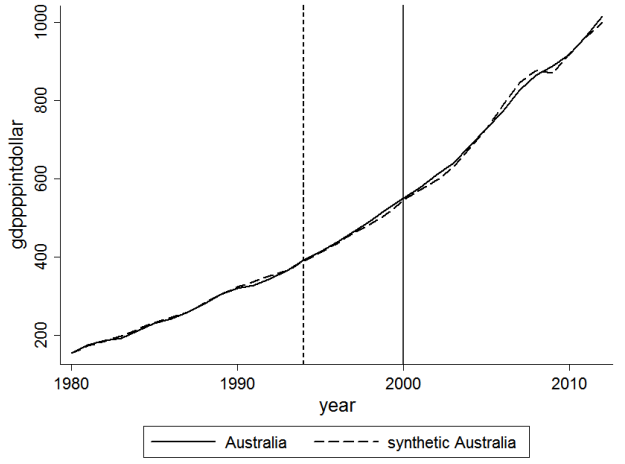

Figure 4: Australia 2000, 1994 as treatment

Table 4—Australia 2000

Variable	*Treated*	*Synthetic*
invest	6698.027	6684.245
governexpen	4681.869	4552.418
import	4334.382	4295.908
export	3991.842	4042.347
gdppppintdollar(1993)	367.256	367.2253
gdppppintdollar(1987)	260.545	260.3292
gdppppintdollar(1980)	154.49	154.5857
Country		*Weight*
China		0.019
Finland		0.36
Greece		0.269
Japan		0.029
Portugal		0.035
Sweden		0.268
United States		0.019
RMSPE		4.186038

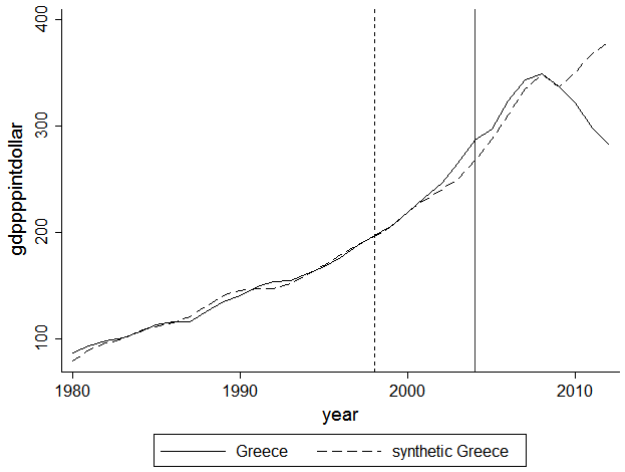

Figure 5: Greece 2004, 1998 as treatment

Table 5—Greece 2004		
Variable	*Treated*	*Synthetic*
invest	3175.92	3023.399
governexpen	2294.14	2448.157
import	3168.09	2960.262
export	2111.646	3182.024
gdppppintdollar(1997)	187.378	189.1682
gdppppintdollar(1989)	135.26	139.6003
gdppppintdollar(1980)	87.056	76.35327
Country		*Weight*
Austria		0.142
Brazil		0.033
Finland		0.741
South Africa		0.084
RMSPE		5.46987

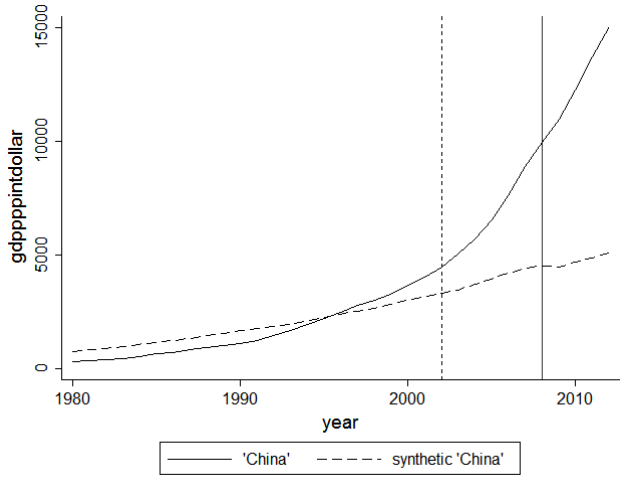

Figure 6: China 2008, 2002 as treatment

Table 6—China 2008		
Variable	*Treated*	*Synthetic*
invest	58770.22	44686.03
governexpen	23801.13	26646.06
import	25267.68	26033.65
export	27566.22	23636.32
gdppppintdollar(2001)	4054.848	3236.39
gdppppintdollar(1990)	1108.378	1714
gdppppintdollar(1980)	302.805	766.9476
Country		*Weight*
Korea		0.754
United States		0.246
RMSPE		482.5943

Winter

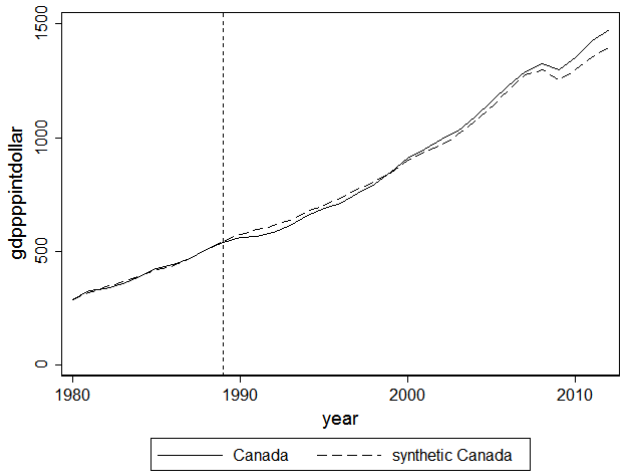

Figure 7: Canada 1988—treatment as hosting

Table 7—Canada 1988		
Variable	*Treated*	*Synthetic*
invest	8674.634	8960.398
governexpen	8545.502	7638.416
import	9680.985	9823.11
export	10460.48	10340.16
gdppppintdollar(1988)	508.124	508.0742
gdppppintdollar(1984)	390.928	390.4858
gdppppintdollar(1980)	287.254	287.6856
Country		*Weight*
France		0.018
Japan		0.025
Mexico		0.074
Netherlands		0.173
Sweden		0.381
United Kingdom		0.329
RMSPE		5.540081

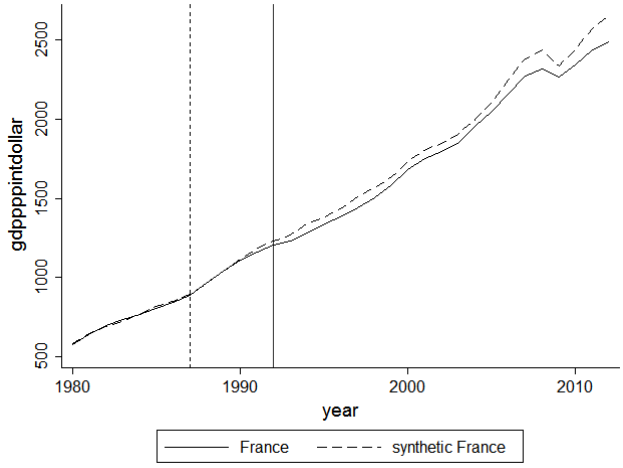

Figure 8: France 1992, 1987 as treatment

Table 8—France 1992		
Variable	*Treated*	*Synthetic*
invest	16256.24	17297.24
governexpen	15922.84	13424.82
import	16453.37	15678.2
export	15864.68	15606.71
gdppppintdollar(1986)	843.169	849.6061
gdppppintdollar(1983)	732.425	725.9433
gdppppintdollar(1980)	578.363	583.8468
Country		*Weight*
Germany		0.324
Mexico		0.287
United Kingdom		0.389
RMSPE		7.413902

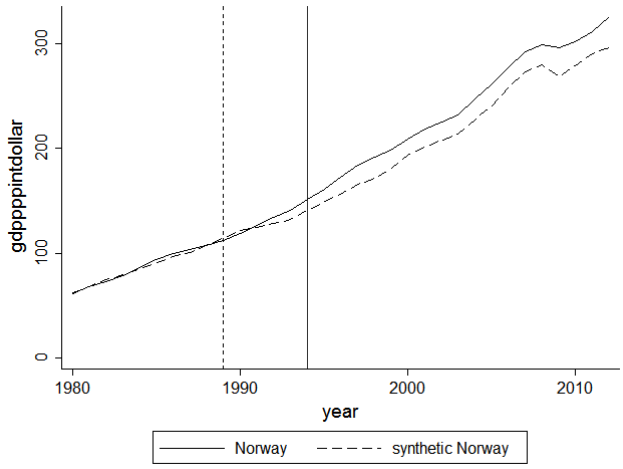

Figure 9: Norway 1994, 1989 as treatment

Table 9—Norway 1999		
Variable	*Treated*	*Synthetic*
invest	2501.135	2004.371
governexpen	1623.517	1807.891
import	2975.176	3060.935
export	3268.042	3124.943
gdppppintdollar(1988)	107.122	107.5506
gdppppintdollar(1984)	86.005	85.26665
gdppppintdollar(1980)	61.278	62.26702
Country		*Weight*
Belgium		0.094
Denmark		0.487
Finland		0.343
Korea		0.022
Switzerland		0.054
RMSPE		1.794856

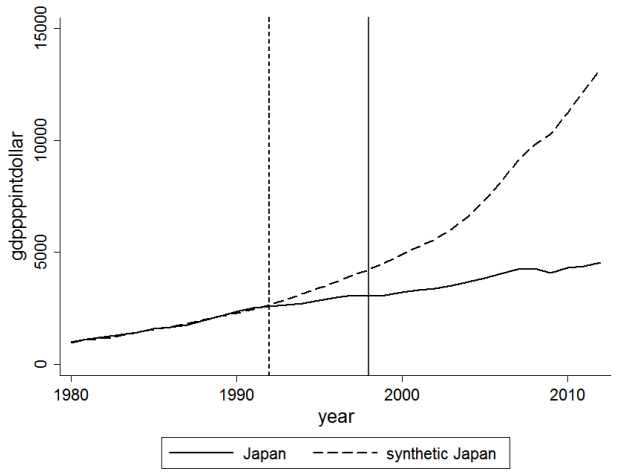

Figure 10: Japan 1998, 1992 as treatment

Table 10—Japan 1998		
Variable	*Treated*	*Synthetic*
invest	50852.18	44417.05
governexpen	23192.63	26800.31
import	16594.83	20517.9
export	19678.89	18222.49
gdppppintdollar(1991)	2519.032	2464.699
gdppppintdollar(1986)	1662.851	1691.734
gdppppintdollar(1980)	996.752	981.9476
Country		*Weight*
China		0.606
Germany		0.165
United States		0.229
RMSPE		39.89157

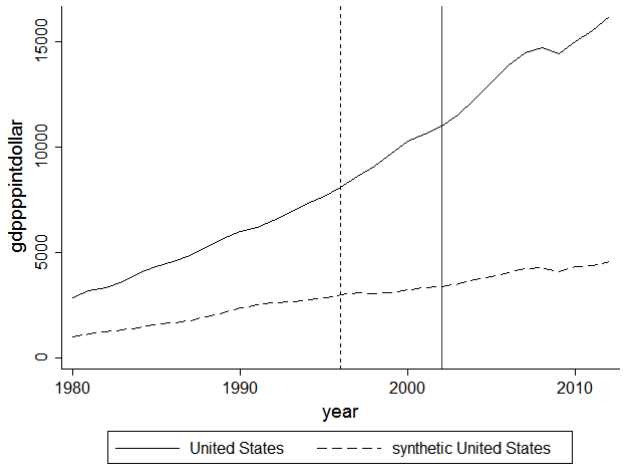

Figure 11: US 2002, 1996 as treatment

Table 11—US 2002		
Variable	*Treated*	*Synthetic*
invest	113496.9	57799.96
governexpen	81086.14	27245.54
import	53308.65	17406.84
export	45962.82	21012.82
gdppppintdollar(1995)	7664.05	2855.739
gdppppintdollar(1988)	5252.625	1968.801
gdppppintdollar(1980)	2862.475	996.752
Country		*Weight*
Japan		1
RMSPE		3323.996

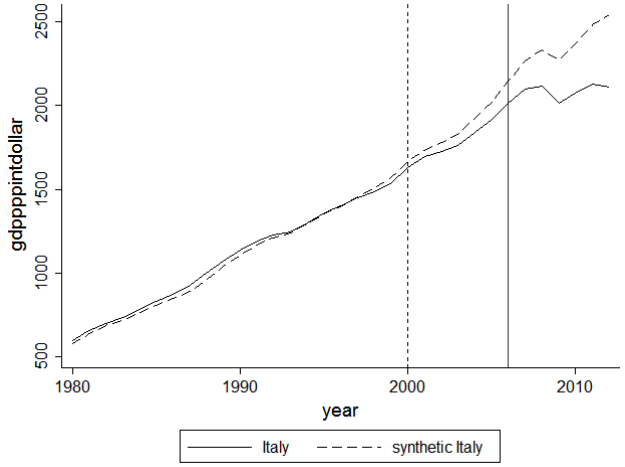

Figure 12: Italy 2006, 2000 as treatment

Table 12—Italy 2006		
Variable	*Treated*	*Synthetic*
invest	22869.81	23994.8
governexpen	19796.71	21752.98
import	21043.7	21372.33
export	22544.67	21917.25
gdppppintdollar(1999)	1534.937	1568.611
gdppppintdollar(1990)	1134.826	1109.029
gdppppintdollar(1980)	594.543	578.5068
Country		*Weight*
Brazil		0.093
France		0.599
Germany		0.154
Japan		0.029
South Africa		0.124
RMSPE		21.61972

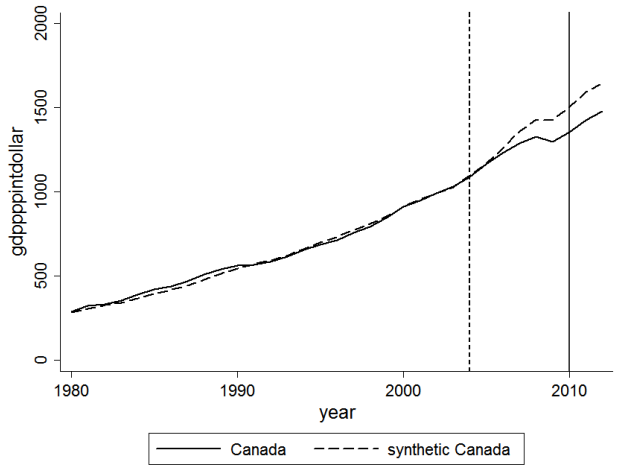

Figure 13: Canada 2010, 2004 as treatment

Table 13—Canada 2010

Variable	*Treated*	*Synthetic*
invest	12690.13	13359
governexpen	12974.39	11702.55
import	19156.39	19256.24
export	20705.09	20456.84
gdppppintdollar(2003)	1029.745	1027.137
gdppppintdollar(1991)	567.344	569.1243
gdppppintdollar(1980)	287.254	282.8009

Country	*Weight*
Brazil	0.122
China	0.014
Netherlands	0.649
South Africa	0.01
United Kingdom	0.205
RMSPE	14.1265

Investments

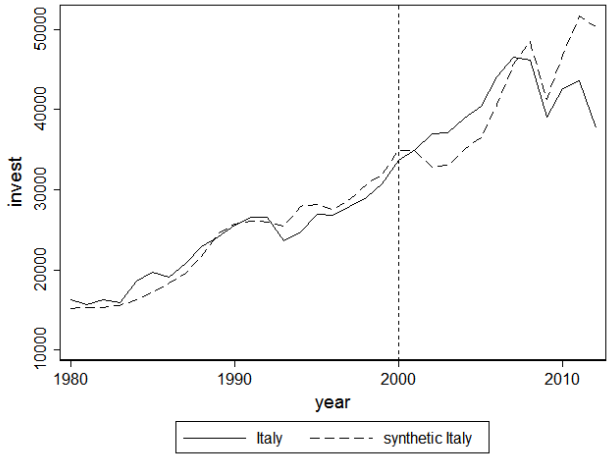

Figure 14: Italy 2006, 2000 as treatment

Table 14—Italy 2006		
Variable	*Treated*	*Synthetic*
gdppppintdollar	1075.017	995.2853
governexpen	19796.71	19449.8
import	21043.7	21341.87
export	22544.67	21745.93
invest(1999)	30706.41	31899.76
invest(1990)	25563.09	25749.32
invest(1980)	16323.18	15143.02
Country		*Weight*
Brazil		0.187
France		0.214
Germany		0.32
Netherlands		0.169
South Africa		0.109
RMSPE		1404.695

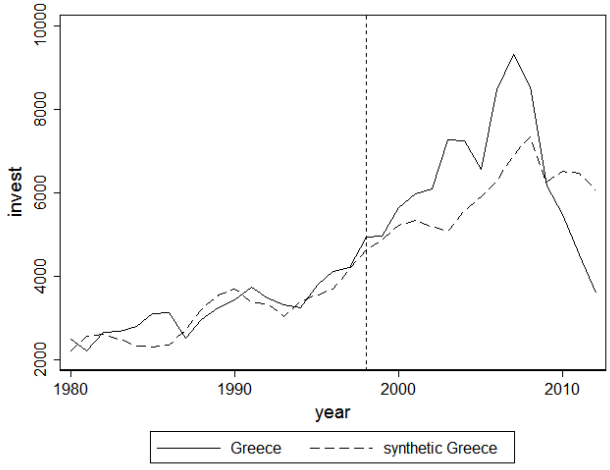

Figure 15: Greece 2004, 1998 as treatment

Table 15—Greece 2004		
Variable	*Treated*	*Synthetic*
gdppppintdollar	132.5141	120.9613
governexpen	2294.14	2123.785
import	3168.09	3362.154
export	2111.646	3112.855
invest(1997)	4204.95	4181.896
invest(1989)	3247.457	3555.527
invest(1980)	2493.98	2220.247
Country		*Weight*
Brazil		0.007
Finlandq		0.349
Portugal		0.518
South Africa		0.126
RMSPE		368.007

Exports

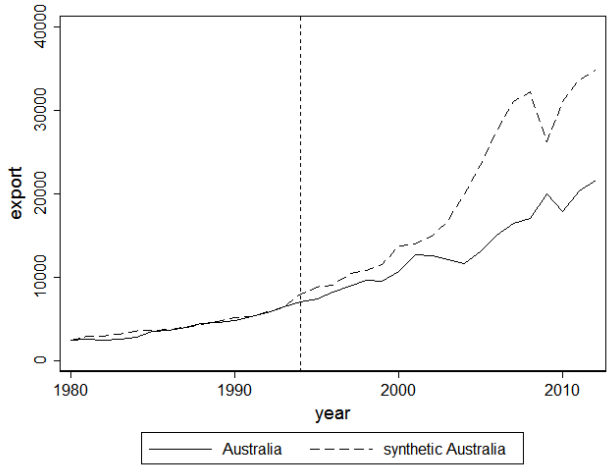

Figure 16: Australia 2000, 1994 as treatment

Table 16—Australia 2000		
Variable	*Treated*	*Synthetic*
invest	6698.027	6668.496
gdppppintdollar	257.6655	256.7701
governexpen	4681.869	4653.956
import	4334.382	4324.472
export(1993)	6445.311	6433.08
export(1987)	4036.203	4026.636
export(1980)	2541.151	2532.391
Country		*Weight*
China		0.05
Finland		0.625
France		0.019
Greece		0.051
Japan		0.007
Sweden		0.227
United States		0.021
RMSPE		314.6375

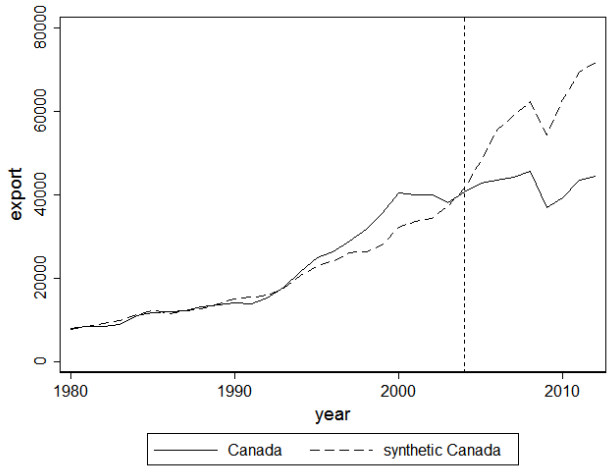

Figure 17: Canada 2010, 2004 as treatment

Table 17—Canada 2010		
Variable	*Treated*	*Synthetic*
invest	12690.13	16525.85
gdppppintdollar	614.0309	686.2384
governexpen	12974.39	12763.38
import	19156.39	18809.64
export(2003)	38121.04	37289.88
export(1991)	13854.57	15473.83
export(1980)	7936.641	7686.818
Country		*Weight*
China		0.062
Netherlands		0.212
South Africa		0.039
Spain		0.084
Sweden		0.237
United Kingdom		0.366
RMSPE		3201.479

Placebo graphs

Summer

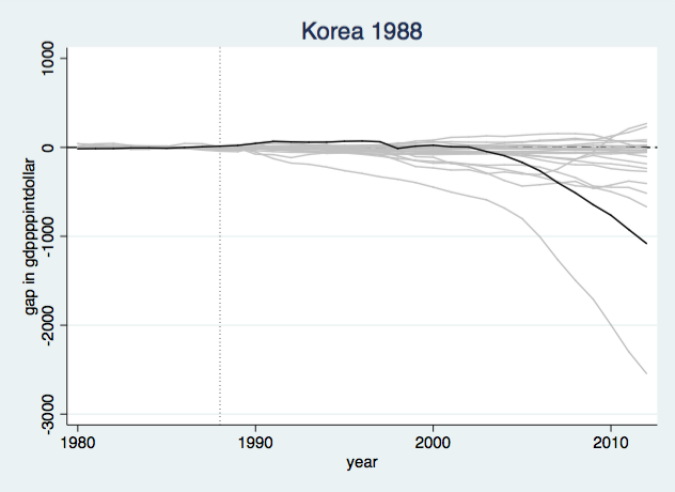

Figure 18

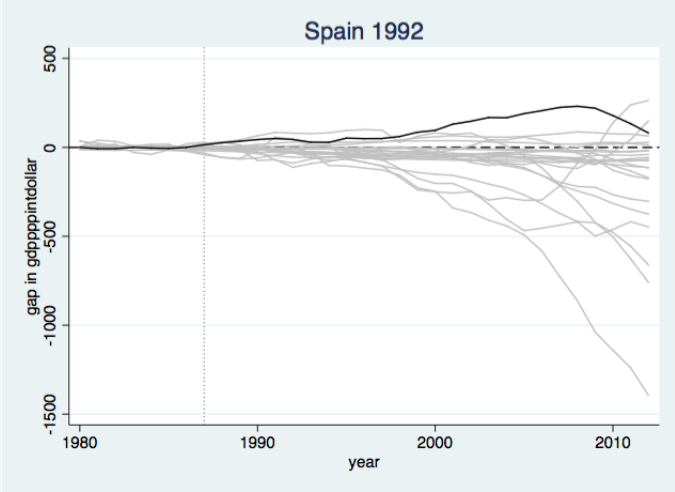

Figure 19

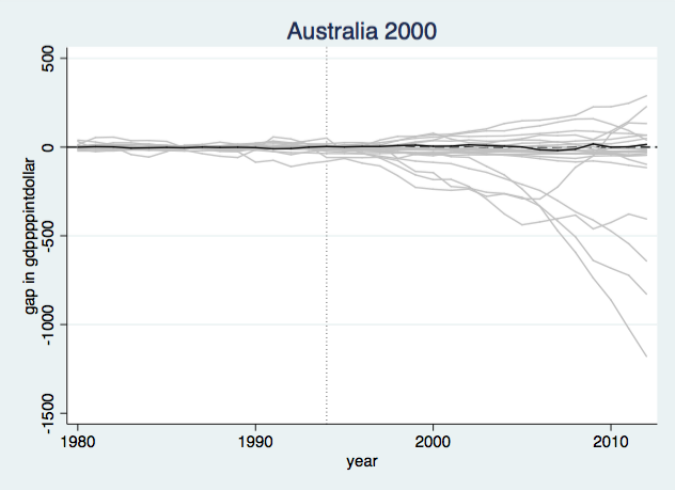

Figure 20

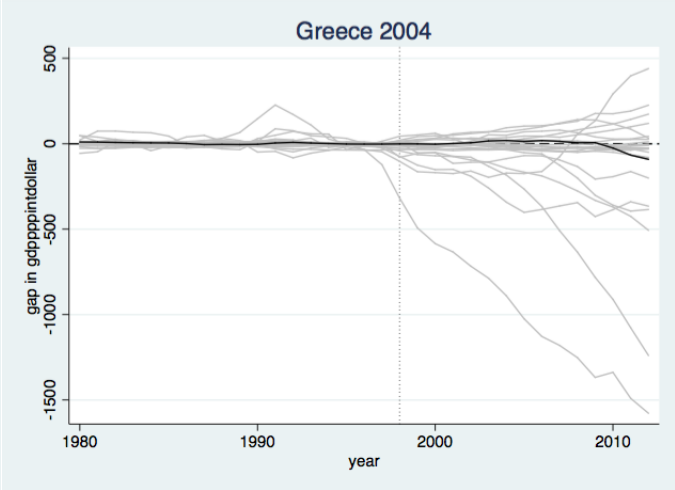

Figure 21

Winter

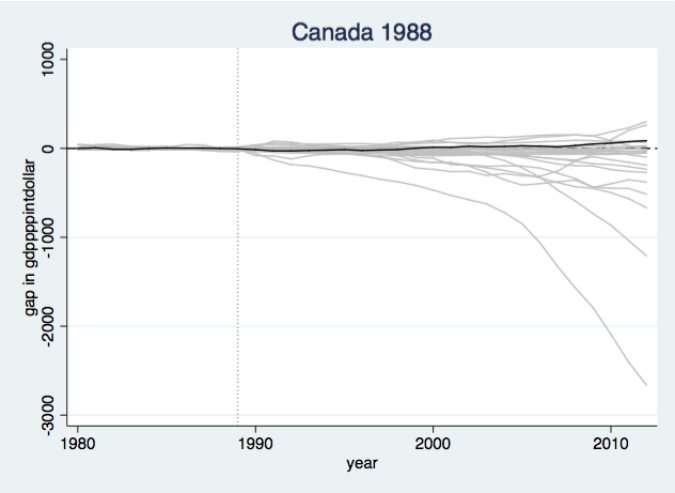

Figure 22

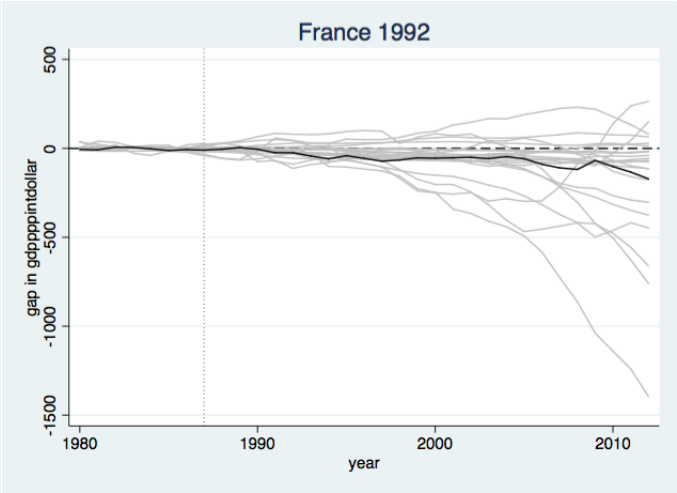

Figure 23

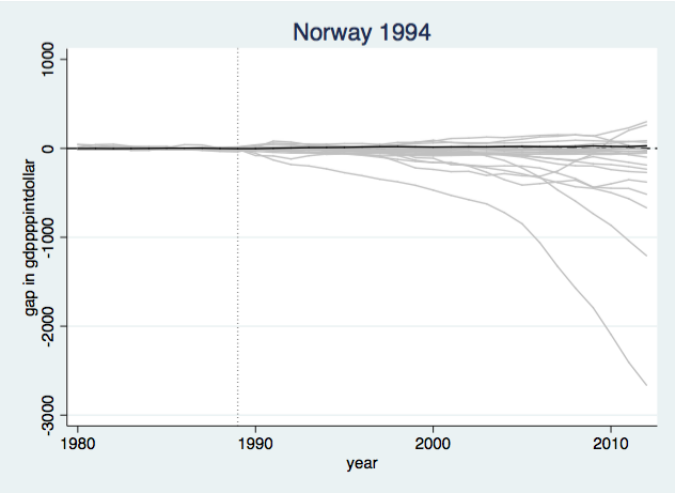

Figure 24

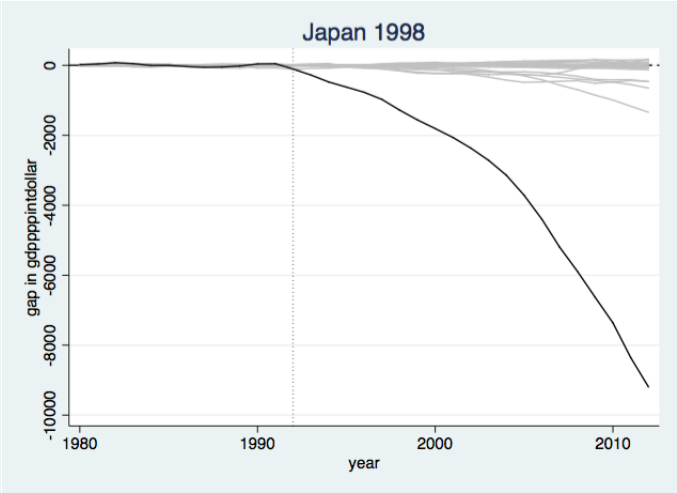

Figure 25

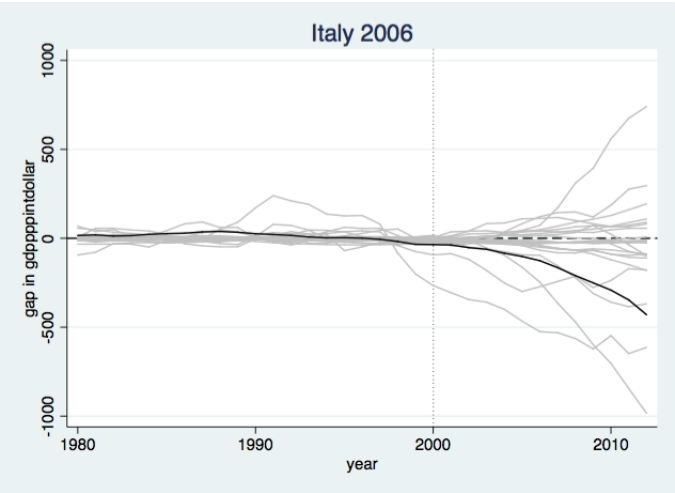

Figure 26

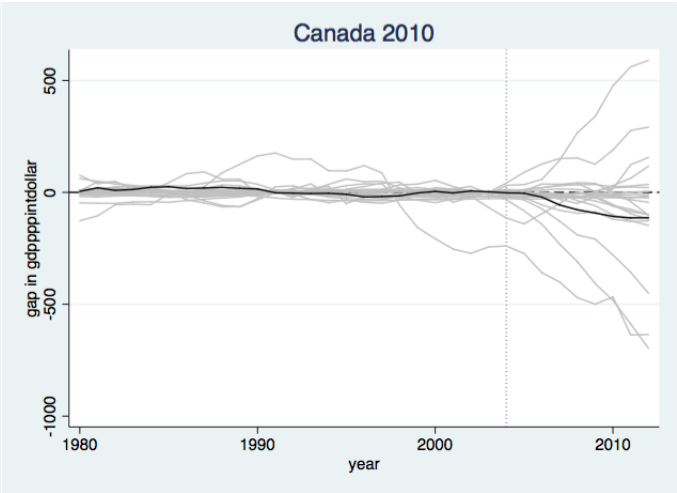

Figure 27

Table 18–Summer Games

OLY.	YEAR	CITY	COUNTRY	CANDIDATE CITIES	CANDIDATE COUNTRIES	ANNOUNCEMENT
XXIV.	1988	Seoul	Korea	Nagoya Melbourne withdrew	Japan	30 September 1981
XXV.	1992	Barcelona	Spain	Brisbane, Paris, Amsterdam, Belgrade, Birmingham, Amsterdam New Delhi withdrew	Australia, France, Yogoslavia, Great Britain, Netherlands	17 October 1986
XXVI.	1996	Atlanta	USA	Athens, Belgrade, Manchester, Melbourne, Toronto	Greece, Yogoslavia, Great Britain, Australia, Canada	18 September 1990
XXVII.	2000	Sydney	Australia	Beijing, Berlin, Istanbul, Manchester, Milan and Brasilia withdrew	China, Germany, Turkey, Great Britain	23 September 1993
XXVIII.	2004	Athens	Greece	Buenos Aires, Cape Town, Rome, Stockholm (five cities were eliminated prior to voting to reduce cost and time effort)	Argentina, South Africa, Italy, Sweden	5 September 1997
XXIX.	2008	Beijing	China	Istanbul, Paris, Toronto, Osaka (five cities were eliminated)	Turkey, France, Canada, Japan	13 July 2001
XXX.	2012	London	Great Britain	Paris, Madrid, New York City, Moscow	France, Spain, USA, Russia	6 July 2005

Table 19—Winter Games

OLY.	YEAR	CITY	COUNTRY	CANDIDATE CITIES	CANDIDATE COUNTRIES	ANNOUNCEMENT
15	1988	Calgary	Canada	Cortina d'Ampezzo, Falun	Italy, Sweden	30 September 1981
16	1992	Albertville	France	Anchorage, Berchtesgaden, Cortina d'Ampezzo, Falun, Lillehammer, Sofia	USA, Germany, Italy, Sweden, Norway, Bulgaria	17 October 1986
17	1994	Lillehammer	Norway	Anchorage, Oestersund, Sofia (Berchtesgaden &Lausanne withdrew)	USA, Sweden, Bulgaria	15 September 1988
18	1998	Nagano	Japan	Aoste, Jaca, Oestersund, Salt Lake City (Sochi withdrew)	France, Spain, Sweden, USA	15 June 1991
19	2002	Salt Lake City	USA	Oestersund, Quebec City, Sion (six other cities made preliminary bids but were eliminated to reduce costs)	Sweden, Canada, Switzerland	16 June 1995
20	2006	Turin	Italy	Sion (six other cities made preliminary bids but were eliminated)	Switzerland	19 June 1999
21	2010	Vancouver	Canada	Pyeongchang, Salzburg (Bern withdrew)	South-Korea, Austria	2 July 2003
22	2014	Sochi	Russia	Salzburg, Pyeongchang, (four other cities made preliminary bids but were eliminated)	Austria, South-Korea	4 July 2007