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ALL THAT GLITTERS IS NOT GOLD.
THE ECONOMIC IMPACT OF THE TURIN WINTER OLYMPICS

by Anna Laura Mancini[*] and Giulio Papini[°]

Abstract

This paper provides an *ex post* evaluation of the 2006 Turin Winter Olympic Games by means of a synthetic control approach on a number of potential outcomes for an event of such magnitude. We find a positive impact on tourism and on the ratio between prices in the centre and in the outskirts of the city. However, we also find a positive effect on municipal per capita debt. Other variables that are often advertised as being the main beneficiaries of staging an event such as the Olympics (value added per capita, employment rate, trade openness and the average level of house prices) show no significant improvement.

JEL Classification: Z20, R11.
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Contents

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1. Introduction

The conventional wisdom around the hosting of major sport events is that such endeavours are largely beneficial for the hosting city: they are supposed to bring employment, tourism, infrastructures and an economic legacy with long lasting benefits for the hosting area, more than compensating the costs of the necessary investments and running expenditures. Proponents of such events advertise mainly three benefits for the hosting area (Baade and Matheson, 2016). First a permanent increase in the availability and quality of the local infrastructure thanks to the large amount of public spending channelled by the event into the local area (a large part coming from the central government). Second, the increase in tourism flows for the duration of the event should lead to a temporary increase in the local demand for goods and services. This should also increase employment in the hosting area, even if a low skilled one for the most part, during both the preparation phase ad the event itself. Third, looking at a longer horizon, a mega event represents a unique opportunity to put a spotlight on the hosting area, promoting tourism as well as attracting investments, creating therefore a potential positive permanent effect on its economic system.

However, a part of the public opinion sees such events as a waste of public money, which could be more usefully redirect towards better uses. Both views offer plenty of anecdotal evidence in favour of their own claims, but robust evidence in favour or against mega events is seldom reported.

The economic literature has tried to assess the impact of these events using two different approaches, often leading to opposite results: *ex ante* evaluation studies frequently support the view of big events as a beneficial economic proposition for the hosting area (and sometimes even for the whole country) while *ex post* studies show mixed results, that range from slightly positive to no effects.

In this paper we use an *ex post* evaluation approach, the synthetic control method, to study the economic impact of the 2006 winter Olympics on the province of Turin, the hosting area. We consider several different outcomes related to the local economy, tourism, urban development and local public finance. The paper adds to the previous literature in mainly two ways. First it uses an estimation

methodology, that to our knowledge has almost never been used in this type of studies (the only exception being Bronzini et al., 2020) and never for a major sport event. We believe this methodology is well suited to the evaluation of the economic impact on a very specific geographical area for which it is difficult to select a proper control group. Second, it considers a large number of outcomes covering almost all the potential tangible benefits considered in previous studies (income, employment, tourism, trade openness, urban real estate) as well as one of the most important burdens (public financial debt) associated with the hosting of a mega-event. Since the different sporting events took place in a number of locations across the provincial territory, between the main city of Turin and the Susa and Chisone alpine valleys, we think that the choice of the province is the ideal unit of analysis.

The rest of the paper is organized as follow: section 2 sums up the existing literature, section 3 describes the event, section 4 presents the data and the empirical strategy, section 5 shows the results and section 6 discusses and concludes.

2. Literature

Both *ex ante* and *ex post* studies on the economic impact of major sports events on the host city or country exist. Generally, prospective studies always find positive effects in terms of employment, tourism, income or GDP, while retrospective studies almost unanimously reduce the magnitude of those positive findings to very small or non-existent.

Kavetos and Szymanski, 2010, and Baade and Matheson, 2016 summarize the short and long run benefits that the existing *ex post* literature associates to hosting the Olympic games. Among the short run effects they include the increase in economic activity in the run-up to the event (employment, in particular in the construction sector and in related businesses, and private expenditures). Among the long run ones[1] they mention the possible legacy related to sporting facilities, public investments in general purpose infrastructures, and the publicity coming from the media exposure during the event, that might affect both tourism and openness to international trade. They review also the main lines of criticism: the jobs created

[1] The recent literature concentrates also on the possible intangible effects of mega-events, like the "feel good" factor or an increase of citizens' happiness and civic pride (among others Atkinson *et al*., 2008, Walton *et al.* 2008, Süssmuth, *et al.* 2010), Kavetos and Szymanski, 2010 and Scandizzo and Pierleoni, 2018 for a review).

are usually of low quality and are likely to crowd out employment in other sectors; the increase in expenditures brought by the preparation and the actual staging of the event are likely to substitute for other types of expenditures that would have taken place in its absence; the maintenance of the frequently underused sports facilities is a considerable source of waste. Moreover, the possible employment and tourism related effects are meant to be local, while the public expenditure in infrastructures will likely require either a within-country redistribution of resources or an increase in public debt. Among the cons, it is worth citing also the risk for the host city of generating a high debt (for the share of public investments financed locally) and of facing an increase in the cost of living and rents (Scandizzo and Pierleoni, 2018).

Based on an overview of the existing *ex post* empirical studies, Baade and Matheson, 2016, conclude that hosting Olympics results in a net gain for the host area only under very specific and unusual circumstances: being attractive to tourists besides the event, but having been previously overlooked. Barcelona and Salt Lake City are two good examples for which the so called "put a city on the map" effect worked. Another important condition would be that the investments for the event (build of sports facilities, renewal of cultural structures and strength of the public transportation system) should be adequate for and useful to the hosting area also after the Games.

The relevant geographical dimension at which one expects to find an effect is a crucial aspect of evaluation studies. It is reasonable to believe that such events will have some kind of economic effect on the local hosting area, but it is more difficult to expect that the country as a whole will be affected. No matter how big the event, any positive impact will almost certainly be lost within the normal fluctuations that affect the national economy. Moreover, gains in the hosting area might be compensated by losses (in terms of tourism flows or public investments for example) to other parts of the country. No wonder, then, that *ex post* studies on country level data tend to find no significant economic effect[2]. When the analysis

[2] Billings and Holladay, 2012, looking at the long run effects of the summer Olympics from 1956 (Melbourne) to 2004 (Athens), find no significant impact on population, real GDP per capita and trade openness. Mitchell and Stewart, 2015, looking at the effects on tourism of three Football World Cup and five Olympic games, find no significant effects in all but one case (Seoul in 1988). The only exception are Brückner and Pappa, 2015, and Rose and Spiegel, 2011, that find a positive and significant effect in export, consumption, investment and output for bidding countries in the time between the initial bid and the actual event. Maenning and Richter, 2012, and Langer et al., 2018,

is restricted to the local area, results are mixed (see Table 1 for an overview). Studies looking at employment find either positive but small (Baade and Matheson, 2002, Hotchkiss et al., 2003, Feddersen and Maenning, 2013b) or no effect Feddersen and Maenning, 2013a, Jasmand and Maenning, 2008). Studies considering income or expenditures find a positive effect either on the hosting area (Baade et al., 2010 and Jasmand and Maenning, 2008) or on the neighbouring areas Leeds, 2008. One study looking at tourist inflows finds a positive effect (Bondonio and Guala, 2011).

Finally, the Olympics can be used by local governments to speed up the ordinary (long) process required to implement general infrastructures, to trigger urban redevelopment and to obtain from the national government additional resources needed for the investments (Maenning, 2017, Essex and Chalkley, 2004 and Essex and Chalkley, 1999). General infrastructures and urban redevelopment can clearly have long run positive effects on the hosting venue (see for an example of urban development not connected to the hosting of the Olympic games Budiakivska and Casolaro, 2018), but these effects could be related to the event itself only if it was a decisive factor in their realization. The construction of sport facilities could affect positively land values in their neighbourhood, but possible negative externalities (congestion and crowds mainly) should be addressed properly during the planning phase (Ahlfeldt and Maenning, 2009, Coates and Humphreys, 2008, and Tu, 2005).

3. The 2006 Winter Olympic Games

At the 1999 session of the International Olympic Committee Turin was awarded the right to host the 2006 Winter Olympics. The Games were part of a modernization strategy for the city in response to the decline of the traditional economic structure based mainly on the automotive industry (Essex and Chalkley, 2004).

The games were scattered around the Turin province. The opening and closing ceremonies, most of the medal ceremonies and the competitions on ice (hockey and skating) took place in the city, curling competition in Pinerolo, a

claim, however, that these findings suffer from selection bias and that, once properly taken into account, the Olympic effect disappears.

smaller town near Turin, while skiing, bob and skeleton took place in six different venues in the Susa and Chisone Valleys (see Figure 1). The games started on February 10th and ended on February 26th, featuring 84 competitions in 7 different sports and involving 2,500 athletes from 80 different nations. During the two weeks, around 20,000 volunteers and approximately 1.5 million people attended the events Bondonio and Campaniello, 2006. The running costs of the event were about 1.2 billion of euros, while the revenues coming from tickets, TV rights and licensing amounted to around 1 billion. The investments were nearly 2.1 billion euros, meaning that the overall estimated cost was 3.3 billion euros[3], two thirds of which were covered using local or national public resources.

The realisation of the planned investments mainly took place in the years 2004 and 2005 and concerned three lines of intervention: non-sporting facilities (Olympic villages, media centre and broadcasting centre), competition venues (ice arenas, bob and skeleton track, ski jumping hills, renewal of existing ski facilities), and road works (including the Torino- Bardonecchia highway, the Turin ring road and several local routes). A fourth class of intervention was devoted to public investments (called "connected public works") aimed at a general redevelopment and improvement of the "Olympic territories". It included the long awaited Turin subway (even if only the first branch), renewed sewer systems, aqueducts and sanitary systems (the spinal unit of the major Piedmont hospital, the strengthening of the helicopter rescue system and the anti-doping laboratories). Finally, to try to enlarge the benefits of the Olympics also to the non-hosting provinces, the Piedmont Region adopted a plan of "connected public works" for the whole regional area (Art. 21 of the Regional Law 166/02), partly financed by the central government within the Olympic context. Of the estimated 2.1 billion euros, approximately one third was dedicated to road works and one half to competition venues and building infrastructures Ramella, 2006. Three quarter of the financial resources needed for the investments came from the national government or from national agencies , eighteen per cent from local administrations (Piedmont Region and the city of Turin for the most part) and the remaining part from private investors Preuss and Weitzman, 2019. The investments made for the Olympic were

[3] Equal to 4.2 billions of dollars in 2006 (5.3 billions of dollars in 2018). According to Baade and Matheson, 2016 it is the second cheapest winter Olympiad from 1998 to 2014.

substantial at the local level: they were equal to the 10 per cent of the total regional investments in 1999 (the year of the bid, slightly more than 2 per cent of the regional GDP). The infrastructures endowment of the Turin province, measured by the index computed by Istituto Tagliacarne, increased substantially after the Olympics in terms of both road and railways as well as of general socio-economic infrastructures (Figure 2).

Looking at tourism, in 2006 both the arrivals and the number of nights spent by visitors increased substantially (Figure 3: touristic stylized facts, left panel). The number of nights increased with respect to 1999 by 83 per cent and kept increasing until 2011. The number of arrivals increased by 66 per cent. The supply of accommodations for tourists rose too, even if by a smaller amount, by 13 per cent (Figure 3: touristic stylized facts, right panel) and kept increasing in the years after the event. The quality of accommodation supply also improved: the incidence of the number of beds in hotels with 4 stars and above increased from 22% in 2002 (first available year) to 25% in 2006 (see also Bondonio and Guala, 2011). These data suggest that more tourists came to Turin for and after the Olympics and that they tended to stay longer.

Finally, the construction works needed to build the new infrastructures and to renew the existing ones as well as the organisational work could have led to an increase in employment. In the hosting area employment increased steadily from 1999 to 2008, both in terms of employed individuals and of employment rate (Figure 4: employment statistics). After 2008 both employment and employment rate declined but that could be easily attributed to the financial crisis that hit economic activity in Italy in the autumn of 2008.

On paper, Turin 2006 had all the right characteristics to be a successful story. Before the Olympics Turin had the reputation of a "one company town", like an Italian Detroit. However the city and the surrounding areas have a high tourist potential: ski resorts in the Alpine valleys, museums (the Egyptian museum being the most known), historical palaces (the network of *Residenze Sabaude,* that entails also the *Reggia di Venaria* a world heritage site of UNESCO since 1997). The surrounding hills (Langhe, Roero and Monferrato) have recently become a world heritage site of UNESCO too. Food and, especially, wine add to this touristic potential. The 2006 Olympics certainly helped putting Turin on the map by

changing drastically its international image. Moreover, a consistent part of the investments made for the Olympic were highly needed, confirming that idea the Games worked as a powerful push factor for the Turin area. The management of some of the sports venues, though, proved highly problematic after the Olympic Games: the bob and skeleton track and the ski jumping facilities for example were dismissed after a decade. Many of them however have been integrated in the territory, like the Olympic stadium that now hosts home games of Torino Football Club, the second team of the city.

4. Empirical strategy

Ideally, we would like to compare the economic outcomes of the Turin province with those of a selected group of unaffected provinces. However, two main issues emerge. First, we have only one treated unit, a situation in which the standard counterfactual models such as the difference-in-difference approach does not perform well (asymptotic assumptions do not hold) because of the very small number of treated units Conley and Taber, 2011. Second it can be difficult to find suitable candidates for the control group, because the hosting area might have a peculiar set of characteristics (in terms of existing infrastructure, size and geographical location for example) hard to mirror.

To overcome these problems, we decide to use the synthetic control methodology proposed by Abadie and Gardeazabal, 2003, Abadie et al., 2010, and Abadie et al., 2015. We then compare the evolution of the Turin province with that of a fictional Turin province in which the Olympic Games did not take place. This imaginary province, the "synthetic Turin", is constructed as an average of other Italian provinces weighted in a way to resemble as much as possible the characteristics of the treated province in the period before the Olympics. The idea beyond that method is that, when the number of non treated units is small, a combination of those units does a better job at reproducing the characteristics of the treated unit than picking any single unit alone. The weights associated to each unit are chosen to minimize a penalty function that depends on the pre-intervention path of the outcome variable and of some predictors. The difference in the dependent variable in the post treatment between the real province and the synthetic province is the measure of the treatment effect.

Following Abadie et al., 2015, let us consider a sample of J+1 provinces in which the first one is our treated unit (Turin). Let T be the total time for which we observe our units, divided between a pre-event period T^0 and a post-event period T^1. Let y^O and y^{NO} respectively be the outcome in the presence or in the absence of the event. We assume that no effect on our variables of interest is in place in the time period prior to the Olympics, i.e. $y_{jt}^O = y_{jt}^{NO}$ if $t \in T^0$ for all J+1 provinces. The effect of the Olympics is given by the difference after the event between the observed outcome in the Turin province (y_{1t}^O for $t \in T^1$) and the outcome we would have observed in the same province in the absence of the event (y_{1t}^{NO} for $t \in T^1$). The counterfactual situation in the post-event period is, however, not observable. Abadie et al., 2010 suggest to use in its place the outcome of the "synthetic province" $y_{st}^{NO} = \sum_{j=2}^{J+1} w_j^* y_{jt}^{NO}$ for $t \in T^1$, where $y_{st}^{NO}$is the outcome of the synthetic province after the treatment and $w_j^*$are the weights that minimize the distance between the pre-event characteristics (using a two-step procedure that first minimize the distance between the pre treatment X's then between the pre treatment Y) of the treated unit and the synthetic control. The estimated effect of the Olympic Games is then $\alpha_t = y_{1t}^O - \sum_{j=2}^{J+1} w_j^* y_{jt}^{NO}$ for $t \in T^1$.

To determine the statistical significance of the estimated effect the authors suggest to run placebo tests. The model is to be estimated on each unit in the donor pool as if it was treated, excluding the actual real treated unit from the sample. In this way it is possible to obtain a distribution of placebo effects. If this distribution contains many effects as large as or bigger than the main estimate, then the estimated effect is deemed not significant. If, however, the estimated effect is bigger than the most part of the placebo tests, it is considered significant. If the synthetic unit fails to mimic properly the real unit in the pre-treatment period, any difference in the post- treatment period could be related to the poor fitting instead of a true effect. This holds for the placebo estimations too. Placebo runs with poor pre-treatment fitting property do not help in determining the significance of the main estimate. For this reason, Abadie et al., 2010 suggest to exclude them from the placebo tests. Finally, another way to assess the significance of the main estimates is to look at the ratio between post- and pre-treatment mean squared prediction error (the average on the post- and pre-treatment periods of the squared differences between the observed outcome and its synthetic counterpart). A large gap in the

outcome after the event does not suggest a significant impact if the gap was large also prior to the event, i.e. if the synthetic control does not closely reproduce the outcome of interest prior to the event. A small ratio suggest therefore that the estimate is not statistically significant.

The synthetic control method has some advantages with respect to more traditional techniques: the control group is chosen using a transparent data-driven approach and only units that are alike in both observed and unobserved determinants of the outcome variable are chosen.

This method has become increasingly popular in those situations in which it is hard to construct a suitable sample of non-treated units (for some recent applications in urban economics and regional economics see Barone and Mocetti, 2014, Budiakivska and Casolaro, 2018, Podestà, 2017). To our knowledge it has been used only once in the attempt to estimate the effects of a "big event" (although of a different nature, the Great Jubilee 2000 in Rome, Bronzini et al., 2020).

5. Data

In order to investigate the array of outcomes we are interested in, we use a number of dependent variables from a variety of sources: value added per capita[4], employment rate, a measure of trade openness (the sum of exports and imports over value added) and tourism flows from Istat; municipal debt from *Certificati di Conto Consuntivo*; house prices in provincial capitals, overall and separately for the city centres and the outskirts, from *Consulente Immobiliare*. For each outcome we also employ a set of explanatory variables such as sectoral and export shares (from Istat), the number of Unesco world heritage sites (from Unesco), geographical features (such as the size of the province and its share of mountainous or coastal surface), the share of graduates in the population (from the Census), population density (from Istat), a measure of institutional quality (developed in Nifo and Vecchione, 2014), and an index of the quality of infrastructure by Istituto Tagliacarne.

All dependent variables, except for the two concerning the housing market that concerns only the city of Turin, are computed at the provincial level (NUTS 3

[4] At the provincial level value added is only available at current prices, we deflate such figures with the national GDP deflator.

level of the European classification of territorial units) on a yearly base. For economic activity, employment, the housing market and municipal financial debt we set 2004 as the year in which the event took place, to include the effect of the construction phase period. For trade openness and tourism, we use 2006 as the year in which the event took place, to evaluate the impact of the increased popularity of the area both as a destination for tourists and source of goods. Due to data limitation, our period of analysis starts in 1995 (1998 for municipal debt and tourism). We decided to focus our attention on the short run, in which the possible effects on our different outcomes should be stronger, and to avoid the possible distortion related to the 2011 financial crisis, that hit the country asymmetrical. For that reason our period of interest end in 2011 (2010 for house prices due to data limitation). For each variable we use a different set of characteristics as predictors for the pre-intervention period, to improve as much as possible the fitting in the years before the Olympics. As in many other studies based on the synthetic control method, we add some lagged values of the dependent variable in the set of predictors, but following the suggestion of Kaul et al., 2015, we decided to include the minimum number of lags (3) needed to ensure a reasonably good fit[5].

A key assumption for the results of the synthetic control to be meaningful is that, in the absence of the treatment, the real Turin and the synthetic Turin would be characterized by similar dynamics. To ensure this common dynamic assumption, from the donors pool we exclude fourteen Italian provinces (Perugia, Campobasso, Brescia, L'Aquila, Ferrara, Modena, Salerno, Crotone, Catanzaro, Taranto, Padova, Vicenza, La Spezia and Genova) in which natural disasters (earthquakes or floods) took place during our observational period , that could potentially have altered their economic systems. We also exclude the other seven Piedmont provinces (Asti, Alessandria, Novara, Vercelli, Verbano Cusio Ossola, Biella, Cuneo) that benefited from the regional connected work program whose financing was connected with the Olympic games.

[5] We repeat our analysis using all the available pre intervention existing lags, as many recent studies do to maximize *ex ante* fit, and the results are qualitatively unchanged.

6. Results

We focus on five different outcomes in order to evaluate the possible impact of the Olympics highlighted by the existing literature (economic activity, trade openness, employment, tourism, and housing market) and we add a sixth dimension that considers the burden faced by local administrations in financing the investments connected to the event. For each measure, we use a unique set of predictors (described below) to try to capture its peculiarity.

In order to evaluate the significance of the divergence between the two paths we run "placebo" experiments in which we substitute each province at a time for Turin and plot the differences between the falsely treated units and their synthetic controls. A failure of the path emerging from the estimation involving Turin as the treated unit to be close to the upper or lower extreme of the plot is interpreted as lack of effect. Furthermore, we evaluate for each outcome the ratio between the post and pre event root mean squared prediction errors for Turin and the other provinces acting as placebos. A high ratio for the treated unit relative to the placebos will also indicate the existence of a significant effect.

To assess the robustness of our results we provide a battery of alternative specifications. We estimate in-time placebo tests, in which we check whether our results depend on the year in which we place the event. To test the sensitivity of our results to one particular province, we repeat our estimation excluding from the donor pool the province that obtained the highest weight in the weighting matrix of the main estimation. We also estimate the synthetic control including all lags of the outcome variable in the pre-treatment period as controls, to maximize the pre-event fits. Finally, we also report estimates including the 21 provinces originally excluded from the donor pool to ensure the common dynamic assumption, to test whether their exclusion was pivotal in obtaining our results.

For every outcome of interest, we report three sets of figures. The first panel shows the time path of the variable in the province of Turin and the one in the counterfactual province resulting from four different specifications: main scenario, all provinces included in the donor pool, main scenario with the exclusion of the main donor, and all lagged values of the dependent variable used to improve the pre-treatment fit. The second panel reports the placebo tests for all previous

specifications and of an additional one in which we excluded the placebo units fitting poorly in the period prior to the event. It also includes the pre/post RMSE plot. The third panel displays two estimations using an alternative time for the event, to check if our results capture dynamics of the outcome in the treated province taking place independently of the event itself.

Table 2 reports the weights attributed to each province entering the synthetic Turin for every outcome in the analysis, Table 3 the time averages of the dependent variables before and after the event for the province of Turin, the synthetic control and the entire sample, and Table 4 the predictors balance between the synthetic and the actual province for each dependent variable.

6.1. Per capita value added

To evaluate the effects on economic activity we consider the per capita value added of the non-industrial sector (from the official figures provided by the National Institute of Statistics, *Istat*). In the donor pool, we have 81 provinces[6]. We do not include the industrial sector for two main reasons: we focus on the sectors most likely to be affected by a mega event, and we want to limit as much as possible the confounding influence of the automotive industry. This sector went through a deep crisis that started in the mid '90s and went on at least until the mid '00s that affected significantly the economy of the province, given that it is the most important industrial sector in the Turin province. As predictors we use: the share of population with a university degree, the share of population with a high school degree, the value added shares of agriculture, services and construction in non-industrial sectors, the employment rate, the export share, the Institutional Quality Index computed by Nifo and Vecchione, 2014[7] and the socio-economic infrastructural endowment index developed by Istituto Tagliacarne. The synthetic province is able to replicate quite well all predictors with the exception of the endowment index and of the population density that are higher compared to the actual Turin.

[6] The data for the value added in the '90s are available not for the actual 110 provinces but for the original 95.

[7] The regulatory quality index is part of the composite Institutional Quality Index, inspired to the World Governance Indicator proposed by Kaufmann et al., 2010, that the authors constructed for the Italian provinces. It should capture the ability of the government to promote and formulate effective regulatory interventions.

The resulting synthetic Turin is the average of 8 provinces, 5 of which are regional capitals and 4 belong to northern Italy. The provinces of Firenze and of Como carry almost half of the weight of the synthetic control. Figure 5. panel a shows a mildly positive impact in the first two years (2005 and 2006) after the start of the construction phase, albeit of little significance as shown by the placebos and RMSPE ratios (Figure 5, panel b). This result is robust to all the alternative specifications and to the time test in which we set the time of the event in 2006, the actual Olympic year.

Repeating the exercise including the manufacturing sector would have led to the conclusion of a modestly significant negative effect of the Games on economic activity, although hard to disentangle from the crisis that hit the local automotive industry in the same years (Figure 14: robustness checks panel b). The result is not driven by a relative increase of the population in the Turin province, which fared worse than its synthetic control in the period following the Olympics (Figure 14: robustness checks panel a).

6.2. Trade openness

For our analysis on trade openness, our dependent variable is an index equal to the ratio between the sum of exports and imports at the numerator and the total value added at the denominator (all from *Istat*). As predictors we use the same set of variables included in the analysis of the per capita value added, using the sectoral shares in the whole economy instead of those in non-industrial sector only. The predictors balance is similar to value added exercise.

The resulting synthetic Turin is quite different from the previous exercise, and it is constructed using 5 provinces, only two 2 of which are regional capitals, all in northern Italy. Despite the international relevance of the event, the province of Turin does not seem to have gained in trade openness (Figure 6), although it started from an already high level of exposure to international trade in comparison with the rest of the Italian provinces. Our synthetic province, however, poorly fits the actual province in the pre-treatment period. In the all lags specification, the one that obtain the best pre-treatment fits, the effect seems to be even negative although statistically non-significant. As stated for the value added, the crisis that hit the automotive industry might drive our results, given that it was not possible to

construct an index for the non-industrial sector only and that the automotive industry is the main exporting sector of the province.

6.3. Labour market

For the labour market exercise, we use as dependent variable the employment rate (*Istat*). We include among the predictors the share of population with a university degree, the share of population with a high school degree, the population density, the sectoral shares of value added, the export share, the Institutional Quality Index and the socio-economic infrastructural endowment. The synthetic province replicates the treated unit well with the exception of the endowment index that is substantially higher.

The resulting synthetic Turin is again the average of 8 provinces, different from the previous ones, 4 of which are regional capitals. The provinces of Milano, Firenze and Varese carry almost 60 per cent of the weight of the synthetic control. No significant impact of the Olympic Games emerges from the analysis (Figure 7). In the all lags specification, a small negative effect seems to emerge, although not statistically different from zero, but again it could be related to the automotive sector long crisis.

As in the case of the per capita value added, the result is not driven by a relative increase of the population in the Turin province (Figure 14: robustness checks panel b).

6.4. Tourism

To study the "Put the city into the map" effect, we use both the number of tourist arrivals and the number of nights spent in the province[8]. As predictors we consider the number of sites included by the UNESCO in the Wold Heritage Sites list, the number of parks and cultural institutions (to capture the potential appeal of the county), the number of per capita beds in touristic accommodations, the coastal surface and the mountainous areas (that generally speaking tend to be more touristy). We choose to place the event one year before the actual staging of the games in order to account for possible anticipatory effects (for which newspapers at the time reported extensive anecdotal evidence). The number of per capita bed

[8] Due to their volatility the outcome variables have been smoothed using a Hodrick Prescott filter.

and the lagged dependent variable are well balanced in the synthetic control, the other regressors show instead a non negligible difference with the treated province. Nevertheless, the pre-treatment fit seems reasonably good for both measures, although the RSMPE ratio is not among the highest.

The synthetic Turin is based on a smaller number of provinces: 4 for the arrivals and 3 for the number of nights. Vibo Valentia (in Calabria) represents almost 60 per cent of the weight of the synthetic control in the case of nights, while Trapani (in Sicily) almost half of the weight in the case of arrivals.

As for the impact on the tourist attractiveness of the province, our exercise confirms the conventional wisdom maintaining that Turin has seen a sustained increase in the number of tourist arrivals and nights (Figure 8 and Figure 9) thanks to the increased visibility granted by the worldwide publicity received by the city and its surrounding mountains. The number of tourists of the actual province is higher than that of the synthetic one from 2005 onwards and according to the placebos is statistically significant. This effect is present in all alternative specifications we used. The Olympics brought to Turin a yearly average increase of almost 116 thousand tourists from 2005 onwards (9 per cent of arrivals in 2004). Our result is in line with Bondonio and Guala, 2011 that find a positive effect of the Winter Games event on tourism in the city of Turin for the period 2004-2009.

The effect on the number of nights spent in the area is even larger than that on the number of tourist and again, according to placebos, statistically different from zero. The games increased on average every year the number of nights spent in the Turin province by almost 700 thousand (17 per cent of the nights recorded in 2004).

As for the time placebos setting the event in 2002 (Figure 8c and Figure 9c), the magnitude of the positive effect might be due to the combination of the insufficient length of the pre-event period and the type of filtering of the data.

6.5. Local public finances

In order to evaluate the burden on local public finances, we sum the per capita financial debt owed by all the municipalities within the province (from their yearly financial statements, *Certificati di Conto Consuntivo*). As predictors we include the province overall size (square kilometre), the mountainous surface of the province

and the socio-economic infrastructural endowment index. The synthetic Turin is based on 3 provinces only and more than 60 per cent of the weight of the synthetic control is associated to Milano. The lagged dependent variable are well balanced in the synthetic control. The pre-treatment fit seems reasonably good for both measures, as confirmed also by a high RSMPE ratio.

The analysis shows a positive impact, although undesired, on the level of financial debt per capita of the municipalities belonging to the province of Turin, which underwent a sizeable increase in the years leading up to the event and only stabilized in 2010 at a value that is 300 euros per capita higher than the counterfactual (Figure 10: municipal debt). This effect is present and statistically significant in all our alternative specifications.

6.6. Housing market

Last, we study the potential impact on the local housing market in the city of Turin, both on the average price per square metre and on the ratio between prices in the centre and in the outskirts. To do this we employ data on Italian provincial capitals taken from *Il Consulente Immobiliare*. The predictors we use in this exercise are the share of graduates, the share of high school diplomats, the employment rate, the population density, the mountainous surface of the province, the per capita value added and the socio-economic infrastructural endowment index. The synthetic province is well balanced in terms of all predictors for both measures. The synthetic Turin for the average price is based on 4 provinces and almost half of the weight is associated to Reggio Emilia. The synthetic control for the gradient variable is instead an average of 8 different provinces with the weight mostly concentrated on two northern cities (Cremona and Treviso) and on a central one (Firenze).

In the housing market we find a weak evidence of an initial fall in average house prices in Turin, perhaps due to the dislocation caused by construction works within the city, followed by a catch up starting from 2008 (Figure 11). The average price per square metre fell over the 2005-10 period by 282 euros. According to the placebos, the effect is significant although the RSMPE ratio is not very high. The same conclusions emerge also from all our alternative specifications.

We cannot rule out the possibility that the negative impact on prices is related to the population decline (Figure 14 panel a) that might have led to a decrease in the demand for houses. The improvements in infrastructures related to the Games might have made the peripheral areas relatively more attractive and therefore partially offset the negative pressure on prices. We construct synthetic central, semi central and outskirts prices using the weights of the average price analysis and, alternatively, of the gradient analysis. In both cases, the negative performance of our measures is driven by the central areas while no effect emerges for the peripheral ones (Figure 13).

As far as the difference between prices in the centre and in the outskirts is concerned, it appears to be significantly lower in the treated unit with respect to the synthetic one (Figure 12). This result appears to be statistically different from zero with also a very high RMSPE ratio. The pre-treatment fit is not very high with the exception of the all lags specification, in which our effect is still present and sizable.

7. Conclusions and discussion

This paper provides an *ex post* evaluation of the 2006 Turin Winter Olympic Games by means of a synthetic control approach on a number of potential outcomes that an event of such magnitude might have affected.

We find a positive impact on tourism flows, municipal debt per capita and the price of houses in the outskirts of the city relative to the ones in the centre. Other variables that are often advertised as the main beneficiaries of the staging of an event such as the Olympics such as value added per capita, employment rate, trade openness and the overall level of house prices show no significant increase.

Despite a novel approach in the estimation of the impact of the Olympic Games, the modest contribution to economic activity and the legacy of indebtedness we find is in line with the cautionary tales reported in the work of Baade and Matheson (2016).

It should be noted that after mounting criticism on the supposed wastefulness involved in the organization of the Olympic Games the IOC has developed a sustainability strategy, which guides the awarding of future events. Among other things, this emphasizes the use of existing infrastructure and of temporary venues

in order to lower the organizational costs and the guarantee that new sports and transport facilities will be useful for the hosting venues also after the Olympics. Twenty years after Turin 2006, the Olympic winter games will be held again in Italy. The main claim of the project that won the 2026 Winter Olympics, presented by Milano and Cortina d'Ampezzo (an alpine resort in northeastern Italy), is its environmental, financial and social sustainability. The project is based on an extensive use of existing sports facilities (90 per cent) and on a distribution of the competitions on a high number of places to avoid concentrations and to benefit a larger area.

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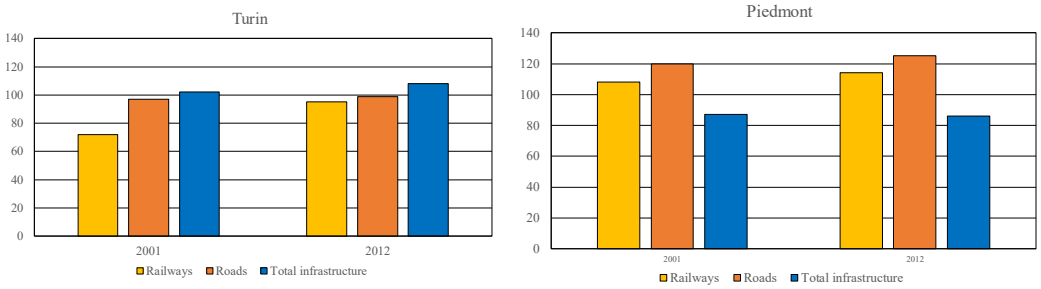
FIGURES AND TABLES

Figure 1: the Olympic venues

Turin province

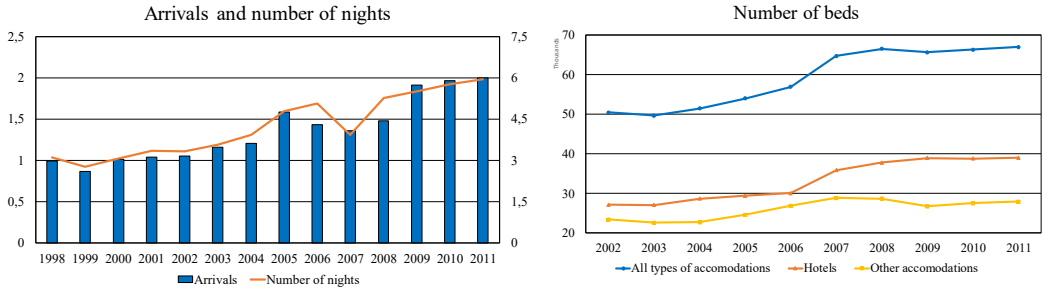
Competition venues of the 2006 Olympic games

Figure 2: structural endowment index



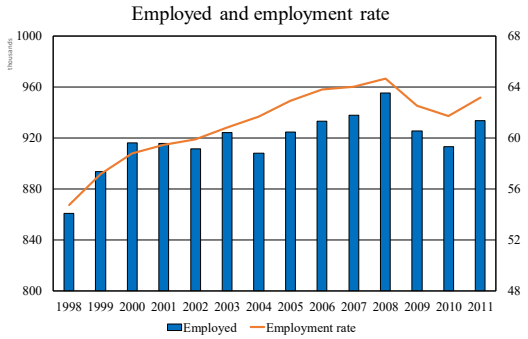
Index of infrastructural endowments (relative to Italy) for the province of Turin and for the Piedmont region; total infrastructures include all transport endowment (rail, roads, airport and port) as well as other economic and social infrastructures (e.g. financial, h and education infrastructures endowments). Data from Istituto Tagliacarne.

Figure 3: touristic stylized facts



Left panel: arrivals (left scale) and number of nights (right scale) in millions in Turin province. Right panel: number of beds in thousands in Turin province (2002 first year available). Data from ISTAT.

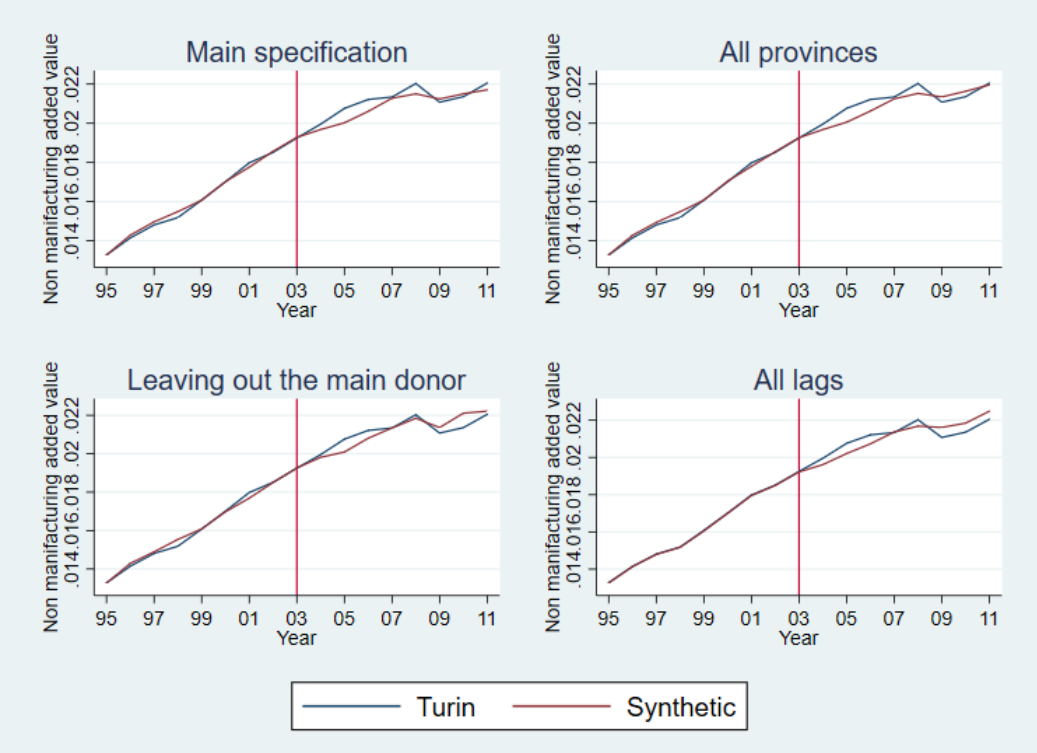
Figure 4: employment statistics



Number of employed individuals (left scale; thousands) and employment rate (right scale) in Turin province.
Data from ISTAT.

Figure 5: per capita value added

a) main effect



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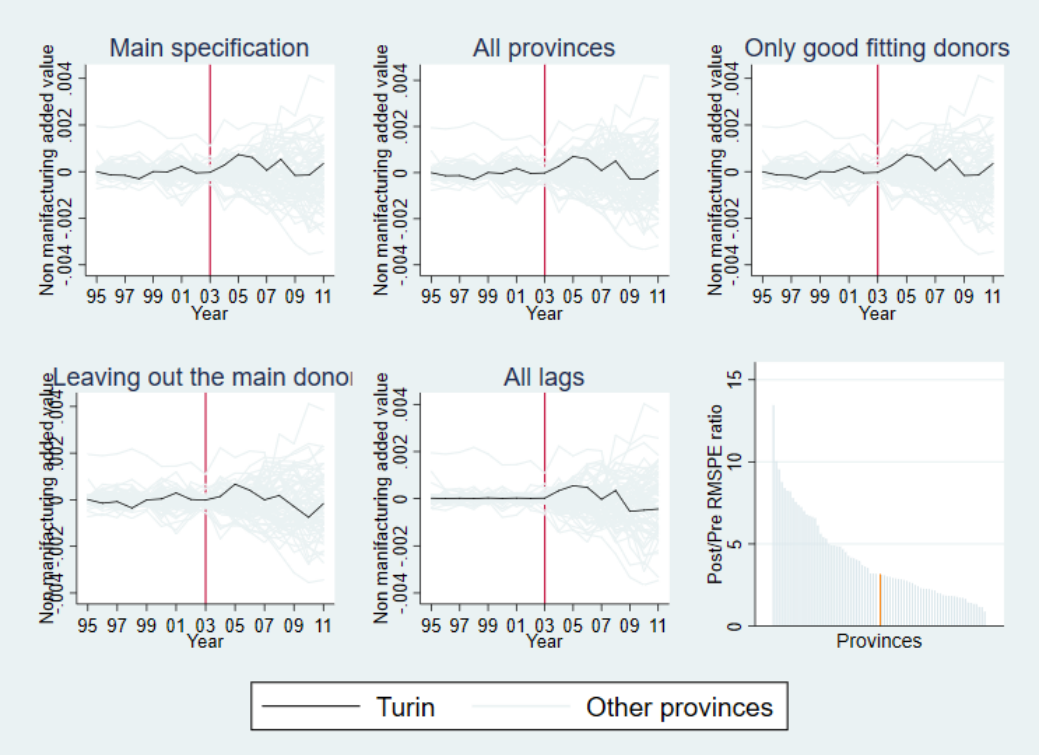


c) time placebo

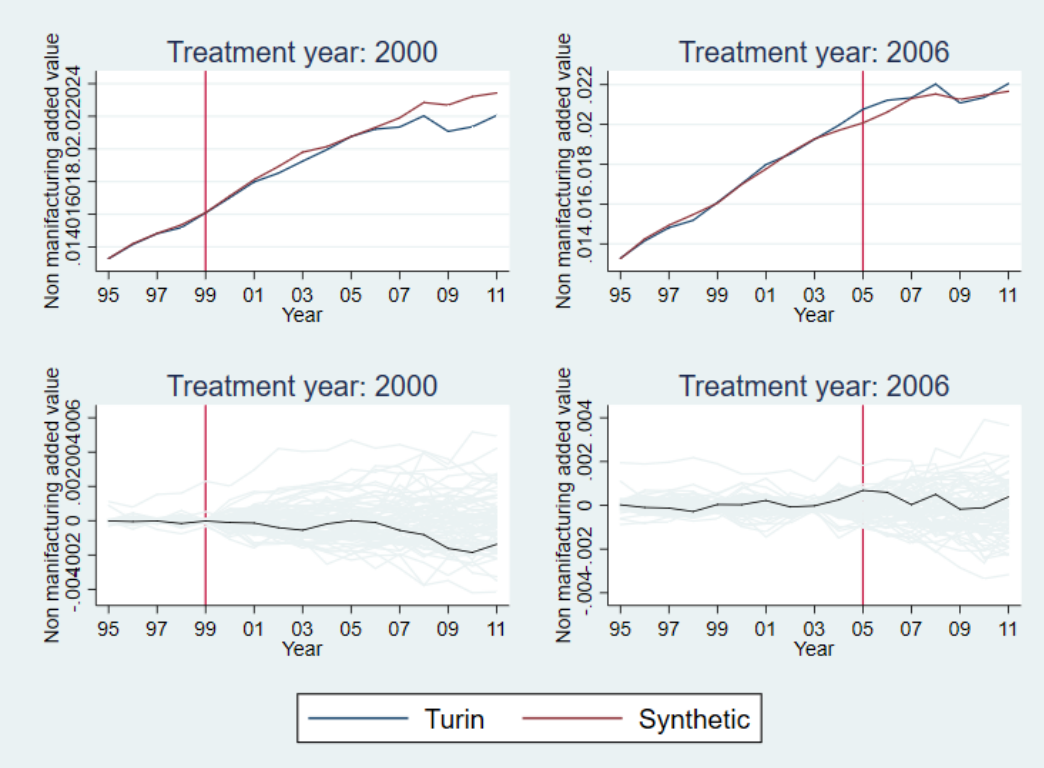
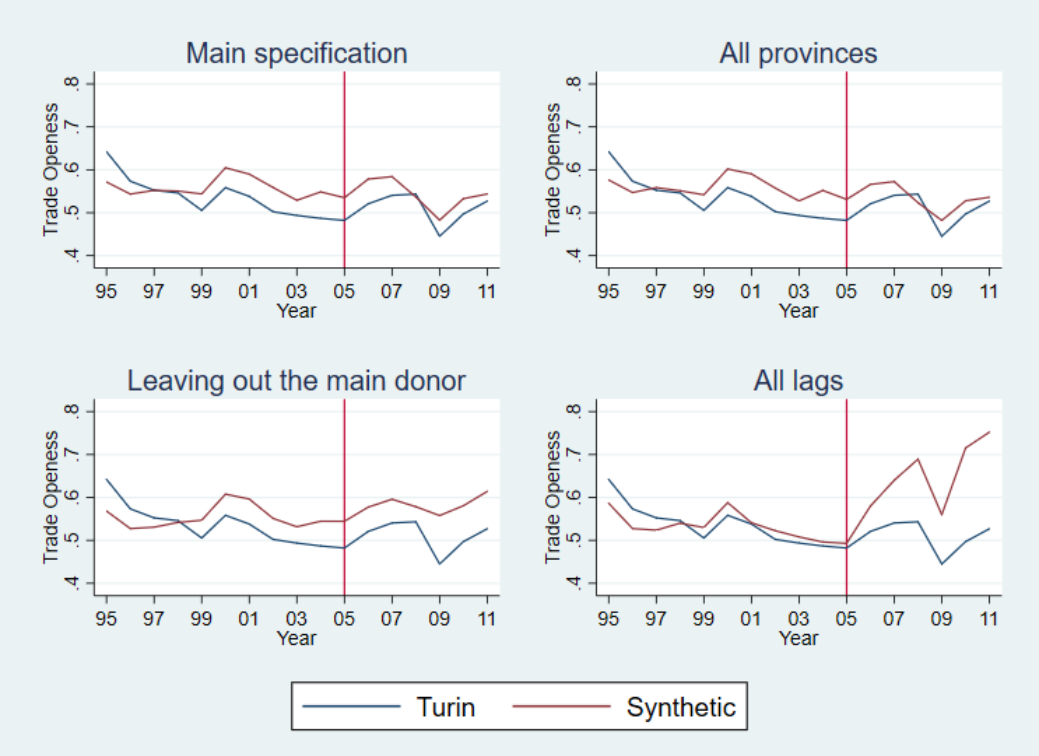


Figure 6: trade openness

a) main effect



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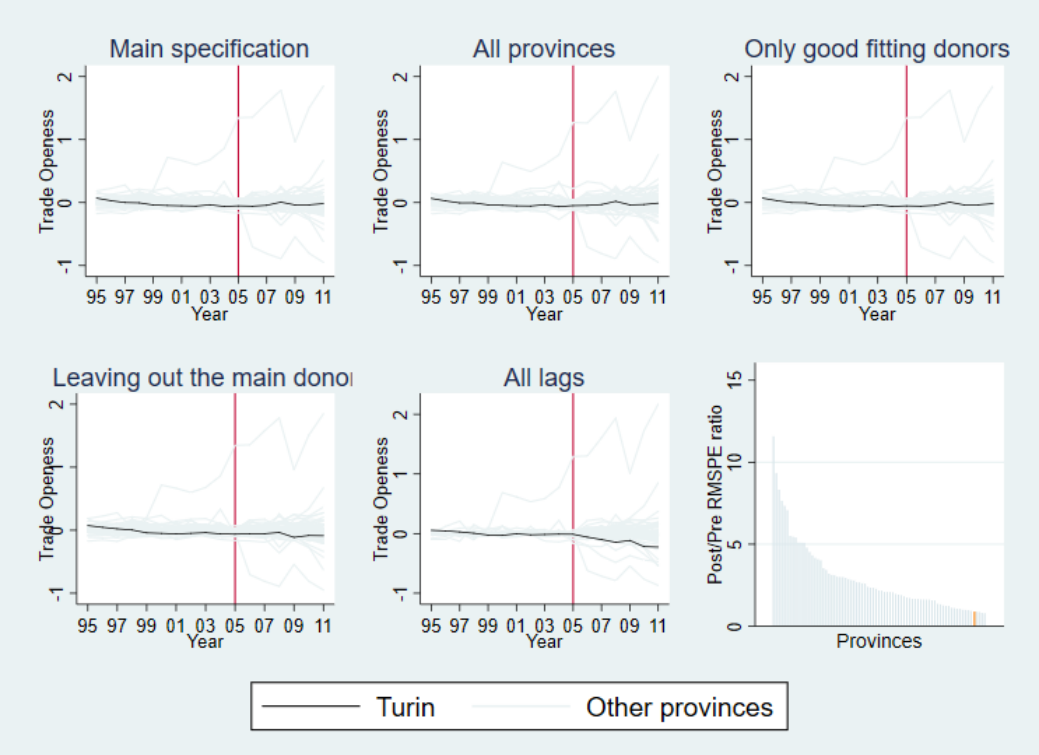

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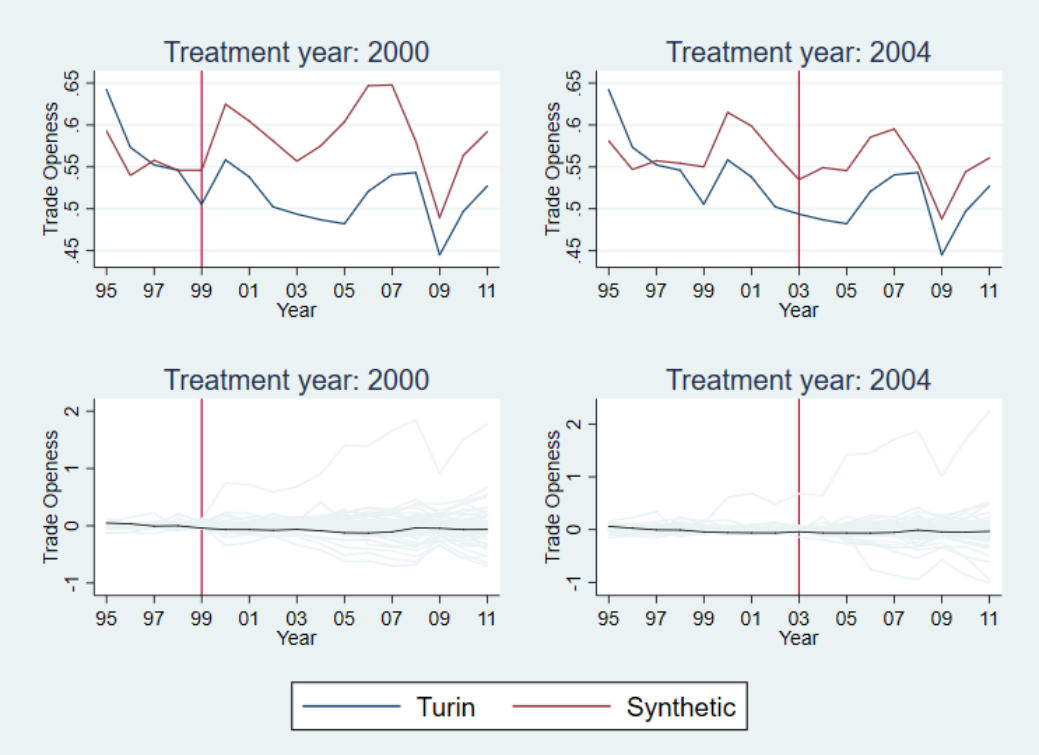
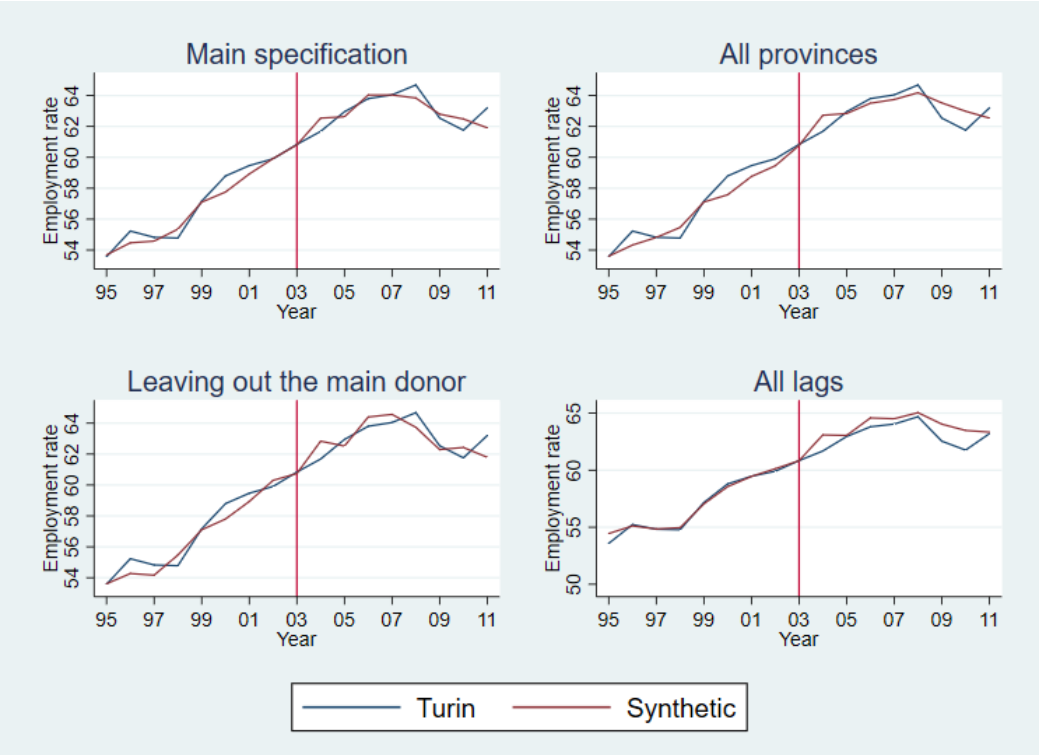


Figure 7: employment

a) main effect



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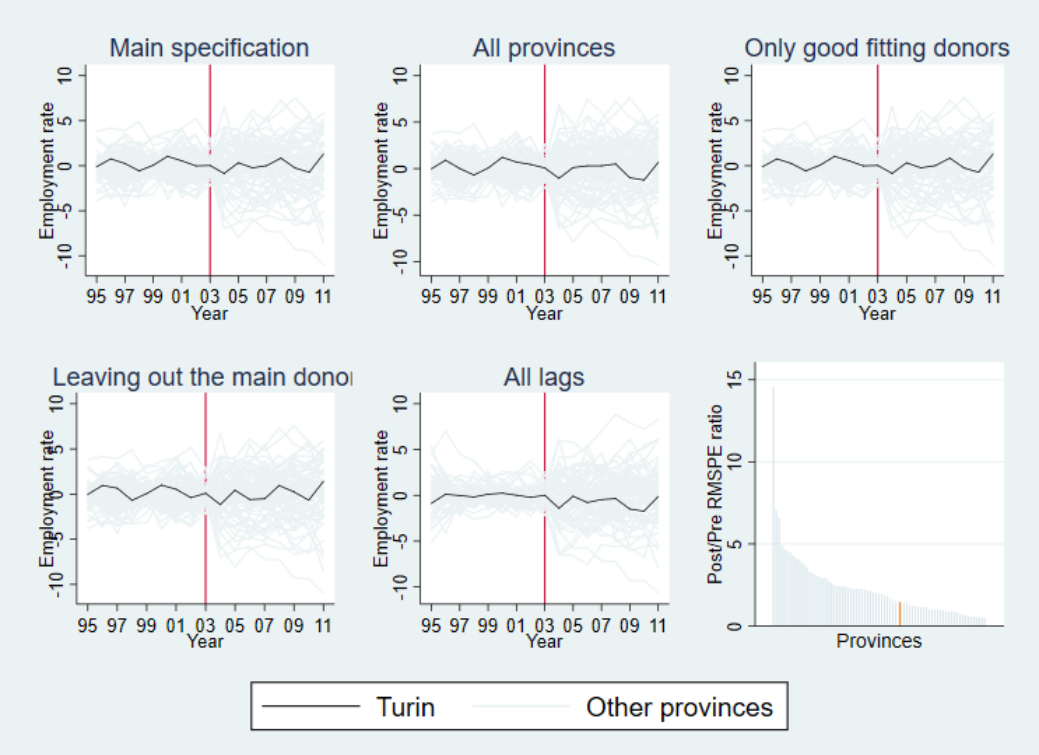

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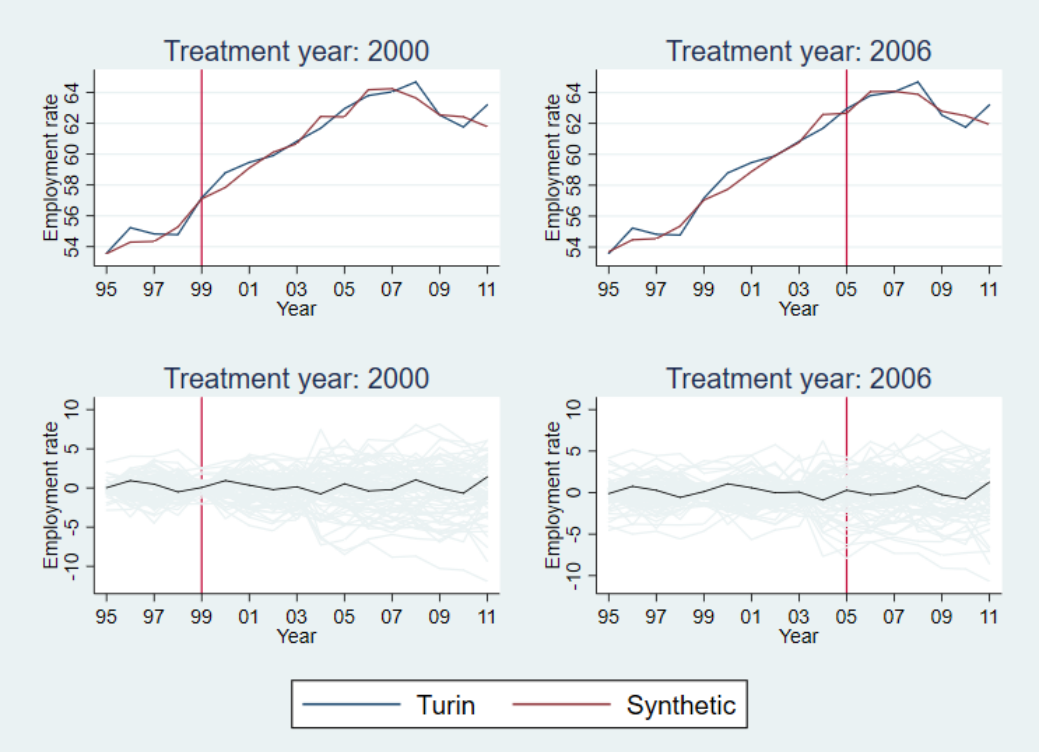
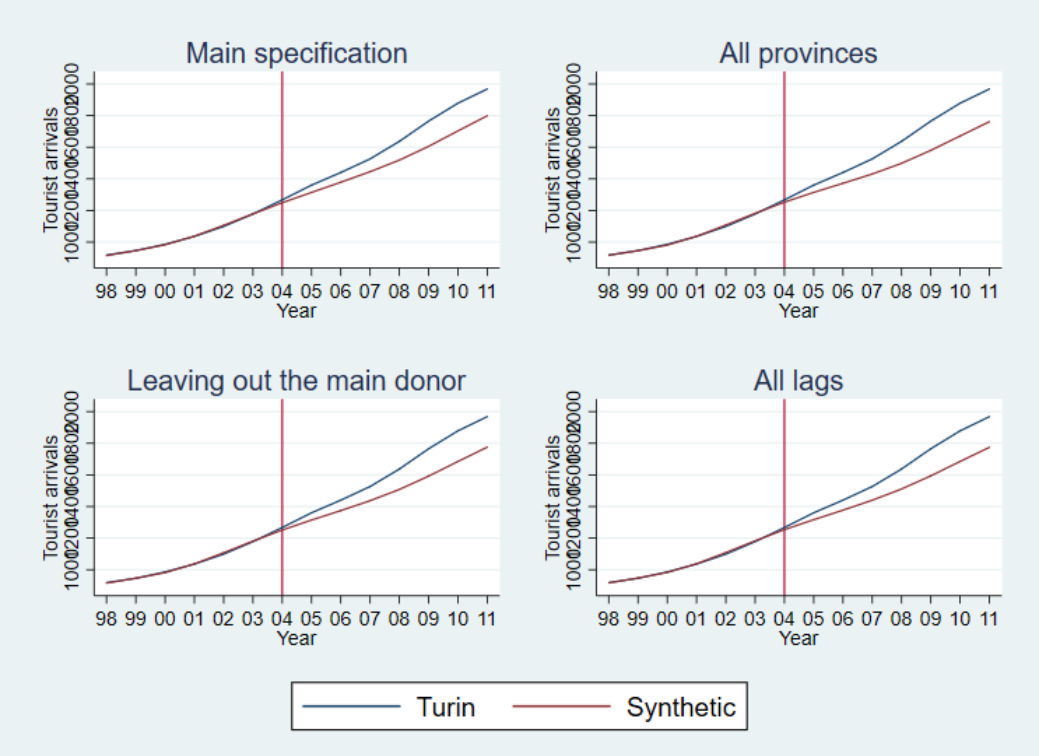


Figure 8: touristic arrivals

a) main effect



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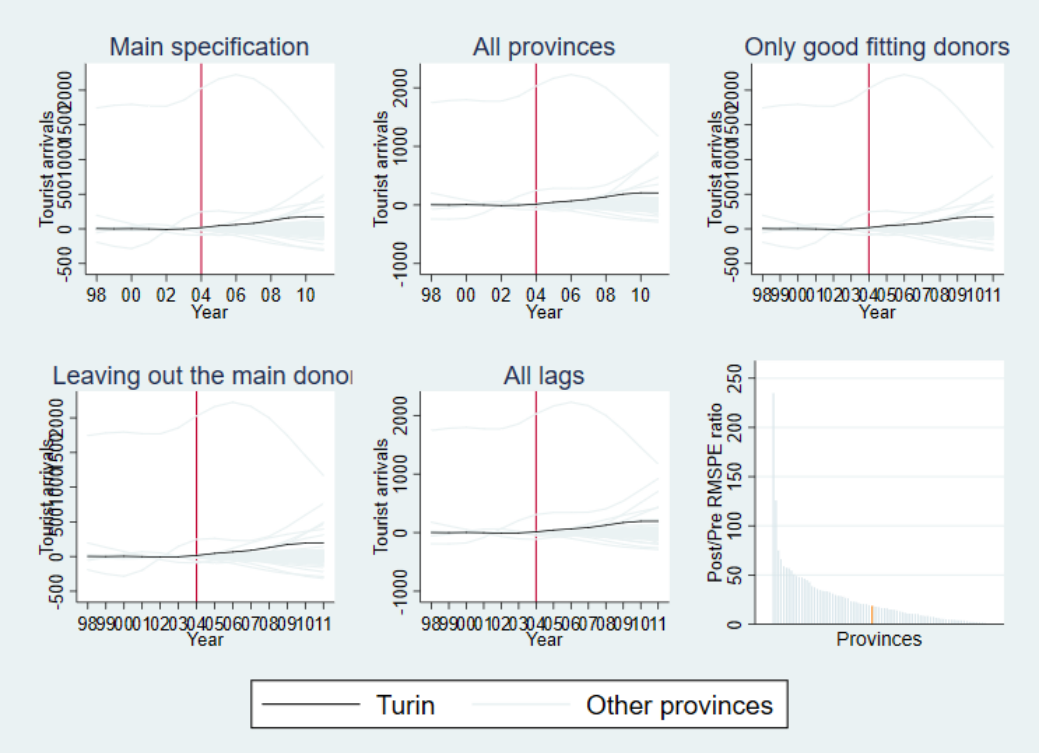

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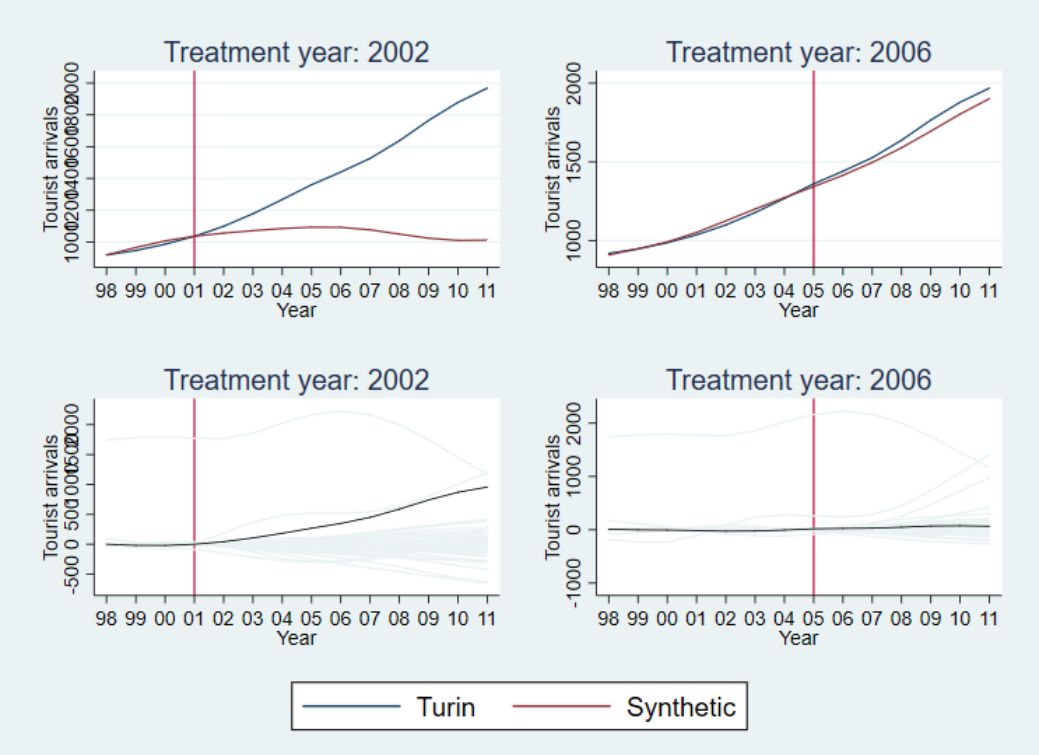
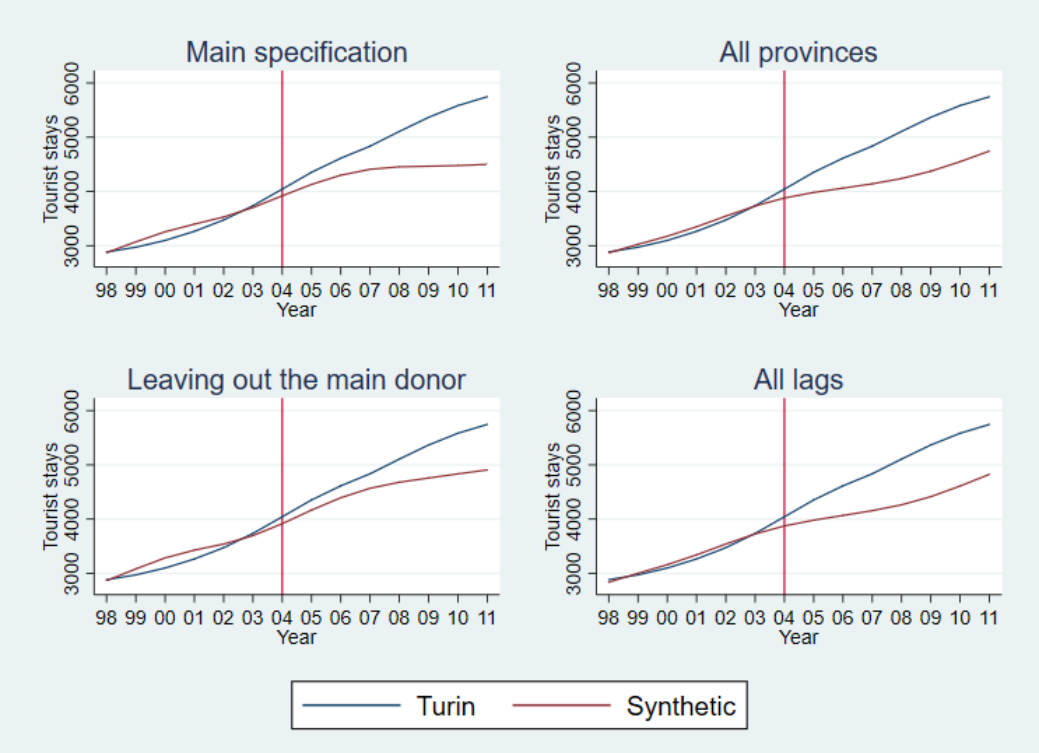


Figure 9: touristic stays

a) main effect



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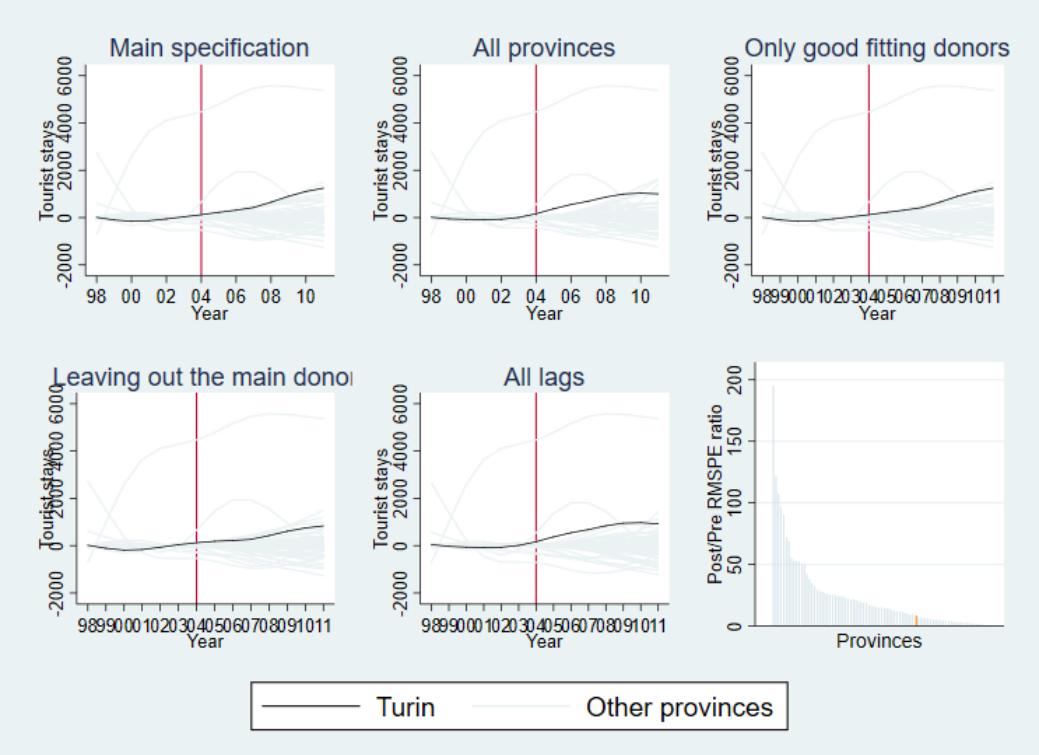

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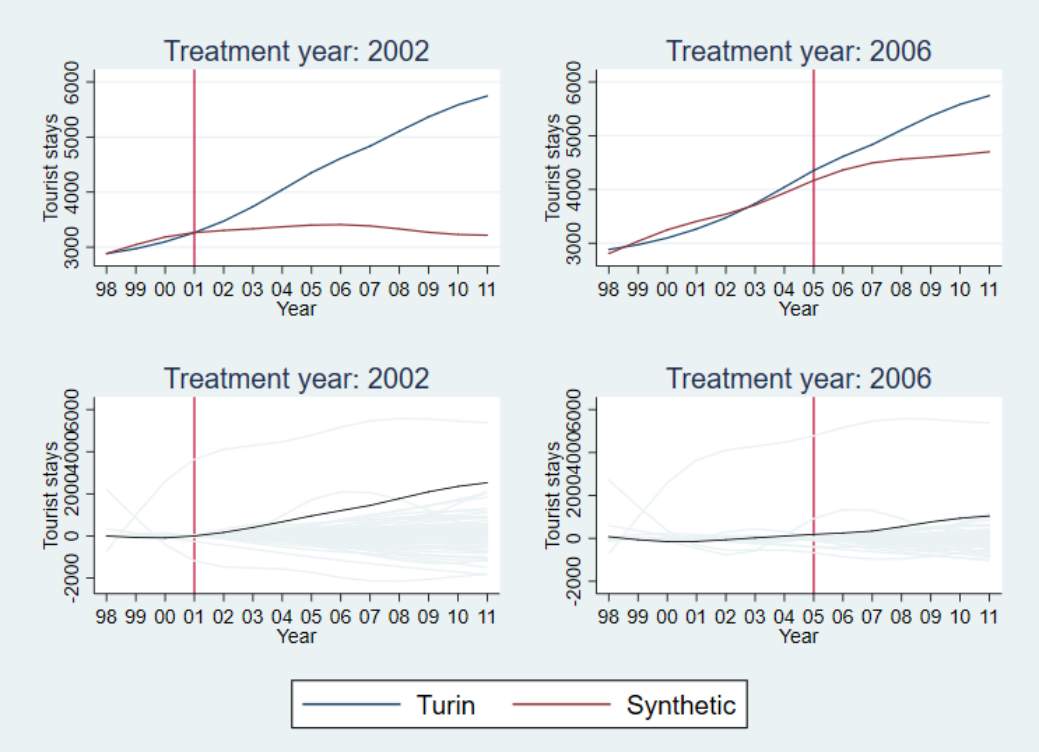
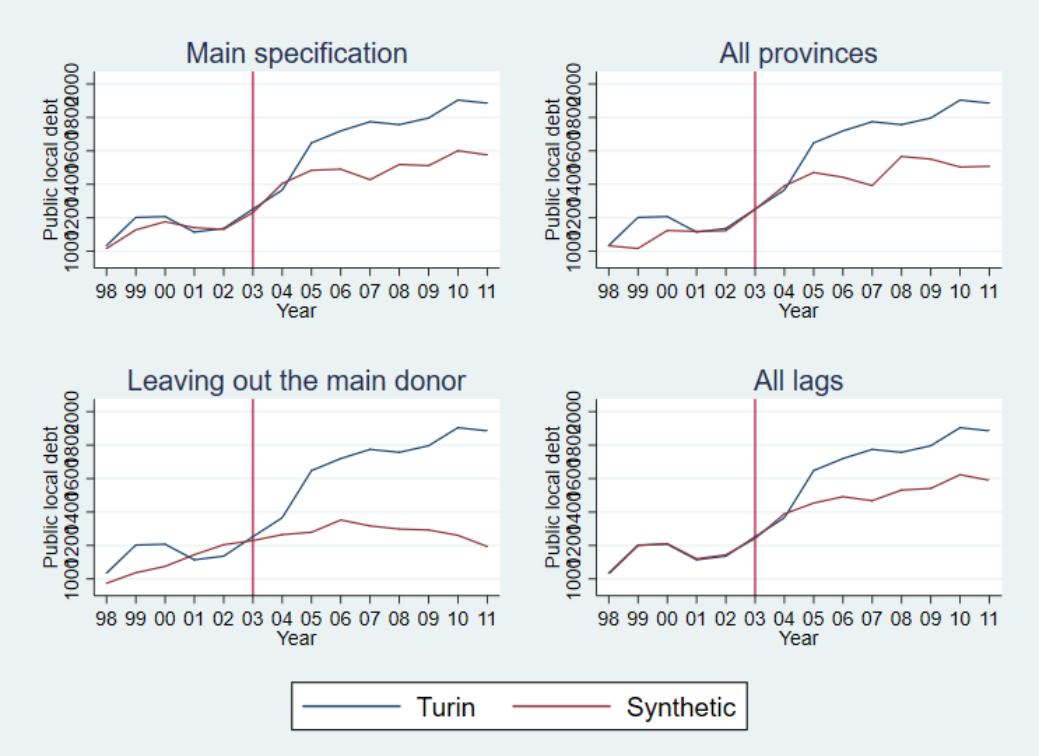


Figure 10: municipal debt

a) main effect



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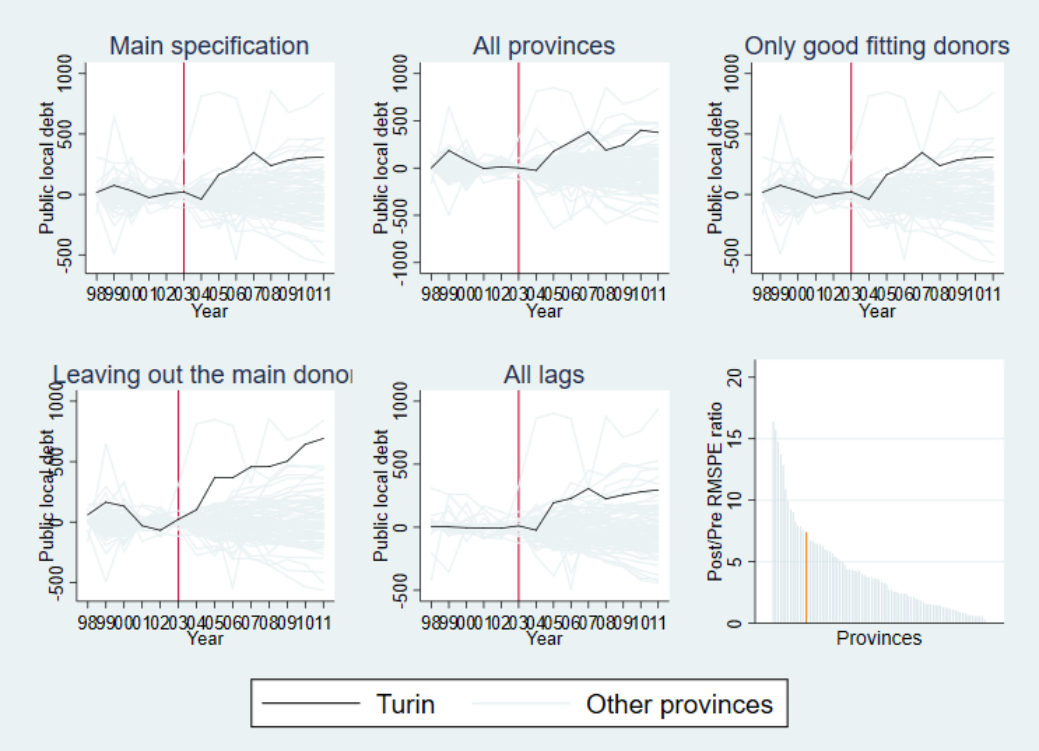

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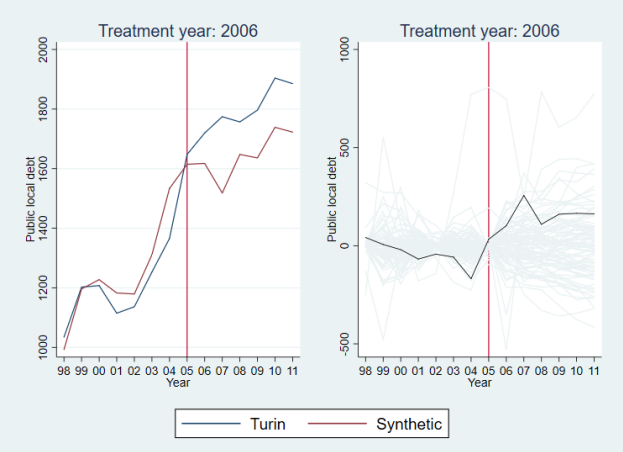
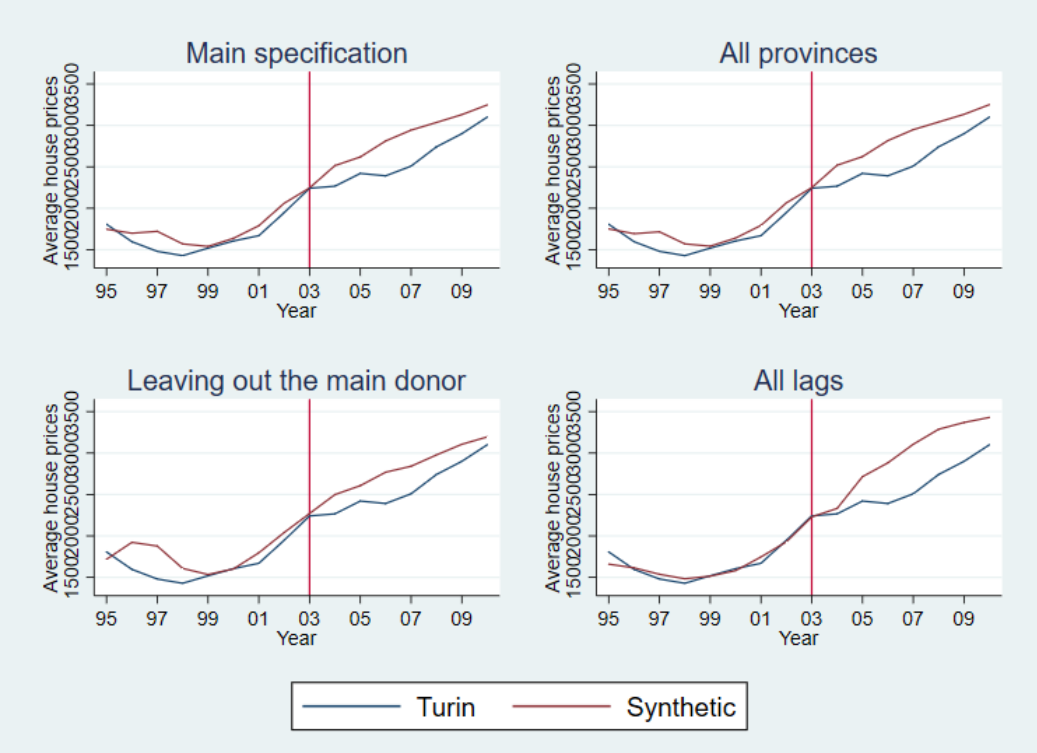


Figure 11: average house price

a) main effect



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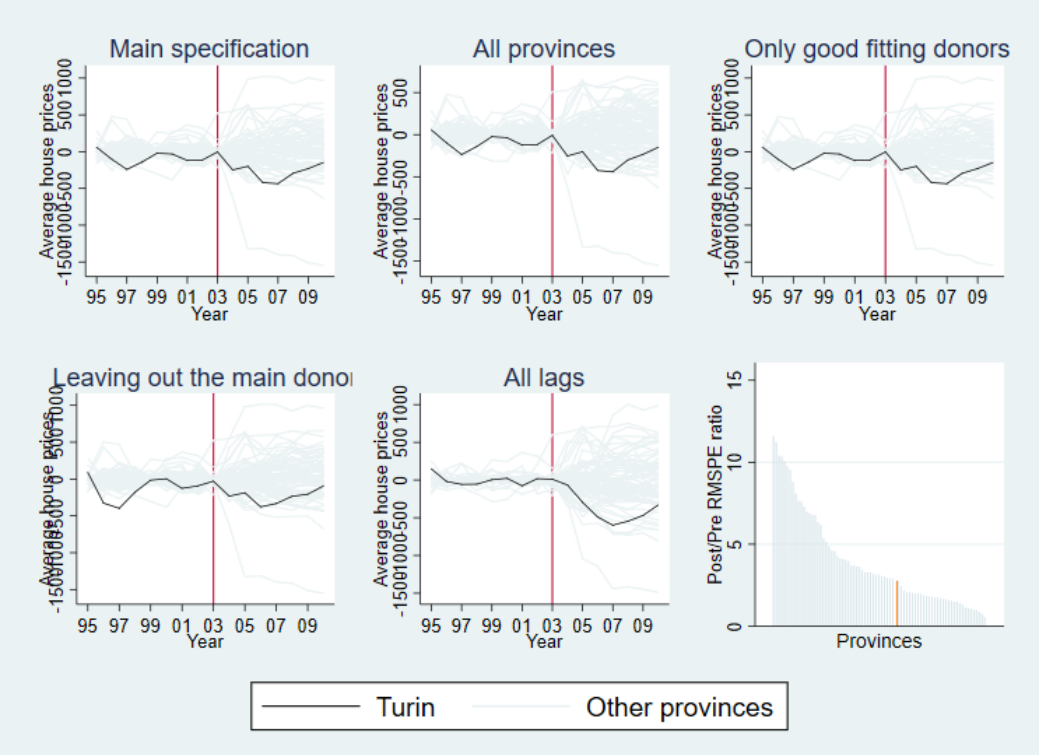

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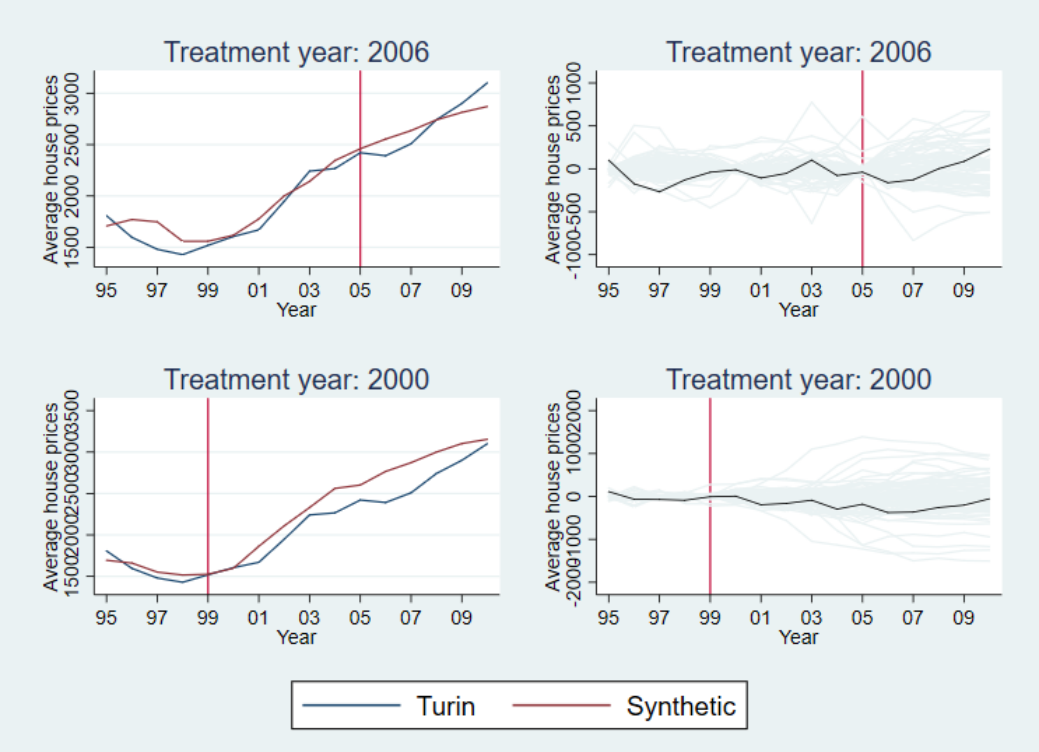
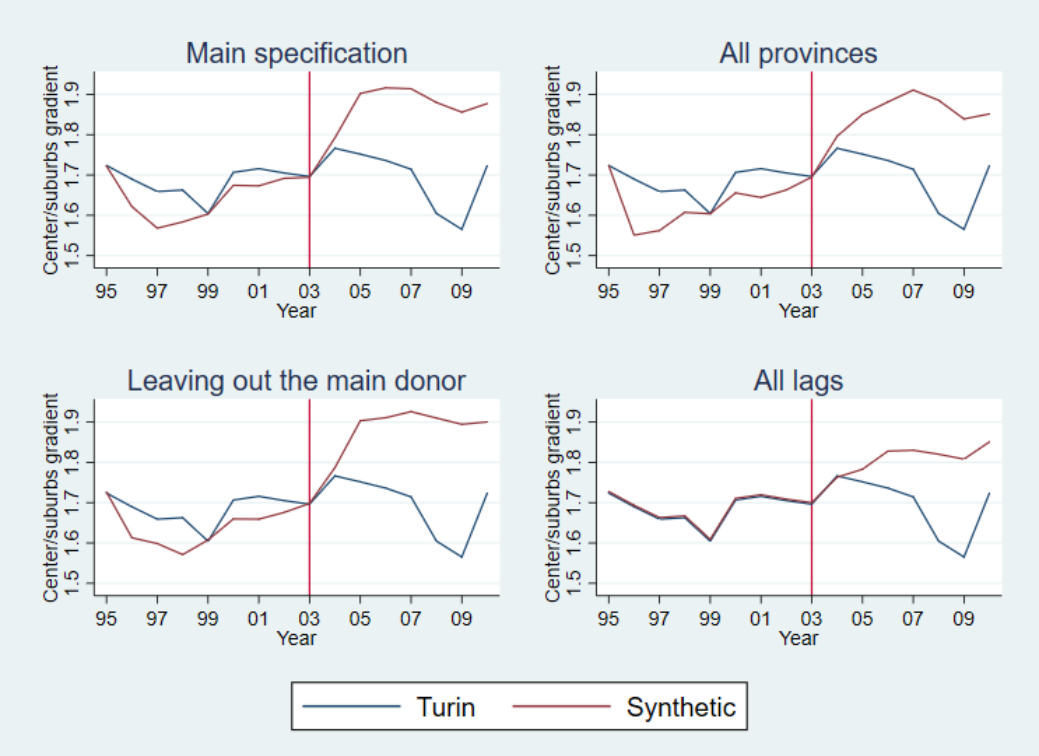


Figure 12: centre/outskirts gradient

a) main effect



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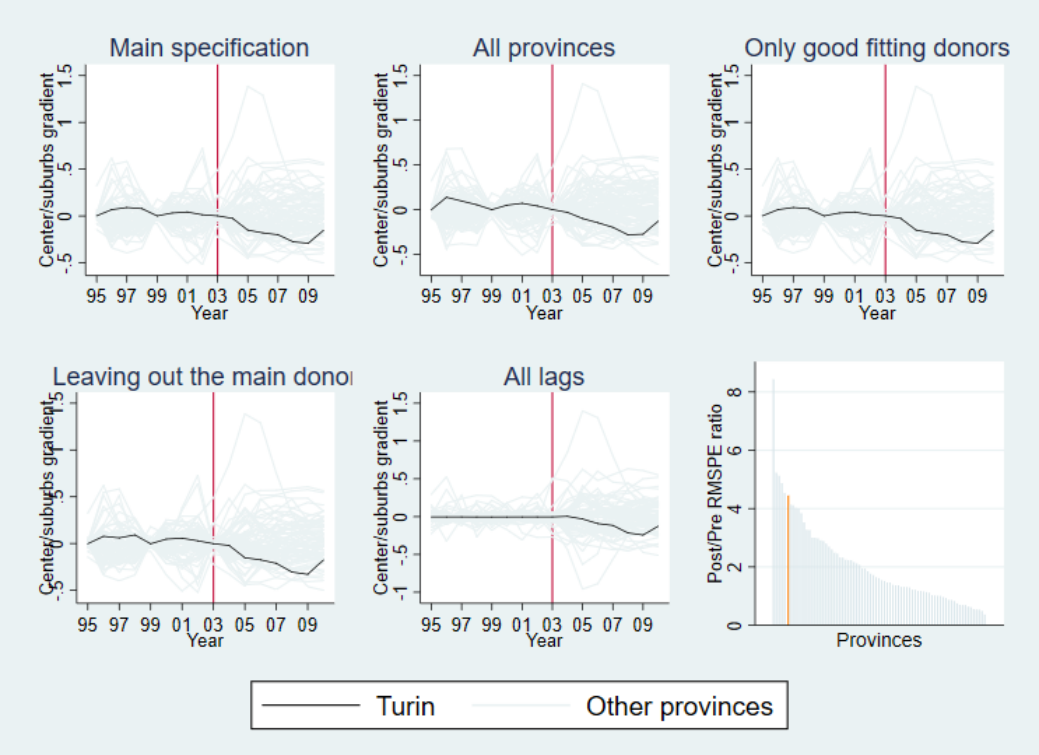

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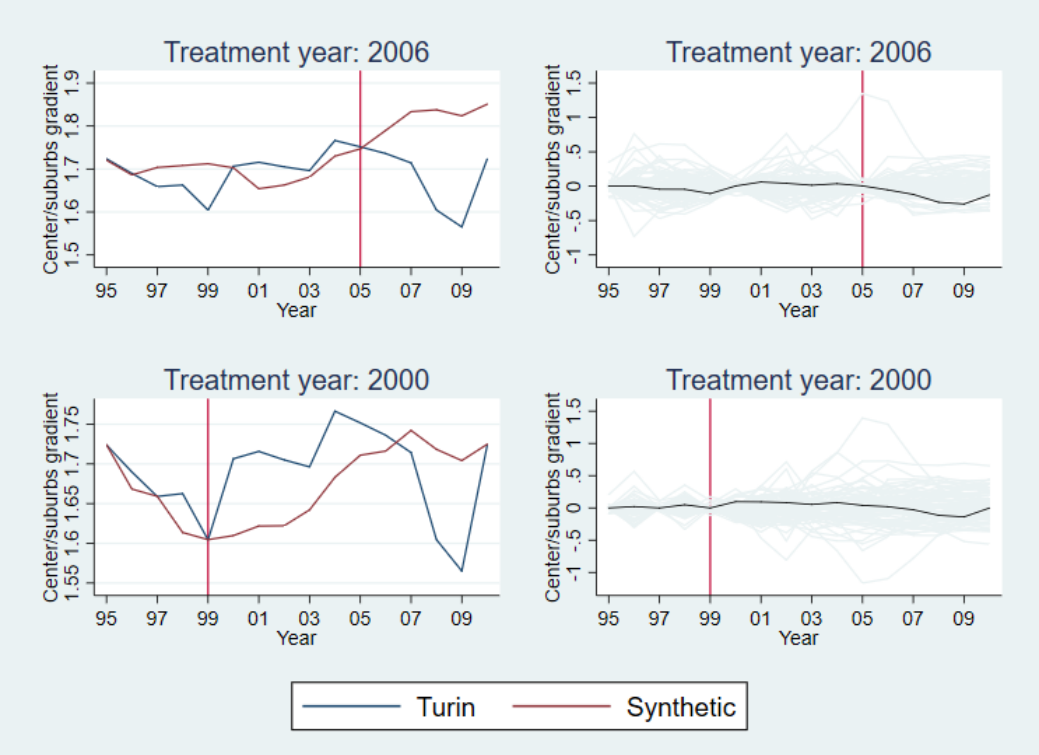
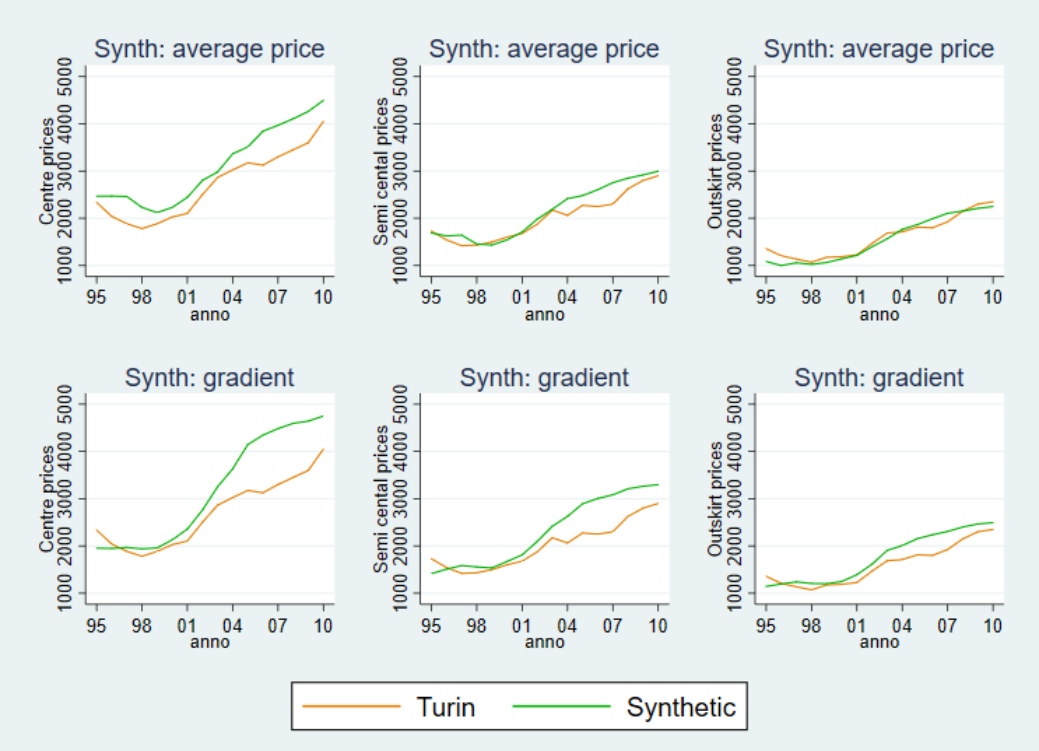


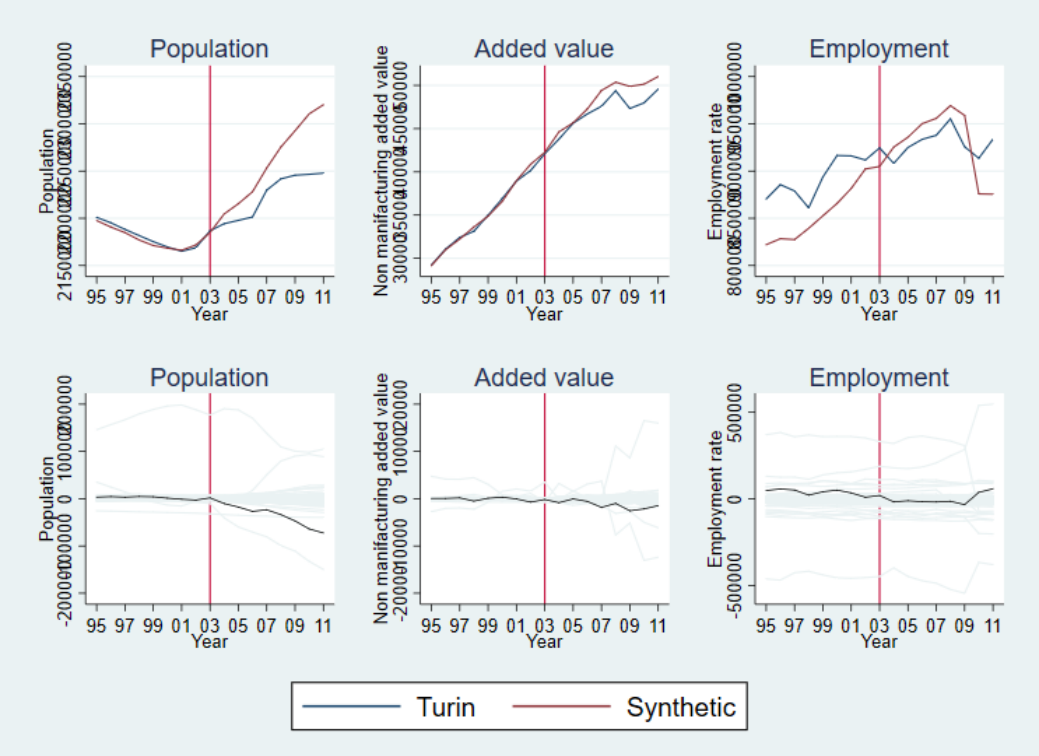
Figure 13: centre and outskirts prices



In each panel the synthetic label refers to the time series of the variable in the y axis constructed with the weights derived from the synthetic control estimated on the variable in the title.

Figure 14: robustness checks

a) population



b) total value added

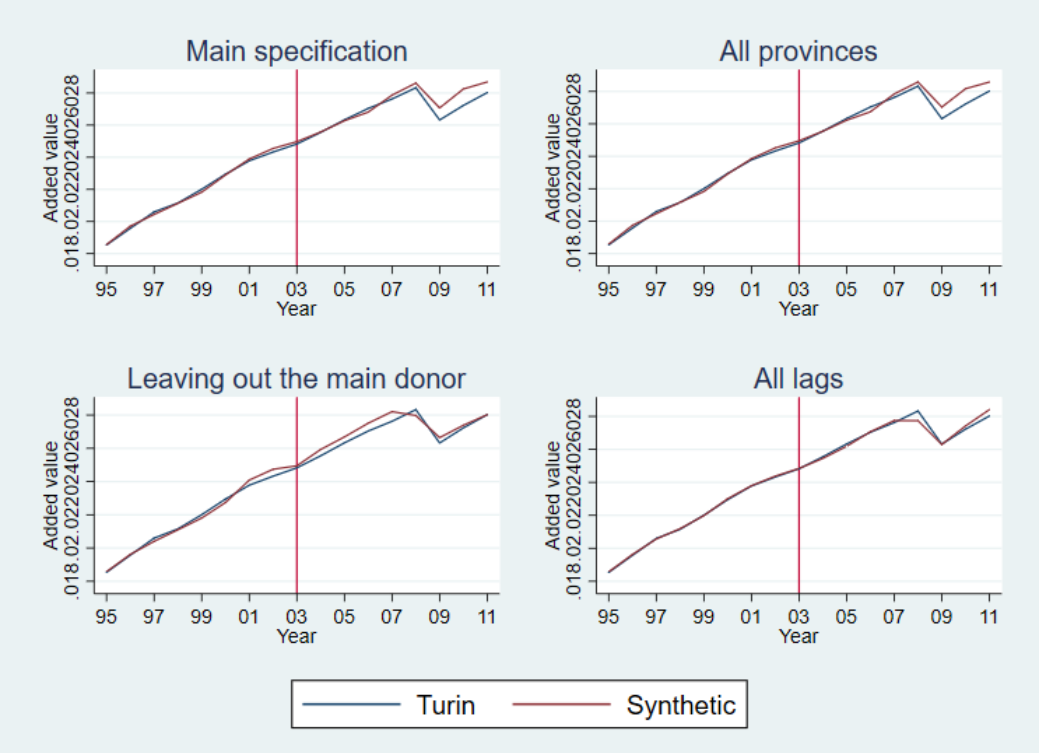


Table 1: literature summary

Study	Event	Geo Level	Time	Method	Results
Baade and Matheson, (2002)	1984 Summer Olympic Games (Los Angeles)	City of Los Angeles	Short run	Linear regression	An increase of 5.043 temporary jobs
Baade and Matheson (2002)	1996 Summer Olympic Games (Atlanta)	City of Atlanta	Short run	Linear regression	Between 3,467 and 42,448 new jobs
Hotchkiss et al. (2003)	1996 Summer Olympic games (Atlanta)	Georgia Counties	Medium run	Diff-in-diff	Positive employment impact but no significant wage effect
Leeds (2008)	2002 Winter Olympic games (Salt Lake City)	Colorado counties	Short run	Linear regression	Positive effect on ski resorts expenditures in Colorado
Jasmand and Maenning, (2008)	1972 Summer Olympic games (Munich)	Lander	Long run	Diff-in-diff	An increase in income, no effect no employment
Baade, Bauman and Matheson (2010)	2002 Winter Olympic games (Salt Lake City)	Utah counties	Short run	ARMA model	Positive effect on taxable sales of the hospitality industry but negative effect on those of general merchandise stores
Bondonio and Guala (2011)	2006 Winter Olympic Games (Turin)	North Italian Cities	Medium run	Diff-in-diff	Positive effect on tourists arrivals lasting after the event (medium term)
Maenning and Feddersen (2013b)	1996 Summer Olympic games (Atlanta)	Georgia Counties	Short run	Non parametric identification strategy	No significant effect of employment
Feddersen and Maenning (2013a)	1996 Summer Olympic games (Atlanta)	Georgia Counties	Short run	Non parametric identification strategy	Small employment effect during the games, only in some specific low skilled sectors
For an evaluation of the estimated costs of the different events, see **Baade and Matheson, 2016**					

Table 2: Donors pool[9]

Per capita VA	Employment rate	Tourist arrivals	Tourist nights
Firenze (0,323)	Firenze (0,287)	Trapani (0,456)	Vibo Valentia (0,585)
Varese (0,305)	Milano (0,19)	Varese (0,351)	Trapani (0,315)
Como (0,198)	Varese (0,152)	Milano (0,189)	Roma (0,100)
Roma (0,105)	Gorizia (0,13)	Vibo Valentia (0,004)	
Cremona (0,041)	Napoli (0,086)		
Bolzano (0,015)	Massa Carrara (0,06)		
Napoli (0,01)	Roma (0,058)		
Reggio Calabria (0,004)	Bergamo (0,037)		

Trade openness	Per capita municipal debt	Average house prices	Centre-outskirts price ratio
Firenze (0,457)	Milano (0,62)	Reggio Emilia (0,493)	Parma (0,25)
Milano (0,281)	Potenza (0,248)	Matera (0,269)	Firenze (0,233)
Massa Carrara (0,154)	Bolzano (0,133)	Roma (0,217)	Cremona (0,168)
Firenze (0,457)		Frosinone (0,02)	Treviso (0,126)
Como (0,073)			Latina (0,098)
Ravenna (0,036)			Palermo (0,06)
			Roma (0,026)
			Trieste (0,004)

Table 3: Pre/post averages

Outcome	Turin		Synthetic Control		Sample	
	Pre	Post	Pre	Post	Pre	Post
VA per capita (€)	16,25	21,22	16,28	20,95	17,65	22,23
Trade openness (%)	54,58	50,53	56,04	54,27	36,26	42,06
Employment rate (%)	57,18	63,08	56,97	63,12	53,80	58,22
Tourist arrivals (units)	1.098.836	1.653.632	1.091.078	1.537.763	792.821	952.874
Tourist nights (units)	3.352.535	4.842.947	3.392.412	4.307.591	3.309.671	3.708.310
Debt per capita (€)	1.158	1.731	1.138	1.503	657	883
House prices (€/sq. m)	1.699	2.618	1.799	2.900	1.423	2.341
Centre-out. price ratio	1,69	1,70	1,65	1,88	1,66	1,75

Pre and post refer to time averages over 5 years before and after the event.

[9] The weights used in the robustness checks are available upon request.

Table 4: Predictor balance

Predictors	Per capita VA		Trade openess		Employment	
	Treated	Synthetic	Treated	Synthetic	Treated	Synthetic
Agricultural sector (%)	1,21	1,36	0,86	0,99	0,90	1,07
Construction sector (%)	5,59	5,76	4,21	4,29	4,12	4,13
Industrial sector (%)			25,35	25,37	26,21	26,21
Services sector	93,02	93,08	69,45	69,50	68,64	68,65
Export share (%)	32,00	28,45			32,00	30,23
University grad. (%)	7,38	7,48	7,37	8,04	7,38	7,87
High school grad. (%)	24,87	25,2	24,84	25,61	24,87	25,86
Employment rate (%)	57,18	59,58	58,11	60,10		
Institutional index	0,55	0,59	0,55	0,67	0,549	0,560
Infrastructural index	103,14	147,98	103,94	119,73	103,14	147,17
Population density	320	489	320	597	320	782
Dep.variable (t-n)	13,28	13,28	64,21	57,18	53,58	53,69
Dep.variable (t-n/2)	16,08	16,08	55,83	60,48	57,16	57,10
Dep.variable (t-1)	19,25	19,28	48,21	53,50	60,84	60,81

Predictors	Tourist arrivals		Tourist nights		Per capita municipal debt	
	Treated	Synthetic	Treated	Synthetic	Treated	Synthetic
Infrastructural index					103,77	108,45
Population density					317	1.178
Beds per capita (units)	0,023	0,027	0,023	0,166		
Cultural inst. (units)	45	20,44	45	23,3		
UNESCO sites (units)	2	1,24	2	0,3		
Parks (units)	108	24	108	14,35		
Surface (sq. km)					6.827	3.596
Costal surface (sq. km)	0	86,07	0	166,39		
Mount. areas (sq. km)	3533	66	3.533	287	3.533	1.943
Dep.variable (t-n)	918.480	914.530	2.882.960	2.871.050	1.035	1.018
Dep.variable (t-n/2)	1.098.870	1.106.030	3.472.88	3.529.680	1.115	1.142
Dep.variable (t-1)	1.267.200	1.248.880	4.042.31	3.918.920	1.253	1.232

Predictors	Average house prices		Centre-outskirts price ratio	
	Treated	Synthetic	Treated	Synthetic
University grad. (%)	7,38	7,46	7,38	7,36
High school grad. (%)	24,87	26,82	24,87	24,84
Employment rate (%)	57,18	57,29	57,18	58,06
Infrastructural index	103,14	94,67	103,14	103,54
Population density	320	265	319,51	317,28
P.C. value added (€)	21,97	21,61	21,97	27,78
Dep.variable (t-n)	1.808	1.748	1,72	1,72
Dep.variable (t-n/2)	1.519	1.540	1,60	1,60
Dep.variable (t-1)	2.242	2.245	1,70	1,69

t is the year of event. n is the number of years available before the event.

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