



BANCA D'ITALIA
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Temi di discussione

(Working Papers)

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Number

1208



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ISSN 1594-7939 (print)

ISSN 2281-3950 (online)

Printed by the Printing and Publishing Division of the Bank of Italy

THE ECONOMIC EFFECTS OF BIG EVENTS: EVIDENCE FROM THE GREAT JUBILEE 2000 IN ROME

by Raffaello Bronzini^{*}, Sauro Mocetti^{**} and Matteo Mongardini^{**}

Abstract

This paper assesses the short- and long-term economic impact of the Great Jubilee 2000 on the city of Rome's economy; this is an important Catholic event that occurs every 25 years. By applying the synthetic control approach, we find that the value added per capita increases slightly in the short term while in the long term it is not significantly different from what it would have been if Rome had not hosted the Jubilee. However, we do find a significant effect on the employment rate. Consistently with these findings, we document a shift of the local economy towards less productive sectors, such as construction and services requiring a lower skill content, and an overall productivity loss for/in Rome with respect to the counterfactual scenario. The investment in infrastructure, facilities and urban requalification did not significantly affect tourism or house prices in the long run, with exception of peripheral residential areas which experienced an appreciation.

JEL Classification: R00, R11, R12, R58.

Keywords: mega events, synthetic control method, urban economic growth, house prices.

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1. Introduction *

Countries and cities fiercely compete at the international level to host big events, like Olympic Games or Football World Championships, because such events are supposed to bring economic prosperity to the host area and are considered important promotion opportunities. However, their economic impact should not be taken for granted. In the short term they usually spur an increase in tourism and other expenditures that push local demand, but in the long term the economic benefits are uncertain and rarely overcome the organizing costs (Owen 2005; Coates 2007). In a recent survey on the impact of Olympic Games, for example, Baade and Matheson (2016) conclude that current expenditures and the costs to provide the necessary infrastructure are usually bigger than the economic benefits, coming from the increase in tourism, the improvement of amenities and the promotion effect.

This paper assesses the economic impact of a big event different from those examined by the empirical literature so far – the Great Jubilee 2000 – on the economy of the province of Rome. This is a large extraordinary religious event that occurs every 25 years in Rome, the capital of the Catholic Church. Even though the nature of the event is different from those usually investigated, it shares with them some important characteristics able to enhance the local economy: it spurred a large amount of public and private investment, improved local infrastructure and amenities, and attracted an impressive amount of tourists.

A crucial issue in the empirical studies of big events is the choice of a suitable strategy to identify their economic impact. We apply the synthetic control method which is based on the construction of a proper counterfactual for the economy of Rome, represented by a weighted average of the outcome variable of other provinces that in principle should mimic what would have been happened to Rome if it had not hosted the Jubilee (Abadie et al., 2010).

We find that after ten years value added per capita of Rome was not significantly different from that of the synthetic control, whereas we do find a significant effect on the employment rate. Consistently with these findings, we document a shift of the local economy towards less productive sectors, as constructions and services with lower skill content, and an overall productivity loss of Rome with respect to the

* We thank Vernon Henderson, Jaewon Lim, Paolo Sestito, two anonymous referees, the participants at the 38th AISRE conference (Cagliari, September 2017), at the 65th NARSC conference (San Antonio, November 2018) and seminar participants at the Bank of Italy for useful comments. The views and opinions expressed in this paper pertain to the authors only and do not represent in any way those of the Bank of Italy.

counterfactual. The promotion effect associated to the event and the huge investments in infrastructures, facilities and urban requalification did not result in a permanent upward shift in tourism activities. On the contrary we find an appreciation of housing values in peripheral areas, likely due to an improvement in urban mobility.

The literature that evaluates the economic impact of mega-events is mainly focused on sport happenings and mostly employs panel data models and pre- post-estimates. For example, Rose and Spiegel (2011) use a panel of countries to investigate the effect of hosting Olympic games on exports. The rationale is that hosting games increases country visibility that, in turn, should stimulate trade. They find a positive gap on export not only for the hosting countries, but also for unsuccessful candidates (candidate countries that eventually did not host the games).¹ Brükner and Pappa (2015) find a positive effect of bidding for Olympic games also on country consumption, investment, and output. Fourie and Santana-Gallego (2011) estimates a standard gravity model of bilateral cross-country tourist flows and show that hosting mega-sport event promotes tourist arrivals before and during the event, but not afterwards. Furthermore, since the effects of big events are typically geographically concentrated some studies focused on sub-national geographical areas.²

One shortcoming of the contributions recalled so far is that they apply standard econometric approaches, instead of most suitable identification strategies such as counterfactual methods. Only recently certain studies challenged previous findings by using latter strategies. Maennig and Richter (2012), Billings and Holladay (2012) and Langer et al. (2018) argue that countries that hosted or bid for Olympic games are structurally different from the others and therefore selection might have biased previous results. By using only a subset of countries that did not host the event properly chosen as controls, they find no effects of hosting games on exports, consumption, investment or output. For further in-depth critical discussions of the economic literature on the impact of major sport events see Baade and Matheson (2016), Maennig (2017) and Scandizzo and Pierleoni (2018).

This paper contributes to the existing literature in many respects. First, while the analyses of sport events are copious, quantitative assessments of the economic effects

¹ The interpretation is that the bid for the games, not hosting them, has an impact on trade, because through the candidature countries signal their trade liberalization intentions and stronger outward orientation.

² Jasmand and Maennig (2008), using a panel of German regions and difference-in-differences estimates, find that 1972 Munich Olympic Games had a positive effect on income of hosting regions but not on their employment. Baade and Matheson (2004) focus on FIFA World Cup using a panel of US cities that hosted the event in 1994, by comparing actual and predicted personal income; they conclude that host cities experienced a loss as the expenditures overcame monetary gains.

of non-sport events are very rare.³ Moreover, the Great Jubilee shares many features with big events examined by the literature but it shows also some peculiarities that makes the study of the event particularly interesting. In particular, the Jubilee moved a sensible amount of public and private investment, and attracted an impressive number of tourists, moreover it lasted more and involved a much wider range of infrastructure and amenities than sport events examined so far. Therefore we might expect that its impact on the local economy is deeper than those triggered by other types of events. Second, we are the first to employ the synthetic control method to these case and we believe that is most suitable strategy to evaluate the effects of economic shocks that hit one specific geographical area, while accounting for endogenous selection into the treatment. Third, we use provinces as geographical unit of analysis (NUTS 3) which is a more proper unit with respect to broader geographical areas, to evaluate the impact of a local event.⁴ Finally, we examine the impact of the event using a large set of outcome variables, differently from what has been done in most of previous studies, thus allowing to a more comprehensive view of the real effects of the event.

The rest of the paper is organized as follows: Section 2 describes the event; Section 3 and 4 present the data and the empirical strategy, respectively; Section 5 shows the results; and Section 6 concludes.

2. The Great Jubilee 2000

The Jubilee is the main religious event for the Catholic Roman Church and it is related to the universal pardon: in the year of the Jubilee catholic believers can receive the indulgence (remission of sins) attending religious ceremonies in certain sites located in Rome. The ordinary Jubilees (called also Holy Year) occur each 25 years and lasts a little more than one year.⁵ The ordinary Great Jubilee 2000 lasted from Christmas 1999 (December) to the Epiphany 2001 (January), and was celebrated by Pope John Paul II. The preparation of the 2000 Jubilee catalyzed a large number of projects across the city of Rome and during the year the city experienced a boost in

³ Lamberti et al. (2011) examine the effect of Shanghai World Expo on community participation in tourism development using qualitative information collected by questionnaires.

⁴ It is worth noting that the municipality of Rome represents about 70% of the people living in the province and about 85% of the employees. Moreover, a large fraction of the workers living in the surrounding municipalities commute every day to Rome. Therefore economic variables at the province level used in this paper can be considered as highly representative of the city of Rome.

⁵ Catholic Jubilee was established for the first time in 14th century. From 1300 to 2015 there have been celebrated 34 Jubilees, most of them ordinary; the Pope, chief of the Catholic Church, can also proclaim extraordinary Jubilees for outstanding events.

tourism presences. Therefore, it can be considered a mega-event able to create a strong positive shock on the economy of Rome.

Supporters of mega events argue that they are able to spur the economic expansion of the hosting city or country through a number of channels. First, public and private investments made in preparation for the event enhance the endowment of local private capital, infrastructure, and facilities. Citizens and firms therein located take advantage from the investments, and local production capacity increases, together with the competitiveness and attractiveness of the hosting geographical area. Second, mega events attract an extraordinary number of tourists boosting local demand for goods and services. Finally, the event represents a unique promotion opportunity for the city, which can be able to attract tourists and external flow of investment over the long-term, and by this channel eventually triggering a virtuous circle of economic expansion.

As regards the investment, a large plan of public expenditures in preparation of the 2000 Great Jubilee was officially approved in 1996 by the competent authorities (*Commissione per Roma Capitale*). Afterward, the plan was changed several times and downsized, mainly to respect the amount of allocated public funds or temporal deadlines. However, in its final version it included more than 800 projects, almost all realized from 1996 to 2000, and it mobilized a substantial amount of resources. Total investments amounted to about 1.88 billion of euros, mostly financed by state funds (Law n. 651/1996). More than the 90% of the total investments were made in province of Rome (Benevolo et al., 2003). As a result, the public program was similar to an expansive fiscal policy that was not financed by local taxes.

A large share of the plan was absorbed by public investment for infrastructure (about 43% of the total expenditure) such as projects aimed at improving the mobility, enhancing metropolitan road, railroad and car parking. Among others, we can recall the development of the motorway city-ring (Gran Raccordo Anulare), Fiumicino-Airport, and railroad Viterbo-St.Peter, the renewing of "Termini" railroad station, the realization of a central road tunnel in Lungotevere Sassia, the parking of Gianicolo, the musical Auditorium; other investment projects strengthened local and urban railroads and hospital emergency.⁶ Among the remaining part, nearly 17% of the total public investment was allocated to improve the cultural assets; 14% to maintain and requalify of the urban public areas; another 14% for people security. The rest was destined to the reception, information, and communication: among them there are the public incentives for investment of private structures (e.g. hotels).

⁶ Many of the aforementioned public works were important public intervention planned for Rome far before the Jubilee, however the event represented a unique opportunity to speed up their realization and sometimes to expand their scope (Rutelli, 2001).

The total direct expenditures planned for the Jubilee represented a significant amount at the local level: it was nearly 11% of the total investment realized in the region of Latium in 1995 (nearly 2% of the regional GDP). Besides public expenditures strictly related to the Jubilee, there were also other private or public expenditures which were indirectly related to the event that are hard to compute, such as private spending to renew the structures for reception. According to some estimates the overall private and public investment related to the event reached about 6.5 billion of euro, nearly one tenth of the regional GDP (Rutelli, 2001; Ciccarone et al. 2015).

Official regional data show that investment over GDP ratio in Latium increased from about 80% of the national average in the first half of the 1990s, to almost 90% in 2000-2001 and it slightly decreased in the following years (Figure 1a).⁷ Overall, the index that measures the endowment of transport infrastructures in the province of Rome (relative to the Italian average) increased from 129% in 1991 to 155% in 2001 and 194% in 2007 (Figure 1b); an increase is recorded also for the total index that includes all the socio-economics infrastructures.

Another important driver of the economic expansion triggered by mega events is the tourism. Actually, Rome experienced a huge spike in tourism arrivals and, to a lower extent, of expenditures in 2000. In the year of the Jubilee the number of nights spent in Rome, a measure of tourism performance related to the duration of the stay, increased by 42% (from 17 to more than 24 million; Figure 2a). The expenditure of the foreign tourists increased by 20% (from 4.8 to 5.8 billion of euros; Figure 2b); the lower growth with respect to that of nights spent is likely (partially) due to the lower budget of pilgrims with respect to other tourists.

To sum up, the Jubilee is an event that has a high potential for increasing and changing the pattern of development of the hosting city. Indeed, realized infrastructure and investment planned for the Jubilee are facilities that have wider utilizations than those strictly related to sport event, which on the contrary often creates problems of underutilization after the event. Moreover, it lasts over a longer period of time than sport events and consequently might have a more durable impact on tourism and a higher promotion effect.

⁷ We use regional figures because data on investment at the provincial level are not available.

3. Data

The geographical units of analysis are the Italian provinces (NUTS3 level of the European classification of territorial units), corresponding to *counties* in the UK and *departments* in France. In the long temporal window considered in this study the number of provinces has varied over time. In order to have an homogenous partition of the territory across years we re-construct the time series of the variables described below considering the 95 provinces existing since the 1980s (i.e. the beginning of our period of analysis).

We use several outcome variables in order to gauge the effect of the Great Jubilee. First, we employ the *value added per capita*, as a proxy for per capita GDP, and therefore the overall level of economic development. Second, we examine the *employment rate* in order to evaluate the effect on the local labor market. Third, we investigate the *house prices* (also distinguishing between different areas of the city) to capture potential other effects of the investments made in the transport infrastructure and other facilities on the residential market. Finally, we provide some descriptive evidence on the impact on *tourism*.

Our first outcome variable is the value added per capita. Figures on value added at the province level are drawn from the territorial accounts of the national institute of statistics (ISTAT); they represent the official figures on the value added at the local level and are consistent with the national accounts.⁸ Figures are deflated using the national GDP deflator.

Following a rather consolidated approach (Abadie and Gardeazabal, 2003; Barro and Sala-i-Martin, 2004), we include as controls and predictors for the value added per capita: the capital stock per capita, the employment rate, the share of graduates (as proxy for human capital) and the population density (to account for agglomeration economies). In a richer specification we also include the export propensity (i.e. export over value added), the sectoral shares and a proxy of social capital. These variables are both predictors of the value added per capita and might also capture different exposure of each province to external shock depending on the structural characteristics of the

⁸ Data on the value added published by ISTAT cover the periods from 1995 to 2010. Figures from the period 1990 to 1995 are estimated backward using the GDP growth rate estimates by Istituto Tagliacarne (2011).

local economy. The capital stock is drawn from the research institute CRENOS⁹, while other variables mentioned above are mostly drawn from ISTAT.¹⁰

As further outcome variables we also look at house prices that are calculated using data from *Il Consulente Immobiliare*, a semiannual survey conducted for a review published by *Il Sole 24 Ore* media group (Muzzicato et al., 2008). Data on house prices are broken down into two property categories (new and existing) and three locations for each city (center, semi-center and outskirts). The main advantages of this survey are its long time range (starting from mid 60s) and broad territorial reach, as it comprises data on all provincial capitals.

Descriptive statistics on the main variables used in the empirical analysis (and their sources) are reported in Table 1.

4. Empirical strategy

While the financial cost from hosting big events can be reasonably measured, the overall economic impact on the host city is much more difficult to estimate. Ideally one needs to compare the patterns over time in the GDP per capita of the host cities with that of a control group of unaffected cities. However, two main issues make this exercise particularly challenging. First, there are typically few treated units¹¹; this is due to the fact that big events are fairly rare and that comparable data on the host cities are difficult to assemble. Second, big events are often targeted to cities that have peculiar characteristics with respect to other cities (e.g. in terms of size, infrastructures, growth potential, etc.), making the choice of the control group particularly important for a proper policy evaluation exercise.

To address these issues we adopt the synthetic control method for comparative case studies (Abadie and Gardeazabal, 2003 and Abadie et al., 2010). Specifically, we use a combination of other Italian provinces to construct a “synthetic” control that resembles to Rome before the Great Jubilee. The donor provinces used to construct the synthetic control are selected by an algorithm that assigns weights based on donors’ similarity to Rome with respect to relevant covariates and past realizations of the

⁹ These figures are available at the regional level. Province level figures are estimated to be consistent with value added and population at the province level.

¹⁰ Data on human capital and sectoral shares are taken from population censuses conducted by Istat. As censuses are run every 10 years, inter-census data are obtained through interpolation.

¹¹ For example, the difference-in-difference strategy does not perform well when the treated units are few or in the limit only one. This is especially true when considering that the standard errors obtained from such regressions are not corrected for small sample units (Conley and Taber, 2011).

outcome variable. The subsequent evolution of the synthetic control with respect to Rome is used to identify the impact of the Great Jubilee.

Formally, we have a balanced panel with 95 provinces observed from 1980 to 2010. The sample includes Rome that hosted the Great Jubilee in 2000 and other 94 provinces that serve as potential controls. This set of controls units is conventionally called the “donor pool”. Years before 2000 are pre-intervention periods ($T0$) while those after 2000 are post-intervention periods ($T1$). The treatment effect for Rome at time $t \in T1$ is defined as:

$$\tau = Y_{Rome,t}(1) - Y_{Rome,t}(0)$$

where $Y_{Rome,t}(1)$ and $Y_{Rome,t}(0)$ are the Rome’s outcomes with and without the Great Jubilee.

$Y_{Rome,t}(0)$ is not observed and has to be estimated. This is the well-known fundamental problem of causal inference. To address this point, a synthetic control is built as a weighted average of the units in the donor pool. A synthetic control can be represented in our case by a (94×1) vector of weights $W = (w_1, w_2, \dots, w_{94})$ with $w_1 + w_2 + \dots + w_{94} = 1$. The vector W is chosen to minimize the difference between the pre-intervention characteristics of the treated unit and the control units (with more weights, in turn, assigned to those variables that have a large predictive power on the outcome of interest). Therefore, the treatment effect for Rome at time $t \in T1$ is defined as:

$$\tau = Y_{Rome,t}(1) - \sum_{j=1}^{94} w_j Y_{j,t}$$

The synthetic control method has many advantages with respect to traditional regression analysis in terms of transparency and strength of the identification assumptions. On one side, the control group is not chosen arbitrarily but with a transparent data-driven approach. On the other side, only units that are alike in both observed and unobserved determinants of the outcome variable (as well as in the effect of those determinants on the outcome variable) are chosen, thus improving with respect to other statistical techniques traditionally used to refine the control group.¹²

The synthetic control method has been recently applied in many different fields such as, among others, the economics of terrorism (Abadie and Gardeazabal, 2003), political science (Abadie et al., 2015) and the growth-enhancing effects of

¹² For example, propensity score matching is a suitable approach to restrict the donor pool to a subsample of control units more similar to the treated units before the treatment. However, is undoable when there is only one treated unit.

liberalizations (Billmeier and Nannicini, 2013). Interestingly, it seems potentially very well suited for the urban economics and economic geography applications (e.g. Barone and Mocetti, 2014; Gobillon and Magnac, 2016; Peri and Yasenov, 2018).

5. Results

5.1 The impact on the value added per capita

We first consider the value added per capita and we provide simple graphical evidence. In Figure 3 we plot the value added per capita for the province of Rome, all the other Italian provinces and the subset of provinces that are capitals of a regions (i.e. larger cities with administrative duties as Rome) in a 10 years interval before and after 2000. The three lines have a parallel trend although the value added per capita in Rome higher with respect to the national average and to that of the other regional capitals. Moreover, it is possible to detect a slight positive divergence of the value added per capita in Rome in the first half of the 2000s. This simple graphical representation mirrors what we would obtain using a standard difference-in-differences strategy to estimate the impact of the Great Jubilee: the impact is positive and statistically significant when comparing Rome to all the Italian provinces (with an estimated effect around 5%) and not statistically different from zero when comparing Rome with the other regional capitals (Table 2). However we should refrain from the temptation of interpreting this evidence as causal: first, we have just one treated unit; second, the estimated effect varies a lot depending on the chosen control group. Therefore it is important to identify a proper counterfactual having similar structural characteristics and a path in the outcome variable parallel to that of Rome in the period before 2000.

As discussed in the previous section, we address these identification threats using the synthetic control method. The method delivers positive weights for Aosta, Milan, Trento and L'Aquila if we use a parsimonious set of predictors of the value added per capita, and for the same provinces except of Imperia in place of L'Aquila if we use a richer set of predictors (our preferred specification). Weights are reported in Table 3. On the economic ground the choice made by the algorithm is reasonable as most of the cities are capitals of central-northern regions and, therefore, like Rome, they have more administrative duties; Milan is the province with the largest weight and indeed it is a metropolitan area comparable to Rome for size and agglomeration economies.

In Table 4 we report the value added per capita and the growth predictors in the five years before the Jubilee of the treated province (Rome), the average of the entire

set of province in the donor pool, and of the synthetic provinces built using the base and the full set of predictors of the value added growth. As clearly shown, the synthetic provinces closely mimic Rome in terms of value added per capita while the difference with the average province is much higher. Thus, synthetic control seems a good counterfactual of the province of Rome, as far as possible suitable to assess the economic impact of the Jubilee.

In Figure 4 we compare the dynamic of the value added per capita in Rome and in the synthetic control, using two different set of predictors of the outcome variable, over 30 years. The evolution of the outcome variable in the treated and in the (synthetic) control province mostly overlaps until 1999, underscoring the credibility of the synthetic control as a counterfactual estimator. In the aftermath of the Great Jubilee, the trend in the treated region slightly starts to positively diverge from the control unit; however, the positive impact vanishes in the second half of the decade.

In Figure 5 we provide a couple of robustness checks. First, we exclude the province of Milan that has the highest weight in the construction of the synthetic control (left panel); indeed, the synthetic control method usually delivers positive weights for just a few units and one may wonder whether the estimates are sensitive to the particular performance of a single province. The patterns are similar to those observed with our baseline specification: after 2000 we observe a slightly positive effect that however disappears in the second half of the 2000s. Second, we use value added per squared kilometer instead of the value added per capita (right panel). Indeed, the latter reflects both the trends in value added and in population whereas one may want to examine the impact on value added solely, thus we scaled that variable on an exogenous and time invariant variable such as geographical surface of the province. Again we do not find different dynamic patterns between the treated and the synthetic units.¹³

In Figure 6 we replicate the analysis taking 1995 as the year of the treatment: this allows us to take into account that investments in the preparation of the event (and therefore potentially economic spillovers on the local value added) might had started before 2000. As before we use different set of predictors. The results are similar to those of our baseline specification, i.e. the value added per capita in the province of Rome has a similar pattern with respect to that of the control unit with the exception of a temporary positive gap in the first half of the 2000s. These results are not surprising.

¹³ One further potential concern in the context of this study is the potential existence of spillover effects. In particular, it is possible that the Jubilee had effects on value added per capita in provinces other than Rome and, in particular, in provinces that are spatially close. However the other provinces of Latium (i.e. the region of Rome) do not enter with positive weights in the construction of the synthetic control and therefore we do not have this potential source of bias in our exercise.

Indeed, the expenditures for public works (which would influence the GDP on the demand side) were mostly concentrated close to 2000 (and partly even later). Moreover, the effects of public works on the GDP through the increase of the supply side are produced after the completion of the works. Finally, the effect of the Great Jubilee on the city growth can also pass through other channels, such as the arrival of tourists and/or the promotion effect of the event, which are manifested from 2000 on.

As large scale (asymptotic) inference cannot be conducted on synthetic control estimators. Abadie et al. (2010) suggest the use of permutation methods that essentially consist in running placebo studies reassessing the pseudo-effect of the treatment on the untreated comparison units, and compare them to the actual effect on treated unit. In this way, we obtain synthetic control estimates for provinces that did not experience the Jubilee. Applying this idea to each province in the donor pool allows us to compare the estimated effect of the Jubilee on Rome to the distribution of placebo effects obtained for other provinces. We will deem statistically significant the effect of the Jubilee on Rome if the estimated effect for Rome is unusually large relatively to the distribution of placebo effects. For reasons of graphical representation we restrict the analysis to placebo evidence for the largest 35 provinces (those with a population above 500,000 in the year before the Jubilee). Figure 7 (left panel) shows the results of this test. The black line represents the estimated gap between the outcome variable for Rome and the synthetic control; the grey lines denote the same gap for the placebo runs. According to these results, in a confidence interval setting we would conclude that the estimate effect for Rome is not significant at the conventional confidence levels.

Another method to assess the statistical significance of the Jubilee's effect is to look at the RMSPE before and after the event. Figure 7 (right panel) reports the ratios between the post-2000 RMSPE and the pre-2000 RMSPE for Rome and for the other provinces of the placebo studies. The rationale is that a large gap in the value added per capita after the event, between each province and its synthetic counterpart, is not indicative of a significant impact if the gap was large also in the pre-event period, i.e. if synthetic control does not closely reproduce the outcome of interest prior to the event. In our context, a large post-2000 RMSPE is not indicative of a large effect of the Jubilee if the pre-2000 RMSPE is also large. This ratio for Rome is not larger than those obtained for many other provinces in the placebo exercise, and therefore also with this method we can conclude that the effect on value added per capita of the Jubilee was not significant.

5.2 The impact on the employment rate

We move now to the second main outcome variable, the employment rate that for reasons of data availability is observed only from 1993 on. In the Figure 8 we show the employment rate for Rome and for its synthetic counterpart. As before we use two specifications for the synthetic control, one more parsimonious that uses the same variables used before (substituting employment rate and value added per capita as dependent variable and predictor, respectively) and one enriched with sectoral shares, export orientation and social capital. In the more parsimonious specification the synthetic control largely reflect the employment rate of the province of Milan, while in the richer specification the donors are roughly equally represented by the provinces of Imperia, Genoa, Milan and Reggio Calabria.¹⁴ With both specifications we do find a substantial positive effect: in the end of the 2000s, after ten years from the Jubilee, the employment rate in Rome was about 4 percentage points higher than that of its synthetic control.

In Figure 9 we conduct two robustness checks. First, we exclude the province with the higher weight in the construction of the synthetic control (left panel). Second, we use employment density (i.e. employment per square kilometer) instead of employment rate (right panel). In both cases the patterns are qualitatively similar to those observed with our baseline specification.¹⁵

As before we run placebo studies to get some insights on the statistical significance of the estimated impact. Figure 10 (left panel) shows that the black line (representing the estimated effect of the Jubilee for the province of Rome) is large with respect to the distribution of the gaps in the placebo studies. Figure 10 (right panel) reports the distribution of the ratios of post-Jubilee over pre-Jubilee RMPSPE for the 35 largest provinces: Rome clearly stands out in the figure recording the 3rd highest RMSPE ratio. The post-Jubilee gap is about 5 times larger than the pre-Jubilee gap. If one were to pick a province at random from the sample, the chances of obtaining a ratio as high as this one would be $3/35 = 0.086$. Thus we can conclude that the impact of the Great Jubilee on the employment rate of the province of Rome was positive and statistically significant at the 10% level.

¹⁴ The donors with a strictly positive weights are Milan (69%), Palermo (28%) and Reggio Calabria (3%) in the baseline specification and Imperia (31%), Genoa (23%), Milan (20%) and Reggio Calabria (26%) in the richer specification.

¹⁵ Contrarily to the robustness checks performed with the value added per capita, we cannot resort to a cross-validation approach and we cannot replicate the analysis taking 1995 as the year of the treatment because employment statistics are available only from 1993 on.

So far we find that the Jubilee had a positive impact on employment but no effects on the value added: how do we reconcile this apparently contrasting evidence? One hypothesis is that there has been a sectoral shift from high- to low-productivity sectors, a sort of “Dutch disease” effect. In such a case, the expansion of employment rate would be compatible with no changes in value added per capita because of a relative labor productivity loss of Rome. In order to verify this hypothesis we need to examine the dynamic of the sectoral employment. Unfortunately reliable time series for sectoral employment at the provincial level are available from 2000 on and therefore we cannot apply the synthetic control method for each sector.¹⁶ To overcome this limitation we consider the synthetic control built using employment rate as outcome variable and we compare the employment growth of Rome with that of this synthetic counterparts in the period 2000-2010, for the whole economy and for each sector.¹⁷

Figure 11 reports the results of this exercise. Between 2000 and 2010 the overall employment grew faster in Rome than the counterfactual (19% and 14%, respectively), consistent with previous results (top-left panel). About 55% of the difference in the employment growth is attributable to the construction sector, trade activities and hotels and restaurants (top-right panel). Interestingly enough, the sectors with a larger contribution to employment growth in Rome with respect to the synthetic control are also those characterized, at the beginning-of-the-period, by a lower labor productivity (bottom-left panel). Unsurprisingly the implied effect of this sectoral shift to lower-productivity sectors is that the value added per capita in the province of Rome has declined with respect to that of the synthetic control (bottom-right panel). Specifically, after ten years the labor productivity slightly increased in the control unit and, in contrast, it decreased by around 5 percentage points in the province of Rome.

5.3 The impact on the house prices and city attractiveness

The Jubilee was accompanied by a wide set of interventions devoted to the improvement of mobility and requalification of the urban areas. These might have had some effects on the attractiveness of the city and on house prices (Roback, 1982). The requalification of the cultural and building heritage might have a positive effect on house prices, especially downtown where it is mostly located. Moreover, investment in transport infrastructures, by improving mobility and commuting within the city, might

¹⁶ Data are the territorial and sectoral breakdown of the national accounts and are provided by ISTAT.

¹⁷ In unreported evidence we also use the synthetic control built using value added per capita as outcome variable. The results are substantially similar and are available from the authors upon request.

have changed the appeal to reside in the periphery relatively to more central and expensive areas. As a results house demand and prices could have been changed differently between central and peripheral areas.¹⁸ In order to explore these issues we replicate previous analysis using house price as outcome variable and also distinguishing between house prices in the central and in the peripheral areas. Finally, we also provide some descriptive evidence on overall city touristic attractiveness as proxied by expenditure of foreign tourists.

In Figure 12 we report the dynamics of house prices in Rome and its synthetic counterpart before and after the Jubilee, using as before two specifications with a different set of predictors. However, we do not detect any visible impact of the Jubilee on house prices.¹⁹

In Figure 13 we replicate the analysis going beyond city-average prices and allowing differential effects between the house prices of the city center and those of the peripheral neighborhoods. While we continue to find negligible effect on house price for the more central areas, we record a substantial increase of the house prices in periphery of Rome with respect to its synthetic counterpart.²⁰ More specifically, house prices per square meter were about 2,000 Euros in 2000 and increased to nearly 4,000 Euros ten years later; the increase was substantially lower in the peripheries of the other province capitals (from 2,000 to 3,000 Euros). This effect might be plausibly attributed to the improvement of the transport infrastructures realized for the Jubilee.

In Figure 14 we exclude, as robustness check, the province of Milan to examine whether our results are driven by this particular donor. Concerning house prices in the city center (left panel), we find that house price display a relatively larger appreciation with respect to the synthetic control; however the latter does not closely reproduce house price in the city of Rome in the pre-treatment period, thus the reliability of this result in our view is limited. Concerning house prices in the periphery (right panel), our main results are confirmed.

In Figure 15 we consider 1995 (instead of 2000) as the treatment year, as house price might anticipate the expected benefits of the event. However we do not find any

¹⁸ One may also think to congestion effects due to the event (and/or permanent effect due to a positive shift in the arrival of tourists) that might have pushed individuals to relocate in residential suburbs. However, this effect is less plausible as we document that the tourism shock was temporary.

¹⁹ The donors with a strictly positive weights are Genoa (8%), Milan (84%) and Venice (8%) in the baseline specification and Genoa (11%) and Milan (89%) in the richer specification.

²⁰ The province capital used to build the synthetic control are Genoa, Venice and Milan (with the latter weighting about 93%) in the case of house prices in the city centers and Genoa, Milan, Bolzano and Bologna (accounting for 31%, 42%, 10% and 17%, respectively) in the case of peripheral areas.

detectable anticipation effect of the Jubilee on house price while we continue to find a differential effect between city center and periphery after the event.

The analysis of house prices is completed by looking at the statistical significance by using the same methods previously employed. As shown in Figures 16 the results for the central areas are also not significant from a statistical point of view. On the contrary, the estimated impact for the peripheral areas is statistically significant: the black line (that represents the estimated gap for Rome) is larger with respect to the distribution of the gaps in the other placebo studies (bottom-left panel). At the end of the sample period, the estimated gap for Rome ranked 1st out of 35 tests. This indicates that the probability of estimating a larger effect under a random permutation of the treatment is $1/35 = 0.029$. In a confidence interval setting, we would conclude that the estimate effect is positive and significant at a 5% confidence level, though the evidence from the distribution of the ratios of post-Jubilee over pre-Jubilee RMPSPE is somewhat weaker (bottom-right panel).

Supporters of mega event argue that they represent a unique opportunity to promote the city and favorite the tourism venue. Even though Rome represents a standard target for international and domestic tourism, the improvement of the amenities resulting from the Jubilee's interventions might have had a positive long-term impact on tourists' flows and city attractiveness. Therefore, we chose to analyze the effect of Jubilee on tourism expenditure sourced by the Bank of Italy. Expenditure is a nice variable to measure the economic impact of tourism, better than e.g. the number of overnights, but such data have some limitations. First, we observe only international and not domestic tourism expenditure; second, data start from 1997 and this prevents us from applying the synthetic control. Therefore we proceed as follows. First, we select 9 provinces that had similar foreign tourism expenditure over population (i.e. in the interval $\pm 50\%$ with respect to that of Rome) in the three years before the Jubilee: the cities include Aosta, Florence, Forli-Cesena, Gorizia, Imperia, Siena, Trento, Udine and Verona. In Figure 17 we report the dynamics of the per capita tourism expenditure for Rome and for the "similar" provinces. We notice a sharp jump in tourism expenditure for Rome in correspondence of year of the Jubilee, as expected. In the following three years there was a drop in foreign tourists' expenditure, particularly pronounced for the province of Rome: we interpret this evidence as a consequence of the 2001's terrorist attacks in US which affected international touristic flows. In the second part of decade tourism expenditure of Rome returned to values similar to its counterfactual. This descriptive evidence is consistent with a negligible long-term impact of the event on tourism.

6. Conclusions

This paper contributes to the existing literature on the economic impact of the big event by studying the effect of the Great Jubilee of 2000, the most important Catholic event that occurs every 25 years, on the economy of Rome. To address this issue we exploit the synthetic control method and we examine a large set of economic outcomes, such as value added, employment, house prices and tourism over a period of ten years after the event.

According to our findings, the impact of the Jubilee on the value added per capita was negligible. However, we do find instead a positive impact on employment rate and employment growth, though mostly concentrated in sectors with lower skill content, mainly construction and certain branches of services. Coherently with these findings, over the decade we document a labor productivity loss of the city of Rome with respect to the counterfactual. Furthermore, we show that house prices in the peripheral neighborhood increased significantly with respect to what observed elsewhere, likely thanks to mobility and infrastructure investments that increased the attractiveness of certain peripheral areas. Finally, we fail to find any significant impact on tourism expenditure.

A cost-benefit analysis is beyond the scope of the paper, nevertheless, we can relate the costs of the investment to the increase in employment induced by the event – in ten years about 58,000 employees more than the counterfactual. Considering only the projects directly related to the event (costed about 1,88 billions), we get that each extra-employee has costed about 32,000 euros; if we take the overall estimated expenditures (6,5 billions), the costs for an extra-employees goes up to 112,000 euros. It is worth recalling, however, that such investment did not have an impact on per capita value added (proxy of local per capital GDP), because of a productivity loss. The sectoral shift towards less productive branches, that arguably have generated the productivity loss, can be considered an unintended consequence of the mega-event under scrutiny.²¹

The Jubilee is a unique mega-event, thus policy implications of the analysis are not straightforward. Differently from other events the city that hosts it has no competitors and in many cases the Jubilee spurs the realization of projects already planned. In any case, we believe that the variety of the projects realized (which has no comparison), the amount of resources involved, together with the capacity to attract

²¹ Similar unfavorable structural shifts are documented also for economies that become too dependent on low-productive services, such as those linked to tourism (see Copeland 1991 and the so-called “beach disease”).

huge flows of tourists, make the study interesting to derive policy implications also for other types of mega-events. On the whole, we believe that the experience was beneficial for the city's labor market (and to some extent to the house prices in the peripheries), but also that the overall costs were not negligible and that the event failed to create sustained growth in per capita GDP of the city over the medium-long term. Therefore, as documented in other studies (Baade and Matheson 2016), the results of our analysis suggest not to overestimate the economic benefits of hosting mega-event.

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Tables

Table 1. Descriptive statistics

<i>Variable definition [source]</i>	<i>Mean</i>	<i>Std. dev.</i>
Value added per capita [Tagliacarne + ISTAT: territorial accounts]	20.327	5.772
House prices per square meter [Il Consulente Immobiliare]	1.755	807
Capital stock per capita [estimated from CRENOS]	127.491	51.376
Employment rate [ISTAT: Labor Force Survey]	0,553	0,093
Population density [ISTAT]	234,2	315,9
Share of graduated [ISTAT: census]	0,064	0,023
Share of agriculture [ISTAT: census]	0,009	0,007
Share of industrial sector [ISTAT: census]	0,286	0,105
Share of construction sector [ISTAT: census]	0,087	0,022
Share of trade sector [ISTAT: census]	0,229	0,036
Share of private service sector [ISTAT: census]	0,147	0,039
Share of public sector [ISTAT: census]	0,243	0,068
Share of small firms (<50 employees) [ISTAT: census]	0,705	0,062
Export over value added [ISTAT]	0,164	0,125
Social capital: first principal component [various sources]	0,001	1,505

Data refers to Italian provinces observed from 1980 to 2010; linear interpolation is used to impute missing values between census years; monetary values are expressed in euros (constant price 2010). The indicators used to extract the first principal component as proxy of social capital are referendum turnout [Ministry of Interior], share of no profit [ISTAT: census], corruption [Golden and Picci] and blood donation [AVIS].

Table 2. Difference-in-difference estimates

<i>Dependent variable:</i>	<i>Log of value added per capita</i>	
Rome × post-2000	0.047***	0.012
	0.008	0.016
Province FEs	YES	YES
Year FEs	YES	YES
Sample	all provinces	region capitals
# observations	2,945	651

Panel data, where the dependent variable is the log of value added per capita and the variable of interest is the interaction term between the dummy variable for Rome and that for years after 2000. The specification, as in a traditional difference-in-difference setting, also includes province- and year-fixed effects. The model in the first column includes all Italian provinces while that in the second column includes only region capitals (i.e. larger and more comparable provinces). Standard errors clustered at the province level in parenthesis; *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Donors

<i>Province</i>	<i>Weight (base)</i>	<i>Weight (full)</i>
Aosta	0.100	0.152
Imperia	0.000	0.086
Genoa	0.000	0.002
Milan	0.511	0.567
Bergamo	0.184	0.000
Trento	0.096	0.194
L'Aquila	0.109	0.000
Other provinces	0.000	0.000

The weights of the synthetic controls are chosen to minimize the distance with the province of Rome in terms of value added per capita and predictors of its subsequent growth; the weights refers to the provinces that are used to build the synthetic control using a parsimonious or a richer set of predictors, respectively. Base specification includes capital stock per capita, employment rate, share of graduates and population density; full specification adds export orientation, sectoral shares and social capital.

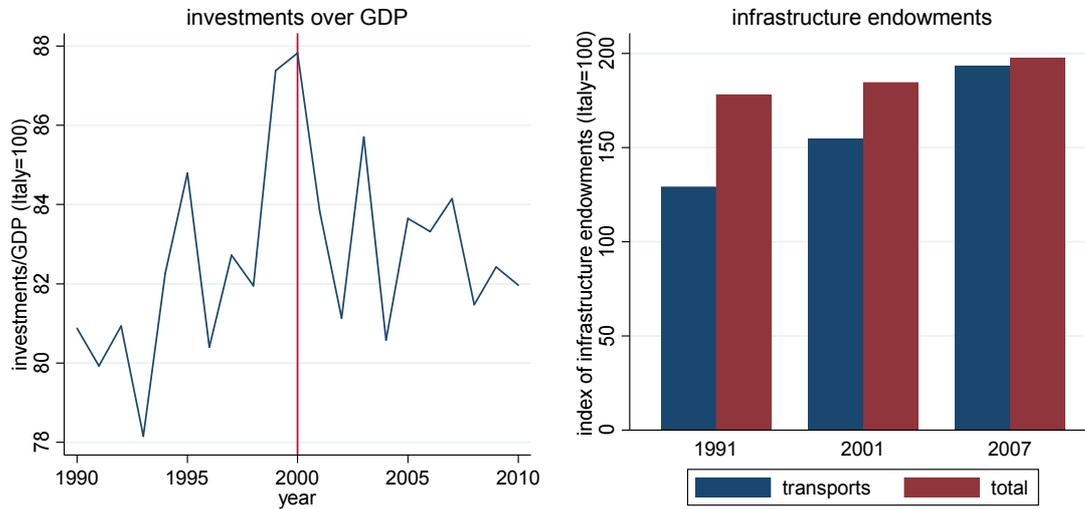
Table 4. Balancing properties

<i>Variable:</i>	<i>Rome</i>	<i>Italy</i>	<i>Synthetic province (base)</i>	<i>Synthetic province (full)</i>
Value added per capita	30,661	21,107	30,817	30,827
Capital stock per capita	220,680	141,248	233,639	231,939
Employment rate	0.511	0.522	0.579	0.588
Population density	695,8	232,6	822,1	834,3
Share of graduated	0.096	0.052	0.063	0.066
Share of industrial sector	0.109	0.266	0.293	0.246
Share of construction sector	0.059	0.088	0.084	0.082
Share of private service sector	0.530	0.390	0.427	0.464
Share of public sector	0.300	0.247	0.193	0.204
Export over value added	0.040	0.148	0.198	0.173
Social capital	-0.032	0.001	0.691	0.715

Data refers to the mean over the five years before the Great Jubilee (1995-1999); the figures for the base and the full synthetic province refers to the weighted average of the same variables for the subsample of provinces that are used to build the synthetic control using a parsimonious or a richer set of predictors, respectively. Base specification includes capital stock per capita, employment rate, share of graduates and population density; full specification adds export orientation, sectoral shares and social capital.

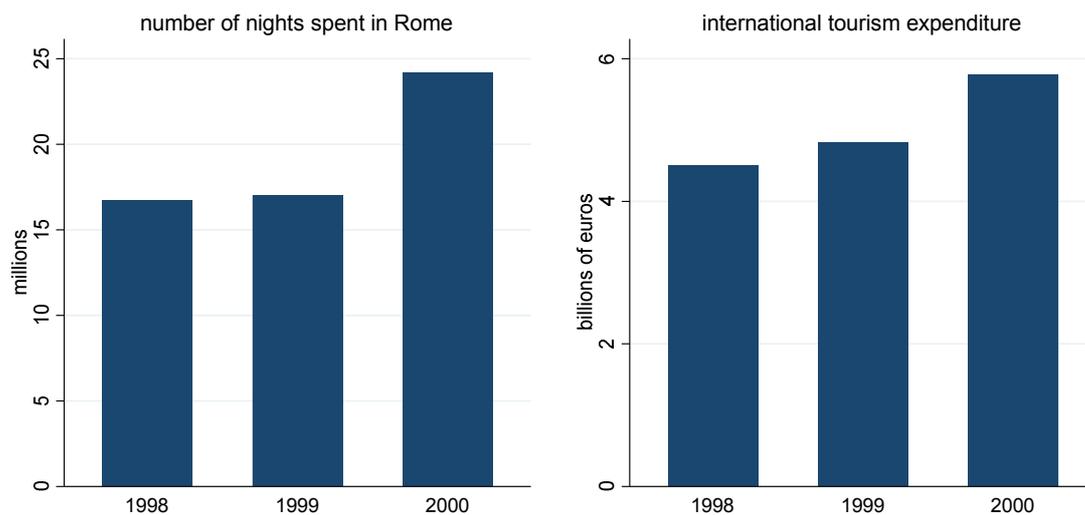
Figures

Figure 1. Investment rate and infrastructural endowments



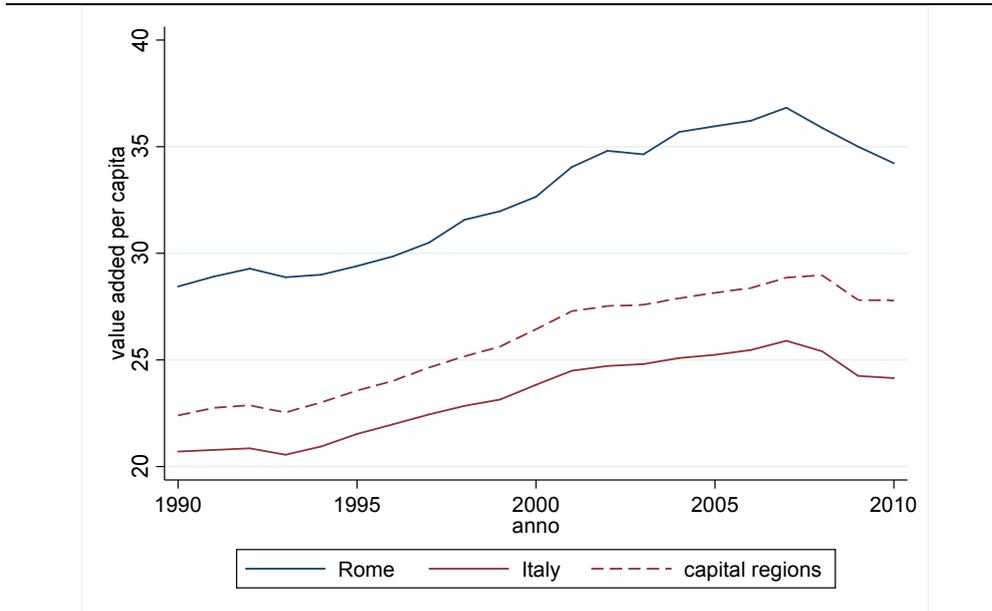
Investment over GDP for Latium (relative to Italy) in the left panel (3-years average) and index of infrastructural endowments for the province of Rome (relative to Italy) in the right panel; transport infrastructures include rail, railroads, port and airport; total infrastructures include also other economic and social infrastructures (e.g. financial, health and education infrastructures endowments). Data are drawn from ISTAT territorial accounts (investment at the regional level) and from *Istituto Tagliacarne* (infrastructure endowments at the province level).

Figure 2. Tourism effect in the year of the Jubilee



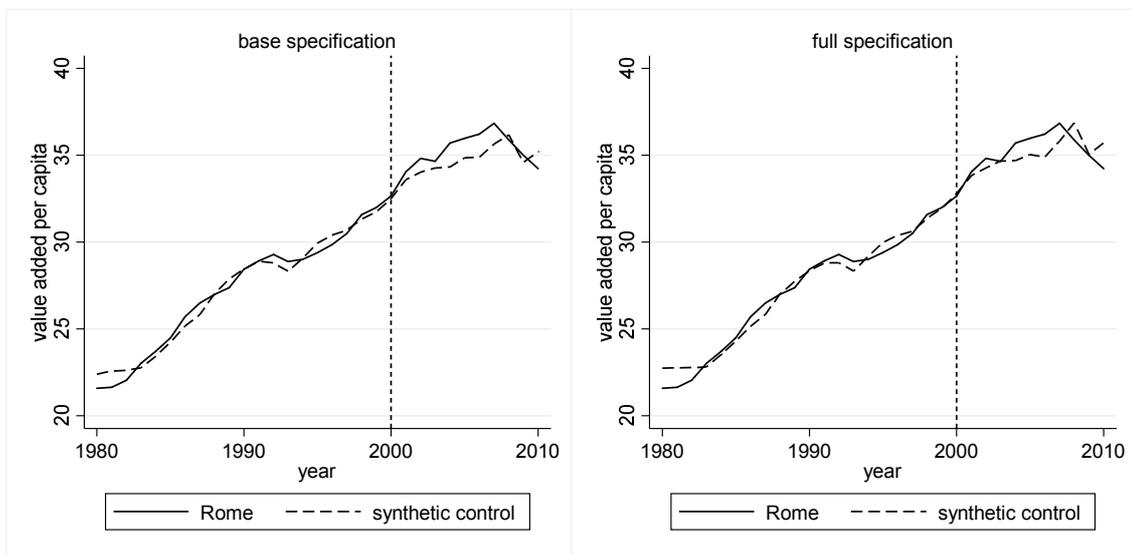
Number of nights spent (left panel) and international tourism expenditure (right panel). Figures are drawn from ISTAT and Bank of Italy.

Figure 3. Descriptive evidence



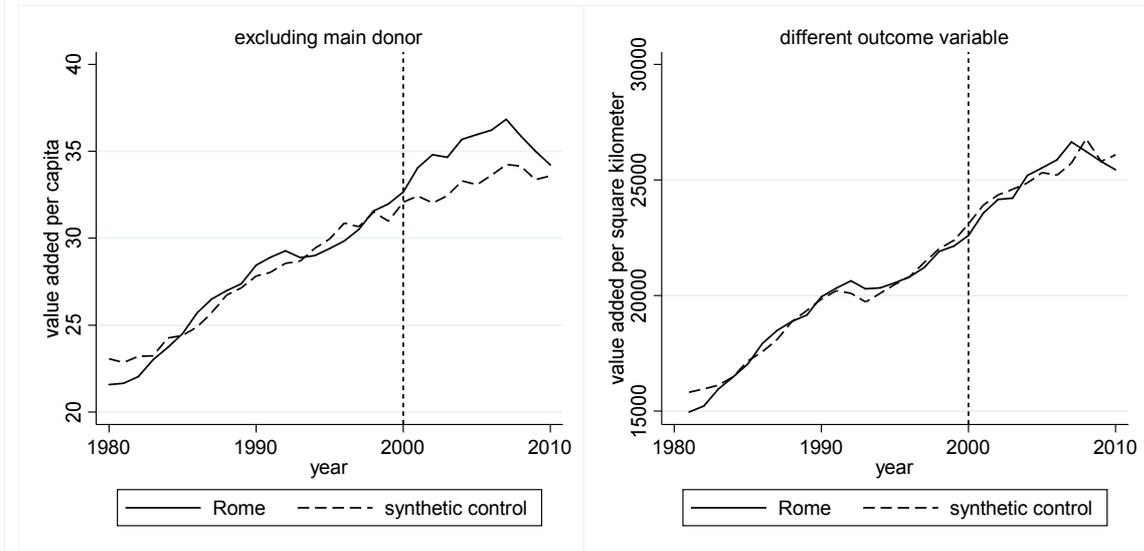
Value added per capita of the treated province (Rome) and of other samples of Italian provinces, before and after 2000.

Figure 4. The impact on the value added: baseline



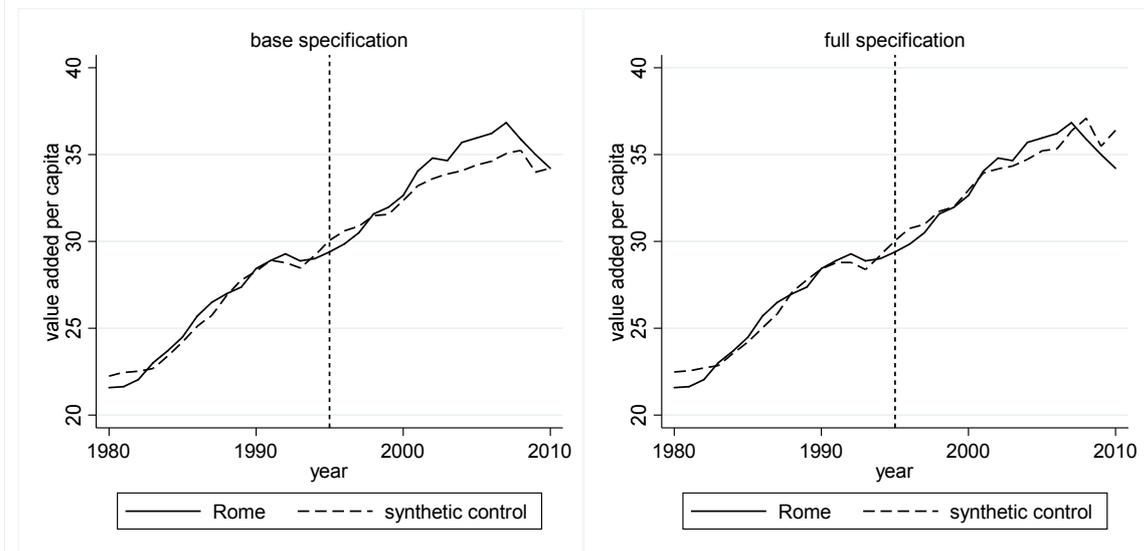
Value added per capita of the treated province (Rome) and of the synthetic control built using a base specification (left panel) and a full specification (right panel). Base specification includes capital stock per capita, employment rate, share of graduates and population density; full specification adds export orientation, sectoral shares, and social capital. The weights used to build the two synthetic controls are presented in Table 3.

Figure 5. The impact on the value added: robustness



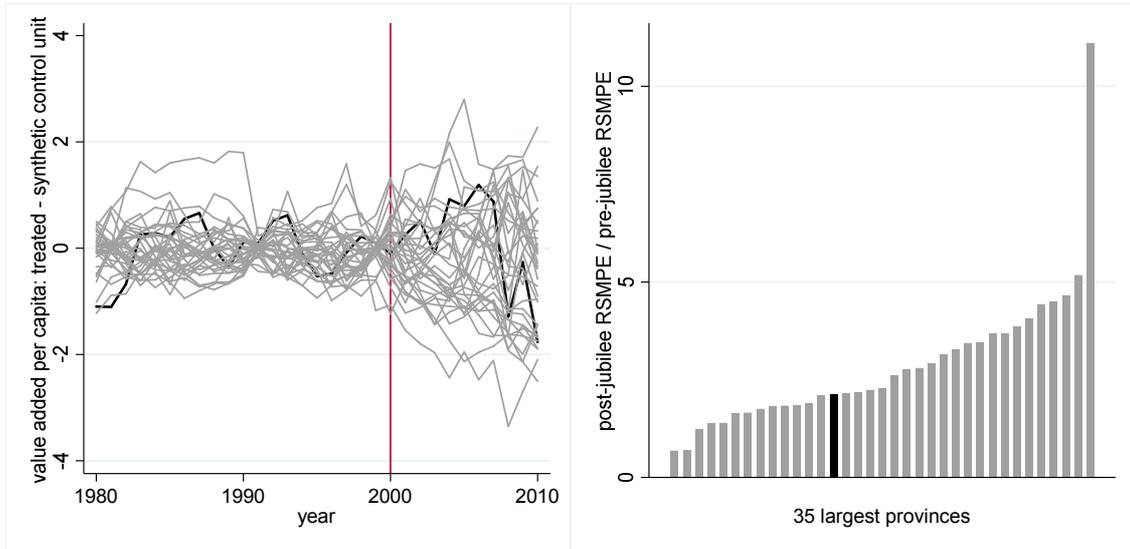
Value added per capita of the treated province (Rome) and of the synthetic control built using a specification excluding the province of Milan (left panel) and using valued added per square kilometer (instead of per capita) as outcome variable (right panel). Each specification includes among predictors capital stock per capita, employment rate, share of graduates, population density, export orientation, sectoral shares and social capital.

Figure 6. The impact on the value added: anticipation effect



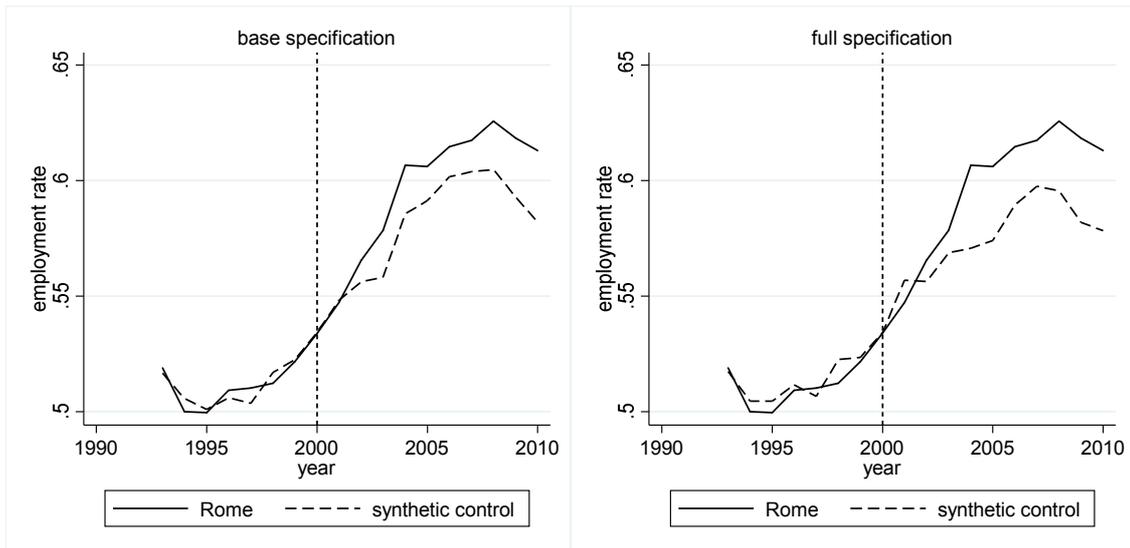
Value added per capita of the treated province (Rome) and of the synthetic control built using a base specification (left panel) and a full specification (right panel). Base specification includes capital stock per capita, employment rate, share of graduates and population density; full specification adds export orientation, sectoral shares, and social capital. The year of the treatment is assumed to be 1995.

Figure 7. The impact on the value added: inference



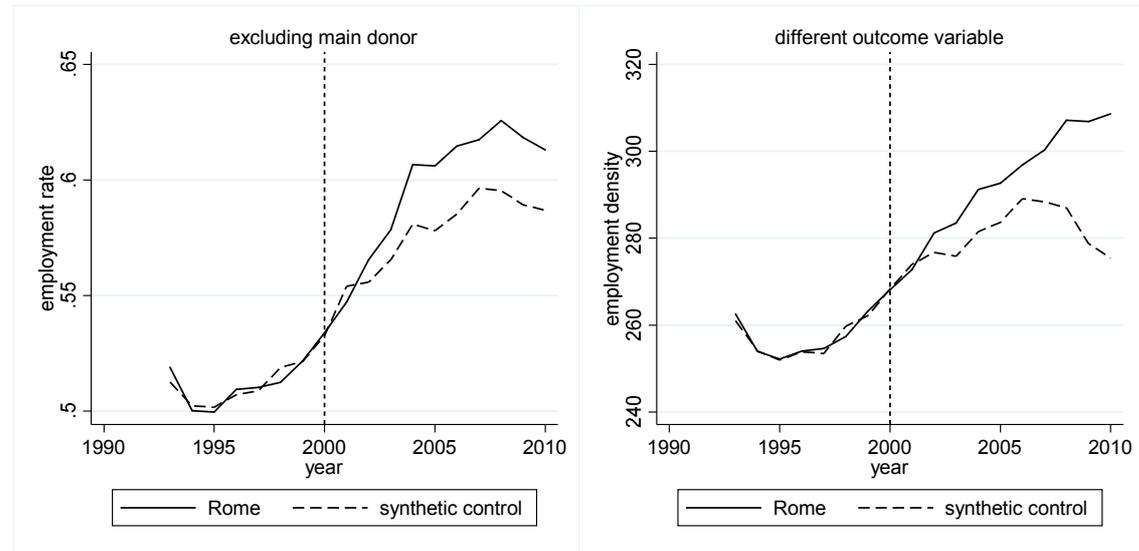
The figures contain inference analysis for the synthetic control method: the left panel shows placebo gaps, i.e. the differences between the outcome in the treated (placebo) units and in the corresponding synthetic units; the right panel shows the post/pre-Jubilee RSMPEs, i.e. the ratios between the root squared mean prediction errors after and before the Great Jubilee for each treated (placebo) units. We consider Rome (the black line in the left panel and the darker bar in the right panel) and 35 control provinces (those with a population above 500,000 before 2000) as placebo.

Figure 8. The impact on employment: baseline



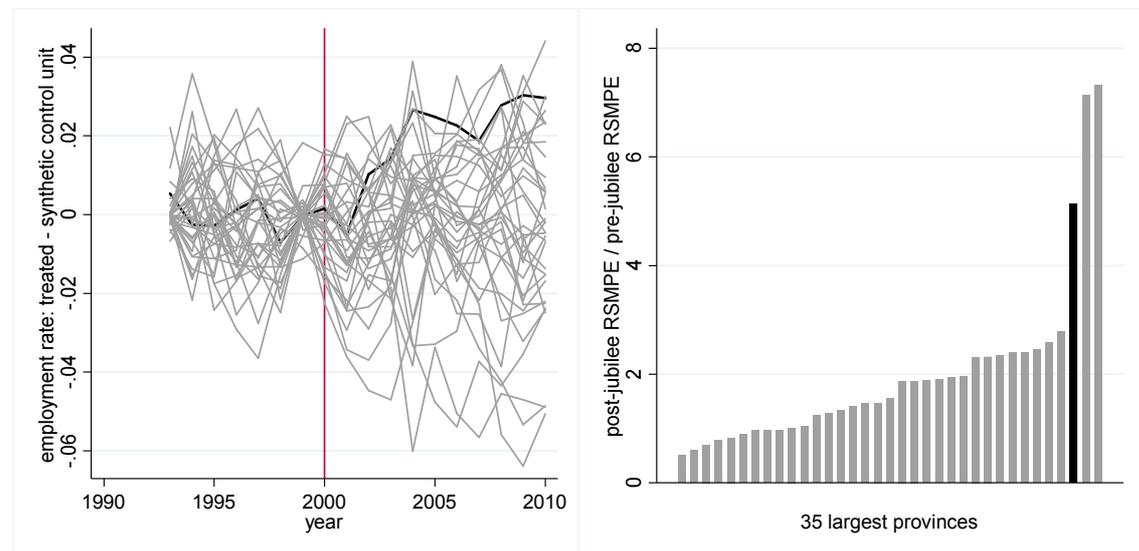
Employment rate of the treated province (Rome) and of the synthetic control built using a base specification (left panel) and a full specification (right panel). Base specification includes value added per capita, capital stock per capita, share of graduates and population density; full specification adds export orientation, sectoral shares and social capital.

Figure 9. The impact on employment: robustness



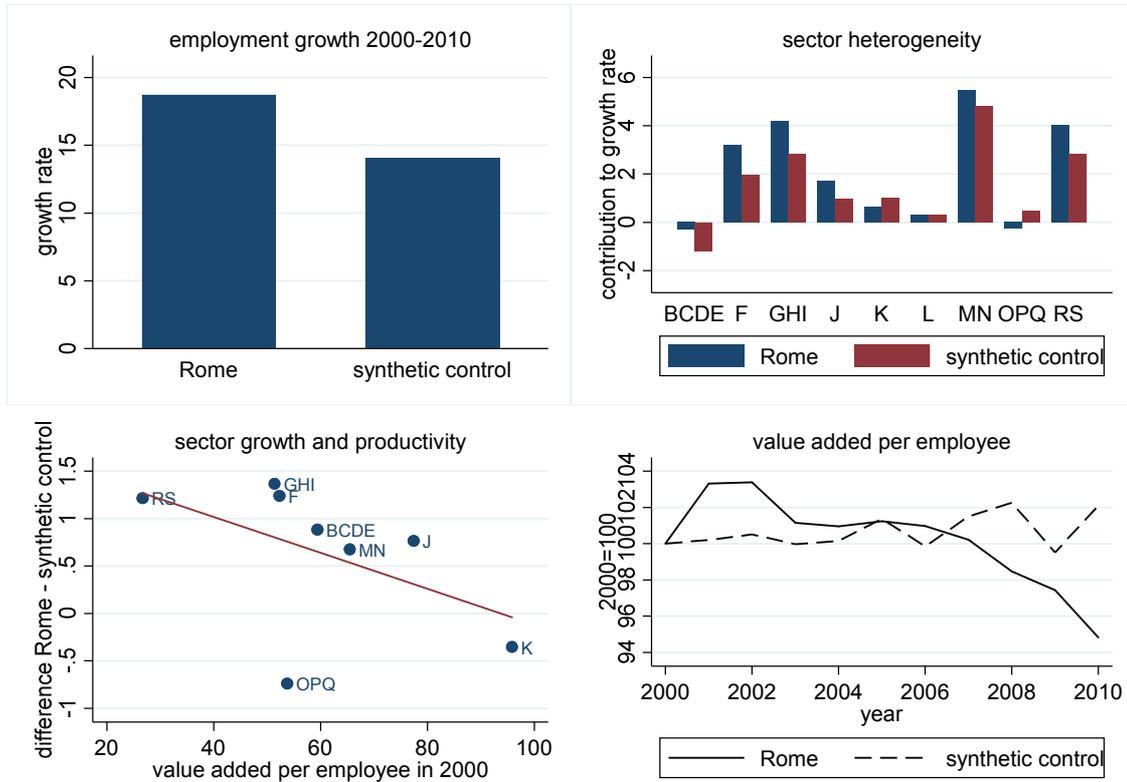
Employment rate of the treated province (Rome) and of the synthetic control built using a specification excluding the province of Imperia (left panel) and using employment density (instead of employment rate) as outcome variable (right panel). Each specification includes among predictors value added per capita, capital stock per capita, share of graduates, population density, export orientation, sectoral shares and social capital.

Figure 10. The impact on employment: inference



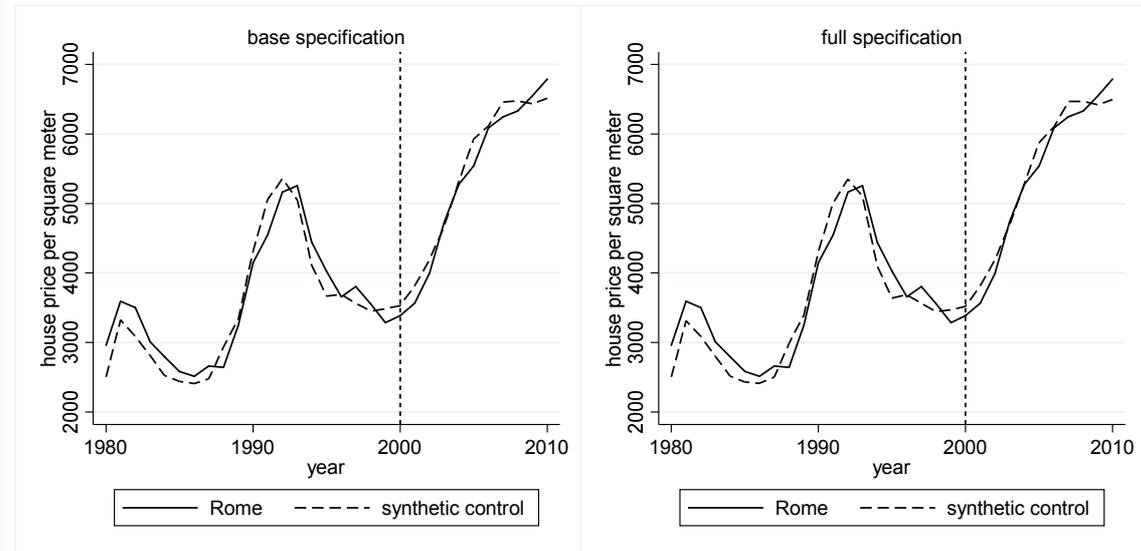
The figures contain inference analysis for the synthetic control method: the left panel shows placebo gaps, i.e. the differences between the outcome in the treated (placebo) units and in the corresponding synthetic units; the right panel shows the post/pre-Jubilee RSMPEs, i.e. the ratios between the root squared mean prediction errors after and before the Great Jubilee for each treated (placebo) units. We consider Rome (the black line in the left panel and the darker bar in the right panel) and 35 control provinces (those with a population above 500,000 before 2000) as placebo.

Figure 11. The impact on employment: sector differences and productivity



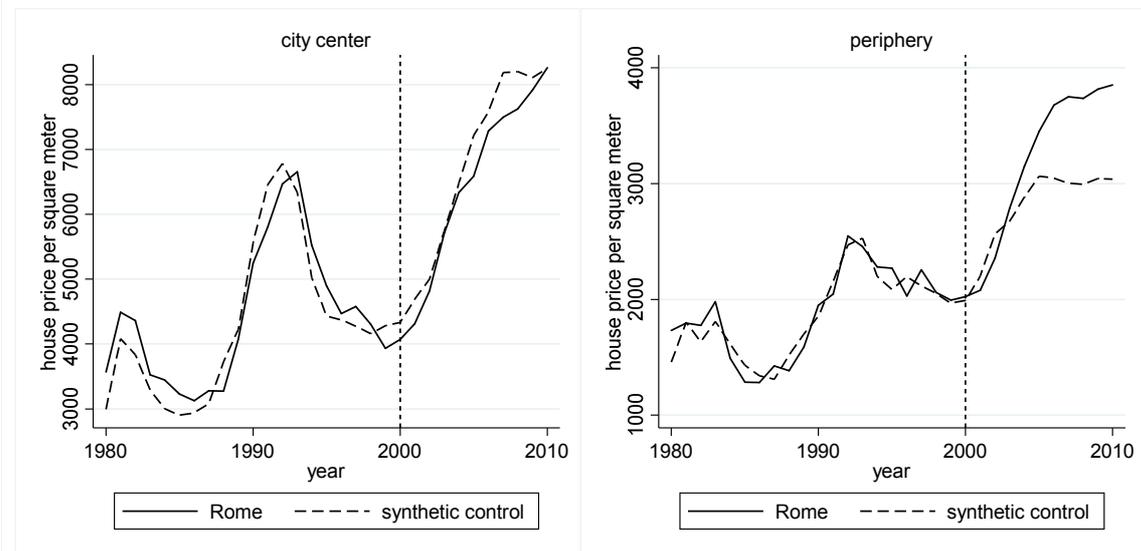
Employment growth, with sectoral breakdown, for the province of Rome and its synthetic counterpart. NACE sector classification: B = mining and quarrying; C = manufacturing; D = electricity, gas, steam and air-conditioning supply; E = water supply, sewerage, waste management and remediation; F = construction; G = wholesale and retail trade, repair of motor vehicles and motorcycles; H = transportation and storage; I = accommodation and food service activities; J = information and communication; K = Financial and insurance activities; L = real estate activities; M = professional services; N = administrative and support service activities; O = public administration; P = education; Q = health; R = arts, entertainment and recreation; S = other services.

Figure 12. The impact on house price: baseline



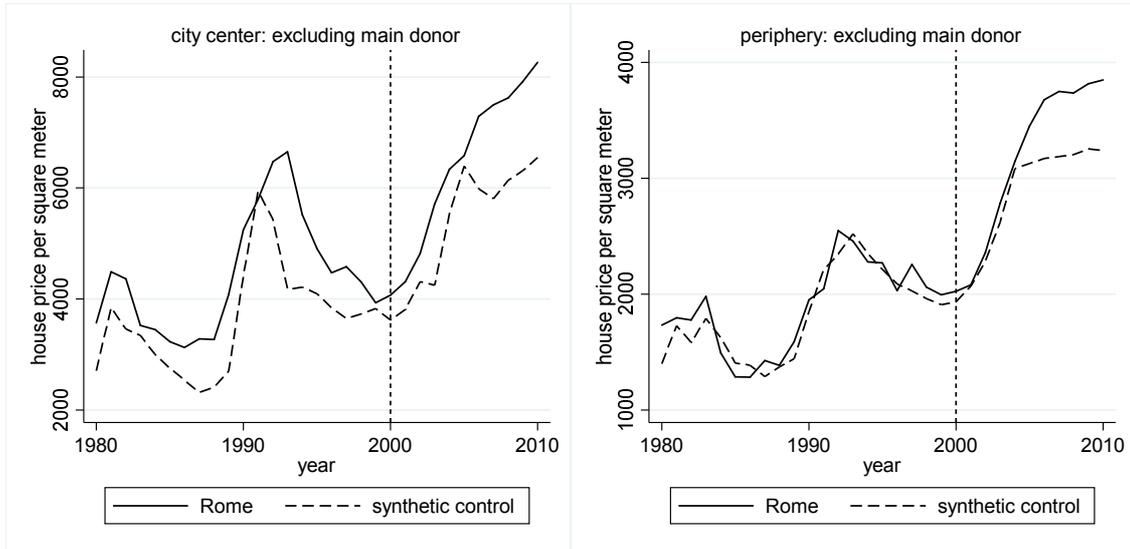
House price per square meter of the treated province (Rome) and of the synthetic control built using a base specification (left panel) and a full specification (right panel). Base specification includes value added per capita, employment rate, share of graduates and population density; full specification adds export orientation, sectoral shares and social capital.

Figure 13. The impact on house price: center vs. periphery



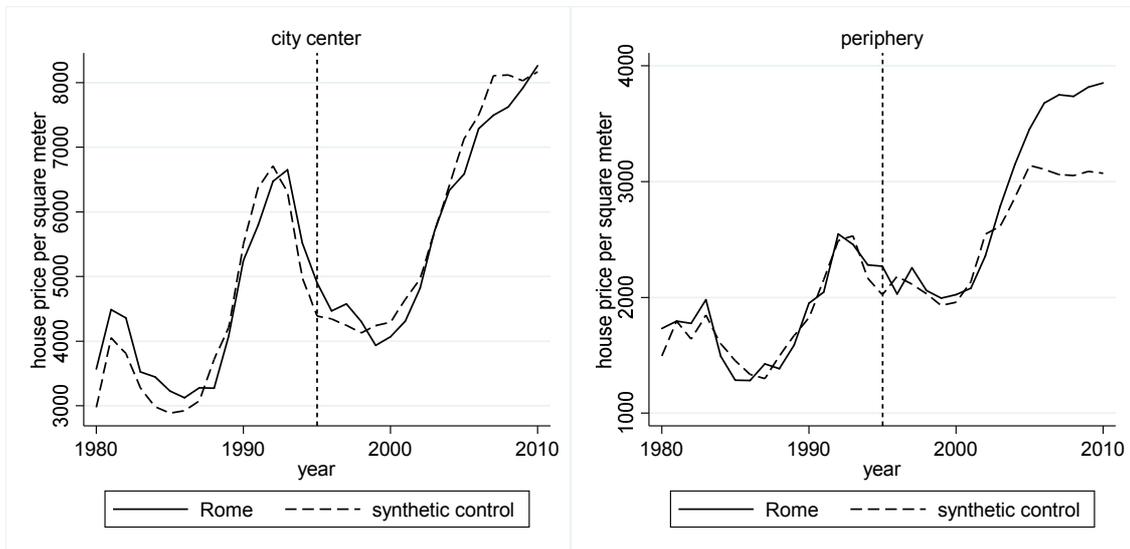
House price per square meter in the center (left panel) and in the periphery (right panel) of the treated province (Rome) and of the synthetic control. Each specification includes value added per capita, employment rate, share of graduates, population density, export orientation, sectoral shares and social capital.

Figure 14. The impact on house price: robustness



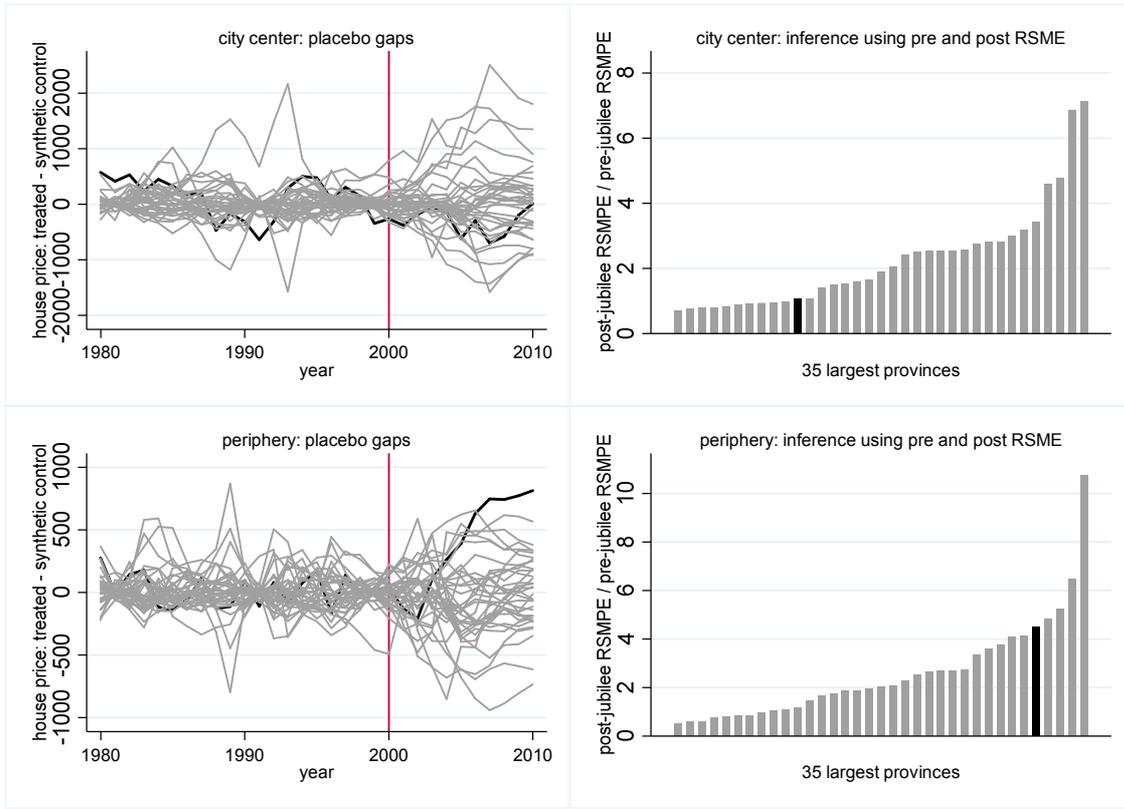
House price per square meter in the center (left panel) and in the periphery (right panel) of the treated province (Rome) and of the synthetic control. In both models we exclude the main donor. Each specification includes value added per capita, employment rate, share of graduates, population density, export orientation, sectoral shares and social capital.

Figure 15. The impact on house price: anticipation effect



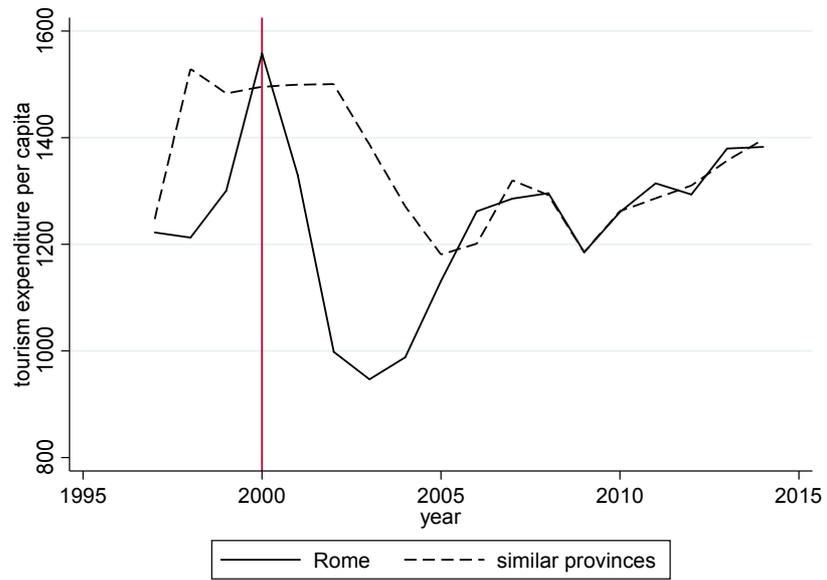
House price per square meter of the treated province (Rome) and of the synthetic control built using a base specification (left panel) and a full specification (right panel). Base specification includes value added per capita, employment rate, share of graduates and population density; full specification adds export orientation, sectoral shares and social capital. The year of the treatment is assumed to be 1995.

Figure 16. The impact on house price: inference



The figures contain inference analysis for the synthetic control method: the left panel shows placebo gaps, i.e. the differences between the outcome in the treated (placebo) units and in the corresponding synthetic units; the right panel shows the post/pre-Jubilee RSMPEs, i.e. the ratios between the root squared mean prediction errors after and before the Great Jubilee for each treated (placebo) units. We consider Rome (the black line in the left panel and the darker bar in the right panel) and 35 control provinces (those with a population above 500,000 before 2000) as placebo. The two graphs on the top refer to house prices in the city center while the two graphs on the bottom refer to house prices in the peripheral areas.

Figure 17. Tourists expenditure



Expenditure of foreign tourists (over population) for the province of Rome and for a group of similar provinces (see the text for further details).

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