The Impact of the Olympic Games on Employment Growth: A Synthetic Control Approach

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Abstract

The Olympics Games stand as the largest sporting event in the world. The Games include approximately 200 countries during the Summer Olympic Games and 90 countries competing in the Winter Games, each occurring once every four years. Potential host cities fiercely compete to host the games under the guise of economic prosperity. Event promoters claim substantial economic benefits, such as employment growth, to be had from hosting these costly games. This paper examines the impacts of the Olympic Games on employment growth rates using a synthetic control approach. Results show transitory increases in employment growth rates following a county being awarded the Olympic Games in Fulton County, GA and Salt Lake County, UT. Results also indicate a decrease in employment growth rate in Los Angeles County, CA due to being awarded the 1984 Summer Olympic Games. Transitory increases in employment growth rates coupled with transitory decreases in the employment growth rate in Los Angeles County suggests that potential hosts should proceed with caution when considering hosting the Olympic Games.

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1 Introduction

Potential hosts fiercely compete to host the Olympic Games, the largest sporting event in the world, in part because of expected economic growth generated by hosting the mega-event. Hosting the Olympic Games costs billions of dollars, a portion of which taxpayers subsidize. For example, public funds accounted for $115 million, in 2018 dollars, of the cost of the 1984 Summer Olympics in Los Angeles, $920 million for the 1996 Summer Olympics in Atlanta, and nearly $2 billion for the 2002 Winter Olympics in Salt Lake City (US General Accounting Office, 2000). The Games cost $761 million in Los Angeles, $4.3 billion in Atlanta, and $2.6 billion in Salt Lake City overall (Flyvbjerg et al., 2016). Host cities use claimed economic benefits resulting from the Olympic Games to justify subsidizing the cost of hosting the Olympic Games. The exorbitant cost of hosting the Olympic Games, and taxpayer subsidization of these costs, makes assessing the tangible economic benefits generated by hosting the Games an important topic.

The claimed benefits from hosting the Olympic Games includes long-term employment growth. Employment growth potentially occurs due to construction associated with the Olympic Games venues and other Olympic-related construction like new hotels and transportation infrastructure. The International Olympic Committe (IOC) requires host areas to have more than 40,000 hotel rooms for the Summer Olympics and nearly 24,000 hotel rooms for the Winter Olympics, an Olympic village capable of housing all participating athletes, and for sport venues to meet their requirements (Baade and Matheson, 2016). Construction projects undertaken to meet these requirements potentially generate increases in local employment. A persistent increase in tourism as a result of hosting the Games represents an additional mechanism for sustained employment growth. If an influx of tourism occurs after the Games, the local labor force will expand to accommodate the increase in tourism. This potential local increase in employment growth serves as the focus of this study.

Previous literature assessed the impact of the Olympic Games on employment growth in the host area, finding inconclusive results. Hotchkiss et al. (2003) and Hotchkiss et al. (2015) found a large, persistent increase in employment growth in Atlanta, GA due to hosting the 1996 Summer Olympic Games. In contrast, Feddersen and Maennig (2013a) revisited the studies and found no impact on overall employment growth in a reply to Hotchkiss et al. (2003). Feddersen and Maennig (2013b)

found only an increase of 29,000 jobs in July 1996, when the Olympic Games were being held, in only Fulton County (the county in which Atlanta is located). Games promoters estimated that the 2002 Winter Olympic Games in Salt Lake City would generate 36,000 job-years of employment. However, the Games increased employment by 4,000–7,000, with this increase dissipating quickly (Baumann et al., 2012b).

Prior research on the economic impact of the games primarily uses either an event study framework comparing outcomes in the host city before and after the Games or a difference-in-differences approach with a relatively small control group. Hotchkiss et al. (2003) use counties within Georgia that did not hold an Olympic event as their control group, while Baumann et al. (2012b) use states adjacent to Utah for example. The synthetic control method (Abadie and Gardeazabal, 2003; Abadie et al., 2010, 2015) represents a reasonable alternative approach to analyzing the economic impact of the Games.

The methodology utilized in this paper follows the approach used by Islam (2019) to examine the impact of introducing an National Football League (NFL) team to a metropolitan statistical area (MSA) on local employment growth. The methodology differs from Islam (2019) by analyzing county-level employment growth, a smaller geographic impact area, and focusing on the Olympic Games. The counties analyzed include Los Angeles County (1984 Summer Games), Fulton County (1996 Summer Games), and Salt Lake County(2002 Winter Games). Essex County, the host of the 1980 Winter Olympic Games, is excluded due to its small size and limited data in the pre-treatment period. The fixed boundaries of counties makes county level analysis preferable to MSAs due to changes in the boundaries of MSAs over time.

Like Feddersen and Maennig (2013b) and Baumann et al. (2012b), the synthetic control results in this paper show that the 1996 Summer Olympic Games in Atlanta and the 2002 Winter Olympic Games in Salt Lake City caused transitory increases in employment growth. Atlanta experienced the largest impact, experiencing an increase in employment growth in several years between being selected to host the Games and hosting the Games. Salt Lake City experienced an increase in only the year following selection to host the Games. The Summer Olympic Games, a much larger event than the Winter Olympic Games, partially explains the smaller impact in Salt Lake County relative to Fulton County. The synthetic control results also show evidence of a negative economic impact from the 1984 Summer Olympic Games in Los Angeles after being awarded hosting rights but two

years prior to hosting the Games.[1]

This paper makes several contributions to the literature. The results show that hosting the Olympics can either increase or decrease employment growth, but these effects are transitory. This paper contains the first evidence of a decrease in employment growth due to hosting the Olympics. Previous literature finds either positive or no impact. The causal evidence of a transitory employment impact due to the 1996 Olympics developed here provides clarity to the debate between Hotchkiss et al. (2003, 2015) and Feddersen and Maennig (2013a). The synthetic control method represents a casual inference method not previously used to examine the impact of the Olympic Games. The introduction of this casual inference method advances the literature.

2 Hosting the Olympic Games: Process and Impacts

The process of hosting the Olympic Games begins nearly a decade before the Games occur in a specific area. The host city selection process involves many steps. Consider, for example, the selection process for the Games of the XXVI Olympiad, informally known as the 1996 Summer Olympic Games, in Atlanta, Georgia. Atlanta submitted their bid as a potential US candidate city for the 1996 Games to the United States Olympic Committee (USOC) in September 1987. 13 other US cities submitted bids to the USOC. The USOC reduced the field from 14 to two, Atlanta and Minneapolis-St.Paul, with Atlanta being selected as the US candidate city in April 1988.

Atlanta then competed with cities selected by National Olympic Committees (NOCs) around the world, including Athens, Greece; Toronto, Canada; Melbourne, Australia; Manchester, Great Britain; and Belgrade, SFR Yugoslavia, for the rights to host the 1996 Games. The following year, IOC members visited each candidate city before holding a vote to select the host city in 1990. Voting consisted of five rounds, with the city receiving the lowest number of votes in each round being eliminated from consideration. Atlanta defeated Athens, Greece 51-35 in round five of voting to become the host of the 1996 Olympic Games (Atlanta Committee for the Olympic Games, 1997). The Winter Olympics follows a similar selection process.

After the awarding of hosting rights, the NOC forms a local Organizing Committee for the Olympic Games (OCOG), and dissolves the OCOG after the Games occur. OCOGs receive local,

[1]Multiple studies utilize the synthetic control method to show transitory impacts (Eren and Ozbeklik, 2016; Kreif et al., 2016; Tirunillai and Tellis, 2017).

state, and federal government subsidies in order to put on the Games. The size of the subsidies depend on the amount of funding the OCOG receives from the IOC and the availability of private funding. The budget of the OCOG primarily includes operating costs of the Games, while the host city is largely responsible for infrastructure (Humphreys and Howard, 2008).

IOC voting on the host city of the Games generally follows the format discussed above, with one notable exception. Only one city, Los Angeles, placed a bid to host the 1984 Olympic Games. The lack of interest in hosting the 1984 Olympics stemmed from events surrounding Games prior to 1984, including violence and financial losses. Mexico City experienced violence and protests in 1968. Eleven Israeli Olympic athletes were killed by terrorists in Munich in 1972. The 1976 Summer Olympic Games in Montreal cost nearly 10 times more that budgeted leading to a debt that took thirty years to eventually pay down. Denver won the rights to host the 1976 Winter games in 1970 but a 1972 referendum on public subsidization of the games failed and the games moved to Innsbruck, Austria. Los Angeles agreed to host following the IOC guaranteeing any losses and confirming the adequacy of the city's existing sports infrastructure for Olympic events (Zimbalist, 2016, pp.1).

From 1960-2016, sports-related costs averaged $5.213 billion for the Summer Olympics, and $3.112 billion for the Winter Olympics, in 2015 US dollars (Flyvbjerg et al., 2016). Non-sport infrastructure, security, opening ceremonies, and other spending add to the total cost of hosting the Games. An extravagant opening ceremony alone cost nearly $350 million at the 2008 Summer Olympic Games in Beijing, China. Security costs soared following terrorist attacks throughout the US on September 11, 2001. Athens estimated security costs at $400 million in their initial bid to host the 2004 Summer Olympic Games, submitted before 9/11. The final cost ballooned to approximately $1.5 billion (Zimbalist, 2016, pp.42–43). Of the more than $13 billion spent hosting the 2016 Summer Olympic Games in Rio de Janeiro, non-sport related infrastructure accounted for $8.2 billion (Associated Press, 2017). Total expenditures to host the Olympics reached as high as $40 billion for 2008 Summer Olympics in Beijing, and $50 billion for the 2014 Winter Olympics in Sochi (Zimbalist, 2016, pp.2).

The Olympic Games represent a major investment undertaken by host cities. Proponents of hosting the Games claim that the events will generate an array of positive outcomes, both socially and economically, in the host area. Opponents claim that there can be negative outcomes, and

the positive impacts that do exist are not large enough to warrant the high cost of hosting these events.[2]

Pride and prestige associated with hosting the Olympics potentially generates an uplifted mood in the host area. Smith (2009) argues for the presence of a connection between hosting mega sporting events and an increase in mental health in the local community. Hosts often believe that hosting the Olympics also generates an increase in physical activity, but Bauman et al. (2013) suggest that physical activity increases much less than projected, or not at all. Atkinson et al. (2008) conduct a willingness to pay (WTP) study to estimate the value of intangible benefits of hosting the London Olympic Games, finding an aggregate household WTP of nearly $2 billion. Atkinson et al. (2008) state that, given that economic studies generally show negligible or negative impacts, this WTP represent a credible approach to assessing the public choice problem of hosting the Olympics. This WTP pales in comparison to the actual cost of the London Games to taxpayers. Of the $14.6 billion it cost to host the 2012 Olympic Games in London, $4.4 billion came from taxpayers (Schwarz, 2015).

Prestige associated with hosting the Olympic Games potentially makes the host a more desirable destination for tourists. Kang and Perdue (1994) found an increase in tourism in South Korea following the 1988 Olympics. The increase peaked in the year following the Games and dissipated in the following years. Giesecke and Madden (2011) found no induced tourism impacts as a result of the 2000 Olympic Games in Sydney, Australia. Induced tourism represents a mechanism for a persistent increase in employment.

Negative impacts such as increases in crime in the host area arise as well. Baumann et al. (2012a) found that the Olympic Games led to a 10% increase in property crime. Hosting the Olympics or other mega-events, such as the World Cup, can cause political unrest due to hosting being unpopular among local residents. This occurred in Brazil prior to hosting the 2014 World Cup; widespread political unrest occurred in Brazil during the Confederations Cup. The Confederations Cup, an international soccer competition held the year prior to the World Cup (in 2013 in the case of Brazil), drew over a million Brazilian protesters to the streets. Protesters disproved of the government spending $15-20 billion for hosting the 2014 World Cup. The protests continued as the World Cup approached. Many Brazilian cities experienced strikes by police and teachers, among

[2]Potential impacts and an assessment of literature are discussed in Scandizzo and Pierleoni (2018).

other workers, in the run-up to the World Cup (Zimbalist, 2016, pp.2).

Hosting the Olympic Games requires large infrastructure investments. In addition to the construction of new sport facilities, the Games also require investment in the surrounding area on non-sport related infrastructure. The Olympic Games potentially draw substantial tourism activity, and hosts must be equipped to handle the increased inflow of visitors. This infrastructure requirement could be beneficial, potentially boosting employment growth due to construction. Additionally, the claimed increases in tourist activity could increase in employment in tourism related industries.

Employment growth represents the economic outcome of interest in this study for two primary reasons. First, mixed results on the impact of the Olympic Games on employment in the literature makes this study necessary to add clarity. Second, the strict infrastructure requirements for hosting the Olympic Games dictated by of the IOC makes an increase in local construction activity almost certain to occur. This increase in construction activity potentially leads to increased employment growth, although it could simply crowd out other local construction projects.

3 Literature Review: Olympic Economic Impact

A substantial literature exists studying the impact of the Olympic Games on employment, yielding inconsistent results. Studies focusing on the 1996 Olympic Games in Atlanta provide an interesting set of conflicting results. Hotchkiss et al. (2003) compare counties near Olympic venues to those not near Olympic venues in Georgia finding a persistent increase in employment due to hosting the 1996 Olympic Games. Feddersen and Maennig (2013a) questioned this positive impact on multiple grounds, with a focus on accounting for pre-treatment trends and the treatment period used. Maennig and Fedderson find no significant increase in employment associated with hosting the 1996 Games after accounting for local time trends. They also perform numerous nonparametric tests in lieu of the standard differences-in-differences model tests, again finding no effect.

Hotchkiss et al. (2015) revisited the topic of their initial paper in response to Feddersen and Maennig (2013a). Hotchkiss et al. (2015) again found evidence that employment growth in Georgia counties near Olympic venues outpaced growth in other Georgia counties. Hotchkiss et al. (2015) reported positive impacts from hosting the Olympics, but at a lower magnitude than their original

paper. In this study they find a smaller impact, 11%. Their comparison of MSAs in Georgia that hosted the Olympics to similar MSAs throughout the southern United States provides their most convincing evidence. Results indicate that MSAs hosting the Olympics outpaced employment gain in other southern states by 5%.

Baade et al. (2002) highlight the importance of the time period studied on results, finding an employment increase of approximately 3,500 to 43,000 from the 1996 Olympics in Atlanta depending on the period examined. Baade et al. (2002) found that much of the expenditures on the Games occurred in 1994 and 1995. Their estimate coincides with the increase of 37,000 jobs projected in Atlanta by Humphreys and Plummer (1995).[3]

Feddersen and Maennig (2013b) conducted an additional study examining mega-events and sectoral employment using the 1996 Olympic Games. They analyzed monthly data for 16 different sectors using a nonparametric approach to isolate any employment effects. Their results show a slight boost in employment, but no evidence of a persistent shift in employment growth. Fulton County (the county in which Atlanta is located) experienced an increase of 29,000 jobs in July 1996 when the Games took place. Three sectors of the economy accounted for the increase retail trade; accommodation and food services; and arts, entertainment, and recreation.

Baumann et al. (2012b) further studied the impact the Olympics on employment growth by analyzing the 2002 Winter Olympics in Salt Lake City, UT relative to outcomes in adjacent states. They found an increase in employment substantially lower than estimated by promoters. Promoters estimated an increase of 35,000 job-years while Baumann et al. (2012b) find an increase of 4,000-7,000 jobs using a control group of states adjacent to Utah. Like Feddersen and Maennig (2013b), the leisure industry accounted for the increase in employment and the effect dissipated after a year. Considering the mixed results on the impact of the Games on local employment growth, slight job growth appears associated with hosting the Olympic Games, but at a magnitude much less than claimed ex ante and dissipating quickly.

Research on the economic impacts of hosting the Games extends beyond employment growth. Rose and Spiegel (2011) find a "robust, permanent and large" increase in exports as a result of

[3]Humphreys and Plummer (1995) estimated an increase of 77,000 jobs in all of Georgia. With 48% of Georgia's population residing in Atlanta, Humphreys and Plummer (1995) claims that 48% of the employment growth would occur in Atlanta. This translates to an increase in approximately 37,000 jobs occurring in Atlanta. With arguably more than 48% of Olympic spending occurring in Atlanta this forecast is likely understated.

hosting the Olympics. Results indicate that countries placing an unsuccessful bid experienced a similar impact. Maennig and Richter (2012) reexamined this peculiar result, finding no impact on exports when using an appropriate matching and treatment methodology, suggesting that results in Rose and Spiegel (2011) may suffer from selection bias.

Baade et al. (2010) assessed the impact of the 2002 Winter Olympic Games in Salt Lake City on local taxable sales. They used quarterly taxable sales data from 1982 through 2006 and estimated an auto-regressive-moving-average (ARMA) model. The overall impact of hosting Olympics, based on impacts estimated for several different local sectors, showed a net negative effect on taxable sales. While hotels, and eating and drinking establishments experienced gains, losses elsewhere outweighed these gains leading to a net loss of $167.4 million. Similarly, in a study analyzing the impact of the 2000 Summer Olympic Games in Sydney Australia, Giesecke and Madden (2011) found that the Olympics generated a loss in real consumption of $2.1 billion.

The research on the economic impact of another mega-event warrants discussion: the World Cup, the largest soccer tournament in the world. Baade and Matheson (2004) study the impact of the 1994 World Cup hosted by the United States using income data from 1970-2000 to estimate the effect of hosting the Games on income growth. Baade and Matheson (2004) compared predicted growth to actual growth in each city that hosted a match. Nine of the thirteen US cities that hosted World Cup matches experienced growth lower than the predicted value, indicating an economic loss from hosting the event. The combined losses total up to $9.26 billion compared to the ex ante estimate of $4 billion in benefits.

Mega-events such as the Olympic Games and World Cup are high cost/low reward investments. Positive economic impacts are generally low, if existing at all. Matheson (2012) discuss that the economic impacts of hosting the mega-events may be even lower for developing countries. Hosting mega-events can allow politicians to clear political hurdles to invest in infrastructure, but this comes with paying a large price for unproductive sports infrastructure. Further reviews of the literature can be found in Scandizzo and Pierleoni (2018) and Baade and Matheson (2016).

4 Empirical Analysis

4.1 Data & Methodology

Data come from the Bureau of Economic Analysis (BEA) Regional Economic Accounts CAINC30 dataset. CAINC30 data includes variables reflecting annual population, per capita income, and employment at the county level over the 1969-2016 period. Population estimates come from the Census Bureau's annual (July 1) midyear population estimates. The BEA uses this population estimate to calculate per capita income. BEA compiles data on the county employment level including full-time and part time jobs. Conversion of data from levels to growth rates, as in Islam (2019), leaves an analysis data set covering 1970-2016.

To examine the impact of the Olympic Games on county employment growth, I use the synthetic control. The synthetic control method appears throughout the economic literature analyzing local employment growth (Munasib and Rickman, 2015; Peri and Yasenov, 2015), as well as in sports economics (Islam, 2019; Pyun, 2018), and in research analyzing overall economic conditions (Grier and Maynard, 2016). Synthetic control creates a synthetic version of the treatment area to provide a counterfactual. The control group provides a comparison to assess the impact of an event or policy. The synthetic version of the treated counties in this study are constructed using a weighted average of other U.S. counties in a donor pool of counties with observable characteristics similar to treated counties that hosted the Games. Donor pools exclude counties contiguous to treated counties and counties that also competed to host the Olympic Games.

The data contains observations for a total of T years. $1, ..., (T_0 - 1)$ constitutes the period before treatment occurs and $T_0, ..., T$ the post-treatment period. The treatment occurs in year T_0. The donor pool consists of $J + 1$ counties, $j = 1, 2, 3, ...J + 1$ defined so that county 1 is treated. The synthetic control method chooses a vector of optimal weights, W^*, for each county in the donor pool that minimizes

$$\sum_{m=1}^{k} v_m (X_{1m} - X_{0m} W)^2 \tag{1}$$

where X_{1m} represents a vector of predictor variables for the treated county (Abadie and Gardeazabal, 2003; Abadie et al., 2010, 2015; Pyun, 2018). X_{0m} represents a (kxj) vector of predictor

variables for counties in the donor pool and j indexes the number of counties in the donor pool. v_m reflects the weight, showing the relative importance assigned to the mth variable when measuring the difference between X_1 and X_0. Each W^* is bounded between 0 and 1, and the total weights must sum to 1.

The synthetic control method selects a weight v_m that minimizes the root mean square prediction error (RMSPE). The RMSPE for Olympic hosting counties is defined as

$$RMSPE = \left(\frac{1}{T_0} \sum_{t=1}^{T_0} \left(Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt} \right)^2 \right)^{1/2} \tag{2}$$

where Y represents the outcome variable. RMSPE measures statistical fit between outcomes in the treated and synthetic county, with a lower RMSPE indicating a better fit. A high post-treatment RMSPE indicates a lack of fit in the post-treatment period, suggesting important impacts in treated counties. Comparison of post-treatment and pre-treatment RMSPE shows the credibility of any impacts found. A large post-treatment RMSPE does not indicate a large impact of treatment the pre-treatment period also has a large RMSPE, as no discernible difference between the pre-treatment and post-treatment periods exist. Therefore, a high post-treatment to pre-treatment ratio indicates a potentially larger impact from treatment (Abadie et al., 2015).

The synthetic control method requires identifying a donor pool of counties that did not receive the treatment. The counties included in the donor pool generate the synthetic control group based on pre-treatment data. Using all US counties as the donor pool poses a problem as the donor pool will contain many counties with little similarity to the treated county. To correct for this, the donor pool excludes counties with large differences in population compared to the treated county. The donor pool includes counties with populations larger than 1,000,000 for Los Angeles County, populations between 500,000 and 1,000,000 for Fulton County, and populations between 500,000 and 1,250,000 for Salt Lake County. Robustness checks show results are not sensitive to using alternative population criterion for identifying the donor pool.

The construction of a synthetic county follows Islam (2019) who analyzed the impact of National Football League teams appearing in US cities. Islam (2019) found no evidence of positive employment growth effects from new NFL teams. The overall average population growth and per

capita income growth during the pre-treatment period, as well as select years of the outcome variable employment growth, Y, construct the synthetic control county. Employment growth every five years before treatment is used for construction when able to do so. Kaul et al. (2015) warn against using all past values of the outcome variable to construct the synthetic control group, as this results in all other predictors having no contributing weight. Kaul et al. (2015) recommends using one lag for the outcome variable and from the year prior to treatment. Although three lags of employment growth are used here, results remain similar when using only one year of employment growth (see Appendix A).

I define the treatment year as the year in which the IOC awards the rights to host the Olympic Games, not the year when the Games occur. Construction of infrastructure related to hosting the Olympic Games takes place between the awarding of the games and the staging of the event and could potentially generate employment impacts. Construction reasonably begins shortly after the awarding of the rights to host the Games. Feddersen and Maennig (2013a) consider the second quarter of 1990 as the beginning of the treatment period when analyzing impact of the 1996 Olympic Games in Atlanta. Baade et al. (2002) found that much of the impact from the 1996 Olympic Games occurred in 1994 and 1995, with smaller impacts occurring in years prior. This highlights the importance of including the entire period after gaining the rights to host the Games in the treatment period. Using this treatment year, the treatment period begins approximately 6-7 years before the Games occur. The specific treatment years are 1978 for Los Angeles County, 1990 for Fulton County, and 1995 for Salt Lake County.

Placebo tests act as sensitivity tests to identify significant impacts on employment growth due to the Olympic Games. In this approach, every county in the donor pool receives a placebo "treatment" as if the county hosted the Olympic Games. Placebo tests compare placebo counties to the county that actually hosted the Olympics. When employing placebo tests, the time path of the outcome variable for the placebo treatments should not significantly deviate from their synthetic counterpart. A large portion of the donor units exhibiting similar impacts to the treated unit in the placebo test calls any initial synthetic control results into question (Abadie et al., 2010).

Cunningham (2018) discusses constructing p-values based on the placebo tests. After assigning placebo treatments to counties that did not host the Olympic Games, post-treatment to pre-treatment RMSPE ratios are calculated. Where the treated county's post-treatment to pre-

treatment RMSPE ratio ranks among the placebo counties is used to calculate a p-value. Consider Los Angeles County as an example. The post-treatment to pre-treatment RMSPE ratios for Los Angeles County and the 19 other counties donor counties are calculated following the placebo test. Los Angeles County's ratio of 3.4614 ranks third out of 20 counties, yielding a p-value of 0.15 (i.e. 3/20).

4.2 Results: The Olympic Games and Employment Growth

Figure 1 presents results for the synthetic control method applied to county employment growth generated by hosting the three Olympic Games. The upper panel shows results for the 1984 Summer Olympics in Los Angeles County, the middle panel the 1996 Summer Olympics in Fulton County, and the bottom panel the 2002 Winter Olympics in Salt Lake County. In each panel a dashed vertical line identifies the treatment year, the year in which the IOC awarded the host the Olympic Games, and a solid vertical line identifies the year in which the Olympic Games occurred. The solid vertical line highlights any impacts experienced around the year the Games occurred, either through construction taking place close to the Games, or job creation due to increases in tourism.

Table 1 shows the counties that contribute to the synthetic Los Angeles County. Middlesex County, MA, a county in Boston containing Cambridge, MA, represents the largest contributor at 0.266. Bronx County, NY follows at 0.239, and Santa Clara County, CA at 0.212. Table 2 shows predictor balance and root mean square prediction error for this case. Average population growth, average income growth, and three select years of employment growth select the synthetic Los Angeles County[4]. Treatment occurred in 1978, so the three years of employment growth rates used include 1970, 1974, and 1977. From Table 2, Los Angeles County and Synthetic Los Angeles County exhibit good predictor balance. Each predictor variable utilized shows little or no difference between real and synthetic Los Angeles County. While a ratio of post-treatment to pre-treatment RMSPE well above 1 suggests a potentially significant impact from hosting the Olympics, a p-value of 0.15 suggests no persistent shift in the post-treatment time path of employment growth.

Results in Figure 1 indicate a potential negative impact on employment growth rate in Los Angeles County after being awarded the Olympic Games. The gap between actual and synthetic

[4]While Islam (2019) selects the three years in five year increments. Here a shorter time span between years is used due to data beginning in 1970.

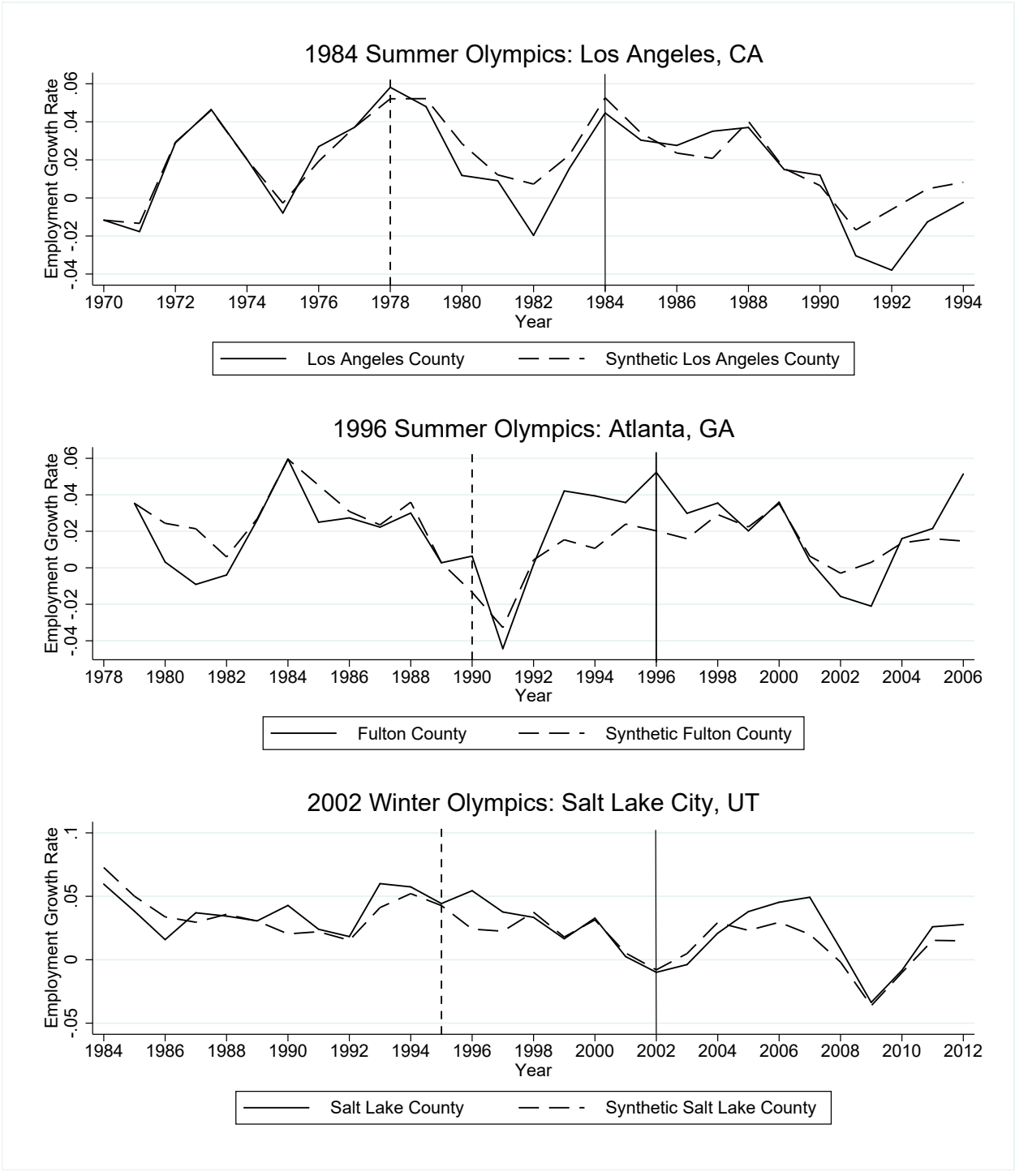

Figure 1: Impact of the Olympic Games on Employment Growth: Actual vs Synthetic

Table 1: Synthetic Control Weights: Los Angeles County

County	Weights
Middlesex County, MA	0.266
Bronx County, NY	0.239
Santa Clara County, CA	0.212
King County, WA	0.163
San Diego County, CA	0.121

Table 2: Predictor Balance and RMSPE: Los Angeles County

Predictor Variables	Actual	Synthetic
Population Growth	0.0046	0.0046
Income Growth	0.0757	0.0765
Employment Growth(1970)	-0.0117	-0.0116
Employment Growth(1974)	0.0202	0.0203
Employment Growth(1977)	0.0371	0.0371
Model Fit Pre-treatment		
Pre-treatment RMSPE		0.0040
Post-treatment/Pre-treatment RMSPE		3.4614
p-value		0.15

RMSPE=Root Mean Squared Prediction Error

Los Angeles appears negative from 1979-1985 with the largest gap occurring in 1982. In 1982 employment in synthetic Los Angeles County grew at a rate of 0.7% while Los Angeles County experienced a decline in employment growth of -2%. A p-value of 0.15 indicates no persistent impact on employment growth. However, a high post-treatment to pre-treatment RMSPE ratio, in addition to results shown in Figure 1 suggest a negative transitory effect on employment growth in Los Angeles County.

Reduced employment growth is a potentially surprising result given the legacy of the 1984 Summer Olympic Games, which were generally regarded as a success. Prior to Los Angeles being awarded the 1984 Summer Olympic Games, no city wanted to be the host, following a series of tumultuous Olympic Games. With the IOC offering a guarantee to cover any losses, and Los Angeles having some appropriate infrastructure in place to host the Games, the city agreed to host. The 1984 Games proved to be one of the most financially successful Games in history, turning a modest profit of $215 million (Zimbalist, 2016, pp.1). The financial success of the 1984 Games spurred renewed competition to host the Olympics in the following years.

The synthetic control results indicate that this financial success came with high costs econom-

ically, in terms of a loss in employment growth. An excess demand for building materials and construction labor induced from hosting the Olympic Games can explain lower output in a tight labor market. In a tight labor market, induced labor demand will not lead to additional output, but instead cause reallocation of scarce resources towards the Olympic Games-related economic activity.

Next, consider the results from the 1996 Summer Olympic Games in Atlanta (Fulton County). Table 3 shows the synthetic control weights following the methods described in Section 4.1. Essex County, MA, which lies adjacent to Boston, represents the largest contributor at 0.42. Montgomery County, MD, a county adjacent to Washington D.C. and the most populous county in Maryland, follows at 0.355.

Predictor balance and RMSPE are presented in Table 4. Predictor balance indicates a good fit with nearly identical population growth, per capita income growth, and employment growth in treated and synthetic Fulton County. A high p-value of 0.5384 indicates no persistent shift in employment growth, but a post-treatment to pre-treatment RMSPE ratio greater than one suggests the potential for transitory impacts.

Table 3: Synthetic Control Weights: Fulton County

County	Weights
Essex County, MA	0.42
Montgomery County, MD	0.355
Fairfield County, CT	0.169
Duval County, FL	0.038
DuPage County, IL	0.017

Table 4: Predictor Balance and RMSPE: Fulton County

Predictor Variables	Actual	Synthetic
Population Growth	0.0120	0.0118
Income Growth	0.0883	0.0882
Employment Growth (1979)	0.0354	0.0353
Employment Growth (1984)	0.0596	0.0595
Employment Growth (1989)	0.0028	0.0027
Model Fit Pre-treatment		
Pre-treatment RMSPE		0.0139
Post-treatment/Pre-treatment RMSPE		1.2955
p-value		0.5384

RMSPE=Root Mean Square Prediction Error

The middle panel of Figure 1 shows the time path of actual employment growth in Fulton County and synthetic Fulton County. Overall actual employment growth lies above synthetic employment growth following treatment through 1997, with the exception of 1991 and 1992. The largest gaps between the actual and synthetic employment growth occur between 1993 and 1997. This increase coincides with the construction of Centennial Olympic Stadium. Construction of Centennial Olympic Stadium started in 1993, on July 10th, with completion and opening of the stadium occurring on May 18th, 1996 (Atlanta Committee for the Olympic Games, 1997). Hosting the Olympics seems to have had a temporary positive impact on employment growth in Fulton County, particularly in the lead up to, and hosting of, the 1996 Summer Games. The largest gap occurs the year Fulton County hosted the Games, when Fulton County outpaced synthetic Fulton County by 3.2 percentage points. Synthetic Fulton grew at a rate of 2% and Fulton County grew at 5.2%. Fulton County experienced large impacts in 1993, and 1994 as well, with employment growth more than doubling in comparison to synthetic Fulton County. While Fulton County experiences significant short-term employment growth, the impact appears to dissipate by 1998.

The 2002 Winter Olympic Games in Salt Lake City serves as the final US Olympics analyzed studied. Like Atlanta, Salt Lake City faced competition to become the host of the Olympic games, prevailing over bids from Quebec City, Quebec, Canada; Sion, Switzerland; and Östersund, Sweden (Baade et al., 2010). Table 5 shows the synthetic control weights. Pima County, AZ, which contains Tuscon, represents the largest contributor at 0.485. DuPage County, IL, a county adjacent to Chicago, follows at 0.364. Oklahoma County, OK, location of the state capital Oklahoma City, contributes 0.146.

Table 6 reports predictor balance and RMSPE. The closeness of predictor variables between Salt Lake County and synthetic Salt Lake County indicates a good fit. As in Fulton County, a high p-value of 0.4737 indicates no persistent shift in employment growth, but a post-treatment to pre-treatment RMSPE ratio greater than one suggest the potential for transitory impacts.

Table 5: Synthetic Control Weights: Salt Lake County

County	Weights
Pima County, AZ	0.485
DuPage County, IL	0.364
Oklahoma County, OK	0.146
Macomb County, MI	0.004

Table 6: Predictor Balance and RMSPE: Salt Lake County

Predictor Variables	Actual	Synthetic
Population Growth	0.0181	0.0181
Income Growth	0.0521	0.0524
Employment Growth (1984)	0.0596	0.0727
Employment Growth (1989)	0.0307	0.0305
Employment Growth (1994)	0.0574	0.0521
Model Fit Pre-treatment		
Pre-treatment RMSPE		0.0115
Post-treatment/Pre-treatment RMSPE		1.1625
p-value: RMSPE		0.4737

RMSPE=Root Mean Square Prediction Error

The the bottom panel on Figure 1 shows the time path of actual employment growth in Salt Lake County and synthetic Salt Lake County. Employment growth rates in Salt Lake County and synthetic Salt Lake County lie close to one another following treatment, with the exception of 1996 and 1997. In 1996 and 1997 Salt Lake County grew at a rate of 5.4% and 3.7% while synthetic Salt Lake County grew at 2.4% and 2.2%, respectively. This spike correlates with hotel expansion in Salt Lake City that occurred from 1994 to 2002. In that span of time, the number of hotel rooms in Salt Lake County increased by 63%, an increase that led the director of sales and marketing for the first five-star hotel in Salt Lake City to state: "There's no doubt we're overbuilt, a 63 percent growth is tough to support no matter where you are. Las Vegas, whatever"(Isidore, 2002). Hosting the Olympics appeared to generate a positive shock on Salt Lake County in the two years following treatment. Similar to Fulton County, the positive employment growth dissipates quickly.

To assess the ability of synthetic control to capture economic impacts, placebo tests act as significance tests. Placebo tests apply the synthetic control method to every unit in the donor pool. This approach indicates whether treatment or randomness drives the results. When employing placebo tests, the time path of the outcome variable for the placebo "treatments" should not significantly deviate from their synthetic counterpart. Figure 2 reports placebo tests for each of the three Olympic Games with the gap in employment growth between the county tested and the county's synthetic counterpart graphed on the Y axis in each year. The bold black line represents the county that hosted the Olympic Games, while the light gray lines each represent a county in the donor pool. Impacts experienced by the host county compared to placebo counties determines the significance of the impacts, based on the percentage of donor units that deviate from the treated

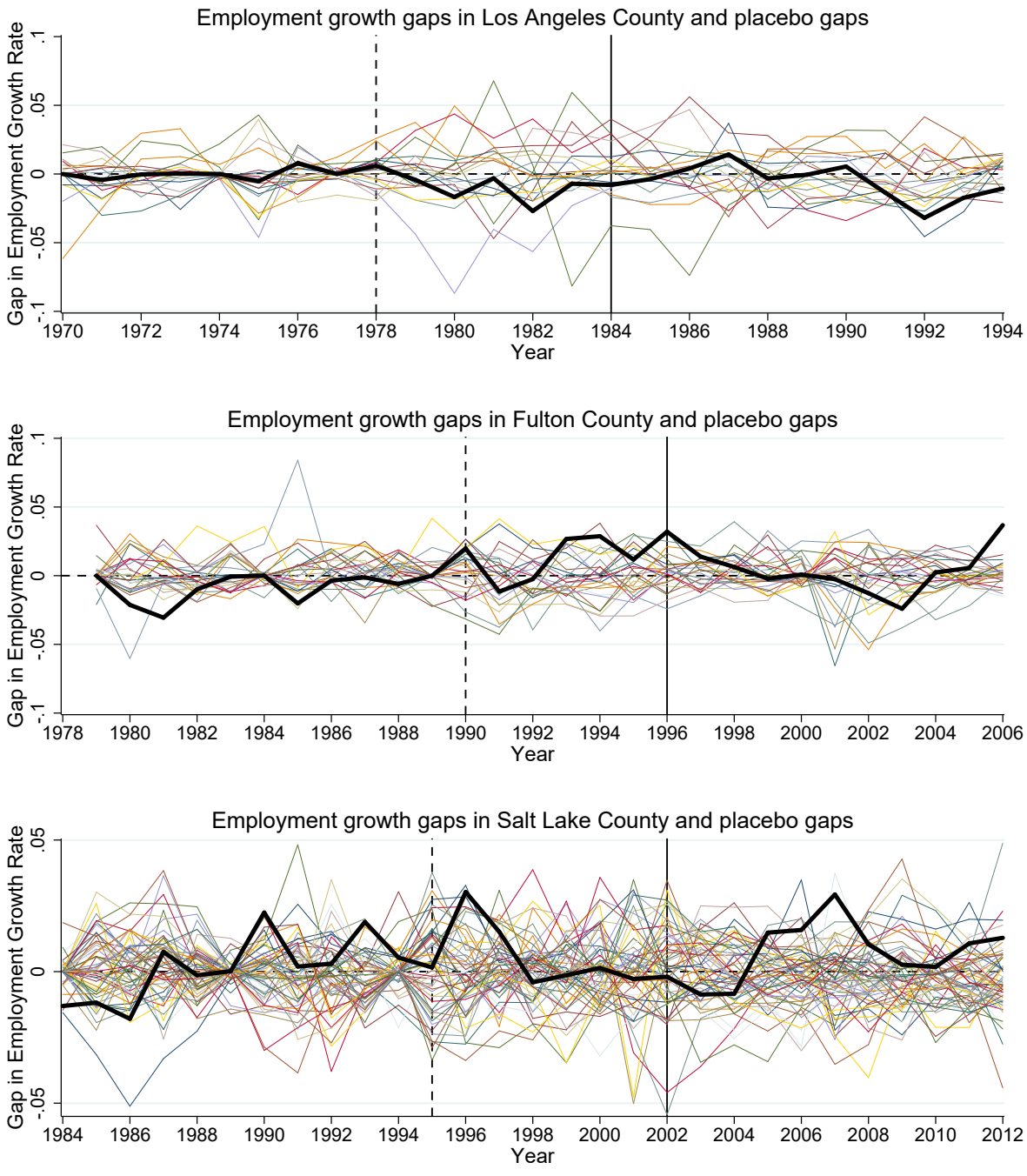

Figure 2: Employment Growth Rate Gaps in Host Counties and Placebo Gaps

county. A large percentage of placebo counties experiencing larger changes in employment growth than the treatment county calls into question the validity of the synthetic control results.

The top panel of Figure 2 shows placebo test results for the 1984 Los Angeles Games. A large portion of the post-treatment period appears to no have a significant impact on Los Angeles County with the exception of 1982. In 1982 only one placebo county experienced an effect larger than Los Angeles. This placebo county is dropped in Appendix B when placebo counties with high mean squared prediction errors (MSPE) are removed from the donor pool (Abadie et al., 2010)[5].

Placebo test results for the 1996 Atlanta Games appear in the middle panel of Figure 2. Fulton county experienced significant increases on employment growth in 1993, 1994, and 1996, in line with the years containing significant employment increases reported in previous studies (Feddersen and Maennig, 2013b; Baade et al., 2002). The bottom panel of Figure 2 shows placebo test results for the 2002 Salt Lake Games. Placebo test results indicate that Salt Lake experienced increased employment growth in only one year, 1996. An increase in employment appears in 2007 as well, however the amount of time passing between treatment, hosting, and this increase coupled with the lack of impact prior to 2007 calls into question attributing this increase to the Olympic Games.

Results in Figures 1 and 2 indicate that each county experienced some transitory impacts to employment growth after acquiring the rights to host the Games. Los Angeles County saw a decrease in employment growth two years prior to the Games being held. Fulton County and Salt Lake County each experienced transitory increases in employment growth. Salt Lake County's growth coincides with a documented increase in hotel construction, while Fulton County's growth matches the time period of construction of the Centennial Olympic Stadium. The lack of a persistent increase in employment growth calls into question the claimed benefit of persistent increases in tourism caused by hosting the Games[6].

[5]Abadie et al. (2010) present placebo tests dropping donor states that have MSPE two times, five times, and twenty times higher than the treated state.

[6]The counties studied represent the focal point of each Olympic Games, but few events were held in other counties throughout the hosting state. Considering the size of the event that the Olympics represents and events being held throughout Olympic hosting states, analyzing spillover effects becomes important. Appendix C presents results analyzing state-level impacts.

4.3 Robustness Checks

4.3.1 Alternate Donor Pools

Due to the subjective nature of selecting counties to include in the donor pool, using alternative population limits to identify donor counties checks the robustness of results. Alternative selection criterion use both a wider and narrower range of county populations to identify donor counties. Figures 3, 4, and 5 present results using alternative donor pool criteria.

For the 1984 Games, donor pools using counties with populations greater than 750,000 and 1,250,000 test for sensitivity, compared to the 1,000,000 population threshold utilized for results above. Figure 3 indicates that results are not sensitive to the donor pool composition, finding a decrease in employment growth in each alternative donor pool. The alternative population criterion for the 1996 Games includes counties with population of 250,000 to 1,250,000, and 500,000 to 850,000 instead of 500,000 to 1,000,000 used above. Figure 4 indicates that Fulton County experienced employment growth in 1993 through 1997 for each alternative donor pool.

Figure 5 presents results for the 2002 Games. While the original donor pool includes counties with populations from 500,000 to 1,000,000, alternative ranges of 250,000 to 1,500,000 and 650,000 to 1,000,000 constitute the alternative donor pools. As with Los Angeles County and Fulton County, initial results for Salt Lake County persist when using these alternative donor pools.

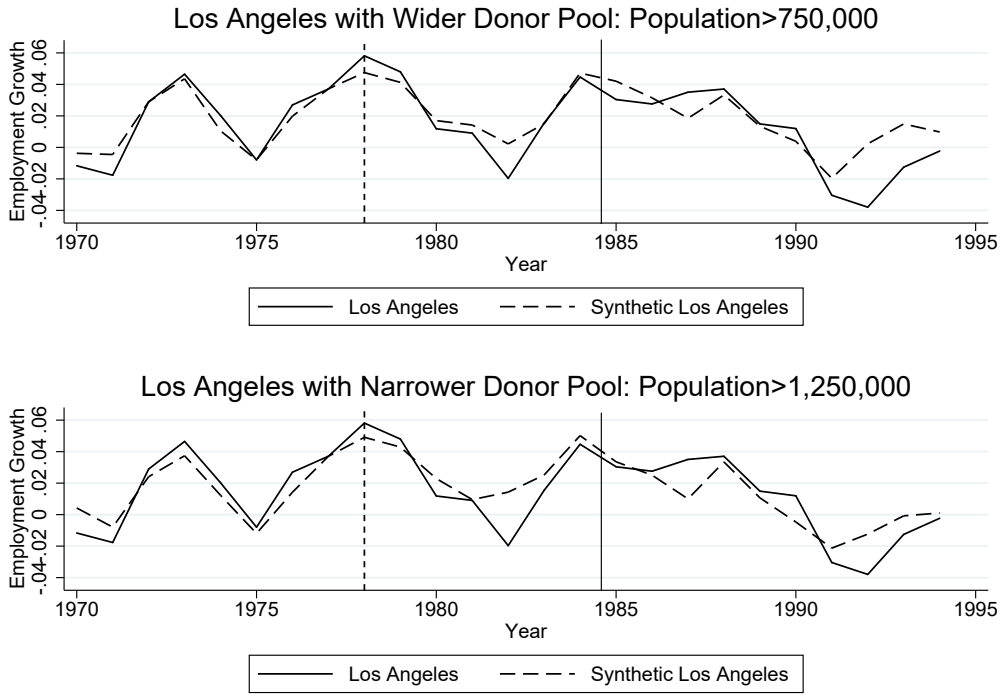

Figure 3: Synthetic Control Results with Alternative Donor Pools: Los Angeles County

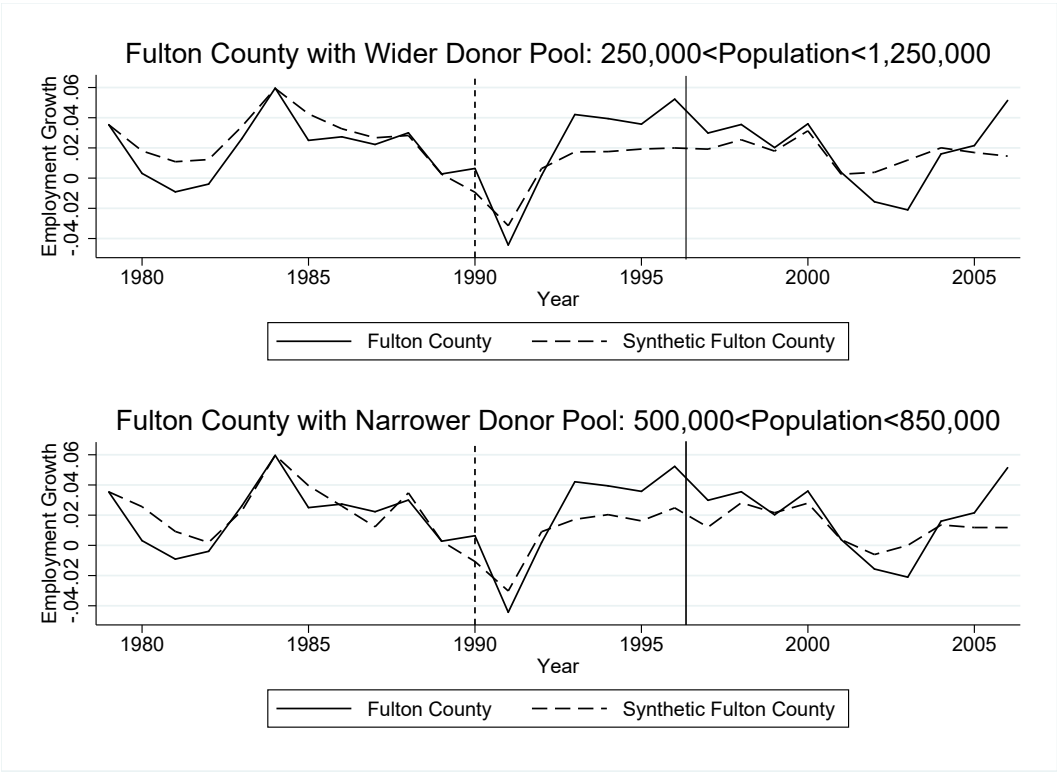

Figure 4: Synthetic Control Results with Alternative Donor Pools: Fulton County

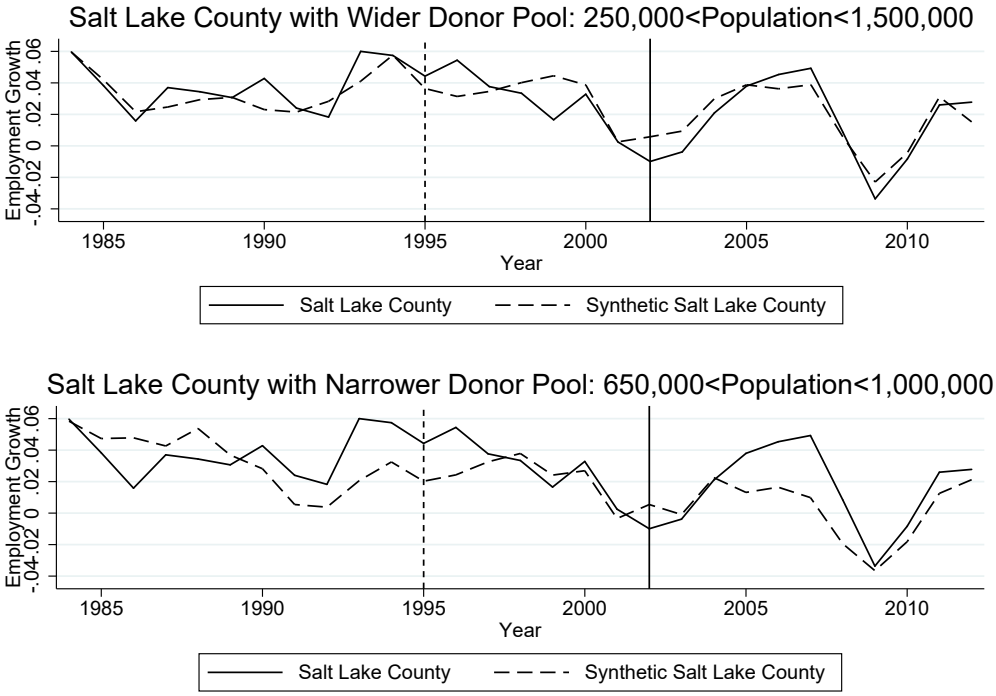

Figure 5: Synthetic Control Results with Alternative Donor Pools: Salt Lake County

4.3.2 Failed Olympic Bids

The three Olympics Games analyzed above generated transitory impacts on employment growth. As a robustness check, I consider unsuccessful bids to host the Games by Minneapolis, MN (Hennepin County) and Chicago, IL (Cook County). Minneapolis unsuccessfully bid against Atlanta to represent the USOC in the competition for the 1996 Olympics. Chicago advanced further into the bidding process, being selected by the USOC to compete with Rio De Janeiro, Brazil; Madrid, Spain; and Tokyo, Japan to host the 2016 Summer Olympic Games (Baade and Sanderson, 2012). Chicago spent more than $100 million on the failed bid attempt (Zimbalist, 2016, pp.42).

Counties may select into bidding to host the Olympic Games based on a belief that the county will experience substantial economic growth in the future. Analyzing counties with unsuccessful bids to host the Olympic Games mitigates concerns of selection bias by counties that bid to host the Olympics. Issues with selection bias appears throughout the literature on the economic impact of the Olympics; for example Maennig and Richter (2012) refute results in Rose and Spiegel (2011) on these grounds.

The analysis of outcomes Cook County, IL and Hennepin County, MN follows the same approach as Los Angeles County, Fulton County, and Salt Lake County, using population growth, income growth, and three select years of employment growth. Cook County, the second largest county in the US, uses a donor pool consisting of counties with populations larger than 1 million. Hennepin County's donor pool includes counties with a population between 500,000 and 1,250,000, the same range used for Salt Lake County. 1988 represents the treatment year for Hennepin County, the year in which the USOC selected Atlanta over Minneapolis, MN.

Table 7: Synthetic Control Weights: Hennepin County

County	Weights
Hartford County, CT	0.365
Prince George's County, MD	0.263
Oakland County, MI	0.203
Contra Costa County, CA	0.133
Fairfax County, VA	0.036

Table 8: Predictor Balance and RMSPE: Hennepin County

Predictor Variables	Actual	Synthetic
Population Growth	0.0071	0.0071
Income Growth	0.0880	0.0880
Employment Growth (1977)	0.0441	0.0441
Employment Growth (1982)	-0.0177	-0.0097
Employment Growth (1987)	0.0422	.0422
Model Fit Pre-treatment		
Pre-treatment RMSPE		0.0155
Post-treatment/Pre-treatment RMSPE		0.7342
p-value		0.8478

RMSPE=Root Mean Square Prediction Error

Table 7 shows synthetic control weights and reports RMSPE for Hennepin County. The largest contributor to synthetic Hennepin County is Hartford County, CT at 0.365, followed by Prince George's County, MD (0.263) and Oakland County, MI (0.203). Table 8 presents predictor balance and pre-treatment model fit. A high p-value and post-treatment to pre-treatment ratio less than one suggest no post-treatment change in Hennepin County. Synthetic control results are presented in Figure 6. Since the USOC did not select Hennepin County's bid to host the Olympic Games, there should be no discernible effects seen after the bid failed. From Figure 6, decreases in employment

growth can be seen between actual and synthetic Hennepin County. However, Figure 7 presents placebo tests, highlighting the absence of any significant gap.

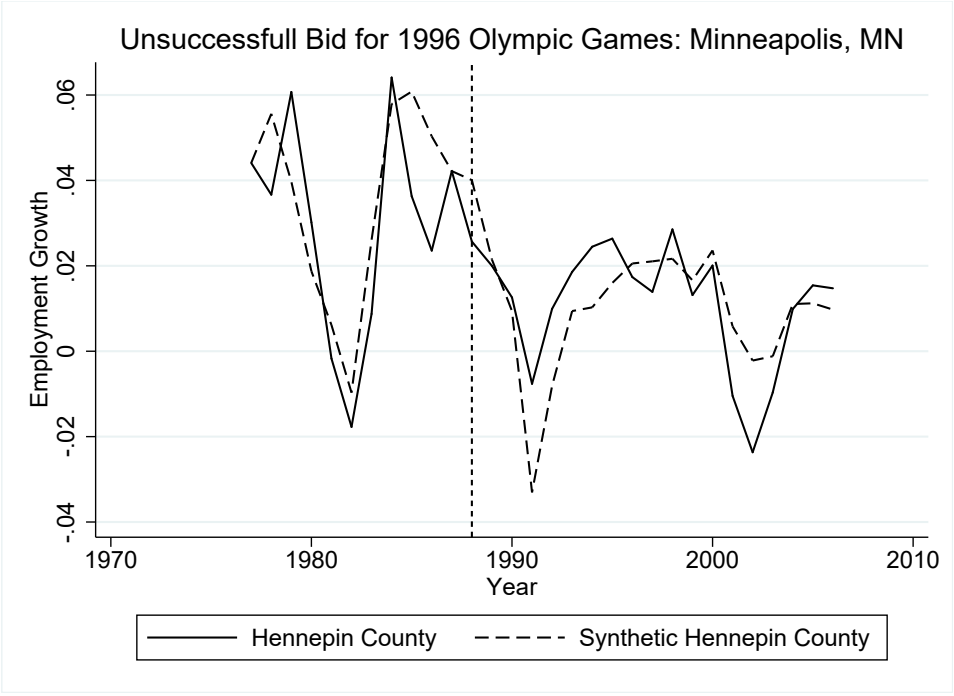

Figure 6: Synthetic Control Results: Hennepin County 1996 Olympic Bid

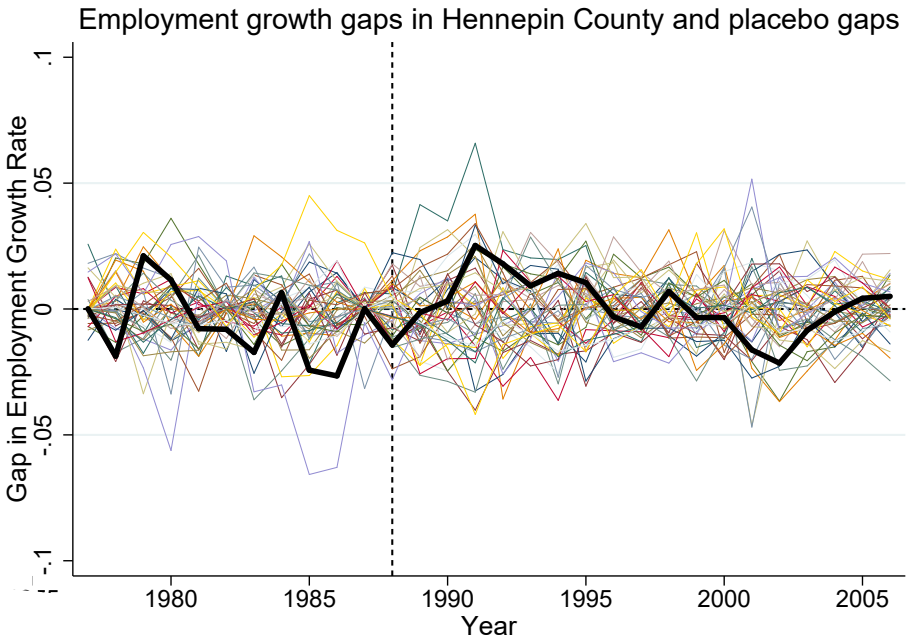

Figure 7: Placebo Tests: Hennepin County

Table 9: Synthetic Control Weights: Cook County

County	Weights
Allegheny County, PA	0.566
Cuyahoga County, OH	0.223
Palm Beach County, FL	0.085
Orange County, CA	0.077
Santa Clara County, CA	0.05

Synthetic Cook County provides an arguably more telling examination of the role played by selection bias in this setting. Chicago made it to the final phase of IOC voting to determine the host the 2016 Summer Olympic Games, costing Chicago $100 million in bid preparation costs in the process. Allegheny County, PA (0.566) and Cuyahoga County, OH (0.223) constitute most of synthetic Cook County, as shown in Table 9. Allegheny County, PA includes the city of Pitsburgh, and Cuyahoga County, OH includes Cleveland.

As with Hennepin County, results on Table 10 show a high p-value of 0.6 and a post-treatment to pre-treatment ratio less than one, indicating no significant impact on employment growth. There are no discernible differences between actual and synthetic Cook County found in either the synthetic control results nor placebo tests shown in Figures 8 and 9. Overall, synthetic control results from

Table 10: Predictor Balance and RMSPE: Cook County

Predictor Variables	Actual	Synthetic
Population Growth	.042808	.0416506
Income Growth	-.0027651	-.0027719
Employment Growth (1998)	.0200487	.0200708
Employment Growth (2003)	-.0071709	-.0071971
Employment Growth (2008)	-.0051212	-.0051128
Model Fit Pre-treatment		
Pre-treatment RMSPE		0.0722
Post-treatment/Pre-treatment RMSPE		0.9521
p-value		0.6

RMSPE=Root Mean Square Prediction Error

these two counties that made unsuccessful bids show no evidence of an economic impact, mitigating concerns that selection bias drives the results in actual host counties. This further validates the robustness of results for Los Angeles County, Fulton County, and Salt Lake County.

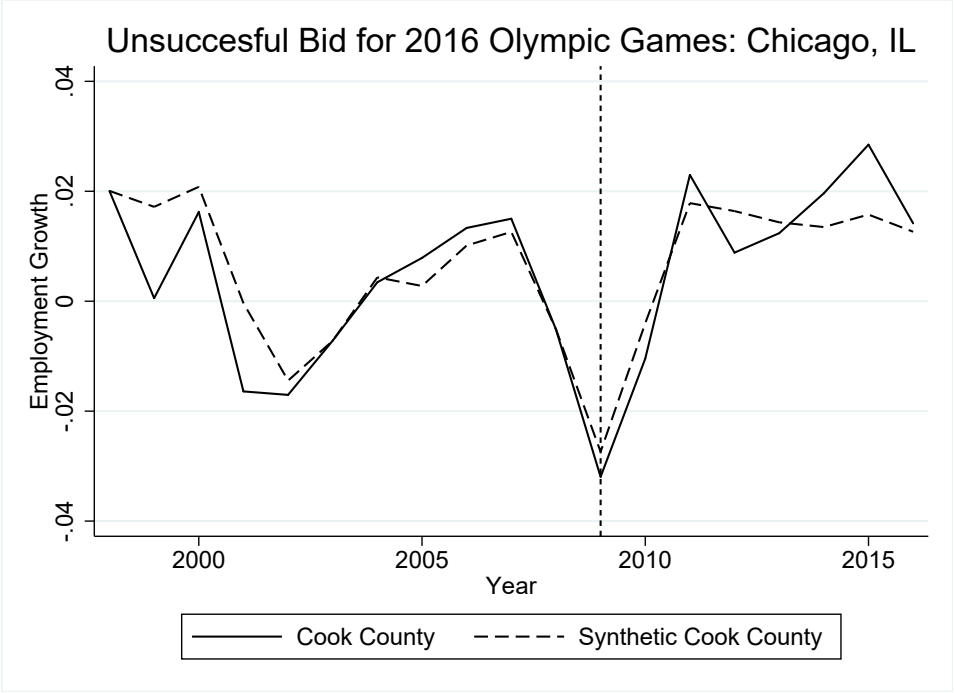

Figure 8: Synthetic Control Results: Cook County 2016 Olympic Bid

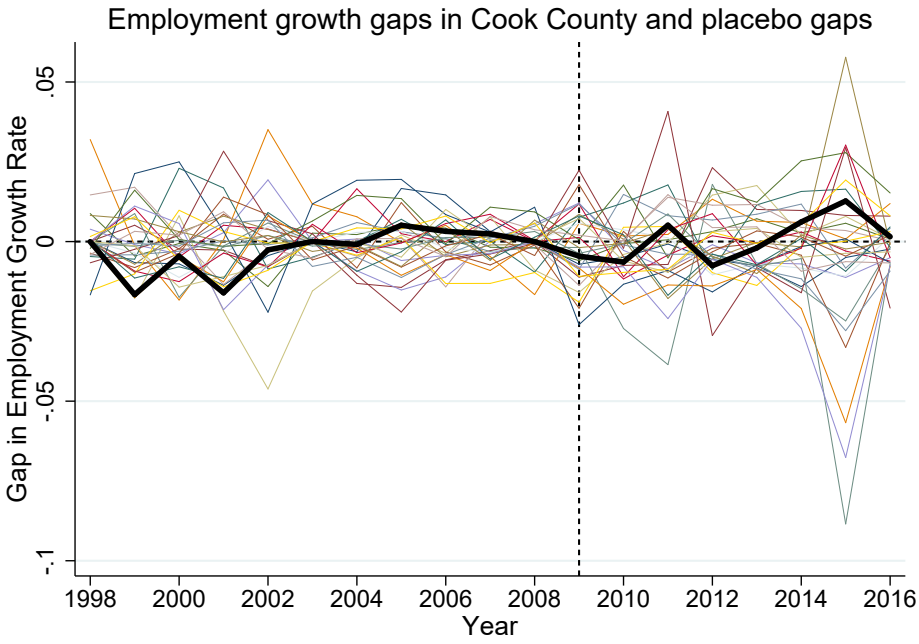

Figure 9: Placebo Tests: Cook County

5 Conclusion

This paper analyzes the impact of three separate Olympic Games held in the United States between 1984 and 2002 on the employment growth rates in the counties that hosted the Games. The synthetic control method assesses this impact by constructing synthetic Fulton, Salt Lake, and Los Angeles counties to provide valid comparison groups for each Games. The Games examined include one Winter and two Summer Games. The results show transitory changes in employment growth following the awarding of the rights to host Olympic Games; positive transitory effects on two counties and a negative transatory impact in one.

A decrease in employment growth occurred in Los Angeles County in 1982, caused by hosting the Games. In contrast, Fulton County and Salt Lake County each experienced transitory increases in employment growth. Fulton County experienced increased employment growth in 1993, 1994, and 1996. Salt Lake County experienced a smaller increase in employment growth in a single year, 1996. The smaller size of the Winter Olympics compared to the Summer Olympics partially explains why Fulton County experienced a larger impact than Salt Lake County.

Back of the envelope calculations reveal the magnitude of the impact of hosting the Olympic

Games by calculating the difference between Olympic host counties and their synthetic counterparts in significantly different years. For Los Angeles County in 1982, the only year of significant impact, the Olympic Games resulted in a decrease about 118,000 jobs relative to synthetic Los Angeles. In 1982 Los Angeles County actually lost over 86,000 jobs, experiencing an employment growth rate of nearly -2%. While Los Angeles County lost employment, synthetic Los Angeles County grew at a rate of 0.7%, accounting for an increase of nearly 32,000 jobs. The increase in jobs in synthetic Los Angeles County, coupled with Los Angeles County experiencing a decrease in over 86,000, leads to a net difference of about 118,000 jobs.

The same approach applies to increase employment growth experienced in Fulton and Salt Lake County. Significant differences between Fulton County and synthetic Fulton County in 1993, 1994, and 1996 led to an increase of about 63,000 jobs. The 63,000 increase resembles the forecasts in Humphreys and Plummer (1995). Job creation of over 24,000 in 1996 due to the Olympic Games resembles results in Feddersen and Maennig (2013b). Feddersen and Maennig (2013b) estimated an increase of around 29,000 jobs in 1996, the year the Games took place. Salt Lake County experienced significant positive employment growth in 1996. Based on the difference between outcomes in Salt Lake County and synthetic Salt Lake County, the Olympic Games accounted for an increase of about 17,000 jobs.

Results show that Olympic-generated increases in employment growth dissipated quickly in Fulton and Salt Lake County, consistent with results in previous research Baumann et al. (2012b) and Feddersen and Maennig (2013b). The transitory increase in Fulton and Salt Lake County can be attributed to increased construction activity following selection as the host city, as well as anticipation of increased future tourism as a result of hosting the Games. The absence of sustained increases in employment growth suggests that anticipated persistent increases in tourism do not occur. While Fulton County and Salt Lake County experienced transitory increases in employment growth, Los Angeles County experienced a decrease.

Overall, results presented in this paper call into question the use of the Olympic Games as a tool for local economic development. While hosting the Games may generate transitory increases in employment growth, the decreases in employment growth in Los Angeles provides evidence that potential hosts should proceed with caution when considering a bid to host the Olympic Games.

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Appendix A Synthetic Control Results with One Employment Growth Lag

Kaul et al. (2015) warn against using all past values of the outcome variable as this results in all other predictors having no contributing weight. Kaul et al. (2015) recommends using one lag for the outcome variable, selecting the year prior to treatment. Results shown in Section 4 select three years of employment growth before treatment occurs. This approach follows Islam (2019).

Table 11 reports pre-treatment RMSPE for each Olympic hosting county using one lag of employment growth the year prior to hosting and three lags of employment growth as seen in Islam (2019). In each county using three years of employment growth generated a lower RMSPE in each Olympics, indicating a better fit. Figure 10 show synthetic control results using one year of employment growth, average population growth, and average income growth to create the synthetic county. For each Olympic Games study, results remain consistent.

Examining Figure 11 Los Angeles County appears to experience a reduction in employment growth in 1982. While this impact appears less significant than seen in Figure 2, the lower pre-treatment RMSPE makes results presented in Section 4.2 preferable. Results seen in Section 4.2 for Fulton County and Salt Lak County remain in Figure 11. Fulton County experiences an increase in employment growth in 1993, 1994, and 1996. Salt Lake County experiences an increase in 1996.

Table 11: Pre-treatment RMSPE: One Lag of Employment Growth vs Three Lags of Employment Growth

County	One Lag of Employment Growth	Three Lags of Employment Growth
Los Angeles County	0.0076	0.004
Fulton County	0.0142	0.0139
Salt Lake County	0.0186	0.0115

Figure 10: Synthetic Control Results: One Lag of Employment Growth

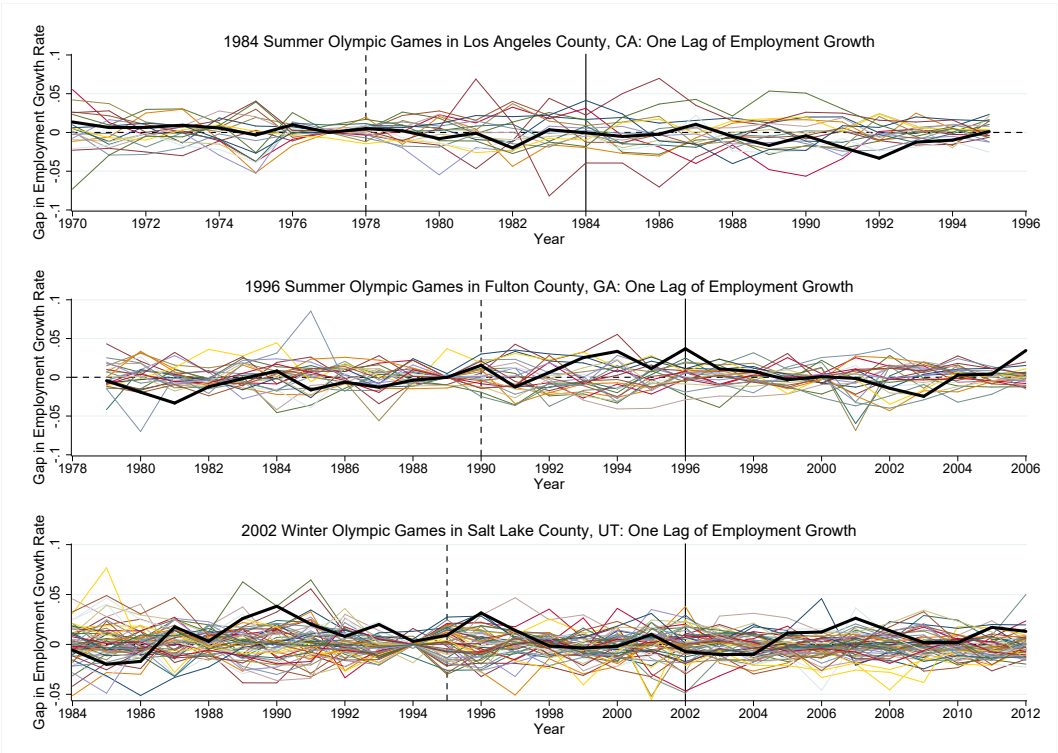

Figure 11: Placebo Tests: One Lag of Employment Growth

Appendix B Placebo Tests Dropping Donor Counties with High MSPE

The following Figures present placebo tests dropping placebo counties that were poor pre-treatment fits, measured by MSPE, as in Abadie et al. (2010). Excluding poor fitting placebo counties highlights years in which an increase in employment growth is experienced. Placebo tests are presented dropping placebos with MSPE two times, five times, and twenty times higher for Los Angeles County. 1982 represents a significant decrease in employment growth from the Olympics in Los Angeles County. When dropping counties with MSPE five times higher and two times higher, Los Angeles County appears to experience a decrease in employment growth in 1980 as well. For Fulton County placebos with MSPE two times and five times higher are dropped, while placebos with MSPE two times higher are dropped for Salt Lake County. Results remain the same for Fulton County and Salt Lake County when dropping poorly fit counties. Fulton County experiences an increase in growth in 1993, 1994, and 1996. An increase in growth in Salt Lake County occurs in 1996, the year following being awarded the Olympic Games.

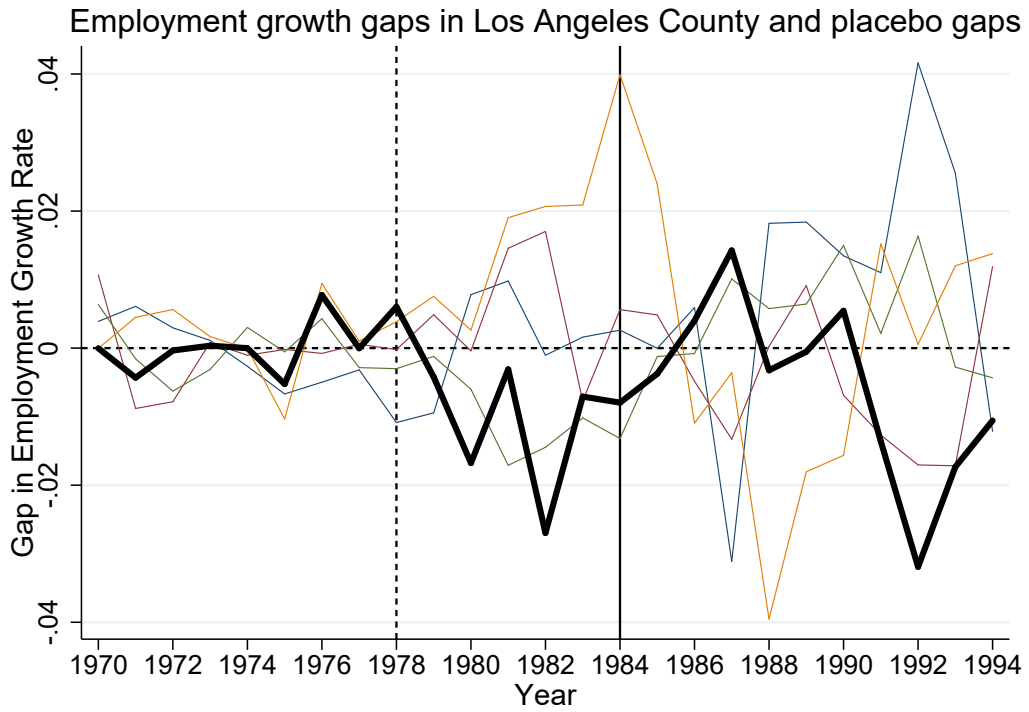

Figure 12: Placebo Tests: Los Angeles County Dropping Counties with MSPE Two Times as High

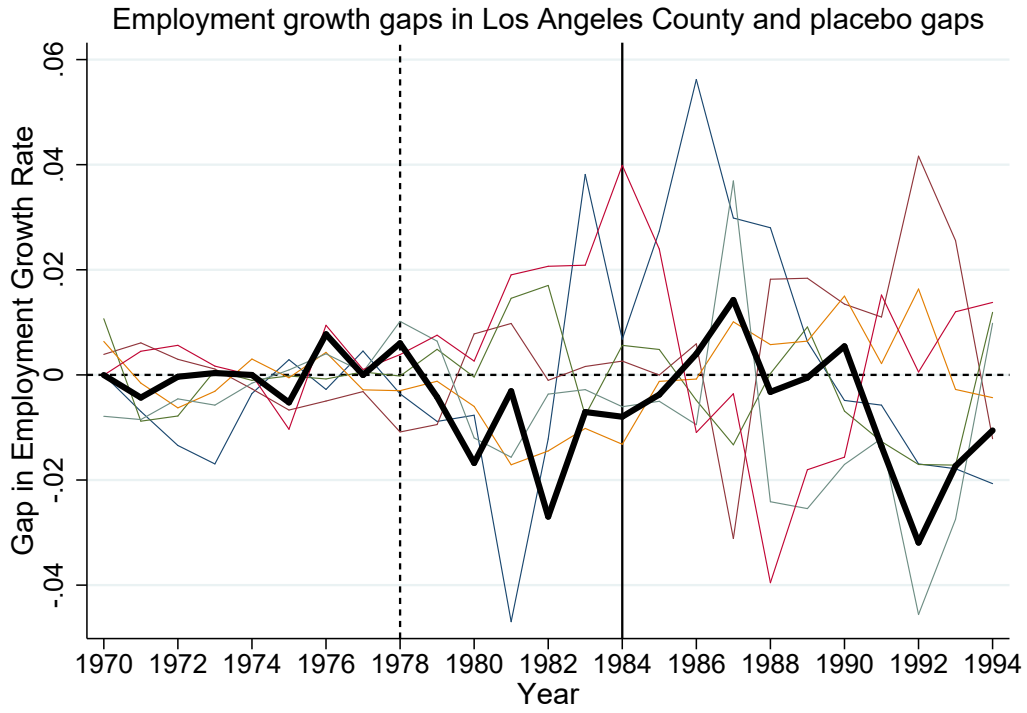

Figure 13: Placebo Tests: Los Angeles County Dropping Counties with MSPE Five Times as High

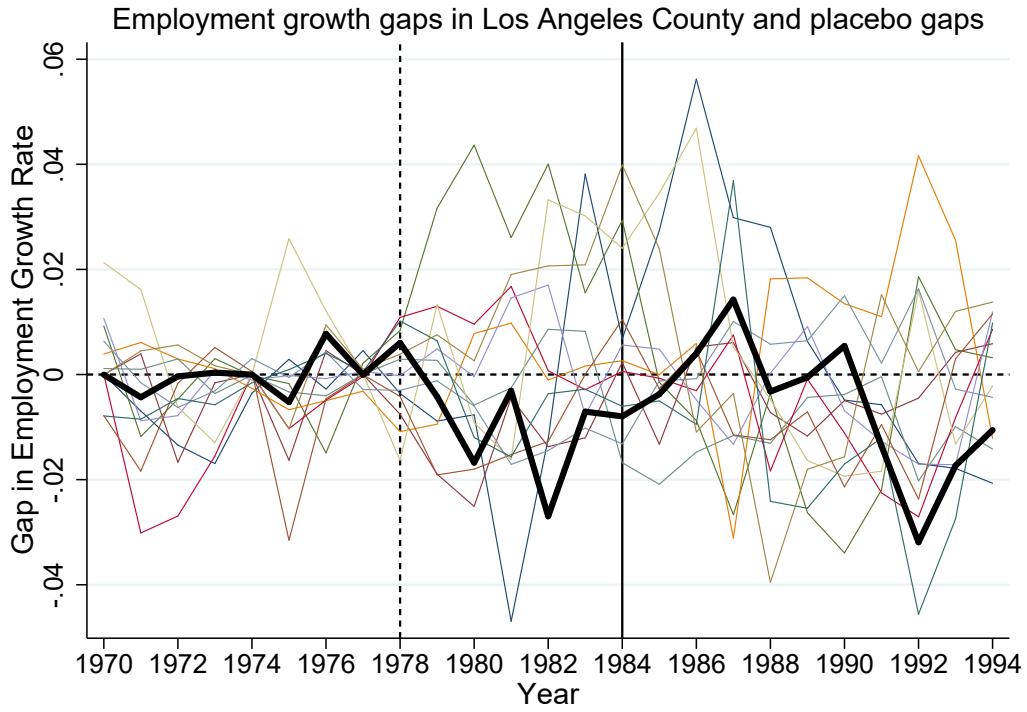

Figure 14: Placebo Tests: Los Angeles County Dropping Counties with MSPE Twenty Times as High

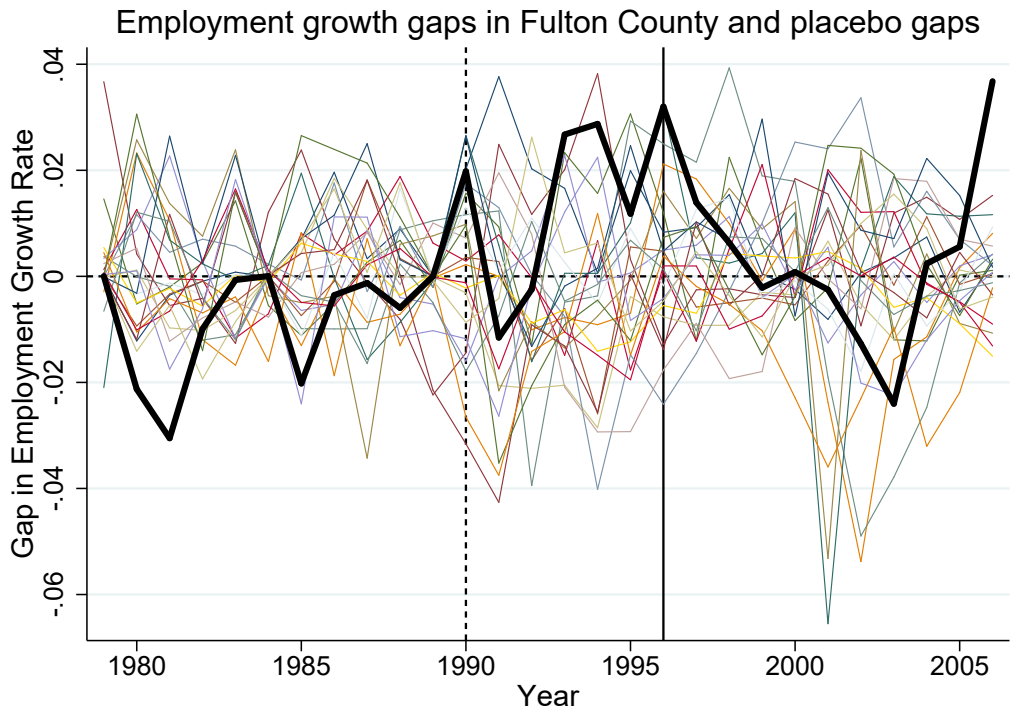

Figure 15: Placebo Tests: Fulton County Dropping Counties with MSPE Two Times as High

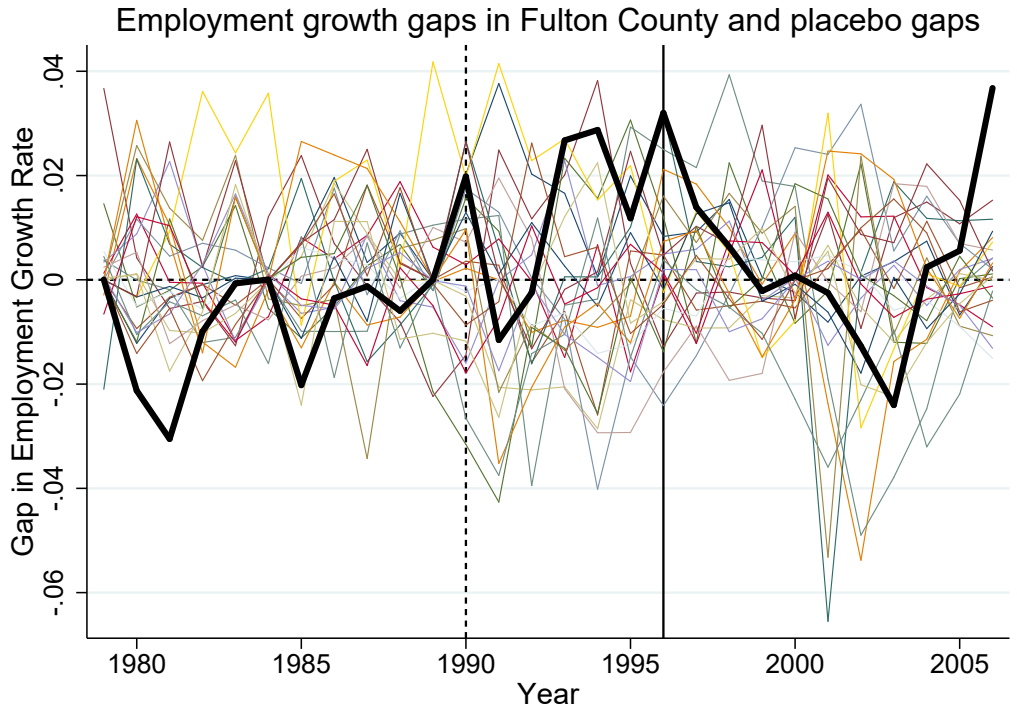

Figure 16: Placebo Tests: Fulton County Dropping Counties with MSPE Five Times as High

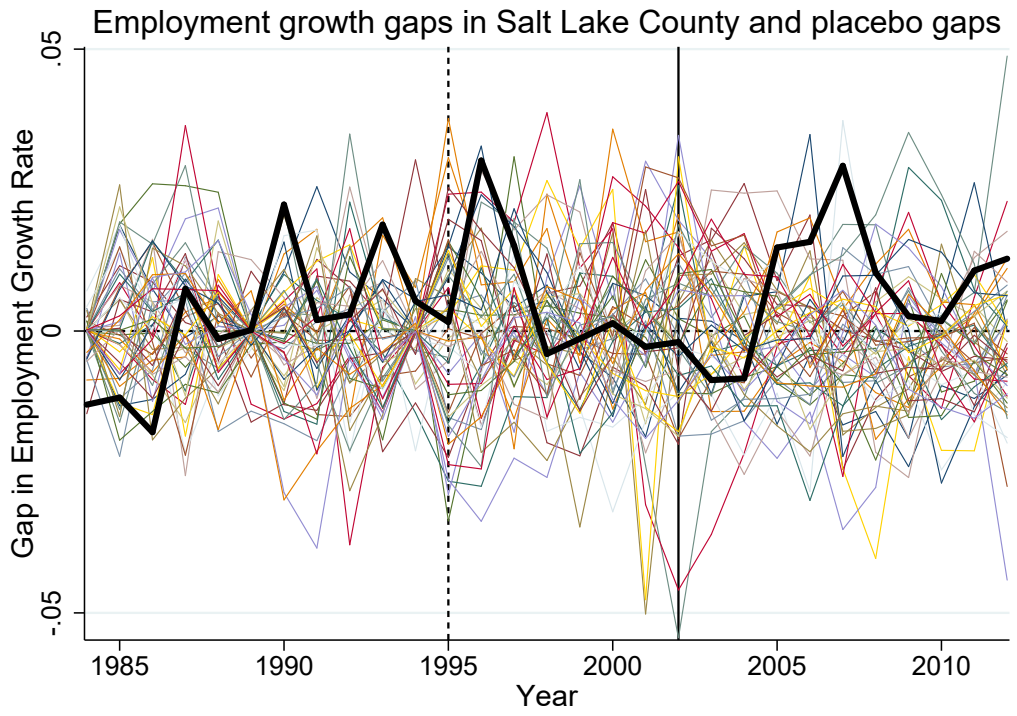

Figure 17: Placebo Tests: Salt Lake County Dropping Counties with MSPE Two Times as High

Appendix C Spillover Effects: State-level Synthetic Control Analysis

While this paper studies of the county which represents the focal point of each Olympic Games studied, various counties in the hosting state held events. For example, the sailing events in the 1996 Olympic Games took place over three hours from Atlanta, GA in Savannah, GA. Considering the size of the event that the Olympics represents and events being held throughout Olympic hosting states, analyzing spillover effects becomes important. The following figures posits two approaches to test for spillover effects. The first approach, seen in Figures 18 and 19, analyzes the host state in its entirety, including the host county. The second approach (Figures 20 and 21) uses the synthetic control approach on host states excluding the host county. Deducting the host county from the state mitigates concern of state-level results being driven by the host county. Tables 12 and 13 presents synthetic weight for each approach. For each state, a portion of the synthetic counterpart is comprised of similar states regardless of the approach used. Results show no clear, significant spillover effects experienced in either California or Utah. However, the positive impact felt from the lead up to the 1996 Olympic Games appears to have been felt throughout Georgia.

Table 12: Synthetic Control Weights: State-Level Analysis Including Host County

Donor State	California Weights	Georgia Weights	Utah Weights
Connecticut	0.448	–	–
Delaware	0.004	–	–
Florida	–	0.332	–
Idaho	0.17	–	–
Michigan	–	0.261	–
Nevada	0.125	–	0.397
New Hampshire	–	0.306	–
New Jersey	–	–	0.259
Rhode Island	–	0.101	–
South Dakota	–	–	0.118
Washington	0.248	–	–
Wyoming	–	–	0.226

Table 13: Synthetic Control Weights: State-Level Analysis Excluding Host County

Donor State	California Weights	Georgia Weights	Utah Weights
Arizona	–	0.086	0.189
Connecticut	0.271	–	–
Florida	–	0.256	–
Idaho	0.327	–	–
Michigan	–	0.184	–
Nevada	0.131	–	0.411
New Hampshire	–	0.223	–
South Dakota	–	–	0.4
Virginia	–	0.25	–
Washington	0.158	–	–
Wyoming	0.113	–	–

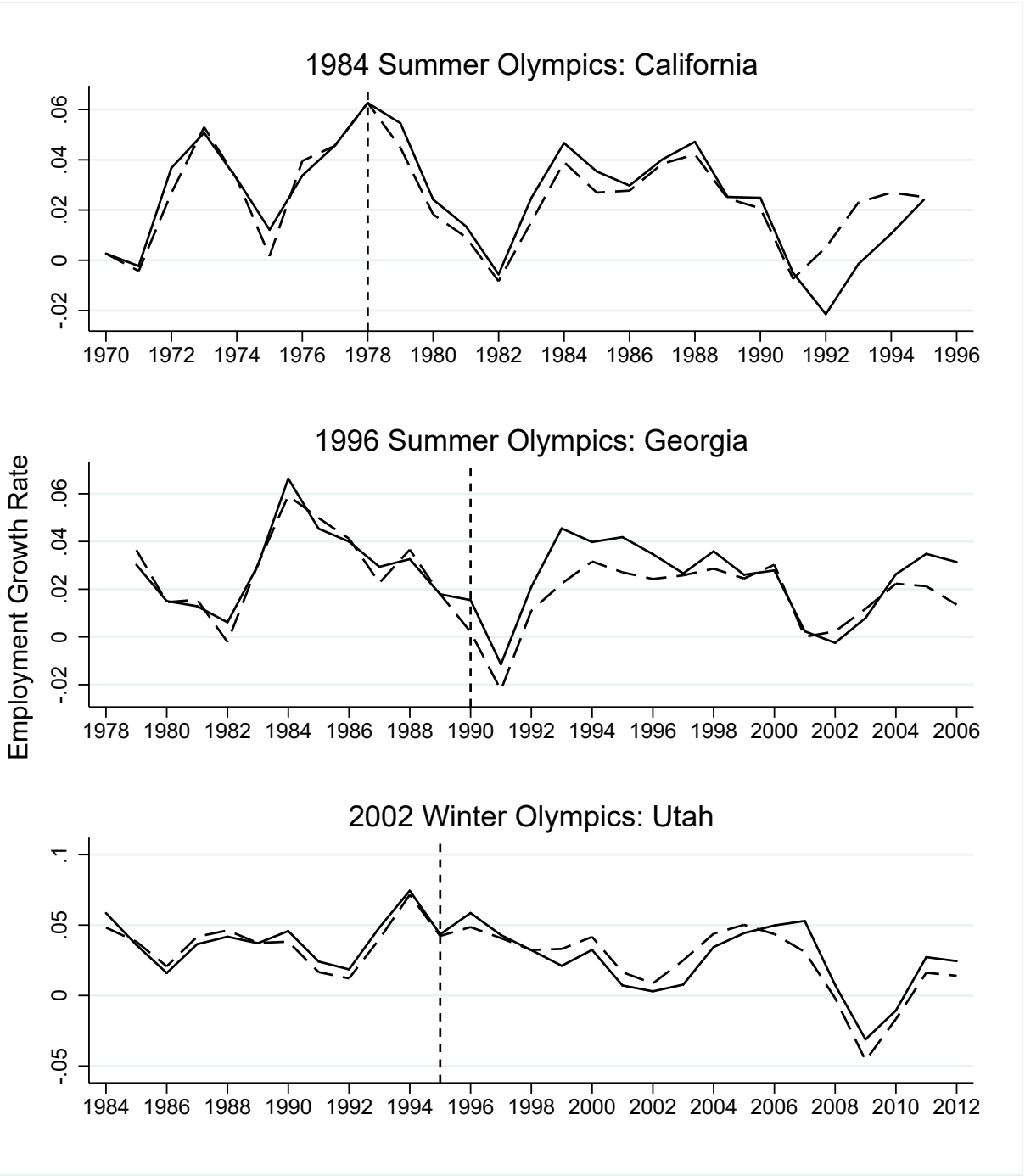

Figure 18: State-level Synthetic Control Results

The solid line indicates employment growth rates experienced in host states, while the dashed line represents their synthetic counterpart.

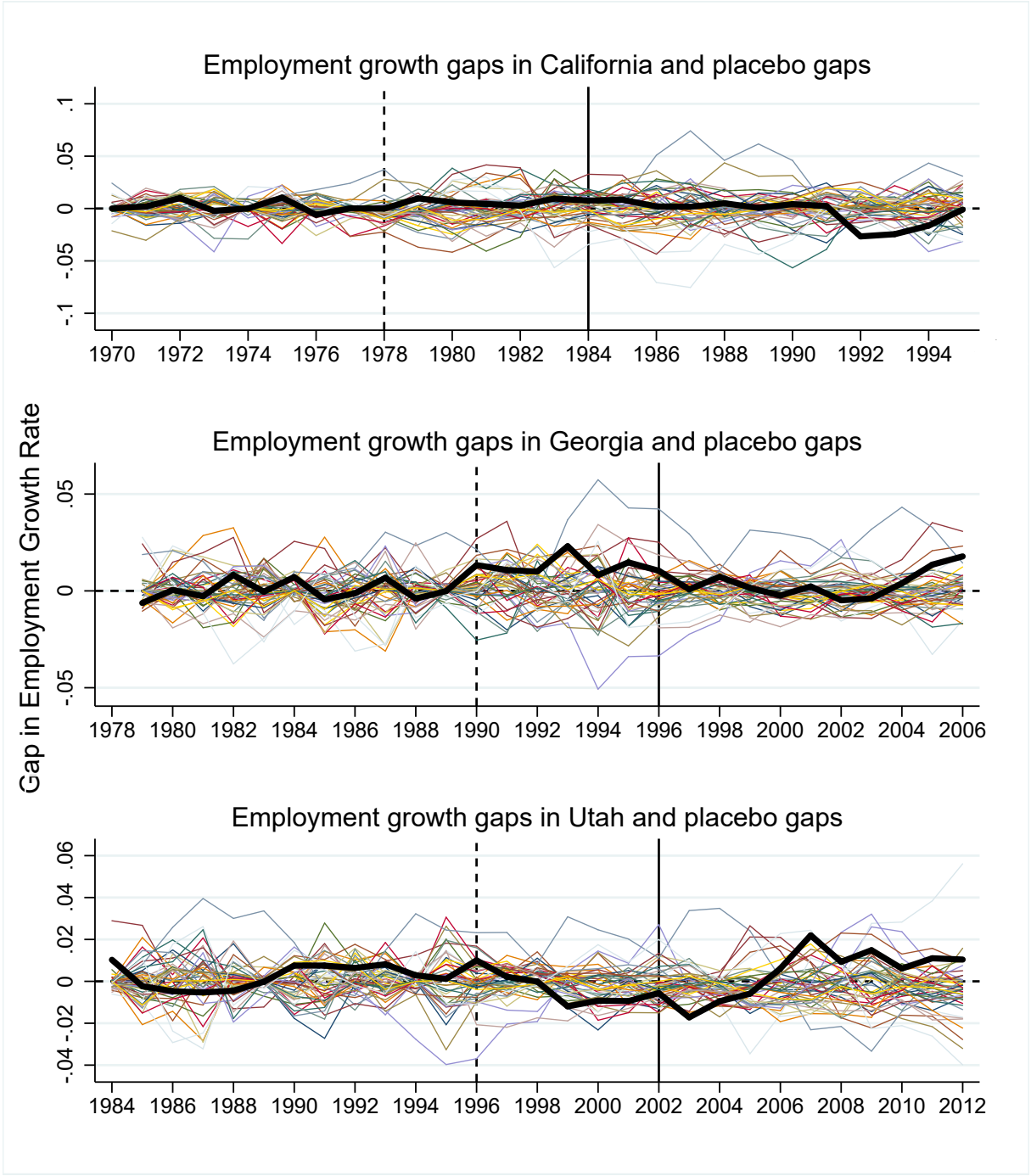

Figure 19: State-level Placebo Tests

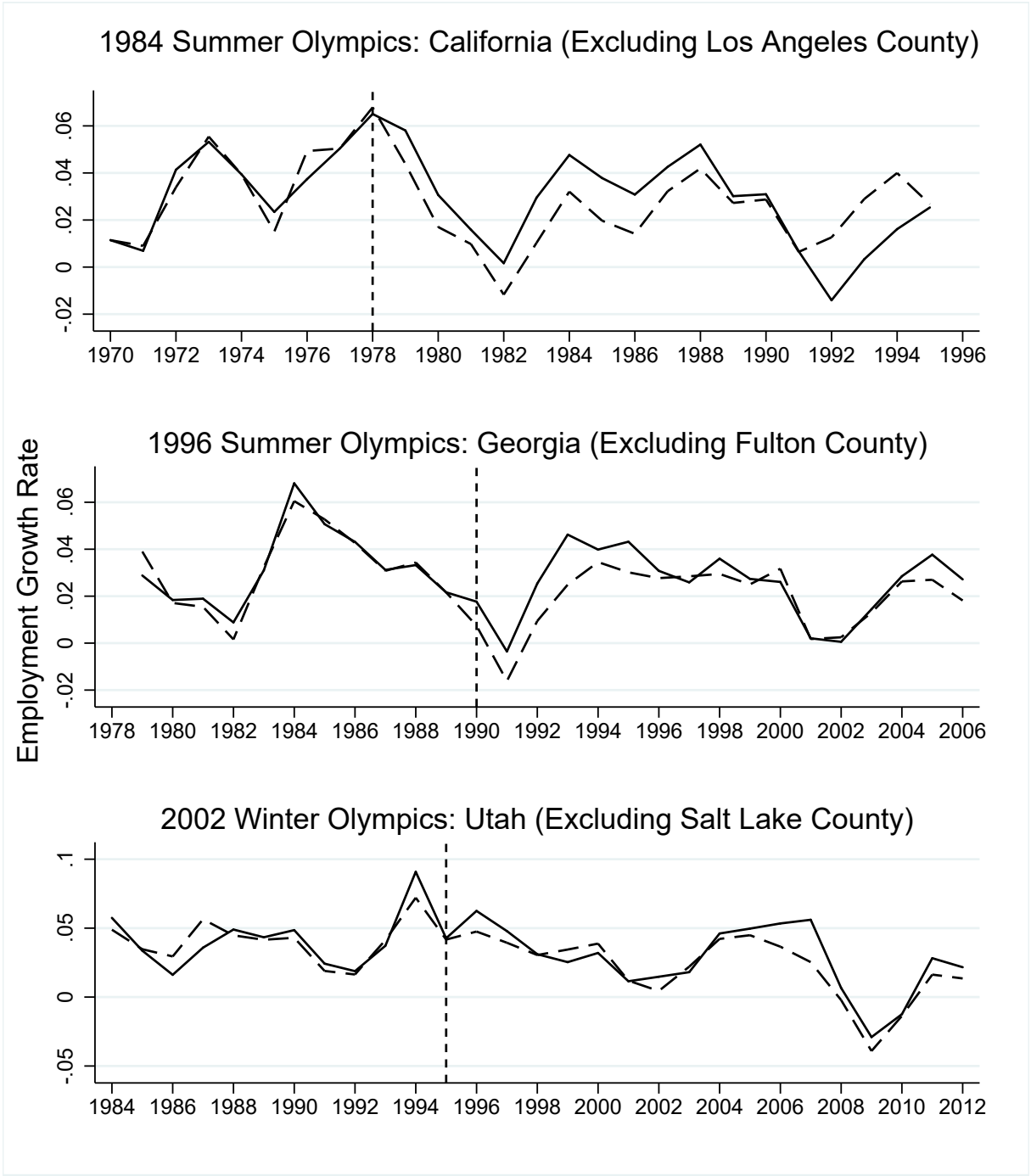

Figure 20: State-level Synthetic Control Results Excluding Olympic Host County
The solid line indicates employment growth rates experienced in host states, while the dashed line represents their synthetic counterpart.

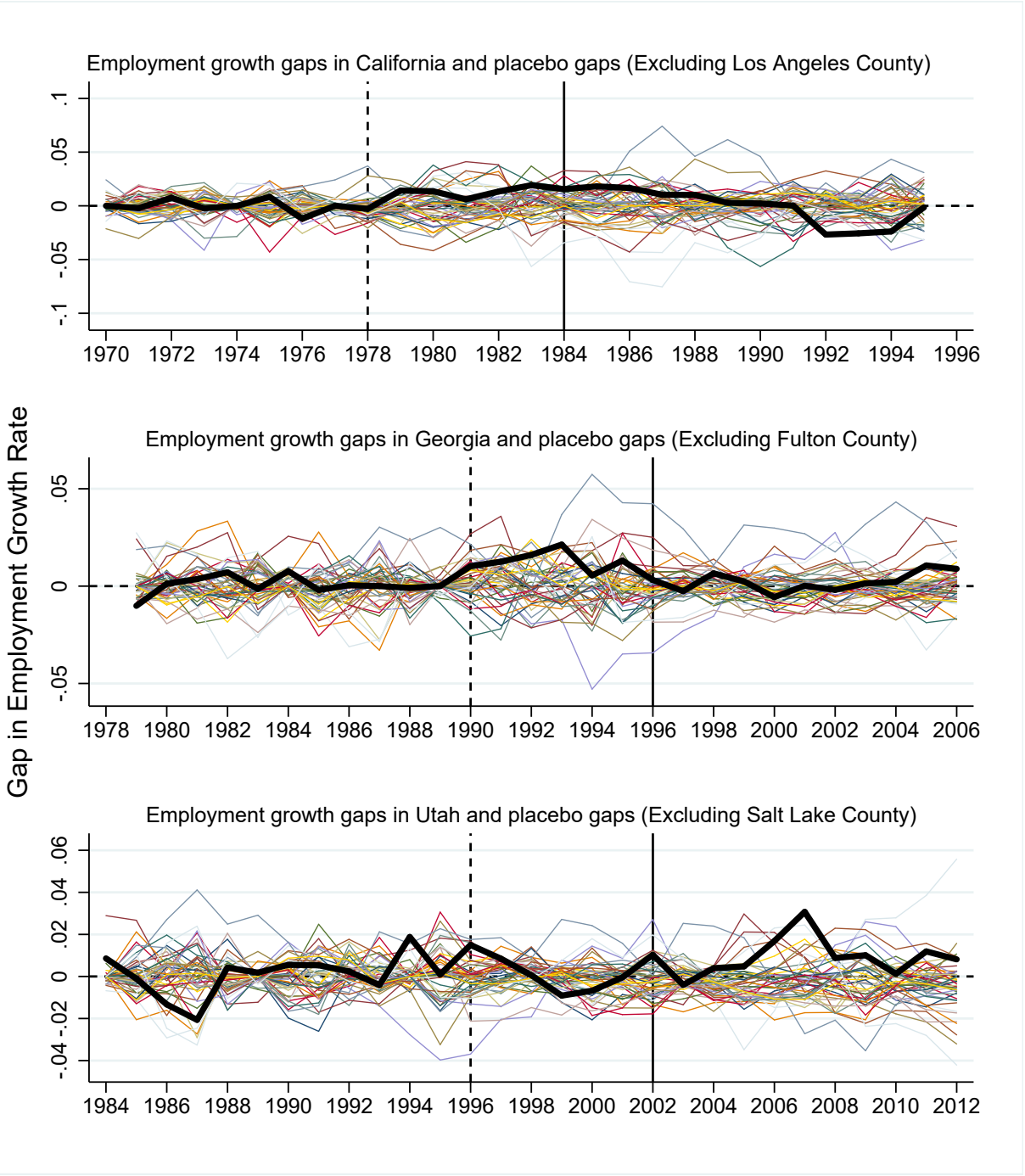

Figure 21: State-level Placebo Tests Excluding Olympic Host County