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The impact of the 1996 Summer Olympic Games on employment and wages in Georgia

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ABSTRACT:
Using a standard differences-in-differences (DD) technique and a modified DD in the slopes this paper determines that hosting the 1996 Summer Olympic Games boosted employment by 17 percent in the counties of Georgia affiliated with and close to Olympic activity, relative to employment increases in other counties in Georgia (the *rate of growth* increased 0.002 percentage points per quarter). Estimation of a random-growth model confirms a positive impact of the Olympics on employment. In addition, the employment impact is shown to not merely be a "MSA effect;" employment in the northern Olympic venue areas was found to increase 11 percent more post- versus pre-Olympics, compared with other similar Southern MSAs. The evidence of an Olympic impact on wages is weak.

Impact of the 1996 Summer Olympic Games on Employment and Wages in Georgia

1. Introduction

In September 1990, Atlanta won the bid to host the 1996 Summer Olympic Games. In spite of the approximate $2.5 billion price tag, the benefits from hosting the Olympics games were expected to out-weigh the costs. Positive media attention, construction of facilities and infrastructure, and employment increases were identified as the primary beneficial output of this massive endeavor.[1] While actual dollar inflows during the Olympics are relatively easy to identify, the "legacy" of the Olympics, in terms of long-term benefits are more difficult to measure. In order to measure, for example, the employment legacy it is important to isolate the increase in employment that would have taken place had the Olympics *not* come to Georgia. With that in mind, the purpose of this paper is to provide quantitative estimates of the impact of the 1996 Olympic Games on employment and wages in Georgia.

Fundamentally, the demand for labor is a derived demand. Exogenous factors that affect the demand for labor include the price of other factor inputs, the demand for output, and the state of technology. Accordingly, one purpose for studying labor demand is to understand how exogenous changes in these variables affect employment and/or wage rates. The Olympic games are expected to have had three exogenous effects on the labor market. First, there is a direct, short-term, effect on employment from the direct spending by the Atlanta Committee for the Olympic Games (ACOG) on goods and services. Second, in conjunction with the Georgia Department of Technical and Adult Services, a Pastor Grant was obtained by ACOG to provide job training. This formal training, in addition to the experience obtained by the estimated 70,000 volunteers, will impact employment opportunities of workers. Third, investments in facilities and infrastructure, as well as migration resulting from positive publicity, are expected to have positively impacted employment and wages well beyond the Olympic event. If it can be shown that an exogenous shock to a labor market, such as the Olympic games, can improve the employment situation of workers, it may prompt urban policy makers to rely more on promoting development projects when tackling the issue of unemployment, instead of relying on alternative strategies such as targeted wage subsidies.[2]

The analysis contained here makes use of state-level Unemployment Insurance employment data (ES202 data) to measure the change in employment experienced by Olympic venue geographic areas and to compare that change with the employment change experienced by geographic areas in Georgia but not affiliated with an Olympic venue and with geographic areas similar to venue areas, but not in Georgia. Differences-in-differences (DD) statistical analyses will provide evidence that overall employment in venue and near-venue areas increased 17 percent more during and after the Olympic games than in non-venue areas. We also show that this increase was not merely a metropolitan phenomenon; employment in the Northern venue (most heavily populated) areas increased 11 percent more during and after the Olympic games than did employment in other similar metropolitan areas in the South. In addition, a random-growth estimation procedure confirms that the employment difference measured post- versus pre-Olympics between venue area and non-venue area counties is not merely the result of systematic differences between the two types of counties.

Not only is there evidence that the *level* of employment increased more in the venue and near-venue Georgia counties, but a modified DD analysis indicates that the *rate of growth* in employment was also positively impacted by the presence of the Olympics. We estimated a nearly 0.002 percentage point per quarter increase in employment growth for venue area counties relative to non-venue area counties, post- versus pre-Olympics.

Analysis of wages did not yield such clear-cut conclusions. While the DD analyses indicate that real per worker wages increased 7 percent more in venue area counties and that the rate of growth increased by nearly 0.001 percentage point per quarter, the random-growth estimator robustness check indicated that the amount of noise surrounding the wage series is too great to draw any definite conclusions.

2. Background and Data

For purposes of analysis in this paper, we identify counties where Olympic venues were located as venue counties and counties adjacent to venue counties as "near-venue" counties. Together these two classifications of counties will be referred to as venue and near-venue (VNV) counties and will serve as the counties expected to be affected by the presence of the Olympic games. The theory is that one would expect to observe employment and wage gains in areas geographically "close" to where Olympic events were held as opposed to those areas not close to Olympic events Figure 1 depicts a map of Georgia with the darkest shaded counties reflecting venue counties and the lighter shaded areas as near-venue counties. There are three main VNV county groups: North (including Atlanta and Athens), Savannah on the coast, and Columbus.

Quarterly employment and wage data for each county in Georgia from 1985 through the third quarter of 2000 were obtained from administrative records made available by the Georgia Department of Labor.[3] Nominal (per worker) wages were converted to real wages using the CPI (82-84=100).

The industry mix in each county in each quarter was also calculated using the administrative data. These data reflect the percent of employment distributed across industries at the two-digit SIC code in 1990.[4] Population levels for each county in 1990 were obtained from the Georgia Institute of Technology State Data and Research Center.[5] The industry mix and population levels in 1990 were included to control for county-level characteristics that might otherwise confound differences measured in county employment and wage levels across venue status.

As an initial look at the potential employment and wage impact of the Olympics, Figures 2 and 3 present average employment indices and average per worker real wage indices for two groups of counties; VNV counties and non-VNV counties. Each quarter plots the average employment (wage) in that quarter for each county category indexed by (i.e., divided by) employment (wage) in the first quarter of 1985. Figure 2 suggests, without controlling for any other characteristics, such as population or industry mix, that employment grew at roughly the same rate across county classification prior to the early 1990s and that both groups of counties experienced a similar employment decline during the recession of the early 1990s. In about the third quarter in 1992 there appears to be some divergence, with the gap opening even more somewhere between 1995 and 1996. Figure 3, plotted with a 4-period moving average overlay to smooth seasonality, suggests that while wages do diverge between the two county categories, the divergence in wages is not as pronounced as the divergence in employment levels. The analysis that follows is designed to quantify the divergence that appears in Figures 2 and 3 and to determine if it is statistically significant after controlling for other county characteristics.

3. Differences-in-Differences in Georgia

A differences-in-differences (DD) approach is undertaken to evaluate the employment and wage impact of the Olympic games.[6] The idea behind the DD approach is to determine whether some statistic of interest (e.g., employment) changed more for one group of observations after some event than for another group of observations. The standard implementation focuses on differences in levels and includes dummy variables in a simple OLS regression indicating whether the time period is pre- or post-event, whether the observation is in the affected group, and an interaction of these two indicators. Given what we observe in Figure 2, however, not only does the level of employment look like it changed pre- and post-event, but it appears as though the rate at which employment was increasing changed as well. Consequently, a modified DD specification will be explored in addition to the standard one. Specifically, we will explore whether there was a change in the employment trend pre- versus post-event that was different for VNV counties than for non-VNV counties. Per worker real wages will also be explored using both the standard and modified DD models.

DD in the Intercept

The standard differences-in-differences (DD) takes the following form for evaluating employment and wage changes across Georgia counties:

$$lnEMP_{it} = \beta_1'X_i + \beta_2 VNV_i + \beta_3 POST_t + \beta_4 VNV_i * POST_t + \varepsilon_{it} \quad (1)$$

$$lnRWG_{it} = \delta_1'X_i + \delta_2 VNV_i + \delta_3 POST_t + \delta_4 VNV_i * POST_t + \eta_{it} \quad (2)$$

where $lnEMP_{it}$ is the log employment in county i in quarter t

$lnRWG_{it}$ is log average real monthly wage per worker in county i in quarter t

X_i is a set of covariates for each county

VNV_i is an indicator for whether the county is a venue or near-venue county

$POST_t$ is an indicator for $t \geq 1994{:}1$ or later in equation (1) and $t \geq 1995{:}1$ in equation (2)

In this framework, the location of the Olympic impact is controlled for by a dummy variable indicating whether the county is a VNV county, and the time is controlled for by a dummy variable indicating whether the Olympics had taken place yet or not. The question of when one would expect to experience the strongest Olympic impact is debatable. One might expect some impact from the moment the announcement was made (September 1990). However, the bulk of the activity did not likely begin until just prior to the Olympics. The models were first estimated defining POST equal to one for each of the years 1991-1998, and the best fit of the employment model was found where POST was equal to one in 1994 and later, and the best fit of the wage model was found where POST was equal to one in 1995 and later.[7] So, in the final estimation POST=1 for each year including and following 1994 in the estimation of equation (1) and POST=1 for each year including and following 1995 in the estimation of equation (2). The coefficients of interest (β_4 and δ_4), therefore, measure the change in employment and wages in VNV counties, relative to non-VNV counties, after the Olympics, relative to before. X_i includes an intercept, quarterly dummy variables, and controls for the industry mix and population in each county in 1990 to control for observable differences between VNV and non-VNV counties that might confound the analysis.[8]

Table 1 contains the results from estimating equations (1) and (2). Over the period 1985 to 2000, the higher the concentration of mining and construction, the lower the growth in employment, relative to the excluded service industry concentration. Real wages increased more in counties which had a concentration of manufacturing and financial, insurance, and real estate. Larger population in 1990 translated into higher employment but lower wages for the county. The coefficients of particular interest to this paper are those corresponding to VNV*POST. The coefficient for the Log Employment equation indicates that employment increased 17 percent more in VNV counties, post-Olympics relative to pre-Olympics, than employment in non-VNV counties.

Wages also experienced a boost in VNV counties. Wages increased almost 7 percent more in VNV counties, post-Olympics relative to pre-Olympics, than wages in non-VNV counties. While it is widely accepted (and supported by anecdotal evidence) that population growth in VNV counties also out-stripped population growth in non-VNV counties, this wage increase indicates that increases in demand for labor in the VNV counties was greater than the growth in supply, driving wages up.[9]

DD in the Slope

Again, Figure 2 not only suggests that employment *levels* were affected by the presence of the Olympics, but that the rate of the change in those levels was also affected. A second, modified DD analysis is undertaken in this section to see whether the rate at which employment and wages changed pre- and post-Olympics was any different for VNV counties versus non-VNV counties.[10] The standard DD specification is modified as follows:

$$\ln EMP_{it} = \alpha_1'X_i + \alpha_2 t + \alpha_3 t{*}VNV_i + \alpha_4 t{*}POST_t + \alpha_5 t{*}VNV_i{*}POST_t + \varepsilon_{it} \tag{3}$$

$$\ln RWG_{it} = \gamma_1'X_i + \gamma_2 t + \gamma_3 t{*}VNV_i + \gamma_4 t{*}POST_t + \gamma_5 t{*}VNV_i{*}POST_t + \eta_{it} \tag{4}$$

where $\ln EMP_{it}$ is the log employment in county i in quarter t

$\ln RWG_{it}$ is log average real monthly wage per worker in county i in quarter t

t is a time trend incremented by one each quarter

X_i is a set of covariates for each county

VNV_i is an indicator for whether the county is a venue or near-venue county

$POST_t$ is an indicator for $t \geq 1994{:}1$ or later in eq. (3) and $t \geq 1997{:}1$ in eq. (4)[11]

In this specification, the location of the Olympic impact is again controlled for by a dummy variable indicating whether the county was a VNV county, and the time period is controlled for by a dummy variable indicating whether the Olympics had taken place yet or not. The impact of location and time is allowed to show up through the change in the trend, t. The coefficients of interest (α_5 and γ_5), therefore, measure the change in employment and wage growth trends in VNV counties, relative to non-VNV counties, after the Olympics, relative to before. Again, X_i includes an intercept, quarterly dummy variables, and controls for the industry mix and population in each county in 1990 to control for observable differences between VNV and non-VNV counties that might confound the analysis. Population in 1990 is also interacted with the time trend as an additional regressor.

Table 2 contains the results from estimating equations (3) and (4). The coefficients on the industrial mix regressors are almost identical to those in Table 1. Interacting 1990 population with the time trend indicates that not only were larger counties better poised for employment growth during the 1990s, but the rate of that growth was also greater. The rate of growth in wages, however, was slower in the larger counties. Focusing attention on the coefficients of particular interest (t*VNV*POST), we find that the rate of growth in employment in VNV counties became almost 0.002 percentage points per quarter larger post-Olympics, relative to pre-Olympics, compared with non-VNV counties. For wages, that number is almost 0.001

percentage point larger growth per quarter for VNV counties, post-Olympics, however given that the best fit for measuring a change in wage growth occurred in 1997, this effect, *at best*, must be considered a lagged Olympic effect, if we are willing to associate it with the Olympic presence at all.

The Random-Growth Model as Robustness Check

A problem that one has in trying to isolate the impact of an event is the potential that those impacted are somehow systematically different than those not impacted and any measure of the impact can, therefore, not be attributed to the event, but, rather, to the systematic differences between the impacted and non-impacted groups. The DD approach tries to control for this sample selection by comparing impacted and non-impacted groups that are as similar as possible and by controlling for other observable characteristics that might confound the impact of the event. Heckman and Hotz (1989) explore a number of other methodologies for quantifying the impact of some event or program.

Heckman and Hotz (1989) prefer the category of models that control for selection based on unobservables, referring to them as a *random-growth model*. In the context of the current problem, the random-growth model compares employment and real wages post- versus pre-Olympics to employment and real wages between two time periods pre-Olympics only. This difference in growth is regressed on changes in explanatory variables across the same time periods and a dummy variable indicating whether the observation (county) belongs to the impacted (VNV) group. Formally, the model is:

$$(EMP_{it} - EMP_{it'}) - (t - t')(EMP_{it'} - EMP_{it'-1})$$

$$= \phi_1'[(X_{it} - X_{it'}) - (t - t')(X_{it'} - X_{it'-1})] + \phi_2 VNV_i + [(\varepsilon_{it} - \varepsilon_{it'}) - (t - t')(\varepsilon_{it'} - \varepsilon_{it'-1})] \quad (5)$$

$$(RWG_{it} - RWG_{it'}) - (t - t')(RWG_{it'} - RWG_{it'-1})$$

$$= \theta_1'[(X_{it} - X_{it'}) - (t - t')(X_{it'} - X_{it'-1})] + \theta_2 VNV_i + [(\varepsilon_{it} - \varepsilon_{it'}) - (t - t')(\varepsilon_{it'} - \varepsilon_{it'-1})] \quad (6)$$

where EMP_{it} is the employment in county i in year t

RWG_{it} is the average real, per worker wage in county i in year t

X_i is a set of covariates for each county

VNV_i is an indicator for whether the county is a venue or near-venue county

t refers to the year and $t > k > t'$, where k is the period in which the event occurs

Equations (5) and (6) are estimated via OLS and the estimates of ϕ_2 and θ_2 are consistent estimates of the impact of the event or program on the observations for which VNV=1 (Pudney 1982). The choices for t and t' should be such that they are safely on either side of the event. For this reason, we consider the event (the Olympic impact) to have occurred between 1990 (the year of the announcement) and 1997 (the year following the Olympics). So, the pre-Olympic period is 1985-1989 and the post-Olympic period is 1998-2000. Annual, instead of quarterly, data are evaluated here to keep the number of possible comparisons pre- and post-Olympics to a manageable level, and to avoid seasonality complications of comparisons.

In addition to providing an estimate of the impact of the Olympics, this model allows one to construct pre-event and post-event tests. The idea behind these tests is to look prior to and after the Olympics and see whether the VNV designation makes any difference in estimated employment and wage levels. For the pre-event test, equations (5) and (6) are estimated for $t' < t < k$, and for the post-event test, equations (5) and (6) are estimated for $k < t' < t$. In both cases, the estimate of ϕ_2 and θ_2 should not be significantly different from zero. If they are, then we must conclude that there are systematic differences between VNV and non-VNV counties, other than the Olympics, that resulted in the measured positive impact on employment and wages post- versus pre-Olympics.

An advantage of this model is that information about the employment and real wage growth in VNV counties prior to the Olympics is used to determine whether their growth changed pre- and post-Olympics. The disadvantage of this model is that any other characteristics of the counties that might affect employment and wage growth, but do not change over the time period are lost as explanatory variables. As a result, the only explanatory variable, other than VNV designation, that is available is county population; industry mix does not change enough within a county to contribute to the analysis.[12]

Table 3 contains a summary of the estimates of ϕ_2 (equation 5) resulting from all possible comparisons for the pre- and post-time periods, as well as the pre-test and post-test results. Since this model is presented merely as a robustness check to the DD analysis, only the sign and significance levels are reported in Table 3. Following Heckman and Hotz (1989), an average of the coefficient of interest is reported, as well. Panel (a) reports the results for testing the impact of the Olympics on employment levels in VNV counties. The majority of the coefficient comparisons (8 out of 12) are positive, indicating a positive impact of the Olympics on employment. In addition, 5 of those 8 positive coefficients are significantly different from zero. The results in this panel support the results from the DD analyses in the previous sections; the Olympics positively impacted employment levels in those counties associated with Olympic venues.

Panels (b) and (c) of Table 3 present the results from the pre- and post-tests, respectively. None of the estimated coefficients in the pre-test is significantly different from zero and two out of three estimated coefficients in the post-test are insignificant, as well. The insignificance of the coefficients in these tests suggests that there is more difference between the VNV and non-VNV counties post- versus pre-Olympics than either pre-Olympics or post-Olympics alone, suggesting a measurable impact of the Olympics.

Table 4 contains the summary of the estimates of θ_2 (equation 6) resulting from all possible comparisons for the pre- and post-time periods. Again, only the sign and significance levels are reported. While 9 of the 12 possible coefficients are positive, none of them is significantly different from zero. This indicates that relative to the growth prior to the Olympic period, growth in real per worker wages post- versus pre-Olympics did not differ, in a statistically significant way, between VNV and non-VNV counties. None of the pre- and post-test coefficients was significantly different from zero either.

The results from estimating the random-growth model strengthen the evidence of the employment impact indicated by the DD analysis. The insignificant random-growth model results for wages, while the DD results were significant, highlights the potential problem with relying solely on the results of a DD analysis for drawing conclusions for the impact of policy.

4. Differences-in-Differences Across MSAs

Given that the vast majority of the Olympic venue activity took place in and around the Atlanta MSA, there is some concern that the economy of the 1990s resulted in what might be identified as a "metropolitan effect" rather than an "Olympic effect," and that the employment increase experienced in this region of Georgia would have taken place even in the absence of the

Olympics. In order to test whether the increase in the Northern VNVs exceeded that of other, similar, metropolitan areas (MSAs) in the South, two additional DD analyses are performed.

Equation (7) corresponds to the standard DD analysis measuring impact of the Olympics on the intercept in log employment; equation (8) corresponds to the DD analysis measuring impact of the Olympics on the trend in log employment:

$$lnEMP_{it} = \beta_1'X_i + \beta_2 OlympicMSA_i + \beta_3 POST_t + \beta_4 OlympicMSA_i*POST_t + \varepsilon_{it} \qquad (7)$$

$$lnEMP_{it} = \alpha_1'X_i + \alpha_2 t + \alpha_3 t*OlympicMSA_i + \alpha_4 t*POST_t + \alpha_5 t*OlympicMSA_i*POST_t + \varepsilon_{it} \qquad (8)$$

where $lnEMP_{it}$ is the log employment in MSA i in year t

X_i is a set of covariates for each MSA

$OlympicMSA_i$ is an indicator of the Northern Georgia Olympic VNV area

$POST_t$ is an indicator for whether the year is 1995 or later[13]

The location of the Olympic impact is controlled for by a dummy variable indicating whether the MSA was that contained by the Northern Georgia VNV area, and the time is controlled for by a dummy variable indicating whether the Olympics had taken place yet or not. Annual data are used for these analyses due to the lack of availability of quarterly data for other MSAs. β_4 measures the change in employment in the *Olympic* MSA, relative to *non*-Olympic MSAs, after the Olympics, relative to before. α_5 measures the change in the rate of employment growth in the *Olympic* MSA, relative to *non*-Olympic MSAs, after the Olympics, relative to before. X_i

includes controls for population levels, price levels, and prior population growth for each MSA in the analysis. The MSAs were chosen based on their similarities to Atlanta in 1990.[14]

Data used for the MSA comparison were obtained from the *State and Metropolitan Area Data Book* produced by the U.S. Bureau of the Census (1998). Based on similarities in population and population growth, 12 MSAs from the Southern region were chosen for comparison with the Northern VNV counties; these MSAs are Charlotte (NC), Dallas (TX), Fort Lauderdale (FL), Fort Worth (TX), Greensboro (NC), Memphis (TN), Miami (FL), New Orleans (LA), Norfolk (VA), Orlando (FL), San Antonio (TX), Tampa Bay (FL). 1990 population levels, the population growth experienced by each MSA during the 1980s, and the CPI during the fourth quarter in 1996 were included in the regression to control for differences (other than employment) across MSAs. Employment data were only available for each MSA from 1990 to 2000.[15]

The regression results presented in Table 5 indicate that employment increased more in the MSAs that were larger in 1990 and had experienced more population growth in the 1980s. Also, the 1996 price level is positively associated with more increased employment. In addition, employment in the Northern VNV (Atlanta Olympic MSA) counties increased 11 percent more than other, similar MSAs, post-Olympics relative to pre-Olympics, and that the *rate of growth* was 0.0012 percentage points greater per year. The implication is that the positive employment impacts identified in Tables 1 and 2 are not entirely a phenomenon experienced by the Northern VNV counties merely by virtue of containing a large MSA.

5. Conclusions

Using primarily a differences-in-differences (DD) methodology, this paper has identified a positive employment impact of the 1996 Summer Olympic games on an extended area of counties that hosted Olympic events. Not only did employment increase 17 percent more in the VNV counties, relative to the non-VNV counties, but the VNV counties also exhibited an advantage in increasing the *rate of growth* in both employment and wages, as well. The 17 percent increase in employment translates into approximately 293,000 more jobs in the VNV county areas post-Olympics, based on the average employment level across all of Georgia prior to the Olympics.

A robustness check confirmed that this employment impact of the Olympics is not attributable to some unobserved, systematic difference across the VNV and non-VNV counties; there appears to be greater difference between VNV and non-VNV counties post- versus pre-Olympics than *either* post or pre Olympics alone. The analysis also confirmed that the increase in employment attributable to the Olympics was not merely an "MSA effect." An additional DD analysis indicated that the employment increase in this geographic area surpassed other, similar MSAs in the South.

The evidence for a wage impact was not as clear. While the DD analyses indicated a significant positive impact of the Olympics on wages and on the rate of wage growth. The random-growth model failed to confirm any statistical significance of the impact. One explanation for lack of a wage impact in light of the increased employment is that population grew in the VNV counties, shifting the supply curve outward enough to offset wage gains generated by increased demand. Unfortunately, population data by county are not reliable enough to test this hypothesis, although anecdotal evidence points towards it confirmation.

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Endnotes

[1]Humphreys and Plummer (1995) and Newman (1999).

[2]Some evidence of the success of other types if development projects is provided by Bartik (2001); Hotchkiss, Sjoquist, and Zobay (1999); and Mayer (1988).

[3]These data are referred to ES202 data. White et al. (1990) provide an extensive discussion about the use of these data.

[4]A more narrow industry classification (say at the 3 or 4 digit level) was not possible given the poor representation of some narrow industries across the state.

[5]The center is housed in the School of Policy Studies at Georgia Institute of Technology <http://www.spp.gatech.edu/about/main.html>.

[6]Applications of the DD approach to different economic analyses can be found in Card (1992); Gruber (1994); Zveglich and Rodgers (1996); Gruber (1996); and Hamermesh and Trejo (2000). Heckman (1996) provides a critique of the sometimes overextended interpretation of DD results. We have heeded his cautions while interpreting our results.

[7]The largest F-statistic value was used as the criterion for determining the best split of the data. This is analogous to a Chow test for a regime break and can also be translated into an adjusted R^2 goodness-of-fit test since the F-statistic is a monotonically increasing function of the adjusted R^2 statistic.

[8]These controls prove to explain a significant portion of the variation in observed employment and wage levels across counties.

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[9]One could easily estimate a DD equation for population, but with the availability of the 2000 census numbers, it is quite apparent that the accuracy of county population estimates between the 1990 and 2000 census is questionable. The population estimate for these in-between years has not yet been updated. In addition, to examine the possibility that the VNV*POST coefficient is not merely capturing a one-time impact that is not sustained, we re-estimated the model with an additional dummy variable and interaction for the period after the Olympics. Not only is the Olympic effect sustained during the post-Olympic time period, the impact seems to increase. These results yield a preliminary view of what we find in the next section which explores the *rate of change* in employment and wages.

[10]The authors are grateful to a referee for recommending this modification.

[11]The F-statistic values in estimating the wage equation (eq. 2) were actually statistically indistinguishable for splits equal to 1995, 1996, and 1997; 1995 was used for reporting the results in this section to be consistent with the split used for the wage equation in the previous section.

[12]Again, population estimates are not very good by the end of the 1990s, but they are used here for lack of another viable explanatory variable. In addition, the variation in population across counties does contribute to explaining variation in employment, so at least it serves as a reasonable proxy.

[13]The same pre-analysis was performed for this model to determine that within the MSA sample, 1995 was the year in which the impact of the Olympics best distinguished between employment differences.

[14]The criteria included a 1990 population level between one and three million people and a positive population growth between 1990 and 1997. The identifying assumptions in a DD analysis require that there are no contemporaneous shock that affects the relative employment and wage levels across Olympic and non-Olympic MSA in the same year, and that the MSAs should be as similar as possible (see Gruber 1994, and Heckman 1996).

[15]MSA employment data can be found on the Bureau of Labor Statistics' web site, <http://www.bls.gov>.

TABLE 1. Differences-in-differences intercept regression results for log employment and for log real per worker wages.

Regressors	Log Employment	Log Real Wages
Intercept	-2.4050***	8.0140***
	(0.0966)	(0.09250
% Agriculture	0.5929***	-1.4728***
	(0.1290)	(0.1236)
% Mining	-1.1569***	-0.6229***
	(0.3449)	(0.3305)
% Construction	-4.4234***	-2.1008***
	(0.1576)	(0.1511)
% Manufacturing	2.5280***	1.3655***
	(0.0989)	(0.0948)
% Transportation,	0.5612***	-0.5757***
Comm., & Utilities	(0.1211)	(0.1161)
% Retail	1.9587***	-2.3729***
	(0.1358)	(0.1301)
% Financial, Insur., &	2.9330***	3.0797***
Real Estate	(0.1897)	(0.1818)
% Public Admin.	-3.2915***	-3.0517***
	(0.1253)	(0.1201)

Log Population 1990	1.0786***	-0.0193***
	(0.0054)	(0.0052)
Quarter2 = 1	0.0299***	0.1860***
	(0.0078)	(0.0075)
Quarter3 = 1	0.0283***	0.2124***
	(0.0078)	(0.0075)
Quarter4 = 1	0.0354***	0.2834***
	(0.0079)	(0.0076)
VNV = 1	-0.2551***	-0.0238**
	(0.0097)	(0.0093)
POST = 1	0.1788***	0.2597***
	(0.0065)	(0.0062)
VNV * POST = 1	0.1719***	0.0694***
	(0.0130)	(0.0125)
Adj. R squared	0.96	0.53
F-value	15,734***	740.81***
N	10,017	10,017

Notes: Excluded industry category is Service. Standard errors are in parentheses.

* => significant at the 90% confidence level, ** => significant at the 95% confidence level, and *** => significant at the 99% confidence level. POST=1 if $t \geq 1994$ for the employment equation and POST=1 if $t \geq 1995$ for the wage equation.

TABLE 2. Differences-in-differences slope regression results for log employment and for log real per worker wages.

Regressors	Log Employment	Log Real Wages
Intercept	-2.6421***	4.3008***
	(0.5742)	(0.52680
% Agriculture	0.5958***	-1.4706***
	(0.1267)	(0.11990
% Mining	-1.1570***	-0.6230*
	(0.3388)	(0.3206)
% Construction	-4.4336***	-2.1084***
	(0.1548)	(0.1465
% Manufacturing	2.5240***	1.3625***
	(0.0972)	(0.0919)
% Transportation,	0.5599***	-0.5767***
Comm., & Utilities	(0.1190)	(0.1126)
% Retail	1.9609***	-2.3713***
	(0.1334)	(0.1262)
% Financial, Insur., &	2.9337***	3.0772***
Real Estate	(0.1864)	(0.1763)
% Public Admin.	-3.2961***	-3.0551***
	(0.1231)	(0.1165)

Log Population 1990	0.8951***	0.1121**
	(0.0566)	(0.0523)
t * Log Population 1990	0.8951***	-0.0014**
	(0.0566)	(0.0006)
Quarter2 = 1	0.0243***	0.1792***
	(0.0077)	(0.0072)
Quarter3 = 1	0.0170**	0.1987***
	(0.0077)	(0.0073)
Quarter4 = 1	0.0231**	0.2703***
	(0.0078)	(0.0074)
t	0.0035	0.0412***
	(0.0061)	(0.0056)
t * VNV	-0.0027***	-0.0001
	(0.0001)	(0.0001)
t * POST	2.1x10-5	0.0006***
	(1.2x10-4)	(0.0001)
t * VNV * POST	0.0018***	0.0009***
	(0.0001)	(0.0002)
Adj. R squared	0.96	0.55
F-value	14,410***	732***
N	10,017	10,017

Notes: Excluded industry category is Service. Standard errors are in parentheses.

* => significant at the 90% confidence level, ** => significant at the 95% confidence level, and *** => significant at the 99% confidence level. POST=1 if $t \geq 1994$ for the employment equation and POST=1 if $t \geq 1997$ for the wage equation.

TABLE 3. Summary of random-growth model results for employment.

Panel (a): *Results of post- versus pre-Olympic impact*

t' \ t =	1998	1999	2000
1986	(+)**	(+)**	(+)
1987	(-)	(+)	(+)
1988	(+)*	(+)**	(+)**
1989	(-)	(-)	(-)

Average of significant coefficients: 3,807.74

Panel (b): *Pre-test results*

t' \ t =	1987	1988	1989
1986	(+)	(+)	(+)
1987		(+)	(+)
1988			(+)

Panel (c): *Post-test results*

t' \ t =	1999	2000
1998	(-)	(-)
1999		(-)***

Notes: Table reports sign and significance of coefficient of impact only. * => coefficient significant at the 90 percent confidence level, ** => coefficient significant at the 95 percent confidence level, *** => coefficient significant at the 99 percent confidence level.

TABLE 4. Summary of random-growth model results for real per-worker wages.

Results of post- versus pre-Olympic impact

t ' t =	1998	1999	2000
1986	(-)	(-)	(-)
1987	(+)	(+)	(+)
1988	(+)	(+)	(+)
1989	(+)	(+)	(+)

Notes: Table reports sign and significance of coefficient of impact only.

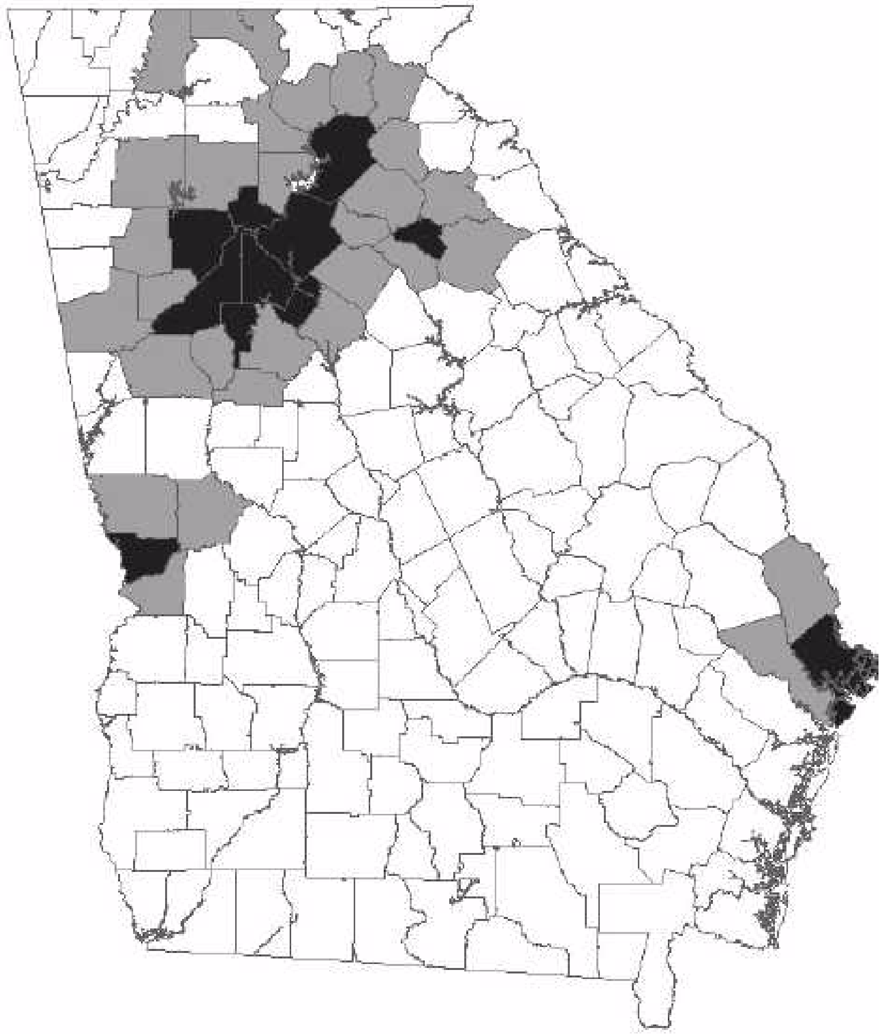
TABLE 5. DD regression results comparing Georgia VNVs with similar MSAs.

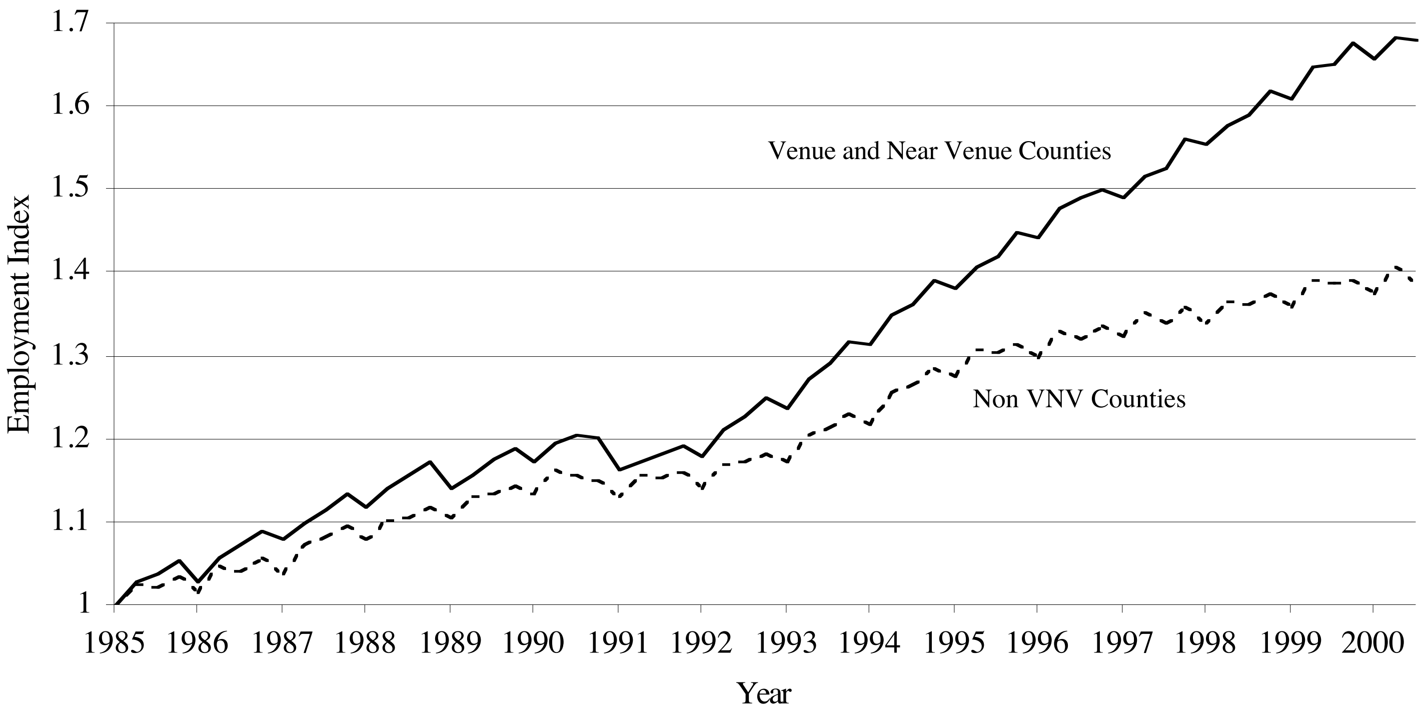
Regressors	DD Intercept Regression	DD Slope Regression
Intercept	11.8221***	10.1042***
	(0.1222)	(0.3381)
Population 1990	0.0006***	0.0006***
	(0.00001)	(0.00001)
CPI 96:3	0.0067***	0.0067***
	(0.0012)	(0.0011)
1980-1990 Population Growth	0.0040***	0.0040***
	(0.0005)	(0.0004)
OlympicMSA = 1	-0.0218	--
	(0.0379)	
POST = 1	0.1182***	--
	(0.0123)	
OlympicMSA * POST = 1	0.1123**	--
	(0.0443)	
t	--	0.0187***
		(0.0035)
t * OlympicMSA	--	0.0002
		(0.0002)
t * POST	--	-0.0003
		(0.0004)

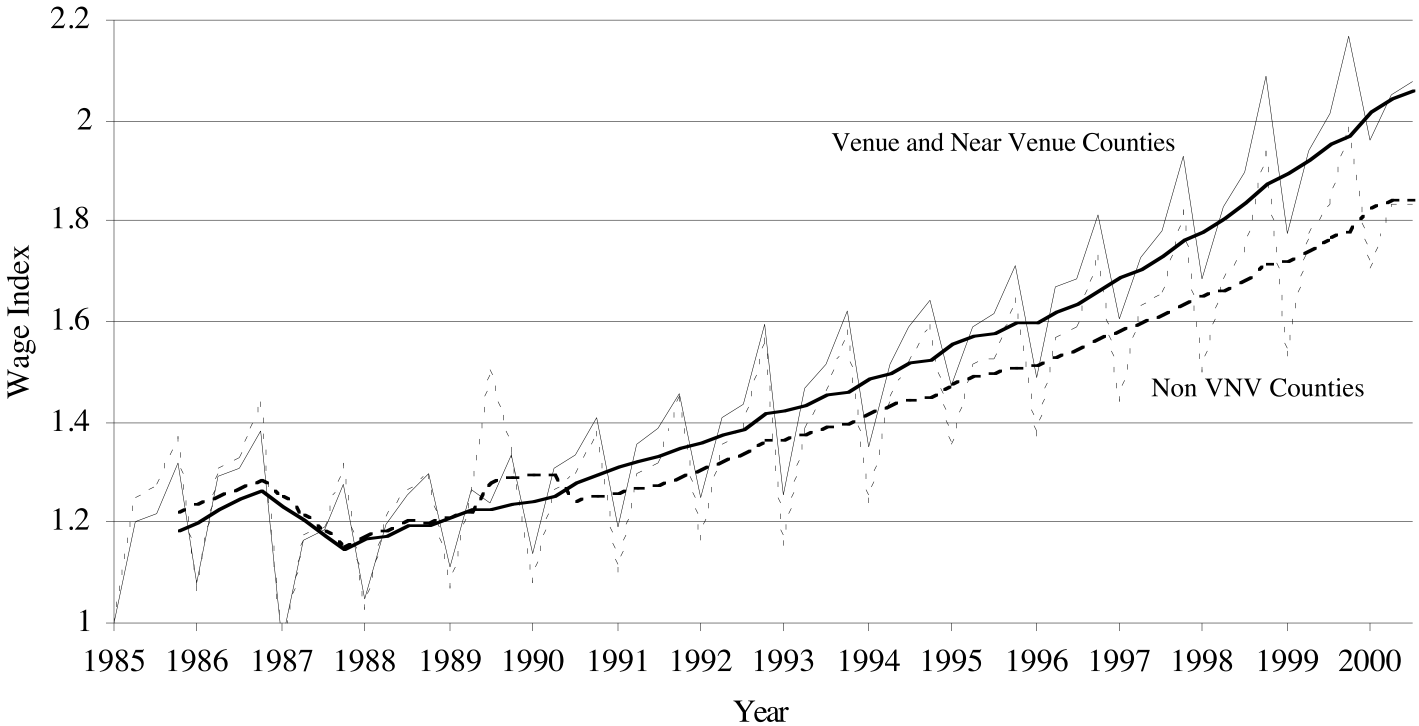
t * OlympicMSA* POST	--	0.0012***
		(0.0004)
Adj. R squared	0.97	0.97
F-value	745***	790***
N	143	143

Notes: Excluded industry category is Service. Standard errors are in parentheses.

* => significant at the 90% confidence level, ** => significant at the 95% confidence level, and *** => significant at the 99% confidence level. Comparison MSAs for the Northern VNV include Charlotte (NC), Dallas (TX), Fort Lauderdale (FL), Fort Worth (TX), Greensboro (NC), Memphis (TN), Miami (FL), New Orleans (LA), Norfolk (VA), Orlando (FL), San Antonio (TX), Tampa Bay (FL). POST=1 if $t \geq 1995$.




1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
Employment Index
Venue and Near Venue Counties
Non VNV Counties
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000
Year



2.2
2
1.8
1.6
1.4
1.2
1
Wage Index
Venue and Near Venue Counties
Non VNV Counties
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
Year