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Regional Income and Employment Effects of the 1972 Munich Olympic Summer Games

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JEL Classification Codes: L83, O18, R11, R53, R58

Keywords: Olympic Games, mega events, income, employment

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1 Introduction[i]

Hosting of the Olympic Games has affected the regions involved in a variety of ways – politically, psychologically, sociologically and culturally, as well as economically (RITCHIE and YANGZHOU, 1987). Applications to host the Olympic Games (or other so-called "mega-events") by cities and regions are based, insofar as rational decision-making may be assumed, on the expectation that the corresponding benefits will exceed the costs incurred (SPILLING, 1996, 321).

With regard to economic targets, which are our primary concern here, the focus is usually on short-term, demand-induced income and employment effects (and related increases in tax revenues). Positive long-term effects oriented to the supply side are typically hoped for, arising from three likely sources. First, the staff of the Organisation Committee and local authorities, as well as the volunteers involved, all gain useful knowledge and training, e.g. foreign language skills, intercultural experience, and new skills in relation to IT and communications systems. Second, urban infrastructure receives a fresh impetus, particularly sports facilities, but also public transport systems,

transport infrastructure in general and telecommunications facilities. Third, cities hope to gain a valuable "image effect" that may generate increased numbers of private and conference tourists, as well as increased (external) investment.

A considerable number of studies point to over-optimistic findings in ex ante analyses of sporting enterprises in general (see, for example, COATES and HUMPHREYS, 2003 and references therein). For the Olympic Games, BAADE and MATHESON, 2002 consider regional political effects as positive, whilst the auction-like character of the decision processes involved lead to expectations of negative economic consequences. On a deeper analytical level, it is worth noting that even in the short-term, i.e. in the run-up to the Games, anticipated positive stimuli for regional economies are minimal when, for example, fiscal policy budget restrictions and/or increases in interest rates, wages, and prices lead to crowding-out effects or to contracts only being awarded to a few local firms (TRAVIS and CROIZÉ, 1987). A further object of criticism is the temporary supply surplus that arises in the aftermath of the Games in the accommodation and real estate markets, along with related price-effect problems. In Barcelona, for example, some 25% of business premises were built between 1988 and 1993. The level of unoccupied premises increased from 0.7% in 1989 to 10.4% in 1992, with the market only regaining equilibrium in 1994/95 (MCKAY and PLUMB, 2001, 14).

Optimistic expectations regarding regional economic effects of the Olympic Games are regularly supported in ex-ante or "impact" studies, which usually concentrate exclusively on short-term effects owing to the availability of a well-established methodology in the form of multiplier analyses, which in some cases are further refined with the aid of input–output analyses.

Given that the scale of logistic and organisational requirements and the construction required for all applicant cities is quite similar and relatively stable over time, studies have regularly arrived at estimates of income stimuli reaching the mid-single-digit US$ billion region. These effects are expected primarily in the Olympic year and the pre-Olympic year and are most relevant to the construction industry, retail clothing, soft drinks and souvenir trade, as well as to the hotel and catering sector (MCKAY and PLUMB, 2001, 15). The relative significance of these stimuli primarily depends on the

scale of the regional or national economy involved. The figures for income impulses lie between 0.07% of GDP for the USA, resulting from the Atlanta Games, to 4.1% of GDP for Greece (MCKAY and PLUMB, 2001, 5), with the projected impulses spread across the 7-year period between the bid decision and actual hosting of the Games. The relative impulses can be correspondingly greater for individual host cities or regions.

Hardly any studies have evaluated previously calculated Olympic Games benefits on an ex post basis (KASIMATI, 2003, 438). Among the exceptions are TEIGLAND, 1999 who examines the tourism effects of the 1992 Olympic Games in Lillehammer (Norway), and BAADE and MATHESON, 2002 and HOTCHKISS, MOORE and ZOBEY, 2003, who examine the impact on employment and incomes, which is also our main concern here. The last two papers test for different income and employment effects in Olympic regions in comparison to other US regions. BAADE and MATHESON, 2002 restrict themselves to a short-term analysis of effects in the Olympic years. However, they conclude that the Olympic Games in Los Angeles 1984 and Atlanta 1996 had no significant effect on the employment situation in these cities. HOTCHKISS, MOORE and ZOBEY, 2003 allowing for mid-term effects of up to four years, find a significant impact of the 1996 Atlanta Olympics on regional employment, but not on wages.

No corresponding ex post study exists for European Olympic host cities. In view of the significant deviation of European labour market structures and European wages, incomes and employment policies from their US counterparts, the results derived by BAADE and MATHESON, 2002 and HOTCHKISS, MOORE and ZOBEY, 2003 are of limited usefulness for European regions. The present study attempts to close this gap using the example of the 1972 Olympic Games in Munich to test for different income and employment effects in German Olympic and non-Olympic regions. As well as considering the structural diversity of the continents examined, the present study differs from the works of BAADE and MATHESON, 2002 and HOTCHKISS, MOORE and ZOBEY, 2003 in three further aspects. First, the 27-year period considered (1961–1988) is significantly longer, which makes it possible to identify more clearly any long-term growth effects arising from the 1972 Munich Olympics. All relevant data issues are discussed in Section 2. Second, we utilize a difference-in-difference (DID) approach, like

HOTCHKISS, MOORE and ZOBEY, 2003 did for the Olympic Games in Atlanta 1996, to assess whether particular areas systematically experienced changes in income and employment due to the Olympics. The DID approach compares changes in a variable of interest before and after a specific policy, event or – borrowed from medical science – treatment in a region with the changes in the corresponding variable in other (control) regions not affected by the event (ATHEY and IMBENS, 2002). We modify the DID approach in two ways. First, as suggested by MEYER, 1995, we included control variables to reduce the residual variance. Second, to account for potential autocorrelation problems in standard DID models, we use the "Ignoring Time Series Information" (ITSI) method suggested by BERTRAND, DUFLO and MULLAINATHAN, 2004. The DID methodology is refined accordingly in Section 3.

Third, we report results not only for comparison of a single combination of post-Olympic and pre-Olympic periods (which may be chosen in an ad-hoc manner), but also for all available combinations. The estimation results for the income effects can be found in Section 3.1, while those for employment are presented in Section 3.2. Finally, Section 4 summarises our main findings.

2 Data

One crucial element of any DID set-up is the definition of the "treatment" and control periods or areas. In their study on the effects of the Olympic Games in Los Angeles 1984 and Atlanta 1996, BAADE and MATHESON, 2002 proceed from the assumption that any Games-related effects occur exclusively in the region (metropolitan statistical area, MSA) in which Olympic competitions take place. In the case of the 1972 Olympic Summer Games, these "venue regions" are the regions of Augsburg, Ingolstadt, Kiel, Munich, Nuremberg, Passau, Regensburg, Ulm and the city of Oberschleißheim, which is located in the Munich rural region. An overview of where the cities are located is given in Fig. 1. HOTCHKISS, MOORE and ZOBEY, 2003 in their study on the 1996 Atlanta Olympics, extend their analysis to include effects in directly contiguous regions ("venue and neighbouring regions"). The delimitations "venue regions" and "venue and neighbouring regions" are both examined in our study as well. Given the possibility that

regions that do not share a common border with the venue regions, but which are nevertheless located close enough for positive spillovers, may profit from the Games, we examine a third alternative delimitation: all regions within a 30-km radius of a venue region ("venue and surrounding regions").

In our sample there are 652 regions, including nine venue regions (35 venue and neighbouring regions and 55 venue and surrounding regions, respectively). The three different types of Olympic regions defined above are then compared with the control group, i.e. all remaining West German regions (excluding West Berlin). For descriptive data, see Table A1 in the Appendix.

In an alternative approach, the Olympic regions are compared exclusively to "structurally similar" economic areas, as the general economic conditions, and hence the economic performance, have evolved differently in different types of agglomeration over the period examined (BADE and NIEBUHR, 2002). Regions are defined as "structurally similar" if the Euclidian distance of their income, employment, population, and economic structure[ii] relative to the Olympic regions was between 0.85 and 1.15 in the years 1961 and/or 1964 (i.e. prior to the Games). The group of structurally similar economic areas was supplemented where necessary with the "venue and neighbouring" or "venue and surrounding" regions. For comparison of Olympic with "structurally similar" regions, 510 "venue and surrounding regions", 427 "venue and neighbouring regions", and 257 venue regions were considered.

Income data for the German NUTS3 regions[iii] have been taken from the Volkswirtschaftliche Gesamtrechnungen der Länder (VGL) series (National Accounts of the German Federal States). Our calculations make use of GDP data for the regions up to and including 1976, which are available for 1961 and then bi-annually for the period 1964–1976. In 1976 the regional gross value added (GVA) was published in parallel to GDP. From 1978 on, only GVA has been published. Using the corresponding national values, all income data have been converted into GDP and GVA shares (Y) for the NUTS3 regions to avoid structural breaks arising from changes in the calculation method. To clarify this, we should stress that our dependent variable is not wage in-

come, but includes company profits, which is important when interpreting the results derived in later stages.

The end of the observation period (1988) precedes the fall of the Berlin Wall in 1989, which led to considerable changes in the income and employment structure of the German regions (e.g. BUETTNER and RINCKE, 2004).

Data on the number of people employed ($LABOUR$) at NUTS3 level for the years 1961 and 1970 are available in the workplace census of the STATISTISCHES BUNDESAMT (German Federal Statistical Office, various years). For the period 1976–1988, data are taken from BADE, 1991. Employment figures for missing years were calculated by interpolating the employment shares for the regions and multiplying these by the corresponding national values, an approach also used by BADE, 1991.

In terms of control variables, we use variables comparable to those of BAADE and MATHESON, 2002 and HOTCHKISS, MOORE and ZOBEY, 2003, in that they are available in the following form for the Federal Republic of Germany: the number of people employed in the previous period ($LABOUR_i^{t-1}$) and the population of the region in the previous period (POP_i^{t-1})[iv], as published for NUTS3 level in the VGL series up to and including 1970. For the years after 1977, data are taken from EUROSTAT, 2001. For the years between 1970 and 1977, population figures were calculated in a similar way to those for employment, as explained above. To consider the effects of the two oil-price shocks, dummy variables (OIL^t) are used, with a value of 1 in the years 1974 and 1982, and 0 in the other years. To control for economic structure, the shares of agriculture and industry (AI_i^t), trade and transport (TT_i^t) and other services (S_i^t) in GDP and GVA were included (ARBEITSKREIS VOLKSWIRTSCHAFTLICHE GESAMTRECHNUNGEN DER LÄNDER, 1976, 2001, various years). The different procedures used by VGL at various times over the period 1961–1988 means that the agriculture and industry shares must be aggregated for the observation period. The proportion of other services must be grouped together for service enterprises, the state, private households, and private non-profit organisations.

To supplement the control variables from the two studies mentioned above, an additional dummy variable ($CITY_i$) has been included to represent urbanisation. This is necessary because of a number of fundamental developments in the Federal Republic of Germany: in the period 1976–1996, employment in agglomeration centres decreased by approximately 20%, and increased in the peripheral regions by some 30%. Analogous developments are also evident for incomes in these areas. The proportion of national income decreased over the period 1976–1996 by some 11% in urban centres, and increased by approximately 11% in the peripheral regions (BADE and NIEBUHR, 2002). The dummy variable for urbanisation is set to 0 for rural regions and 1 for city regions.

3 Estimation method and results

The DID methodology compares the difference between the variable of interest (Y_i, in our case, GDP and GVA shares and employment for the NUTS regions) for the Olympic regions before and after the event with the difference for the control group (non-Olympic regions) before and after the event. "Post-treatment period" is preferred to "post-Olympic period" in the following because – due to investment effects, etc. – Olympic effects might well become apparent before the start of the Olympic Games.

To test whether the variable Y_i

$$Y_i = Y_i^0 \cdot (1 - I_{i,t}) + I_{i,t} \cdot Y_i^1 \qquad (1)$$

developed significantly differently in regions i of group $G \in \{0;1\}$ over the period of time $T \in \{0;1\}$ (where I_i is the indicator of group membership $I_{i,t} = G_i \cdot T_{i,t}$), the DID approach is suitable (ATHEY and IMBENS, 2002).[v]

The model described by ATHEY and IMBENS, 2002 is modified in two ways in this study. First, as suggested by MEYER, 1995, we include control variables to capture any possible influence of further variables, so that the expression

$$Y_i^0 = \alpha + \beta \cdot T_t + \eta \cdot G_i + \tau \cdot I_{i,t} + \sum_{j=1}^{n} \delta_j X_j^i + \varepsilon_i \qquad \textbf{(2)}$$

results and the residual variance is reduced.

Second, DID models in the standard version regularly suffer from autocorrelation[vi] (BERTRAND, DUFLO and MULLAINATHAN, 2004), so that the standard error for $\hat{\tau}$ underestimates the standard deviation of $\hat{\tau}$ and the significance of the estimator is often too high. Following rigorous testing of various methods that correct for serial correlation, BERTRAND, DUFLO and MULLAINATHAN, 2004 recommend use of the ITSI method for large-scale analyses, in which only the averages for data for each region before and after the event are included in the regression equation. Below, as proposed by BERTRAND, DUFLO and MULLAINATHAN, 2004, a panel of T=2 is constructed in which the arithmetic mean is calculated for the variables for all regions for all available combinations of time periods.

In short, we test three alternative definitions of Olympic regions, each of which is compared initially to all German regions and then only to structurally similar German regions. These six alternatives were run for all conceivable ex post periods. The year 1966 was chosen as the earliest year for defining the post-treatment period due to the decision procedure for hosting of the Munich Games: "At the end of October 1965, the president of the NOC for Germany presented the Lord Mayor of Munich his idea of staging the Games. …. The NOC for Germany approved the application … at its general assembly December 18th, 1965. …the application document was submitted to the IOC on December 30th, 1965. … On … April 26th (1967) … Munich was chosen … as the site for staging the Games … On October 13th, 1967 the contest jury of the competition for the planning of the sports sites awarded the prizes. In the period between 1967 and July 1969, the Organising Committee approved necessary programs for space and functions" (ORGANISING COMMITTEE FOR THE GAMES OF THE XXTH OLYMPIAD MUNICH 1972, 1974a, 25, 66, 68). "Work was commenced on (some of) the constructions in the first half of 1968" (ORGANISING COMMITTEE FOR THE GAMES OF THE XXTH OLYMPIAD MUNICH 1972, 1974b, 11).

Owing to the data restrictions mentioned above, the pre-treatment period starts in 1961. With 1966 being the earliest starting year of the post-treatment period, as well as the earliest year for bi-annually published data, we test for significant effects for post-treatment periods of 1966–1968, 1966–1970, … 1966–1988, as well as 1968–1970,

1968–1972, … 1968–1988, etc.. In all, 66 regressions were estimated for both income and employment effects. In this way, we analyse as rigorously as possible the underlying data to detect any significant effects.

3.1 Income Effects

The estimation equation for income effects is

$$Y_i^t = \alpha + \beta \cdot T_t + \eta \cdot G_i + \tau \cdot I_{i,t} + \delta \cdot AI_i^t + \gamma \cdot TT_i^t + \varepsilon \cdot S_i^t + \kappa \cdot LABOUR_i^t + \lambda \cdot LABOUR_i^{t-1} + \pi \cdot POP_i^{t-1} + o \cdot OIL^t + \omega \cdot CITY_i \quad \textbf{(3)}$$

where the shares for agriculture and industry (AI_i^t), trade and transport (TT_i^t) and other services (S_i^t), employment ($LABOUR_i^t$, in 10,000 persons) lagged employment ($LABOUR_i^{t-1}$), population (POP_i^{t-1}, in 100,000 persons), and dummy variables for oil price shocks (OIL^t) and urbanisation ($CITY_i$) serve as control variables. The dummy variables T_t, G_i and $I_{i,t}$ reflect the DID approach. T_t designates time, i.e. before or after the event. G_i labels the group membership, i.e. Olympic region or control region. $I_{i,t}$ is the product of both dummy variables and stands for the income effect.[vii]

The coefficient τ in Table 1 reveals positive income effects due to the Olympic Games. "Venue regions" and "venue and neighbouring regions" both exhibit a significantly higher share of national income in the post-treatment period (1966–1988) than in the pre-treatment period. Only for the comparison between "venue and surrounding regions" and the remaining regions in Germany is no significant effect observed. It should be noted that income data were published bi-annually for this period.

The share of German national income for venue regions increased as a result of hosting the Games by 0.06 or 0.03 percentage points per region, depending on the definition of Olympic regions. These values are substantial compared to initial values for the income shares of the Olympic regions of around 0.7% (venue regions) and 0.2% (venue and neighbouring regions) per region. In other words, ceteris paribus, hosting the Olympics increased the average income share of venue regions between 1966 and 1988 from 0.7%

(0.2%) of German GDP to 0.76% (0.23%) for venue regions (venue and neighbouring regions).

As discussed above, choice of the observation period used in the analysis above was dictated by both data availability and historical developments. To mitigate this limitation, we report results not only for a single combination of pre- and post-treatment periods (e.g. 1961–1964 vs. 1966–1988, as in Table 1), but also for all possible post-treatment periods throughout the time period 1966–1988. For example, we also test 1961–1968 vs. 1970–1988 and 1961–1970 vs. 1972-1988. In addition, we test 1966–1968/1966–1970/1966–1972, etc. against 1961–1964 (data lines 1–3, etc. in Table 2) to allow for the possibility that positive effects due to the Olympics might well end ahead of the year 1988. The two significant results for the post-treatment period 1966–1988 (already reported in Table 1) are in bold type.

Table 2 reports only combinations of post-treatment periods with significant income and employment effects. For example, Table 2 shows that venue regions have significantly different income developments in the period 1966–1968 vs. 1961–1964 compared to the control group of non-venue regions. The same applies for 1966–1970 vs. 1961–1964, etc. Taking either 1966 or 1968 as the starting year of the post-treatment period, the income effects for the venue regions and for venue and neighbouring regions are significantly positive for virtually all conceivable end years of the post-treatment period.

However, for all other possible starting years of the post-treatment period, significant increases in income proportions for the venue regions can be detected only in exceptional cases.[viii] For example, the post-treatment period 1972–1988 is not included in Table 2, indicating that Olympic regions do not experience significantly different income effects in the period that might be considered the “natural” post-treatment or post-Olympic period. Thus, announcement effects and investments made in the run-up to the Olympic Games appear to be one of the main causes of the income increases detected in this analysis.

If the Olympic regions are compared only with the “structurally similar” regions defined above, the Olympic effect is only experienced to a limited degree (Table 3). Significant

effects only occur for "venue and neighbouring regions", and almost exclusively when the observation period starts in 1966. These effects are significant at the 5% level, yet they take values of between 0.01 and 0.02 percentage points, which are clearly below the effects detected in Table 2 for comparison of venue regions with all other German regions. However, when compared to the original value of 0.24%, these income increases are clearly quite considerable.

3.2 Employment Effects

The estimation equation for employment effects of the 1972 Olympic Games is similar to that for income effects, except the population in the region (POP_i^t) is used instead of the lagged population. The equation is thus in line with BAADE and MATHESON, 2002 and HOTCHKISS, MOORE and ZOBEY, 2003:

$$LABOUR_i^t = \alpha + \beta \cdot T_t + \eta \cdot G_i + \tau \cdot I_{i,t} + \delta \cdot AI_i^t + \gamma \cdot TT_i^t + \varepsilon \cdot S_i^t + \chi \cdot POP_i^t + o \cdot OIL^t + \omega \cdot CITY_i \quad \textbf{(4).}$$

Although the dummy variable for urbanisation is only rarely significant, it is nevertheless retained in the estimates to facilitate comparison with the analyses of BADE and NIEBUHR, 2002.

Overall, it is not possible to ascertain any systematic, significant, positive employment effects in the venue regions. Table 4 shows that any employment developments that deviate from those for the other German NUTS3 regions apply only to the venue regions themselves, and even then occur only sporadically. Of a total of 12 possible post-treatment periods between 1966 and 1988 for the venue regions themselves (or 36 when all three delimitations of the Olympic regions are considered), significant effects are only evident in three cases. Moreover, the observation period and the dimensions and direction of the effects point towards a random nature of the significant effects (or a cause beyond the scope of this examination). The effects are negative from 1966 to 1968, the effects are negative (approx. –15,000 jobs) and positive between 1984 and 1986 (12–14 years after hosting of the Olympic Games), with +43,000 jobs.

A lack of significant employment effects in the Olympic regions is also evident for comparison with structurally similar regions, with no single period showing significant effects for all three delimitations.

There is relatively little chance of discovering any significant employment effects at national level using the existing methods and data. Short-term employment effects in the period between naming of the host city and dissolution of the Organisation Committee after the end of the Games – a period of approximately 7 seven years – were estimated in typical impact studies on Los Angeles, Seoul and Barcelona, as well as for the candidate cities Berlin and Paris 2012 to be approximately 60,000–80,000 person years of additional employment.[ix] With an average figure of approximately 21.4 million people in Germany in paid employment in the period 1962–1972 (STATISTISCHES BUNDESAMT, 2004) the typically cited Olympic employment effect of approximately 7000 additional jobs over 7 years would correspond to an annual employment impulse of 0.03%. In view of the typical variances in German employment series, this effect is too small to be statistically significant.

4 Conclusions and future prospects

Theoretical considerations and impact studies of the Olympic Games lead to expectations of short-, medium- and long-term income and employment effects. The present work examines these expected effects by comparing income and employment developments in German NUTS3 regions involved in hosting the 1972 Olympic Games with those in other German NUTS3 regions over the period 1961–1988.

When interpreting the results of this analysis, it should first be noted that the methodology used merely test for different income and employment developments in comparison to other German regions. No test was made on whether the Olympic Games could possibly have had a positive effect on all regions in Germany, rather than just on the venue regions defined above. One aspect that would tend to favour this type of broader spread of effects is the fact that firms capable of providing the construction services required that accounted for some 73% of the Olympic Organisation Committee's budget

(DEUTSCHER BUNDESTAG, 1975; MAENNIG, 2001, 341) were more likely to be based throughout Germany (or even in other countries) than in the actual venue regions. Furthermore, it is also conceivable that greater international recognition also attracted additional numbers of tourists to other German regions, and that this export of services led to increased levels of both income and employment in the tourism sectors of the regions visited. On the other hand, taking into account the absolute size of the Olympic economic effect and of the German economy as a whole, there is, as mentioned in Section 3.2, relatively little chance of identifying any significant employment effects at a national level using the existing methods and data. The same reasoning also applies for income data.

Furthermore, it should be noted that significant differences in the macroeconomic development of Olympic compared to non-Olympic regions are not proof of significant effects of the Olympic Games. The hypothesis of similar macroeconomic development in both control areas might be rejected, but there may be unobserved non-Olympic causes for the differences observed. Critics might attribute the vibrancy of Bavaria in the period 1961¬–1988 to such non-Olympic causes. However, depending on the definition of "Olympic region", only 10¬–50% of Bavarian regions were hosts (and their economic structure was controlled for), although the remaining Bavarian regions were in the comparison group. In addition, regions other than those in Bavaria acted as host locations, and other regions with similar "growth miracles" (e.g. Baden-Hesse Wuerttemberg, Hesse) were also in the comparison group. Moreover, as observed from Table A1, the Olympic regions were economically stronger for most delimitations before the Olympic decision.

What is clear from this study is that the proportion of income for the more narrowly defined "venue regions" and the "venue and neighbouring regions" in relation to German income as a whole increased – depending on the observation period – by between 0.02 and 0.08 percentage points per NUTS3 region. These values are substantial compared to the initial average income shares of the Olympic regions of approximately 0.7% (venue regions) and 0.2% (venue and neighbouring regions). For comparison with similar structure regions at the beginning of the 1960s, the significant effects are smaller

and less frequent. Only for “venue and neighbouring regions” did the income share increase by an average of 0.01 and 0.02 percentage points per Olympic region. However, in comparison to their original mean income share of 0.24%, the Olympic effects are quite considerable. The effects cited here appear to have begun in 1966 or 1968 and were maintained well beyond the year 1972. In contrast, no systematic Olympics-related employment effects in Germany emerged from analysis over this period.

These results are in agreement with those of BAADE and MATHESON, 2002, who concluded that the Olympic Games in Los Angeles in 1984 and Atlanta in 1996 had no significant effect on employment. Although HOTCHKISS, MOORE and ZOBEY, 2003 report significant employment effects for the 1996 Atlanta Olympics, the wage effects they detect are not significant. This divergence in income and employment results for Munich could be explained by the fundamentally different nature of the labour market relations and, in particular, the relatively high mobility of US employees. Beside the implicitly mentioned ”closed shop” structure and highly regulated nature of the German labour market, other theoretical explanations for “jobless growth” can be derived from the export base theory (ANDREWS, 1953) and from the assumption that increases in GDP due to the Olympics benefited production factors other than labour.

The effects found for the 1972 Munich Olympics also provide more grounds for optimism than the findings of SPILLING, 1996 for the 1994 Winter Olympics in Lillehammer, which, in contrast to the long-term income effects of the Munich Olympics, indicate only short-term income effects due to hosting of the Olympic Games.

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Tab. 1: Income effects in Olympic regions relative to all other German regions: Pre-treatment period, 1961–1964, post-treatment period, 1966–1988 (equation 3)

	Venue regions		Venue and neighbouring regions		Venue and surrounding regions	
	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error
α	-0.167**	0.070	-0.173**	0.070	-0.182**	0.071
β	0.005	0.003	0.004	0.004	0.003	0.004
η	-0.079*	0.016	-0.013	0.008	-0.002	0.005
τ	0.061*	0.022	0.025**	0.010	0.012	0.007
δ	0.002**	0.001	0.002**	0.001	0.002**	0.001
γ	0.000	0.001	0.001	0.001	0.001	0.001
ε	0.002*	0.001	0.002**	0.001	0.002**	0.001
κ	0.014**	0.007	0.010	0.007	0.009	0.007
λ	0.041**	0.007	0.045**	0.007	0.046**	0.007
π	-0.01	0.040	0.01	0.040	0.01	0.040
o	-0.059	0.030	-0.062	0.030	-0.058	0.030
ω	-0.014*	0.004	-0.015*	0.004	-0.015*	0.004
SF	0.02		0.01		0.01	
R^2	0.98		0.98		0.98	
F-Statistic	6002.4*		5900.6*		5885.5*	

Comment: SF = Standard Error; regression coefficients explained in Eq. (3), * or ** = significant at the 1% or 5% level.

Data source: ARBEITSKREIS VOLKSWIRTSCHAFTLICHE GESAMTRECHNUNGEN DER LÄNDER, various years a, b, and 1976; BADE, 1997; EUROSTAT, 2001, STATISTISCHES BUNDESAMT, various years.

Tab. 2: Post-treatment periods with significant income effects in Olympic regions relative to all other German regions

T_t		Type of region	$\hat{\tau}$	SF	R^2	F-Statistic
From	Until					
1966	1968	Venue region	0.0469**	0.022	0.983	6791.9*
1966	1970	Venue region	0.0575*	0.021	0.984	7118.8*
1966	1972	Venue region	0.0757*	0.022	0.981	6355.6*
1966	1972	Venue and neighbouring region	0.0223**	0.011	0.981	6251.0*
1966	1974	Venue region	0.0655*	0.021	0.982	6042.9*
1966	1974	Venue and neighbouring region	0.0257**	0.011	0.981	5948.6*
1966	1976	Venue region	0.0653*	0.022	0.981	5926.0*
1966	1976	Venue and neighbouring region	0.0247**	0.011	0.981	5818.0*
1966	1978	Venue region	0.0557**	0.022	0.982	6041.5*
1966	1978	Venue and neighbouring region	0.0250**	0.011	0.981	5940.5*
1966	1980	Venue region	0.0513**	0.022	0.982	6028.5*
1966	1980	Venue and neighbouring region	0.0250**	0.011	0.981	5933.3*
1966	1982	Venue region	0.0543**	0.022	0.981	5865.1*
1966	1982	Venue and neighbouring region	0.0255**	0.011	0.981	5775.2*
1966	1984	Venue region	0.0617*	0.023	0.981	5749.4*
1966	1984	Venue and neighbouring region	0.0263**	0.011	0.980	5658.6*
1966	1986	Venue region	0.0608*	0.022	0.981	5893.7*
1966	1986	Venue and neighbouring region	0.0258**	0.011	0.981	5797.1*
1966	**1988**	**Venue region**	**0.0610***	**0.022**	**0.981**	**6002.5***
1966	**1988**	**Venue and neighbouring region**	**0.0255****	**0.011**	**0.981**	**5900.6***
1968	1970	Venue region	0.0795*	0.022	0.984	6804.5*
1968	1970	Venue and neighbouring region	0.0241**	0.011	0.983	6673.1*
1968	1972	Venue region	0.0754*	0.022	0.981	6275.2*
1968	1972	Venue and neighbouring region	0.0234**	0.011	0.981	6163.6*
1968	1974	Venue region	0.0646*	0.022	0.982	5797.9*
1968	1974	Venue and neighbouring region	0.0260**	0.011	0.981	5709.8*
1968	1976	Venue region	0.0599*	0.022	0.981	5792.1*
1968	1976	Venue and neighbouring region	0.0241**	0.011	0.981	5690.2*

1968	1978	Venue region	0.0538**	0.022	0.982	5840.5*
1968	1978	Venue and neighbouring region	0.0246**	0.011	0.981	5748.2*
1968	1980	Venue region	0.0480**	0.022	0.982	5822.1*
1968	1980	Venue and neighbouring region	0.0243**	0.011	0.981	5739.3*
1968	1982	Venue region	0.0503**	0.022	0.981	5650.6*
1968	1982	Venue and neighbouring region	0.0246**	0.011	0.981	5572.3*
1968	1984	Venue region	0.0596*	0.023	0.981	5547.3*
1968	1984	Venue and neighbouring region	0.0255**	0.011	0.980	5461.4*
1968	1986	Venue region	0.0588*	0.022	0.981	5702.9*
1968	1986	Venue and neighbouring region	0.0248**	0.011	0.981	5611.4*
1968	1988	Venue region	0.0589*	0.022	0.982	5822.3*
1968	1988	Venue and neighbouring region	0.0243**	0.011	0.981	5725.0*
1982	1984	Venue region	0.0607**	0.029	0.975	3155.0*
1982	1986	Venue region	0.0518**	0.026	0.980	3985.8*
1982	1988	Venue region	0.0479**	0.024	0.982	4437.6*
1984	1986	Venue region	-0.0741**	0.030	0.979	4165.0*

Comment: SF = standard error, * or ** = significant at the 1% or 5% level.

Data source: ARBEITSKREIS VOLKSWIRTSCHAFTLICHE GESAMTRECHNUNGEN DER LÄNDER, various years a, b, and 1976; BADE, 1997; EUROSTAT, 2001, STATISTISCHES BUNDESAMT, various years.

Tab. 3: Post-treatment periods with significant income effects in Olympic regions relative to structurally similar regions

T_t		Delimitation	$\hat{\tau}$	SF	R^2	F-Statistic
From	Until					
1966	1982	Venue and neighbouring region	0.0145**	0.007	0.986	5132.9*
1966	1984	Venue and neighbouring region	0.0147**	0.007	0.986	5069.1*
1966	1986	Venue and neighbouring region	0.0145**	0.007	0.986	5108.4*
1984	1986	Venue and neighbouring region	0.0227**	0.010	0.984	3688.3*

Comment: SF = standard error, * or ** = significant at the 1% or 5% level.

Data source: ARBEITSKREIS VOLKSWIRTSCHAFTLICHE GESAMTRECHNUNGEN DER LÄNDER, various years a, b, and 1976; BADE, 1997; EUROSTAT, 2001, STATISTISCHES BUNDESAMT, various years.

Tab. 4: Post-treatment periods with significant employment effects in Olympic regions relative to all other German regions

T_t		Delimitation	$\hat{\tau}$	SF	R^2	F-Statistic
From	Until					
1966	1968	Venue region	-15,358**	6,962.8	0.948	2599.9*
1968	1968	Venue region	-14,917**	6,852.4	0.948	2517.7*
1984	1986	Venue region	43,296*	11,697.6	0.902	967.6*

Comment: SF = standard error, * or ** = significant at the 1% or 5% level.

Data source: ARBEITSKREIS VOLKSWIRTSCHAFTLICHE GESAMTRECHNUNGEN DER LÄNDER, various years a, b, and 1976; BADE, 1997; EUROSTAT, 2001, STATISTISCHES BUNDESAMT, various years.

Tab. 5: Income effects in Olympic regions relative to all other German regions: Pre-treatment period, 1961–1964, post-treatment period, 1966–1988 (equation 4)

	venue location		Neighbouring		Surrounding	
	coefficient	std. error	Coefficient	std. error	coefficient	std. error
α	-84897.33*	24,466.29	-83,410.65*	24,662.83	-88,315.55*	24,664.87
β	-388.77	1,184.88	-475.24	1,209.71	-654.20	1,255.34
η	19616.98*	5,456.21	3,449.49	2,858.07	4,069.55**	1,902.13
τ	444.88	7,621.98	687.54	3,796.50	1,362.67	2,577.37
δ	712.79*	241.08	691.53*	242.96	728.62*	242.79
γ	721.16*	265.38	709.32*	267.62	794.72*	268.27
ε	679.52**	266.92	665.38**	269.03	700.70*	269.01
χ	0.46*	0.004	0.46*	0.004	0.46*	0.004
o	-53,461.51*	10,522.83	-55,078.07*	10,619.45	-53,031.81*	10,596.76
ω	22.525.58*	1,305.19	23,340.1*	1,304.83	23,247.9*	1,301.09
R^2	0.94		0.94		0.94	
F-Statistic	1,988.24*		1,951.12*		1,965.48*	

Comment: regression coefficients explained in equation 4, SF = Standard Error; * or ** = significant at the 1% level or 5% level.

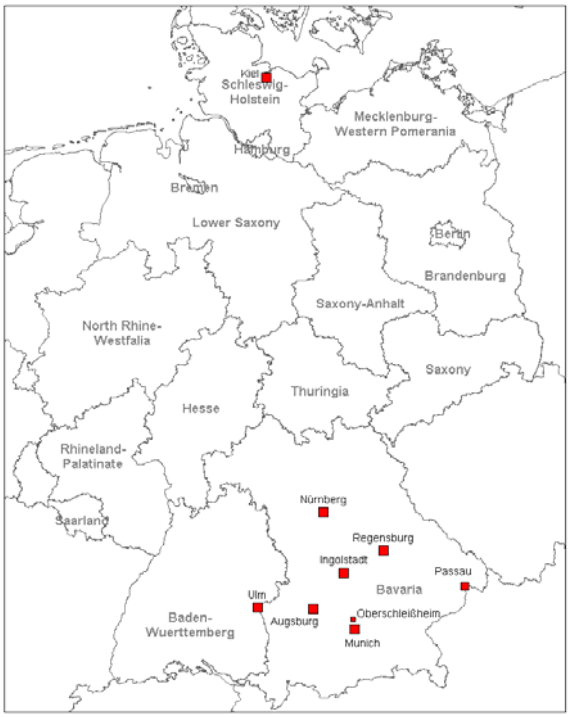
Data source: Arbeitskreis Volkswirtschaftliche Gesamtrechnungen der Länder [2, 3, 4], Bade [9], EU-ROSTAT [21], Statistisches Bundesamt [47].

Tab. A1: Descriptive statistics for Olympic and other German regions 1961/1988

	1961				1988			
	GDP (in Mio. €)		Employment		GDP (in Mio. €)		Employment	
	Olympic Regions	Comparision group	Olympic Regions	Comparision group	Olympic Regions	Comparision group	Olympic Regions	Comparision group
venue regions	1.150	271	161.613	36.870	9.487	3.057	168.475	59.659
venue and neighbouring regions	222	296	31.149	40.256	2.902	3.303	55.515	64.146
venue and surrounding regions	400	277	55.708	37.782	3.569	3.193	65.664	62.291

Data source: ARBEITSKREIS VOLKSWIRTSCHAFTLICHE GESAMTRECHNUNGEN DER LÄNDER, various years a, b, and 1976; EUROSTAT, 2001, STATISTISCHES BUNDESAMT, various years.

Fig. 1: 1972 Olympic venues in Germany



[i] We thank Annekatrin Niebuhr and Silvia Stiller and three anonymous referees for their valuable comments.

[ii] The four variables are described in greater detail in the next paragraphs.

[iii] NUTS denotes Nomenclature of Territorial Units for Statistics (Europe). For the definition of NUTS0/1/2/3 classification, see http://ec.europa.eu/comm/eurostat/ramon/nuts/basicnuts_regions_en.html, July 10, 2006.

[iv] Population figures for the same year often displayed an atheoretical negative influence, and were therefore not considered.

[v] For a detailed discussion of the DID methodology, cf. ATHEY and IMBENS, 2002.

[vi] BERTRAND, DUFLO and MULLAINATHAN, 2004 attribute this to three complementary reasons. First, for the most part, DID studies use relatively long time series. Second, the dependent variables used are typically correlated. Third, the independent variable I_i of a region changes only minimally over time.

[vii] In paragraph 3.2, it denotes employment effects.

[viii] For the observation period 1984–1986, which is admittedly not particularly relevant, there was even a significantly negative income effect.

[ix] Los Angeles 1984: 25,000 person years (PERELMAN, 1985, 121); Atlanta 1996: 77,000 person years (HUMPHREYS and PLUMMER, 1992, 3); Sydney 2000: 5,300–7,500 additional jobs over 12 years (CENTRE FOR REGIONAL ECONOMIC ANALYSIS, 1999, 1). For Athens 2004, an additional 150,000 person years of employment was estimated (MCKAY AND PLUMB, 1991). KWAG, 1988 with an estimated 344,000 person years of additional employment for Seoul 1988, is at the upper end of the scale. The impulse expected from Winter Games is usually smaller, cf., for example, NICHOLS APPLIED MANAGEMENT FOR CALGARY AND UTAH DIVISION OF TRADE DEVELOPMENT, 1988 for Salt Lake City.