The Olympic Games and the Improvement of Economic Well Being

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Abstract This paper investigates whether hosting the Olympic Games will improve economic well being of host countries. It is shown that the economic benefits of hosting the Games can last for up to 16 years. The economy of the host country improves after announcement of successful bid. The improvement peaks in the year of the Games and remains significant for 8 years after the Games.

Introduction

Over the past decade, there has been an increasing interest in the study of the Olympic Games. Existing studies focus on Olympic success. For example, Bernard and Busse (2004) and Lui and Suen (2008) show that population, GDP per capita and whether or not a country is the host of the Games are the main determinants of Olympic success. Johnson and Ali (2004) study the impact of
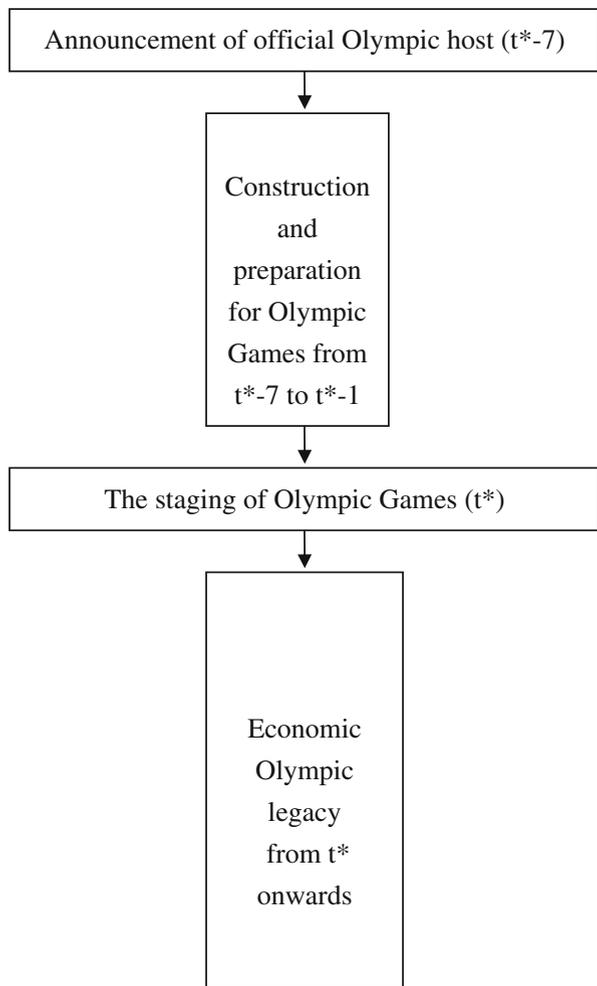
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Fig. 1 Phases of economic activities through the Olympic Games

Announcement of official Olympic host (t*-7)

Construction and preparation for Olympic Games from t*-7 to t*-1

The staging of Olympic Games (t*)

Economic Olympic legacy from t* onwards

political factors on Olympic success. Other pertinent studies include Yao (2006), Hotchkiss et al. (2003), Adranovich et al. (2001) and Lybbert and Thilmany (2000). Most of these aforementioned studies focus on winning medals, some attempt to measure the costs and benefits of the Games, while very few have explored the economic and material improvement of the hosts.

The Olympic events and their preparations are capable of restructuring various aspects of the host economy. Staging the Olympic Games requires the improvement of the transportation, telecommunications, and sports facilities of the host. For example, in the 1988 Seoul Games, many major roads were improved. In the 1992 Barcelona Games, ring roads were built, which are considered the greatest post-Games benefit for the locality today (Millet 1995). In the 2004 Athens Games, the train network for the city was expanded. In

Table 1 Regression results for the whole sample (Y = Per Capita GDP Growth)

Number of observations: 3653

Number of countries: 126

	Arellano-Bond		Panel Regression	
	Specification A	Specification B	Specification A	Specification B
Y (t-1)	0.2202*** (6.83)	0.2201*** (6.82)	0.2219*** (13.67)	0.2219*** (13.65)
Y(t-2)	0.0092 (0.41)	0.0090 (0.40)	0.0056 (0.35)	0.0052 (0.32)
Interest Rate	−0.0009* (−1.78)	−0.0009* (−1.78)	−0.0012*** (−4.59)	−0.0011*** (−4.59)
GDP	−6.302E-13 (−1.15)	−6.281E-13 (−1.14)	−6.043e-13*** (−2.99)	−6.028e-13*** (−2.98)
Gov_Expend	−0.2353*** (−3.97)	−0.2350*** (−3.98)	−0.1586*** (−8.24)	−0.1586*** (−8.23)
Population	9.458E-09* (1.76)	9.501E-09* (1.76)	6.310e-09** (2.52)	6.320e-09** (2.52)
Pop_Growth	−0.5998*** (−3.24)	−0.5994*** (−3.25)	−0.4525*** (−5.03)	−0.4527*** (−5.03)
Pregame	2.0302* (1.88)		0.9683* (1.92)	
Pre7		1.4167 (1.41)		0.6500 (0.54)
Pre6		1.3848 (1.48)		0.5070 (0.42)
Pre5		1.8988 (1.36)		1.1627 (0.97)
Pre4		2.0759 (1.57)		1.2374 (1.03)
Pre3		1.9338** (2.02)		1.0128 (0.85)
Pre2		2.1068 (1.60)		0.8691 (0.73)
Pre1		2.2437** (1.97)		1.3449 (1.13)
Host	3.3040*** (2.71)	3.5213*** (3.21)	2.5038** (2.10)	2.5100** (2.10)
Post1		0.7323 (0.70)		−0.4133 (−0.35)
Post2		3.1922*** (2.86)		1.9500 (1.63)
Post3		2.9843** (2.32)		1.4199 (1.19)
Post4		3.1141** (2.44)		1.4325 (1.20)
Post5		2.8128** (2.33)		1.0633 (0.89)
Post6		2.5957* (1.79)		0.7376 (0.62)
Post7		2.6084*** (2.58)		1.0707 (0.89)
Post8		3.6322*** (3.14)		1.9841* (1.65)
Post9		2.2057 (1.70)		0.4571 (0.38)
Dur2	0.3831 (0.34)		−0.4194 (−0.35)	
Dur3	−0.4409 (−0.50)		0.2517 (0.18)	
Dur4	0.5010 (0.75)		0.4044 (0.25)	
Dur5	0.3523 (0.40)		0.3414 (0.21)	
Dur6	−0.0061 (−0.01)		−0.4062 (−0.25)	
Dur7	−0.9118 (−1.09)		−0.9219 (−0.56)	
Dur8	1.5741*** (3.38)		1.5518 (0.94)	

Table 1 (continued)

Number of observations: 3653

Number of countries: 126

	Arellano-Bond		Panel Regression	
	Specification A	Specification B	Specification A	Specification B
Dur9	2.0858 (1.65)		0.4581 (0.38)	
Wald chi^2	267.50	5363.36		
R-sq(%)			13.88	13.89

t-statistics or z-statistics report in parentheses. *$p<0.10$; **$p<0.05$; ***$p<0.01$

Let t^* be the year of the Games hosted by country and i^*. The definitions of variables in the regression at time t are given as follows:

$Pregame = 1$ if $t^* - 7 \leq t \leq t^* - 1$, $i = i^*$

$\quad\quad = 0$, otherwise

$PreM = 1$ if $t = t^* - M$, $i = i*$, $M = \{1, 2, \ldots, 7\}$

$\quad\quad = 0$, otherwise

$Host = 1$ if $t = t*$, $i = i^*$

$\quad\quad = 0$, otherwise

$PostN = 1$ if $t = t^* + N$, $i = i*$, $N = \{1, 2, \ldots, 9\}$

$\quad\quad = 0$, otherwise

$DurP = 1$ if $t^* + 2 \leq t \leq t^* + P$, $i = i*$, $P = \{3, 4, \ldots, 9\}$

$\quad\quad = 0$, otherwise

the 2008 Beijing Games, an intra-city transportation system and new airports were constructed. The construction of these infrastructures creates jobs and improves the material well being of people in the host countries. In recent editions of the Games, the host countries also put great effort on environmental protection (Hashmi et al. 2008). The staging of Olympic Games attracts tourists and bring benefits to different sectors of the host economies. The improvement of the transportation system, creation of additional leisure facilities and introduction of numerous ecological projects lead to general embellishment of the host cities and improvement in the life quality of the citizens (Preuss 2004).

Researches on the quality of life have been growing in recent years. Quality of life is difficult to measure. Factors affecting the quality of life include wealth, employment, environment, physical and mental health, education, recreation and leisure time, social belonging and so on. Unlike per capita GDP or standard of living, which can be measured in financial terms, it is difficult to make objective or long-term measurements of the quality of life. Therefore, studies by economists on the subject are relatively limited (Nussbaum and Sen 1993; Crafts 1997; Kahneman and Deaton 2010). A potential link between economics and the quality of life is the economics of happiness. Easterlin (1974, 1995) study statistics over time on the reported level of happiness. It is found that individual happiness appears to be the same across poor and rich countries and economic growth

Table 2 Regression results for the sample of hosts (Y = Per Capita GDP Growth)

Number of observations: 446

Number of countries: 11

	Arellano-Bond		Panel Regression		
	Specification A	Specification B	Specification A	Best-fitted Specification A	Specification B
Y(t-1)	0.1647*** (3.00)	0.1746*** (3.20)	0.1740*** (3.76)	0.1762*** (3.85)	0 .1770*** (3.77)
Y(t-2)	−0.0994*** (−2.76)	−0.1026*** (−2.78)	−0.0924** (−2.13)	−0.0919** (−2.13)	−0.0999** (−2.25)
Interest Rate	−0.0682*** (−3.45)	−0.0659*** (−3.48)	−0.0661*** (−6.63)	−0.0662*** (−6.67)	−0.0658*** (−6.55)
GDP	−6.282e−13*** (−4.46)	−6.712e-13*** (−4.63)	−6.547e-13*** (−3.67)	−6.48e-13*** (−3.67)	−6.593e-13*** (−3.67)
Gov_Expend	−0.5964*** (−5.05)	−0.5820*** (−5.05)	−0.5792*** (−8.23)	0.5776*** (8.26)	−0.5814*** (−8.20)
Population	2.918E-09 (0.77)	4.983E-09* (1.87)	3.889E-09 (0.42)	3.99e-09 (0.43)	4.217E-09 (0.45)
Pop_Growth	−0.7198** (−2.31)	−0.7507** (−2.33)	−0.7865** (−2.55)	−0.7729** (−2.53)	−0.7868** (−2.53)
Pregame	0.9622*** (2.68)		0.8817*** (2.67)	0.8720*** (2.65)	
Pre7		0.6691** (2.33)			0.6852 (0.89)
Pre6		0.5315*** (2.66)			0.5446 (0.71)
Pre5		0.9488 (1.47)			0.9450 (1.23)
Pre4		1.091 (1.55)			1.0847 (1.41)
Pre3		0.8582 (1.70)			0.8478 (1.10)
Pre2		0.7913 (1.12)			0.7826 (1.01)
Pre1		1.299** (2.86)			1.297 (1.69)
Host	2.367*** (2.57)	2.375*** (5.00)	2.360*** (3.10)	2.341*** (3.09)	2.371*** (3.09)
Post1		−0.3675 (−0.53)			−0.3761 (−0.48)
Post2		1.955*** (3.99)			1.948** (2.52)
Post3		1.159* (1.86)			1.1017 (1.43)
Post4		1.348* (1.90)			1.285* (1.67)
Post5		1.077* (1.66)			1.020 (1.31)
Post6		0.8828 (1.11)			0.8233 (1.07)
Post7		0.7249 (1.47)			0.7597 (0.98)
Post8		1.666*** (3.59)			1.700** (2.20)
Post9		0.3382 (0.48)			0.3659 (0.47)
Dur2	−0.3978 (−0.57)		−0.3863 (−0.50)	−0.4090 (−0.53)	
Dur3	0.1760 (0.25)		0.2385 (0.26)		
Dur4	0.3412 (0.65)		0.2850 (0.27)	0.5934 (0.98)	
Dur5	0.2395 (0.33)		0.2130 (0.20)		

Table 2 (continued)

Number of observations: 446

Number of countries: 11

	Arellano-Bond		Panel Regression		
	Specification A	Specification B	Specification A	Best-fitted Specification A	Specification B
Dur6	0.05668 (0.06)		0.01445 (0.01)		
Dur7	−0.9239 (−1.36)		−0.9555 (−0.91)	−0.8743 (−1.03)	
Dur8	1.374*** (3.49)		1.3575 (1.30)	1.692** (2.23)	
Dur9	0.2706 (0.37)		0.3576 (0.47)		
Wald chi^2	513.91	77.29			
R-sq(%)			36.28	36.5	36.62

t-statistics or z-statistics report in parentheses. *$p<0.10$; **$p<0.05$; ***$p<0.01$

Let t^* be the year of the Games hosted by country and i^*. The definitions of dummy variables in the regression at time t are given as follows:

$Pregame = 1$ if $t^* - 7 \leq t \leq t^* - 1$, $i = i^*$
$\qquad = 0$, otherwise
$PreM = 1$ if $t = t^* - M$, $i = i*$, $M = \{1, 2, \ldots, 7\}$
$\qquad = 0$, otherwise

$Host = 1$ if $t = t*$, $i = i^*$
$\qquad = 0$, otherwise

$PostN = 1$ if $t = t^* + N$, $i = i*$, $N = \{1, 2, \ldots, 9\}$
$\qquad = 0$, otherwise
$DurP = 1$ if $t^* + 2 \leq t \leq t^* + P$, $i = i*$, $P = \{3, 4, \ldots, 9\}$
$\qquad = 0$, otherwise

does not raise well-being. Hirsch (1976) and Scitovsky (1976) also criticize the value of increased real national income. Other related studies include Campbell (1981), Larsen et al. (1984) and Ng (1996).

Although staging the Olympic Games may improve the well being of the citizens, it is a costly venture. The 1976 Montreal Olympics took Quebec 30 years to repay the outstanding Olympic debt. The Greek government spent USD 2.4 billion to stage the 2004 Olympics. The 2008 Beijing Games cost China USD 40 billion on environmental protection and expansion of railway network, as well as for the construction of roads, sports stadiums and airports for the three host cities-Beijing, Shanghai and Qingdao.

To justify the hefty cost, a careful assessment of its long-run benefits is needed. This paper investigates the improvement of material well being in terms of economic growth of these countries. Our results indicate that the Olympics are more than just short-term economic stimulus. The Olympics economic benefits can last for up to

16 years, suggesting that the investment on infrastructure before the Olympics lays the foundation for further economic development of the hosts.

Data and Model

Socio-economic variables, including GDP, GDP per capita growth, population, population growth, interest rate and government expenditure between 1961 and 2007, are obtained from World Development Indicators (WDI) of the World Bank. Due to data availability, there is a trade-off between the length of data series and the number of variables used. Our sample consists of 126 host and non-host countries of the Olympiad between 1956 and 2012. The total number of observations is 3653 when both country dimension and time dimension are taken into account. Among the hosts, the Soviet Union (host of the 1980 Moscow Olympics) and Germany (host of the 1972 Munich Olympics) are excluded from the list due to insufficient data. Two countries in our sample period hosted more than once. USA hosted the Olympics in 1984 and 1996, whereas Australia hosted in 1956 and 2000. The final sub-sample contains 11 host countries, and the total number of observations is 446 when both country dimension and time dimension are taken into account.

During pre-Olympic years, there was an increase in infrastructure investment on stadiums, transportation network and environmental protection. Improved transportation systems and additional leisure facilities lead to an improvement of
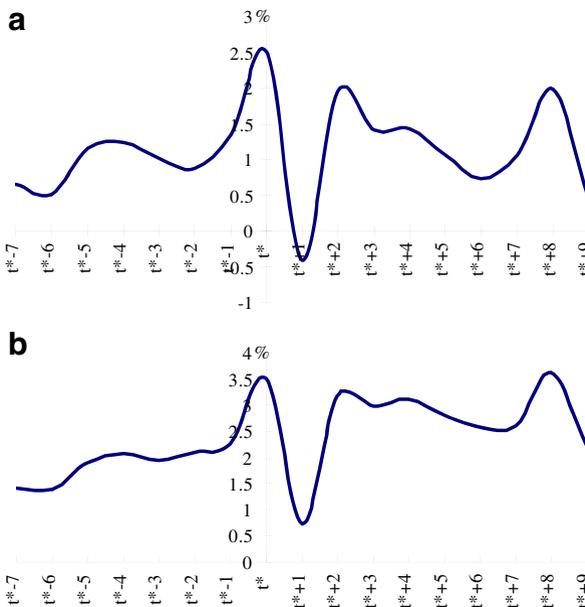
Fig. 2 **a** Additional economic growth of country i* during pre-Games period, year of the Games and post-Games period (by duration model of panel regression using the whole sample). **b** Additional economic growth of country i* during pre-Games period, year of the Games and post-Games period (by duration model of dynamic estimation using the whole sample)

a

b
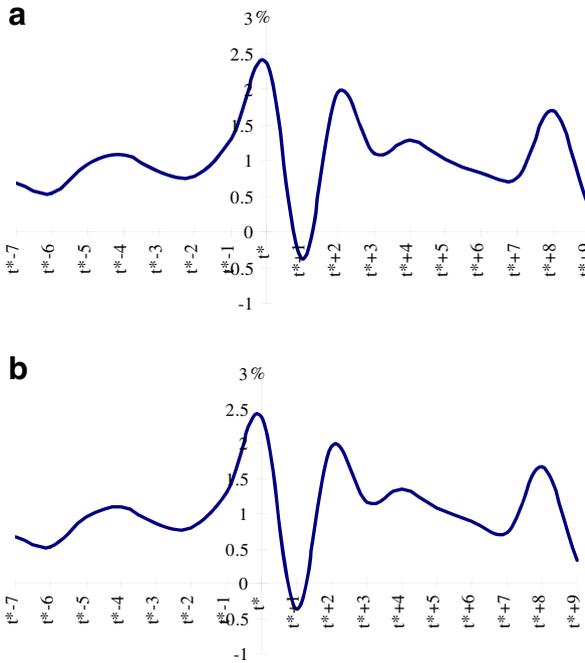
Fig. 3 **a** Additional economic growth of country i* during pre-Games period, year of the Games and post-Games period (by duration model of panel regression using the host-country sample). **b** Additional economic growth of country i* during pre-Games period, year of the Games and post-Games period (by duration model of dynamic panel estimation using the host-country sample)

material well being of the host people and are conducive to economy in the long run.

We estimate two model specifications with different sets of dummies.

Specification A:

$$y_{it} = y_{it-1}\gamma + y_{it-2}\rho + \sum x_{itj}\beta_j + \alpha_1 pregame_{it} + \alpha_2 host_{it} + \sum_{k=2}^{9} Dur_{itk}\alpha_{k+1} + \varepsilon_{it}$$

Specification B:

$$y_{it} = y_{it-1}\gamma + y_{it-2}\rho + \sum x_{itj}\beta_j + \sum_{m=1}^{7} \alpha_m pre_{itm} + \alpha_8 host_{it} + \sum_{k=2}^{9} Post_{itk}\alpha_{k+7} + \varepsilon_{it}$$

where y_{it} is the real per capita GDP growth of country i in year t and x is a set of covariates. The first and second lags of y_{it} are included to control for unobserved effects. The covariates of x include GDP, population, population growth, interest rate and government expenditure are used to control for the non-Olympic effects on growth.

Let t* be the year of the Games hosted by country i*. Figure 1 shows the phases of economic activities through the Olympic Games

To assess the impacts at different stages, dummy variables are used to indicate different stages of the Games. The Olympic effects are measured by a set of duration dummies and year dummies respectively.[1] The definitions of dummy variables at time t for country i in the two specifications above are given as follows:

$$Pregame = 1 \text{ if t*} - 7 \le t \le t* - 1, \text{ i} = \text{i*}$$
$$= 0, \text{ otherwise}$$

$$PreM = 1 \text{ if t} = t* - M, \text{ i} = \text{i*}, M = \{1, 2, \ldots, 7\}$$
$$= 0, \text{ otherwise}$$

$$Host = 1 \text{ if t} = t*, \text{ i} = \text{i*}$$
$$= 0, \text{ otherwise}$$

$$PostN = 1 \text{ if t} = t* + N, \text{ i} = \text{i*}, N = \{1, 2, \ldots, 9\}$$
$$= 0, \text{ otherwise}$$

$$DurP = 1 \text{ if t*} + 2 \le t \le t* + P, \text{ i} = \text{i*}, P = \{3, 4, \ldots, 9\}$$
$$= 0, \text{ otherwise}$$

Specification A examines the Olympic effects during the pre-Olympic period, year of the Games and post-Olympic period. A dummy variable is used for pre-Olympic period and eight duration dummy variables are included to measure the effect for different durations in post-Olympic years.

Specification B investigates the year-on-year change of the Olympic effects on economic improvement. Eight post-Olympic dummies are used to measure the benefits during post-Games year(s).

A dynamic panel regression is a panel regression with lag dependent variables. The introduction of the lag dependent variables into a static panel model give rise to the dynamic nature of the model, but it also complicates the estimation of the fixed and random effects of the panel model. Since the lagged dependent variables may be correlated with the error term, the ordinary least squares estimators in dynamic panel model are inconsistent. To better estimate the Olympic effect on growth, the estimation method of Arellano and Bond (1991), which adjusts for the bias, is employed in this paper. Adopting from the notion of instrumental variables, Arellano and Bond (1991) treats the model as a system of equations, in particular, one period as one equation in the system. An assumption of the model is that the number of temporal observations is greater than the number of regressors in the model. The

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[1] Some host countries allow a full set of Olympic dummies, from 7 years before the host years to 9 years after the Games, to be equal to one in the respective years, whereas the Olympic hosts near the end of the sample timeframe only permit a segment of Olympic dummies to be equal to one. Taking 2012 Olympics as an example of segmented dummies, it allows pre-Olympic dummies from 2005 onwards to be equal to one, zero otherwise.

instrument(s) applicable to each equation can differ so that the degree of biasness can be reduced (Baum 2006).

Estimation Results

Table 1 reports the results for the sample containing all the participating countries, which shows an additional 1 % to 2 % per capita GDP growth from the host announcement year (t^*-7) to 1 year prior to the year of the Games (t^*-1) by Specification A, as prescribed by both the Arellano-Bond approach and the dynamic panel regression. Estimation results for both specifications suggest that the growth is the greatest in the year of the Games. The staging of the Olympics contributes additional 2.5 % per capita GDP growth.

Both methods produce fairly similar results. In the Arellano-Bond model, both specifications imply post-Olympics benefits are likely to last for up to 8 years after the Games. The short-term cost based on the rough calculation of the announced monetary cost as a ratio of the GDP of corresponding host countries in the hosting year are about 1 % to 3 % of the GDP, excluding non-monetary costs, such as the shadow wage of volunteers. Therefore, long-term benefits of hosting the Games outweigh the short-term cost.

Table 2 reports the results for the sample of the host countries. More evidence emerges from the sub-sample of 11 host countries, namely Australia, Canada, China, Great Britain, Greece, Italy, Japan, Mexico, South Korea, Spain and the USA.

The estimation results are consistent with those from the whole sample that hosting the Olympics is beneficial to economic growth in the long run. The estimated coefficient for *Dur8* using both estimation methods are significant. The additional growth brought about by the Olympics during pre-Games period is approximately 1 %. An additional 2.4 % is found for the year of the Games, while an additional 1.4 % to 1.7 % are found during different years of the post-Games period. Figures 2a, b, 3a and b provide pictures of the dynamic effects.

The coefficients of *year* dummies in specification B are plotted. The four figures are virtually identical. There is a noticeable increase in economic growth in the year of the Games and a dip in the year right after the Games. The additional per capita GDP growth increases gradually since the announcement of the successful bid and reaches the peak in the year of the Games. The growth slows down afterward. For post-Games years, additional growth resulting from the Olympics is generally positive.

As a robustness check, we examine if the per capita GDP growth around the Olympic year for the host countries are relatively higher than non-Olympic periods. We exclude the Soviet Union (host of the 1980 Moscow Olympics) and Germany (host of the 1972 Munich Olympics) since they are not in our sample due to insufficient data. Figure 4a to j display the per capita GDP growth of each host between 1960 and 2008. A visual inspection of these Figures suggests that the economies of most of these countries perform well during the Olympic periods. A dip in the growth rate in the year immediately after the Games is generally observed. Some countries, such as South Korea, has an apparent bell-shaped growth path centering around the year of the Games (Fig. 4f).

Fig. 4 **a** Per capita GDP growth
of Italy during 1961–2006 (Host
year: 1960). **b** Per capita GDP
growth of Japan during 1961–
2005 (Host year: 1964). **c** Per
capita GDP growth of Mexico
during 1961–2007 (Host year:
1968). **d** Per capita GDP growth
of Canada during 1966–2005
(Host year: 1976). **e** Per capita
GDP growth of USA during
1961–2005 (Host years: 1984
and 1996). **f:** Per capita GDP
growth of South Korea during
1967–2007 (Host year: 1988). **g**
Per capita GDP growth of Spain
during 1961–2006 (Host year:
1992). **h** Per capita GDP growth
of Australia during 1960–2006
(Host year: 2000). **i** Per capita
GDP growth of Greece during
1961–2006 (Host year: 2004). **j**
Per capita GDP growth of China
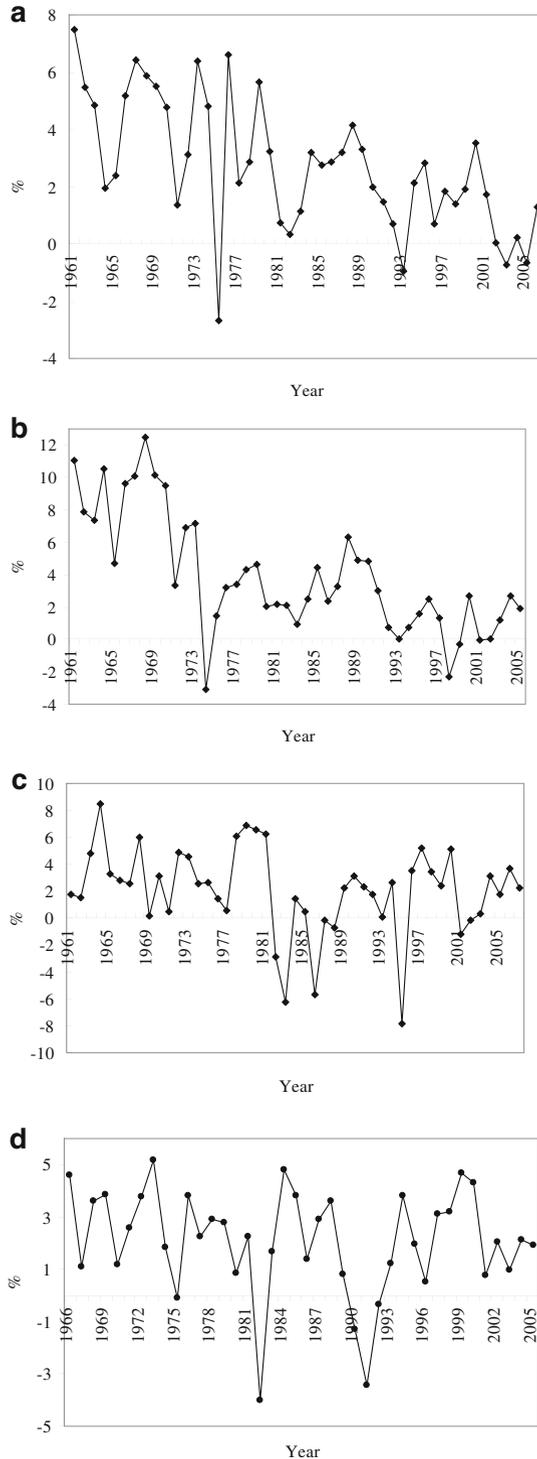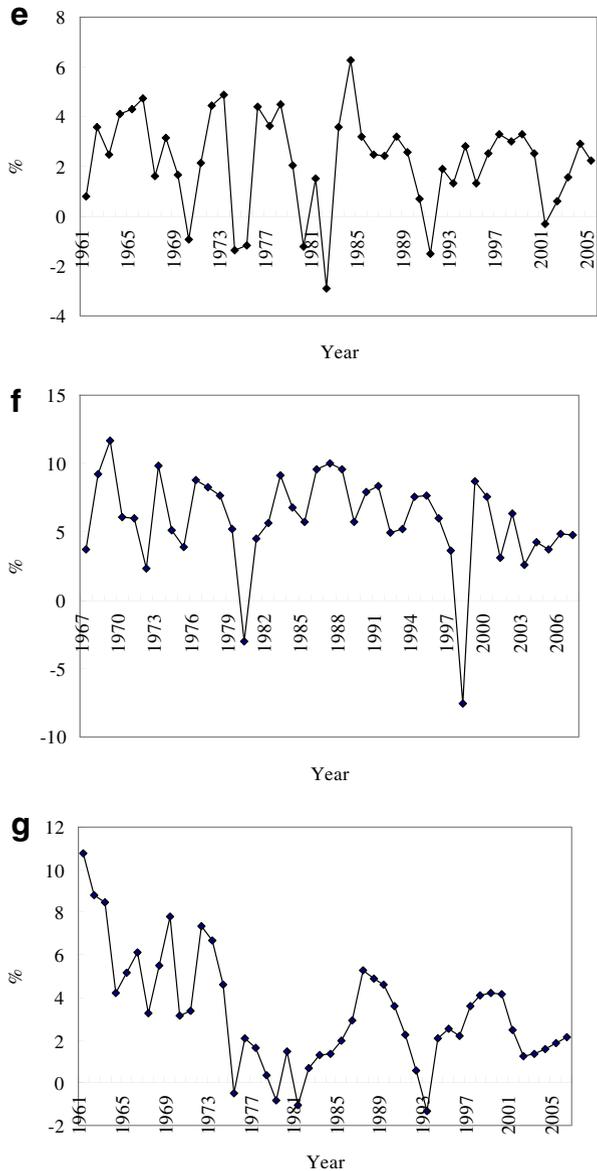during 1987–2006 (Host year:
2008)

Fig. 4 (continued)

e

f

g

Conclusion

The Olympic Games has a profound impact on the quality of life for people of the host countries. Preparation work for the Games, including the construction of stadiums and transportation network, involves huge investment during pre-Olympic years. The Games and the associated events attract capital and tourists, and the investment on infrastructure creates jobs and improves the material well being of the citizens.

Fig. 4 (continued)
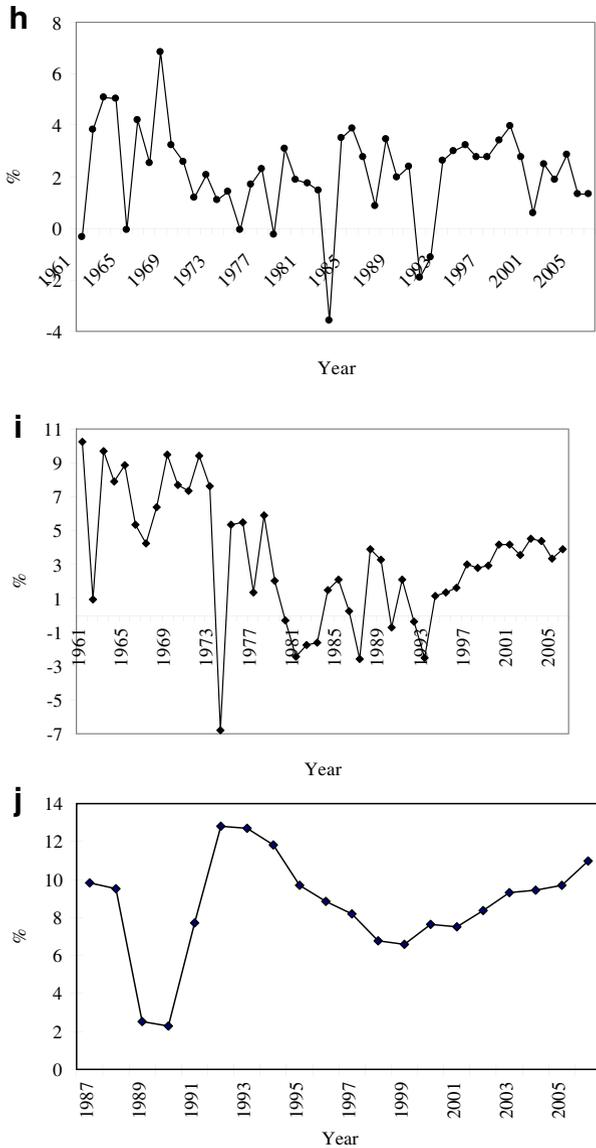
This paper investigates how the economy of a host country was improved over the pre- and post-Olympic periods. It is found that the host countries enjoy nontrivial additional per capita GDP growth. The economy started to improve after the announcement year of the successful bid. There is a noticeable improvement in the year of the Games and a dip in economic growth in the year following the Games. The direct and indirect economic benefits of hosting the Games can last for up to 16 years. Therefore, despite the high cost of hosting the Olympics, our results suggest that benefits outweigh the cost.

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