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A Fiscal View on Analyzing the Impact of Organizing Mega Sporting Events

Sheng-Tung Chen*

Department of Public Finance, Feng Chia University, Taiwan

This paper focuses on explaining the Post Olympic Effect on mega sporting events which include the Summer Olympic Games and the FIFA World Cup. By applying the neoclassical one-sector aggregate production function model and Hansen's threshold model (1996, 2000) to analyze the impact of organizing mega sporting events, the hypothesis of the Armey curve (1995) is investigated. Data for countries hosting the Summer Olympic Games and the FIFA World Cup over the period from 1980 to 2008 are collected. The empirical results show that 7 of 13 countries support the hypothesis of the Armey curve and the Post Olympic Effect is found to occur in France and Italy with an over-expansion in government size as far as FIFA is concerned. The effect is partially supported in Greece, Spain, and South Korea as the Summer Olympic Games are considered with an over-expansion in government size.

Keywords: sporting events, critical government size, threshold model
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*Correspondence to: Department of Public Finance, Feng Chia University, 100 Wenhwa Rd., Seatwen, Taichung, Taiwan, 40724; Tel: +886-4-2451-7250 ext. 4310; e-mail: stonchen@fcu.edu.tw.

1 Introduction

The economic effects of holding the Summer Olympic Games and the FIFA World Cup always attract much attention from the time the primary investment is made until the games end. Some empirical studies indicate that a country usually encounters an economic recession for one or two years after the mega sporting event ends.[1] However, the economic characteristics and level of stability may play an important role in terms of the seriousness of the recession. Furthermore, this kind of recession phenomenon is always referred to as a "Post Olympic Effect."

Recently, it has been asked whether the recent debt crisis in Greece may have resulted due to the over-expansion of government expenditure in order to hold the Summer Olympic Games in 2004. We know that the host country of the Summer Olympic Games captures the attention of people all over the world and it is also a good time for the country to introduce itself and may generate huge amounts of travel revenue due to holding the games. However, many researchers have argued that the Summer Olympic Games in 2004 may not have been the major factor that triggered the budget crisis. George Papandreou who served as Prime Minister of Greece following his party's victory in the 2009 legislative election claimed that the Summer Olympic Games in 2004 was not the major problem that brought about the Greek government's debt crisis. Bad debt management on the part of the government, erroneous reforms and political problems may have instead been the major reasons for the crisis. Greece has officially announced that the Greek debt amounted to about 382 billion U.S. dollars in 2011 whereas expenditure on the Summer Olympic Games in Athens in 2004 amounted to only 10 billion U.S. dollars. Therefore, the Greek government does not believe that the Games was a major factor that caused the crisis. Therefore, whether there exists a Post Olympic Effect or not still gives rise to some debate and there are no consistent answers.

As another example, the successful Summer Olympic Games in 1996 in Atlanta brought about a total benefit that was estimated to be around 5.1 billion U.S. dollars

[1]Getz (2008) has classified events into four categories based on scale, with the categories being: mega events, periodic hallmark events, regional events, and local events. Mega events such as the Olympics and the FIFA World Cup normally involve large scale investments, require complex decision making by different parties, and give rise to large potential impacts.

to the state of Georgia alone, but the benefit still could not cover the associated cost and resulted in a deficit. Therefore, we can say that to hold a major sporting event may bring about economic benefits for the country, but the over-expansion in government expenditure may have a negative impact on the economy after the event. Furthermore, the impact may vary according to the host country characteristics. To build new structures and a stadium for the sporting event can lead to economic benefits before the event, but such construction projects may become a waste of resources or a major cost burden if the government can not use them efficiently after the sporting event ends. So, the Post Olympic Effect arises after the sporting event takes place. In spite of an extensive literature on sports economics, it is still not clear how exactly sporting events impact an economy. The main reasons are twofold: first, although part of the sporting event's legacy can be accurately captured and measured (i.e., costs, revenues, expenditures…), a number of other "qualitative" impacts are much harder to quantify, such as the impacts on sports communities, social cohesion, the environment or urban regeneration. Secondly, the methodologies used in the various sporting events impact studies are often very different from one another in essence and robustness, and are often undertaken in very different contexts, leading to regular contradictions and misconceptions about how a sporting event can be expected to impact an economy.

In order to compare the effects of the government size on economic growth before and after the sporting event, the Summer Olympic Games and FIFA World Cup are targeted as the subject of our research. The possibility of an over-expansion of government size in countries in which such events take place is examined before the sporting event and is checked using the threshold model. If the government size exceeds the budget's capacity, the Post Olympic Effect occurs. According to Sterken (2006), there are two kinds of approaches used to discuss the economic effects of major sporting events. One involves prior analysis before the event takes place which means that the prior analysis is used to predict and evaluate the economic effect of the sporting event in specific areas or countries. Furthermore, most studies apply the input-output model or computable equilibrium model to figure out the effect. However, Sterken (2006) indicates that there exist shortcomings between the two models. The major disadvantages are the uncertain setting of the function and the parameters which give rise to discrepancies in the results. Besides, the economy

will change its behavior before the sporting event. For instance, the host countries may try to increase government expenditure to complete the public construction projects for the mega sporting event. If the original model's setting cannot capture the changes that take place, the results will be biased.

Another way of analyzing the effect of the sporting event is by using post hoc analysis. Sterken (2006) indicates that the post hoc analysis will not be constrained by the uncertainty of exogenous models and variables or changes in economic behavior. However, the post hoc analysis is still constrained by model choice. The post hoc analysis of major sporting events has also taken place in the following cases. Baade and Matheson (2004) analyzed the effect of the 1994 FIFA World Cup held by the United States. Kim *et al*. (2006) analyzed the post hoc effect of the 2002 FIFA World Cup hosted by Japan and South Korea. Besides, Baade and Matheson (2002) used the city view to analyze the post hoc effect of the Summer Olympic Games. Hotchkiss *et al*. (2003) analyzed the effect of the 1996 Atlanta Summer Olympic Games on local employment and wages. More rigorous studies are skeptical of the net economic benefits of hosting mega events (see, e.g., Owen, 2005). Owen (2005) indicated that ex-post studies have consistently found no evidence of positive economic impacts from mega sporting events. The costs of holding such events seem considerable.

Sterken (2006) and Preuss (2004) indicate that there have already been a huge number of prior analysis studies since the 1972 Munich Summer Olympic Games. For example, Humphreys and Plummer (1995) perform a prior economic effect analysis of the Atlanta Summer Olympic Games in 1996. The Olympics in Sydney was analyzed by Andersen (1999) and Papanikos (1999) who examined the prior effect of the Olympics in Athens in 2004. Furthermore, the prior effect of the FIFA World Cup was analyzed by Goodman and Stern (1994) who focused on the 1994 FIFA World Cup hosted by the U.S. as their research subject. The 2006 Germany FIFA World Cup was also analyzed by Ahlert (2001) and Rahmann and Kurscheidt (2002).

The individual dummy variables used as methodology to study the growth impact of major sporting events had been discussed by Sterken (2006). However, Sterken (2006) did not answer the question as to whether the Post Olympics Effect was due to the over-expanding government size before the major sporting events.

Thus, in our research, we can test whether the government spending was over expanding before the events. So, we test the optimal government size before discussing the Post Olympics Effects. Vedder and Gallaway (1998) empirically found the relationship between government size[2] and economic growth to be asymmetric. Over expanding government size will damage economic growth and decreasing it will stimulate economic growth. That means that government size has a nonlinear effect on economic growth and the relationship is asymmetric. The threshold model is applied to identify the nonlinear effect. Vedder and Gallaway (1998) set this asymmetric relationship as an "Armey curve" which is proved by Armey (1995). Armey (1995) indicates that if the government size is over-expanding, there will be excessive investment in the country. A crowding-out effect on private investment and attaching too much weight to taxes and liability interest will damage the economy, but a small government size will have the effect of promoting economic growth. More specifically, Vedder and Gallaway (1998) have inferred that the government's size and economic growth exhibit an inverse U-shaped relationship. Because of this inverse U-shaped relationship, the optimum government size that promotes the highest economic growth rates can be found. For example, Vedder and Gallaway (1998) used a single square regression function to estimate the optimum government size for the U.S. and found it to be 17.45% during 1947–1997.

In this paper, the threshold regression model of Hansen (1996, 2000) and the neoclassical one-sector aggregate production function together with the two-regime threshold autoregressive (hereafter, two-regime TAR) model of Tong (1983) are used to test whether or not the Armey curve exists in 13 countries that hosted the mega events. The data are collected from countries which have held the Summer Olympic Games or the FIFA World Cup over the past 40 years. The results show that 7 of these 13 countries have significant thresholds. The evidence for China, France, Germany, Greece, Italy, South Korea and Spain supports the hypothesis of the

[2]Here, government size refers to government expenditure / GDP, and we set this definition as government size in this research. As we use government expenditure, we find that it may increase with GDP directly. Therefore, it cannot exactly provide information regarding the expansion in government size. So, Vedder and Gallaway (1998) provide five classifications of government size to test and find that the Armey curve exists. The classifications are: (1) Total expenditure / GDP, (2) Income security expenditure / GDP, (3) Health care expenditure / GDP, (4) National defense expenditure / GDP, and (5) Net investment expenditure / GDP. We choose Total expenditure / GDP as the indicator of government size. This definition is also widely used in Gwartney *et al*. (1998), Ram (1986) and Lin (1994).

Armey curve, and the estimated values of the threshold range from 12.404% to 21.909%. As the optimal government size is identified, we compare the real government size to the optimal ones before the events. If the government size is over expanding, then we can conclude that the Post Olympics Effects may be caused by the over-expansion in government size. Moreover, each country's threshold value of the critical government size is compared with its own threshold value 4 years prior, and each country's rate of economic growth is compared with its own economic growth rate 4 years later. The results for the FIFA World Cup and the Summer Olympic Games show that an over-expansion in government expenditure before the events and Post Olympic Effects existed in France and Italy. The evidence for other countries such as China, Germany, South Korea, and Spain does not support the overspending-recession scenario. Although the causality between prior over-spending and the subsequent recession is definitely not consequential, the paper at least finds some evidence of post Olympic effects. In particular, the typical example is the Summer Olympic Games hosted by the Greek government in 2004.

2 The Empirical Model and Methodology

The neoclassical one-sector aggregate production function which represents the relationships between government expenditure and real GDP growth can be derived in our research. We have modified research by Lee and Chen (2007) to consider the effect of government expenditure in the neoclassical one-sector aggregate production function. Government expenditure is treated as a public good, which includes basic infrastructure used in construction and non-material construction. Thus, the general production function is considered to be of the Cobb-Douglas type which is as follows:

$$Y = F(L_t, K_t, A_t) = A_t^{\alpha} L_t^{\beta} K_t^{\gamma}, \quad \alpha, \beta, \gamma > 0, \tag{1}$$

where Y is real output, L is the aggregate labor force, K is the aggregate real capital stock, and A is a measure of technology. We consider the effect of government expenditure and exports to be important factors affecting technology growth (Feder, 1982), and government expenditure to be non-rival and non-excludable (Samuelson, 1954). The one-sector aggregate production function

had been widely applied in discussing economic growth. Crespo-Cuaresma and Reitschuler (2004) discuss economic growth and defense spending, and also indicate that government spending as well as the export sector are likely to have a technology augmenting effect on the economy. The concept is also provided by Benoit (1973), Balassa (1978) and Feder (1982). Therefore, the export sector is included in eq. (1). Lee and Chen (2007) assume that the effect is multiplicative, and the growth rate of real output is given by:

$$DY_t = \alpha_0 + \beta_1 DK_t + \beta_2 DL_t + \beta_3 DX_t + \beta_4 DG_t + \varepsilon_t , \tag{2}$$

where DY is the growth rate of real GDP, DK is the growth rate of the real capital stock, DL is the growth rate of the labor force, DX is the growth rate of real exports, and DG is the growth rate of total government expenditure. The term ε_t is assumed to be a Gaussian white noise error process with a constant variance.

This allows for a non-linear government expenditure-growth link and provides a convenient framework for testing for linearity, which is given by:

$$DY_t = \alpha_0^j + \alpha_1^j DK_t + \alpha_2^j DL_t + \alpha_3^j DX_t + \alpha_4^j DG_t + \varepsilon_t . \tag{3}$$

The level of total government size, GY_t, is the variable that is responsible for the regime which is active. That is:

$$j = \begin{cases} 1, & if \quad GY_t \le \gamma \\ 2, & if \quad GY_t > \gamma \end{cases} . \tag{4}$$

The threshold parameter, γ, needs to be estimated as well. We can predict the estimators and the parameters and arrive at the sum of squared errors as follows:

$$S_1(\gamma) = \hat{e}_t(\gamma)' \hat{e}_t(\gamma) . \tag{5}$$

The optimum threshold value is given as:

$$\hat{\gamma} = \arg\min S_1(\gamma) . \tag{6}$$

The variance of the residual is expressed as:

$$\hat{\sigma}^2 = \frac{1}{T} \hat{e}_t' \hat{e}_t = \frac{1}{T} S_1(\hat{\gamma}) . \tag{7}$$

As Hansen (1996) points out, the threshold value γ can be found by estimating equations (5)-(7) through finding the minimum one of the sum of squared errors in a re-order threshold variable. The threshold variable can be set by the exogenous variables out of the theoretical model. Therefore, in this research we set government size as the threshold variable. Furthermore, we try to determine the optimal government size that suits the Armey hypothesis. Besides, the heteroskedasticity-consistent Lagrange multiplier (LM) of Hansen (1996) used to test the null hypothesis of the linear assumption has also been considered in our research. Hansen (1996) uses a statistic of his own large sample distribution function to transfer and calculate the asymptotic *p*-value of a large sample to test the null hypothesis of no threshold effect existing. Under the null hypothesis, the distribution of the *p* value statistic is uniform, and this kind of transformation can be calculated using the bootstrap method.

Besides, we follow the Maximum Likelihood Estimator of Hansen (1996), which is used to test the threshold value γ to achieve the asymptotic distribution of the statistic. The null hypothesis of the threshold value is $H_0 : \gamma = \gamma_0$, and the likelihood ratio statistics are as follows:

$$LR_1(\gamma_0) = \frac{S_1(\gamma_0) - S_1(\hat{\gamma})}{\hat{\sigma}^2}, \tag{8}$$

where $S_1(\gamma)$ and $S_1(\hat{\gamma})$ are the residual sum of squares from equation (7) given the true and estimated values, respectively. The asymptotic distribution of $LR_1(\gamma_0)$ can be used to form valid asymptotic confidence intervals regarding the estimated threshold values. The statistics for $LR_1(\gamma_0)$ are not normally distributed and Hansen (2000) computes their no-rejection region, $c(\alpha)$. That is, if $LR_1(\gamma_0) \le c(\alpha)$, where $c(\alpha) = -2\ln(1-\sqrt{1-\alpha})$, then the null hypothesis of $H_0 : \gamma = \gamma_0$ cannot be rejected.

Through the theoretical introduction above, the threshold parameter and delay parameter are estimated. We next conduct the threshold test for the potential threshold variable and Hansen (1997) suggests performing a two-dimensional search over the parameter and the delay parameter and estimating the model for any given combination of parameter and delay parameter by applying the method of sequential conditional least squares to choose the minimization of the residual variance (Lee

and Chen, 2007). With the estimated threshold value, we can find the threshold value of government size. We set the threshold value as the critical value to show the effect of expanding government size on the change in economic growth. Therefore, with the critical value, we can show whether the government size is above the critical value before the sporting event was held. If government size is over-expanding and the economic growth rate after the event is less than that in the year of holding the sporting event, we can say that the Post Olympic Effect may come from the over-expansion in government size. Therefore, 13 countries which have hosted the FIFA World Cup and/or the Summer Olympic Games in the past 40 years will be considered in our research. We will also discuss the critical value of government size of those countries through the threshold model and try to figure out the relationship between an over expanding government size and the Post Olympic Effect.

3 Data Description and Empirical Results

3.1 Data Description

In our study, we will attempt to use the fiscal view to test whether the government is over expanding the government size before the mega sporting events. The reason why we cannot just examine the effect of the government expenditure directly in relation to hosting the mega sporting event is due to the lack of data which, as Flyvbjerg and Stewart (2012) indicate, suggests that "other project types are typically on budget from time to time, but not the Olympics". In addition, the government expenditure related to the mega sporting event lasts for a long period of time and cannot be separated from the whole. Therefore, an alternative approach is to test whether the government size exceeds the optimum before the events. Zhao (2010) identifies the Post Olympic Valley Effect (POVE) as the phenomenon that occurs when economies are hit by a post-Olympic economic downturn. Furthermore, Zhao (2010) also points out that "the main cause of the phenomenon is a dramatic increase in investment at the pre-Olympic stage allied to excessive social and psychological expectations." Ma and Yang (2008) also indicate that "the Olympic Games in Beijing will speed up the steps of the economic construction in the Beijing

area and even throughout the whole country; meanwhile, the valley effect will be unavoidable." Therefore, the effect of hosting the mega sporting event may be considered as a whole in the discussion. As for the availability of data for those countries which had hosted the Summer Olympic Games or the FIFA World Cup, 13 countries as shown in Table 1 are targeted to be the subjects of our research. The data for those countries that have hosted the Summer Olympic Games and/or the FIFA World Cup between 1980 and 2008 have been collected. Some countries (e.g., Germany, South Korea and Spain) have held both events during the period, and some (e.g., China, France and Greece) have held just one event. The list of host countries is provided in Table 1.[3] As the model represented by equation (2) shows, we need to collect data for a nation's real GDP, real gross fixed capital formation, labor force, real exports of goods and services, and real general government final consumption expenditure. Following the definition given in the Labour Force Statistics (2011 Edition, OECD), the labor force is defined as working-age population in a country. The variable descriptions are shown in Table 2, and the data sources are the World Bank data set and the OECD website. The descriptive statistics are included in Table 3.

Table 1: List of Countries Hosting Summer Olympic Games or the FIFA World Cup in the Past 40 Years

Country	Data Period	Summer Olympic Games	FIFA World Cup
China	1981-2009	2008	-
France	1961-2009	-	1998
Germany	1971-2010	1972	1974, 2006
Greece	1961-2010	2004	-
Italy	1961-2009	-	1990
South Korea	1964-2010	1988	2002
Spain	1971-2009	1992	1982
U.S.A.	1961-2010	1984, 1996	1994
Australia	1966-2008	2000	-
Japan	1961-2009	1964	2002
Russia	1991-2009	1980	-
South Africa	1981-2009	-	2010
Mexico	1981-2009	-	1986

[3]Canada's 1976 Olympics and Argentina's 1978 World Cup are not included in our regressions because the data on the labor force are missing for both countries.

Table 2: Data Sources

Variables		
DY	WB	[Real GDP growth rate (constant 2000 US$)]
DK	WB	[Growth rate of Gross fixed capital formation (constant 2000 US$)]
DL	WB	[Growth Rate of Labor force, (OECD Annual labor force statistics, total)]
DX	WB	[Growth Rate of Exports of goods and services (constant 2000 US$)]
DG	WB	[Growth Rate of General government final consumption expenditure (constant 2000 US$)]
GY	WB	[General government final consumption expenditure (constant 2000 US$)/real GDP(constant 2000 US$)]

Notes: WB (World Bank) http://www.worldbank.org/ OECD: Organisation for Economic Co-operation and Development http://stats.oecd.org/index.aspx?queryid=24861.

Table 3: Descriptive Statistics

Country	U.S.					
Variables	DY	DK	DL	DX	DG	GY
Mean	0.032	0.035	0.015	0.060	0.024	0.170
Variance	0.001	0.005	0.000	0.004	0.002	0.000
Maximum	0.159	0.162	0.032	0.188	0.250	0.202
Minimum	-0.032	-0.160	-0.001	-0.094	-0.022	-0.142
Country	Australia					
Variables	DY	DK	DL	DX	DG	GY
Mean	0.035	0.045	0.021	0.056	0.039	0.177
Variance	0.000	0.003	0.000	0.002	0.001	0.000
Maximum	0.072	0.144	0.049	0.164	0.105	0.193
Minimum	-0.023	-0.102	0.005	-0.060	0.012	0.158
Country	China					
Variables	DY	DK	DL	DX	DG	GY
Mean	0.101	0.116	0.016	0.121	0.096	0.153
Variance	0.001	0.006	0.000	0.014	0.003	0.000
Maximum	0.152	0.298	0.030	0.320	0.210	0.173
Minimum	0.038	-0.138	0.006	-0.103	-0.026	0.138
Country	France					
Variables	DY	DK	DL	DX	DG	GY
Mean	0.030	0.033	0.008	0.057	0.033	0.228
Variance	0.000	0.002	0.000	0.003	0.000	0.000
Maximum	0.071	0.117	0.043	0.161	0.070	0.257
Minimum	-0.027	-0.090	-0.001	-0.124	-0.007	0.204

Table 3: Descriptive Statistics (Continued)

Country			Germany			
Variables	DY	DK	DL	DX	DG	GY
Mean	0.020	0.014	0.012	0.056	0.021	0.200
Variance	0.000	0.002	0.002	0.003	0.000	0.000
Maximum	0.053	0.082	0.286	0.137	0.064	0.225
Minimum	-0.051	-0.114	-0.013	-0.136	-0.021	0.180
Country			Greece			
Variables	DY	DK	DL	DX	DG	GY
Mean	0.037	0.035	0.007	0.074	0.038	0.174
Variance	0.002	0.012	0.000	0.010	0.002	0.000
Maximum	0.132	0.243	0.066	0.344	0.148	0.203
Minimum	-0.064	-0.355	-0.025	-0.195	-0.072	0.138
Country			Italy			
Variables	DY	DK	DL	DX	DG	GY
Mean	0.028	0.023	0.003	0.057	0.025	0.209
Variance	0.001	0.003	0.000	0.004	0.000	0.000
Maximum	0.082	0.117	0.015	0.200	0.054	0.234
Minimum	-0.052	-0.121	-0.055	-0.175	-0.033	0.184
Country			Japan			
Variables	DY	DK	DL	DX	DG	GY
Mean	0.042	0.045	0.008	0.076	0.039	0.161
Variance	0.002	0.006	0.000	0.008	0.001	0.000
Maximum	0.129	0.243	0.024	0.239	0.126	0.200
Minimum	-0.063	-0.140	-0.009	-0.239	-0.004	0.139
Country			Russia			
Variables	DY	DK	DL	DX	DG	GY
Mean	0.005	-0.025	-0.001	0.025	-0.005	0.137
Variance	0.006	0.033	0.000	0.015	0.002	0.000
Maximum	0.100	0.210	0.015	0.126	0.034	0.168
Minimum	-0.145	-0.415	-0.019	-0.300	-0.118	0.106
Country			South Africa			
Variables	DY	DK	DL	DX	DG	GY
Mean	0.023	0.032	0.032	0.027	0.029	0.193
Variance	0.001	0.006	0.000	0.004	0.001	0.000
Maximum	0.056	0.142	0.042	0.109	0.068	0.218
Minimum	-0.021	-0.175	0.010	-0.195	-0.060	0.163

Table 3: Descriptive Statistics (Continued)

Country			South Korea			
Variables	DY	DK	DL	DX	DG	GY
Mean	0.070	0.108	0.024	0.172	0.055	0.154
Variance	0.001	0.019	0.000	0.017	0.001	0.001
Maximum	0.141	0.596	0.059	0.560	0.113	0.220
Minimum	-0.069	-0.229	-0.016	-0.040	-0.009	0.118
Country			Spain			
Variables	DY	DK	DL	DX	DG	GY
Mean	0.030	0.032	0.015	0.063	0.046	0.159
Variance	0.001	0.005	0.000	0.003	0.000	0.001
Maximum	0.081	0.142	0.040	0.167	0.093	0.215
Minimum	-0.037	-0.160	-0.018	-0.116	0.005	0.110
Country			Mexico			
Variables	DY	DK	DL	DX	DG	GY
Mean	0.023	0.029	0.028	0.082	0.021	0.117
Variance	0.001	0.015	0.000	0.007	0.001	0.000
Maximum	0.088	0.210	0.051	0.302	0.103	0.134
Minimum	-0.062	-0.290	0.010	-0.137	-0.028	0.096

3.2 Empirical Results

According to Table 4 and the likelihood ratio test of equation (8) as Figure 1 describes, the asymptotic distribution of $LR_1(\gamma_0)$ can be used to form valid asymptotic confidence intervals regarding the estimated threshold values where the optimal government size will be. We can find significant threshold values of government size in 7 countries which include China, France, Germany, Greece, Italy, South Korea and Spain. Furthermore, the threshold values are 14.621%, 21.929%, 19.558%, 16.024%, 20.885%, 14.318%, and 12.404%, respectively. We set those threshold values as the critical values that will cause the economic growth setting to change with the government's size. However, from the LM values, we cannot find the threshold values of government size for the other 6 countries which include the U.S., Australia, Mexico, Japan, Russia and South Africa. This means that the critical value does not exist in the above 6 countries. Therefore, the change in government size does not affect the economic growth with the threshold effect.

In Table 5, we present the government size and economic growth data for the 6

countries which have hosted the FIFA World Cup and have significant threshold values of government size. We can find that France hosted the FIFA World Cup in 1998 and that the government size is over the critical value of 21.929%. The economic growth rate is obviously lower than in the FIFA current year. The Post Olympic Effect is found to exist in France and the over-expansion in government expenditure is also found to have occurred before the FIFA World Cup was held. The main contribution of our research is to identify whether the government size was over expanding before the mega sporting event. However, in order to identify the optimal government size, we need to try to apply the concept from Vedder and Gallaway (1998) who test the existence of the Armey curve to obtain the optimal government size. Actually, we did obtain strong evidence to prove the over expansion of the government size before the FIFA year in 1998 in France. Besides, the government size also actually decreased from 23.750% to 22.797% year by year after the event. Furthermore, the economic recession also occurred after the year in which the event took place, although in the second year after the event the economic growth was higher than during the year of the event but actually declined after that. The average economic growth rate in the 4 years after the event was only 2.434%, which was lower than in the event year (3.378%). Based on the definition of the Post Olympics Valley Effect from Zhao (2010), the effect may occur with a time lag and it did occur in that way. In addition, the over expansion in government size was found to exist in Italy which hosted the FIFA World Cup in 1994. The critical government size was 20.885% in Italy, and the government size in all 4 years prior to the event exceeded the critical value. The economic growth rate is also less than for the current FIFA World Cup year. The Post Olympic Effect is also found in Italy as it hosted the FIFA World Cup in 1994 and the government's over-expansion also played an important role in the effect. However, two exceptions, namely, South Korea and Germany, can be found. The Post Olympic Effect was also found to have occurred in the two countries, which means that the economic growth in the years after the FIFA World Cup was held was less than in the current FIFA year. Nevertheless, the over-expansion of government size is not found to exist in South Korea and Germany. It should be noted that Spain is also a special case which experienced an over-expansion in government expenditure before the FIFA World Cup was held, but the Post Olympic Effect was not found to hold after the FIFA

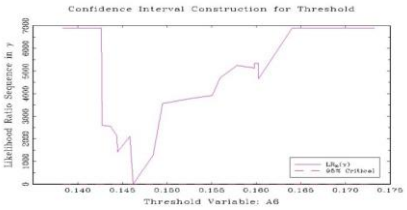
World Cup was over. Therefore, the expansion in government size does not have a critical effect on the Post Olympic Effect as the FIFA World Cup result indicates.

The results for the Summer Olympic Games are presented in Table 6, and the case for Greece more or less supports the Post Olympic Effect. That is, all government sizes in the four years prior to the mega event were larger than the critical value (i.e., 16.024%). Besides, all economic growth rates, except that for 2006, were lower than the growth rate for the current year of the Summer Olympic Games in 2004 (i.e., 4.368%). The situation also exists in Spain and South Korea which held the Summer Olympic Games in 1992 and 1988, respectively. The critical values of government size for South Korea and Spain are 14.318% and 12.404%, respectively, and their government sizes both exhibit over-expansion in the years before the Olympic year. However, the cases of China and Germany were not found to support the Post Olympic Effect. If we take China as an example, not only did China not over-expand its government size before the Summer Olympic Games in 2008, but the economic recession also did not appear in the aftermath of the mega sporting event.

Table 4: Threshold Test for Potential Threshold Variable

	U.S.	Australia	China	France	Germany	Greece	Mexico
Threshold Estimate	16.233%	18.469%	14.621%	21.929%	19.558%	16.024%	11.143%
LM-test for no threshold	8.941	10.054	11.348*	14.894**	13.104**	13.568**	9.319
Bootstrap P-Value	0.350	0.218	0.067	0.007	0.022	0.017	0.248
	Italy	Japan	Russia	South Africa	South Korea	Spain	
Threshold Estimate	20.885%	15.530%	13.027%	18.375%	14.318%	12.404%	
LM-test for no threshold	13.467**	10.429	8.100	8.098	11.700**	11.624*	
Bootstrap P-Value	0.018	0.135	0.401	0.421	0.046	0.087	

Note: “**”and “*” denote statistical significance at the 5% and 10% levels, respectively.



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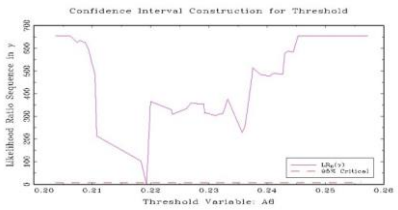

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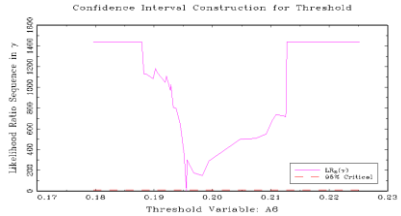

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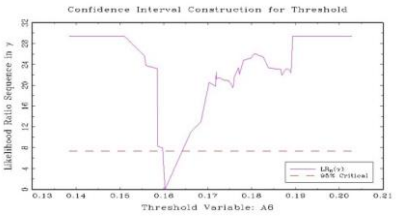

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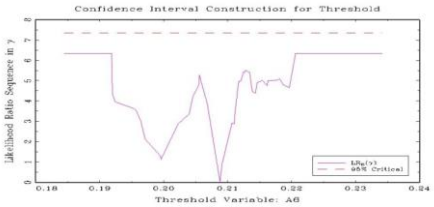

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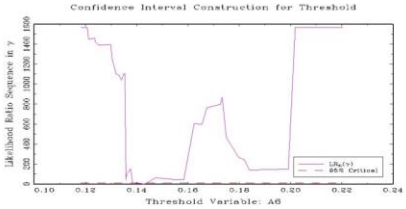

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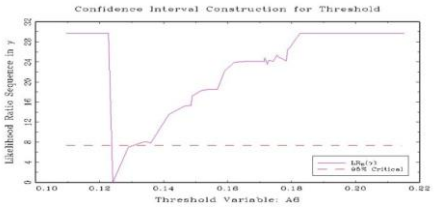

Spain

Figure 1: Likelihood Ratio for the Threshold Test

Table 5: Government Size before the FIFA Year and Economic Growth after the FIFA Year

Countries		GM(1974)	SP(1982)	IT(1990)	FR(1998)	SK(2002)	GM(2006)
Government size	Threshold value	19.558%	12.404%	20.885%	21.929%	14.318%	19.558%
	4 years prior	18.855%	12.886%	21.542%	25.232%	13.578%	19.054%
	3 years prior	19.449%	13.421%	21.867%	24.701%	12.762%	19.192%
	2 years prior	19.564%	13.590%	21.812%	24.957%	11.952%	18.862%
	1 year prior	19.825%	14.161%	21.206%	24.719%	12.073%	18.789%
FIFA year GS		20.745%	14.655%	21.268%	23.750%	11.823%	18.287%
Government size	1 year after	21.865%	14.868%	21.344%	23.325%	12.010%	17.960%
	2 years after	21.276%	14.878%	21.382%	22.916%	11.918%	18.314%
	3 years after	21.021%	15.172%	21.243%	22.797%	11.960%	19.945%
	4 years after	21.254%	15.376%	20.451%	23.013%	12.118%	19.558%
GDP growth	FIFA year	0.890%	1.246%	2.053%	3.378%	7.150%	3.700%
	1 year after	-0.867%	1.770%	1.534%	3.292%	2.803%	3.269%
	2 years after	4.949%	1.785%	0.773%	3.680%	4.619%	1.083%
	3 years after	3.347%	2.321%	-0.888%	1.836%	3.957%	-5.127%
	4 years after	3.008%	3.253%	2.152%	0.929%	5.179%	3.690%

Notes: The government size in red means that it is above the critical value of the government's size. The economic growth in red means that it is below that for the current FIFA year.

4 Conclusions and Policy Implications

This article has applied the Hansen (1996, 2000) threshold model to test the hypothesis of the Armey curve. A total of 13 countries that hosted the FIFA World Cup and/or Summer Olympic Games during the past 40 years are used. The threshold values of government size on economic growth for these countries are investigated, and the results show that 7 of these 13 countries have significant thresholds. The evidence shows that the hypothesis of the Armey curve is supported in China, France, Germany, Greece, Italy, South Korea and Spain.

Table 6: Government Size before the Summer Olympic Games Year and Economic Growth after the Summer Olympic Games Year

Countries		GM(1972)	SK(1988)	SP(1992)	GR(2004)	CH(2008)
Government size	Threshold value	19.558%	14.318%	12.404%	16.024%	14.621%
	4 years prior	X	14.746%	15.685%	18.899%	14.266%
	3 years prior	X	14.318%	16.209%	18.273%	14.443%
	2 years prior	18.855%	13.837%	16.598%	18.941%	14.274%
	1 year prior	19.449%	13.332%	17.162%	17.723%	13.943%
Olympic year GS		19.564%	13.194%	17.599%	17.579%	13.856%
Government size	1 year after	19.825%	13.499%	18.255%	17.381%	13.830%
	2 years after	20.745%	13.769%	17.925%	16.844%	14.144%
	3 years after	21.865%	13.405%	17.869%	17.601%	X
	4 years after	21.276%	13.599%	17.672%	17.251%	X
GDP growth	Olympic year	4.300%	10.641%	0.929%	4.368%	9.600%
	1 year after	4.777%	6.744%	-1.031%	2.280%	9.200%
	2 years after	0.890%	9.155%	2.383%	5.543%	10.400%
	3 years after	-0.867%	9.393%	2.757%	2.996%	X
	4 years after	4.949%	5.876%	2.417%	-0.157%	X

Notes: The government's size in red means that it is above the critical value for government size. The economic growth in red means that it is below that for the current Olympic year.

Moreover, the Post Olympic Effect indicates that a country usually encounters an economic recession after an over-expansion in government size for a few years after the mega event. Therefore, the thresholds of government size for these 7 countries are estimated to check whether or not the over-expansion in government size took place prior to the event year and the recession occurred in the years after the event year. We compare the threshold and economic growth in the mega-event year with each country's government size for the 4 years prior to the mega-event year and each country's economic growth for the 4 years after the mega-event year. The evidence shows that the Post Olympic Effect is supported in France and Italy, which were found to have over-expanded their government size before the FIFA World Cups in 1990 and 1998 and experienced economic recession in the 4 years after the event. The government's over-expansion in size also occurred in Greece,

Spain and South Korea as they hosted the Summer Olympic Games, but the recession did not fully take place in the next 4 years. The motivation underlying the hosting of a mega event like the Olympics and the FIFA World Cup seems to be elusive to economists. However, our evidence partially supports the Post Olympic Effect, especially in the cases of France and Italy.

Based on the assumptions of the Armey curve, the policy implication indicates that a country needs to pay attention to the government's expenditure when it considers hosting a mega event such as the Olympics or FIFA World Cup. With the calculations provided in the paper, the optimal government expenditure can be estimated. A country's warning signal of the government expenditure can be set. That is, a host country needs to pay careful attention to the level of government expenditure, and compare it with its optimal level. Special note of the over-expenditure problem has to be taken before the sporting event. Then, the Post Olympic Effect can be avoided.

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