Empirical Study on the Economic Impact of Major Sports Events on First-tier Cities in China

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Abstract: In order to investigates the economic impact of major sports events on first-tier cities in China, this paper focusing on Beijing, Guangzhou, and Hangzhou from 2000 to 2023. Using the least squares method, it examines the relationship between economic growth, the frequency of sports events, and industrial structure. The empirical results show that the frequency of major sports events and outputs from the financial and retail sectors positively impact economic development. Different levels of development among cities lead to varied impacts on specific industries. Beijing's dual Olympic Games significantly boosted various sectors, while Guangzhou's established economy experienced relatively smaller marginal effects. Hangzhou used sports events to promote financial and industrial growth, optimizing its economic structure. These findings provide decision-makers with insights for effective planning of sports events, emphasizing their potential to enhance tourism, retail, and infrastructure, ultimately boosting urban competitiveness and long-term economic growth.

Keywords: Sports Events; Economic Growth; Industrial Output; Regression Analysis

1. Introduction

With the acceleration of globalization and urbanization, major sports events have become an important means for cities to enhance their international visibility and promote economic development. Events such as the Olympics, Asian Games, and World Cups are not only grand sports competitions but also significant platforms to showcase the comprehensive strength of nations and cities. Globally, hosting major sports events has become a goal pursued by many countries and cities, aiming to enhance city image and visibility while leveraging the economic effects of these events to drive urban economic and social development.

Research by the National Bureau of Economic Research in Boston shows that hosting major sports events has a positive impact on a country's international trade [1]. Major sports events can enhance the host country's social, cultural, political, and international status, promote urban economic development, increase employment opportunities, stimulate the development of the tertiary industry, and generate positive social benefits, contributing to people's physical and mental health (Fourie & Spronk) [2]. Internationally influential events can drive employment and GDP growth, becoming strategic tools for local governments to achieve urban transformation and development (Bryson Frick Simmon) [3].

However, the extent of the positive economic impact of sports events on the host country and their long-term effects have been subjects of debate. The high costs of hosting the Sochi Winter Olympics in 2014, the Rio de Janeiro Summer Olympics in 2016, and the PyeongChang Winter Olympics in 2018 led some cities to withdraw their bids for the 2022, 2024, and 2028 Olympics. For instance, Boston's mayor stated, "I refuse to mortgage the city's future," when deciding to withdraw from the 2024 Olympic bid. Hamburg in Germany, Budapest in Hungary, and Rome in Italy also withdrew their bids due to financial burdens. Ultimately, only Paris in France and Los Angeles in the United States continued to bid.

Hosting major sports events has no long-term impact on a country's GDP (Billings & Holladay) [4]. The events lead to local price increases, raising the cost of living for residents. While major events provide a substantial number of jobs, most of these are temporary, causing significant unemployment

and related ecological and developmental issues, such as generating large amounts of waste and noise pollution, degrading the urban environment, and reducing urban comfort (Gibson) [5]. Hosting major sports events is a "double-edged sword"; excessive hosting can undermine the local economy (Flyvbjerg & Stewart) [6]. The actual costs of every Olympic Games from the 1992 Barcelona Olympics to the 2014 Sochi Winter Olympics exceeded the initial budget, and strictly regulating budget systems and focusing on sustainability are conducive to achieving pre-selection balance (Gao) [7]. While sports events bring direct economic benefits from ticket sales and advertising rights and indirect benefits from promoting sports consumption and optimizing sports industry structures, they can also result in negative economic effects, such as increased government financial burdens (Liu & Zhao) [8]. Hosting iconic sports events positively influences tourism investment and brand building in the host city (Wu) [9]. Achieving paper profitability from the Olympics is challenging; host countries value the economic boosts in attention and branding brought by the Games (Xue & Hou) [10].

This paper uses Beijing, Guangzhou, and Hangzhou, cities that have hosted the Olympics or Asian Games, as case studies to explore the relationship between economic growth and structural evolution from 2000 to 2023. Comparatively, Beijing, as the political center and dual Olympic city, has unparalleled political advantages. Guangzhou, as the capital of China's largest economic province, has years of reform and opening-up experience. Hangzhou, as the capital of Zhejiang Province and an important new first-tier city in the Yangtze River Delta economic zone, has gradually developed unique industrial advantages. What are the commonalities and differences in the impact of major sports events on these three distinctive cities? This study will provide a reference for the economic effects of sports events in China.

2. Overview of Economic Development in Beijing, Guangzhou, and Hangzhou
This study selects Beijing, Hangzhou, and Guangzhou as research objects. These three cities have hosted multiple major sports events, such as the Olympics and Asian Games, from 2000 to 2023, providing a rich data foundation

and research value.
To clearly list the major sports events held annually in Beijing from 2000 to the present, the following is a statistical method based on multiple criteria:

2.1 Criteria for Major Events
An event is recognized as a major event if it meets most (at least three) of the following five criteria: First, in terms of participation, the number of athletes exceeds 1,000, and the total number of personnel, including referees, coaches, and volunteers, usually reaches thousands. Second, in terms of audience size, the number of on-site spectators exceeds 50,000, or the global television and online audience can reach hundreds of millions. Third, the duration of the competition usually lasts at least a week, up to a month. Fourth, in terms of media coverage, the event receives global media coverage, including television, internet, newspapers, and social media, or extensive international media reporting and broadcasting. Fifth, in terms of economic impact, the event significantly boosts the economy of the host city and country, including tourism, catering, accommodation, and other aspects, or has a budget of hundreds of millions of dollars.

2.2 Beijing
As the capital of China, Beijing hosted the 2008 Summer Olympics and the 2022 Winter Olympics. These major sports events not only enhanced Beijing's international reputation but also had profound impacts on the city's economy, society, and culture. Beijing, as a research object, can provide rich cases on the multi-faceted impacts of major sports events on urban economies.
As shown in Figure 1, from the economic data of Beijing from 2001 to the present, it can be seen that the per capita disposable income of urban residents has increased from 11,939 yuan to 43,897 yuan, indicating a significant growth trend and reflecting a notable improvement in residents' living standards. At the same time, various major industries, such as industry, construction, wholesale and retail, and finance, have shown varying degrees of growth. Among them, the output value of industry and finance has increased particularly significantly, demonstrating their important position in Beijing's economy. In addition, the per capita housing floor area of urban residents

has also increased, from 17.62 square meters in 2001 to 33.63 square meters in 2022, indicating improved living conditions for residents.
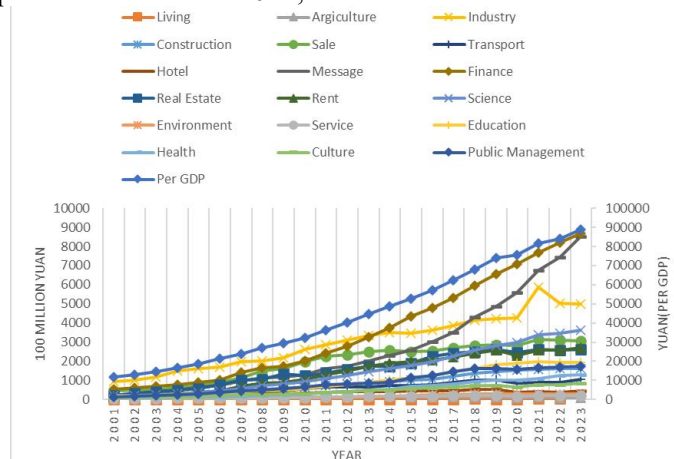

Figure 1. Distribution of Primary, Secondary, and Tertiary Industries in Beijing from 2001 to 2023

2.3 Guangzhou

Guangzhou is the economic center of southern China and hosted the 2010 Asian Games. The Asian Games played a significant role in promoting Guangzhou's economic development and urban construction, especially in infrastructure development and the growth of the service industry. By studying Guangzhou, we can explore the long-term impact of major sports events on urban economic development.

As shown in Figure 2, from the economic data of Guangzhou from 2000 to the present, it can be seen that the per capita disposable income of urban residents has increased from 25,758 yuan in 2000 to 161,634 yuan in 2023, and the output of various industries has also increased significantly. The total industrial output value increased from 310.002 billion yuan to 2,552.95 billion yuan, and the total wholesale and retail trade rose from 81.28 billion yuan to 1,006.792 billion yuan, reflecting the significant growth and development of Guangzhou's economy during this period. Meanwhile, fiscal revenue and expenditure also saw substantial increases, rising from 21,990.77 million yuan and 25,859.65 million yuan to 194,415 million yuan and 297,166 million yuan, respectively.
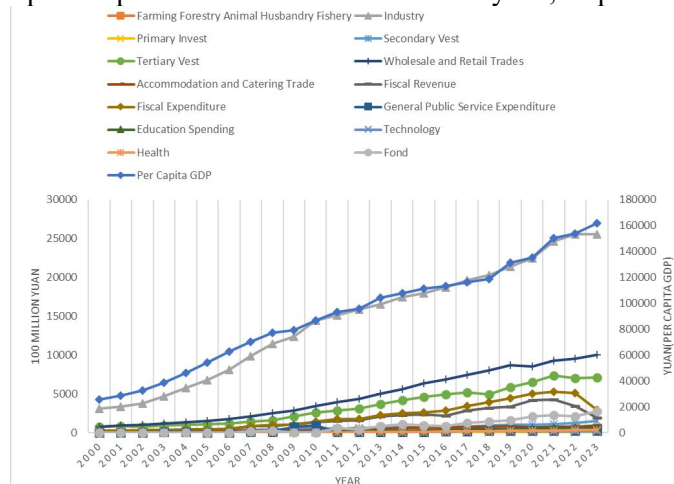
Figure 2. Distribution of Primary, Secondary, and Tertiary Industries in Guangzhou from 2000 to 2023

2.4 Hangzhou

Hangzhou is one of China's innovation cities and economic centers, successfully hosting the 2022 Asian Games. The hosting of the Asian Games not only promoted urban construction and the development of the tourism industry in Hangzhou but also played a positive role in the adjustment of the city's economic structure and industrial upgrading. By selecting Hangzhou as a research object, we can analyze the impact

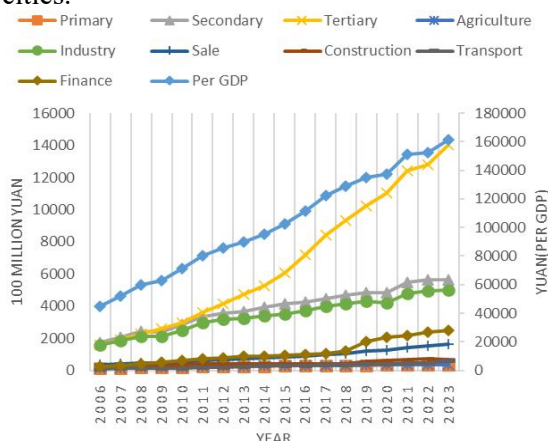of major sports events on emerging economic cities.

Figure 3. Distribution of Primary, Secondary, and Tertiary Industries in Hangzhou from 2006 to 2023

As shown in Figure 3, from the economic data of Hangzhou from 2000 to the present, it can be observed that the per capita regional GDP increased from 44,639 yuan in 2006 to 161,129 yuan in 2023. The output values of various industries and major sectors also saw significant growth. The industrial, wholesale and retail, construction, transportation, and financial sectors all experienced substantial increases in output, reflecting the rapid economic development and overall enhancement of Hangzhou's economic strength.

3. Empirical Tests and Results

3.1 Descriptive Statistical Analysis

As shown in Table 1, the economic data of Beijing from 2000 to 2023 shows a high growth rate in GDP and various economic sectors, with significant improvements in income and living standards. Although the unemployment rate has experienced fluctuations, it remains generally manageable. The contributions of different industries and economic sectors are balanced, demonstrating a robust development trend. Correlation analysis indicates that GDP is significantly positively correlated with per capita disposable income (INCOME) and the output value of the tertiary sector (THIRD), reflecting the characteristic of coordinated overall economic development.

Table 1. Descriptive Statistics of Beijing's Economic Data

Variable	Mean	Median	Man	Min	Std	Variance	Skewness	Kurtosis
GDP	101555	92758	200000	28097	54063.07	2922815138	0.412159	-1.02622
CITYINCOME	44442.85	40306.31	88650	11939	25199.8	635029850.8	0.352314	-1.25289
LIVING	27.97227	29.32	33.63	17.62	5.219536	27.24356126	-0.71842	-0.89695
JOBLESS	11.94682	9.15	37.19	5.19	9.286191	86.23333701	2.243018	3.810534
INCOME	40595.48	36817	81752	10399	23409.56	548007705.9	0.348777	-1.24705
FIRST	114.0391	111.5	159.8	80.8	23.8226	567.5161265	0.363499	-0.58529
SECOND	3827.857	3856	7389	1127.2	1863.487	3472583.933	0.220043	-1.04048
THIRD	16859.71	15020.3	37129.6	2653.6	11210.93	125684907.8	0.390478	-1.18366
AGRI	115.8478	113.4	162	81.8	24.18604	584.9644269	0.339547	-0.60072
INDUSTRY	3002.178	3090.1	5855.1	920.2	1395.586	1947660.747	0.226362	-0.82903
ARCH	861.1087	803	1614.2	212.3	493.0105	243059.3617	0.278459	-1.36507
SALE	1966.235	2356.3	3126.7	442.8	961.4395	924365.8787	-0.46915	-1.3951
TRANSPORT	626.7609	637.3	1065.3	227.6	270.9606	73419.63158	0.027044	-1.35414
HOTEL	338.2217	372.6	538.1	103.3	129.2356	16701.84269	-0.46239	-0.88881
MESSAGE	2682.165	1758.8	8514.4	233	2448.635	5995813.123	1.127363	0.253975
FINANCE	3567.474	2783.2	8663.1	519.7	2698.251	7280557.005	0.573076	-1.05261
REALESTATE	1556.326	1588.1	2612	233.6	837.713	701763.0402	-0.12009	-1.43488
SERVICE	1441.435	1488.1	2710	146.4	910.9441	829819.2033	-0.06355	-1.60161
SCIENCE	1529.161	1245.9	3630.1	195.2	1146.464	1314380.281	0.543692	-1.06205
ENVIRONMENT	154.1565	115.5	307	27.3	110.631	12239.21439	0.335486	-1.68024
PUBLICSERVICE	139.2348	139.9	229.2	45.5	58.56263	3429.581462	0.000783	-1.53994
HOSPITAL	532.2304	417.6	1290	73.6	410.7422	168709.1922	0.534922	-1.15768
CULTURE	440.1609	430.1	836.1	101.6	250.0799	62539.96431	0.151465	-1.49561
ENTERTAINMENT	900.2696	825.6	1724.8	137	569.2702	324068.604	0.207911	-1.50717
EDUCATION	948.6913	788	1960.9	160.8	652.2078	425374.9963	0.42957	-1.37182

As shown in Table 2, from 2000 to 2023, the economic data analysis of Guangzhou shows significant growth in both GDP and residents' income (INCOME), with the tertiary sector

(THIRD) dominating the economy. There is active consumer spending (CONSUMPTION) and import/export trade (IMPORT/EXPORT); the public service sector shows high expenditures in education (EDU), technology (TECH), and health (HEALTH). Correlation analysis indicates that GDP is significantly positively correlated with consumer spending (CONSUMPTION), residents' income (INCOME), and the tertiary sector (THIRD), reflecting coordinated economic development and the government's emphasis on public services.

As shown in Table 3, from 2006 to 2023, Hangzhou's GDP and various industries have shown steady growth. The secondary and tertiary sectors have been the main drivers of economic growth, with significant development also seen in the financial and transportation sectors. Overall, Hangzhou's economic structure is balanced and stable, with a relatively symmetrical and smooth distribution of data.

Table 2. Descriptive Statistics of Guangzhou's Economic Data

Variable	Mean	Median	Man	Min	Std	Variance	Skewness	Kurtosis
GDP	91425.58	40650.6	25758	94387	161634	-0.04558	-0.95719	1.025534
CONSUMPTION	28780.13	13459.89	10671.78	29350.09	49480.27	0.040824	-1.50609	2.108664
INCOME	39741.48	22151.71	13380.47	36245.8	80500.86	0.467409	-1.10895	2.045428
ARGI	348.1579	132.767	163.05	358.7	582.79	0.178852	-1.04027	1.269602
INDUSTRY	14374.21	7339.029	3100.02	15481.59	25574.41	-0.12203	-1.20534	1.512619
FIRST	8.289167	8.423723	0.8	3.705	33.77	1.452857	2.11524	9.533354
SECOND	652.7571	360.6672	141.13	613.075	1511.13	0.555637	-0.07471	1.172818
THIRD	3422.473	2286.242	775.88	3003.305	7381.6	0.391075	-1.26869	2.122391
INPORT	456.3546	196.2047	114.13	540.45	712.58	-0.54103	-1.09814	2.286267
OUTPORT	549.5554	288.8575	116.24	576.945	976.19	-0.14312	-1.43333	2.008521
SALE	4722.06	3185.54	812.8	4156.475	10067.92	0.303223	-1.43451	2.26181
HOTEL	482.0929	263.5301	142.53	477.01	944.7	0.173317	-1.51811	2.236285
GINCOME	1748.683	1305.348	219.9077	1557.41	4307.964	0.518805	-0.83074	1.767527
GEXPEND	2143.219	1684.956	258.5965	1795.13	5286.932	0.609874	-0.89314	2.221539
SERVICE	217.423	225.8878	32.9561	138.3666	977.3199	2.455176	6.239393	43.92488
EDU	248.5216	214.1389	25.1923	199.4148	643.39	0.674066	-0.99653	2.676607
TECH	87.0711	83.14453	1.5293	55.2562	243.9456	0.548818	-1.18236	2.472496
HEALTH	122.1209	120.2592	12.1814	71.2773	364.7	0.902643	-0.60585	3.385803
GOVFINANCE	803.5092	857.3147	17.8772	532.6852	2788.3	0.884124	-0.32901	2.995895

Table 3. Descriptive Statistics of Hangzhou's Economic Data

Variable	Mean	Median	Man	Min	Std	Variance	Skewness	Kurtosis
GDP	102409.7	98815.5	161129	44639	36812.59	1355167394	0.05	-1.248
FIRST	264.021	272.8	347	149.88	65.207	4251.944	-0.39	-1.138
SECOND	3885.897	4043.725	5667	1763.65	1218.978	1485908	-0.212	-0.991
THIRD	6702.453	5682.225	14045	1569.89	4112.847	16915510.5	0.426	-1.217
AGRICULTURE	271.222	285	357	155	67.926	4613.948	-0.454	-1.176
INDUSTRY	3416.722	3456.5	4984	1559	1068.951	1142655	-0.204	-1.006
SALE	881.944	801	1652	337	406.225	165018.5	0.506	-0.817
ARCHITECTURE	431.444	408.5	701	175	161.21	25988.5	0.353	-0.675
TRANSPORT	292.889	287.5	646	107	144.83	20975.5	0.736	0.351
FINANCE	1136.667	911.5	2490	248	725.903	526935.3	0.777	-0.686

3.2 Explanation of Variable Selection

The impact of sports events on the economy is a dynamic process. To better capture this dynamic process, this study employs the stepwise regression method, selecting the per capita regional GDP of Beijing, Guangzhou, and Hangzhou from 2000 to 2023 to represent the economic development level of the host cities as the dependent variable. The output values of various industries, including industry, wholesale and retail, construction, transportation, and finance, as well as the number of events, are chosen as independent

variables for regression analysis to assess the contribution of each factor to the economic indicators.

A multiple regression model is established, with per capita GDP, financial sector output, and retail sector output as dependent variables, and the number of events, infrastructure investment, and the number of tourists as independent variables. The model is formulated as follows:

$Y = c + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_n X_n + \epsilon$ (1)

where Y represents the dependent variable, $X_1, X_2 ... X_n$ represent the independent variables, c is the constant term, $\beta_1, \beta_2, ..., \beta_n$ are the regression coefficients, and ϵ epsilon is the error term.

Using the stepwise regression method on Beijing's relevant economic data (Table 4), we analyzed the relationship between per capita disposable income and various economic sectors, as well as sports events. The results indicate that the number of sports events (EVENT), cultural industry (CULTURE), education sector (EDUCATION), financial sector (FINANCE), per capita housing floor area (LIVING), information transmission, software, and information technology services (MESSAGE), real estate sector (REALESTATE), wholesale and retail sector (SALE), and transportation, warehousing, and postal services (TRANSPORT) have significant positive impacts on Beijing's GDP. In contrast, the healthcare and social work sector (HOSPITAL) and scientific research and technical services sector (SCIENCE) have significant negative impacts on GDP.

Table 4. Regression Analysis Results and Additional Statistics for Beijing

Variable	Coefficient	t-Statistic	Prob.		
C	987.4982	0.471285	0.6476		
EVENT	473.7041	5.534854	0.0002		
CULTURE	58.08772	12.30651	0		
EDUCATION	20.61542	6.778408	0		
FINANCE	11.4471	6.557662	0.0001		
HOSPITAL	-71.52414	-12.39553	0		
LIVING	539.6355	4.064464	0.0023		
MESSAGE	18.29645	25.4116	0		
REALESTATE	10.02511	9.670555	0		
SALE	4.106645	4.810526	0.0007		
SCIENCE	-33.89616	-7.812824	0		
TRANSPORT	25.53988	7.37455	0		
R²	0.999682	F-statistic	10068.17	DW stat	2.151814

Using the stepwise regression method on Guangzhou's relevant economic data (Table 5), we analyzed the relationship between per capita regional GDP and various economic sectors, as well as sports events. The results indicate that the number of sports events (EVENT) has a significant positive impact on Guangzhou's per capita regional GDP.

Table 5. Regression Analysis Results and Additional Statistics for Guangzhou

Variable	Coefficient	t-Statistic	Prob.		
C	84347.68	9.646864	0		
EVENT	28311.62	1.869464	0.0749		
R²	0.137082	F-statistic	3.494895	DW stat	1.347394

Using the stepwise regression method on Hangzhou's relevant economic data (Table 6), we analyzed the relationship between per capita regional GDP and the number of sports events, the financial sector, the industrial sector, the wholesale and retail sector, and the tertiary sector. The results indicate that the number of sports events (EVENT), the financial sector (FINANCE), the industrial sector (INDUSTRY), and the tertiary sector (THIRD) have a significant positive impact on Hangzhou's income. In contrast, the wholesale and retail sector has a significant negative impact on income.

Table 6. Regression Analysis Results and Additional Statistics for Hangzhou

Variable	Coefficient	t-Statistic	Prob.		
C	15240.6	10.0697	0		
EVENT	1870.18	3.27243	0.0067		

FINANCE	7.37198	2.97564	0.0116		
INDUSTRY	24.1819	19.1953	0		
SALE	-60.229	-5.8896	0.0001		
THIRD	7.30677	15.3057	0		
R²	0.99964	F-statistic	6572.38	DW stat	2.28241

4. Research Conclusions and Recommendations

By establishing models of economic growth and structural change for Beijing, Guangzhou, and Hangzhou—three cities that have hosted large-scale events such as the Olympics and Asian Games—this study provides the following conclusions based on econometric analysis results:

Beijing: The numerous explanatory variables affecting per capita GDP in Beijing can be attributed to the city's hosting of the 2008 Summer Olympics and the 2022 Winter Olympics. The Olympics, being larger in scale than the Asian Games, stimulated growth in various industries. These events not only attracted a large number of international tourists and investments but also promoted comprehensive improvements in transportation infrastructure, cultural facilities, and urban image. Additionally, Beijing has hosted multiple large international events, broadening the economic impact of sports events.

Hangzhou: As an emerging first-tier city, Hangzhou has leveraged large sports events to promote the development of the financial and industrial sectors, contributing to the optimization of the city's economic structure and industrial upgrading. These sports events attracted investments and tourists, further driving improvements in infrastructure and the growth of the service industry.

Guangzhou: As the capital of Guangdong Province, the most economically developed province in China, Guangzhou's highly developed and comprehensive economy limits the relative economic stimulus effect of sports events. Guangzhou already possesses a strong economic foundation and a diversified industrial structure, making the marginal effects of sports events less pronounced in this context.

Overall, large-scale sports events have a significant positive impact on the economies of the three cities. Specifically, the impacts are manifested in the following aspects:

Direct Economic Effects: Sports events attract a large number of tourists, increasing consumer demand and driving the development of the retail, catering, accommodation, and other service industries, directly boosting the city's economic income.

Long-term Economic Effects: Infrastructure construction and improvements enhance the city's overall competitiveness and attractiveness, laying a foundation for long-term economic development. In particular, in Beijing, sports events have played an important role in promoting the development of the cultural, educational, and information transmission sectors.

Government Support and Policy Guidance: Reasonable government fiscal spending and policy guidance are crucial in promoting the development of sports events and related industries. For instance, Guangzhou has effectively stimulated economic growth by increasing fiscal investment to support infrastructure and public service improvements.

Industrial Structure Optimization: Hosting sports events promotes the optimization and upgrading of the city's industrial structure. For example, Beijing has enhanced its economic level and innovation capacity by developing cultural, educational, and information transmission industries.

In terms of policy recommendations, firstly, cities should strengthen the planning and management of large sports events, taking into account their economic foundation and development needs to avoid resource waste and economic burdens from excessive hosting. Secondly, governments should increase support for sports events, particularly in infrastructure construction and public service investment, to ensure the smooth execution of events and maximize their economic benefits. Thirdly, sports events should be used to promote the development of diversified industries, especially cultural, educational, and financial sectors, to enhance the city's overall competitiveness and economic resilience. Fourthly, cities should focus on optimizing post-event utilization of sports venues and related facilities, developing plans to avoid idle wastage and ensure long-term economic benefits from sports events.

In conclusion, sports events significantly drive urban economic development. Cities should leverage these opportunities through sound planning and policy support to promote sustained and healthy economic growth. This research provides empirical evidence for policymakers, indicating that fostering sports events and related industries can effectively elevate urban economic levels and support sustainable urban development.

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