

## Impact of G20 Summit on Hangzhou House Prices

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**Abstract:** The G20 Hangzhou Summit made Hangzhou the focus of world attention, greatly enhanced Hangzhou's international image and urban competitiveness, promoted economic development, and also promoted the development of Hangzhou's real estate market. This paper chose quarterly panel data from 26 cities in 2015 and 2017 and set up a difference-in-differences (DID) model for quantitative analyzing the impact of G20 summit on Hangzhou house prices. This research found that the G20 summit had a significant impact on house prices in Hangzhou, it overall raised Hangzhou house prices by 1416.201yuan/m<sup>2</sup>.

### 1. Introduction

Urban mega-events, such as hosting international conferences and large-scale events has a great influence on urban development. For example, international metropolises such as Pittsburgh and Brisbane have achieved major transformations in urban development through the hosting of international summits [1]. Because of the propaganda held during mega-events, the huge sensation effect will quickly strengthen the image of the city in the short term, and increase international reputation [2]. Therefore, the mega-events can stimulate the economic growth of the host city, promote consumption and investment, and expand employment [3]. At the same time, it can significantly promote the industrial transformation and development, create opportunities for urban spatial reconstruction [4]. In addition, urban mega-events have contributed greatly to improving urban infrastructure. The iconic stadiums and related facilities of today's large-scale urban events have been designed with the issue of continued use after the competition in mind, which can both meet temporary needs and be included in the overall planning as a permanent building [5]. These factors will affect the city's real estate market.

The G20 Summit was held in Hangzhou, Zhejiang Province from September 4 to 5, 2016. This is the first time for China to host the G20 Leadership Summit and the second time for an Asian country to host it since the 2010 G20 Summit in Seoul, South Korea. The success of the G20 Hangzhou Summit has brought tremendous development opportunities to Hangzhou, greatly enhanced Hangzhou's international image, and is an opportunity for Hangzhou to start a new round of development. The purpose of this study is to use the G20 summit held in Hangzhou as a natural experiment. Using the quarterly panel data from 26 cities in 2015 and 2017 and set up a difference-in-differences model for quantitative analyzing the impact of G20 summit on Hangzhou housing prices. The rest of this study is structured as follows. Section 2 outlines the literature on the impact of urban mega-events on housing prices and the difference-in-differences method. Section 3 describes the data and methodology. Section 4 presents and analyze the results. Section 5 concludes.

### 2. Literature Review

The G20 summit is considered a major urban event in Hangzhou. The concept of an urban mega-event originated in the field of tourism. In 1984, Ritchie defined mega-events as starting from long-term goals or current purposes, single or short duration, which can increase the attractiveness of tourist destinations, strengthen the popularity and influence of tourist destinations, and attract tourists the surrounding economy and activities of a certain era significance [6]. These large-scale activities

require public funding or public support to establish hardware facilities [7]. With the increasingly frequent international economic and cultural exchanges, urban mega-events play a very special role in the development of the city, which not only directly affects the development of the city's economy, but also brings unprecedented opportunities to the construction and renewal of the city's physical space and promotes social and cultural progress [8]. As a strategic tool for the government to improve the city's competitiveness, urban mega-events can indirectly affect the evolution of urban spatial structure, involving urban function migration, spatial expansion, urban agglomeration, industrial structure adjustment, social population distribution, and transportation structure, which can better meet the intention of the city government to realize urban development [9].

From the perspective of social impact, hosting a large event such as the Olympic Games will increase the population near the venues, then the consequent commerce and industry will promote the economic vitality of the area and promote urbanization. Meanwhile, the rent and housing price in the vicinity will rise sharply [10]. Shin concluded that the Guangzhou Asian Games greatly enhanced Guangzhou's political status, making Guangzhou a central city of southern China, and Guangzhou also used the opportunity of the Asian Games to solve the problem of compact urban space, strengthen its own production and accumulation capabilities, and develop the city's real estate development potential [11]. Ye et al. used the hedonic price model to study the influence of the Youth Olympics on house prices in Nanjing, proved that Youth Olympics is a key factor in the phased rise in house prices, and that house prices around the core area of the Youth Olympic venues were most affected. Its influence is decreasing radioactively. Two years after the successful bid, the influence of the Youth Olympic Games began to appear, and the average house price will rise by 1.37% per month [12].

Bauer et al. studied the changes in house prices near the German nuclear power plant after the Fukushima nuclear power plant accident. The Fukushima nuclear power plant accident led to a fundamental change in German energy policy. Nearly half of German nuclear power plants were closed immediately. After that, the house prices near the German nuclear power plant were reduced by nearly 6%, and the house prices near the closed nuclear power plant even fell by 10.8%, and that unfavorable economic factors such as unemployment and lower taxes were the main reasons for the decline in housing prices [13]. Kavetsos studied the changes in London house prices after the announcement of the London Olympic Games from the dimensions of whether it is the host area and the distance from the venue. The study showed that house prices in the four major host locations rose by 2.2% due to the Olympic Games. And the price increased by 5% within three miles of the sports venue, and the impact of each mile away from the venue decreased by 0.4% [14]. Pan Meiyang used the DID model and took Hangzhou as the control group to study the influence of the Youth Olympic Games on the house price in Nanjing. The study showed that from the preparation period of the Youth Olympic Games to the official holding of the games, the house price in Nanjing increased by 7.26%, and the driving effect on housing price had a lag of 2 years [15].

### **3. Data and Methodology**

#### **3.1 Experimental group and control group.**

This paper takes Hangzhou as the experimental group. Based on the city's development level, housing price level and city representativeness, and excluding incomplete data and cities with a large gap between housing price level and Hangzhou, 25 cities were selected as a control group. The experimental and control cities are shown in Table 1.

Table 1 Experimental group and control group

Experimental group	Control group
Hangzhou	Shanghai, Shenzhen, Tianjin, Nanjing, Guangzhou, Chongqing, Wuhan, Changsha, Taiyuan, Shenyang, Dalian, Changchun, Hefei, Fuzhou, Nanchang, Jinan, Qingdao, Zhengzhou, Haikou, Chengdu, Guiyang, Kunming, Xi'an, Ningbo

### 3.2 Variable declaration and the data source.

Since the housing price depends not only on the event factors, but also on the internal economic development level and demand status of each city, these internal demand characteristics can be expressed by GDP, real estate investment, population and other indicators. These factors are added in order to comprehensively consider the impact of internal and external factors on housing price changes, so as to more fully illustrate the impact of G20 summit on housing prices. The interpreted variable selected in this study is the quarterly average price of commodity residential. The data comes from the CRIC database, and the explanatory variable data comes from China Land Monitoring Network, the National Bureau of Statistics, and the Municipal Bureau of Statistics. The G20 Hangzhou Summit was held from September 4th to 5th, 2016, so quarterly house prices from January 2015 to December 2017 were selected for analysis, and panel data for a total of 12 quarters were obtained. Specific variables and definitions are shown in Table 2.

Table 2 Variable definition and data source

Variable name	Variable definition	Unit	Data source
hp	The average price of quarterly commercial housing in the city	yuan /m <sup>2</sup>	the CRIC database
gdp	Quarterly urban GDP	100 million yuan	Bureau of statistics
invest	Quarterly investment in urban real estate development	100 million yuan	Bureau of statistics
people	Permanent urban population	10000	Bureau of statistics
cpi	Consumer price index		Bureau of statistics
income	Urban per capita disposable income	yuan	Bureau of statistics
area	Urban quarter commercial housing sales area	10000 m <sup>2</sup>	Bureau of statistics
lp	The average price of quarterly house land in cities	yuan	China Land Monitoring Network
t	Time dummy variable: t=0 before and t=1 after the G20 summit		
treated	Group dummy variables, control group =0, Hangzhou =1		
gd	The interaction term, gd=t*treated		

This paper uses the quarterly average price of urban house as the explanatory variable, and uses the city's macro quarterly data as the control variable. Among them, since the data of the city's resident population is published once a year, it is assumed that the number of urban population is unchanged throughout the year; the consumer price index uses quarterly mean, quarterly true values are used for the remaining variables. When entering the model for fitting, each variable is standardized to eliminate dimensional differences, facilitate observation and compare estimated coefficient sizes. The descriptive statistics of each variable are shown in Table 3.

Table 3 Descriptive statistics of variables

Variable	Number of samples	Average	Standard deviation	Minimum	Maximum
hp	312	14339.830	4179.15	5236.600	25211.100
invest	312	446.352	277.098	8.600	1330.100
area	312	459.150	320.152	33.200	2135.000
people	312	851.565	587.233	164.800	3392.110
gdp	312	2619.249	1761.287	246.900	8648.980
cpi	312	101.802	0.714	99.867	104.033
income	312	10235.310	3010.664	6232.000	41335.000
lp	312	12185.490	14540.360	2070.000	66579.000

### 3.3 Model specification.

In this paper, the DID method was used to analyze the impact of G20 summit on housing prices in Hangzhou. The core of the method is to treat the G20 summit as a natural experiment, that is, the selection of experimental subjects is given exogenously, and the entire sample is divided into a treatment group affected by the event and a control group not affected. On the one hand, the G20 summit has led to the difference in the prices of house buildings in Hangzhou before and after the event, and on the other hand, it has led to the difference between Hangzhou and other cities that have not hosted the G20 summit at the same time. Based on this assumption, first calculate the amount of change in the housing price of the treatment group and the control group before and after this event, and then calculate the difference between the two changes, that is, the difference-in-differences.

$$hp = \beta_0 + \beta_1 t + \beta_2 treated + \beta_3 gd + \sum_{m=1}^N \alpha_m control + \varepsilon_{it} \quad (1)$$

Where,  $\beta_0$  is a constant term;  $t$  is a time dummy variable;  $treated$  is a group dummy variable;  $control$  is other control variables;  $gd$  is the interaction term between time dummy variable and group dummy variable,  $gd=t*treated$ ;  $\varepsilon_{it}$  is an error term.  $\beta_0, \beta_1, \beta_2, \beta_3$  And  $\alpha$  are parameters with estimates. The main observation is the significance of the coefficient before the interaction term. If  $\beta_3$  is significant, it indicates that the G20 summit would have an impact on Hangzhou house prices.

## 4. Results analysis

### 4.1 The DID model result analysis.

In this paper, the coefficient of the interaction term represents the net effect of the treatment. A total of two regressions were performed. The column  $\phi$  of Table 4 shows the regression results without considering the control variables. The column  $\varrho$  shows the regression results after adding each control variable to the model.

The column  $\phi$  indicates the parameter estimated value without considering each control variable. From the calculation results, it can be seen that the explanatory variable  $t$  is significant at the significance level of 1%, which means that in the absence of a control variable, the housing prices in Hangzhou are significantly different before and after the G20 summit. As for Hangzhou itself, the impact of the G20 summit exists. The interaction term is significant at the significance level of 10%, indicating that the hosting of G20 summit has a positive effect on the Hangzhou housing price.

The column  $\varrho$  is the parameter estimation after bringing in the control variables. The results show that six variables such as time dummy variables, interaction items, quarterly sales area, population, quarterly GDP, and average house land price are significant. As can be seen from the standardized coefficient, the most influential explanatory variables are the average price of house land, quarterly GDP and per capita disposable income. The explanatory variable  $t$  is significant at the significance level of 1%, indicating that the housing price in Hangzhou is still significantly different before and after the G20 summit with the addition of control variables. The explanatory variable  $treated$  is not

significant, which means that compared with the cities in the control group, there is no significant particularity in the price of commercial housing in Hangzhou, and the price of housing in Hangzhou and the control group can be compared. The interaction term is significant at a significance level of 5% and the coefficient is positive, indicating that the G20 summit indeed has a positive impact on the price of commercial housing in Hangzhou, and the hosting of the G20 summit has increased the average price of commercial housing in Hangzhou by 1416.201 yuan /m<sup>2</sup>.

Comparison the column  $\phi$  and  $\varrho$ , it can be seen that after adding the control variable, the goodness of fit increased sharply, rising from 0.035 to 0.802, which indicates that the percentage of the explained variable difference that the model in the column  $\varrho$  can explain is about 80.2% . It indicates that the fitting degree of the model is good and it has good explanatory ability, and the increase of explained variables can measure the change of housing price more comprehensively. The coefficient of the interaction items in the column  $\varrho$  has decreased in comparison, which indicates that the increase of control variables can more clearly strip out the influence of the G20 summit. The G20 summit has indeed promoted the housing price in Hangzhou.

Table 4 The DID model result analysis

Explanatory variables	$\phi$		$\varrho$	
	Coefficient	Standardized coefficients	Coefficient	Standardized coefficients
Constant	12341.070***		15917.710	
t	3652.306***	0.166***	1651.242***	0.075***
treated	3736.010**	0.065**	-517.737	-0.009
gd	1503.194*	0.019*	1416.201**	0.018**
invest			0.600	0.015
area			-3.024***	-0.088***
people			-1.948**	-0.104**
gdp			1.742***	0.278***
cpi			-116.696	-0.008
income			0.091	0.214
lp			0.554**	0.731**
R <sup>2</sup>	0.035		0.802	
	***p<0.01   **p<0.05   *p<0.1			

#### 4.2 Robustness test.

The DID model proves that the G20 summit has a certain effect to promote the housing price in Hangzhou, but there are other factors that may affect the local housing price. For this reason, we can assume that the G20 summit will be held in September 2015. If it held in September 2015, then define the variable t as 1 between the third quarter of 2015 and the third quarter of 2017, and the value of 0 as the first quarter of 2015 to the second quarter of 2015. The results are shown in Table 6 Result 1. The interaction term coefficient in the third quarter of 2015 was not significant, which ruled out the possibility of other factors leading to the rise in Hangzhou house prices during the study period, which proved that the G20 Summit did have an impact on Hangzhou house prices.

In addition, we can also assume that the G20 summit is not held in Hangzhou but in another city, that is, to change the experimental group to test the robustness. Since Ningbo is close to Hangzhou and is also in Zhejiang Province, the robustness test assumes that the G20 summit will be held in Ningbo in September 2016, we can define the variable treated in Ningbo as 1, and set the interaction term gd to measure the impact of the G20 summit. The results are shown in Table 5 Result 2. It is assumed that after the venue is moved to Ningbo, the interaction term coefficient is not significant, which indicates that in terms of comparison between cities, the impact of the G20 summit only exists in Hangzhou.

Table 5 Robustness test result

Variable	Result 1				Result 2			
	Coef.	t-value	p-balue	Sig	Coef.	t-value	p-balue	Sig
gd	1211.246	1.25	0.212		1130.147	1.19	0.236	
t	1016.108	2.52	0.012	**	1533.183	2.75	0.006	***
treated	2307.366	3.77	0	***	1928.62	3.98	0	***
invest	4.645	3.72	0	***	-4.648	-2.01	0.046	**
area	-3.87	-3.51	0.001	***	2.695	1.3	0.193	
people	-0.899	-2.08	0.039	**	-2.905	-3.33	0.001	***
gdp	0.631	2.31	0.021	**	1.261	3.55	0	***
cpi	732.357	3	0.003	***	287.725	0.84	0.399	
income	0.351	5.27	0	***	0.095	0.97	0.334	
lp	0.151	2.98	0.003	***	0.595	9.69	0	***
_cons	-69973.7	-2.83	0.005	***	-24020.2	-0.69	0.488	

## 5. Conclusion

This study takes Hangzhou as an experimental group, collects data from 26 cities in 12 quarters, establishes a difference-in-differences (DID) model, and empirically analyzes the impact of the G20 summit on Hangzhou house prices. The main conclusions of this article are as follows.

(1) The G20 summit has a premium effect on housing prices in Hangzhou. In general, the G20 summit has a positive impact on house prices in Hangzhou. From the perspective of the city, there is a significant difference in house prices before and after the G20 summit, which can prove that the G20 summit has a premium effect on Hangzhou house prices, with an average premium of 1416.210 yuan per square meter.

(2) The results of the DID model show that the positive impact of the successful G20 summit on Hangzhou's house prices after adding the control variable is significant at a 95% confidence level. The robustness test further confirmed that the G20 Summit was a driving factor for the rise in house prices in Hangzhou during the study period.

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