

The Research of Housing Characteristic Price in the west region of Jinji Lake in Suzhou industrial district based on Hedonic Model

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基于Hedonic模型的苏州工业园区
金鸡湖以西地区住宅特征价格研究
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INTRODUCTION

Research Background



With the urbanization accelerating in China, real estate development grows in full swing. External environment plays a key role in house price changes, such as Metro and park leads higher house price. **To safeguard the public interest, revert the property value-added effect by the public investment to public financial resources, quantifying external environment impact should be done firstly.** In the minimum, it can rise public concern for the environment potential value, in a higher level, it can be decision-making basis of the urban planning.

Hedonic Pricing Method(HPM)

Hedonic pricing method (HPM) is an effective approach to estimate the environmental effect on market price. It believes that housing is composed of lots of different attributes, and the price is determined by the effectiveness that all attributes brought to people. [As the different combinations of the attribute, housing prices differ.](#)

$$P = f(L, S, N)$$

P=house price, L=location, S=structure, N= neighborhood

HPM Specific Functional Form

Model Type	Function
Linear form	$P = a_0 + a_1L + a_2S + a_3N + \varepsilon$
Logarithmic form	$\ln(P) = a_0 + a_1\ln(L) + a_2\ln(S) + a_3\ln(N) + a_1'L' + a_2'S' + a_3'N' + \varepsilon$
semilogarithmic form	$\ln(P) = a_0 + a_1L + a_2S + a_3N + \varepsilon$

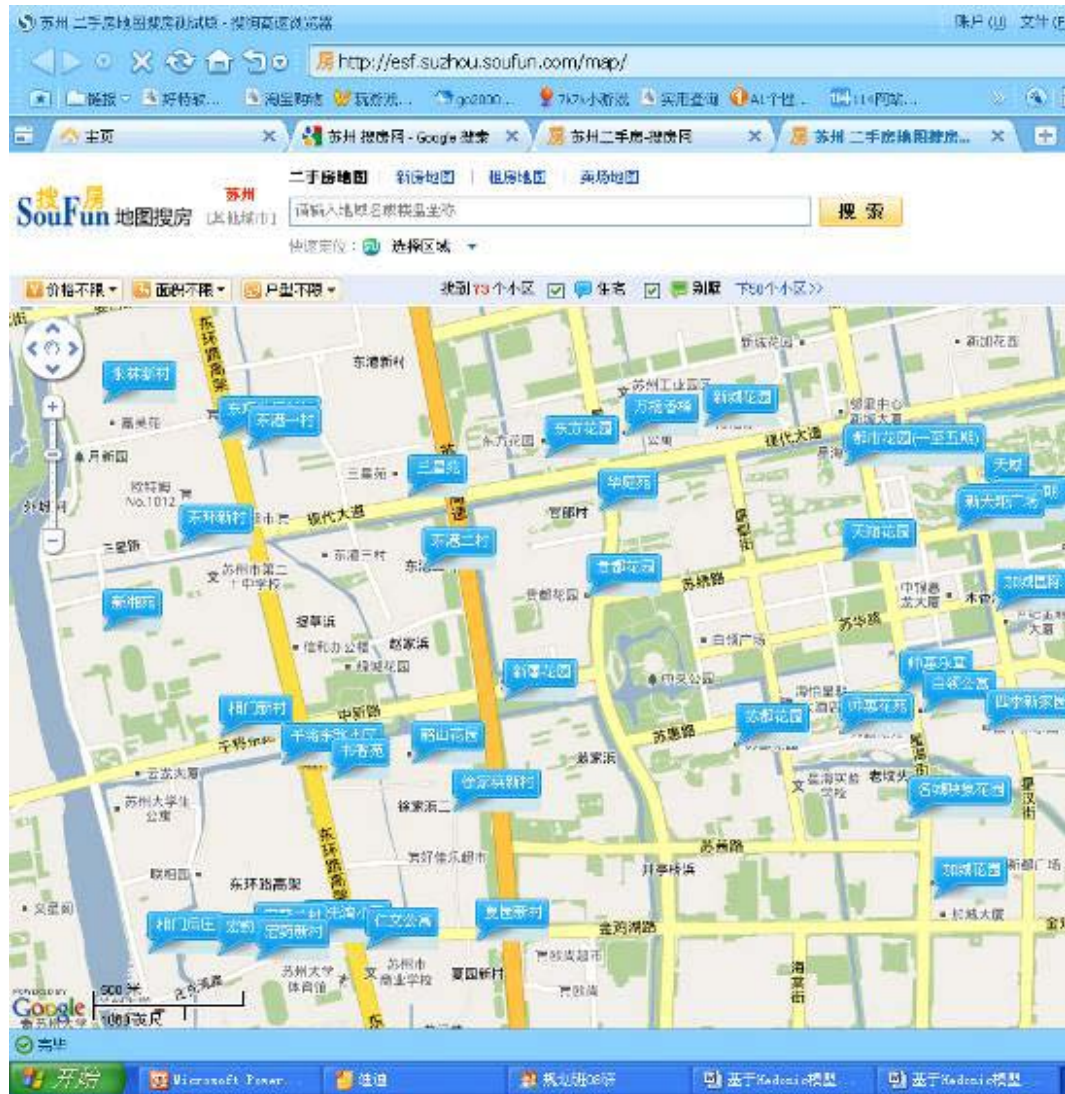
ε =error term, a_0 =constant term

SAMPLE & DATA

Research District



Dependent Variable



This study regards average price of unit area of second-hand house as the dependent variable to investigate the external environment. The data source is Suzhou Soufun website.

Independent Variable

Variable type	Variable element	Variable name	Variable definition
Dependent variable	Average price of unit area of second-hand house		Average price of unit area of second-hand house
Internal factor	Building type	Building type	multi-storey dwelling and high-rise dwelling 1 score landscape house 1.5 score townhouse 2 score villa 3 score
		Building type square	Building type score square, price difference between adjacent type increases
	Real estate Quality	Quality	Setting 1-4 point , 4 level
		Quality square	Quality score square, price difference between adjacent score increases
	Building age	Building age	2010 subtract real estate open or complete date
External factor	Lake	Distance to nearer lake	Shortest space distance to nearer lake
		Distance to jinji lake	Shortest space distance to jinji lake
		Lake view	Whether obtain lake view (1 = yes , 0 = NO)
	CBD	Distance to whole CBD	Shortest space distance to whole CBD
		Distance to office tower	Shortest space distance to office tower
		Nearer plazas within 600M	Whether nearer plazas is within 600M, (1 = yes , 0 = NO)
	Expressway	Expressway within 300M	Whether expressway is within 300M, (1 = yes , 0 = NO)
		To the east of expressway	Whether is to the east of expressway, (1 = yes , 0 = NO)
	Subregional centre	Distance to subregional centre	Shortest space distance to subregional centre
		subregional centre within 300M	Whether subregional centre is within 300M (1 = yes , 0 = NO)
		subregional centre within 600M	Whether subregional centre is within 600M (1 = yes , 0 = NO)
	MALL	Distance to mall	Shortest space distance to mall
		Mall within 300M	Whether mall is within 300M (1 = yes , 0 = NO)
	Top-grade dining area	Distance to dining area	Shortest space distance to dining area
		dining area within 600M	Whether dining area is within 600M (1 = yes , 0 = NO)
	Industrial district	Distance to industrial district	Shortest space distance to industrial district
		industrial district within 300M	Whether industrial district is within 300M (1 = yes , 0 = NO)
		industrial district within 600M	Whether industrial district is within 600M (1 = yes , 0 = NO)
	MTR station	MTR station within 600M	Whether MTR station is within 600M (1 = yes , 0 = NO)
		MTR station within 900M	Whether MTR station is within 900M (1 = yes , 0 = NO)



External Factors

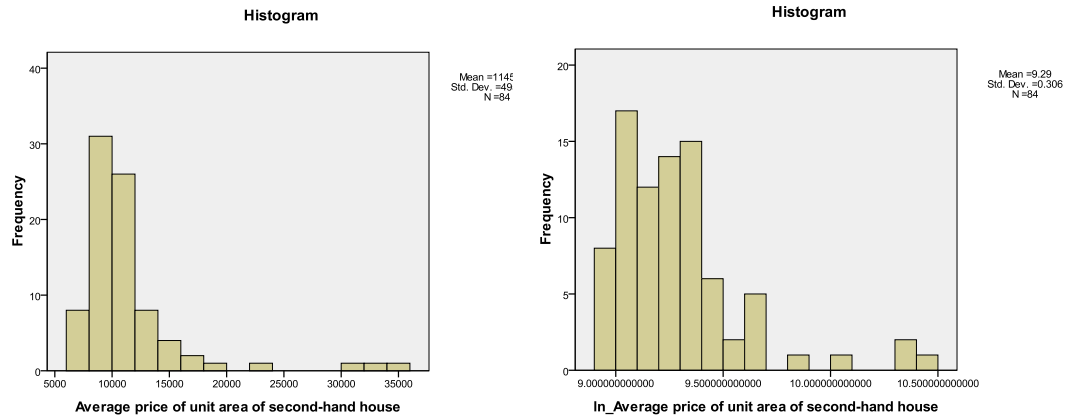
Description Statistics

	N	Minimum	Maximum	Mean	Standard deviation
Average price of unit area of second-hand house	84	7539	35867	11453.73	4953.157
Quality	84	1	4	2.77	.869
Quality square	84	1	16	8.44	4.663
Building type	84	1	3	1.15	.431
Building type square	84	1	9	1.50	1.608
Building age	84	1	12	6.24	2.453
Distance to nearest lake	84	140.3	3533.0	1513.682	921.3943
Distance to jinji lake	84	213.5	3533.0	1882.081	911.7591
Lake view	84	0	1	.19	.395
Distance to office tower	84	51.0	4094.0	1602.207	1081.2335
Distance to whole CBD	84	51.0	4094.0	1481.533	1109.1096
Nearer plazas within 600M	84	0	1	.20	.404
Expressway with 300M	84	.0	1.0	.202	.4042
To the east of express	84	.0	1.0	.226	.4209
Distance to subregional centre	84	28.9	4874.0	1972.137	1378.8168
subregional centre within 300M	84	.0	1.0	.167	.3749
Subregional centre within 600M	84	.0	1.0	.298	.4600
Distance to dining area	84	146.1	4491.0	1982.894	822.6063
Dining area within 600M	84	.0	1.0	.060	.2380
Distance to mall	84	260.8	3076.0	1568.914	663.8825
Mall within 600M	84	.0	1.0	.060	.2380
Distance to industrial district	84	104.6	2283.0	682.361	450.8000
industrial district within 300M	84	.0	1.0	.214	.4128
industrial district within 600M	84	.0	1.0	.524	.5024
MTR station within 600M	84	.0	1.0	.036	.1867
MTR station within 900M	84	.0	1.0	.083	.2780
effective N (列表状态)	84				

REGRESSION

Regression Process

First of all, more probably significant factor is identified by stepwise regression, with the principle that each element only allowed 1-2 variable to be selected in function. Then, dependent variable is determined to select the Log form, based on the Box-Cox transformation, which makes dependent variable closer than before. **Secondly**, Setting 95% confidence interval, independent variables with linear and Log form respectively doing stepwise regression. Comparing the adjusted R2 (linear from adjusted R2=0.894; Log form adjusted R2=0.900), **Log form was chosen as the final form of the regression function.**



Regression Result

$$P = e^{10.599X_1 - 0.099X_2 - 0.104X_3 + 0.08X_4 + 0.096X_5 + 0.068X_6 + 0.118X_7 - 0.015X_8} e^{0.137X_8}$$

P= Average price of unit area of second-hand house;
 X1= distance to Jinji lake;
 X2= distance to entire CBD;
 X3= quality square;
 X4= building type square;
 X5= subregional centre within 300M;
 X6= MTR station within 900M;
 X7= building age;
 X8= lake view

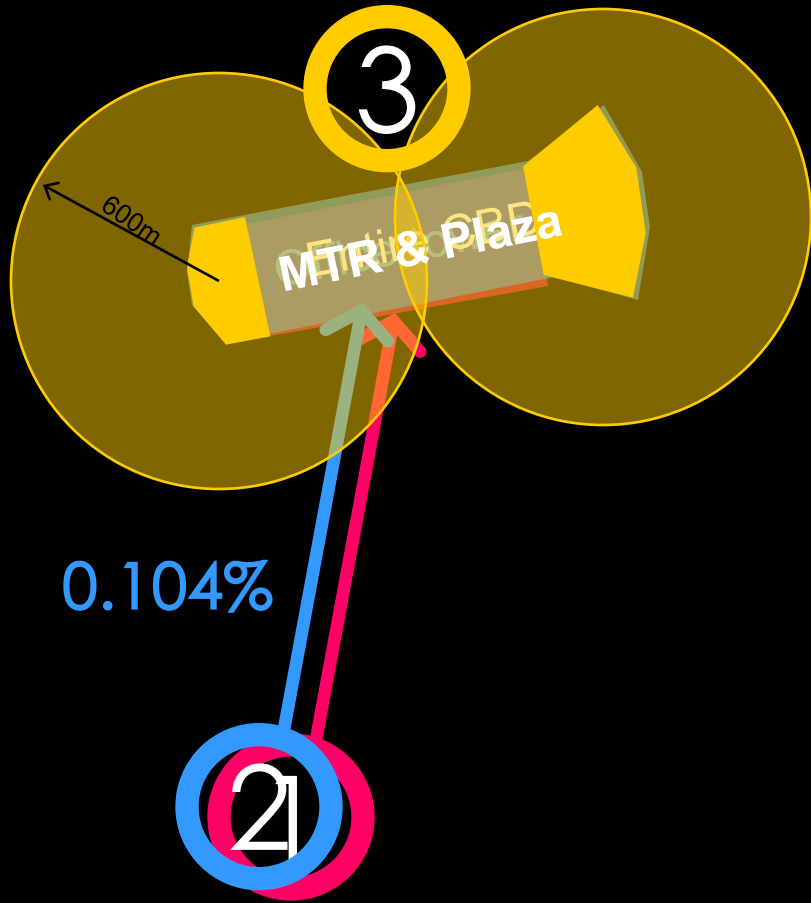
Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.954 ^a	.910	.900	.09681961736 1984	1.723

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.559	.181		58.246	.000
	Quality square	.008	.003	.124	2.582	.012
	Building type square	.096	.008	.504	11.619	.000
	Building age	-.015	.005	-.122	-2.901	.005
	ln_distance to jinji lake	-.099	.026	-.233	-3.872	.000
	Lake view	.137	.042	.177	3.253	.002
	ln_distance to whole CBD	-.104	.013	-.387	-8.132	.000
	Subregional centre with 300M	.068	.033	.084	2.070	.042
MTR station within 900M	.118	.042	.107	2.814	.006	

FUNCTION ANALYSIS



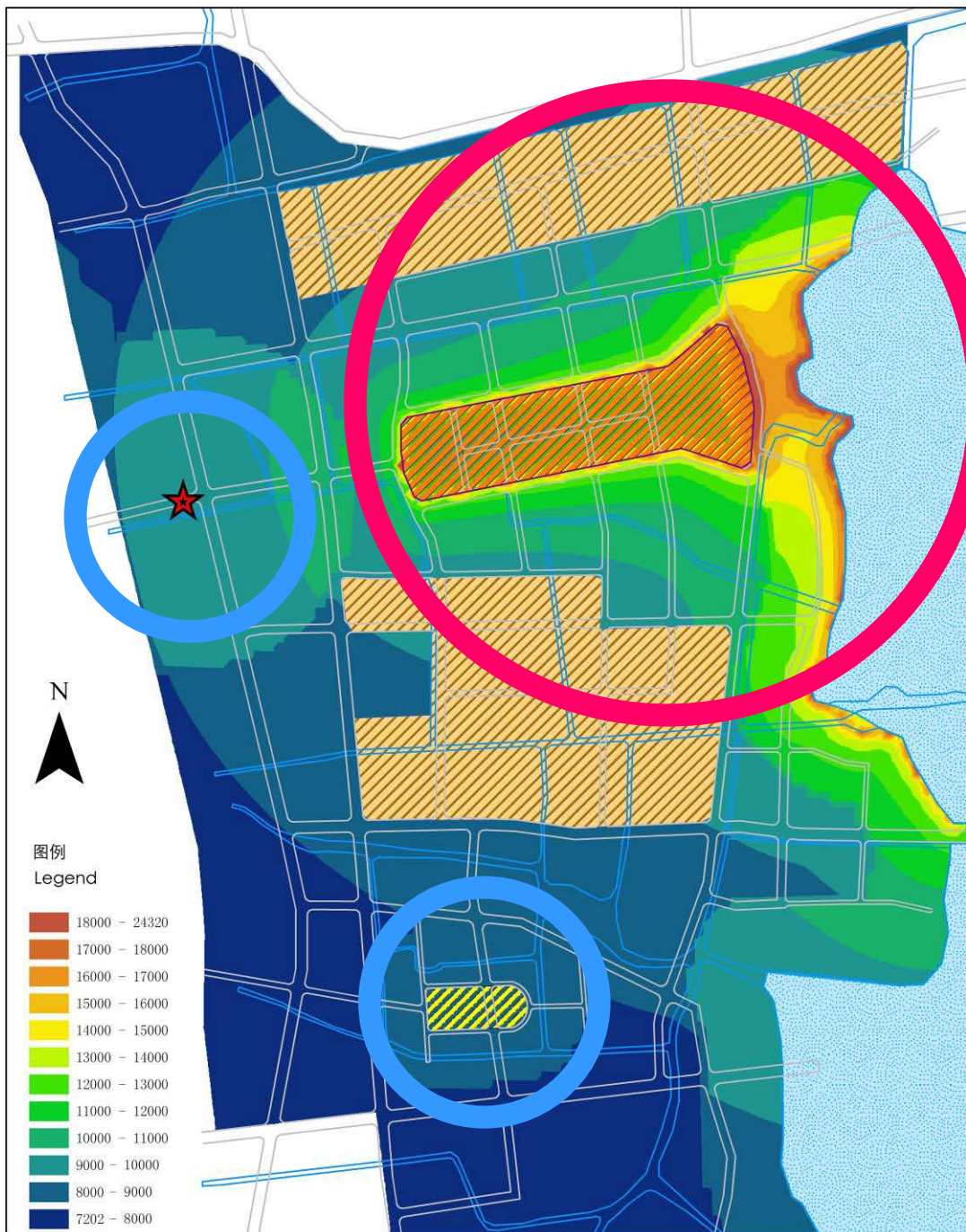
Jinji Lake & Dushu Lake



CBD

External Environment Visualize Simulation

JinJi lake and CBD generate the largest scale price force, the highest land value locates in the interchange between CBD axis and JinJi Lake, its value-added effect decreases outwards in exponential form. At the same time MTR station, subregional center, also generate the different kind of price forces, driving up surrounding house price.



FURTHER DISCUSSION

The Range of Value-added Effect of Jinji Lake

$$P = e^{10.599X_1 - 0.099X_2 - 0.104e^{0.08X_3} e^{0.096X_4} e^{0.068X_5} e^{0.118X_6} e^{-0.015X_7} e^{0.137X_8}}$$

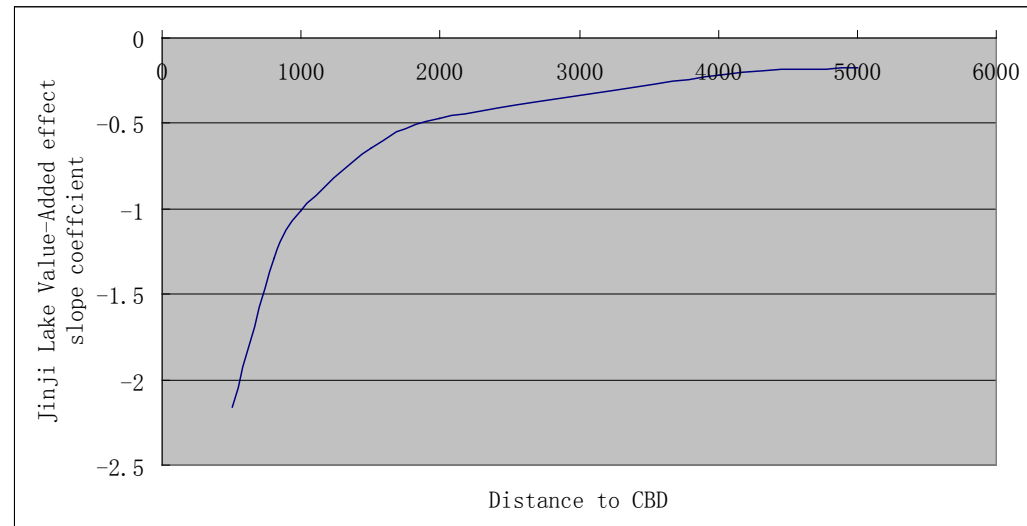
$$Y' = -0.099e^{10.599X_2 - 0.104e^{0.08X_3} e^{0.096X_4} e^{0.068X_5} e^{0.118X_6} e^{-0.015X_7} e^{0.137X_8} X_1^{-1.099}}$$

When $X_2=1500$; $X_3=7$; $X_4=1$; $X_5=0$; $X_6=0$; $X_7=5$; $X_8=0$

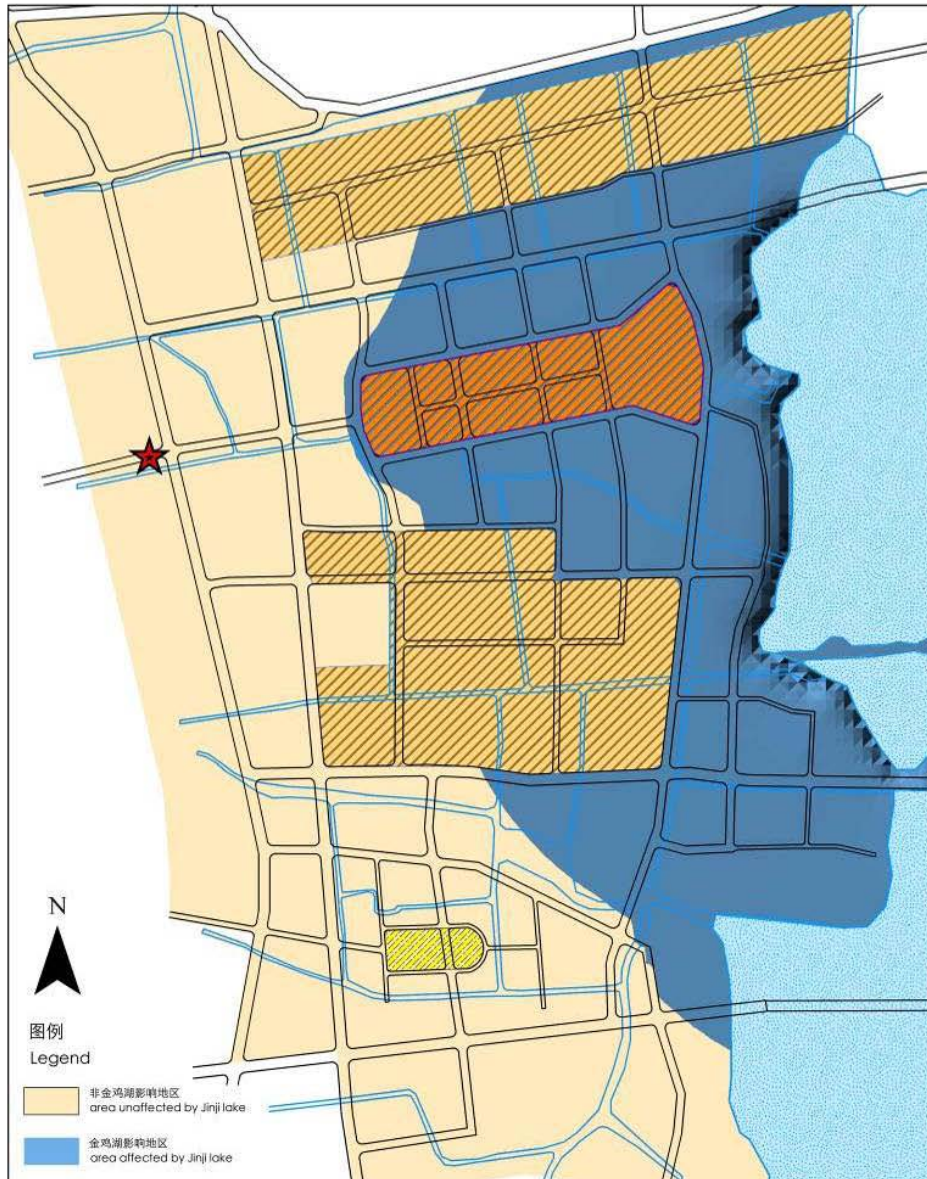
$Y' = -2001.524762 * X_1^{-1.099}$ (as the chart shows)

When $X_1 = -0.5726$, $Y' = 1600m$

According to walking 400M in 5 min,
JinJi lake value-added range is 20
min walking distance.



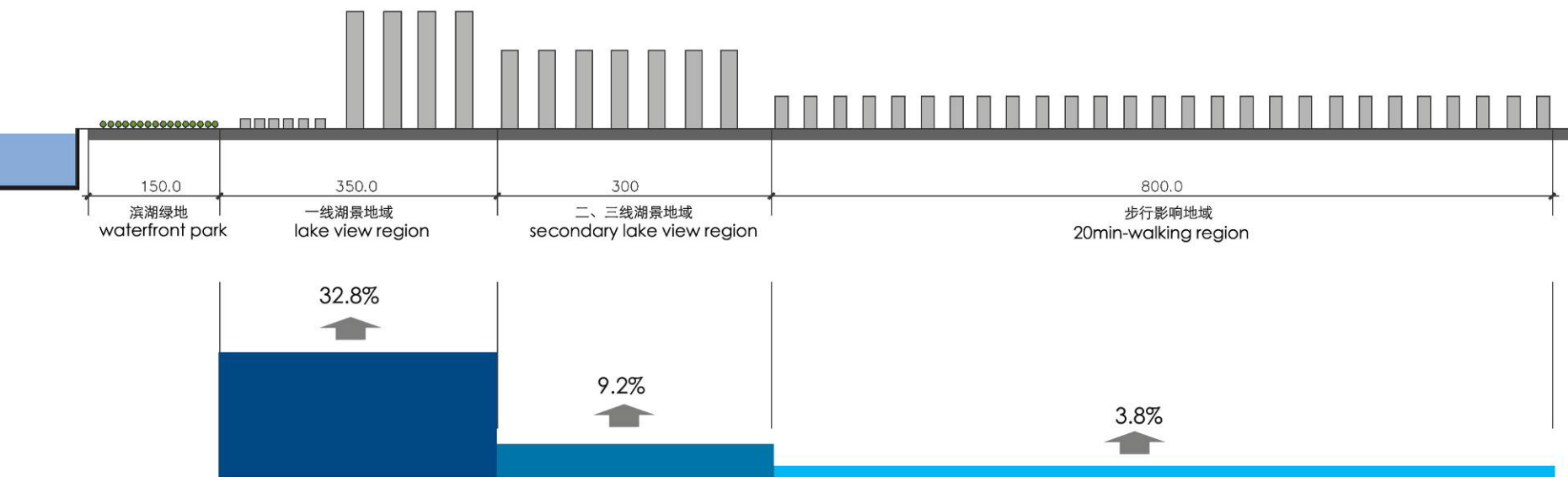
The Range of Value-added Effect of Jinji Lake



In practice, other external factors will have different influences on Jinji Lake effect range. After simulation, we found that practical range is still about 1600M, fluctuating in 200M,

JinJi Lake Effect Section Analysis

According to the affected principle, Jinji Lake value-added effect is divided into three rings, **Lake view region**, **secondary lake view region** and **20-min - walking region**.



CBD impact on JinJi Lake Value-Added Effect

According to the regression function and partial derivation function of distance to Jinji Lake, CBD's impact on JinJi lake value-added effect can be easily found. Along with reduction of distance to CBD, JinJi lake value-added effect and range obviously changes. **While distance to CBD reduces from 3000M to 400M, the prices in lake view region goes up 8.9%, the effect range increases about 400M.**

$$P_{400} = 23197 X_1^{-0.099}$$

$$P_{1500} = 20217 X_1^{-0.099}$$

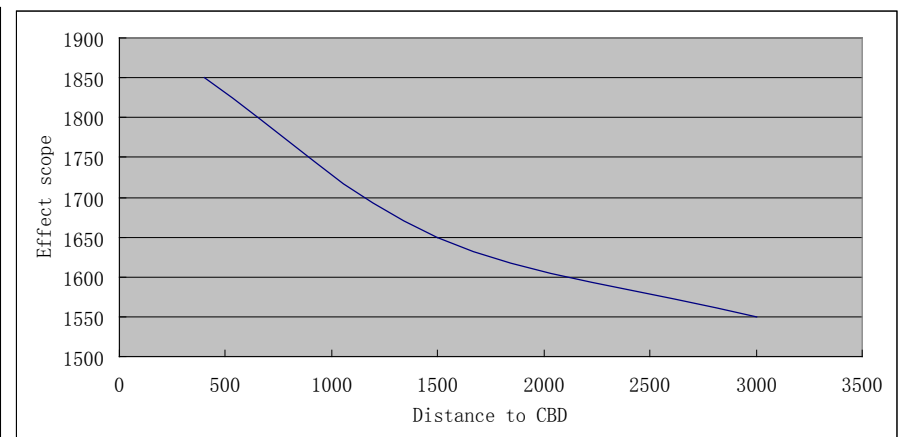
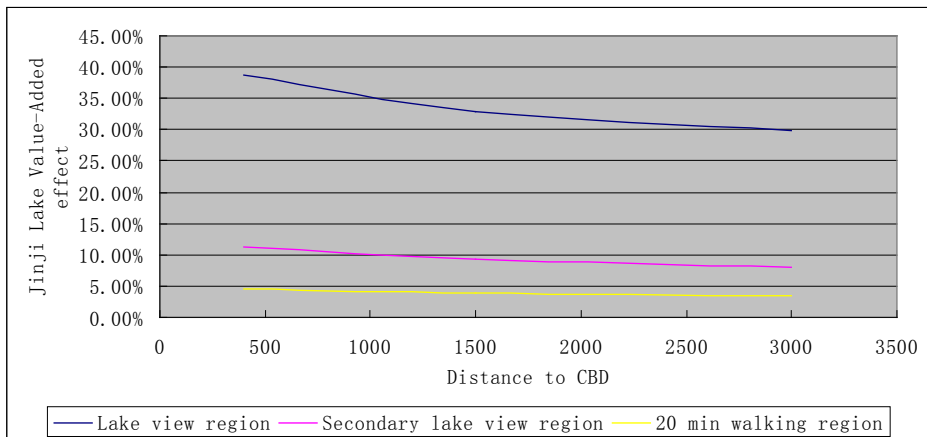
$$P_{3000} = 18811 X_1^{-0.099}$$

$$Y_{400}' = -2296.50 X_1^{-1.099}$$

$$Y_{1500}' = -2001.52 X_1^{-1.099}$$

$$Y_{3000}' = -1862.35 X_1^{-1.099}$$

effect ring	Lake view region			Secondary lake view region			20 min walking region		
	CBD400M	CBD1500M	CBD3000M	CBD400M	CBD1500M	CBD3000M	CBD400M	CBD1500M	CBD3000M
Effect range	500M			800M			1900M	1650M	1500M
Value effect	38.70%	32.80%	29.80%	11.20%	9.20%	7.90%	4.50%	3.80%	3.50%



SUMMARY

Large-scale environment and commuting element have a significant impact on house price

From the analysis of the results, except for internal factors, elements relating to commuting and large-scale environment access to the final function in different forms, which explains when people choose the apartment ,the most important factors are surrounding environment and commute convenience.

Dushu lake Development has problems

The fact that the distance to Jinji lake and lake view was selected in, shows problems of Dushu Lake development. Its shoreline in private land transfer mode have a negative impact on its value-added effect. So There is no obvious impact on further real estate but only where can get Dushu lake view.

Jinji Lake Value-added Effect

According to the affected principle, value-added effect is divided into three rings, Lake view region, secondary lake view region, 20-min -walking region.

The value-added effect in lake view region is about 30% of mean total house price, which decreases outwards in exponential form.

20-min-walking distance range is defined by the principle that difference prices between adjacent property is less than the 1% of mean total house price.

Environment Elements has Agglomeration Effect

According to the regression function, just like the commercial agglomeration effect, positive external environment's gathering will make each single environment element have greater effect, just like $1+1>2$.

END