
Study on the scope that subway engineering influence the price of peripheral real estate*

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abstract

According to the problem that in what scope can subway engineering influence the prices of peripheral real estate, this paper summarized the problems in similar research presented, and put forward that the influence is taken by factors of person, and the influence can be studied by the probability of choosing subway. Different from other similar research, based on the analysis of the factors which can influence people choose subway or not, this paper constructs the logistic model. Testing the model by using the research data of Beijing, this paper get the list on which we know in what scope can subway engineering influence the surrounding real estate prices by adjusting the logistic model variable X4. Finally, discussed the model applicability and in different cities to application.

key words: subway engineering; Funding Model; subway election probability; influence scope; logistic

1. Background Information, Situation of Study, and Analysis

Subway is one of public transportation, with high efficiency, energy-saving and environmental protection, and great transport capacity. Therefore, subway engineering's development will enormously improve the current condition of public transportation. By the end of 2009, 10 cities have already set up and formally operated the urban railway network, over 900 km total mileage. Besides, another 27 cities have been constructing, or planning new urban railway network. The planning mileage reaches to more than 7500 km^[1]. As urban infrastructure, subway will turn out to be the main force among which can satisfy the need of public transportation in metropolis. However, with high constructing and operating costs, subway engineering, on one hand, will put great pressure on local government's finance. On the other hand, it may also affect the growth of subway's development which also can't satisfy the needs from public transportation with the quick increase of urbanization. In order to increase the rate development of subway, theory circle and practice circle have discussed the financing modes, like BOT, PPP and so on, from the aspect of subway engineering project's construction and operation. Nevertheless, almost all the research on the financing modes can hardly break away from marketization of public project's financing. Therefore, in order to coordinate the application of financing mode, some aspects have also done research on the effects of subway's development, aiming at the outer effects which brought by subway project's construction can make up private capital from non-government financing input.

Among the researches on the effects of subway development, researches at home focus on effects subway construction have on the surrounding land's price and house price. Besides, the researches also pay much attention to how to judge the scope of subway's effect by studying the price of surrounding house. The typical literature are Wang Xia (2004)^[2], Zhang Xiaosong (2005)^[3] and Liu Guiwen (2007)^[4]. The first one takes light rail number 13 in Beijing as an example, and gives an explanation of distribution characteristics of house price along the subway. The research has showed that light rail sites in inner part of city has less influence on house price and vice versa. The scope focus on within 1 kilometer. The second one firstly analyses the beneficial subject from the development of urban

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railway system which takes railway system lines in Sapporo, Japan, and sites of Xinzhuang and Lianhua Road in number 1 line of Shanghai metro as an example. Then they research, analyse and draw to describe the relationship between house price and length between sites of subway along urban railway system. Besides, they build up theoretical calculation model for the influential range of railway profit based on the equal travel time. The result has showed the influence urban railway system have on the house price is limited. The price of house along the system has reverse relation to the length between sites, and the further sites are to the inner city, the more effect on house price. The last one makes sure the influential range railway number two in Chongqing to each site based on the theory of "equal time". The influential radiuses from 0.21 km to 2.98 km.

As for the effects on subway sites, there are two typical thoughts among researches we have done now. The first one is to draw the draft which show the change of house price accompanied by growing length to subway sites by do some research on the price of house surrounding subway sites. With the draft, to find the turning point on the draft next by which to make sure the influential circle brought by subway sites. The second one is to build up equal relationship based on equal travelling time between subway and another kind of transportation. Then to make sure the influential circle by taking advantage of the relationship. However, there are limitations in both of the thoughts. As for the former one, the thought is based on phenomenon. The date about house price should be sufficient and evenly distributed. Otherwise, it will affect application of thought and accuracy of analysis. Besides, because of the explanation based on the phenomenon, the research has lose the chance to discover the essence of effects brought by subway sites. As for the latter one, its limitation is complex influential factors to house price. The relationship built up in the thought can be seen as a assumed condition, and it is hard to satisfy in reality. Therefore, the application of thought should be improved.

The thesis has put forward new idea differing from conclusion we have made. That is "human" is the essential factor affecting house price around the subway. Seeing from the cities which have already had subways, subway has collected extremely high popularity and large visitor flowing rate with core value and exterior value. This has provided the rising of price of house around subway. Urban Economics has already explained, so the thesis will not refer it. We can regard the change of length between people's residence and subway sites which affect the probability of people choice of subway as point cut. If all the accessible transportation can reach to the destination, the basic principle of selecting subway is the closer people live to the subway sites, the higher rate to select subway. Besides, the probability has changed apparently around the subway sites. Therefore, mode logistic can be used to discover the changing principle.

2. Introduction of logistic^{[5][6][7]}

Model logistic is a kind of mode with binary dependent variable, nonlinear regression which was came up with Verhulst, Belgium biologist and mathematician. This kind of mode is used to observe changes of event probability affected by different factors, which widely applied to biology, medicine, and finance.

In mode logistic, suppose a continuous response variable exists in theory which represents event probability. Its range is from negative infinity to infinity. When the value of the variable has passed a critical point (like $c=0$), the event happened. Then we get:

$$\text{when } y_i^* > 0, \quad y_i^* = 1$$

$$\text{In another condition, } y_i^* = 0$$

y_i^* is variable in reality. $y_i^* = 1$ represents event happened, $y_i^* = 0$ represents events have not happened. If we suppose response variable y_i^* and argument x_i has kept a kind of lineal relationship, that is $y_i^* = \alpha + \beta x_i + \varepsilon_i$. Then we can get:

$$P(y_i^* | x_i) = P[(\alpha + \beta x_i + \varepsilon_i) > 0]$$

then

$$P(y_i^* | x_i) = P[\varepsilon_i \leq (\alpha + \beta x_i)]$$

To make the conditional probability of event happening as $P(y_i^* = 1 | x_i) = p_i$, then we can build up mode logistic,

$$p_i = \frac{1}{1 + e^{-(\alpha + \beta x_i)}} = \frac{e^{(\alpha + \beta x_i)}}{1 + e^{(\alpha + \beta x_i)}} \quad (1)$$

According to (1), range of x_i is $(-\infty, +\infty)$, and range of p_i is $(0, 1)$, which satisfy probability of event happening. Next we can get conditional probability of event without happening is

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