The impact analysis of geological disaster emergencies on the real estate business investment decision-making-Wenchuan sample

Xia Wang

School of Public Administration, Southwestern University of Finance and Economics, Chengdu, China
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ABSTRACT

Being set in the background of the earthquake geological disaster emergencies in Sichuan region and the states' acroeconomic tightening monetary policy, this paper establishes a model of perpetual American call options about downward price jump- diffusion, analyzes the impacts on the real estate investment decision- making in Sichuan region from the earthquake.

Key words: earthquake, investment decision- making, emergencies
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INTRODUCTION

The type of "5·12" Wenchuan earthquake is "Mainshock aftershock. Type, Aftershocks Frequently occur after the Main earthquake. caused serious economic losses and the public psychological shadow. For the real estate market after the earthquake disaster, the negative impact of the earthquake embodied in: Epicenter and the surrounding area houses were damaged to varying degrees, Real estate prices negative expected,Sales slowed, Start delayed, Construction and installation costs rise.Prospective buyers regard the   seismic and quality of the house as a primary seismic conditions; The conception of Housing, Investment and Rational expectations migration occurs, wait and see attitude intensified. With Dujiangyan of sichuan province as an example (see Table 1), After the earthquake, the investment during January to June amounted to 86.863 million yuan, the year-on-year growth rate of -30.57. The investment during January to September amounted to 1183.35 million yuan, the year-on-year growth rate of -46.58. Commercial housing sales area was 71860000 square meters during January to May [1-5]. Increased slightly in June and July, In September, 11790000 square meters Increased. The impact of earthquake on the real estate industry is very obvious, by the effect of the aftershock, not to determine the expected, Commercial housing demand structure changed, Showing the state of local residents home consumption demand increase,but the demand for investment and speculative rapidly reduced. Before the earthquake and the national macro-control, developers were holding the land more and more, land prices had also pushed higher more [6-9]. After the earthquake, consumer attitudes and psychological expectations had changed profound.,the real estate market prices of the earthquake zone declined rapidly, the hands holding in real estate developers Whether could be development recently exists great question.,funds When to withdraw has more uncertain.Demand uncertainty compounded subsequent land development'process. Plus, in order to solve various contradictions and problems in the operation of commercial housing market, The country has issued a series of macro Regulatory policy, 2007 January to 2008 June, the national adjustable reserve rate 15 times, also issued 405700000000 central bank bills,, freezing a considerable number amount of liquidity.that made the real estate development market which highly dependent on bank credit directly affected by the tight monetary policy, enterprises funds chain was facing a severe test [10-15]. All of these factors will seriously affect the supply,demand and the developers investment decisionmaking of real estate market in the earthquake district.

Table 1 Dujiangyan city   estate development in in 2008 1~ 10

Month	Investment in real estate development	Commercial housing construction area	New commercial housing construction area	Commercial housing sales area
1-2 Month	32479	126.01	0.83	1.69
1-3Month	51647	155.06	7.15	4.45
1-4 Month	77351	171.32	16.54	7.85
1-5 Month	85044	171.32	16.54	7.86
1-6 Month	86863	171.34	16.71	7.94
1-7 Month	87308	171.34	16.71	7.96
1-8 Month	88247	171.34	16.71	7.96
1-9 Month	101248	179.24	24.50	9.65

Data sources: l Bureau of Statistics Chengdu city

Real estate investment decision-making is a complex process,it needs to analyze and measure many influence factors, a large part of these factors impacted on the project value is sudden and discrete, such as earthquakes occur, sudden change in policy, etc…This paper use the price signal is mixed Brown Poisson jump process describing this change,as WenChun a sample, Focus on the impact of geological disaster emergencies on the real estate business investment decision-making.

MODEL
In the real estate enterprise project investment process, Many uncertainties influence factors including: government policy,development cycle, land costs, construction costs,etc. Many of these factors is uncertain, but some can be predicted.But, geological disaster emergencies are arenot, are exogenous to the economic system,which has the characteristics of less frequent and discrete jump, once appear, will have a dramatic impact on the economy. Outstanding performance is the impact on the market price,for the general relief materials which prices is upward jump shock,while, for the real estate enterprise project investment which prices is downward impact. In the model of this paper, It is assumed that the real estate enterprise investment project value(V) is a function of the price of P(price), Option value of investment by F (P) to represent. This paper discusses the problem of geological disaster emergencies   impact investment timing just translate to the problem of that When the price reaches a critical value for what is worth to investment or continue to wait for the opportunity .

Assumption: （1）risk neutral hypothesis;(2)Real estate development enterprises have the right of using the land in name,who is waiting for an opportunity to develop;(3) all of the project investment of the real estate enterprise comes from quity capital, one part for land leasing I1, part of I2 for construction cost of real estate project;(4)Not consider the technical aspects of uncertainty;(5)The main variables of uncertainty comes from the market demand and external impacts. Assuming that Pdq is the impact of price on real estate; dq is the average arrival rate   is λ   of Poission process,and Assuming that the probability of occurrence   is λdt, Effects of dq on real estate price expressed in percentage. In the infinitesimal, interval dt,the impact of the real estate makes price changsing, if no unexpected events occur, real estate prices according to Brown. dynamic fluctuation. The sales prices(P) of real estate projects building commercial housing   with mixed Brown sports / jump diffusion process:

$$dP = \alpha P dq + \sigma P dz + P dq \tag{1}$$

$$dq = \Phi P, \begin{cases} \lambda d\,t, \\ 0, \quad 1 - \lambda d\,t \end{cases} \tag{2}$$

Available The contingent claims approach or Dynamic programming to solve the optimal investment rule,The following only gives the solution of simple process:
By Bellman Equation:

$$rF(p)dt = E[dF(p)] \tag{3}$$

And

$$dF = \frac{\partial F}{\partial T} dt + \frac{\partial F}{\partial P} dp + \frac{1}{2}\sigma^2 \frac{\partial^2 F}{\partial P^2}(dP)^2 \tag{4}$$

Substitution formula(2)to formula (4), according to ITO lemma :

$$dF = \frac{\partial F}{\partial t} dt + \alpha P \frac{\partial F}{\partial P} dt + \sigma P \frac{\partial f}{\partial P} dz + P \frac{\partial F}{\partial P} dq + \frac{1}{2}\sigma^2 P^2 \frac{\partial^2 F}{\partial P^2}(dz)^2 \tag{5}$$

Substitution formula(5)to formula (3),then comes the partial differential equation of investment value function:

$$\frac{1}{2}\sigma^2 P^2 F''(P) + (\gamma - \delta)PF'(P) - (\gamma + \lambda)F(P) + \lambda F[(1+\Phi)P] = 0 \tag{6}$$

Boundary conditions are as follows:

$$F(0) = 0$$
$$F(P^*) = \alpha P^* - (I_1 + I_2 \text{e - } \rho \text{T})$$
$$\frac{\partial F}{\partial P}|P = P^* = \frac{\partial V}{\partial P}|P = P^*$$

By the boundary conditions,differential equation (6) has the following form solution:

$$F(P) = A_1 P^{\beta_2} + A_2 P^{\beta_2} \tag{7}$$

Substitution formula(7)to formula (6),then comes the characteristic equation of formula (6):

$$\frac{1}{2}\sigma^2 \beta(\beta-1) + (\gamma - \delta)\beta - (\gamma + \lambda) + \lambda(1+\Phi)^\beta = 0 \tag{8}$$

When P→0, the investment option V (P) has no value,so Coefficient A2 is zero,which corresponds to negative roots of β2,By formula (7) and boundary conditions can be determined in A1 and β1 (β2 shows no analytical solution), Then adding the boundary conditions:

$$P^* = \frac{\beta}{(\beta-1)\alpha}\left(I_1 + I_2 e^{-\beta}\right) \tag{9}$$

By formula (7) ~ (9) can Reasoning the real estate investment threshold value P* and investment decisions of geological disaster emergencies's impact, when P≥P*, should immediate investment. Faced with the question of the real estate enterprises whether to invest in the current, the investment rules are as follows: NPV (P) + F (P) > 0, the current can be investment.

EMPIRICAL ANALYSIS AND RESULTS
Effects of seismic events on the earthquake zone in real estate investment decision of the enterprises is mainly reflected in the change of investment opportunity changing which due to market demand and price uncertainty. This paper mainly investigate the jump process parameters λ (average event occurrence probability) and the impact effect on the investment decision critical values,But,the parameters in the movement of Brown,such as price expected prices growth rate (μ), Investment project market price fluctuations rate (σ),and other influence factors are not as Priority.

This paper using the actual data of a specific projects in real estate enterprises to validate the model and investment rules, in order to test the impact of the real estate enterprises by the earthquake in the development process and whether intention to develop in the optimal decision threshold. the empirical data came from the relevant government.

The basic situation of the project as follows:①the projects address: Dujiangyan City of Sichuan province,Ring Road 2 district,②area: 37411.6 square meters,③total building area: 41000 square meters,④land cost: 42130000 RMB,⑤total investment of the projec: 11166 ten thousand RMB,⑥period: Commenced in October 2007, be completed in September 2008.after the earthquake"5·12", the first phase of the project for housing maintenance and reinforcement costs was 142 million RMB,as the second phase the seismic level of the project improving,the cost of

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the original plan increase by 20%.the original schedule from be completed in September 2008 delayed, Project stopped after 5112, Until September 28th tto resart the project.

Using the statistics of Similar commercial housing sales price in each quarter price which come from Dujiangyan City Real Estate Trading Center, Estimate the price of the expected growth rate a= 0.84% and volatility σ= 191%.The overall average yield of Real estate market μ was 3.23%,As the first phase of this project residential development from the starting to the completion   entirly cost a total of about two and a half years, so, according to the bond rate of 2006,the risk free interest rate was 3.14%,the ratio of the γ was 1.05%.

(1) Impact on the critical value of the average incidence of events λ
Substituting the above assumptions and data into the formula (8), could draw the solution β1, β2, (Negative roots discarded), and then substituted them into the boundary conditions A1, β1, but can not get it Analytical solutions, The following is discussion   the numerical solution and its significance in the particular case. The paper Calculated by means of mathematical computing software M at lab 6.5. In the case of Φ=-0.02, the calculation results are shown in Table 2.

Table 2: The impact effect of λ on the optimal exercise boundary P*, when Φ=-0.02

λ	0	0.25	0.5	0.75	1
P*	3895.19	5654.54	6254.70	6634.13	6903.26

Table 2 shows that when geological disaster emergencies occurred, The optimal exercise boundary P* increasedwith the average incidence λ of the events increase,After the geological disaster emergencies, the national tighting macro-control frequency increase, Business investment would be reduced or delay .(Especially for some of enterprises, whose funds scale to develop is small or medium), Reflected in the case was investment be delayed
(2)The impact effect of Φ on the optimal exercise boundary P*.

Table 3: The impact effect of λ on the optimal exercise boundary P*, when λ=1

λ	0	0.3	0.5	0.7	0.9
P*	3895.19	4116.53	4335.07	4065.31	5885.64

Table 3 shows that with the increase of |Φ |, The optimal exercise boundary P* has a first increased and then decreased process. The increased was because of unexpected adverse events and its adverse impacts on the prediction,that firms were reluctant to invest, the activities of the enterprise tended to invest even more delays.The decreased was because of irreversible investment had occurred in the unexpected adverse events, For the enterprises abandon the construction project is a cost,once   foreseen adverse effects is too large for abandoned or excessive delay,the enterprise will investment to recover the cost as soon as possible.

(3) When λ and Φ,all is zero
When λ and Φ,all is zero, This project P * is 3895.19 yuan / square meter, is close to the real estate investment trigger   price before the earthquake investment, So in this case exercise the option, developers will increase income. under the influence of the eological disaster emergencies, The cost of real estate enterprises is increased,the sale slumps,critical investment price increased,If the option is exercised,the developer will suffer losses. However, due to the amount difference is less, If the government timely adjustments policy and guides consumer to the rational expectations, then will gradually decreased the trigger price of the impact for real estate investment,promote investment, avoid supply delay.

CONCLUSION

This paper studies the impact of geological disaster emergencies and the tight monetary policy,on investment decision of real estate enterprises in earthquake area, using an empirical analysis to verify the practicability of the model, The results show that: The impact of geological disaster emergencies on the real estate market is temporary, The optimal exercise boundary P* increased with the average incidence λ of the events increase, but along with the time increase, Influence of the boundary on the best implementation will gradually reduce; with the increase of |Φ |, The optimal exercise boundary P* has a first increased and then decreased process.According to the characteristics of the geological disaster emergencies zone in real estate enterprises shows, the government should implement regional release liquidity policy, Continue to create favorable conditions from the financial, taxation, land etc, for the healthy development of the real estate industry after the geological disaster emergencies zone, To strengthen the new project seismic capacity, seismic standards,and   residential safety supervision, Strengthen the confidence in the market outlook of local and foreign developers, housing consumers, to ensure the healthy, the geological disaster emergencies district real estate market development.

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