Habitat International 53 (2016) 8–17

Contents lists available at ScienceDirect

Habitat International

journal homepage: www.elsevier.com/locate/habitatint

Assessing investment value of privately-owned public rental housing projects with multiple options

Dezhi Li [a, *], Kai Guo [a], Jia You [a], Eddie Chi-Man Hui [b]

[a] Department of Construction and Real Estate, Southeast University, PR China
[b] Department of Building and Real Estate, The Hong Kong Polytechnic University, Hong Kong

ARTICLE INFO

Article history:
Received 2 September 2015
Received in revised form
29 September 2015
Accepted 23 October 2015
Available online xxx

Keywords:
Public rental housing
Multiple options
Investment value
NPV
Real option pricing model

ABSTRACT

Public rental housing (PRH) has been officially designed as the mainstream of China's affordable housing. However, very few private developers treat PRH as an ideal investment target on account that its investment value seems too low on the basis of traditional valuation method represented by the Net Present Value (NPV) method. Thus, disregarding for financial and operational issues of PRH projects, the normal role of a private developer in the supply of PRH is an agent which earns meager but stable agent fee. Consequently, the government has to bear a heavy financial and operational burden in PRH projects aiming to keep the sustainability of PRH projects. To improve this situation, a privately-owned PRH provision mode, Building-Own-Operation-Concession (BOOC) mode, is proposed, where the private developer is in charge of the life cycle management of PRH projects through a concession contract from the government, including the fund-raising, construction, operation and even demolition. Besides complying with all PRH relevant regulations, the private developer is entitled with multiple options to abandon, transfer and expand of targeted PRH project. Based on the NPV method and Real Option Pricing Model, a method for assessing the investment value of a PRH project in BOOC mode is proposed. Then, the proposed method is exemplified in a hypothetical privately-owned PRH project in Nanjing city of China. The proposed provision mode BOOC and valuation method are expected to show a new perspective for accelerating the sustainable development of PRH.

1. Introduction

Since its economic reform and opening up, China's housing price has been rising rapidly and remains obstinately high, which makes medium and low income families hardly afford it. In order to solve this problem, the government puts forward a housing system mainly comprising low-rent housing (LRH) and economically affordable housing (EAH), which however have many inevitable shortcomings. On one hand, the selling price of EAH is still unaffordable for most medium-low income families. On the other hand, LRH is only available for families with the lowest income. There are few families can fit the standard of LRH and EAH. For example, from 2006 through 2010, only 11.40 million urban lowest income households are supplied with LRH, and 3.60 million urban medium-low income households are supplied with EAH in the whole China.[1] Considering the relatively high urbanization rate of China, around 7% of urban households are scarcely covered by LRH and EAH together. What's worse, it seems more embarrassing for those in a "sandwich layer", who can neither meet the standard of LRH nor afford EAH. Along with the accelerating pace of urbanization, quite a large number of university graduates join the "sandwich layer", as a matter of course, PRH came into being with the aim of providing affordable housing in 2009. Till 2013, Chinese central government announced PRH projects as the mainstream of the affordable housing system. In 2014, LRH projects were converted into PRH projects. In the near future, it is expectable that PRH will be blossoming everywhere.

However, it is shown that there is not enough funding for the implementation of PRH projects nationally, so the sustainability of PRH hinges on the financial support from the government (Li et al., 2014). Moreover, local residents take it for granted that government rent is lower than market rent. Say, it is investigated that government rent is 20% lower than market rent in Beijing, 40% in Chongqing, 10% in Shanghai, and 30% in Shenzhen (Zeng, 2013). The investment and payment of PRH isn't in direct proportion, which is hardly attractive to private developers. Therefore, the government

* Corresponding author.
E-mail address: njldz@seu.edu.cn (D. Li).

[1] See: http://house.ifeng.com/pinglun/detail_2012_05/09/14409008_0.shtml.

http://dx.doi.org/10.1016/j.habitatint.2015.10.018
0197-3975/

has to bear the cost solely, which inevitably increases the burden of the public financial expenditure. In the near future, provided that the government fails to afford PRH project and abolish it, the needed probably won't access to PRH projects. This frustrating tendency is yet under the assumption that private developers just construct and operate the PRH projects in a formalistic way, and the assessment of PRH projects is using the traditional method NPV, regardless of its limitations. If private developers implement PRH projects flexibly in terms of abandoning, transferring and expanding PRH projects, will they take part in the provision of PRH projects? Will those PRH projects turn sustainable? This paper, aiming to give a satisfactory answer to the above-mentioned questions, tries to construct a new mode for the implementation of PRH projects under the guidance of real option theory, which has been flexibly applied in various industries, such as vaccination strategies for clinical therapeutics (Favato, Baio, Capone, Marcellusi, & Mennini, 2013), financial application of real estate (Pezeshkian, Lashgari, & Stiller, 2014), and photovoltaic systems of power industry (Biondi & Moretto, 2014). Imaginably, a new PRH provision mode proposed, private developers would make more profit than in traditional modes.

This paper is carried out according to the following structure. An overall review of the domestic and foreign relevant researches on China's PRH and real option theory are made in Section "Literature review". On the basis of it, Section "The BOOC mode and its embodied options" discusses current PRH construction modes and analyzes their deficiencies accordingly. Then, the application of real option theory in PRH projects and the options in BOOC mode are summarized in details. On top of it, Section "The Pricing Model of BOOC Mode" demonstrates the valuation process of BOOC mode as well as real option pricing model. A case study to present the application of proposed BOOC mode and the relevant evaluation methods is conducted in Section "Case study". Lastly, Section "Conclusions" draws conclusions and puts forward suggestions for the further researches.

2. Literature review

Affordable housing is one of the main approaches to solving housing problem world-wide. As one important kind of affordable housing, PRH project has become popular in many countries. A lot of scholars have conducted researches on affordable housing and its improvement approaches from different perspectives. For example, Ha (2008) investigated the characteristics and problems of social housing estates in South Korea, pointing out the necessity for the private sector, civil society and the government to work together in close partnership to work out a more practical housing and community scheme. Horn, Ellen, and Schwartz (2014) explored the influence of The Housing Choice Voucher Program (HCV) on low income households, spotting the inefficiency of HCV in providing low income households with well-equipped residential communities. Verdugo (2014) studied the relationship between immigrants' location choices and affordable housing supply and found that immigrants benefit from better housing conditions in cities with more affordable housing supply.

In the light of above literature, it is obvious that affordable housing plays a critical role in guaranteeing the stability and living quality of a region, therefore, the sustainability of affordable housing becomes a focus of attention in modern society. Chen, Stephens, and Man (2013) pointed out that it is impossible to sustain an affordable housing program without widespread public support. Hwang, Zhao, and Ng (2013) identified the critical factors affecting schedule performance of affordable housing projects in Singapore and found out that "coordination among various parties" is one of the top three factors to assure the implementation of project schedule objectives. Disney and Luo (2015) investigated the impact of Right to Buy (RTB) policy on social welfare in UK, which allows tenants to purchase affordable houses at a substantially dropped price and mitigates the financial burden of affordable housing projects. Chaskin and Joseph (2014) stated that Chicago has been implementing the greatest effort to redevelop urban residential communities and addressing urban poverty through public-private partnership (PPP) modes in the United States. Regarding Chinese scholars, Ma, Wang, and Ma (2014), Gao (2014), Luo (2014) and Xiao and Liu (2014) introduced Real Estate Investment Trusts (REITS) as a new way for PRH financing. Wang and Zhu (2014) believed that governmental spending on PRH projects is still the best way. Yao (2015) suggested a Public-Private-Partnership (PPP) mode to make a win–win situation between government and private developers in PRH project. Yu (2014) found shortage of funds to be the major problem in the sustainable development of PRH projects in China.

With regard to real option theory, it was firstly introduced by Professor Stewart Myers of the MIT Sloan School of Management in 1977 (Myers, 1977). Since then, a lot of scholars apply real option theory into decision-making in circumstances with uncertainty and flexibility. Among them, Karsak and Özogul (2005), casting away the traditional cash flow methodology, proposed a real option evaluation approach to evaluate a flexible manufacturing system investment. Liu (2013) analyzed the influencing factors of foreign banks entering into China using real option theory. Santos, Soares, Mendes, and Ferreira (2014) compared real option approach with traditional methods, Net Present Value in particular, assessing an investment in energy production under uncertain circumstances. Park, Kim, and Kim (2014) investigated how uncertain energy policies affect the financial viability of an offset project using a real option-based model, and expected to assist private entities in establishing proper investment strategies for Clean Development Mechanism (CDM) projects under uncertain energy policies. Many scholars also have conducted researches on real option in real estate development. For example, Titman (1985) estimated the value of the undeveloped land where the future price of building units was uncertain using the option pricing model. Rocha, Salles, Garcia, Sardinha, and Teixeira (2007) introduced real option method into real estate and identified the optimal strategy and timing for construction phrase. Lee and Jou (2007), by means of real options, investigated how to choose a density ceiling and how a regulator makes policies forcing developers to develop the property less densely. Liu (2009, 2010) assessed the investment value of real estate using real option valuation. Hui, Ng, and Lo (2011) evaluated Kwun Tong Town Center, the largest urban redevelopment project in Hong Kong, using the real option model Monte Carlo method and found real option-pricing model an efficient way to appraise the optimal timing and its feasibility. Yao and Pretorius (2014) developed a long-dated American call option pricing model for valuing development land under leasehold. Using the Black–Scholes model modified with value leakage, Li et al. (2014) assessed the investment value of a privately-owned PRH project with deferral option.

Based on the above literature, it is widely acknowledged that getting private sector involved effectively is the major solution to the sustainable development of PRH projects. Yet, the strategies to attract private developers vary from different regions. In addition, real option theory is widely used in uncertain circumstances, such as energy, foreign investment and commercial housing investment decisions. Furthermore, very few scholars put forward privately-owned PRH and corresponding valuation model with modified Black–Scholes model. But, given more flexibility, the private sector may enjoy more real options in privately-owned PRH projects, and thus privately-owned projects may become more profitable. Considering all, this paper tries to propose a new privately-owned