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Procedia Economics and Finance 24 (2015) 50 – 59

Procedia Economics and Finance

www.elsevier.com/locate/procedia

International Conference on Applied Economics, ICOAE 2015, 2-4 July 2015, Kazan, Russia

# Empirical Testing of Real Option in the Real Estate Market

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**Abstract**

Existing researches have used real options valuation (ROV) theory to study investment in energy, oil and gas, and pharmaceutical sectors, yet little works have empirically examined ROV theory to study investment in a real estate market of EU countries that undergone severe economic crisis and now recovering. The aim of this paper is to test empirically ROV application for real estate development project with significant volatility in terms of price and cost and under strict legislation's constraints. Paper illustrates empirical testing of ROV application of the investment project "Sun Village" developed by the ABC Project Ltd Company in Latvia in 2014. We apply three ROV methods: option space matrix "Tomato Garden", Black-Scholes option pricing model and binominal option pricing model before we presented final research result. The flow chart of ROV application in real estate development projects presented in our research can serve as a "road map" for many similar projects in EU suffering real estate market bubble burst and present uncertainty.


Selection and/or peer-review under responsibility of the Organizing Committee of ICOAE 2015.

*Keywords:* real estate, real option, Black Scholes option pricing model, binominal option pricing model

## 1. Introduction

EU countries as Italy, Spain, France, UK etc. faced huge price decrease in real estate sector after the bubble burst. In years 2008-2010 Latvia as many other EU countries faced crisis that dramatically influenced real estate prices, as a result many investors have lost their capitals. One of the theories developed on how to address these hurdles associated with decision–making under uncertainty is that of real options. Real options theory view investments as rights but not obligations, thereby whenever real options valuation (ROV) is conducted it values the seemingly unvaluable – managerial flexibility to optimally time an investment so that its value is maximized. The energy, oil and gas, and pharmaceutical sectors are the leaders in successfully adopting the real options framework

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Selection and/or peer-review under responsibility of the Organizing Committee of ICOAE 2015.
doi:10.1016/S2212-5671(15)00611-5

according to Kodukula and Papudesu (2006). However, there are few examples of ROV application in real estate business. What's more, Kokukula and Papudesu (2006) argue that "that the current real options literature has been primarily academic, whereas practical "how-to" guides as well as publications on real world success stories have been rare". We are going to fill the gap in this paper.

Real options theory originated in 1977 with the ground-breaking idea of Stewart Myers that Black-Scholes financial option pricing model developed in 1973 can be applied to capital-budgeting, later it was proved by Folta and O'Brien (2004) and Borison (2005). Myers (1977) originally defined "real options" as: "opportunities to purchase real assets on possibly favourable terms". Since the inception of the term, it has been stretched substantially by prominent researchers as Adner and Levinthal (2004) and Reuer and Tong (2007). Gilbert (2005) argues that an option exists when company has the right, but not obligation, to perform a deal. Since there is a right to invest, but not an obligation to do so, real options theory implies that investments should be postponed in anticipation of future developments. Once additional information is received and some uncertainty resolved *then* management can make the optimal decision according to Rivoli and Salorio (1996). Dixit and Pindyck (1994) argue that real option allows measuring the ability of postponing or aborting the project after irreversible investment expense will be made.

The purpose of the real option theory in general is to attach monetary value to the managerial flexibility. Real options akin to financial options depend in general on six factors – value of the underlying, implementation costs of the option, time till expiration, volatility, risk free rate and the value lost over option's duration. While analogies between financial and real options exist, there are, as Mun (2002, p. 99) puts it, "key differences". The foremost is that in financial markets, holder of the option (at least theoretically) cannot affect its value; for real options the opposite is true argue Copeland, Koller and Murrin (2000, p. 399). While the value of real option's drivers most likely will fluctuate due to external influences, such as economic climate, inflation, rivalry or substitutes, changes in legislations, there are also internal influences according to Li, et al. (2007). The latter category refers to company's core competencies in active investment management after implementation suggested by Mauboussin (1999). To such proactive management of real options, Luehrman (1995) appositely refers to as "gardening". Managers are gardeners; they do the cultivating and eventually decide which tomato to pick and which not to. Firstly introduced by Luehrman (1995), a stylised map "Tomato Garden" is divided in a six regions framework: "invest now; maybe now; probably later; maybe later; probably never; invest never". In the 'Tomato Garden" a Black-Sholes value of European call option or deferral option is expressed as a percentage of underlying assets (discounted free cash flow of project). Luehrman's (1995) writings on real options addressed investments in real assets as European options, wherein only a single real option – *deferral*, was considered. But his approach has since been acknowledged as too simplistic and flawed by Borison (2005). In reality, most real options resemble American style options albeit with a more complex structure according to Mun (2002, p. 172).

One more approach to valuing real option is developed by Cox, Ross and Rubinstein (1979) as a Binomial options pricing model (BOPM). Gilbert (2005) mentions that binomial lattice approach is the most convenient, flexible and intuitive in valuing real options. Its advantage is that it can value both European and American real options and can also deal with multiple uncertainty sources as well as allows managing the volatility. However, BOPM main weakness is that it is hard to compute, since it requires many time steps to produce the sufficiently accurate result. In using binomial lattices, the higher the number of time-steps, the higher the level of granularity, and hence, the higher the level of accuracy according to Mun (2002, p.145). While Hull (2005, p. 355) indicated that for a financial options about thirty time steps yield good results, Kodukula and Papudesu (2006, p. 96) indicate that in ROV about *four till six* time steps commonly are sufficient for good approximations. Stepping time essentially represents the length of each time step or how much time passes between sequential nodes and is selected arbitrarily by Mun (2002, p. 144). While Binomial option pricing model faces difficulties producing accurate result due to complications in "many-step" calculation process, Black-Scholes option pricing model (BS-OPM) approach may handle this limitations. Mun (2002) mentioned that option value should be added to the net present value (NPV) calculated through DCF approach and form extended NPV value (eNPV).

Thus, we are going to integrate "Tomato Garden" map as well as both BS-OPM and BOPM methods in our conceptual model of reach before we will present research results. Since the binomial tree is recombining, we can also estimate the probability of exercising the option at the end of the option life. This can be done by using Pascal's triangle (named after the discoverer) as recommended by Kodukula and Papudesu (2006). A sensitivity analysis will show also the impact of main drivers of the option's value and will provide additional information for decision