Option Pricing for Real Estate

This is **an abstract of a paper** written by Dr. Eddie Hui from the Hong Kong Polytechnic University on Option Pricing Theory (OPT). Its application was demonstrated using an actual real estate development project in London, England.

Judgements on the best possible use(s), the optimal scale, the floor size, the likely market rents or prices, the required development time, the estimation of project costs, the phasing of construction, the risks involved, and the probable returns are crucial for the success of a development project.

There are **several methods for evaluating development projects**. These include the comparative method, investment method and residual method. Although they may incorporate techniques such as Discounted Cash Flow (DCF) and Net Present Value (NPV), they neglect some of the inherent characteristics of a development project:

a) **Economically Irreversible** = once a property is built, it generally will last for some time and used for some particular purpose. Multiple ownership and zoning laws further increases its irreversibility.

b) **Sequence of Building** = Investment decisions are made before the property is completed, rented, sold or occupied. In between commencement and completion, new information and circumstances may arise rendering earlier decisions redundant.

Hence, it would be advantageous if a method could be derived to **capture the "operating flexibilities"** in terms of timing and the scale of development so that it would give the developer an option to review ∕ revise his decisions in response to unforeseen market changes. These operating flexibilities can be seen as a set of **"Real Options"** which can improve the upside and limit the downside. It also enables the developer to capitalize on his good fortune should the market turn out to be more favorable than anticipated.

The application of OPT involves a quantitative analytical approach for evaluating complex multi-option real estate development projects. Typically, a development project would have **the following basic options**:
1) The option to <u>defer</u>

2) The option to <u>expand</u>
3) The option to <u>contract</u>
4) The option to <u>switch use</u>

As the value of an investment (V) is a function of various parameters: the direct cost of investment <I>, the stream of cash flow <C>, the magnitudes of up and down movements in prices <M>, future time <T>, and the risk-free interest rate <R> is =

V = f (I, C, M, T, R)

And the options enable the developer to adapt his future actions in response to market conditions via deferral <d>, expansion <e>, contraction <c>, and switching use <s>, V is thus revised to =

V = f (I, C, M, T, R, d, e, c, s)

Moreover, these options NPV (O) expand an investment opportunity's value NPV (E) by improving its upside while limiting its downside relative to the developer's initial expectations NPV (S) =

NPV (E) = NPV (S) + NPV (O)

NPV (E) = NPV of the project with options
NPV (S) = NPV of the project without options
NPV (O) = NPV of the options

The **degree of interaction and additivity among the options** are governed by the following factors:
A) whether the options are of the <u>same direction</u>
B) the separation of their <u>exercise time</u>
C) their relative degree of being <u>in or out of the money</u>
D) their <u>sequential order</u>

Selecting a suitable quantitative model for the options requires judgement on the information gathered about the future. This in turn not only depends on the most probable forecast the developer (or analyst) makes based on past experience, statistics and researches but also on the confidence with which he makes his forecasts. The model used for the sample project in the paper is the **standard binomial contingent claim method** and this is preferred to others because:

a) it can handle <u>compoundness</u>

b) it can handle anticipated <u>discrete cash flows</u> and exogenous competitive arrivals
c) it can handle <u>multiple flexibilities</u> and capture their interactions

In summary, OPT offers a unifying evaluation approach for real estate developers by **integrating capital budgeting and strategic planning under one single roof of value maximization**. Nonetheless, it should not be seen and used as a "for all and be all" analytical tool as there is always the chance for that thousand and one cause which may alter "market sentiment".

Comparative Real Estate Global Indexes (CREGIS): 4th Q1999 (+/- from 3rd Q1999)
One average private home / unit in Hong Kong can buy
1. Around 1.82 counterpart units in Toronto (-1.6 %)
2. Around 0.95 counterpart units in San Francisco (-2.0%)