Falling Economy Forces Refinement in Calculations. When Making Decisions, Real Options Analysis Could Be an Answer for the Developers and Builders.

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ABSTRACT

Globalization and competitiveness are not the only treats that developers and builders encounter today. Falling economy is forcing many developers and builders to slow down their projects or even to close their businesses. They are taking these approaches, because they are reacting to the market. Reactive builders are those who do not know the consequences of their acts and simple react most of the time with panic, closing all possibilities to improve their strategies. Proactive builders in the other hand take advantage of the behavior of the market when analyzing a project. Through a study case, this paper will show how a project can be analyzed to know the impact of the economy using the Real Options approach (ROA). Uncertainties and flexibility capture value for the projects that traditional tools cannot calculate. Active builders and developers can change events rather than reacting to them, and they make things happen. .

Keywords: Options, Real Options, Proactive Management, Project Valuation

INTRODUCTION

This paper shows why changes in calculations have to be done. Builders cannot continue protecting themselves from uncertainties in a reactive way, applying big discounts rates when calculating Net Present Value (NPV) to make decisions about the future of their projects. What they are doing when applying big discount rates is killing their projects. With new tools like Real Options Approach (ROA) and decision tree analysis, proactive builders can look constantly for options that increase project value and help them when is time for make decisions.

Net Present Value (NPV) analysis assumes that a project must be accepted only when NPV is positive. As a consequence of this rule, many projects have died before they were even born. The Real Options approach is now a common way to analyze an investment when options to invest or not to invest, wait or not to wait, build or not to build can be considered as part of business.

New strategies can be used to analyze a project when a competitor arrives and affects the behavior of the market or when the economy slow down. When a monopoly exists and clients for a product are always willing to buy a new product, the project's owner can easily determine the number of products to build according to his or her own projections and the amount of money he or she is willing to invest. Different story exists when economy is falling. Many builders have the tendency of overbuild when they notice the economy is falling or slowdown trying to get the last clients available. This behavior far for improve the economy, forces to delay any improvements. New buyers will exists only when the exiting inventory disappear.

Traditionally builders develop a cash flow data for the project assuming a specific number of units to build every period and a specific number of units to sell every period of time. To protect for uncertainties related with cost expenses, selling prices and slow downs, usually builders use a high discount rates. In this way many times, they kill their projects. High discount rates bring a consequence; the NPV becomes many times very small or negative. The decision is always based in positive results because nobody wants to build something to lose money. Only experienced builders know that many negative NPV provide profit at the end, and very often the builders assume that positive results comes from good management, not from the flexibility to decide to proceed ahead with a new group of units or to stop building or slow down the project to reduce the inventory of units to sell.

When builders start wondering about the dilemma related with the number of units they are going to build, they wish to have a magic crystal ball that allow them to know the future in the early stages of the project and help them to make decisions about the proper number of units to build and the right price to sell. These types of dilemmas are present when a competitor arrives and when the economy slowdown forcing them to cut the number of units they are accustom to build. When it happens and the builder is ready in a middle of the project, he or she is forced to accelerate the project and finish it before the competitor; or slow down to keep the construction pace with sales speed. When the project has changes, the finances and profits of the project can change dramatically.

To prevent these kind of situations builders many times create scenarios trying to know the final results when accelerate the project because a good times or des-accelerate it due to a bad times in sells. But these scenarios are only a snap shot or a picture at a specific time of the project. How wonderful could be to have a better view about the future that helps in decision making when a situation arrives. It can be possible using a tree analysis in combination of real options analysis.

CASE STUDY

A builder bought a land for $10 Million US dollars for a new development. The builder invested $2 Million dollars to extend a road to access the property and create an upscale primary marketing window. After an initial design, he estimate the area to be platted as roads, easements, drainages and right of ways and the area to be used for the condominiums. He estimates the cost of the development in $60 Million and he decided a series of buildings with units that range from 1249 to 1800 square feet. A total of 800 units he plans to build in a four years after the development is ready. When he started putting together all the expenses and the possible income and taxes (See table No. 1), he find out that the actual Net Present Value of the project is negative ($4 Million Dollars). He worked very hard to get this project and finding that the project will give no profit, was disappointed for him.

He then decided to share all his numbers with a friend of him, who is a builder too and has more experience. After his friend first look, he commented. My friend I was in the same situation as you many years back in my professional life and I learned by experience that many times when I started a new project with a negative net present value, I got positive results at the end. I attributed the difference between my previous calculations and the final results to my good management skills and the added value of the land after I started building. Because I never could figure out how to calculate the missing part between the NPV obtained from calculations and my profits at the end, I decided to investigate how I could improve my calculations. Today with the falling economy, the new way to make calculations is very important for us. I learned that we can use a theory derived from the stock market called options that when is applied in real projects take the name of Real options approach (ROA).

To analyze the project with ROA, we start with the static cash flow that you ready have in the table 1. To prepare it, you made decisions about the number of units you intend to build every year and the number of units, you think can sell in the same period of time. All decisions are made in advance. This type of cash flow is named static cash flow because every thing is decided before project stars and builders try to reproduce what was decided to prevent profit loss.

Table 1: Static Cash Flow without Flexibility (in Millions)

Year	0	1	2	3	4	5
Selling Price			160	180	190	264
Construction Cost			50	50	50	50
Land Cost-P1	10					
Land Development-P1		60				
Access Road	2					
Financing	0.04	0.48	2.40	0.00	0.00	0.00
General & Adm. Exp 5%	0.05	0	3	3	3	3
Owner's Compens. 1%	0.01	0	1	1	1	1
Sales & Marketing	0.06	0	10	11	11	16
Pre-tax Earnings	-12	-60	95	116	126	195
TAXES 24%/year	0.24	0	23	28	30	47
Free Cash Flow	-$12	-60	72	88	95	148
Discount Rate 6%/Year	0.06	0.94	0.89	0.84	0.79	0.75
PV	268	-57	64	74	76	111
Land Cost	12					
First Invt. Development	60					
Second Invt. Construction	200					
NPV	-4					

An option is an opportunity to make decisions and if it is convenient for the builder, he or she decides to execute the option and if it is not convenient, he or she left the opportunity to pass. Projects are excellent candidates to be analyzed with ROA, because you can develop them in stages or phases, where a stage opens the possibility for the next and so on. Options can be simple or compound. Compound options can be sequential or in parallel, also called simultaneous.

Projects developed by phases can be analyzed as options. The flexibility to decide a construction phase after another phase is ready, adds value to the project. Flexibility can not be measured with traditional tools. Fortunately today ROA can do that. The option value is the part that we need to add after the NPV is calculated and is the additional part that traditional tools cannot measure. To evaluate a construction project with traditional tools requires the decision to build at a specific time in order to have a cash flow and use it to calculate the NPV. The decision to build has to be done in advance. With RO theory decisions can be made after waiting to see how events unfold. If events are favorable, the option is exercises; if events are unfavorable there is no obligation to exercise it (Black and Scholes, 1973).

Let return to your calculations, The NPV of that project is -$4 Million dollars. Let assume that the project value can go up 22% (u=1.22) or down 18% ($d=1/u = 0.82$). Ups and downs are related to volatility prices (Hull 1997). When you put your project in stages or phases, it is similar to compound options. A compound option derives its value from another option. The first investment creates the right but no the obligation to make a second investment, which in turn gives the option to make a third investment, and so on. You have the option to abandon, contract or scale up the project at any time during its life. For example, you must complete the development before you can start building. In simultaneous or parallel options, both options are available at the same time. The life of an independent option can be longer or equal to the dependent option. We can analyze your project in a sequential mode.

We could divide your project in three options, the acquisitions, the development of the land and the construction. Because you ready made an investment on the land and the road, we are going to consider only two sequential options. Each phase has to be completed before the next phase can begin. Suppose that you are not sure if it is convenient for you to start construction immediately in reason of the falling economy or the competitiveness of the market, but you need to know when to start or if it is the case to abandon the project and sell the land to another builder. The development will take a year and can not be delayed more than two years, because the third year will be the maximum time allowed to starts it. Construction cost was estimated in $200 Million dollars. The risk-discount rate you used to analyze the problem was 6%. If existing today the whole project, it has a present value of $268 Million dollars (Its value came from table 1, expected cash flow discounted at the risk adjusted rate of 6%. The annual volatility of the expected future cash flows is estimate to be 20% and the risk-free interest rate over the next five years is 3%. The volatility was assumed this time, but when no data exist, a simulation of sales can be done in Monte-Carlo software or in a spread sheet in excel.

We are going to analyze if you can have the flexibility to decide each year between start the development or keep the option open for the following year for a maximum of two years. After that, the construction of the buildings starts. During the construction, you can decide each year to continue or to abandon the project. Abandon means that you are not going to loose money, because abandonment means that you have the option to sell the remaining land to another builder, or stop the construction for a while until changes in the market improve. When something do not work for you, can be attractive for another builder. Calculation can be done to analyze more in detail to temporarily stop or slowdown or stop and sell the land to another builder. We are going to keep the problem simple this time during the learning process and then when you became familiar with this new way of making calculations, you can start solving more and more questions or even analyze more complex problem combining the ROA with game theory to analyze the entrance of a new competitor in the market.

EVENT TREE

Decision Tree Analysis (DTA) is a traditional method used to develop expected values under uncertainty. The PV of the decision is estimated by discounting the expected cash flow at the weighted average cost of capital (WACC) when the builder is using his or her own money and a loan from a bank, or at a risk free rate on the market, like in this case study.

$$PV = \frac{p * CF_{up} + (1-p) * CF_{dwn}}{(1-r_{free})} \qquad (1)$$

While appearing to be a good approach, the DTA method assumes the discount rate is for an equal chance of *p* or *(1-p)* probability values for any pattern of cash flows that are perfectly correlated. The cash flows to value options are different. Using the ups *(u)* and downs *(d)* in the binomial tree, (Hull, 1997) defined the annual standard deviation of the risky asset as follows:

$$u = e^{\sigma \sqrt{\frac{T}{n}}} \qquad (2)$$

$$d = \frac{1}{u} \qquad (3)$$

T is number of years *(T=5)* and *n* the number of periods *(n=5)*. For our example *u = 1.2214* and *d = 0.819*. Using the PV of the project and an estimated volatility of returns from a simulation, we can construct the event tree shown in Figure 1. This event tree provides the values of the underlying project without flexibility. At year 1, when the market goes up 1.22, the project value becomes $268*1.22 = $ 327. If the market goes down 0.82, the project value becomes $268*0.82= $219. Moving to the right, continue in similar fashion for every node at the binomial tree until the last step in figure 1. The values in a blue font color represent the value of the project at that node and at the year shown at the top of the figure 1.

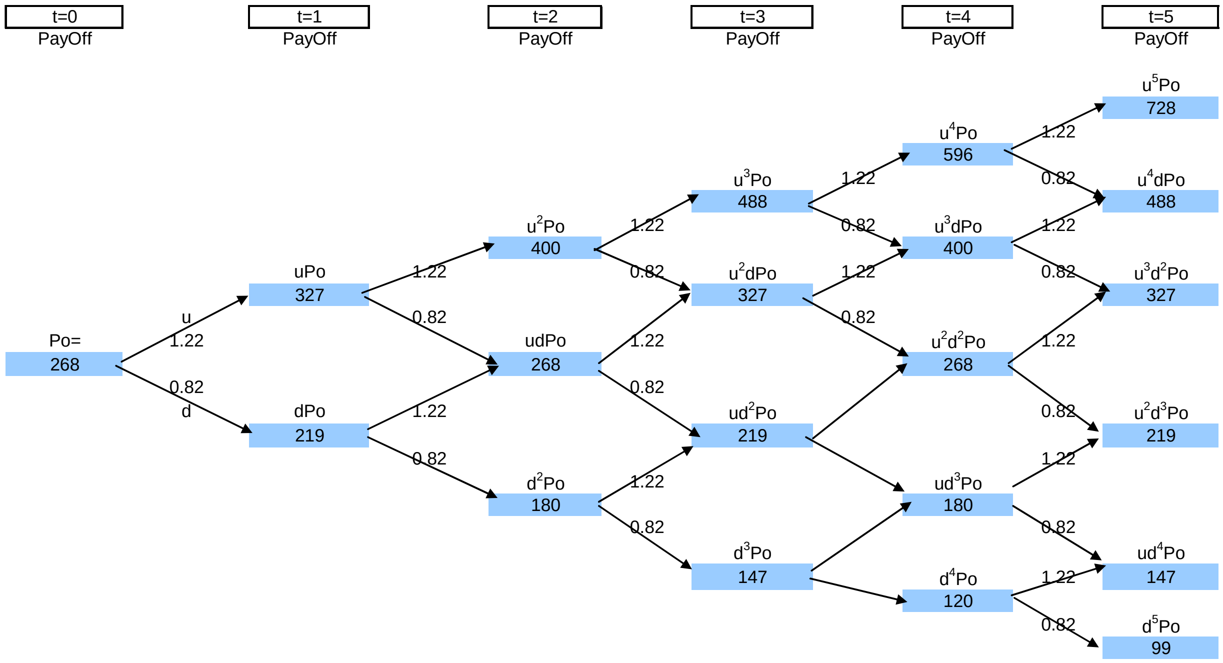

Figure 1. Project Value

Once the value of the project is found, probabilities are needed to solve the tree in backwards (Cox, 1979). Knowing there is a project today with the payoff shown in Figure 1, we can find the probability of having a project with those payoffs today. We can calculate the probabilities with the payoffs of the first period. Figure 2 shows the expected values of the project at year one. The expected value of P_o knowing P_u and P_d is given by equation 4.

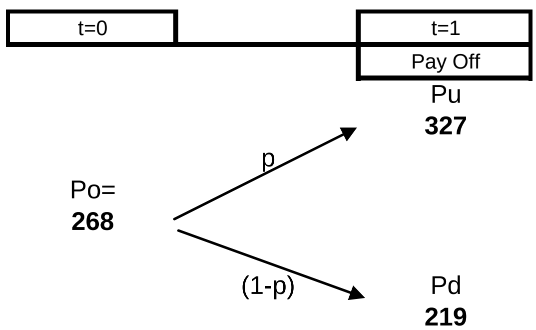

Figure 2. Risk Neutral Probabilities

$$Po = p.\frac{Pu}{(1+rf)^t} + (1-p).\frac{Pd}{(1+rf)^t} \tag{4}$$

Solving for p in the above equation and using t=1 we have p = 0.5247, and *(1-p)* =0.4753. With these probabilities and a risk free rate *(r_f=3%)*, we can reproduce the same tree of Figure 1, starting the calculations from year 5th and finding the expected value of $268 Million at year zero. While solving the problem in backwards, we calculate the probabilities. Doing this procedure, the option analysis is operationally identical to decision tree analysis, but with the key difference that the probabilities are transformed so as to allow the use of the risk-free discount rate (Trigeorgis, 1998)

OPTION VALUATION

An option is an opportunity to make a decision. The owner of the option has the right but not the obligation to exercise it or not at the expiration date. The owner exercises the option only if it is the smart thing to do. If the option is not exercised, it becomes valueless. The value of the option will then be either the difference between the cost and the expenditures or zero.

As we stated before, options can be simple or compound. Compound options that have the same life and occur at the same time are called simultaneous compound options. Compound options can be sequential options, when the life of the second occurs only when the previous option is exercised. Most engineering and construction projects have several phases and can be viewed as sequential options, where an option is available only if an earlier option is exercised.

In this case, there are two sequential options available on this project. Construction depends of the land development. The option value calculations are done in sequence, starting with the second option, in this case the construction phase. We can consider that this project is the only asset that the builder has. Calculations have to be done in backwards. Figure 3 shows the option values located under the value of the project at each node of the binomial tree, calculated by backward induction. Each node represents the maximization of exercising the option by investing $200 Million dollars versus letting the option to expire (abandon). Each intermediate node represents the value maximization of continuation versus exercising the option.

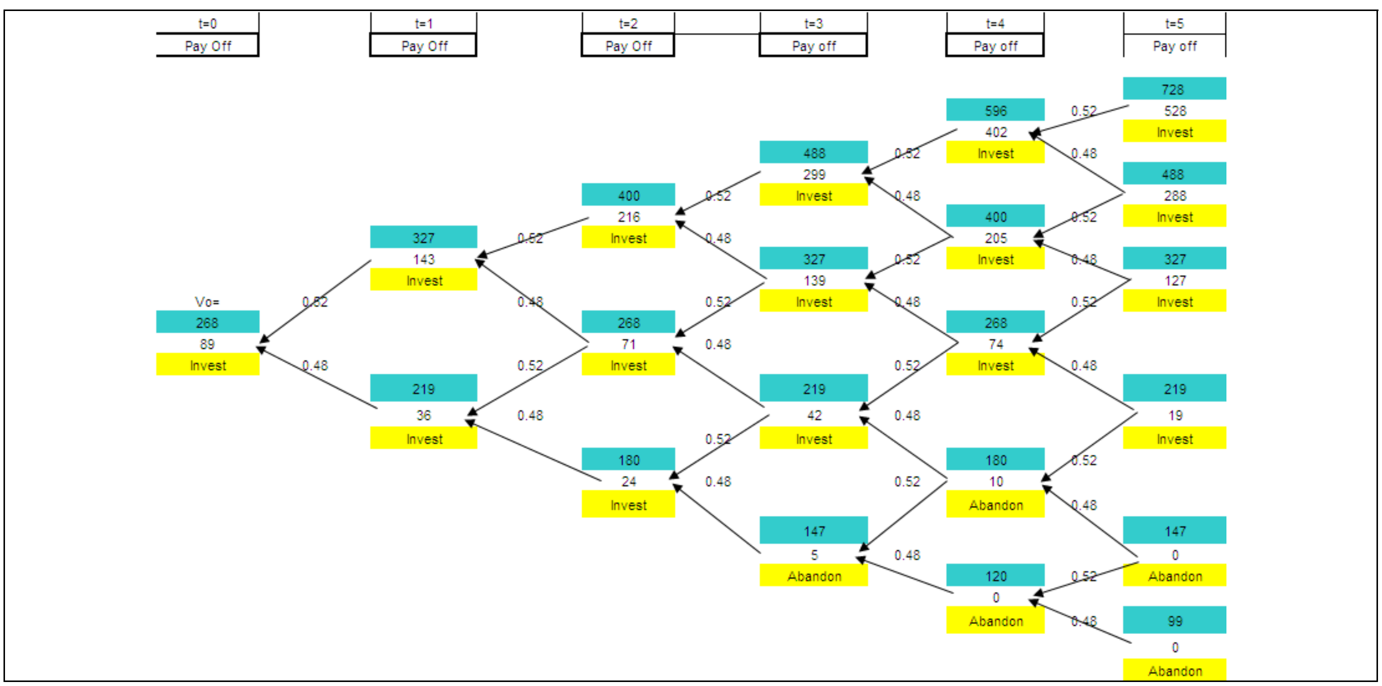

Figure 3. Option Valuation: The option to build and Actions

Starting with the terminal nodes that represent the possible values of the project at year 5th, at the upper right node, the expected asset value is $728 Million dollars. If you invest $200 million to build the project, the net pay off will be $728-$200=$528 Million dollars. Since the objective is to maximize the return, we would exercise the option by investing. There is enough money to pay the construction expenses. Thus the option value at this node is $ 528. Similar calculation will de done at the other nodes at year 5th. Observe the lower two nodes, the value of the option is zero. There is not enough money to build. In those cases, the option is not worthy, and then the decision will be to abandon the project. Abandon not mean leave the project. Abandon means that another decision can be made. Will be better for the owner of the project to sell the land to another builder or stop the project for a while. When something is no worthy for one builder, it can be an opportunity for another. Someone can be interest in buying that land. Figure 3 shows the option valuation and actions to take in a yellow background.

Because we are making the calculations in backwards, let us see how the calculations are made at the intermediate nodes: Starting at the top of the year 3rd (Fig 4.), calculate the expected asset values for keeping the option open and accounting for the downstream optimal decisions. This is simple: first, we discount at a risk free the weighted average of potential future option values using the risk neutral probabilities as follow:

For example at the upper node of year two (See Fig.4), the maximum value is:

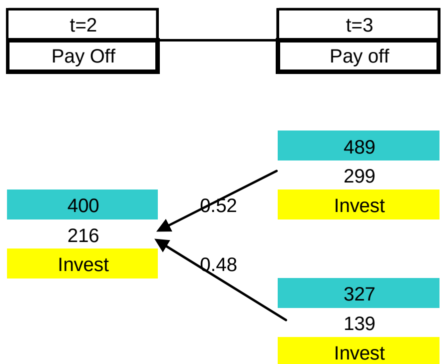

Figure 4. Valuation for the upper node of year two.

MAX
- Present value of the project at the beginning of the year $400 (Fig.4) minus Construction Cost $200 = $ 200 or,
- The value given to the expansion whose value is equal to the project with flexibility (value that comes from the upper two nodes of year 3 discounted at a free rate):

($299*0.52 +139*0.48)/(1+0.03)[1] = $216. Since this value is the highest, we keep the option to invest. Of course, because our maximum value comes from the option that includes the construction phase, the decision at this node is to invest or continue ahead as shown in figures 3 and 4 with yellow label. When the maximum value becomes less than zero, the option value becomes =0, we choose abandonment. In a similar way, the binomial tree valuation can be completed all the way to time =0 using the described approach.

The next step is to calculate the first option, the option to develop the land. Remember calculations are done in backwards. First we calculate the option to build; now we know in which nodes, the value of the project support the expenses of the construction. Then, we will analyze if given the value of the project after taking out the expenses to build, the project support the expenses to develop the land. The construction takes four years from the seven maximum allowed time for this project. Development phase one takes a year. It means that from the three years left, the maximum time allowed to decide to build or not goes from the beginning of year one to the beginning of year three.

Figure 5 contains the option valuation for the binomial tree first option, from year zero to year 3.. In blue is the project value, in white are the values after exercising the option to build and in a pink color are the values after the option to develop the land is analyzed. In yellow are recorded the actions to take from the analysis of the options to develop the land.

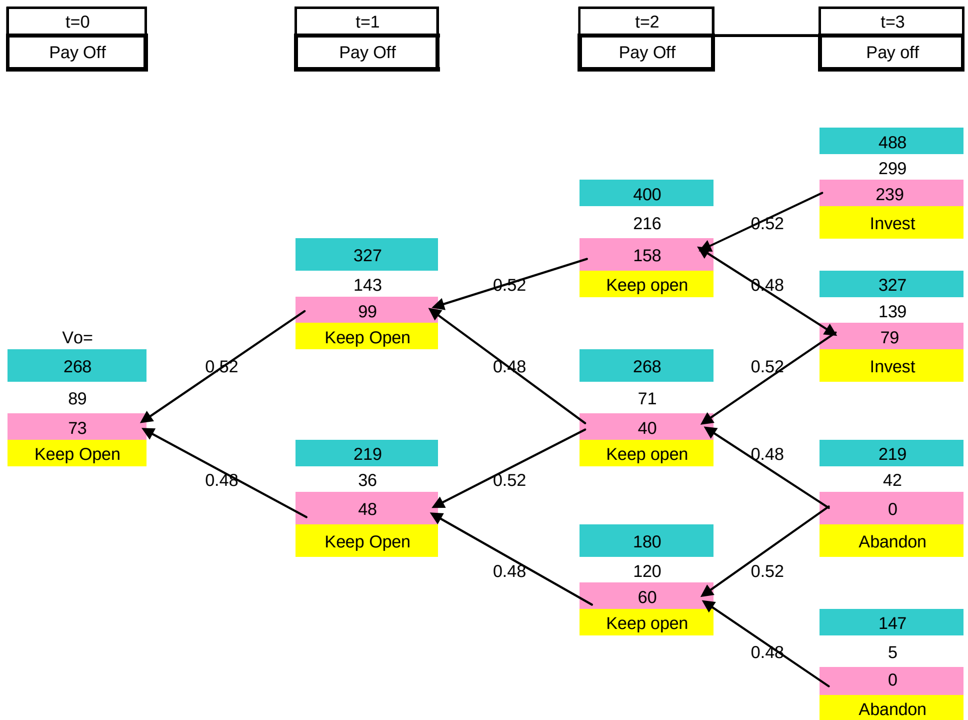

Figure 5. Valuation Option: The option to develop the land

As previous calculations show, the maximum value at the upper node on year 3, is 239. The PV of the project at this node is the result of subtracting $60 Million (Value of the development) from the value of the project after subtracting the construction cost. $239 = $299-60. Since we have enough money to pay the construction cost and the development cost, we choose the option to invest. At the lower node of year 3, the value of the project after discounting the construction cost is only $5 Million dollars. If we pretend to exercise the option to invest in this project, we need to discount $60 from the $5. It will give as a result a negative value. It means that the option to develop the land is no worthy. At this point is better to abandon the project and recuperate the initial investment selling the land. At this node the value of the option becomes zero.

The $158 value (pink color), resulting from the calculations of the maximum value at the upper node of the second year comes from taking into account the flexibility to decide every year the new phase. The maximum value of $216-$60=$156 or from the average cost discounted by the risk free rate for one year. We always choose the maximum value obtained, because we want to maximize our profits. This number comes from the first and second node of year three ($239 and $79). There are two methods to get the value of the option when we move backwards in the tree: The risk neutral analysis and the replicating portfolio, but we are using the first method, that uses the equation 4 and the values from figure 5. At the node in study, we have:

$$Po = .52 * \frac{\$239}{(1+.03)^1} + (.48) * \frac{\$79}{(1+.03)^1} = \$158 \qquad (5)$$

At this point, we have enough money to build and develop the project too. We do not have the obligation to develop the project at the year two, we can wait until year three, and then we can select the option to keep open the option to develop the land. Observe that since our objective is to maximize our returns, we would exercise the option by keeping our option opened.

Figure 6. contains the binomial tree for the combined sequential compound options. Observe for example that if the market always goes well, you can delay the investment for the development until the beginning of the year three if you want to finish your project by the year 7. It not means that you have to wait necessarily until year three to develop the project. You can decide to invest any time since the year zero, because you have the option to

invest since year zero. Observe in the same figure 6 that if the market goes bad, you only have the option to delay the development one year. After that, if the market continues down, you need to abandon the project or stop for a while until the conditions of the market change or sell the land to another builder.

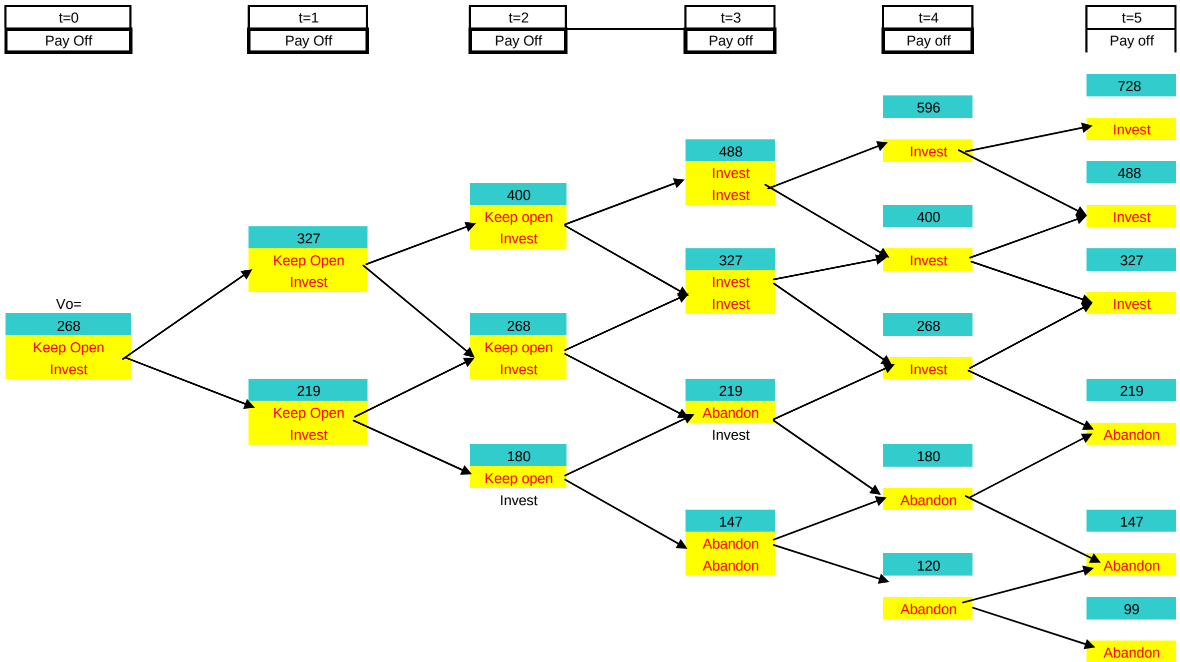

Figure 6. Binomial tree for the Combined Sequential Compound Option

We did not finish yet. We have a project that worth today $268 Million dollars and an expected profit of 61 Millions (Value of the options at year zero=$73 (See fig 5 at year 0) minus the cost of the land and the road improvement) $61=$73-$10-$2. Observe that with the flexibility to make decision later rather than before, our calculations results improved from -$4Million to $61 Million. It is a $65 Millions that come from the flexibility to make good decisions, knowing the consequences of each decision and the flexibility to delay the construction of the development. Because this project consists in many units, we can have more options during the construction phase, having each year the opportunity to decide how many units to build. For making the problem short and simple, we did not extend the number of sequential options this time. The method allows you to analyze many options, only you need to solve the problem in backwards, it means, analyzing the last options first and then the previous to the last and so on.

Projects and builders are similar to labyrinths and competitors. Suppose that two competitors need to go from point A to point B as shown in Figure 1. Also, both of them have the opportunity to study the labyrinth before attempting it.

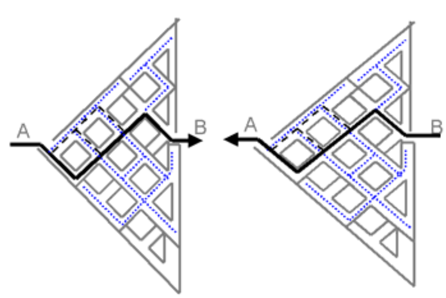

Figure 7. First competitor's solution to the maze

The first competitor, being a cautious person, decided to go and analyze the consequences of each action every time he needed to decide between two ways so that he would choose the shortest route. After reaching point B, he returned to point A by moving backwards and measuring the consequences of each decision in each node. In our problem calculations in backwards, a rate free of return was used instead of a market rate. Option valuation always uses a risk-free rate instead of a market rate because the consequences of a decision are known before the time has arrived and before decisions are made. Therefore, there is not risk involved. The first competitor for the maze was ready for the competition. The second competitor considered the problem typical and decided that he knew the game, his previous training was more than adequate, and in the end, there was no single solution, so he felt confident he could find a way to point B early.

Projects are labyrinths of decisions, and builders are the competitors that want to solve them. Active builders, like the first competitor, start the project by analyzing all the decisions that need to be made and their consequences. Passive builders, like the second competitor, know that calculations are always made with some margin that covers for bad decisions. Passive managers think that there will always be money left if they finish the project both on time and within budget. They are convinced of this because traditional tools always use the market rate to discount any expense regularly with a big margin for security.

It is easy to recognize that the first competitor, the active builder, is going to do a better job during the competition. If each decision implies a gain in time and money, the first competitor, who previously calculated all the consequences, is going to outperform the second one since the latter one will have to lose money and time in each decision, which will not lead to point B.

CONCLUSIONS

The Real Options Approach (ROA) enables management to quantify properly the additional value of the project's operating flexibility. In the absence of such flexibility, the tree gives results identical to those of traditional discount cash flow. The ROA expands NPV approach. However ROA is superior, since combines the best features of Decision Tree Analysis and NPV without their drawbacks.

Expanded (strategies) NPV = Static (passive) NPV of the expected Cash Flows + Option Premium (value of strategic options from active management)

In our case study, the initial calculation of the NPV gave us a value of the project of -4 Million enough to decide not to proceed with the project but after solving the problem incorporating the flexibility to decide, the construction phase after another phase is ready, the expected value of the project, increased to $61 Million. It means that $65 Million came from the flexibility to make good decisions when information arrives. The traditional calculations of cash flow are enough to kill projects. Under traditional methods, there is no reason to develop projects like this, because nobody chooses to lose money or work hard for a few dollars. Many builders use high discount rates that reduce the present value (PV) of the expected cash flows to cover the risk present during the project duration. Better tools are available to solve the same problem. Real options could be the answer and when game theory is added in the decision tree, the combination of the tree analysis, ROA and game theory will be more powerful. Unfortunately, for one competitor is easy to tailor, but more complicated problems of an N-person game remain to be solved (Copeland, 2001).

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