

Assessing enterprises' value with Monte Carlo Simulation: In Application of Microsoft Excel

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Abstract. Assessing enterprise's value can either be a conventional project operation or a company investment that allows managers to effectively improve their business decisions in order to maximize enterprise values. However, traditional methods that can be used for accessing enterprise's value neglect the uncertainty of parameters. So in this case, the paper introduces Monte Carlo simulation, solves the problem by which traditional models are overlooked. The paper concentrates on how to do Monte Carlo in application of Microsoft Excel.

Keywords: Assessing Enterprise's Value ; Microsoft Excel ; Monte Carlo Model

1 Introduction

People commonly use DCF, IRR, CMPA, EVA and so on to evaluating enterprises' value. Most of these traditional models need to consider one parameter that called free cash flow. When estimating this parameter, the prior models are short of accurate method. For example, when estimating free cash flow we often calculate ROI to get future growth rate then calculate the FCF year by year. Obviously, the application of this method lack operability. Because of this weakness, this kind of model usually used in the field of education only.

Monte Carlo simulation precisely solve this problem. This model improve the traditional methods and enhanced the operability by thousands of simulation tests.

2 Introduction of Monte Carlo simulation

Monte Carlo simulation also called random simulation, it was put forward by American scientists in 1940s. The method obtain the approximate results by statistical analysis and stochastic simulation of random variables. Take DCF model as an example, If the free cash flow of the investment project in the future is expressed as a random variable with a certain probability distribution, we can improve the accuracy of traditional model according to the probability distribution of these random variables.

Under the manual condition, it is difficult for people to operate thousands of tests. In this case, people prefer to use matlab in the application of Monte Carlo simulation. In fact, the common Microsoft Excel is enough to solve this problem. The following paper use an example to show how to complete that exactly.

2.1 Problem description

Here is a hypothetical scenario, our purpose is to assess the value of the following enterprise. The discount is 10%.

There is a new enterprise, the initial investment of this enterprise is 2.5 million. It is expected to obtain mature period in 3 years. According to the industry analysis, the company's final value is expected to achieve 5 million. In the operation of this company, the sales of the first year is appeared to be normal distribution which average is 1.8 million and standard deviation is 0.5 million. Based on the life circle rule of this product, sales will grow in the rate of 10% per year. It also need to be invested 1 million fixed cost per year. The unit variable costs of this new product is evenly distributed from 3 to 5. An agency carry on a market research on the price of this product, the result is as follow.

Tab1. The result

unit price	2	3	4	5	6	7	8
Probability	10%	10%	20%	20%	30%	5%	5%

2.2 Steps of Monte Carlo simulation(all the data and figures are randomly generated , just for explanation)

(1)Determine the model.Here use equation 1 as a model to compute the value of enterprise.

$$value = \sum_{t=1}^N \frac{E(CF_t)}{(1+r)^t} + \frac{E(CF_{N+1})}{(r-g_n)(1+r)^N} \quad (1)$$

(2)Build the model interface.According to the description of the question, model interface including initial parameter input area,data generation area,data output area(middle results),data output area(final results),statistical area,graphics area,test area and so on .

(3)Input initial data.Input data in (A2:B10) like following figure1.

	A	B
1	1. Input area	
2	Initial investment (million)	2.5
3	Average initial sales (million)	2
4	SD of initial sales (million)	0.5
5	Growth rate of sales (%)	10%
6	Fixed cost per year (million)	1
7	Unit variable cost (min)	2
8	Unit variable cost (max)	4
9	Discount rate (%)	10
10	Final value value (million)	5

fig.1 Input initial data.

(4)Use NORMINV(RAND(),E5,E6) in B14 to get the result of initial sales.Use BEP model to get price in B15.Use function ROUND(RAND*(B8-B7)+B7,B7) to output the result of unit variable cost.

	A	B
13	2. Data generation	
14	Initial sales (million)	2.70
15	Price (yuan)	5.00
16	Unit variable cost	3.47

fig.2 Result of initial sales

(5)Complete output area(middle result).

	3. output area (middle)	1st year	2nd year	3rd year
19	Sales (million)	2.63	2.89	3.18
20	Income (million)	13.15	14.46	15.91
21	Total cost (million)	9.77	10.65	11.61
22	Free cash flow (million)	4.38	4.82	5.30

fig.3 Complete output middle result area

(6)Complete output area (final result).

Here use equation1 and quote NPV() function in EXCEL.Get the result of enterprise's value .

	4. output area (final)	
26	Enterprise's value	13.20

fig.4 Complete output final result area

(7)Complete test area.

According to distribution of price, build data group that including one thousand tests.Detailed skill is as follow.Firstly, input 100 unit price based on the probability of price above. Secondly,select data

sheet function to build {Table(B15,F31)} which contains 1000 simulation test data of present value(full figure omitted here), this data sheet apply the eq1 and independent variable is price here.

	A	B	C	D
31	5. Tests area			
32	12.53	2	2	2
33	1	-4.27	-5.63	0.03
34	2	-5.57	-6.09	-2.61
35	3	-0.99	-3.74	-16.43
36	4	0.86	-0.27	-1.03
37	5	-6.07	-0.19	-1.37
38	6	-4.31	-5.07	-3.81
39	7	-4.52	0.27	-6.04
40	8	-3.46	-0.63	-2.93
41	9	-9.95	-3.35	-7.26
42	10	-3.81	-4.86	-1.45

fig.5 Complete test area.

(8)Complete statistical area.

Here are four index need to be considered.The mean ,standard deviation,minimum,maximum of 1000 test data above. The function use here is AVERAGE(),STDEV(),MAX ()and MIN().

45	6. statistical area	
46	Mean of 1000 tests	11.29
47	Standard deviation of 1000 tests	9.51
48	Minimum of 1000 tests	-16.27
49	Maximum of 1000 tests	49.47

fig.6 Complete statistical area

(9)Complete graph area.

This area contains two parts. First is control panel parameter table(f8) and second is frequency distribution statistics table(f7).This area is built to count the probability of the present value based on the 1000 test data.The function used here is FREQUENCY(),INDEX(),ROUND().FREQUENCY here is used to get the frequency distribution statistics table .F6 shows part of this table and blank B56 use ROUND() combined maximum to determine the first scale.And the design of the control panel parameter table.Here use INDEX() combined with the data in the frequency distribution statistics table.In this example use INDEX(F56:F87,J55) to fill B57. F56: F87 varies 32 scales in this example.

	A	B	C	D	E	F
53						
54	7. Graph area					
55		scale	frequency	frequency	grand total	>value
56	1	-17.00	0	0.00%	0.00%	100.00%
57	2	-15.00	1	0.10%	0.10%	99.90%
58	3	-13.00	1	0.10%	0.20%	99.80%
59	4	-11.00	1	0.10%	0.30%	99.70%

fig.7 Frequency distribution statistics table

	H	I	J	K
55	Fine-tune the control parameters	19		
56	present value	19		
57	>value proabilityY	19.72%		
58	Vertical line coordinates	X	Y	
59	Interval scale step	2		
60	Lowest point coordinates	19	0	
61	Curve focus coordinates	19	19.72%	
62	The highest point coordinates	19	1	

fig.8 Control panel parameter table

(10)Complete graph.

Microsoft Excel can be used to draw graph based on the handled data to simulate present value.Use Insert graph function to draw probability distribution graph(f9),Cumulative probability graph(f10) and probabilistic decision graph(f11) based on the data of the previous part which can be used to show the detailed information and process status of the enterprises' value.

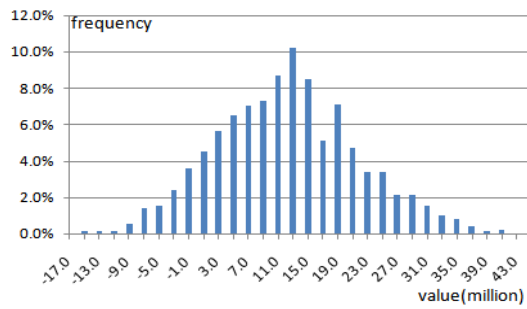


fig.9 Probability distribution graph

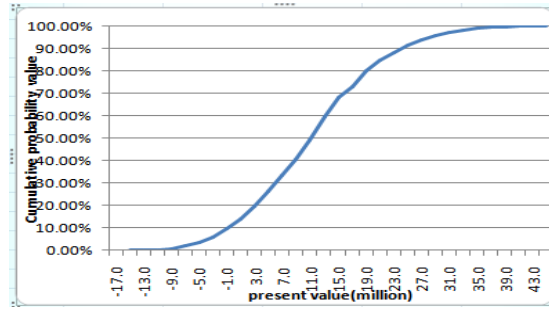


fig.10 Cumulative probability graph

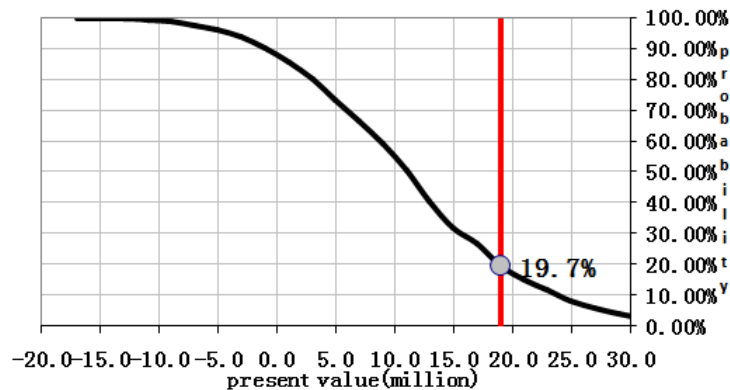


fig.11 Probabilistic decision graph

From the figure , the information users can easily get the information which is wanted.If the investor need to make the decision for investing ,the graph clearly show the probability of the present value after three years.

3 Conclusions

Based on the previous example,through plenty of tests in Monte Carlo,the uncertainty of the free cash flow in the future can be solved in a better way.It provides a more scientific method to accessing enterprise' value.With the help of Microsoft Excel can avoid the difficulty of manual computation. Above all, the author thinks this method can be utilized and promoted.

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