Capítulo 10

Financial Engineering case study: Alcatel-Lucent, S.A. Mexican Capital Market (BMV)

Amadeo Cabrera

A. Cabrera
Universidad Iberoamericana

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Abstract

This paper presents the analysis of financial behavior for an Information Technology company in the Mexican Capital Market (BMV). It is also compared to its operations statistics in the New York Stock Exchange (NYSE) and the Euronext (Paris) markets. Risk vs. Profit model methodology is developed, using the mathematical theorems of Lagrange, Levy and Ito´s lemma. Also modeling software (*Consultant and Financial Management)* is used to determine the Internal Return Rate (IRR) and Net Present Value (NPV) financial valuations. There is a Put-Call analysis and decision making. It will be established the bank financial cost for this company and will be compared to the Bank of Mexico reference rates CETE 7/CETE 14/CETE 28 – It is determined the Market Information System – MIS – to understand the value created by this company in the correspondent stock market. Finally it is presented a brief story of the company – in a finance-economic scenario - both at a corporative level and in the Mexican market particularly

Key words: Mathematical modeling, risk-profit analysis, finance valuation, stock market

10 Introduction : Company profile

Alcatel-Lucent Mexico (ALU) offers an extensive selection of services and appliances to enable the telecom operators as well as government entities and private corporations with the state of the art technologies and IT services and solutions. Alcatel-Lucent Mexico is a leading company to fulfill and develop data transmit and switch technology and most of the ADSL broad band Internet access in country is enabled based on its products. Also one of two voice callas transverse an Alcatel-Lucent equipment to arrive to its destination. IPTV and Cable TV providers are as well supported by a broad range of Alcatel-Lucent technology products and it has a prominent participation in the Transport, Energy, Military and Government segments.

Alcatel-Lucent started operations in Mexico stock exchange market on November 2004, and it is registered as an Anonymous Society under the Mexico commerce standards and regulations – Alcatel-Lucent, S.A. –

According to the listing in the Mexican stock exchange market we have the following information:

- Sector : Information Technologies
- Sub Sector : Technological equipment and Hardware
- Branch : Telecommunications equipment
- Economic Activity : Telecommunications

In the international market, Alcatel-Lucent is a European corporate based in France. In 1989, AT&T Technologies separates into several business units, including AT&T Network Systems, AT&T Global Business Communications Systems, AT&T Microelectronics and AT&T Consumer Products, which later combine with Bell Labs to become Lucent Technologies. In 1996 Lucent Technologies launches its separation from AT&T with an initial public offering, which is at the time the largest ever on the New York Stock Exchange. On November 30, 2006, Alcatel and Lucent Technologies merge.

10.1 Risk-Profit Models and the Theorems of Lagrange, Levy and Ito's lemma

10.2 Mathematical Risk-profit model

$$\mathrm{MRR} = \int_{A}^{B} + \frac{(\lim C)^{\pi}}{(\lim D)^{TC}} + \left[\frac{\log B}{\ln A}\right]^{3/4} + \frac{(\lim D)^{TC}}{(\lim C)^{\pi}} + \frac{\ln A + \log B}{C - D} + e^{2} \tag{1}$$

$$\ln \frac{\left\{\left[\frac{p_a^M + p_1^M}{\left[\frac{PPP_1}{V}\right]^{1/2}}\right]^{3/4} + \left[\frac{MP_a^a + M_a^1}{Ac}\right] + e^2\right\}^{\left(\frac{D_0 - D_f}{1/2}\right) - \left(\frac{IPC}{IPC_2}\right)^{\frac{4}{4}}}}{\left\{\left[\frac{[V_V - P_V]^{1/2}}{V_O - p^{Uh}} + \frac{2}{4}\left[\frac{(p^{VL})}{(P_u)}\right] - \frac{U_a}{V La}\right] - \left\{\left[\frac{V_c - P_c}{\left[\frac{V_a}{p^{Uh}}\right]^{1/2}}\right] + f^{P_u} - \left[f^{P_u + f}\right]_{\infty \ldots}^{Va + V La}\right\}\right.} + \log \frac{\left\{\left[\frac{p_a^M + p_1^M}{\left[\frac{PPP_1}{V}\right]^{1/2}}\right]^{3/4} + \left[\frac{MP_a^a + M_a^1}{Ac}\right] + e^2\right\}^{\left(\frac{IPC}{IPC_2}\right)^{3/4}}}{\left\{\frac{[V_V - P_V]^{1/2}}{V_O - p^{Uh}} + \frac{2}{4}\left[\frac{(p^{VL})}{(P_u)}\right] - \frac{U_a}{V La}\right\}^{\left(\frac{D_0 - D_f}{1/2}\right)}}{\left\{\left[\frac{V_c - P_c}{\left[\frac{V_a}{p^{Uh}}\right]^{1/2}}\right]^{3/4} + f^{P_u} - \left[f^{P_u + f}\right]_{\infty \ldots}^{Va + V La}\right\}} + e^2$$

$$\frac{Lim\ P_1 \to P_7}{\frac{a\left[\frac{Pu + \partial p^{VL}}{p^{Uh}}\right] + \left(\frac{\partial P_V}{\partial P_C}\right) - \left(\frac{\partial V_V - 1}{\partial V_C + 1}\right)^{1/2}}{\int_{P_u}^{V_o}}} - \frac{a\left[\frac{Pu + \partial p^{VL}}{p^{Uh}}\right] + \left(\frac{\partial P_V}{\partial P_C}\right) - \left(\frac{\partial V_V - 1}{\partial V_C + 1}\right)^{1/2}}{\int_{P_u}^{V_o}} \int_{p_7}^{p_1} \square$$

$$\mathrm{MRR} = \int \left\{\frac{\left\{\left[\frac{p_a^M + p_1^M}{\left[\frac{PPP_1}{V}\right]^{1/2}}\right]^{3/4} + \left[\frac{MP_a^a + M_a^1}{Ac}\right] + e^2\right\}^{\left(\frac{IPC}{IPC_2}\right)^{3/4}}}{\left\{\frac{[Vu - P_V]^{1/2}}{V_O - p^{Uh}} + \frac{2}{4}\left[\frac{(p^{VL})}{(P_u)}\right] - \frac{U_a}{V La}\right\}^{\left(\frac{D_0 - D_f}{1/2}\right)}}{\left\{\left[\frac{V_c - P_c}{\left[\frac{V_a}{p^{Uh}}\right]^{1/2}}\right]^{3/4} + f^{P_u} - \left[f^{P_u + f}\right]_{\infty \ldots}^{Va + V La}\right\}}\right\} + \left\{\frac{\left\{\left[\frac{p_a^M + p_1^M}{\left[\frac{PPP_1}{V}\right]^{1/2}}\right]^{3/4} + \left[\frac{MP_a^a + M_a^1}{Ac}\right] + e^2\right\}^{\left(\frac{D_0 - D_f}{1/2}\right) - \left(\frac{IPC}{IPC_2}\right)^{3/4}}}{\left\{\left[\frac{[V_V - P_V]^{1/2}}{V_O - p^{VL}} + \frac{2}{4}\left[\frac{(p^{VL})}{(P_u)}\right] - \frac{U_a}{V La}\right] - \left\{\left[\frac{V_c - P_c}{\left[\frac{V_a}{p^{Uh}}\right]^{1/2}}\right] + f^{P_u} - \left[f^{P_u + f}\right]_{\infty \ldots}^{Va + V La}\right\}\right\}}\right\}$$

$$\frac{\lim\left\{\frac{Lim\ P_1 \to P_7}{\frac{a\left[\frac{Pu + \partial p^{VL}}{p^{Uh}}\right] + \left(\frac{\partial P_V}{\partial P_C}\right)^{3/4} - \left(\frac{\partial V_V - 1}{\partial V_C + 1}\right)^{1/2}}{\int_{P_u}^{V_o}}}\right\}^{\left(\frac{IPC}{IPC_2}\right)^{3/4}}}{\lim\left\{\frac{a\left[\frac{Pu + \partial p^{VL}}{p^{Uh}}\right] + \left(\frac{\partial P_V}{\partial P_C}\right)^{3/4} - \left(\frac{\partial V_V - 1}{\partial V_C + 1}\right)^{1/2}}{\int_{P_u}^{V_o}} \int_{p_7}^{p_1} \square\right\}^{\frac{D_0 - D_f}{1/2}}} + \tag{2}$$

10.3 Alcatel-Lucent Stock Exchange analysis – Mexico/New York/Euronext (Paris)

10.4 Operation Statics (Oct. 23 2105) – Mexico, BMV, Mexico issuers

Figure 10.1

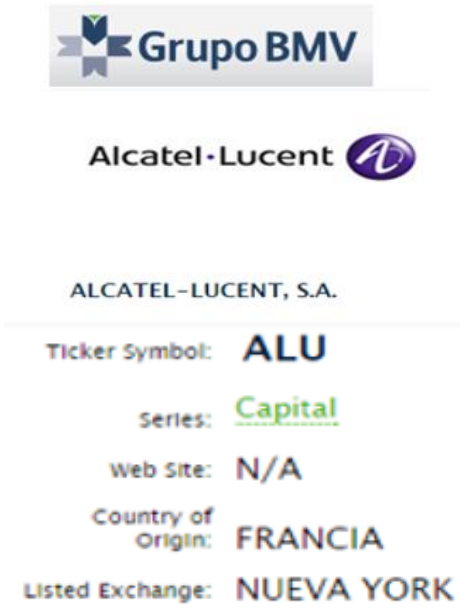


Table 10.1

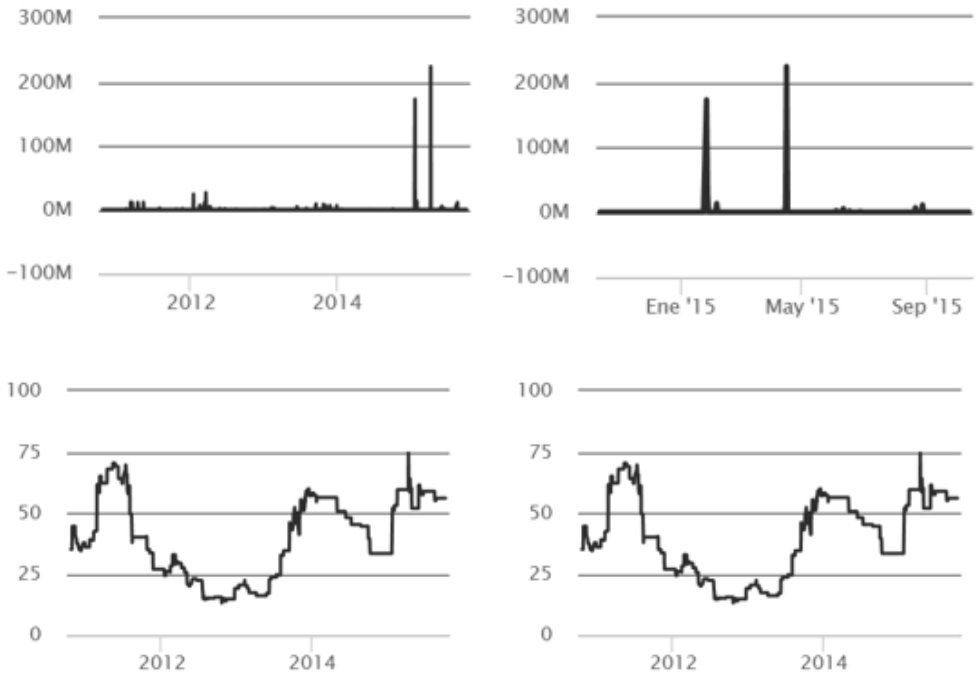
Symbol	Series	Issuers	Maximum	Minimum
ALU	Capital	ALCATEL-LUCENT, S.A.	55.7	55.5

Change	PPP	Max. Previous Year	Min. Previous Year	Shares Outstanding
-5.628294	0.5	58.09	33.33	2,824,203,000

Partitions						
1P	2P	3P	4P	5P	6P	7P
56.00	56.00	56.00	56	56.00	56.00	56.00

Fuente: https://www.bmv.com.mx/es/emisoras/estadisticas/ALU-6405 ALU, Mexico market, last 5 years. Shares(M), Price (MXP)

Graphic 10.1



Fuente: ALU, Mexico market, Year 2015. Shares(M), Price (MXP)

10.5 Alcatel-Lucent risk-profit model numeric evaluation, Mexico market – BMV – Mathematical Risk-Profit Model, Levy evaluation

Figure 10.2

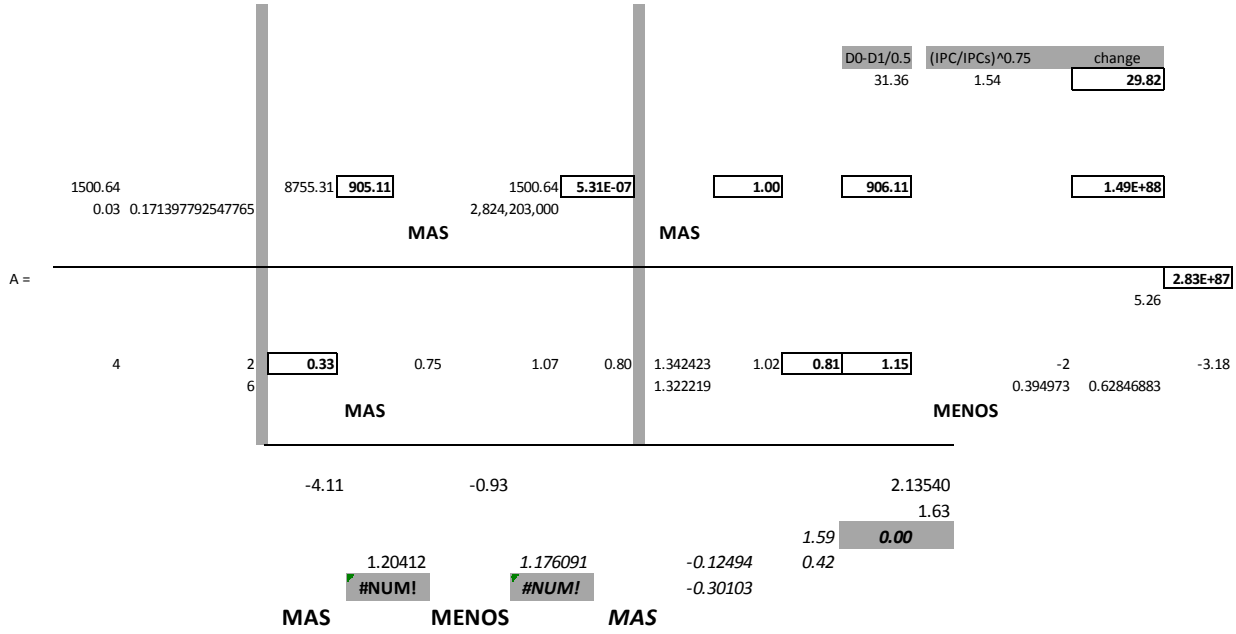
Pa^m	55.7
Pi^m	55.5
V	5.62
PPP	0.5
MPa^a	58.09
MPa^i	33.33
Ac	2,824,203,000
P1	55.7
P2	55.7
P3	55.7
P4	55.7
P5	55.5
P6	55.5
P7	55.5
Pu	15
P^vl	16
P^uh	55.7
Vc	18
Vv	19
Pc	20
Vlu	21
Vu	22

D0-D1/0.5	(IPC/IPCs)^0.75	change
31.36	1.54	**29.82**
TC	**Pi**	
15.68	1.78355	

Fuente: http://www.banxico.org.mx/ (*Mexico market reference values*)

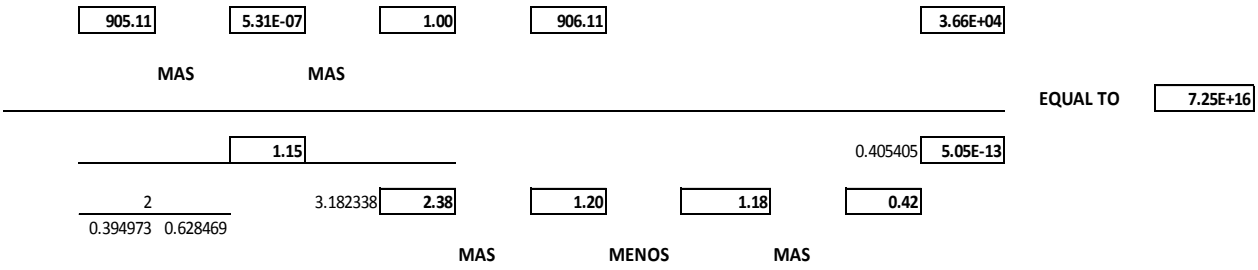
10.6 Numeric resolution "A" section for the model, Levy

Figure 10.3



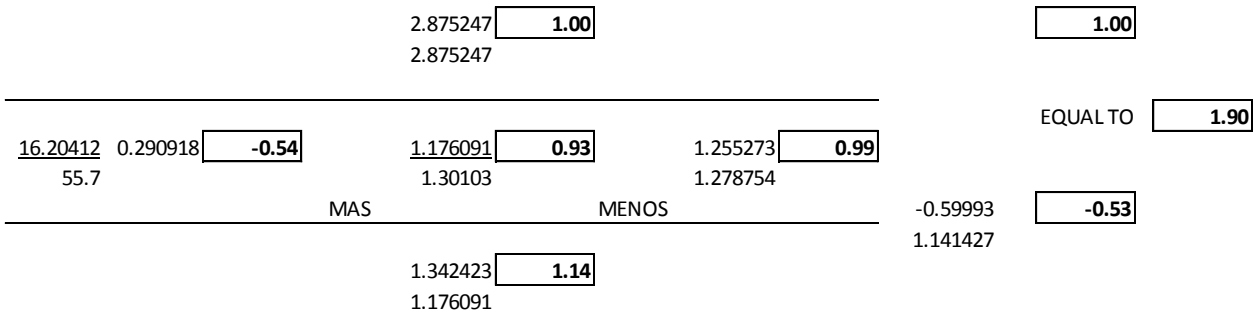
10.7 Numeric resolution "B" section for the model, Levy

Figure 10.4



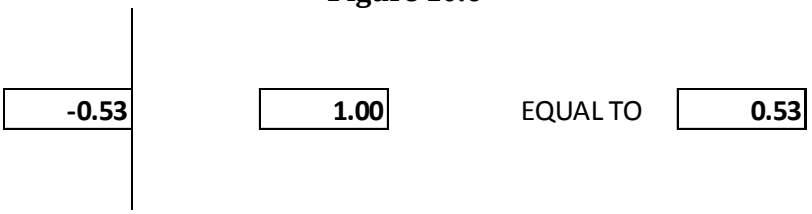
10.8 Numeric resolution "C" section for the model, Levy

Figure 10.5



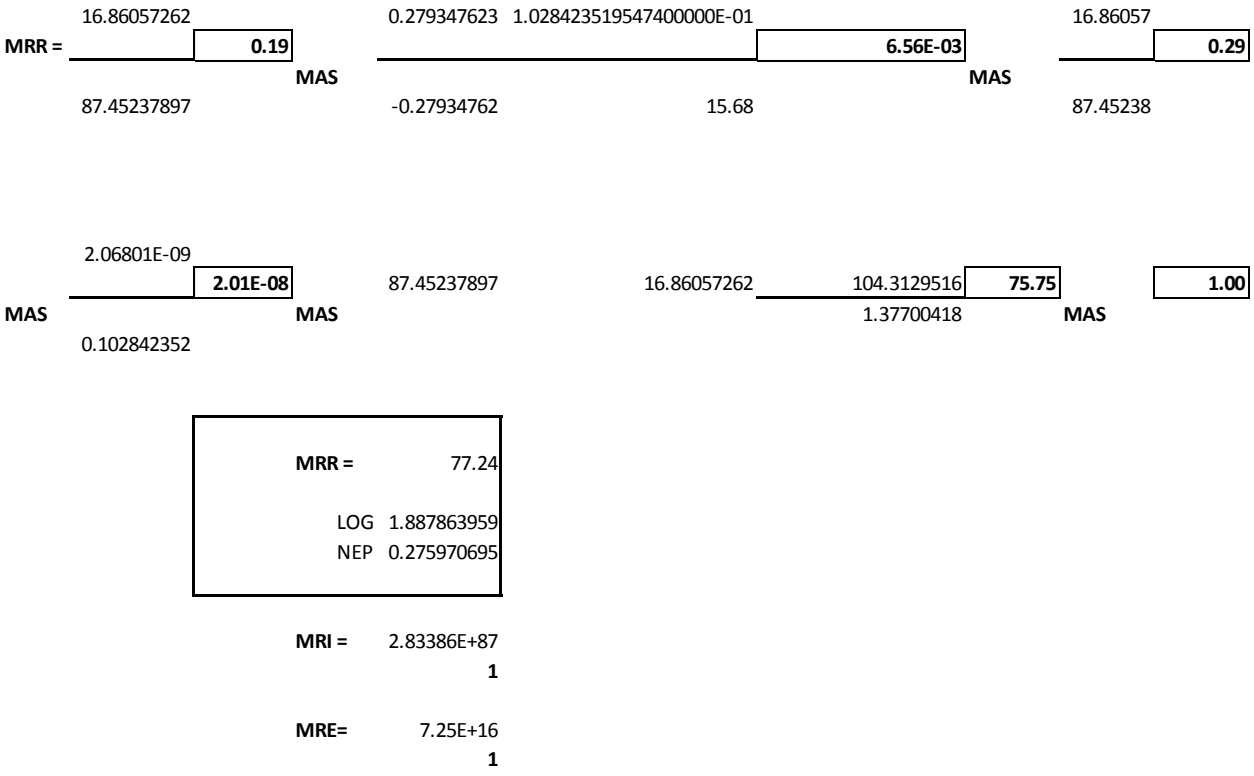
10.9 Numeric resolution "D" section for the model, Levy

Figure 10.6



10.10 Numeric resolution "Risk-Profit" model, Levy

Figure 10.7



10.11 Interpretation of the numeric valuation of the mathematic Risk-Profit Model.

It is important to consider that advance mathematic methods should be used to numerically value this complex expression, a sound understanding of ***stochastic calculus*** and ***fractals*** comprehension should be used to interpret and understand the valuation. In some cases there are results the violate the ***linear resolution*** for an equation space and we need to take into consideration the variations of results that can be accomplished doing the interpretation of statistical data in more than a two-space scenario, here it is where fractals and stochastic calculus should be used to understand and accommodate for such results in valuations. An excel work file was produce to perform the numeric analysis and get the values shown here.

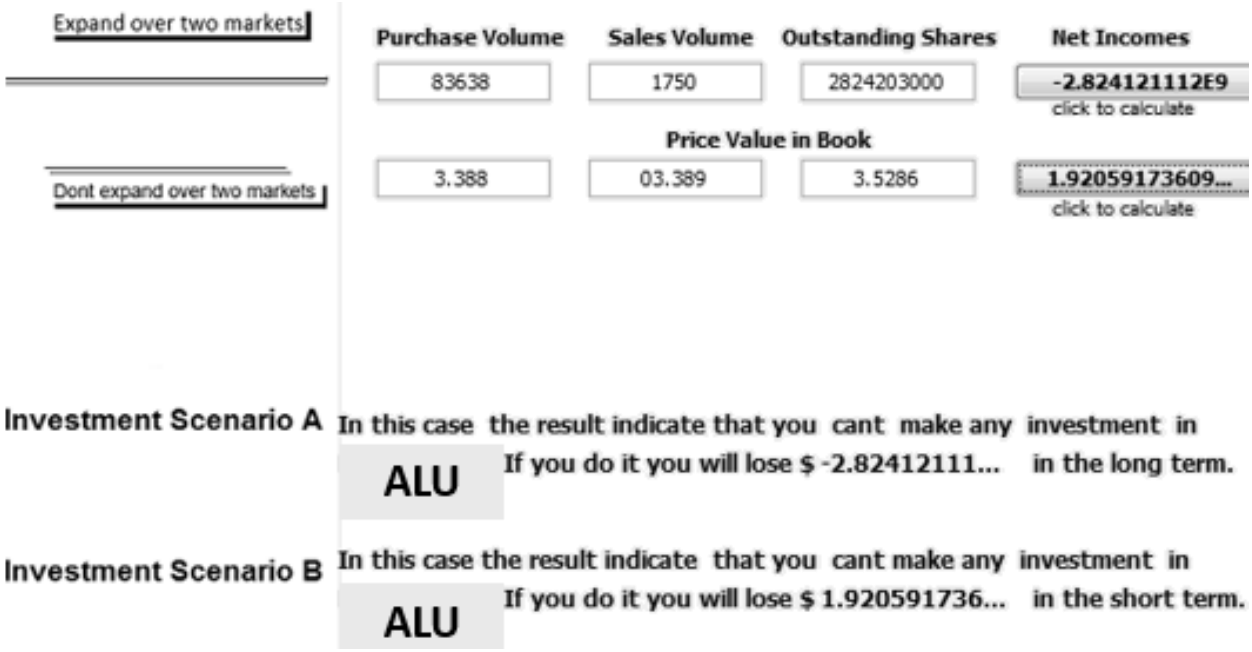
Most of the time the results should be derived from Logarithmic values, we used both base10 -*common logarithm* - and *Napier's logarithms*

Also we use approximation to values between -1 (***ex-ante***) and +1 (***ex-post***). This two are Latin locutions that in modern financial explain the revenue of a specific stock share both ***before*** the trading takes place and ***after*** it takes place. So the mathematical model really tries to predict the behavior of a stock in the market where we are mathematically modeling and analyzing the data

We have considered in this case both ALU stock exchange statistics and the Bank of Mexico values around the inflation rate, years 2014 and accumulated in 2015 and also exchange rates vs. US dollars so we can compare to different markets where ALU operates internationally.

10.12 Investment Strategies Valuation and Transactions

Figure 10.8



10.13 Investment strategies valuation and transaction analysis, for ALU

For the valuation of this scenario we use the *Consultant and Financial Management* software. The analysis is based in the Mexican Stock market exchange statistics for ALU. The base of the analysis are the following values: Purchase volume, Sales volume, Capital circulation (total number of shares) Sales position, Purchase position and price in book per share

The values are introduced to the software interface, and there will be three possible investment scenarios, long term, short term and when there is competition between different companies in the same market segment.

For the ALU case we don't considered the third scenario, because there is no single direct competition, in the Mexican market for all the product and services offered in the ALU portfolio.

For the long term scenario, the software calculates a NO inversion, scenario and this could be the real recommendation for the Mexican market regarding this stock. Mainly this result is related to the LOW trading statics we found in this shares in the Mexican market.

A similar result is observed in the short term scenario, where we get a NO investment recommendation. Mainly we need to be clear that in the Mexican market the ALU stock has been low trading for the last 4 months (June 2015 to the date) and basically this result shows that comparing the profit in the last months of the market share value, we could not be doing a good profit out of the investment in this stock purchase.

10.14 Market Information System (SIM)

Figure 10.9

SIM Annual rate = 48 %= 4 % * 12

Time limit = Time inicial + Operativity

Market-SIM = Time inicial * Val-Book *Asset

Activity	Operativity	Time inicial	Time limit	Val-Book *Asset	Market-SIM
INICIO	0	0	0	3.5286	0
Proc A	3.412	3	6.41	3.5286	10.59
Proc B	3.362	7	10.36	3.5286	24.7
M 1*	4.08	0		3.5286	0
Proc C	0.05	11	11.05	3.5286	38.81
M 2*	8.16	0		3.5286	0
Proc D	3.4	15	18.4	3.5286	52.93
Proc E	1.9	17	18.9	3.5286	59.99
Final	0	0	0	3.5286	0
					0
					37.4

Proc A: Maximum Value

Proc B: Minimum Value

M1: Bank of Mexico inflation rate (accumulated whole year to December 2014)

Proc C: Change

M2: Inflation rate doubled

Proc D: Maximum Last year

Proc E: Minimum Last year

Note 1: Values in Euros, taken form Euronext & Bank of Mexico statics information (exchange rates taken at 31-dec-2014)

Note 2: Accumulated inflation and interest rate goal, got form the Bank of Mexico (full year 2014)

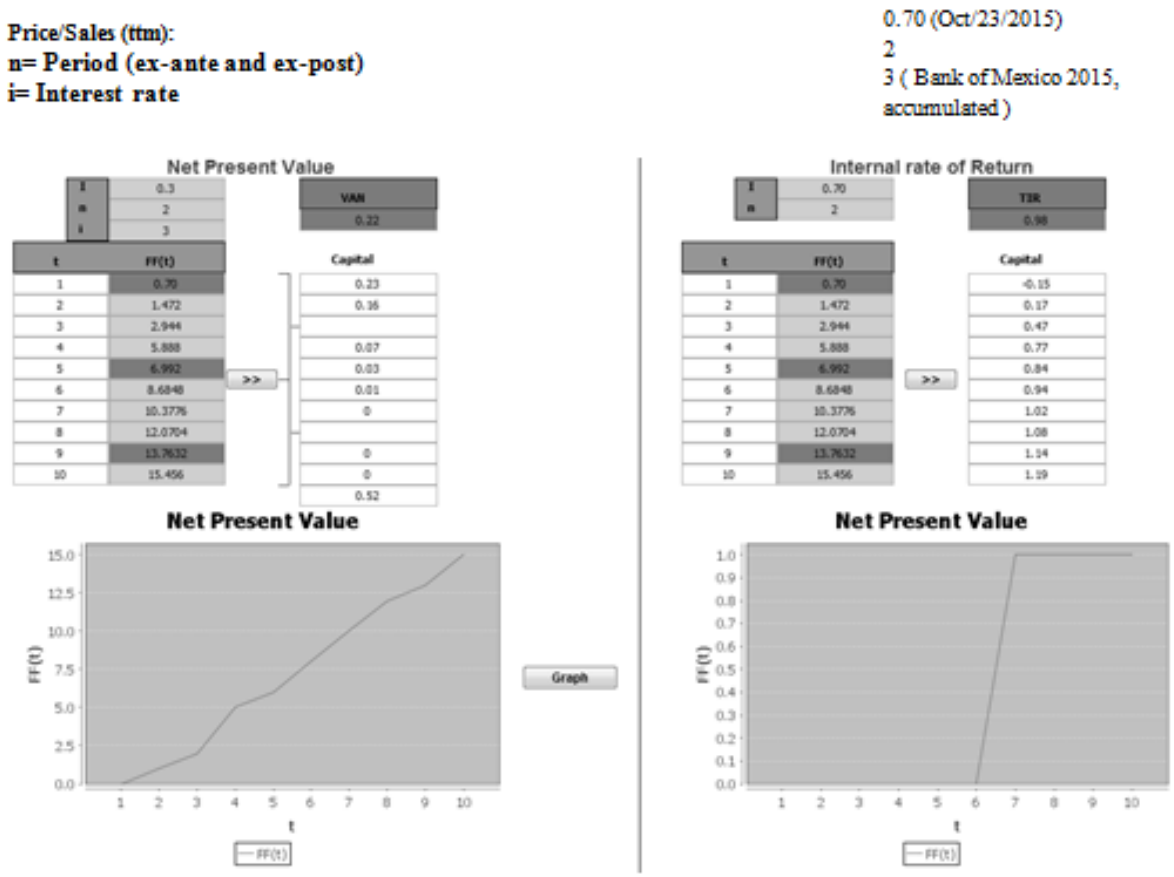
In this analysis, ALU generated a POSITIVE SIM of $37.4 (Euros) for 2014. When a SIM is Negative, this means the company does not generate an extra value for the stock. A SIM Positive, like ALU case, means the company generates an extra capital for the stock market.

In this analysis we can find that different to the Mexico market, analyzing Euronext Market (PARIS index) we can find that ALU is generating value for the market where the corporative for this company resides. Also we can find analyzing the statics information for this stock exchange in Euronext that trading is considerably more active than in Mexico or even New York stock exchanges markets, meaning that definitively Europe is the major market or the base market for the ALU Company and where it is really creating value for the shareholders.

10.15 Finance Valuation, IRR, NPV

To calculate the Net Present Value (NPV) and Internal Return Rate (IRR) we use the Utility Price of the Operating Statistics of the Station (Price/Sales or Price/Earnings). In this case ALU.

Figure 10.10



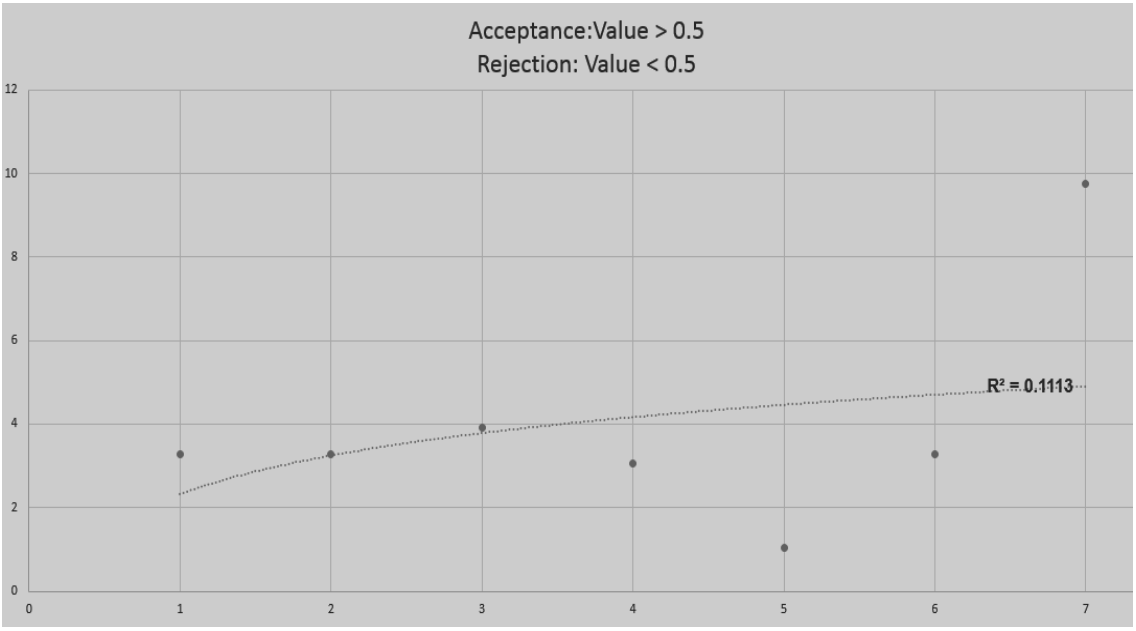
So the result of this analysis, we fond the following :

Alcatel-Lucent (ALU) – NYSE

NPV = 0.22 in the stock market

IRR = 0.98 (lower than the objective of the interest rate of the Bank of Mexico)

Figure 10.11



10.16 Net Present Value, Internal Return Rate and R^2 valuation for ALU.

Net Present Value (NPV) is defined as the difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of a projected investment or project.

The following is the formula for calculating NPV:

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_o \qquad (3)$$

Where

Ct = net cash inflow during the period t

Co = total initial investment costs

r = discount rate, and

t = number of time periods

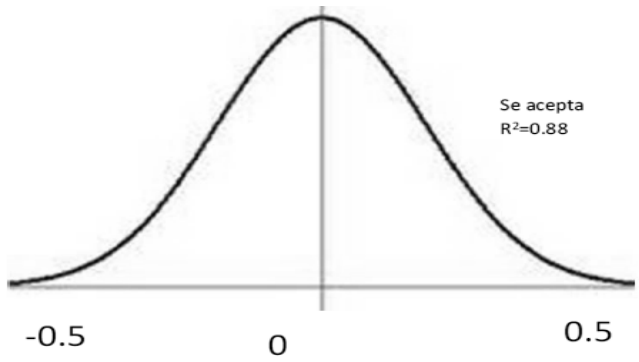
A positive net present ***value*** indicates that the projected earnings generated by a project or investment (in present dollars) exceeds the anticipated costs (also in present dollars). Generally, an investment with a positive NPV will be a profitable one and one with a negative NPV will result in a net loss. This concept is the basis for the Net Present Value Rule, which dictates that the only investments that should be made are those with positive NPV values http://www.investopedia.com/terms/n/npv.asp

Internal Return Rate – IRR, is a metric used in capital budgeting measuring the profitability of potential investments. Internal rate of return is a discount rate that makes the net present value (NPV) of all cash flows from a particular project ***equal to zero***. IRR calculations rely on the same formula as NPV does.

To calculate IRR using the formula, one would set NPV equal to zero and solve for the discount rate *r*, which is here the IRR. Because of the nature of the formula, however, IRR cannot be calculated analytically, and must instead be calculated either through trial-and-error or using software programmed to calculate IRR.

Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project. IRR is uniform for investments of varying types and, as such, IRR can be used to rank multiple prospective projects a firm is considering on a relatively even basis. Assuming the costs of investment are equal among the various projects, the project with the highest IRR would probably be considered the best and undertaken first

Figure 10.12



Graphic 8 Hypothetical test of Gauss

Fuente: http://www.investopedia.com/terms/i/irr.asp

According to the hypothetical test of Gauss the R2 value is accepted or rejected in the following conditions:

Acceptance: Value > 0.5

Rejection: Value < 0.5

10.17 Sell (Put) vs. Purchase (Call)

10.18 Mathematical model

Figure 10.13

Negative to the Cost:

COST

$$y1 = \log_2(x - 2)$$

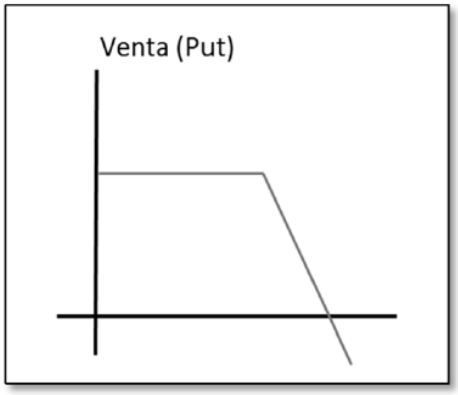
Equation 1 Exponential Function to locate asymptotes(negative)

Positive to the margin:

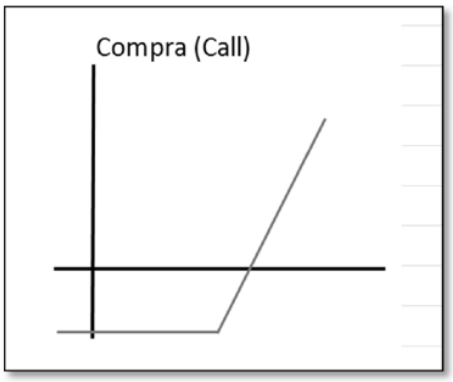
MARGIN

$$y2 = \log_2(x + 2)$$

Equation 2 Exponential Function to locate asymptotes (positive)



Graphic 1 Sales (Pull)

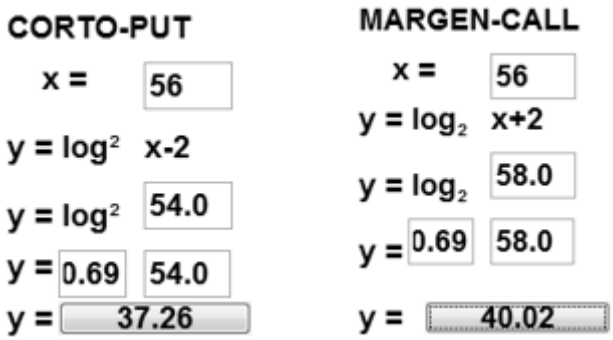


Graphic 2 Shopping (Call)

10.19 Numeric Resolution

Alcatel-Lucent, S.A.

Figura 10.14



So for this market (BMV) the ALU stock should be considered for SELL (Put) if the value gets to $37.26 MXP. It is also recommended that it should be considered for Purchasing (Call) if the value goes to 40.02 MXP or higher (with a positive increment in the short term)

10.20 Alcatel-Lucent WACC and comparison to the Mexican reference market Bank of Mexico reference rates CETE 7/CETE 14/CETE 28

Figure 10.15

Consider Banxico (Bank of Mexico) rate 4%

The results depend on the length of

Time (From 1 month to 6 months)

- Monthly
- By two Months
- By three Months
- By four Months
- Semiannual

The pay Bank for PYME acquisitions will be:

Monthly =0.3333%

By two months= 0.6667%

By three months= 1.0000%

By three months= 1.3333%

Semiannual= 2%

Figure 10.16

For subsidies Payments in the different Banks use the 4% defining the respective rates.

The results depend on the length of time

- CETE 7
- CETE 14
- CETE 28

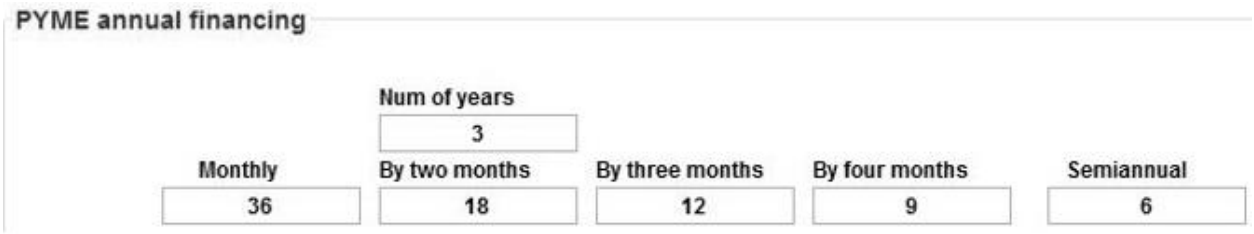
The pay Bank for PYME subsidies will be:

CETE 7=0.0778%

CETE 14=0.1556%

CETE 28=0.3111%

Figure 10.17



To determine the PYME partialities in the following 3 years we need to identify the periodicity

The results depend on the length of

Time (From 1 month to 6 months)

– Monthly
– By two Months

– By three Months

- By four Months

- Semiannual

The number of PYME Partialities:

Monthly=36

By two months=18

By three months=12

By four months=9

Semiannual= 6

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