# Evaluation of Call Stock Options in the Kuwait Stock Exchange

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**Abstract:**

The options pricing on financial assets represents a subject of great interest to academics and practitioners in the financial markets; it is also a phenomenon that has preoccupied specialists in financial and mathematics domains. The Black-Sholes model (1973) is the benchmark model of many models; this model provides us with a basic tool for the pricing option contracts traded in markets. Moreover, it was based on many assumptions that are the stability of volatility, the risk free rate, and the normal distribution. The main objective of the present study is the exhibition and the interpretation methods that are related to the assessment and pricing of options on financial stocks market through the comparison between the theoretical options prices under Black-Scholes model, Monte Carlo Simulation method, and the current option prices on market; in addition to the validity test of both models in order to predict the market prices by an empirical study for the period from 26 December 2013 to 08 May 2014, with daily data using R software and its packages. Finally, It was found that the Black-Sholes model does not perform when the volatility is higher in both periods 6 and 9 months, but for one year the B-S model proved its ability to predict the current prices with a positive relationship. Other findings highlighted the outperformance of the Monte Carlo Simulation Method to predict the current price only when the volatility is lower for both periods 6 and 9 months.

**Keywords:** Pricing options, Black-Scholes model, option market, Call option, Kuwait stock exchange, Monte Carlo Simulation, Regression analysis.

**Jel Classification Codes :** C13, C15, G12, G13, G15, G17.

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## I- Introduction :

Finance is one of the most rapidly changing and fastest growing areas in the corporate business world, and financial options became a big debatable topic in the field of finance. The options contracts are one of the most important financial engineering products, it held between two irrevocable parties that give the holder the right not the obligation to buy or sell an underlying asset to certain conditions, within a specified period of time. Options pricing has been subject of active research in the academic world, There are several mathematical models for pricing different type of options, building on that mathematics and economists have been creating various models and formulas to evaluate option contracts, because it necessary to raise the issue of pricing and interest in techniques that allow modeling asset prices and try to control the risks arising especially in developing countries.

In 1973, economists Myron Scholes and Fisher Black provide a broad perspective on the adoption of options as a precautionary tool. The Black-Sholes model based on a portfolio of risk-free assets and risk assets under a set of assumptions in which they won the Nobel Prize in Economics in 1997. It is considered the benchmark model and the biggest successful and useful in financial theory, both interims of approach and applicability. (Black. F and Sholes. M, 1973). In the years following the emergence of the model was witness to the development of new versions, which is aimed at revisiting one of the assumptions of the Black Scholes model (1973). For example, the Merton 1992 AMIN and Jarrow fixed interest models, which criticized the assumption of interest stability, Rubinstein (1994), which did not reject any restriction at the distribution level, the Cox and Ross (1976) , Hull et White models (1987), Wiggins (1987), Melino et Tornbull (1992), which ignored the stability of oscillations, Amin and Ng (1993) While Bales (1995) incorporated jumps within the distribution approach to value, the list goes on, but it should be noted that most of them remained captive to the complexities of mathematics in the academic arena.

We are entering the area of the explosion of information and the high volatile in markets either emerging or developed which are associated and integrated even the main differences between these markets such as the investment climate, the markets size and the stability. As for the Arab financial markets, the talk about options and their pricing is still far away. Unless we are excluded from the narrow range of the Kuwait financial market, it is the only one that offered the Call Options on 28 March 2005 to be the first Arab market to trade this type of derivatives.

The effectiveness of the Black-Scholes model, which is recognized for pricing the European options and even the American options through the developed versions, leads us to think about their application to the Arab stock exchanges. We aim from this study to compare the theoretical values of the option with the current value based on the available options data on the Kuwait Stock Exchange. The rest of this paper organized as follow: section 2 presents some literature review, section three shows the data and methodology, section 4 results and comments, and finally we will present the main conclusion. Derivatives markets provide several important economic profits, consist the ability to manage the price risk of cash market or tangible positions. In open markets where large numbers of possibility buyers and sellers rivaling for best prices, futures markets effectively discover and establish competitive prices.

Options markets have been growing rapidly since the seventies 1973's years, when the economists Black-Sholes presented a formula for pricing European options type, this formula have been as benchmark model, and it is widely applied in many academic researches, although the many criticisms on this model. The following figure presents the development of options and futures from 2013 to 2016 on billions ( see Figure 01).

In 2016, options accounted for 38% of the total volumes traded and futures, 62%. This is a change on 2015, when options accounted for 42% of global volumes traded. Overall, options volumes fell by 8%, while the number of futures contracts traded increased by 10% on 2015. The figure 02 shows the breakdown by product and by region.

**II– Literature review**

Several researchers have contributed to this subject in previous studies, including but not limited to the study of the study of (E. Maré and E. Flint, 2017), investigated on the Fractional Black-Scholes Option Pricing, Volatility Calibration And Implied Hurst Exponents in South African Context, the authors aim to address theoretical and practical issues on option pricing and implied volatility calibration I fractional B-S market. The data of this study contain tow groups; the first one consists of 529 weekly observations of implied volatility on the FTSE/JSE Top40 index over the period of 2005 to 2015, the second one consists of 146 weekly observations of implied volatility skew for listed futures options on the US Dollar to South African Rand (USD/ZAR) exchange rate over the period of 2013 to 2015 using the FBSI and LC models, the main result of this investigation are; the FBSI model be seems the equity implied volatility surfaces very well, but that more flexible hurts exponent paramertisation is required to fit accurately the currency implied volatility data. The study of (Juing et al, 2017), which untitled by on forecasting Taiwanese Stock Index Option prices : The role of Implied Volatility Index, this investigation aimed to compare the performance of four models which are GARCH ,GARCHvix, and the historical models (HS20d and HS252d) over the period from January 2014 to May 2015, using Taiwan Weighted Stock Index (TAIEX) for the total of 839 trading days, the results of this investigation shows that Both GARCH and GARCHvix models perform better than the historical volatility models for forecasting call value of TXO, in addition the GARCHvix model outperform the GARCH model other finding conclude that the GARCH model can be effectively improved with the additional information contained in VIX furthermore The usage of GARCHvix can greatly reduce model mispricing for TXO value, finally the volatility index is important for option traders to efficiently predict TXO option value with GARCH model. The investigation of (Xia. W, 2017), pricing Exotic power options With a Brownian-Time Changed Variance Gamma Process, the main objective of this study is to examine the performance of the Brownian-Time changed variance gamma model using S & P500 index over the period of 2 July 2015 to 2 July 2016, with a number of total 253 observations, this examination concluded that the Pricing for plain-vanilla options is considerably efficient and, an asymmetric power options can be regarded as a plain-vanilla option a new powered price stock and follows the same pricing mechanism. The symmetric power options can be priced in two approaches, with infinite series expansion and the other with some advanced functional. The pricing of symmetric power options takes significantly more time finally, the estimator of the log stock price at a fixed time point is asymptotically unbiased, Pricing through simulations readily available. The study of (Huhta. T 2017), forecast on the performance of the Black-Sholes option pricing model: Empirical Evidence on S & P500 call options in 2014, the aim of this investigation is to show empirical evidence about false assumptions of the Black-Sholes model and complete it by relaxing unconditional restrictions, using US S & P500 index options, which is consist of 634029 put and 634398 call options during 2014. The main results of this investigation are ; the Black- Sholes model is found to mispricing US S & P500 index options, because of the main criticisms of this model which are the constant of volatility and the normal distribution, the GARCH (1,1) model provided statistically significant and it founded more practical than the Black-Sholes model because it take on account the time varying on forecasting volatility, other findings showed that the B-S model is found overprice OTM and ATM options and undervalued on ITM options moneyness. (Prof et al, 2016b), focused on the analysis of the Efficacy of Black-Scholes Model From call Options On Nifty50 Index, for the period of 7 years from January 2008 to December 2014, it based

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on the secondary data which is compiled from the India (NSE) website using the ordinary least square (OLS) regression analysis. The aim of this study is to analyze the efficiency of theoretical price predicting the market price of call options; it also considers the impact of moneyness on the efficiency of theoretical price of the call options. The result of this investigation shows that the Black-Scholes model is the best reflected mathematical model and performs well in predicting the market price of call options; it also highlighted the importance of the theoretical prices in making trading decisions. The study of (Xiaozhong et al, 2016c), untitled by a universal difference method for time- space fractional Black-Scholes equation, this paper construct a new kind of universal difference method to solve the time-space fractional B-S equation. In order to find the solution, the authors utilized a Pentium ( R) dual core CPU 3.00 GHz, they experimented by utilized universal difference scheme in the MATLAB 7.0 environment, to calculate the price of European call option by a numerical example. The result indicats that the theoretical analysis demonstrates that the universal difference method satisfies conditional stability and convergence, in other hand all the numerical results illustrated that the time-space fractional B-S equation is effective and the universal scheme is feasible to solve the TFBS. While the study of (Uleman. F, 2016), investigated on the stochastic calculus for finance: An application of the B-S model on option pricing of crude oil, the data that is used in this paper collected from the Chicago Mercantile Exchange (CME) website, the option prices examined over the period of 7 months from 30 November 2015 to 13 June 2016, the main objective of this study is to compare the Black-Scoles option prices ( put, call contracts) to the actual option prices of the CME group. The results showed the CME seem to have based their calculations of European put option prices on the Black-Scholes model, as the final values differ only on small scales; on the contrary, call option prices of the theoretical calculations differentiated more from the real data, the authors explained this result by the current financial instabilities, furthermore, the result shows a higher/lower volatility rates, it mean that with around 30 observations of historical data the Black-Scholes model can predict the best option prices at an expiry date after 48 days. The study of (huang et al, 2016a)untitled by Option pricing with the realized GARCH model: An analytical approximation approach, they aim to compare the validity of realized GARCH, EGARCH, NGARCH, GFR-GARCH, HN-GARCH and GARV models, using daily returns of the S & P500 index options during the period of 2000 to 2012 for in sample and reserve 2013 to 2014 for out of sample, they conclude that the persistence parameter is larger than that obtained with joint estimation, the parameters in the Realized GARCH model are substantially different other finding shows the Realized GARCH model outperforms the other models in addition, the total IVRMSE shows that the Realized GARCH model has the smallest pricing error and the GARV model has a slightly higher pricing error, moreover the EGARCH model has the worst pricing performance. The Realized GARCH model has better pricing ability when the volatility index is higher and the GARV model works better when the volatility index is lower finally, the Realized GARCH model has the best performance on average.

## II– Methods and Materials:

Our data conclude the American option contracts type, which was traded on 26/12/2013 for (6 months, 9 months and one year) expiry date. On the Kuwait Stock Exchange, we have chosen a proposed implementation within this area (08/05/2014), where we obtained the value of options on this date through the daily bulletin of the website of the Kuwait Stock Exchange. Our data also contains the B-S variables.

### 1-1 Kuwait stock exchange:

Boursa Kuwait is a private entity that was established in April 2014, with the aim to take over and manage the Kuwait Stock market and progressively transition it’s operations, while delivering on three main fronts; transparency efficiency and accessibility. Bursa Kuwait was founded by the capital markets Authority (CMA) commissioner's Council, under resolution No.37/2013, dated 20/11/2013 and the capital markets Authority (CMA) Law. No (7/2010).

**1-2 Forsa Equity options:**

Call options were first introduce to Kuwait stock exchange (KSE) by Markaz in March 2005 through Forsa Financial Fund. Forsa is an open and fund managed by Markaz structured to write option contracts. Currently, Forsa is the sole market maker for call options at the KSE and the put options will be traded soon. A Forsa call option is an American style option contract between the option seller and the option buyer where by Forsa grants option buyer the right , not the obligation to buy a specified number of shares at a specified price ( Exercise price), on or before a settlement date ( Expiration date). To acquire this right, the option buyer pays Forsa (option seller) the option premium or the option price. Forsa options are priced using the Cox Ross Rubinstein Binomial model which is widely used to price American options type. The premium depends on the following: the underlying price, strike price, time left to expiry, the volatility of stock, cost of funding and dividends. Under normal market conditions, and to minimize the effect of price manipulation, Forsa considers the underlying price to be equal to Weighted Average Trading Price (WATP), which is calculated by dividing the sum of the value of each trade over the total volume of trades of the underlying share during the day.

**1-3 Hypothesis of study :**

H1: The Black-Scholes model was able to evaluate options on stocks in the Kuwait Stock Exchange.

H2: The Monte Carlo Simulation method was able to evaluate options on stocks in the Kuwait Stock Exchange.

H3: The Black-Sholes prices have a significant to predicting current prices.

H4: The Monte Carlo Simulation call prices have a significant to predicting current prices.

Data of the stock:

The current price of the stock (S) is the share price at the valuation date specified in our case with the value of spot, where we obtained it through the historical data of the share price of the sample and is one value per share in the three maturity periods. The rate of return without risk (r) is the interest rate on government bonds or the rate of borrowing at international banks such as EURIBOR and LIBOR. We obtained this from the Central Bank of Kuwait website on 26/12/2013. We calculated the arithmetic average of the KIBOR value for each maturity prior:

$$r_{6months} = \frac{0.8125 + 2.0625}{2} = 0.94$$

$$r_{9months} = \frac{0.94 + 1.19}{2} = 1.06$$

$$r_{12months} = \frac{1.0625 + 1.3125}{2} = 1.19$$

The value of volatility expressed in standard deviation (σ) for stock prices during the historical year starting from the date of concluding the transactions in 26/12/2013, to obtain the value of annual volatility for each type of shares.

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(R_i - \overline{R})}{2}}$$

It should be noted that some historical data for stocks with some interruptions in trading were problematic in estimating volatility, where the value of the standard deviation increased when we took into account the days of trading off and determined by zero values in the historical price series of shares. Deviation value ignoring interrupts.

**1-4 Data for the option**

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The price of the implementation (k) is the contract price agreed in advance between the parties, where it maintains its fixed value for the life of the option and is published by the Kuwait Stock Exchange on the list of options. The time remaining on the due date, since we chose the primary date and estimated number of days to the year, i.e the number of days of the period divided by the number of days of the year.

**1-5 The Black-Scholes model**

The Black-Scholes model is the benchmark model; it was presented by Black Fisher and Myron Scholes. It is a reference and fundamental solution to options assessments and is widely used on most stock exchanges because it is flexible and easily applicable. It is a mathematical formula designed to give a price of an option as a function of certain variables. (A. Shinde and K.Takale, 2012)

The story of this model began in 1900 with a doctoral dissertation when Louis Bachelier gave an analytical valuation formula for options using an arithmetic Brownian motion which is very important to capture movements in stock prices which rise and fall due to unforeseen circumstances(K.Takale, 2012), and a normal distribution for share returns. He obtained the following formula for the valuation of a European call option on a non-dividend paying stock. (Bellalah et al, 1998)

$$C(S,T) = SN(\frac{S-K}{\sigma\sqrt{T}}) - KN(\frac{S-K}{\sigma\sqrt{T}}) + \sigma\sqrt{T}_n(\frac{S-K}{\sigma\sqrt{T}})$$

In the first time B-S present a simple application to get a portfolio without risk, contain one asset without risk and the rest with risk. The mathematical model explains that the asset prices follow a geometrical Brownian process, so they represented again the idea of Luis Bachelier in order to analyze the dynamical prices, in another word the stochastic differential equation: (J. Hamon, 2004)

$$\frac{dS_t}{S_t} = \mu dt + \sigma d\omega t$$

We assume that we have this probability: $(\Omega, f, (f_t), p)$

$$f_0 = \{\phi, \Omega\}\; f_1 \leq f_2 \leq \dots\dots\; f_T\, T \prec \infty$$

is the filtration of generalized geometric Brownian process $\omega t$, The model which determines the growth of prices in the continuous time with a risky asset. We assume the growth on $S_t^0$ follow the differential equation: (Denada. P, 2002)

$$ds_t^o = rs_t^o dt \qquad S_0^0 = 1 \qquad \text{With:} \quad t \geq 0 \qquad ds_t^o = e^{rt}$$

We assume that the growth of asset prices follows the stochastic differntial equation:

$$dS_t = S_t(\mu dt + \sigma d\omega t)\; S_0 \succ 0$$

**1-5-1 The B-S model assumptions :**

- The short term interest is constant;
- The stock price follow the random walk in continuous time with constant variance and homogeneous;
- There is no dividends pays on stocks or other distributions;

- The option is European type;
- There are no transaction costs;
- The distribution of possible stock prices at the end of any finite interval is log-normal ( Black. F and Sholes. M, 1973)

The Black –Sholes formula for the European options (Dalbarade. J, 2005)

$$C - P = S - ke^{-rt}$$

$$P = C - S - ke^{-rt}$$

$$C = S.N(d_1) - ke^{-rt}.N(d_2) - S + k^{-rt}$$

$$P = ke^{-rt}\left[1 - N(d_2)\right] - S\left[1 - N(d_1)\right]$$

So the put option formula is: $P = ke^{-rt}.N(-d_2) - S.N(-d_1)$

Where: $N(-x) = 1 - N(x)$

And : $$d_1 = \frac{\ln(\frac{s}{k}) + (r + 0.5\sigma^2)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

**1-6 Monte Carlo Simulation method**

Monte Carlo Simulation method can be applied for the European option, but can’t apply for the American option style; through simulating the possible paths for a stock price during the life of option from “t” to “T”.

**Generating the stock price using Monte Carlo Simulation**

The stock price in this method follows approximately a Geometric Brownian Motion, random walk, the equation bellow represents the generation of the stock price:

$$S_{(t_J+1)} = S_{(t_J)} * e^{\left[(r-0,5\sigma^2)*\sqrt{\Delta}+\sigma*\sqrt{\Delta}\in_J+1\right]}$$

With: $S_{(t_J)}$ is the initial stock price, and $\in_J +1$ is the IID N (0, 1).

The simulation of the option value based on the present value of the average of payoff:

call option $Max = \left[S - K;0\right]$

put option $Max = \left[K - S;0\right]$

The present value given by the following formula:(Crack. C, 2009)

$$PV = Average * e^{-r*t}$$

**IV- Results and discussion :**

In order to test the existence of the effect of the Black-Sholes model and the Monte Carlo Simulation method on predicting the current prices we will show the descriptive statistics of both models in different time to maturities (6 months, 9 months and one year), after that we will show the estimation results which will appear the ability of both models to predicting the current prices.

The table 01 shows the descriptive statistics of the current and theoretical prices of call options and their characteristics, in three different times to maturities. The standard deviation indicates a higher fluctuation in their prices in the period of one year than the other maturities, while the Black-Sholes prices show a high volatility comparatively by the Monte Carlo Simulation and in the same period. A small deviation have appeared in the period of 6 months from the mean value, when the Monte

Carlo Simulation prices has a lower fluctuation comparatively by the current prices, followed by the Black-Sholes. In the period of 9 months there also a small derivation from the mean of the current prices, but with a higher fluctuation in the Black-Sholes model. The Skewness is positive and different to zero that indicates a right tail and non-normal distribution of prices, which confirmed by the Kurtosis that is different to 3.

Table 02 shows the relationship between the current price and the theoretical prices under three different times to maturities, using the Least Ordinary Square (OLS), Regression Analysis in order to examine the effect of each model (Black-Sholes the Monte Carlo Simulation method) on the current price, the estimation results highlights that the theoretical prices of both models in the time of 6 months to maturity not significant at 1%, 5%, 10% level, to predicting the current prices, while the coefficient of the B-S and the Monte Carlo Simulation models show a negative/positive relationship with the current price respectively; the Adjusted-R is nearly to 0,28 that means only 28% of the prediction of the current prices can be explained by the theoretical prices, and 72% of the variation explained to other factors, the model was accepted depending on Fisher probability.

The estimation results for testing the relationship between the current price and the theoretical prices under 9 months time to maturity, using the Least Ordinary Square (OLS), Regression Analysis and the two models (Black-Sholes the Monte Carlo Simulation method) the outputs of estimation indicates that the theoretical prices of both models in the 9 months time to maturity have a significance at 1%, 5%, 10% level, to predicting the current prices, while the coefficient of the B-S and the Monte Carlo Simulation models appear the same relationship a negative/positive with the current price respectively; the both models explain the current prices with 0.60 which indicated by the Adjusted-R that means only 60% of the prediction of the current prices can be explained by the theoretical prices, and 40% of the variation explained to other factors, the model was accepted depending on Fisher probability at 1%, 5%, 10% level.

Table 03 shows the relationship between the current price and the theoretical prices under one year time to maturity, after the estimation the outputs highlights that the theoretical prices of the Black-Sholes model in one year time to maturity have a significance at 1%, 5%, 10% level, , and a positive relationship to predicting the current prices . The Monte Carlo Simulation method appears a negative relationship with the current price and it is not significant; the both models explain the current prices with 0.63which indicated by the Adjusted-R that means only 63% of the prediction of the current prices can be explained by the theoretical prices, and 37% of the variation explained by other factors, the model was accepted depending on Fisher probability at 1%, 5%, 10% level.

The figures emphasize the numerical results of the Greek letters, wherein we arrange the values of the parameter of sensibility depending on their indicators; Delta with stock prices, Gamma represent the sensibility of the delta on the stock prices changing, Vega depending on the return volatility, Theta with the time to maturity and Rho arranged depending on the risk-free rate using R program, We selected three times to maturity for this presentation: (6 months, 9 months one year, during the period of study which gave the next figures:

The figure 3 above presents the Five Greek letters; Delta, Gamma, Vega, Theta and Rho in order to analyze the situation of the call option contact under three different time to maturity 5 months, one year and two years; Delta values range between 0.39 and 0.02, this values indicate the possibility of the execution of the contract is lower and the change of 1% on the stock price leads to the change in the call option value between 39% and 2%, Gamma value range between 0.24and 0.0001 means that the delta is efficient to take the decision of the execution or not of the contract. Vega value range between 0.11 and 3.19 that means when the fluctuation of the returns is higher the value of the put/call option will be with higher depending on the volatility level. Theta ranges between -0.8 and -1.03, the last parameter Rho range between 0.003 and 7.98.

The figure 4 above shows the Greek letters of the period of 9 months; Delta values range between 0.40 and 0.06, this values indicate the possibility of the execution of the contract is higher than the first period, when the change of 1% on the stock price leads to the change in the call option value between 40% and 6%, Gamma value range between 0.19and 0.001 means that the stock price is lower than the strike price. Vega value ranges between 6.05 and 0.98 that means the change in the volatility by 1% leads to the change on the option price by the value of Vega. Theta ranges between -0.84 and -5.56, the last parameter Rho range between 0.01 and 1.7.

For the maturity of one year the result shows that, the change on stock price by 1% leads to the change on call option value by 0.01% and 0.39% that means it is necessary to buy between 9% and 39% shares for each call option contract, whereas the gamma value range between 0.0016 and 0.15 means that the change on the stock price by 1% leads to the change on delta by the change of gamma value. Vega value ranges between 0.9 and 7.42 that means the change in the volatility by 1% leads to the change on the option price by the value of Vega. Theta ranges between -0.31 and -5.33, the last parameter Rho range between 0.04 and 1.92.

## V- Conclusion:

In this investigation we examine the potency of the B-S model and Monte Carlo Simulation method for pricing the call option contracts type on Kuwait stock exchange for a simple of 20 companies in different sectors during 26/12/2013 and 08/05/2014 with daily data. We found that the Black-Scholes model was not able to evaluate options, when the volatility is higher which is appeared in the descriptive statistics results, in order to know the effect of the theoretical prices on the current price we use the Regression analysis (OLS).

The estimation result indicated that there is a big effect on the markets prices by the theoretical prices which is clear by the R-adjusted 66% in the period of 9 months with significance at 1%, 5%, and 10% level. While the first period (6 months) showed that the both model are insignificance with a small level of derivation of the theoretical prices from the mean of the current prices and the negative/positive relationship of the two models B-S and MCS respectively. The last period (One year) indicates that the Black-Sholes model is outperform than the Monte Carlo Simulation method with a small level of volatility 21%, and a positive relationship to predicting the current prices which explain the first finding that the Black-Sholes model is not perform on higher level of volatility. While the Monte Carlo Simulation method is not perform in the period of the one year because of the augmentation on the level of volatility.

In order to analyze the options positions we calculated the parameters of sensibility, which indicated the possibility of the execution of the call option is near to At-the money with a value of 40% which is improved by the delta value, that means there is a call parity between the stock price and the strike price, which put the holder in uncertainty position to execute or not, in other word the possibility of the execute or not execute is equivalent at the settlement date.

## - Appendices:

**Table (1): Descriptive Statistics of Market Price and Theoretical Prices of Option**

| | Mean | Std. Dev | Skewness | kurtosis |
|---|---|---|---|---|
| | | 6 months | | |
| Current prices | 10.88045 | 21.66788 | 2.660774 | 8.824603 |
| B-S prices | 17.24152 | 31.57210 | 1.817234 | 4.542244 |
| MCS prices | 11.86316 | 23.58973 | 2.136296 | 6.235892 |
| | | 9 months | | |
| Current prices | 15.55591 | 27.78826 | 1.950436 | 5.359912 |
| B-S prices | 21.88993 | 40.52979 | 1.923711 | 5.106726 |
| MCS prices | 17.54158 | 33.96156 | 1.925841 | 5.200614 |
| | | 1 year | | |
| Current prices | 22.20721 | 36.57602 | 1.485599 | 3.409204 |
| B-S prices | 25.89938 | 48.32228 | 2.006139 | 5.506381 |
| MCS prices | 18.46632 | 42.45896 | 2.787366 | 10.01497 |

**The source : Authors.**

**Table (02): Estimation of the current price of call options on the theoretical prices (6moths)**

| | Coefficient | Std. Dev | T. statistic | P. value |
|---|---|---|---|---|
| Constant | 5.238919 | 5.154255 | 1.016426 | 0.3246 |
| B-S | -0.029301 | 0.457809 | -0.064003 | 0.9498 |
| MCS | 0.518136 | 0.612724 | 0.845627 | 0.4102 |
| R- Squared | 0.274377 | F. Statistic | 3.025003 | |
| Adj- R | 0.183674 | P. Value | 0.076858 | |

**The source : Authors.**

**Table (03): Estimation of the current price of call options on the theoretical prices (9 moths)**

| | Coefficient | Std. Dev | T. statistic | P. value |
|---|---|---|---|---|
| Constant | 5.493841 | 4.025470 | 1.364770 | 0.1901 |
| B-S | -0.696844 | 0.330066 | -2.111226 | 0.0499 |
| MCS | 1.441478 | 0.394070 | 3.657928 | 0.0019 |
| R- Squared | 0.696647 | F. Statistic | 19.52014 | |
| Adj- R | 0.660958 | P. Value | 0.000039 | |

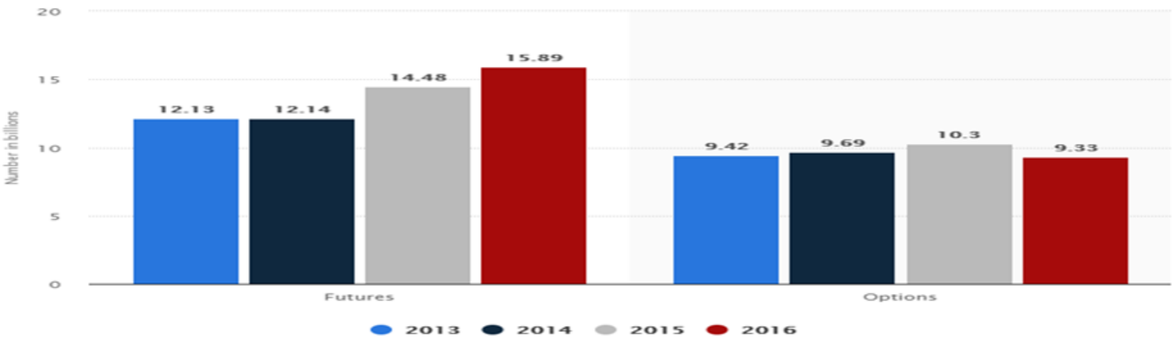
**The source : Authors.**

**Table (04) : Estimation of the current price of call options on the theoretical prices (1year)**

| | Coefficient | Std. Dev | T. statistic | P. value |
|---|---|---|---|---|
| Constant | 6.016945 | 5.528864 | 1.088279 | 0.2917 |
| B-S | 0.647498 | 0.212534 | 3.046554 | 0.0073 |
| MCS | -0.037041 | 0.242514 | -0.152737 | 0.8804 |
| R- Squared | 0.669877 | F. Statistic | 17.24794 | |
| Adj- R | 0.631038 | P. Value | 0.000081 | |

**The source : Authors.**

**Figure (01): number of futures and options contracts traded worldwide from 2013 to 2016 (in Billions)**



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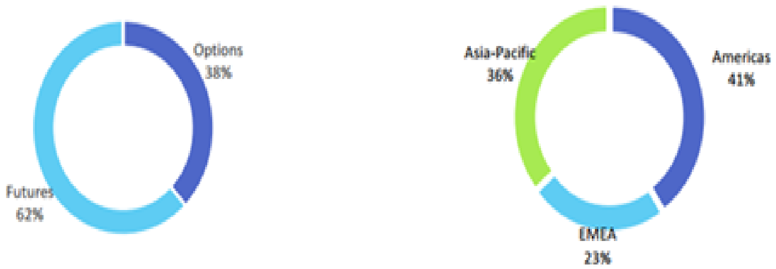
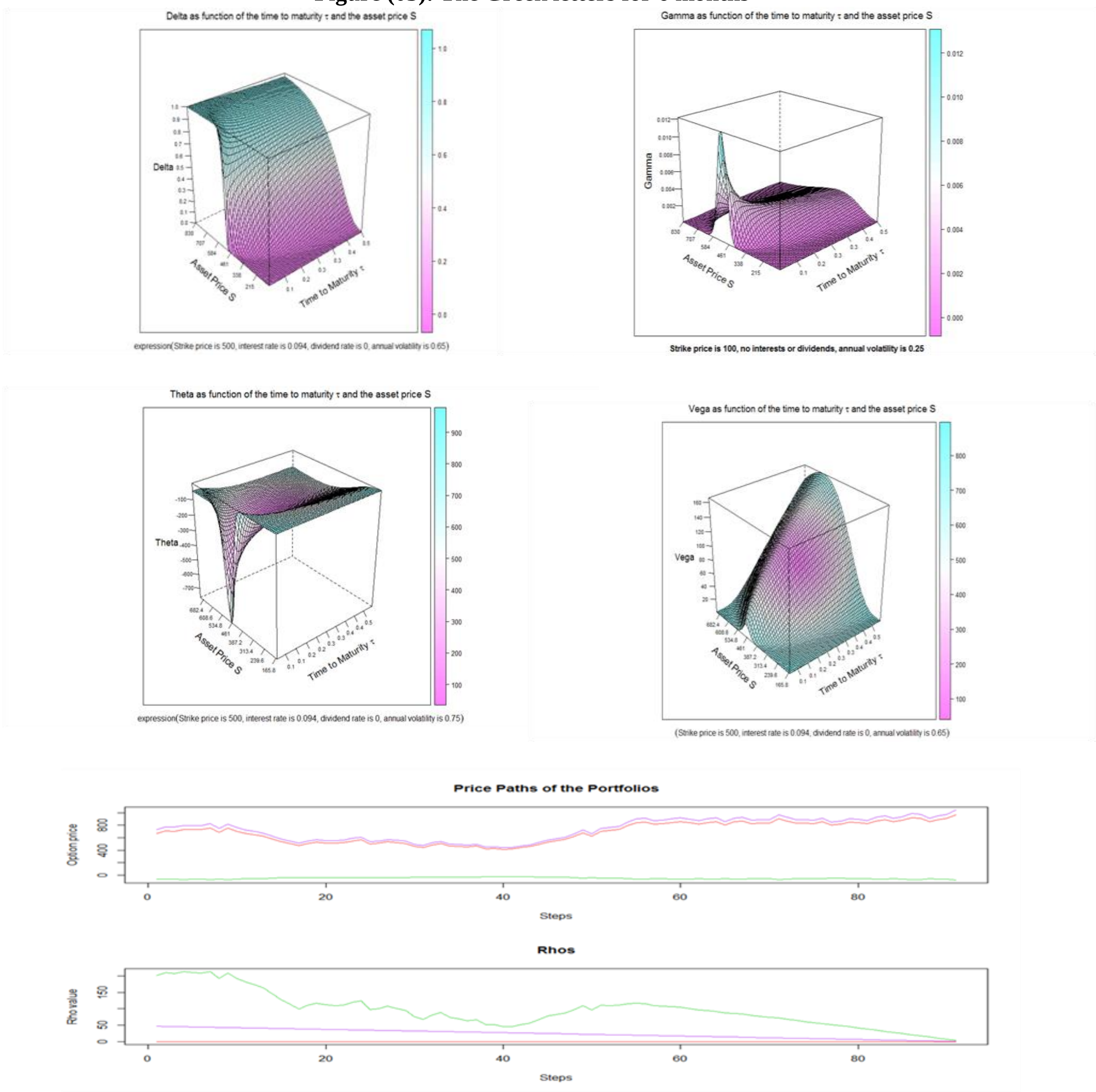
**The source: www.statista.com**

**Figure** (02): **breakdown by product and region**



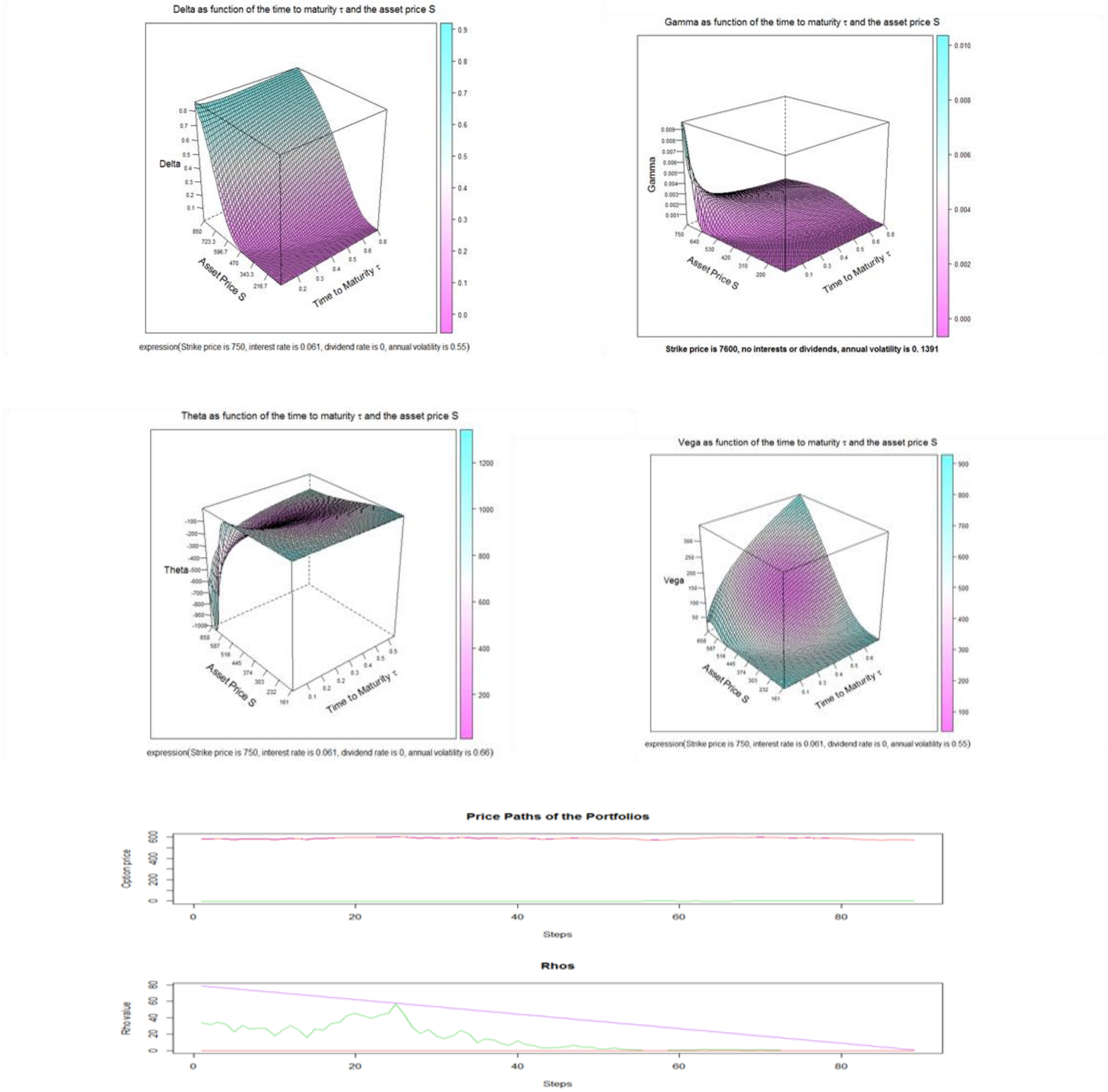

**The source: World Federation of Exchange, IOMA, 2016 Derivatives report.**

**Figure (03): The Greek letters for 6 months**



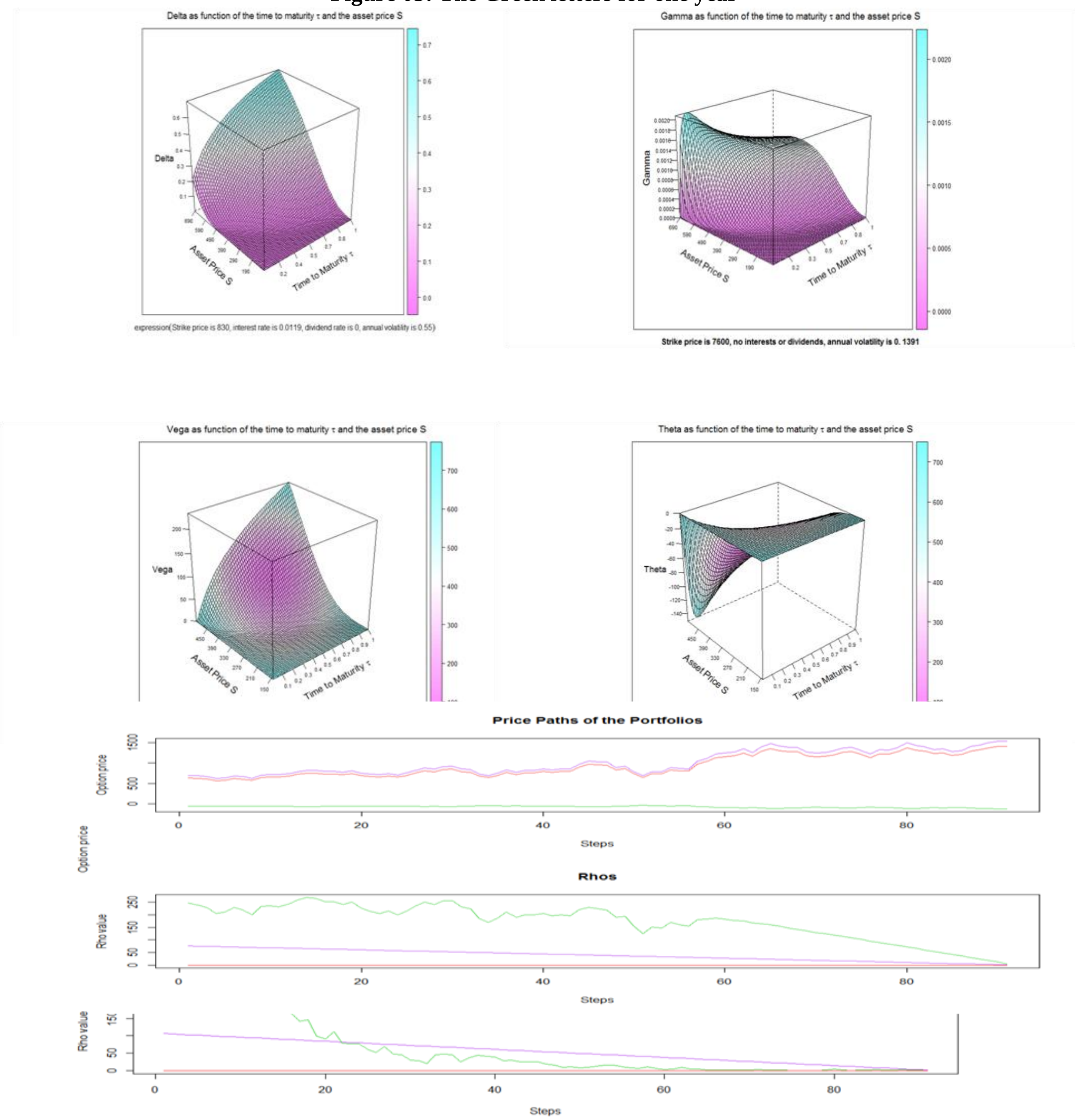

**The source : Authors.**

**Figure 04: The Greek letters for 9 months**




**The source : Authors.**

**Figure 05: The Greek letters for one year**




**The source : Authors.**

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