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Pricing of Call Options According to the Black Model

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Abstract: The global economy is entering a new, more complex phase, which is called the era of globalization - loaded and affected by a set of global financial and economic variables that had, still and will continue to have a radical and profound impact on the performance and work of financial institutions of all kinds and classification's, from the perspective that financial institutions play a vital role in economic activity. . In addition, the multiplicity of activities and works of financial institutions made them face modern risks that they did not face before. The risk of stock price fluctuations and credit risk is still a concern of every financial institution; As it is closely related to the main function of the majority of financial institutions, which is credit, despite the economic reforms and protocols established by international bodies; However, the work of these institutions is still exposed to the risk of fluctuations in the price of their shares. On this basis, the study came to shed light on the most prominent tools for managing stock price risk and hedging it, which are options contracts, and revealing their hedging effectiveness in terms of risk and return for the user of these contracts in hedging the risk of stock price fluctuations.

Keywords: options - black – stocks.

Introduction

The financial markets are one of the important markets in economic life locally, regionally and globally, as they play a major role in providing financing to institutions, individual investors, and even countries that suffer from deficits in their budgets. It has become necessary for those in charge of the global financial industry to study these markets and develop solutions to all the problems they suffer from. In recent years, especially the years that witnessed many financial crises, there was a spread of the phenomenon of bankruptcy of some banks and institutions, which resulted in the emergence of the risk of fluctuations in the price of their shares, or what is sometimes called the risk of the price of the underlying asset. This risk is one of the most important risks that harm the financial markets and affect them greatly. At that time, financial engineering reached the invention of financial tools specialized in dealing with such a risk, as well as other risks, which are "derivatives". The most prominent type of derivatives traded at the time was options contracts, and the use of these contracts is to hedge against the risk of price fluctuations resulting from a particular event. The first appearance of these contracts was in the early seventies, then their use increased over time. The options contract allows the contract participants to hedge the risk when it is believed that the price of the underlying asset will rise or fall.

The important question is: Are these tools effective and flexible in hedging price risk? Are there other financial instruments that can rise to these contracts in terms of effectiveness and flexibility? From this point of view, our study came to discover the effectiveness of pricing options contracts and their role in

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hedging price risk, and to show the extent to which the European edited options outperform them in terms of the effectiveness of hedging.

Options

The option is one of the tools that investors use to hedge the risks resulting from the change in the prices of assets, whether in-kind or financial. It is used with the aim of achieving profits or at least avoiding losses, and therefore the option can be defined as (a contract between two parties that gives the investing party (the option buyer) the right to buy or sell a certain number of the agreed-upon asset to the other party who is obligated to implement on a specific date in return for a commission Agreed.(vora,2002:12)

If the contract gives the option buyer the right to buy or sell a financial asset (shares, bonds, currencies) from another party (the issuer or seller of the option) at a price agreed upon in advance, provided that it is executed at any later time during the contract period. This option is called the American option.

But if the execution is on the date specified for the expiry of the contract without the ability to be executed during the term of the contract, then this option is called the European option. (Brealey & myer, 1991:109)

First: the most important characteristics of the options

There is a set of characteristics and advantages that characterize the options, which can be summarized as follows :- (shehab, 1996:78)

1. The buyer of the option has complete freedom to implement or not to implement the contract, as it is a right and not an obligation, so it is called the option. However, it remains binding on the other party (the writer or seller of the option) in the event that the buyer implements it.
2. In the case of dealing with an option on shares, there is no relationship between the company issuing the shares and the parties to the option contract.
3. The price agreed upon and specified in the option contract is called the contract price or the execution price. As for the market price, it is the price at which the asset (the stock) is sold in the current market at the time of the contract execution.
4. The option buyer pays a certain non-refundable amount in the form of a specified premium to the other party (the writer or seller of the option). This relationship is not related to the option implementation or non-implementation of the option by the buyer, but rather it is in exchange for the seller's obligation to implement the contract.
5. The option contract includes the following components: (kane & marcus, 1986:65)

- The two parties to the contract (seller - buyer).
- Date of contract .
- The type of the asset subject to the contract.
- Execution date, whether the option is European or American, each according to its system.
- The value of the premium paid by the buyer to the option writer (seller), which usually depends on the market value of the asset, the execution price and interest rates.

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Call Option

The contract is a purchase option when it gives the first party the buyer the right to buy (if he wants to implement the contract) from the other party that issued the option a specific asset in a specific quantity and at a specific price and on a specific date (or during a certain period of time) according to the agreement. This is in return for the other party from the option buyer receiving a certain premium determined by the terms of the contract. Thus, the option writer becomes obligated to sell the underlying asset to the first buying party if the buyer wishes to implement the contract (rodicffe, 1994:169).

Analyzing the position of the buyer and seller of the Call option

As it is possible to analyze the situation of the buyer of a stock option versus the seller of this option, and through the analysis the following becomes clear :- (hull, 1993:81)

1. The buyer has a strong motive to contract to buy the shares, as his expectations indicate an increase in the market value of the share during the contracting period, and he can face one of the following two situations:

- Loss in the event that his expectations regarding the rise in the market value of the share price during the contracting period are not fulfilled, and he will refrain from execution, as he prefers to buy the stock at the low price from the market, and his losses are determined only from the value of the premium he paid for the option contract.

  Profit in the event that his expectations regarding the increase in the market value of the share are realized during the contract period, then he exercises his right and requests execution, and his profits are represented in the difference between the market value of the share at the time of implementing the option and the value of the share in the option contract minus the premium paid to the option writer.

2. The seller (the option writer) has a strong motive when contracting, as his expectations indicate a decrease in the market value of the stock during the contracting period, and he may face one of the following two situations: (dubofsky, 1992:114)

- Loss in the event that his expectations regarding the stock price drop during the contracting period are not fulfilled, and upon the buyer's request for execution, his losses are represented in the difference between the value of the stock in the option contract and the stock's market value. This loss is reduced by the amount of the premium that he receives.
- Profit in the event that his expectations regarding the stock price drop during the contracting period are realized, the buyer will not ask for execution, and the seller's profits are represented in the amount of the premium he gets from the buyer.

Put Option

The contract is an option to sell if it gives the first party, the buyer, the right to sell (if he so desires) to the second party issuing the contract, a specific asset in a specific quantity, a specific price, and a known date (or during an agreed period of time). This is in return for the option writer receiving a certain premium from the buyer, and thus the option writer becomes obligated to implement the contract if the option buyer wishes to implement it. (chance,1998:239)

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Analyzing the position of the buyer and seller of Put Option

1. The buyer has a strong motive when contracting, as his expectations indicate a decrease in the market value of the stock during the contracting period, and he can face one of the following two situations:- (dale, 1997:54)

- Loss in the event that his expectations regarding the stock price drop during the contract period are not fulfilled, and he will refrain from implementation, preferring to sell the stock in the market. His losses are represented in the amount of the premium he paid to the option writer.

  Profit in the event that his expectations regarding the share price decrease during the contract period are fulfilled, and then he exercises his right and requests execution, and his profits are represented in the difference between the purchase value of the share at the time of contracting and specified in the contract and the market value of the share at the time of execution, minus the premium paid to the option writer.

2. The seller has a strong motive when contracting, as his expectations indicate an increase in the market value of the stock during the contracting period, and he can face one of the following two situations: (samets, 1994:91)

- Loss in the event that his expectations regarding the share price drop during the contract period are not fulfilled, and with the buyer's request for execution, his losses are represented in the difference between the value of the share in the option contract and the market value of the share on the date of execution, and these losses decrease by the amount of the premium.
- Profit in the event that his expectations regarding the stock price drop during the contract period are fulfilled, and the buyer did not request execution, preferring to sell the stock in the market, and the seller's profits are represented in the amount of the premium received from the buyer.

Option contract pricing

The process of option pricing consists of the option premium and the factors that affect the option premium, then a discussion of the Black option pricing model, according to which the options will be priced.

Option Premium Components

The option premium is defined as the cost of purchasing the option, that is, it is the price that the option buyer pays to the editor for the purpose of owning the right to buy or sell the underlying asset of the option (Levy & Post, 2005:651). The option and its seller, and it is determined by supply and demand deals in the options market, in other words, if the seller and buyer of a particular option do not agree on a specific price, the option cannot be traded (Kaeppel, 2002:47). There are two components of the option premium, the intrinsic value.) and time value.) The option premium can be expressed by the following relationship (Fincham, et.al., 2005:3):

Option premium = intrinsic value + time value

The intrinsic value is the return that can be achieved if the option is executed directly. As it is a measure of the cash flow that the investor receives from executing the option, which is within the possibility of making a profit (while ignoring the transaction costs and the option premium). The intrinsic value of the purchase option is either zero or is calculated by the market credit spread minus the execution difference for the underlying asset, whichever is greater. As for the intrinsic value of the put option, it is either equal to zero or is calculated by the execution difference minus the market difference for the underlying

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asset, whichever is greater. These relationships are expressed as follows (Smart & Megginson, 2009:772):

Intrinsic value of the call option = market spread – execution spread

Intrinsic value of the put option = Execution difference - Market spread

The intrinsic value of the option is the economic value of the option in the event of implementation, and other than that, and when there is no positive economic value that results from the implementation of the option directly, then it is said that the intrinsic value is zero. When the option has an intrinsic value, it is said to be "in the money" (In The Money), and when the execution difference for the purchase (sell) option exceeds (below) the market difference for the asset contract, then the option to buy (sell) is said to be "outside the possibility of making a profit" ((Out The Money and it will not have an intrinsic value. As for the option whose execution difference is equal to the market difference of the contract, it is said about it "at the possibility of making a profit." Because of the inability to profit from the implementation of those options (Fabozzi & Peterson, 2003: 96)

Pricing of options contracts using the Black Model

The process of pricing the call option goes through a series of steps, which are as follows:

- Calculate (d1) using d1 = $\mathbf{d_1 = [\ln (R_0/R_K) + \sigma^2 T/2]/\sigma\sqrt{T}}$
- Calculate (d2) using d2 = $\mathbf{d_2 = [\ln (R_0/R_K) - \sigma^2 T/2]/\sigma\sqrt{T}}$
- extract the value of the cumulative normal distribution function for (d1) and (d2) from the normal distribution table (Appendix A).
- Calculate Volatility Using $\boldsymbol{\sigma} = \sqrt{\sum \frac{(Xt-X)^2}{N-1}}$
- Pricing the put option using $\mathbf{C^E = LA[R_0N(d_1) - R_KN(d_2)]}$
- Extract the delta value with $\mathbf{\Delta C = e^{-rt}N(d1)}$
- Extract the gamma value from $\boldsymbol{\Gamma} = \frac{e^{-d_1^2/2}}{R_0\sigma\sqrt{2\pi T}}$
- Extract the theta value by $\boldsymbol{\Theta c} = -\frac{R_0\sigma e^{-d_1^2/2}}{2\sqrt{2\pi T}} - r_c R_k e^{-r_{cT}} N(d_2)$
- Extract the value of the vika by $\mathbf{v} = \frac{R_0\sqrt{Te^{-d_1^2/2}}}{\sqrt{2\pi}}$
- Extract the value of Rho through $\mathbf{Rho\ c = R_k T e^{-rT} N(d_2)}$

As for the pricing of the put option, it goes through the same series of steps adopted in the pricing of the purchase option, using equations

- $\mathbf{P^E = LA[R_KN(-d_2) - R_0N(-d_1)]}$
- $\mathbf{\Delta p = e^{-rt}[N(d_1)-1]}$
- $\boldsymbol{\Gamma} = \frac{e^{-d_1^2/2}}{R_0\sigma\sqrt{2\pi T}}$

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- $\mathbf{\Theta p = -\frac{R_0 \sigma e^{-d_1^2/2}}{2\sqrt{2\pi T}} + r_c R_k e^{-r_c T} N(-d_2)}$
- $\mathbf{v = \frac{R_0 \sqrt{T e^{-d_1^2/2}}}{\sqrt{2\pi}}}$
- $\mathbf{Rho\ p = -R_k T e^{-rT} N(-d_2)}$

It is worth noting that the options pricing equation needs five basic inputs, which are the factors affecting the option price, which are as follows:

1. Base Asset Contract Spread (R_0):

   The base contract for the options of interest in pricing is the price of the base asset, so the daily settlement spreads for this contract will be adopted throughout the studied period.

2. Option Execution Difference (R_K):

   One execution difference will be adopted for the two options of buying and selling, by using the first annual difference of the base asset contract on the first trading day that could be obtained, which amounts to (120) basis points. This will make it possible to price these two options in light of all possible possibilities for the possibility of making a profit.

3. Time Remaining to Maturity (T):

   The time remaining until the option's maturity is calculated as a percentage, the numerator of which represents the number of days remaining until the day of maturity and the denominator is the number of days in the year (365). This means that time is calculated as a percentage of the year. For example, the number of days remaining until the option maturity is (185) days and therefore (T=0.507) on this day, and so on for the rest of the contract days.

Volatility with changes in the relative spread of the underlying asset contract (σ):

The volatility used in Black's option pricing model is the annual volatility of changes in the relative spreads of the underlying asset contracts. Black's model assumes that the annual volatility remains constant, and since the data used are daily data, the standard deviation extracted from the equation $\boldsymbol{\sigma = \sqrt{\sum \frac{(Xt - X)^2}{N-1}}}$ will be multiplied by the root of √25.

Risk Free Rate (R_f):

The risk-free interest rate used in Black's option pricing model is the interest rate swap rate. Simple interest rate swap rates are used and then converted to continuously compound interest rates using the equation Rf = ln(1+DR). Black's model assumes that this rate of interest remains constant throughout the life of the contract. Therefore, it will depend on the swap rate for the first studied day, which is (1.115%) and will remain fixed until the maturity of the contract.

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Table of prices and values of Greek terms for the purchase option according to the Black Model.

Day	Call Option Price	Intrinsic Value	Time Value	Dalta	Gamma	Thetta	Viga	Rho
1	25.3795802	**0**	25.379579	0.6161998	0.0060727	-40.19324	28.429733	14.997027
2	25.298592	**0**	25.298586	0.6155741	0.0060895	-40.3036	28.362683	14.926449
3	25.1766781	**0**	25.17668	0.61463	0.006115	-40.47061	28.26164	14.820406
4	24.8491058	**0**	24.849106	0.612079	0.0061843	-40.92488	27.989416	14.536574
5	24.7253099	**0**	24.725314	0.6111096	0.0062108	-41.09867	27.88627	14.429743
6	24.6009938	**0**	24.600995	0.610133	0.0062375	-41.27439	27.782535	14.322694
7	24.4761464	**0**	24.476143	0.6091492	0.0062647	-41.45208	27.678205	14.21543
8	24.3926122	**0**	24.392609	0.6084892	0.0062829	-41.57165	27.608317	14.143799
9	24.0560399	**0**	24.056039	0.6058157	0.0063573	-42.05907	27.326039	13.856307
10	23.9288013	**0**	23.928805	0.6047989	0.0063857	-42.24573	27.219043	13.748097
11	23.8009982	**0**	23.801004	0.6037742	0.0064145	-42.43458	27.111412	13.639666
12	23.6726304	**0**	23.672629	0.6027412	0.0064436	-42.62565	27.003136	13.531016
13	23.543676	**0**	23.543674	0.6017001	0.0064731	-42.81899	26.894211	13.422145
14	20.8548948	**0**	20.8549	0.5719247	0.0068459	-41.84817	25.690903	12.207157
15	20.7282983	**0**	20.728298	0.5707269	0.0068771	-42.0374	25.579777	12.101402

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						2		
16	12.4619861	**0**	12.461986	0.4498306	0.0079904	-34.41331	20.845833	8.3817362
17	16.1956425	**0**	16.195646	0.5106178	0.0075016	-38.78039	23.265142	10.096537
18	16.0783448	**0**	16.078345	0.5091328	0.0075334	-38.94265	23.151728	9.9987471
19	15.7631154	**0**	15.763121	0.5051032	0.0076195	-39.38387	22.845582	9.7372753
20	15.6439912	**0**	15.643988	0.5035651	0.0076525	-39.55261	22.729354	9.6389635
21	19.9056644	**0**	19.90566	0.637636	0.0095424	-83.81622	17.797279	6.5636144
22	19.2187045	**0**	19.218706	0.6347424	0.0098988	-86.92707	17.199644	6.1515165
23	18.9544415	**0**	18.954439	0.6336292	0.0100426	-88.1824	16.969292	5.9959348
24	18.5053094	**0**	18.505314	0.6317369	0.0102963	-90.3962	16.577246	5.7353322
25	18.2303528	**0**	18.230348	0.6305782	0.0104576	-91.80418	16.336888	5.5781764
26	17.4752902	**0**	17.475287	0.627396	0.0109262	-95.89353	15.675559	5.1560994
27	17.281211	**0**	17.281212	0.6265779	0.0110532	-97.00119	15.505277	5.0498831
28	16.9858301	**0**	16.985826	0.6253328	0.0112518	-98.73471	15.245871	4.8900226
29	16.6850693	**0**	16.685067	0.6240647	0.0114612	-100.5617	14.981464	4.7295087
30	25.3795802	**0**	25.379579	0.6161998	0.0060727	-40.19324	28.429733	14.997027
31	25.298592	**0**	25.298586	0.6155741	0.0060895	-40.3036	28.362683	14.926449

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32	25.1766781	**0**	25.17668	0.61463	0.006115	-40.47061	28.26164	14.820406
33	24.8491058	**0**	24.849106	0.612079	0.0061843	-40.92488	27.989416	14.536574
34	24.7253099	**0**	24.725314	0.6111096	0.0062108	-41.09867	27.88627	14.429743
35	24.6009938	**0**	24.600995	0.610133	0.0062375	-41.27439	27.782535	14.322694
36	24.4761464	**0**	24.476143	0.6091492	0.0062647	-41.45208	27.678205	14.21543
37	24.3926122	**0**	24.392609	0.6084892	0.0062829	-41.57165	27.608317	14.143799
38	24.0560399	**0**	24.056039	0.6058157	0.0063573	-42.05907	27.326039	13.856307
39	23.9288013	**0**	23.928805	0.6047989	0.0063857	-42.24573	27.219043	13.748097
40	23.8009982	**0**	23.801004	0.6037742	0.0064145	-42.43458	27.111412	13.639666
41	23.6726304	**0**	23.672629	0.6027412	0.0064436	-42.62565	27.003136	13.531016
42	23.543676	**0**	23.543674	0.6017001	0.0064731	-42.81899	26.894211	13.422145
43	20.8548948	**0**	20.8549	0.5719247	0.0068459	-41.84817	25.690903	12.207157
44	20.7282983	**0**	20.728298	0.5707269	0.0068771	-42.03742	25.579777	12.101402
45	12.4619861	**0**	12.461986	0.4498306	0.0079904	-34.41331	20.845833	8.3817362
46	16.1956425	**0**	16.195646	0.5106178	0.0075016	-38.78039	23.265142	10.096537
47	16.0783448	**0**	16.078345	0.5091328	0.0075334	-	23.15172	9.998747

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						38.94265	8	1
48	15.7631154	**0**	15.763121	0.5051032	0.0076195	-39.38387	22.845582	9.7372753
49	15.6439912	**0**	15.643988	0.5035651	0.0076525	-39.55261	22.729354	9.6389635
50	15.5642872	**0**	15.564283	0.5025315	0.0076747	-39.66611	22.651427	9.5733441
51	11.6902521	**0**	11.690252	0.4368754	0.0082044	-35.32413	19.994383	7.7317927
52	13.3892425	**0**	13.389239	0.4677093	0.0080011	-37.8188	21.194362	8.5031616
53	13.0831791	**0**	13.083177	0.4630556	0.0080892	-38.23087	20.873071	8.2521555
54	19.1173808	**0**	19.117379	0.5550205	0.0072958	-44.57215	24.148531	10.780741
55	18.9825039	**0**	18.982503	0.5536635	0.0073327	-44.79567	24.027219	10.672333
56	18.8469518	**0**	18.846948	0.5522927	0.0073702	-45.02217	23.905062	10.563725
57	18.7107022	**0**	18.710706	0.5509078	0.007408	-45.25174	23.782045	10.454918
58	18.3439531	**0**	18.343954	0.5471433	0.0075118	-45.8794	23.449697	10.163794
59	18.2051021	**0**	18.205107	0.5457037	0.0075516	-46.1208	23.323413	10.054258
60	25.5006527	**0**	25.500652	0.617133	0.0060477	-40.02916	28.529848	15.102714

Conclusions

The option premium consists of two values, namely the intrinsic value and the time value, and this is evident through the intrinsic and time value columns of the purchase option. If the options had no time value at all, the values of all options that are at or outside the possibility of making a profit would be zero. But it is otherwise and as is clear from the positive time values of these options. In addition, when we look at the table, we find that the purchase option on the studied days has no intrinsic value, and the reason for this is due to the movement of the difference in the base asset contract below and above the

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execution difference throughout the studied days. This is what made the purchase option to be within the possibility of making profit sometimes and at other times outside the possibility of making profit throughout the period, and that their bonuses include a time aspect in all the days studied, and their bonuses are very much based on the time aspect. This is another confirmation of the accuracy of Black's model in depicting the components of the underlying asset option premium.

The premium for a put option increases with the spread of the underlying asset and vice versa. This result confirms the direct relationship between the purchase option premium and the asset contract difference, and the inverse relationship between the purchase option premium and the execution difference. This confirms the accuracy of Black's model in depicting the nature of the relationship between the premium of the purchase option and the difference in the underlying asset contract.

The option's profit potential varies during the life of the contract. As it is noted, the option to buy started when the possibility of making a profit and then became outside the possibility of making a profit. This result confirms that the option can fluctuate from one case to another, especially in highly volatile markets such as stock markets.

The temporal decrement in the time value of the option, as is evident through the columns of the time value of the purchase option. In other words, the time value of the call option expires with zeros on the day of maturity and increases as the time moves away from the expiration date. This makes sense because the longer-lived option has a higher probability of moving until it becomes within the possibility of making a profit from the short-lived option. This result confirms the accuracy of Black's model in depicting the fact of the temporal decrease in the time value of the option premium.

There is a correlation between the intrinsic value and the time value of the option. The more and more the option becomes within the possibility of making a profit, the greater its intrinsic value and the lower its time value. This is because the probability of the option achieving more intrinsic value decreases more and more. This result confirms the accuracy of Black's model in depicting the relationship between intrinsic value and time value and their relationship to the possibility of making the option for profit, regardless of the type of this option, whether it is buying or selling.

The more the option becomes within the possibility of making a profit, the greater its premium will be. This result confirms the accuracy of Black's model in embodying the effect of the relationship between the difference in the underlying asset contract and the option execution difference on the premium of this option.

The response of the option premium to changes in the underlying asset contract difference varies during the life of the option contract. Call options that are deeply out of the box have their premium slightly affected by the change in the spread of the underlying asset, and their delta, which is a measure of the relative change in the option price, is close to zero. As for the premium for the purchase option, which is within the possibility of making a profit in depth, the majority of it includes the intrinsic value, and therefore such a premium is strongly linked to the difference in the base asset contract and has a delta close to the correct one. This means that the delta of a buy option increases as the option becomes more and more profitable and decreases as the option becomes out of profit potential. This demonstrates the accuracy of Black's model in determining the value of the option's delta, which reflects the sensitivity of this option's premium to the difference in the underlying asset contract.

The Gamma of the call option reaches its highest levels for options that are close to profit potential and close to maturity. This result confirms the accuracy of Black's model in determining the option's Gamma value, which reflects the sensitivity of the option's delta to the variation of the underlying asset contract.

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The negative sign of theta indicates how much the time value of an option decreases as it approaches the expiration date. As the maturity date approaches, the value of theta increases because the time value of the option decreases more rapidly in the remaining few days of the option's life. The amount of diminishing depends on the status of the option, whether it is within, at or outside the possibility of making a profit, and this result indicates the accuracy of Black's model in determining the value of theta, which measures the sensitivity of the option premium to change in the time remaining to maturity.

Viga for call options is at its maximum value in options that are profitable and have a long time to maturity. As it is clear from the table, the Viga started with a large positive value and gradually decreased during the life of the option contract, approaching zero on the day of maturity. In addition, the positive sign of VIGA indicates the positive relationship between the volatility in the spread of the underlying asset contract and the premium for the two purchase options. This result confirms the accuracy of Black's model in depicting the relationship between volatility and option premium and in determining the value of VIGA, which measures the sensitivity of the option premium to fluctuations in the spread of the underlying asset.

Decreased sensitivity of the underlying asset options premium to changes in the risk-free rate as these contracts approach their maturity date. This is evidenced by the gradual depreciation of RAW in the table. When looking at the table, it becomes clear that there is a direct relationship between the risk-free rate and the premium of the purchase option, and this is evident from the positive sign of the RAW. This result confirms the accuracy of Black's model in depicting the relationship between the risk-free rate and the premium of the underlying asset options, and indicates the accuracy of the model in determining the RAW value, which measures the sensitivity of the option premium to change at the risk-free rate.

The value of any option, whether it is a buy option or a put option, is not less than zero in any case, regardless of its type and the possibility of making a profit. This is because the option is a tool with limited liability, meaning that the liability of the option holder does not exceed the limits of the premium paid, as it is the maximum that he can lose. As is clear from the table, the option varied in the possibility of making a profit during the studied period, but it did not happen that the option premium became negative (less than zero) on any of the studied days of the life of these contracts. It is also noted that the premium for any option is not less than its intrinsic value, that is, it is greater than or equal to its intrinsic value. This is evident by comparing the column numbers of the total option premium and its intrinsic value for both the buy and sell options. Also, the price of call options did not exceed the spread of the underlying asset contract. This result demonstrates the accuracy of Black's model in depicting options price limits.

All the previous results collectively confirm one fact, which is that Black's model is accurate in pricing European options contracts written on the underlying asset.

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