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Efficient Method to Extract New Parameters of Index Options by KOWA system

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Abstract

In these days, the importance of money is increased. The wise investors want to have an useful tool which provides overall information in Option market. The KOWA system is the useful tool to provide this overall information. It is Ko's Option Windows Agent that provides overall information from fragmentary data exported by HTS.

Conventionally Option Greeks are used for position traders. But they have used the fragmentary Greeks such as delta, gamma, theta, etc. This paper suggests the new parameters extracted by overall view. Those are omega, mu and sigma. It can be extracted by KOWA system on real time. And the methods to compute the new Greeks are also inspected.

The examples are appended which are based on real data of Korean Option market. These new Greeks might be very useful to the wise investors. And KOWA system might be a very useful tool.

Keywords: *Index Options, Option Greeks, KOWA System*

1. Introduction

Nowadays most people live in capitalistic economy. There are three economic players - government, businesses and households. The businesses change the world and it is also changed with time. The value of businesses can be traded on stock market that is called the flower of capitalism. Institutions want to avoid risk when they hold stocks. So derivative market exists inevitably for risk hedging. In 2011 Korean Option market is the first derivative market in the world.

There are three kinds of investors in Korean Option market - foreigners, domestic institutions and individuals. These groups have clear tendency of trading. Foreigners like to trade ATM. Domestic institutions usually have OTM short positions. And individuals have tendency to buy OTM like horse racing. Who is the wise investor? The wise investor must be the one who gets money and feels comfortable.

Therefore anyone who wants to invest for participating on changing world must be a wise investor. The KOWA system can help these wise investors [1]. This system provides overall information of full spread options. This information is extracted by several fragmentary data which are exported by HTS. The procedure to get the overall information is done automatically by this system.

This paper suggests new parameters. The Option Greeks are very important to the investors who have composite Option positions. But these data belong to separate exercise price. So it is also fragmentary information. The new parameters suggested by this paper are information by overall view.

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Furthermore the methods to extract these new parameters are inspected. There are two kinds of methods. One is an exhaust search method. And the other is an efficient one. These methods are explained below.

Finally, Examples are appended. The real Option data is used for these examples. These parameters are very useful to the wise investors. And KOWA system must be a powerful tool among the wise investors.

2. KOWA System

Ko suggests the Windows program to extract overall information by full spread Options [1]. This program is called KOWA - Ko's Option Windows Agent. KOWA system is operated automatically and provides the overall information on real time.

This system has message dispatch control to export fragmentary information to excel files. It manages Excel VBA codes and supports Access database to merge these fragmentary information. After all the overall information are provided by tables or charts.

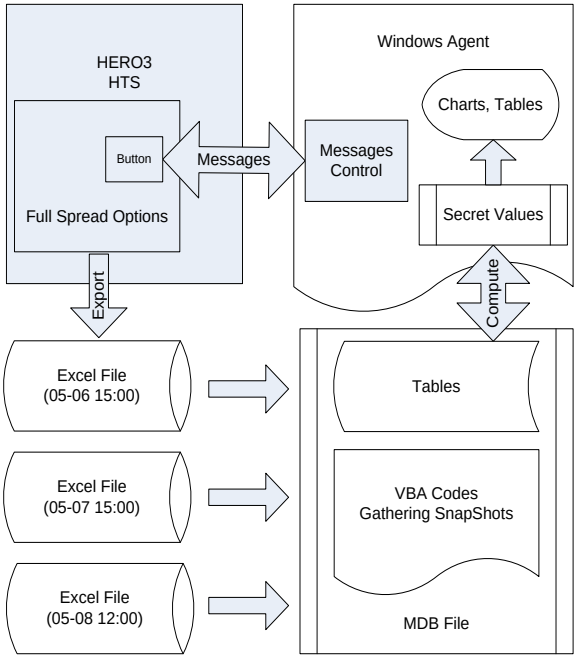

Figure 1. Structure of KOWA System

2.1. Index Range

Option items are divided by Call and Put. Besides, there are many Option items on derivative market. These Option items firstly divided into Call and Put. And then these are divided into several exercise prices near current KOSPI200 index. The market guarantees at least 13 items each Call and Put. The displacement of exercise price is 2.5. So 6 times 2.5 is 15. If current index is 265, the biggest exercise price is 270, and the smallest exercise price is 240. Trading on ATM, at the money is efficient. ITM, in the money, there is a shortage of liquidity in markets. OTM, out of the money, there is an abundance of liquidity in markets and the price is cheaper.

Figure 2 shows full index range. If the close index of yesterday is 265.53, ATM today must be 265. Consequently 6 OTMs above and 6 OTMs below are determined.

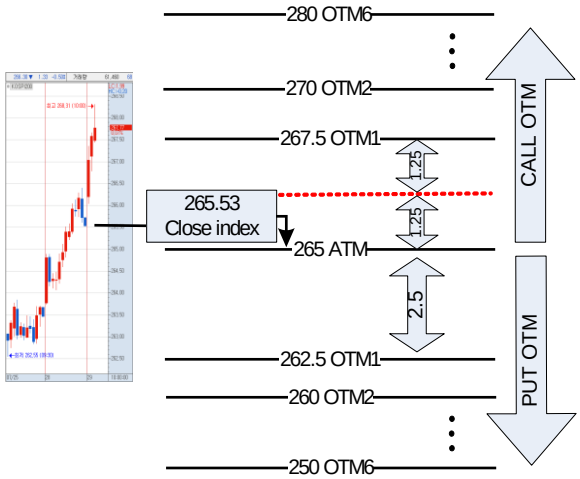

Figure 2. Full Index Range

Individual Option item looks like trading independently. But whole Option items are actually moved as one. No one can cheat the whole Option items. The wealthy black conspirator can move only individual Option item. Therefore the overall view information could tell the truth of market.

2.2. Secret Values

Ko suggests that theta is one of the secret values which can be extracted by KOWA system [1]. Theta is one of Option Greeks. And it is referred as one day decrement of time value premium.

Figure 3 shows these Theta curves. OTM has small magnitude and ATM has the biggest magnitude. High magnitude means high profit and low winning probability. And low magnitude means low profit and high winning probability. So the checked region is safe in one day for short position.

Current month theta curve cross over 267.5 and next month theta curve cross over 270. The region overlapped over 270 is safe within a day because of the pressure. The wise investors can enter short position in these regions by high winning probability.

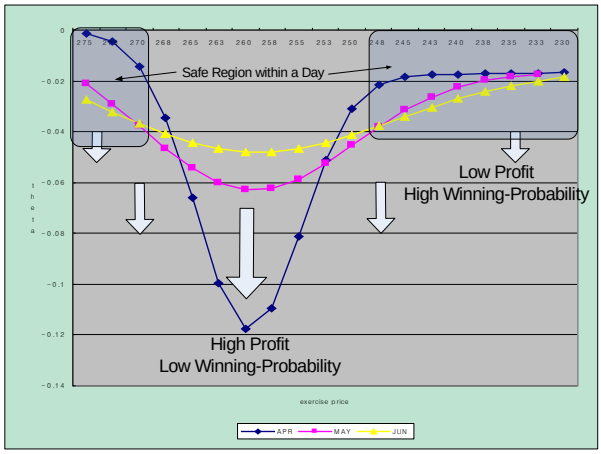

Figure 3. Secret Values from KOWA

3. New Parameters

3.1. Overall View

Overall view is very important to the wise investors. But conventional Option Greeks are fragmentary. These are calculated by an individual Option item. KOWA system can make overall view parameters.

Figure 4 shows conventional parameters and new parameters. The conventional parameters are calculated by individual Option item. But the new parameters are extracted by KOWA system.

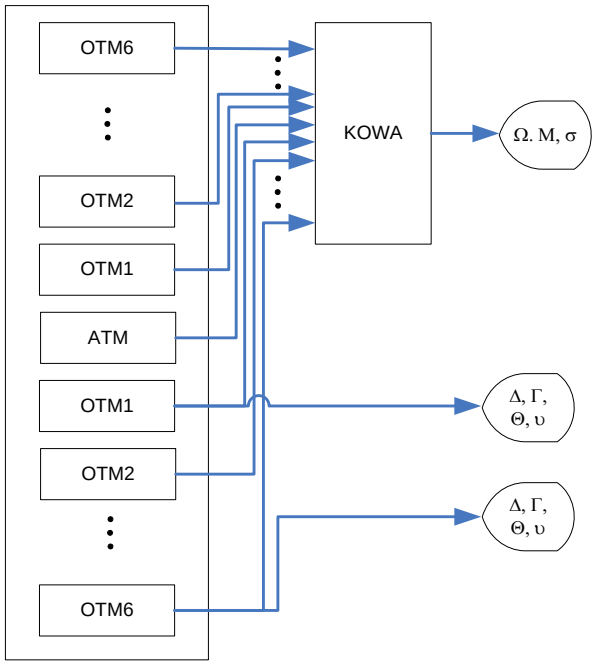

Figure 4. Conventional Greeks and New Parameters

The new parameters are omega, mu and sigma. And these are inspected below.

3.1. The Option Greeks

In mathematical finance, especially Options, the Greeks are the quantities representing the sensitivity of the price of derivatives to a change in underlying parameters on which the value of an instrument or portfolio of financial instruments is dependent.

Delta (Δ) measures the rate of change of the theoretical option value with respect to changes in the underlying asset's price. Delta is the first derivative of the value of the option with respect to the underlying instrument's price.

Gamma (Γ) measures the rate of change in the delta with respect to changes in the underlying price. Gamma is the second derivative of the value function with respect to the underlying price. All long options have positive gamma and all short options have negative gamma. Long options have a positive relationship with Gamma because as price increases, Gamma increases up as well, causing Delta to approach 1 from 0 (long call option) and 0 from -1 (long put option). The inverse is true for short options.

Theta (Θ), measures the sensitivity of the value of the derivative to the passage of time. By convention, it is usual to divide the result by the number of days in a year, to arrive at the amount of money per share of the underlying that the option loses in one day.

Vega (ν) measures sensitivity to volatility. Vega is the derivative of the option value with respect to the volatility of the underlying asset.

Table 1. Conventional Option Greeks

notation	name	meaning
Δ	delta	price rate with respect to index
Γ	gamma	delta rate with respect to index
Θ	theta	price decay during one day
ν	vega	price rate with respect to volatility

3.2. The New Parameters

The Conventional Greeks referred above are delta, gamma, theta and vega. This paper suggests three more Greeks by overall view. These new Greeks are omega, mu and sigma. The shape of OIP is similar to Gaussian distribution. So this OIP shape represents the characteristics of whole Options. The OIP shape has characteristic parameters - area, medium and sigma. These parameters can be appropriate Greeks - omega, mu and sigma.

Table 2. New Greeks

notation	name	meaning
Ω	omega	area
M	mu	center of the area
σ	sigma	standard deviation

Omega (Ω) measures area of OIP shape which shows the power of traders. Someone bets to upside and someone bets to downside. The omega indicates the volume of someone. Mu (M) measures the medium of OIP shape which indicate the center of weight of index. Sigma (σ) is the standard deviation of OIP shape which shows volatility. If volatility raise sigma may move in the same direction. These new Greeks are extracted by KOWA system. And there are two kinds of methods.

3.3. Definitions

3.3.1. OIP: OIP is open-interest price that is very important to indicate the characteristics of Options. The open interest contracts are contracts made buy or short but not liquidated. It means the amount of disagreement of traders. But the contracts do not have a unit. So to make it significant, open-interest needs to be multiplied by price. This value is OIP.

Figure 5 shows Option price by full spread Options. Option price consists of intrinsic value and time premium. The red line (CALL) is located above another red line (CALL-I) which mean intrinsic value.

ATM and OTM have no intrinsic value.

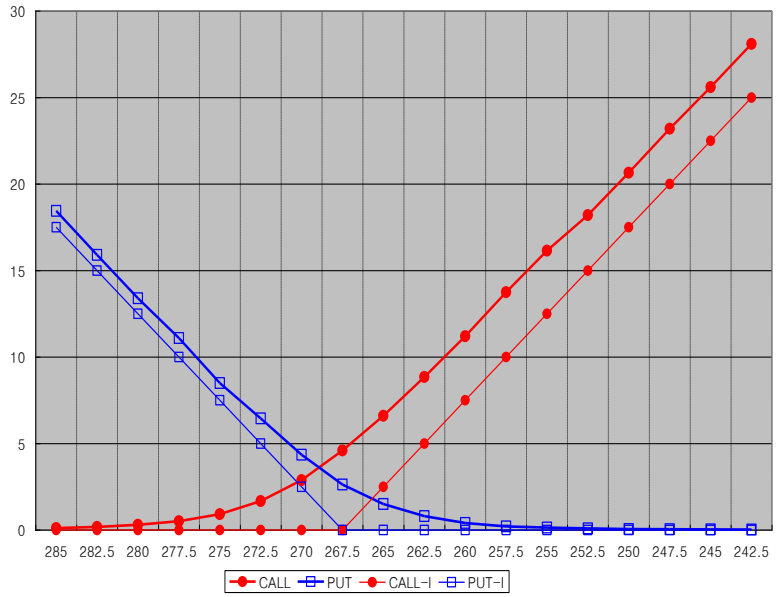

Figure 5. Price and Intrinsic Values

Figure 6 shows open interest contracts and Option price by full spread Options. At the far OTM the Option price is very small but open interest contracts is big. In the contrary, at the far ITM the Option price is big but open interest contracts is very small. So the product of Option price and open interest contracts is shaped like Gaussian distribution.

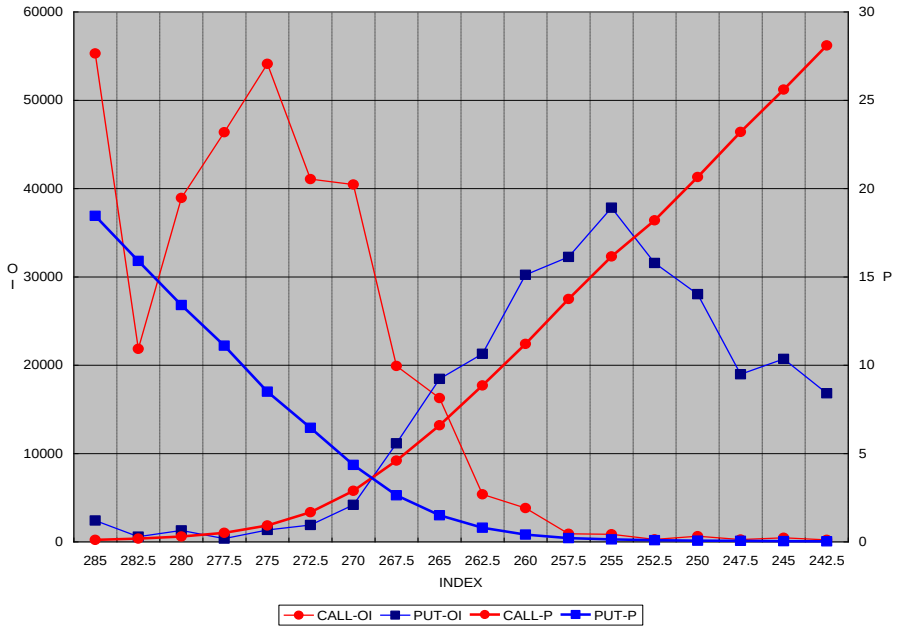

Figure 6. Open Interest

Figure 7 shows OIP respect to index. The biggest value of OIP is near ATM. And both far OTM and far ITM have very small value of OIP.

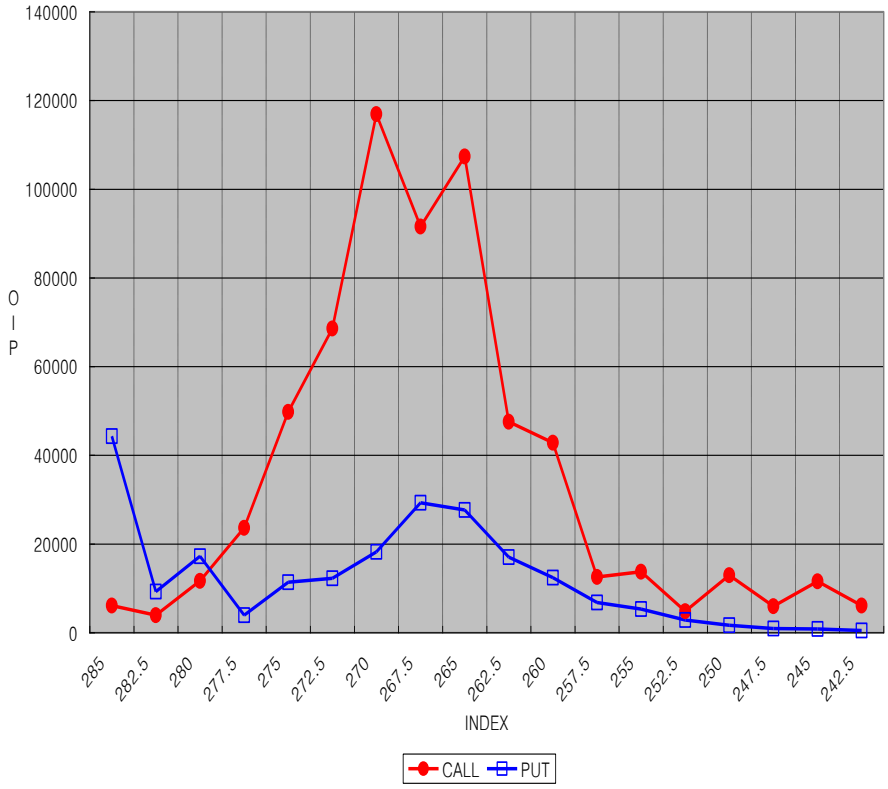

Figure 7. OIP

3.3.2. IRL: IRL is index of resolution low. The x-axis is KOSPI200 index that shows exercise price of Options. In order to find the new parameters, the new domain is needed. For convenience, integer is better. As mentioned above, the market guaranteed 6 OTMs. So the range of index is from ATM-15 to ATM+15. And in order to make a shape, it needs 10-multiplication and interpolation. So conversion rule is written below

IRL=floor((INDEX-(ATM-15))*10)+1
INDEX=(IRL-1)/10+(ATM-15)

There could be IRH that means index of resolution high. The only difference is 100-mutiplication rather than 10. If IRH is used, the tick of KOSPI200 index and IRH become the same amount.

4. Method to Extract New Parameters

4.1. Exhaust Search Method

Exhaust Search Method is to find matching Gaussian shape to given OIP. First of all the domain of x-axis must change from INDEX to IRL. This conversion is shown at Figure 8. INDEX from 255 to 285 is converted as IRL from 1 to 301. The displacement of INDEX is 2.5 and the displacement of IRL is 1. So IRL is integer and it is multiplied by 10 of INDEX. Therefore the chart blow needs an interpolation.

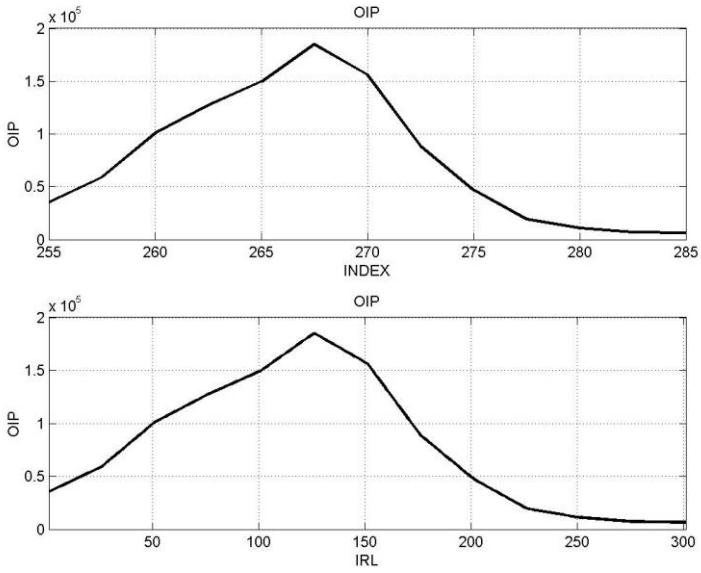

Figure 8. OIP Respect to IRL

Figure 9 shows an appropriate Gaussian. Gaussian also has the domain of IRL. And the appropriate Gaussian is made which are has parameters - medium and standard deviation. There is one more parameter, magnitude that is magnitude of top-medium point. But this can be replaced by OIP magnitude.

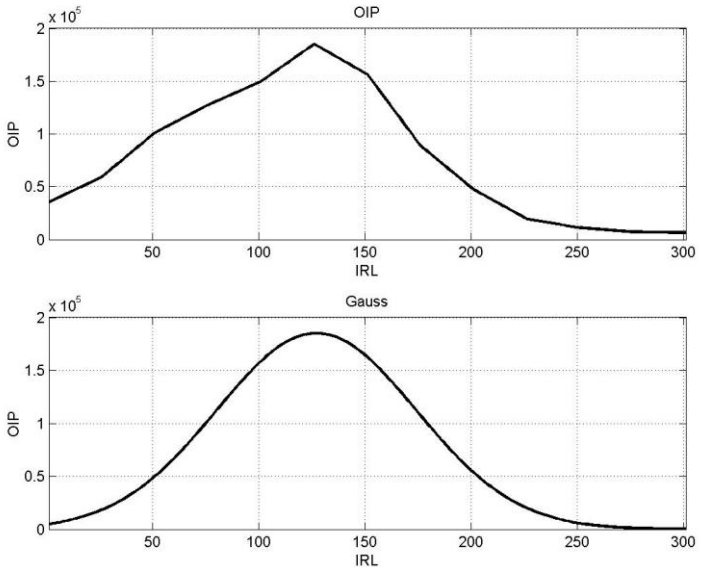

Figure 9. OIP and Gaussian shape

Figure 10 shows difference area between OIP and Gaussian. The medium is the same of the top of OIP. But the standard deviation is not known yet. So the matching Gaussian can be found by using loop of sigma from 1 to 30.

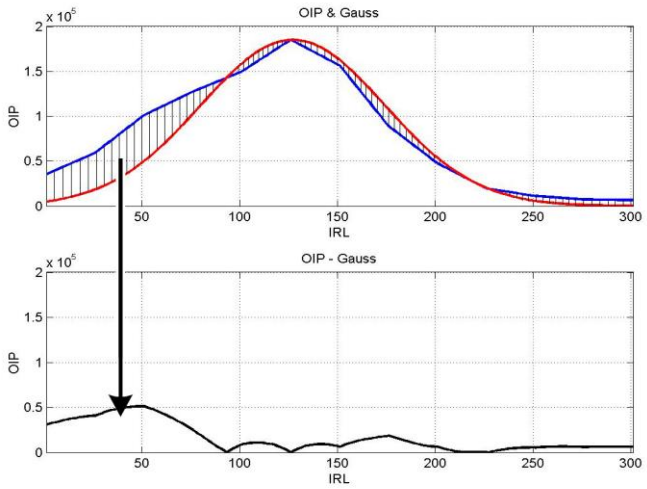

Figure 10. Matching Gaussian and Difference Area

The goal is to find the parameters - mu and sigma. It is to find the matching Gaussian by the smallest difference area. Figure 11 shows difference area surface respect to double loop parameters.

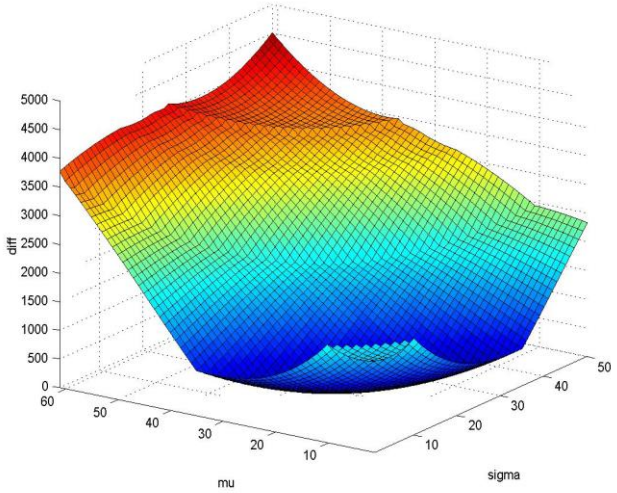

Figure 11. Difference Area Respect to Double Loop

4.2. Efficient Method

The exhaust search method mentioned above is not recommended. Because it takes a lot of time and it is not accurate. Furthermore there might be a different shape from Gaussian. The probability is a matter of area. The area of distribution indicates probability. So more efficient method is to use this area. Figure 12 shows a certain OIP and matched cumulative density function. This CDF can be easily computed by only summation. The omega is total summation of CDF. The mu is 50% of omega. And the sigma left and sigma right are 15.85%, 84.15% respectively.

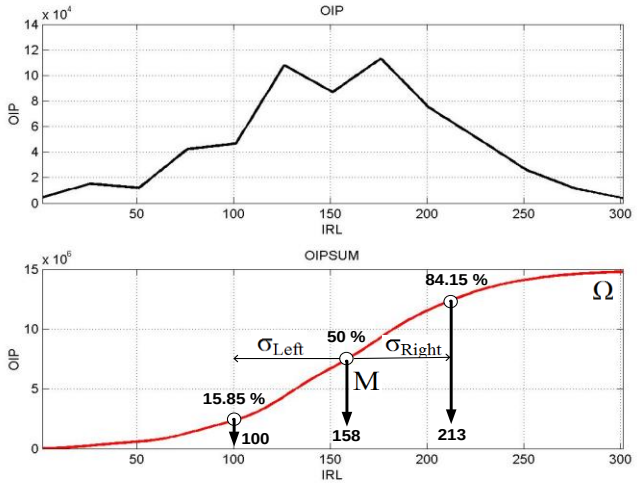

Figure 12. Efficient Method to Find New Parameters

The sigma can be computed as average of left and right sigma. This new method is very efficient and has no limit of various possible OIP shapes.

5. Examples

Using the suggested efficient method, Examples are shown below. The OIP of Call Option at two consequent days are chosen. Left chart is Call OIP at 27 Aug 2014. The omega is 24.8M. In this OIP the domain of x-axis is IRL. All new parameters must be computed in IRL. And only mu can be converted in INDEX domain. The mu is 140 in IRL and 266.4 in INDEX. The sigma is 58. The left sigma is 63 that is difference from 77 to 140. And the right sigma is 53 that is difference from 193 to 140.

Right chart shows also Call OIP at 28 Aug 2014. The omega decreases to 14.7M. It means the degree of competition is reduced. And the mu moves to 158. And the sigma moves to 56.5.

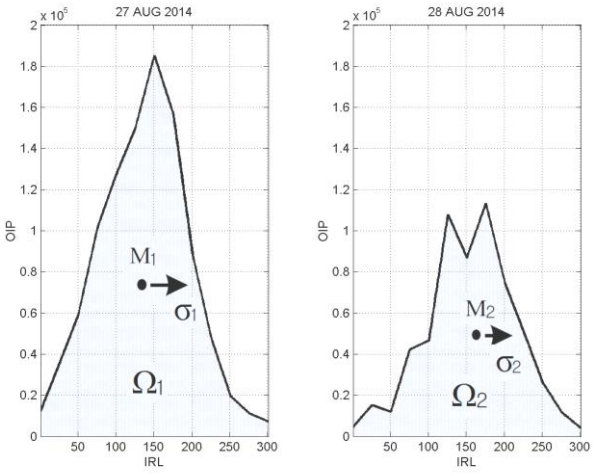

Figure 13. New Parameters of two OIPs

Table 3. New Parameters

Greeks	27 AUG 2014		28 AUG 2014	
	IRL	INDEX	IRL	INDEX
Ω	24.80M		14.77M	
M	140	266.4	158	268.2
σ	58		56.5	
σ_{Left}	63(77)	(260.1)	58(100)	(262.4)
σ_{Right}	53(193)	(271.7)	55(213)	(273.7)

6. Conclusion

In these days, the importance of money is increased. And it could be compared as the energy to change the world. The investors might be hidden men to give power to the challenging businesses. These wise investors want to have an useful tool which provides overall information in Option market. The KOWA system is the useful tool to provide this overall information.

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The examples are appended which are based on real data of Korean Option market. These new Greeks might be very useful to the wise investors. And KOWA system might be a very useful tool.

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