

# A Case Study of Option Shock in the Korean Stock Market

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This case study reviews the option shock, which occurred during the last ten minutes of trading on the expiry date of KOSPI200 options, Nov. 11<sup>th</sup>, 2010. KOSPI200 index plummeted by 2.79% on Nov. 11<sup>th</sup> 2010, which triggered the market collapse. By investigating participants' behavior of the suspicious trading and their actual derivatives positions specifically, our study shows that the Nov. 11<sup>th</sup> Option Shock was the result of multiple violations of related regulations. Traders at an international securities company in Hong Kong made unfair profit with an intent to manipulate the market. Their colleagues in Korea also made money using the confidential trading information from the counterpart subsidiary in Hong Kong. The asset management firm placed option orders with trading amount well over the limit set by the regulatory code, and the local securities firm neglected to monitor the trading limit of the asset management. With these series of violations, billions of dollars of market capital evaporated, and investors lost millions of dollars. Similar incidences on the option expiration date have occurred all over the world. This study can provide the practical implications for policy makers and market participants. It also provides us with an excellent teaching opportunity in the areas of finance and business ethics.

Key Words: Option, Derivatives, Expiration day, Korea Exchange

## 1. Introduction

"What's happening? Why is the key index plunging?" Trading rooms in yeouido (the financial district in Seoul) were suddenly filled with traders' surprise and shock. It had been an ordinary trading day and people were in good moods. Key stock market indexes were

on a positive momentum. Streets were busy and vibrant with the start of the two-day G20 summit in Seoul.

However during the last ten minutes of trading on the expiry date of KOSPI200 options, Nov. 11<sup>th</sup>, 2010, KOSPI200 index plummeted by 2.79% to 247.51. It was the biggest drop in a single trading day. KRX (Korea Exchange) and FSC (Financial Service Commission) im-

논문접수일: 2017. 07. 18.      1차 수정본 접수일: 2017. 09. 22.      게재확정일: 2017. 10. 22.

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mediately inspected this plunge, and later found that Deutsche Securities Korea constructed speculative positions in excess of normal arbitrage positions, using the combination of short synthetic futures (short call options and long put options) and long put option positions in KOSPI200 options that were slated to expire on that day.

According to the investigation reports, during the last ten minutes of trading when the closing price is to be decided, they made a manipulative selling in seven orders for the component stocks of KOSPI200, with the trading value of around KRW 2.4trillion (US\$ 2.1 billion). For example, they sold Samsung Electronics that they had purchased through index arbitrage trading and held for a year, at 4.5% to 10% lower prices than the immediately preceding price. These manipulative orders forced KOSPI200 index down by 7.11p compared to the immediately preceding price and they gained KRW 44.9 billion of illegal profits.

The media called this mini crash the Nov. 11<sup>th</sup> Option Shock, or Option Terror. One brokerage firm surveyed its employees to find the Nov. 11<sup>th</sup> Option Shock as the most salient event of the year 2010.<sup>1)</sup> This option shock has several implications for Korean financial markets in the sense that: 1) it is the first market price manipulation case which brought to the court, 2) the price manipulation was made to market index not an individual stock,

3) the spot market index manipulation was made by Futures market and 4) it was a never-ending story because it could happen anytime again.

Considering the impact of this historic option shock on the market, it is important to examine the cause and effect of this event in detail. The related research is very limited in Korea, despite the importance of the event. This case study provides the opportunity to analyze participants of the suspicious trading and their actual derivatives positions specifically.

In the following sections, this paper provides a review of relevant literature, explores the whole story of option shock on Nov. 11<sup>th</sup>, 2010, highlights the responses by the authorities and summarizes the implications.

## II. Literature Review

Since the mini crash of Nov. 11<sup>th</sup>, 2010 occurred on the day of the derivatives expiration date, it is related to the expiration day effect. The expiration day effect means the increase in trading volume and/or price volatility on the date of derivatives trade expiration in futures or options. Research on the expiration day effect has been actively conducted since the 1980s and this academic research has led to the revamp of the regulations related to the derivatives trading. An

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1) MT news, 12/28/2010, <http://news.mt.co.kr/mtview.php?no=2010122601422569638&type=1>

early study on the expiration day effect comes from Stoll and Whaley (1987). They show the increase in trading volume and volatility of S&P500 on triple witching days.

Similar incidences around the option expiration date have occurred throughout the history of the financial market all over the world (Stoll and Whaley, 1991). Therefore, after the pioneer study of the expiration day effect, similar studies were conducted in each country: SE300 in Canada (Chamberlain, Cheung and Kwan, 1989), LSE in the UK (Pope and Yadav, 1992), Nikkei225 in Japan (Karolyi, 1993), DAX in Germany (Schlag, 1996), SPI in Australia (Lien and Yang, 2005). All these studies show that there exists the effect of expiration day.<sup>2)</sup>

We note that the study on the expiration day effect has policy implications because it leads to the change of option trading regulations. In fact, in the US, the settlement price for the expiration date was changed from the Thursday closing price to the Friday opening price. However, the empirical study on the effect of the regulation change shows that the intended goal was not achieved (Herbst and Maberly, 1990; Hancock, 1993). To mitigate this undesirable effect, the average price (Hong Kong, Sweden, etc.) or the opening price (US, Canada, etc.) is used.

There are a few studies on the expiration day effect in Korea. Interestingly, early studies came to different conclusions. Kim Tong-Suk and Choe Hyuck (1999) insists that they could not find the expiration day effect, but Park Chang-Gyun and Lim Kyung-Mook (2003) shows the effect was found significantly in the Korean stock market. This difference could stem from the illiquidity of the futures market in the 1990s because the stock futures market was opened in 1996. After the early studies, a significant number of later many research reports that the expiration day effect exists in Korea (Chay Jong-Bom and Ryu Hyeuk-Sun, 2005; Choe Hyuck and Eom Yun-Sung, 2007; Kim Sung-Wha and Jun Sang-Gyung, 2012; Kim Young-Sung, Kim Heui-Jung and Chay Jong-Bom, 2013, Yoo Jin, Chung Sung-Won and Kwon Soon-Chae, 2015).

Several studies (Nam Gil-Nam and Lee Hyo-Seob, 2012; Lee Kyoo-Bok and Kim Seok-Ki, 2014) suggested the policy improvement measures on the expiration day effect after the option shock of Nov. 11<sup>th</sup>, 2010. Yang Cheol-Won and Yoo Ji-Yeon (2016) and Oak Sun-Kee (2012) contemplate the legal aspect of the expiration day effect using option shock.

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1) The expiration day effect can be measured in terms of changes in volume, yield, and volatility. All those three effects are significantly observed in some cases, while only one or two effects are observed in others. However, for research purpose, we express the expiration day effect even when only one of effects occurs.

### III. What Happened on Nov. 11<sup>th</sup>, 2010 and Who Caused It

#### 3.1 Reconstruction of the story

Just before market close on Thursday, November 11<sup>th</sup>, 2010, a massive sell-off of stocks occurred. The day was also the expiration date of many options contracts. The huge selling started about 14:50 KST, ten minutes before the closing of the market. A group of unidentified foreign investors unloaded KRW 2.4 trillion (US\$ 2.1 billion) of stocks through Deutsche Bank Group’s Korean securities unit, causing the benchmark KOSPI to nosedive 53.12 points or 2.7 percent to 1914.73. This wiped out KRW 30 trillion (approx. US\$ 27 billion) in just ten minutes. The size of the dumping accounted for one-third of the total daily trading. The rest of the market participants could not respond to the large order properly because Deutsche Securities Korea made the order in the last ten minutes, during which all transactions were processed together at final auction while ordinary trading was suspended.

Regulatory agencies immediately suspected

that foreign hedge funds had bombarded the market with sell orders - speculative hands purchased the option contracts right before the expiration date and unloaded their stock holdings to trigger the tumble of share prices and make huge profits. Those investors holding options contracts that yield profits when the stock prices drop hit the jackpot during the process. Such option contracts had become very cheap to buy as the expiration date approached and as the KOSPI seemed to have taken an upturn. <Table 1> and <Figure 1> illustrate how serious the shock was.

#### 3.2 Major players

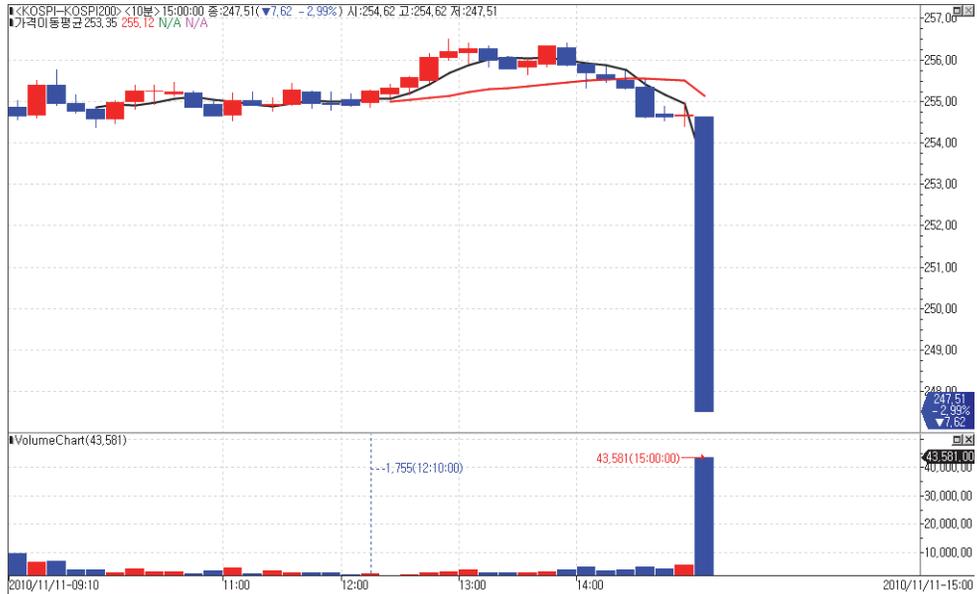
It had been rumored in yeouido that many financial institutions made great losses and had been collaborating to hide those losses. Nevertheless, three players stood out.

##### 3.2.1 Wise Asset Management

Wise Asset Management had traded option contracts and had made profits for a while, but suffered large losses before the market closing because of the option shock. Its loss mostly resulted from a short position in the

<Table 1> A New Record created on Nov. 11<sup>th</sup>, 2010 (Unit: \$bn)

Type	New Record	Previous Record
Net selling by foreigners	13,099	12,459 (2010.5.7)
Net program selling	9,313	9,131 (2008. 9.11)
Net program arbitrage selling	18,041	10,660 (2007.12.13)
KOSPI200 trading volume	39.32mn Contracts	37.28mn Contracts (2010.6.10)



Source: Infomax

<Figure 1> KOSPI200 Chart on Nov. 11<sup>th</sup> 2010

strangle. The buyers of the put option contracts asked Wise Asset to sell at 499,000 won per contract × 100,000 × (closing price – strike price of KOSPI200).<sup>3)</sup> The liability rose to KRW 89.9 billion. Wise Asset Management had broken the regulatory code by investing 370 times of their capital (only KRW 12.4billion) much more than 5 times over legal limit specified by the code. Consequently, Wise Asset was unable to pay out the liability. Instead, Hana-Daetoo Securities, which sold options on behalf of Wise Asset Management, paid KRW 76.3 billion .

Bad luck continued. The information about the massive loss quickly spread throughout the market, triggering a fund run. The National

Pension Service and other investors in the various funds of Wise Asset Management ran to withdraw hundreds of billion won. On Nov. 26<sup>th</sup>, an employee embezzled KRW 3.8 billion. These series of events around the option shock severely damaged the reputation of Wise Asset Management critical to asset management business. In response, Wise Asset Management sued Deutsche Securities Korea about the option shock.

### 3.2.2 Hana-Daetoo Securities

Hana-Daetoo Securities, a Korean brokerage firm, lost KRW 76.3 billion. They shouldered this amount on behalf of Wise Asset

3) '100,000' denotes the contract size.

Management which turned out to be insolvent. Wise Asset Management also declined to pay Hana-Daetoo arguing that the mutual fund was not obligated to compensate the loss. Hana-Daetoo conducted due diligence on Wise Asset Management for the payment and possible acquisition. It also sued major shareholders of Wise Asset Management and brought a lawsuit against Deutsche Securities Korea on Feb. 25<sup>th</sup>, 2011 in Seoul Central Court. The KRX issued a warning to Hana-Daetoo about the failure of risk management and the late margin deposits on the derivative trades by Wise Asset Management. Hana-Daetoo had been required to receive KRW 80 billion by one day before the event. Thus, if Hana-Daetoo had received the deposit as required, it would have had much less problem with the option shock.

### 3.2.3 Deutsche Securities Korea

A series of trading orders(7 to 8) from Deutsche Securities Korea made up most of a KRW 2.4 trillion (US\$ 2.1 billion) sell-off at the Nov. 11<sup>th</sup> Option Shock. In addition to the trading that was suspected manipulative, Deutsche Securities breached KRX rules, which require disclosing computer-driven trades, by filing a report one minute late to the KRX. Korean regulators estimated that Deutsche Securities Korea made KRW 45 billion of unfair

profit with the trading and suspected manipulation and insider trading such as buying put options before sending massive selling orders.

## IV. The Reconstruction of the Shock and the Result<sup>4)</sup>

### 4.1 Derivatives position of Wise Asset Management

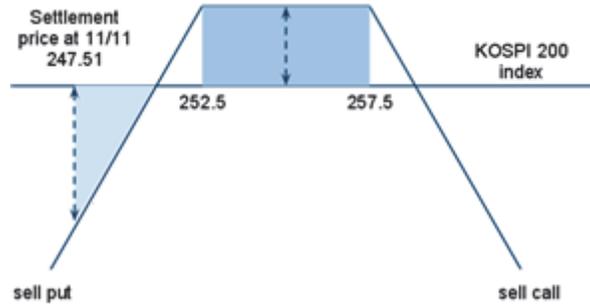
Wise Asset Management was the biggest victim of the Option Shock. It sold strangle (short strangle) with the KOSPI200 index underlying. In a short strangle, an investor sells a put and a call with the same expiry date but with different exercise prices. This strategy offers limited profit, but with an unlimited downside. A trader would believe short strangle useful if she expects little volatility in underlying asset in near term. This type of strangle strategy had been very popular among institutions in yeouido.

〈Figure 2〉 describes the short strangle Wise Asset Management conducted. The firm called this product the Dark Horse Fund. The Dark Horse Fund had a very simple structure: it sold 180,000 contracts of the put option at the exercise price 252.5 and 70,000 contracts of the call option at the exercise price of 257.5.<sup>5)</sup> As far as KOSPI200

4) Since our paper tries to focus on financial issues of the event, it does not thoroughly investigate motivations of the offenders or flaws of related laws, etc. Authors hope that more studies on these issues will be conducted in the future.

5) Each contract denotes 100,000 units of KOSPI200 index value.

- ① Sell put option by 180,000 contracts (Exercise price 252.5) +
- ② Sell call option by 70,000 contracts (Exercise price 257.5)



Source: Hankyung.com<sup>6)</sup>

〈Figure 2〉 Structure of strangle that Wise Asset Management had sold short (unit: KRW)

remained stable between 252.5 and 257.5, the fund could have made KRW 1.8 billion. However, its loss would explode if KOSPI200 moved far beyond the range. Unfortunately for Wise Asset, this is what happened during the Option Shock. On Nov. 11<sup>th</sup>, 2010, the KOSPI200 dropped from 254.86 (opening price) to 247.51 (closing price). The fund lost KRW 89.9 billion.<sup>7)</sup> The fund broke the law by betting more than legally allowed. Korean regulators computed the risk adjusted values of option contracts as (number of contracts) × (KOSPI200 Index) × (100,000). The fund could invest only KRW 62 billion, 5 times of its asset value, but instead invested KRW 4.5 trillion, around 73 times of the legal limit.

This trade by Wise Asset Management resulted in large ramifications. Several local se-

curities houses, notably Hana-Daetoo Securities, suffered huge losses as the Dark Horse Fund was unable to pay back the payoff of the short strangle. Wise Asset Management and its top managers fell under scrutiny from both market and regulatory agencies. On the other hand, international investors, who purchased the contracts, won windfalls as the KOSPI plummeted. Some of them were presumed to hit the jackpot.

After a joint investigation, Korean regulators and exchange - Financial Services Commission (FSC), Financial Supervisory Services (FSS) and Korea Exchange (KRX) - argued that Deutsche Securities Korea violated the prohibition on market manipulation by exploiting the relationship between spot and future markets using KOSPI200 stocks and derivatives

6) <http://www.hankyung.com/news/app/newsview.php?aid=2010111518821/> and <http://www.hankyung.com/news/app/newsview.php?aid=2010111972671/>

7) KRW 89.9 billion was calculated as  $(252.5 - 247.51) \times 100,000 \text{KRW} \times 180,000 \text{ contracts}$ , but excluding the profits earned from options sold, which was known as KRW 18 billion.

trading.

Korean regulators also notified suspects and misconduct to the Securities and Futures Commission of Hong Kong (SFC) and the Hong Kong Monetary Authority, the U.S. Securities and Exchange Commission (SEC), and the Federal Financial Supervisory Authority of Germany (BaFin). In particular, the FSS asked the BaFin to help identify the owner of the account in question and any illegal activities in the trading. Such requests were made through a formal channel of the International Organization of Securities Commissions (IOSCO). Further penalties on Deutsche Securities Korea would follow. "KRX will not take any actions on profits Deutsche Securities Korea made. Prosecutors may deal with it, however," bourse spokesman Won Young-joon told Reuters.

In a statement on 25 Feb. 2010, Deutsche Securities Korea said in a statement, "Deutsche Securities Korea deeply regrets the KRX action, however, respects its decision to impose such penalties."

#### 4.2 New trading rules

After the long investigation of the case, the FSC concluded that there were a few legal violations. The FSC's press release (2011) describes their investigation results. "Deutsche Securities Korea failed in its duty to notify the Korea Exchange on time about its program trades, hurting investor trust in our

regulatory system and causing confusion (in the market)," said Lee Cheol-Jae, an executive director of the exchange's Market Oversight Division. In sum, the FSC ruled that Deutsche's South Korean unit manipulated stock markets with unusual arbitrage positions in derivatives. In accordance, Korean regulators imposed several penalties on the bank. First, they brought charges against Deutsche Securities Korea and five Deutsche Securities staff members in Hong Kong, New York, and Seoul at the prosecutors' office. Second, they requested the suspension of the managing director of global equity derivatives at Deutsche Securities Korea from office for six months. Third, they suspended the partial business operation of Deutsche Securities Korea for six months. Fourth, KRX fined Deutsche Securities Korea KRW 1 billion (US\$ 885,000), seemingly minor, but the maximum member fine and, as well, issued a warning notice to Hana-Daetoo Securities Co., Ltd. for violating market rules with regard to derivatives product margin trading.

Also, the Korea Exchange has updated rules to prevent similar events. First, it imposed new Program-Trading rules and Random-End rules. Both rules attempt to ensure that the markets deal with the impact of significant order flows during the expiration session around market closing. Here is a summary of the new rules.<sup>8)</sup>

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8) KRX market notice(<http://eng.krx.co.kr/coreboard/BHPENG09004/view.jsp?bbsSeq=19884&secretYn=N>)

■ *Program-Trading rules*

*Market Participants will be allowed to place Program-Trading orders during 'the expiration session' without having pre-disclosure requirements when there is significant imbalance in the amount of disclosed trading buy orders and sell orders (applied to both KOSPI Market & KOSDAQ Market).*

■ *Random-End rules*

*The trading hours will be extended up to five minutes if the final call price moves by more than three percent from the preliminary call prices at the last five minutes of the auction session (applied only to KOSPI Market).*

Additionally, KRX revised regulations about ex-post margin system and position limit of KRX derivative market such as re-enforcing the selection criteria of qualified institutional investors (QIIs), establishing maximum exposure amount per ex-post margin account of QII and administration thereafter, setting guidelines for risk management of QIIs and revising quantity limit of open interests.<sup>9)</sup> These rules are designed to prevent reckless and disruptive transactions that Wise Asset Management, Hana-Daetoo Securities and Deutsche Securities Korea had demonstrated. "The regulations that we implement are intended to discourage speculative, unfair and abnormal transactions. Institutional trading will not be impacted negatively," said Ernst Lee, a spokesperson for Korea's Financial Services Commission.

## V. Conclusion

Participants in Korean financial market were proud of having globally the most liquid derivatives market. It was another 'Miracle of Han-River' for Korea. But the trading volume shrank by about 90% from the 2011 peak to the 2016 low. This is the result of policy actions of financial market authorities that were trying to curb the trading of individual investors. Financial authorities change regulations regarding derivatives market because derivatives products were regarded as one of the main causes of financial crisis of the year 2008.

During these regulatory changes, the Nov. 11<sup>th</sup> Option Shock in the Korean stock market made a profound impact on the Korean financial sector. The Nov. 11<sup>th</sup> Option Shock was a real shock in the sense that price manipulation was made to the market index not the individual stock, though the authority has been improving the derivatives market system after the 2008 crisis. Thus, the Option Shock can teach an important lesson to risk managers, brokers, investors and regulators about how to prevent such events and how to deal with them once they occur.

As this case study shows, the Nov. 11<sup>th</sup> Option Shock was the result of multiple violations of related regulations. Traders at a foreign securities company in Hong Kong made

9) KRX market notice(<http://eng.krx.co.kr/coreboard/BHPENG09004/view.jsp?bbsSeq=19885&secretYn=N>)

an unfair profit with the intent to manipulate the market. And their colleagues in Korea also made money using the confidential trading information from the counterpart in Hong Kong. The asset management firm placed option orders with trading amounts well over the limit set by regulatory code, and the local securities firm neglected to monitor the trading limit of the asset management. With these series of violations, billions of dollars of market capital evaporated, and investors lost millions of dollars.

This case study examined the cause and effect of the Nov. 11<sup>th</sup> Option Shock in detail. Similar incidences on the option expiration date have occurred all over the world. However, there were also endeavors to improve the market systems with the result of research in many countries. Therefore, this study could provide practical implications for policy makers and market participants. Shocks to the capital market could happen again anytime, but lessons from this study would increase substantially the preparedness for the next event.

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## 〈Appendix〉 R code for VaR analysis

```

rm(list=ls()) # delete all memory
# type setwd('c:/Tmp/option') to
change directory to find the source
code
# type source('wise.R') to execute
the source code

# unit: billion KRW
profit <- function(x){
  1.8-max(252.5-x,0) *18-max(x-257.5,0)*7
}

# upload data
data <- read.csv
('c:/Tmp/option/kospi.csv',
header=TRUE)
ret <- -diff (as.matrix (log(data[2])),lag=1)
s <- sd (ret) # should use egarch
in serious analysis
mu <- mean(ret)

# Simulation VaR
nsim <- 10000
p0 <- data [1,2]
r1 <- rnorm(nsim, mean = 0, sd = s)
r2 <- sqrt (10)*r1
p2 <- matrix (0,nsim,2)

for (i in 1:nsim) {
  p2[i,1] <-profit (p0*exp (r1[i]))
  p2[i,2]<-profit (p0*exp (r2[i]))
}
d1<-quantile(p2[,1], prob=c(0.01,0.05))
# 1-day VaR for (99%,95%)
d2<-quantile(p2[,2], prob=c (0.01,0.05))
d3<-sqrt (10)*d1 # 10-day VaR

d4<-d3*3 # capital requirement 3
times of 10-day 99% VaR

# Historical VaR
h0<-p0*exp(ret)
h1<-h0*0
for (i in 1:length(h1)){
  h1[i] <- profit(h0[i])
}

# quantile values of realized KOSPI 200
h2<-quantile (h1,c(0.01,0.05)) # 1-day VaR
h3<-sqrt (10)*h2 # 10-day VaR
h4<-h3*3 # capital requirement

# stress testing
s1<-profit (exp(min(ret)) *p 0)
s2<-profit (exp(max(ret)) *p0)

# linear function given slope (b) and
a point (x1,y1)
#linf <- function (b,y1,x1,x){
# z <- b*(x-x1) +y1
# }

#xp <- matrix(c(247.51,252.5,-88.8,1.8),nrow=2)
# -88.8, not 8.88
#bput <- (xp[2,2]-xp[1,2])/(xp[2,1]-xp[1,1])
# slope of put payoff

# strangle profit given kospi200 = x
#profit <- function(x){
# vp <-linf(bput,1.8,252.5,x)
# vc <-linf(-bput,1.8,257.5,x)
# min(1.8,vp,vc)
# }

```

## 한국 주식시장의 옵션쇼크 사례연구

한병석\* · 전상경\*\* · 김은지\*\*\* · 강형구\*\*\*\*

### 요 약

본 연구는 2010년 11월 11일 국내 주식시장에 큰 충격을 주었던 옵션사태의 원인과 결과, 정책적 의미에 대해 심층 분석을 다루고 있다. 그간 11월 11일 옵션충격이 가지는 중요성에도 불구하고 관련연구가 국내에서는 매우 제한적이었다는 점에서 본 연구의 학술적 의의가 있다. 또한 본고는 옵션쇼크를 초래한 실제 거래 포지션을 구체적으로 분석한다는 점에서 이전의 연구와 차별성을 가진다. 연구결과에 의하면, 2010년 11월 11일 옵션쇼크는 파생상품시장과 관련된 복수의 규정이 위반되어 발생했다는데 옵션쇼크를 초래한 당사자들의 거래는 다음과 같이 분석할 수 있다. 홍콩에 소재한 증권회사 직원들은 시장을 조작하려는 의도를 가지고 불공정 한 이익을 거두었다. 그리고 한국지사의 동료들은 홍콩으로부터의 거래 정보를 활용하여 수익을 얻었다. 해당거래에서 큰 손실을 입은 국내 자산운용회사는 옵션거래 한도를 초과하여 거래하였음에도 불구하고, 이 주문을 중개한 국내의 또 다른 증권회사는 이러한 사실을 적절히 모니터링하지 못했다. 이처럼 적절히 통제되지 않은 일련의 법률위반에 따라 하루만에 수십억 달러의 시가 총액이 증발되었고, 투자자들은 수백만 달러의 손실을 입었다. 이와 유사한 옵션 만기일 쇼크는 전세계에서 발생했다. 그러나 많은 국가에서는 다양한 연구결과를 활용하여 시장규정과 시스템을 개선하기 위한 노력을 병행하였다. 본 연구는 정책 입안자와 시장 참여자에게 실질적인 참고자료를 제공할 수 있다는 점에서 의미가 있다. 자본 시장에 대한 충격은 언제든지 다시 발생할 수 있지만 본 연구에서 시사한 바는 또 다른 쇼크를 대비하는데 큰 도움이 될 것이다.

주제어: 옵션, 파생상품, 만기일, 한국거래소

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## 〈Teaching Note〉

# A Case Study of Option Shock in the Korean Stock Market

## Synopsis

Assume you are a risk manager in Wise Asset Management and monitor the strangle position illustrated in the text (e.g. Figure 2) at one-day before the option shock (Nov 10th, 2010). Conduct the following three analyses using the data about KOSPI200 from 2000/11/11 to 2010/11/10. Students can download data at the link below (Google Finance).

- <https://www.google.com/finance?q=KRX%3AKOSPI200>

## Teaching Points

1. Understanding the structure of derivative markets or products

Instructors can briefly explain Korean Derivatives Market. They can teach how market participants design financial products using derivatives. For example, this case introduces strangle position. It also shows how hedge funds can manipulate the market with

massive orders combined with derivative positions.

2. Learning and practicing Value at Risk

Standard textbooks such as Hull (2011) offer good introduction. Instructors can construct appropriate reading assignment using the textbooks or other Internet sources.

3. Learning how to assess risk of derivative positions

After students learn how to compute VaR, they can interpret the results and develop recommendations. Students can take the role of risk managers in classroom.

4. Developing policy implications about market microstructure

Students can compare the Korean regulatory systems with others. Then, they develop recommendations to the other countries. Students can criticize the responses of the Korean regulators with the application of legal and financial insights.

## Assignment Questions

- Q1. Briefly explain Korean Capital Market and list up the derivatives products in KRX.
- Q2. Compute the loss borne by Wise Asset Management using numbers from Figure 2.
- Q3. Conduct a 1-day and 10-day VaR (95%, 99%) analysis using the Monte Carlo simulation method.
- Q4. Conduct a 1-day and 10-day VaR (95%, 99%) analysis using an historical simulation analysis
- Q5. Conduct a stress test
- Q6. Assess the penalties on Deutsche Securities Korea. Are they enough to prevent future market manipulations?

## Analysis

For instructors,

- R code to solve these problems is at the appendix
- Spreadsheet analysis for the students not familiar with R is available at

[https://docs.google.com/spreadsheets/d/1WFZA04XRBc4i5RHR6k1RhrQcDqHp\\_DcDltaVtaZw28Y/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1WFZA04XRBc4i5RHR6k1RhrQcDqHp_DcDltaVtaZw28Y/edit?usp=sharing)

- Students can use whatever program they prefer including Excel. Nevertheless, it is always good a exercise to try understanding codes written in other languages.
- Q1. Briefly explain Korean Derivatives Market and list up the derivatives products in KRX.
- A1. As the first derivative product launched by the KRX, KOSPI200 Futures have shown remarkable growth since their listing in May 1996. It was ranked the 8th among world stock index futures in 2012 in terms of trading volume. Also, KOSPI200 Options, which were listed in July 1997, one year after the listing of KOSPI200 Futures, showed extraordinary growth in a short time and were the most actively traded derivative product in the world for thirteen consecutive years from 2000 to 2012. A contract refers to a futures or an option contract which is listed in Korea Exchange. The following products are currently listed in Korea Exchange.

- Q2. Compute the loss borne by Wise Asset Management using numbers from Figure 2.
- A2. KRW 89,9 billion

<Listed Derivatives Products>

Stock Index products	Equity Products	ETF Products	Interest Rate products	Currency products	Commodity products
<ul style="list-style-type: none"> <li>▪ KOSPI200 Futures</li> <li>▪ KOSPI200 Options</li> <li>▪ MINI KOSPI200 Futures</li> <li>▪ MINI KOSPI200 Options</li> <li>▪ KOSPI200 Sector Index Futures</li> <li>▪ KOSDAQ150 Futures</li> <li>▪ Euro STOXX 50 Futures</li> </ul>	<ul style="list-style-type: none"> <li>▪ Single Stock Futures</li> <li>▪ Single Stock Options</li> </ul>	<ul style="list-style-type: none"> <li>▪ ETF Futures</li> </ul>	<ul style="list-style-type: none"> <li>▪ 3-years KTB Futures</li> <li>▪ 5-years KTB Futures</li> <li>▪ 10-years KTB Futures</li> </ul>	<ul style="list-style-type: none"> <li>▪ USD Futures</li> <li>▪ USD Options</li> <li>▪ JPY Futures</li> <li>▪ EUR Futures</li> <li>▪ CNY Futures</li> </ul>	<ul style="list-style-type: none"> <li>▪ Lean hog Futures</li> <li>▪ Gold Futures</li> </ul>

\* Source : KRX website

Loss from selling put option :  
 $(252.5 - 247.51) * 100,000 \text{KRW} * 180,000$   
 contracts

But excluding the profits earned from options sold, which was known as KRW 18 billion.

Q3. Conduct a 1-day and 10-day VaR (95%, 99%) analysis using the Monte Carlo simulation method.

A3. When we are X percent sure that loss will not be greater than V dollars in the next N days, V is called N-day VaR at X%. Historical daily volatility is 1.73%. Daily mean return is set to zero: Historical daily average return is 0.05%, which is not significantly different zero. Given these parameter values, the sequence of the

Monte Carlo simulation method is as follows.

- ① Simulate a return from  $N(0, 1.73\%)$
- ② Multiply this simulated return to the KOSPI200 value at one-day before the option shock (255.13). This gives one simulated value of KOSPI200 on Nov. 11<sup>th</sup>.
- ③ Value the strangle position at the simulated KOSPI200 value.
- ④ Iterate this procedure many times
- ⑤ Compute 1-day and 10-day VaR at 99% and 95% using percentile function

The answers are:

1-day VaR: 157.6 bn (99%), 108.6 bn (95%)  
 10-day VaR is simply  $10^{0.5}$  times the 1-day VaR

Regulators usually require a bank's capital for market risk to be at least three times of a 10-day 99% VaR. Thus, the minimum capital level for Wise Asset Management was KRW 1,495 bn. This could have prevented the disaster well. Standard textbooks such as Hull (2011) offer details about this procedure.

Q4. Conduct a 1-day and 10-day VaR (95%, 99%) analysis using an historical simulation analysis

A4. Let us conduct the historical simulation analysis with 10-year data supplied as following sequence.

- ① Multiply daily returns realized for the last 10 years to the KOSPI200 value at Nov. 10. This generates simulated index values on Nov. 11<sup>th</sup> based on historically realized returns for the last 10 years.
- ② Evaluate strangle position at each simulated index value
- ③ Find 1% and 5% quantile values to find 99% and 95% 1-day VaR
- ④ Compute 10-day VaR

The answers are:

1-day VaR: 199.6 bn (99%), 115.8 bn (95%)  
 10-day VaR is simply  $10^{0.5}$  times the 1-day VaR

Thus, the minimum capital requirement for the Wise Asset Management is KRW 1,894 bn, much larger than the firm's loss KRW 8.8 bn. The VaR values from historical simulation

method are greater than those from Monte Carlo simulation. This is usual.

Q5. Conduct a stress test

A5. Stress testing estimates how a firm's portfolio would have performed under the most extreme moves in the past 10 to 20 years. In our 10-year data, the most extreme moves are -12% and +11%. To apply -12% (seven standard deviation daily), the loss would be KRW 521 bn, which is again far larger than the realized loss of KRW 8.8 bn.

Q6. Assess the penalties on Deutsche Securities Korea. Are they enough to prevent future market manipulations?

A6. There is debate on the penalties given the ramification of the incidence. To summarize the penalties on Deutsche securities Korea:

- ① KRW 1.1 billion for fine
- ② Suspension from proprietary stock trading and exchange-traded derivatives for six months: Such suspension is estimated to cost around KRW 11.2 billion.
- ③ Several staff members are prosecuted.
- ④ Intangible loss: Reputation and brand image are damaged. Credit rate of Deutsche Securities Korea is downgraded. Some key clients including National Pension Service, the largest asset manager in the world, halted trading with

Deutsche Securities Korea.<sup>10)</sup>

⑤ Criminal charges and investigations in progress

Some market watchers doubt whether the FSC's investigation was made thoroughly and transparently. Next are assessments from market. Many argue that while the penalties are apparently insignificant, their long-term effect can be potentially large.

- "It is hard to believe Deutsche Bank risked their reputation and charges from Korean authorities in order to earn a mere 40 million dollars in the derivatives trading after massive selling of local stocks worth more than two billion dollars." an analyst at a local brokerage said by phone on condition of anonymity. "I doubt the FSC's claim that Deutsche bank manipulated the market intentionally for trading profit"<sup>11)</sup>
- "The penalties imposed by the FSC were too weak, relative to their misconducts of market manipulation," an unnamed fund manager at a local asset management firm told Xinhua. "Assuming that Deutsche Securities Korrea intentionally

distorted local stock markets as FSC insists, the suspension of some business operations for only six months could be too generous," he said.<sup>12)</sup>

- Another analyst at a local brokerage said, "Deutsche Bank's South Korean unit will not be damaged by the 6-month suspension because it focuses on over-the-counter trading, not on the exchange-traded derivatives."<sup>13)</sup>
- "The damage to Deutsche Bank's reputation will be significant regardless of small fine or mere 6-month suspension," said Namgil Nam, a research fellow and head of derivatives at Korea Capital Market Institute in Seoul. "The severe penalty will show the market that South Korean authorities are determined to clamp down on misconduct."<sup>14)</sup>
- Wolfgang Gerke, a professor of finance, on Friday told Reuters that while the bank's global reputation was unlikely to suffer in the long run, "it is certainly not trivial on a regional level."<sup>15)</sup>

10) <http://www.koreaherald.com/business/Detail.jsp?newsMLId=20110310000832/>

11) [http://news.xinhuanet.com/english2010/business/2011-02/24/c\\_13748393.htm](http://news.xinhuanet.com/english2010/business/2011-02/24/c_13748393.htm)

12) [http://news.xinhuanet.com/english2010/business/2011-02/24/c\\_13748393.htm](http://news.xinhuanet.com/english2010/business/2011-02/24/c_13748393.htm)

13) [http://news.xinhuanet.com/english2010/business/2011-02/24/c\\_13748393.htm](http://news.xinhuanet.com/english2010/business/2011-02/24/c_13748393.htm)

14) <http://www.bloomberg.com/news/2011-02-23/deutsche-bank-gets-six-month-korean-proprietary-trade-ban-over-stock-rout.html>

15) <http://www.bworldonline.com/content.php?title=Deutsche%20Bank%E2%80%99s%20Korea%20unit%20fined%20for%20derivative%20trades&id=27108>

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