An expiration effect on the price relationship between the KOSPI 200 stock index and its nearby futures markets : A new approach

Hyun Kyung Kim[a,1], Seung Oh Nam[b], Sol Kim[c,2]

[a]Korea Advanced Institute of Science and Technology Business School

Hoegiro 87, Dongdaemoon-gu, Seoul, 130-722, Republic of Korea

[b]Soonchunhyang University

646 Eupnae-ri, Shinchang-myeon, Asan-si, Chungcheongnam-do,

336-745, Republic of Korea

[c]Hankuk University of Foreign Studies

270 Imun-dong, Dongdaemoon-gu, Seoul, 130-791, Republic of Korea

Tel : +82-2-958-3697

Fax : +82-2-958-3604

November, 2009.

[1] Speaker. Hyun Kyung Kim. E-mail : khk144@business.kaist.ac.kr, Tel : +82-2-958-3697, Fax : +82-2-958-3604

[2] Corresponding author, Sol Kim. E-mail : solkim@hufs.ac.kr, Tel : +82-2-2173-3124, Fax : +82-2-958-4645

An expiration effect on the price relationship between the KOSPI 200 stock index and its nearby futures markets : A new approach

Abstract

This article investigates the abnormal price movements that have the expiration day effects on the relationship between the KOSPI 200 stock index and its nearby futures prices in Korean financial markets. Unlike early studies that examined the abnormal price movements around the expiration day of derivatives contracts just separately in each financial market, this study examines whether the price relationship between the underlying asset and its nearby futures markets is associated with the expiration day of futures contracts using the concordance correlation coefficient, which allows us to analyze the agreement between two financial markets. Examining transaction price data from June 14, 1996 to December 14, 2006 shows that the concordance correlation coefficient between the KOSPI 200 stock index and its nearby futures prices increases as the expiration day of futures contracts comes closer. This result implies that the price relationship between the KOSPI 200 stock index and its futures markets is associated with the expiration day effects of futures contracts and that this effect can be captured by the concordance correlation coefficient.

Keywords : abnormal price movement; price relationship; expiration day effects; concordance correlation coefficient

I. Introduction

The abnormal price movements of the underlying asset and the relevant derivatives market around the expiration day of derivatives contracts have been of special interest to practitioners and researchers. Many researchers, including Alkeback and Hagelin (2004), and Chou, Chen, and Chen (2006), argue that these abnormal price movements occur more frequently around the expiration day of derivatives contracts because of the influence of action by arbitragers, speculative strategies, and price manipulation activities. Previous studies have investigated this distortion by classifying it into the expiration day effect or the maturity effect. The expiration day effect involves the abnormal price movement of the underlying asset market, and the maturity effect explains the abnormal price movement of the derivatives market around the expiration day of derivatives contracts.

In 1978, Klemkosky undertook the first major study of the expiration day effect. He found that stock prices show a 1% average residual decline in the week prior to the expiration of an option series, and a 0.4% rise in the subsequent week. Since Klemkosky's study in 1978, a number of empirical studies have investigated the expiration day effect. They focus on changes in mean return, volatility, price reversals, and trading volume of the underlying asset around expiration day. Using a t-test for two groups divided into expiration day and non-expiration day, Stoll and Whaley (1990, 1991) reported that the significantly larger trading volume of the stock index is associated with the expiration day of its derivatives contracts. Pope and

Yadav (1992) provide the evidence of downward price pressure and an increase in trading volume before the expiration day of options, using United Kingdom data. They used a non-parametric test to compare the distributions of square returns for the two periods in the test for the volatility of stock returns. Chen and Williams (1994) observed an abnormal expiration day effect on trading volume; however, they reported that the differences in mean return and standard deviation were statistically insignificant. Stoll and Whaley's (1997) study of SPI futures contracts in Australia found no evidence of price reversals, but observed the trading volume effect for the expiration day. Corredor, Lechon, and Santamaria (2001) corroborated these patterns. Their research uses the GARCH type model and the bootstrap technique to test for the expiration day effects. They reported that the expiration day of the Ibex-35 index derivatives is associated with an increase in the trading volume of the underlying asset. However, they have no significant effect on either the mean return of underlying asset market or the level of volatility on the expiration day. Vipul (2005) also examined the expiration day effect on the trading volume and volatility of the underlying asset using the non-parametric Wilcoxon matched-pairs signed rank test. He observed an abnormal movement in trading volume in the underlying asset market. However, he found that the volatility of the underlying asset is not significantly affected by the expiration day of futures or options. On the other hand, Bollen and Whaley (1999), and Chow, Yung and Zhang (2003) reported no expiration day effect on the trading volume of the underlying asset, using mainly the t-test. The study of Chow, Yung and Zhang (2003) found that the expiration day of futures and options in Hong Kong financial markets may be associated with a

negative price effect and some return volatility on the underlying stock market; however, the expiration day of futures and options has no effect on the trading volume of the underlying stock market.

In terms of the maturity effect, Samuelson (1965) undertook the first research. For this reason, the maturity effect is known as the Samuelson effect. He reported that the volatility of the futures contracts increases as the expiration day of futures approaches, under the assumption that the underlying asset price follows a first-order autoregressive process, and that the futures price is an unbiased estimator of the underlying asset on the expiration day. Since Samuelson's research in 1965, the relationship between the volatility of derivatives prices and the time to maturity of derivatives contracts has been investigated in all the financial literature related to the maturity effect. Grammatikos and Saunders (1986) examined the possibility that information arrival was directly linked with contract maturity. They found that the expiration day of the derivative contracts had a strong effect on volume, but no such relationship could be found for price variability. Galloway and Kolb (1996) reported that the maturity effect originates because, as the expiration day approaches, the price of futures contracts reacts more powerfully to new information about the underlying commodity than does the price of the underlying asset contract further from expiration. Bessembinder, Coughnour, Segiun and Smoller (1996) also concluded that the maturity effect in the futures market is affected by negative covariance between the spot price and the net carry cost. However, Chen, Duan, and Hung (1999) concluded that the volatility of the futures prices decreases when the

contract is closer to its maturity, in contrast to the result of Samuelson's research on the maturity effect. In addition, Moosa and Bollen (2001) found no evidence of the maturity effect in futures prices, using the S&P 500 futures contracts.

Like this, the previous researches on the abnormal price movements of underlying asset and its derivatives markets around the expiration day of derivatives contracts have just been separately studied in each financial market. However, there is not yet any study that has examined the price relationship between the underlying asset and its derivatives markets around the expiration day of derivatives contracts. Many previous researchers, including Hull (2002), insisted that there is a close relationship between the expiration day of derivatives and the degree of convergence between the underlying asset and its derivatives prices. Furthermore, the behavior of the derivatives markets cannot be understood without the underlying asset markets. Hence, the expiration day effects have to be considered based on the price relationship between two financial markets. Therefore, the research on the price relationship between two financial markets around the expiration day of derivatives contracts will make an important contribution, apart from the previous researches which have been separately studied in each financial market.

To examine whether the price relationship between the stock index and its futures contracts in Korean financial markets is associated with the expiration day of futures contracts, in this study, the price relationship between these two Korean financial markets is investigated by measuring the agreement between two financial markets

using the concordance correlation coefficient. We expect that the concordance correlation coefficient can explain the price relationship or the agreement between two financial markets particularly, rather than previous methodologies used in the financial research area such as the commonly used Pearson correlation, because the concordance correlation coefficient is the aggregate measurement dealing with the mean, the variance, and the Pearson correlation coefficient at once. In order to verify that the concordance correlation coefficient can provide more detailed information about the expiration day effects of futures contracts on the price relationship between the stock index and its futures markets, this study carries out the comparison between the concordance correlation coefficient and the Pearson correlation coefficient.

This paper is organized as follows. Section 2 describes the data employed in this paper and section 3 explains the methodologies used for analysis, including the concordance correlation coefficient. Section 4 presents empirical results. In section 5, we summarize the results and present our conclusions.

II. Data Description

In June 1994, the KOSPI 200 stock index market was introduced and, later, in May 1996, the futures market in the KOSPI 200 stock index was introduced. The KOSPI 200 stock index is a market value-weighted index comprised of 200 major stocks in the Korean stock market. This index reflects the overall movement of the Korean

stock market. The KOSPI 200 stock index futures take the KOSPI 200 stock index as the underlying asset, and the futures trade on the Korea Exchange (KRX). Table 1 presents basic summary information about the KOSPI 200 stock index futures.

<Insert Table 1>

To investigate the price relationship between the KOSPI 200 stock index and its associated nearby futures contracts in Korean financial markets, and the expiration day effects on the price relationship between these two financial markets, this study uses the minute-to-minute intraday price data offered by the Korea Exchange (KRX) from June 14, 1996 to December 14, 2006. June 14, 1996 is the next day of the first expiration day after the opening day of futures contracts, and December 14, 2006 is the last expiration day in 2006. For futures price data, only the price data of futures contracts that is closest to the expiration day is used to provide the most frequent observations. Because the minute-to-minute intraday price data offered by KRX has missing values during April 2005, November 2005, and December 2005, the stock index price data and its associated nearby futures price data traded during this correspondent period are excluded in this study. For this reason, the excluded data in this study are from March 11, 2005 to June 9, 2005, and from September 9, 2005 to March 9, 2006.

Table 2 provides descriptive statistics for the minute-to-minute intraday price data on the KOSPI 200 stock index and its associated nearby futures price items.

Descriptive statistics shown in Table 2 are divided into those for each futures contract and for the overall period of analysis.

<Insert Table 2>

III. Methodology

This study investigates whether there are abnormal price movements that have an effect on the price relationship between the stock index and its nearby futures markets around the expiration day of futures contracts using transaction price data on the KOSPI 200 stock index and its nearby futures contracts in the Korean financial markets. In this study, this effect is called 'the expiration day effects' to distinguish this effect from 'the expiration day effect' and 'the maturity effect' in previous studies.

Following the cost-of-carry model proposed by Cornell and French (1983), the price relationship between the stock index and its futures markets is represented as the following equation.

$$F = Se^{r(T-t)} \quad (1)$$

where $T-t$ is the time delivery date in futures contract (in years), F is the stock index futures theoretical price today, S is the stock index market price today, and r

is the risk-free rate of interest per annum, expressed with continuous compounding, for an investment maturing at the delivery data (i.e. in $T - t$ years).

The stock index futures market price must always agree with the stock index futures theoretical price in theory. However, it is often possible to make an arbitrage profit in real financial markets since arbitrage opportunities can be generated by the market friction, such as various transaction costs and information asymmetries. In this context, Hull (2002) insisted that arbitrage behavior reveals in the financial markets if the stock index futures market price does not correspond with its theoretical price because profits can be made by index arbitrage. Furthermore, arbitrage behavior tends to continue until arbitrage profit disappears and arbitrage profit disappears at the same rate that arbitrage activity increases. In other words, the more active arbitrage behavior is, the greater the tendency for agreement between the stock index futures market price and its theoretical price shows. Hence, we can anticipate that the agreement between the stock index futures market price and its theoretical price increases as the expiration day of futures approaches based on the previous researches, which stated that the arbitrage behavior is more active as the expiration day of derivatives approaches.

As mentioned previously, this study uses the concordance correlation coefficient to investigate the price relationship between the KOSPI 200 stock index and its nearby futures contracts. The concordance correlation coefficient is mainly used in the biometrics research area until now, but this study is focusing on the use of the

concordance correlation coefficient in the financial research area. The attempt to observe the price relationship between two financial markets using the concordance correlation coefficient is reasonable in that this coefficient can measure the degree of agreement between two financial markets.

The concordance correlation coefficient is originally proposed by Lin (1989) to measure the agreement between two raters or two methodologies. This coefficient has the merit of measuring the precision and the accuracy between two measurements at the same time, compared with the commonly known Pearson correlation coefficient which can only measure the precision. For reference, the precision means how far each observation deviates from the line fit to the data, and the accuracy means how far this line deviates from the 45° line through the origin.

Following the definition of the concordance correlation coefficient, the concordance correlation coefficient between Y_1 and Y_2 is calculated by equation (2).

$$\rho_c = 1 - \frac{E[(Y_1 - Y_2)^2]}{\sigma_1^2 + \sigma_2^2 + (\mu_1 - \mu_2)^2} = \frac{2\sigma_{12}}{\sigma_1^2 + \sigma_2^2 + (\mu_1 - \mu_2)^2} = \rho C_b \qquad (2)$$

where ρ_c is the concordance correlation coefficient, ρ is the Pearson correlation coefficient, and C_b is a bias correction factor.

In equation (2), $E[(Y_1 - Y_2)^2]$, which is characterized by the expected value of the

squared difference, represents the degree of concordance between Y_1 and Y_2, and the rest of equation is proposed in order for the value of the index to be scaled between -1 and 1. The last part of this equation represents the relationship between the concordance correlation coefficient and the commonly used Pearson correlation coefficient.

As indicated by equation (2), the concordance correlation coefficient has the feature of the aggregate measurement dealing with the mean, the variance, and the Pearson correlation coefficient, at once. Hence, an analysis using the concordance correlation coefficient can get more information about the relationship between two measurements, compared with an analysis using the previous methodologies including the Pearson correlation coefficient.

To investigate the price relationship between the Korean stock index and its futures markets and the expiration day effects of futures contracts on the price relationship between these two financial markets, this paper analyzes two of the agreements between the KOSPI 200 stock index and its associated nearby futures contracts using the concordance correlation coefficient. The one is the agreement between the KOSPI 200 stock index market price and its futures market price, and the other is the agreement between the KOSPI 200 stock index futures market price and its theoretical price. The first case holds a meaning for practitioners in that both the KOSPI 200 stock index and its futures market prices can be directly observed in real financial markets. In comparison, the second case holds a meaning for researchers

when no arbitrage assumption based on the cost-of-carry model is considered, comparatively.

This study calculates two types of the concordance correlation coefficients on a daily basis for each case to measure the agreement between two Korean financial markets. For second case, the KOSPI 200 stock index futures theoretical price is calculated by using equation (1) before the calculation of the concordance correlation coefficient. From these results, we can find a change in the agreement between two financial markets, according to the trading days. In addition, this study also calculates two types of the Pearson correlation coefficients on a daily basis, similar to the case of the concordance correlation coefficient, to evaluate how the concordance correlation coefficient is appropriate to measure the agreement between two financial markets through the comparison between the result from the concordance correlation coefficient and the result from the commonly used Pearson correlation coefficient.

After the calculation of the two types of the concordance and the Pearson correlation coefficients, this study carries out the simple regression analysis using these coefficients to capture the expiration day effects on the agreement between the KOSPI 200 stock index and its associated nearby futures contracts. We set the concordance correlation coefficients ($\rho_{c,t}$) as the dependent variable and the time to maturity of futures (TM_t) as the independent variable for the simple regression analysis using the concordance correlation coefficient; on the other hands, we set the Pearson correlation coefficients (ρ_t) as the dependent variable, and the time to

maturity of futures contracts (TM_t) as the independent variable for the simple regression analysis using the Pearson correlation coefficient. These simple regression models are represented in equation (3) and equation (4).

$$\rho_{c,t} = \alpha_0 + \alpha_1 \times TM_t + \varepsilon_{c,t} \quad (4)$$

$$\rho_t = \beta_0 + \beta_1 \times TM_t + \varepsilon_t \quad (5)$$

IV. Empirical Results

The overall period of analysis is from June 14, 1996 to December 14, 2006. As previously mentioned, this study makes two approaches to investigate the price relationship between the stock index and its futures markets. The first approach is the analysis of the relationship between the stock index market price and its futures market price. This approach can have a meaning in that the concordance correlation coefficient and the Pearson correlation coefficient are calculated by using market prices which can be directly observed in financial markets. On the contrary, the second approach is the analysis of the relationship between the stock index futures market price and its theoretical price. This approach has some trouble calculating the stock index futures theoretical price; however, the agreement between the stock index and its futures markets can be more easily evaluated because the concordance and the Pearson correlation coefficients between the stock index futures market price and its futures theoretical price are always one, following the cost-of-carry model.

Table 3 show descriptive statistics for the concordance correlation coefficients and the Pearson correlation coefficients on a daily basis. Descriptive statistics in Table 3 are divided into those for each futures contract and for the overall period of analysis.

<Insert Table 3>

In the case of the concordance and the Pearson correlation coefficients between the stock index futures market price and its theoretical price, both these concordance and Pearson correlation coefficients are always exactly one since the stock index futures market price must always agree with the stock index futures theoretical price, theoretically, as previously stated. Likewise, both the concordance and the Pearson correlation coefficients between the stock index market price and its futures market price also have to get toward one for similar reasons. However, we can know that these coefficients are different from one in real financial markets for the most part, as shown in Table 3. Aside from the degree of getting closer to one, we can find that the Pearson correlation coefficients are greater and closer to one than the concordance correlation coefficients from most of result in Table 3. This result infers that, as compared with the Pearson correlation coefficient, the concordance correlation coefficient goes through a complicated procedure to evaluate the agreement between two financial markets because that both correlation coefficients get closer to one means that it rises in the degree of agreement between two financial markets. In addition, the result of the concordance correlation coefficient is distinguished from

the result of the Pearson correlation coefficient when the concordance and the Pearson correlation coefficients between the stock index market price and its futures market price are compared with these coefficients between the stock index futures market price and its theoretical price. Following the results of Table 3, the concordance correlation coefficient between the stock index market price and its futures market price are significantly different from this coefficient between the stock index futures market price and its theoretical price; on the other hand, there is little to choose between the Pearson correlation coefficients. This result means that the concordance correlation coefficient offers more detailed information about the price relationship than the Pearson correlation coefficient. Consequently, this result implies that the concordance correlation coefficient has more conservative standards for the evaluation of agreement and provides the detailed information about the price relationship, as compared with the Pearson correlation coefficient.

To examine the expiration day effects of a futures contract on the price relationship between the stock index and its futures markets, this study performs simple regression analyses using the concordance and the Pearson correlation coefficients. In these simple regression analyses, the concordance and the Pearson correlation coefficients are set as the dependent variables, and the time to maturity of the KOSPI 200 stock index nearby futures contracts is set as the independent variable for each simple regression model, respectively. Table 4 represents the results of these regression analyses. The results of regression analyses in Table 4 are also divided into those for each futures contract and for the overall period of analyses, similar to

the result of Table 3. For reference, the last part of this table is the simple regression result using the means of each correlation coefficient, which are calculated according to the time to maturity of nearby futures contracts.

<Insert Table 4>

First of all, Table 4 shows that all coefficients of the time to maturity are negative values, which are significant under the 5% level of significance, for the overall period of analysis. This result implies that each correlation coefficient increases closer to the expiration day of futures contracts. In other words, it means that the agreement between the stock index and its futures prices increases closer to the expiration day of futures contracts. On the contrary, the results of the simple regressions using the means of each correlation coefficient, which are represented in the last part of Table 4, are slightly different from the results for the overall period. Following the results using the means of each coefficient, the coefficients of the time to maturity are significant in the case of using the concordance correlation coefficients, while the coefficients are not significant in the case of using the Pearson correlation coefficients under the 5% level of significance.[3] For individual futures contracts, these patterns are more clearly appeared. The coefficients of the time to maturity are significant under the 5% level of significance in the case of 24 futures contracts among total 39

[3] From the result of the concordance correlation coefficient, the coefficient of time to maturity for the concordance correlation coefficient between the stock index market price and its futures market price is not significant under the 5% level of significance; however, the coefficient for the concordance correlation coefficient between the stock index futures market price and its futures theoretical price is significant under the 5% level of significance. Therefore, this study can conclude that the coefficient of time to maturity for the concordance correlation coefficient is more significant than the coefficient for the Pearson correlation coefficient.

futures contracts in the simple regression analyses of the relationship between the stock index market price and its futures market price using the concordance correlation coefficient, while the coefficients of the time to maturity are significant in the case of only 3 futures contracts in the simple regression analyses using the Pearson correlation coefficient. Also, in the simple regression analyses of the relationship between the stock index futures market price and its futures theoretical price, the coefficients of the time to maturity are significant in the case of 35 futures contracts among total 39 futures contracts when using the concordance correlation coefficient; however, the coefficients of the time to maturity are significant in the case of only 3 futures contracts when using the Pearson correlation coefficient. Therefore, we can conclude that the expiration day effects of futures contracts can be captured by the concordance correlation coefficient and it is desirable to use the concordance correlation coefficient to analyze the expiration day effects of futures contracts on the relationship between the stock index and its futures markets rather than to use the Pearson correlation coefficient.

To increase the robustness of the result, this study reruns simple regression analyses after several observations, which can pervert the results due to lack of the number of futures contracts contained in each time to maturity, are deleted. If the number of futures contracts contained in each time to maturity is scarce, the result of simple regression analysis can be distorted by these observations. Thus, in this study, simple regression analyses are performed after cases that the number of futures contracts contained in each time to maturity is less than 20 are excluded. Table 5

represents the results of these regression analyses. The results of regression analyses in Table 5 are also divided into those for each futures contract and for the overall period of analyses, and the last part of this table also represents the simple regression results using the means of each correlation coefficient.

<Insert Table 5>

The result of Table 5 is similar to the result of Table 4 on the whole. First, in the case of using the concordance correlation coefficients, the coefficients of the time to maturity are negative values, which are significant under the 5% level of significance, for the overall period of analysis. For the result using the means of concordance correlation coefficients, the coefficients of the time to maturity also have significant negative values under the 5% level of significance. On the other hand, in the case of using the Pearson correlation coefficients, the coefficients of the time to maturity are not significant under the 5% level of significance for the overall period of analysis, even though the coefficients of the time to maturity are significant when using the means of Pearson correlation coefficient. For individual futures contracts, there is also little difference between the result of Table 4 and Table 5. Like the result of Table 4, the cases that the coefficients of the time to maturity are significant using the concordance correlation coefficient are much more than the cases that the coefficients of the time to maturity are significant using the Pearson correlation coefficient.

From the results of both Table 4 and Table 5, we can infer that the expiration day

effects of futures contracts in the Korean financial markets can be captured by the concordance correlation coefficient whereas cannot be captured by the Pearson correlation coefficient. From this result, we can conclude that it is desirable to use the concordance correlation coefficient to analyze the expiration day effects of futures contracts on the price relationship between the stock index and its futures markets, rather than the commonly used Pearson correlation coefficient. This result is consistent with the previous findings that an analysis by the concordance correlation coefficient can provide more detailed information than an analysis by the Pearson correlation coefficient. In theory, this result also has a significant meaning in that the concordance correlation coefficient has more conservative standards for the evaluation of agreement and contains the measurements of precision and accuracy, as compared with the Pearson correlation coefficient which contains only the measurement of precision.

V. Summary and Conclusion

This study investigates the abnormal price movements that have the expiration day effects on the price relationship between the KOSPI 200 stock index and its nearby futures markets. The purpose of this study is to verify whether there is the expiration day effects on the price relationship between the underlying asset and its derivatives markets in Korean financial markets, using the concordance correlation coefficient which can analyze the agreement between two financial markets.

This study focuses on the price relationship between the stock index and its nearby futures markets in terms of the abnormal price movements around the expiration day of futures contracts. The abnormal price movements of the underlying asset and the derivatives markets around the expiration day of the derivatives contracts were mainly investigated by classifying the distortion into the expiration day effect or the maturity effect in previous studies. The expiration day effect involves the abnormal price movement of the underlying asset market, and the maturity effect explains the abnormal price movement of the derivatives market around the expiration day of the derivatives contracts. However, no study has yet examined the price relationship between these financial markets around the expiration day of derivative contracts.

In this study, the concordance correlation coefficient is used to observe the price relationship between the KOSPI 200 stock index and its associated nearby futures markets. Until now, this coefficient has mainly been used to evaluate the agreement between two readings from the same sample in the biometrics research area; however, this study attempts to apply this coefficient in the financial research area. Through the concordance correlation coefficient, which can evaluate the agreement between two financial markets, we investigate whether there are abnormal price movements that have an effect on the price relationship between the KOSPI 200 stock index and its nearby futures markets around the expiration day of futures contracts.

To investigate the price relationship and the expiration day effects on the

relationship between the KOSPI 200 stock index and its nearby futures markets, this study uses the minute-to-minute intraday price data from June 14, 1996 to December 14, 2006 for the KOSPI 200 stock index and its associated nearby futures contracts. From the result of the concordance correlation coefficient on a daily basis, we know that, in most cases, the concordance correlation coefficients are not one. This result implies that arbitrage profit is possible in Korean financial markets. We also know that this coefficient increases closer to the expiration day of futures contracts from the result of the simple regression analyses to analyze the expiration day effects. This result implies that the agreement between the KOSPI 200 stock index and its futures markets increases around the expiration day of futures contracts because the arbitrage trading activity is more active as the expiration day approaches.

Finally, this study compares the result from the concordance correlation coefficient with the result from the commonly known Pearson correlation coefficient to evaluate how the concordance correlation coefficient can explain the expiration day effects on the price relationship between two financial markets. From this comparison, we can find that the expiration day effects of futures contracts cannot be captured by the Pearson correlation coefficient, but can be captured by the concordance correlation coefficient. The reason for this result can be explained by the difference in information between the concordance and the Pearson correlation coefficients. Theoretically, the concordance correlation coefficient measures the precision and the accuracy between two measurements, at the same time; however, the Pearson correlation coefficient measures only the precision between two measurements. In

this way, we can say that an analysis using the concordance correlation coefficient can provide more detailed information than an analysis using the Pearson correlation coefficient, and the concordance correlation coefficient has more conservative standards for the evaluation of agreement, as compared with the Pearson correlation coefficient. In conclusion, it is desirable to use the concordance correlation coefficient to analyze the expiration day effects of futures on the price relationship between the KOSPI 200 stock index and its futures markets, rather than the Pearson correlation coefficient.

References

Alkeback, P., & Hagelin, N. (2004). Expiration day effects of index futures and options : evidence from a market with a long settlement period. *Applied Financial Economics*, 14, 385-396.

Bessembinder, H., Coughenour, J. F., Seguin, P. J., & Smoller, M. M. (1996). Is there a term structure of futures volatilities? Reevaluating the Samuelson hypothesis. *Journal of Derivatives*, 4(2), 45-58.

Bollen, N. P. B., & Whaley, R. E. (1999). Do expirations of Hang Seng Index derivatives affect stock market volatility?, *Pacific-Basin Finance Journal*, 7, 453-470.

Chen, C., & Williams, J. (1994). Triple-witching hour, the change in expiration timing, and stock market reaction. *The Journal of Futures Markets*, 14(3), 275-292.

Chen, Y., Duan, J., & Hung M. (1999). Volatility and maturity effects in the Nikkei index futures. *The Journal of Futures Markets*, 19(8), 895-909.

Chou, H. Chen, W., & Chen, D. (2006). The expiration effects of stock-index derivatives – Empirical evidence from Taiwan futures exchange. *Emerging Markets Finance and Trade*, 42(5), 81-102.

Chow, Y., Yung, H. H. M., & Zhang, H. (2003). Expiration day effect : The case of Hong Kong. *The Journal of Futures Markets*, 23, 67-86.

Cornell, B. and French, K. (1983). Taxes and the pricing of stock index futures, *Journal of Finance*, 38(3), 675-694.

Corredor, P., Lechon, P., & Santamaria, R. (2001). Option-expiration effects in small markets : The Spanish stock exchange. *The Journal of Futures Markets*, 21, 905-928.

Galloway, T. M., & Kolb, R. W. (1996). Futures prices and the maturity effect, *The Journal of Futures Markets*, 16(7), 809-828.

Grammatikos, T., & Saunders, A. (1986). Futures price variability : A test of maturity and volume effects. *Journal of Business*, 59(2), 319-328.

Hull, J. C. (2002). Fundamentals of Futures & Options Markets, 4th edition, *Prentice Hall*.

Moosa, I. A., & Bollen, B. (2001). Is there a maturity effect in the price of the S&P 500 futures contract?, *Applied Economics Letters*, 8, 693-695.

Lin, L. I. (1989). A concordance correlation coefficient to evaluate reproducibility, *Biometrics*, 45(1), 255-268.

Pope, P. F., & Yadav, P. K. (1992). The impact of option expiration on underlying stocks : The UK evidence. *Journal of Business Finance & Accounting*, 19(3), 329-344.

Samuelson, P. (1965). Proof that properly anticipated prices fluctuate randomly. *Industrial Management Review*, 6, 41-49.

Stoll, H. R., & Whaley, R. E. (1990). The dynamics of stock index and stock index futures returns. *Journal of Financial and Quantitative Analysis,* 25, 441-468.

Stoll, H. R., & Whaley, R. E. (1991). Expiration-Day Effects: What Has Changed?. *Financial Analysts Journal*, January-February 1991, 58-72.

Stoll, H. R., & Whaley, R. E. (1997). Expiration-day effects of the all ordinaries share price index futures : Empirical evidence and alternative settlement procedures. *Australian Journal of Management*, 22(2), 139-174.

Vipul (2005). Futures and options expiration-day effects : The Indian evidence. *The Journal of Futures Markets*, 25, 1045-1065

Table 1. Selected specifications of the KOSPI 200 stock index futures traded on the Korea Exchange (KRX)

Underlying Asset	KOSPI 200 Index
Contract Size	KOSPI 200 Index times KRW 500,000
Contract Months	The four consecutive near months from the quarterly cycle (March, June, September and December)
Trading Hours	~ 06DEC98 : 9:30~11:30, 13:00~15:15 (Last trading day 9:30~11:30, 13:00~14:50) 07DEC98 ~ 21MAY00 : 9:00~12:00, 13:00~15:15 (Last trading day 9:00~12:00, 13:00~14:50) 22MAY00 ~ : 9:00~15:15 (Last trading day 9:00~14:50)
Tick Size & Value	0.05 point, representing a value of KRW 25,000
Last Trading Day	Second Thursday of the contract month
Final Settlement Day	The following day of the last trading day
Final Settlement	Cash
Daily Price Limit	10% of the previous closing price
Position Limit	Net position of 7,500 contracts
Circuit Breakers	When the lead month contract hits ±5% of the previous closing price for 1 minute, and the difference between the current price and the theoretical price is ± 3% or more, the trading of all contracts are halted for next five minutes. For the next ten minutes following the cooling-off period, orders are collected and then matched at a single price. As well, the futures and options markets are automatically suspended if the stock market is halted. Trading in the stock market is halted for twenty minutes if the KOSPI falls 10% or more from the previous closing value and this continues for one minute or longer.

Source : KRX (Korea Exchange) Information Center

Table 2. Descriptive statistics for the minute-by-minute intraday price data on the KOSPI 200 stock index and its associated nearby futures price item

Contract	Observation		Mean		Minimum		Median		Maximum		Standard Deviation		Skewness		Kurtosis	
	Index	Futures	Index	Futures	Index	Futures	Index	Futures	Index	Futures	Index	Futures	Index	Futures	Index	Futures
1996/09	16733	16733	88.359	88.092	80.33	81.90	89.08	88.50	95.03	95.60	3.478	2.831	-0.339	-0.218	-0.842	-0.742
1996/12	16011	16011	80.321	81.033	70.87	70.95	79.84	81.30	89.24	89.20	4.494	4.563	0.002	-0.265	-0.700	-0.575
1997/03	15168	15168	70.749	69.627	64.00	61.85	70.51	69.10	76.35	76.50	2.784	3.067	-0.024	0.068	-0.807	-0.553
1997/06	16131	16131	71.013	70.098	61.59	61.00	70.70	68.50	80.93	81.30	4.299	5.338	0.347	0.440	-0.260	-0.708
1997/09	16743	16743	77.186	78.940	70.31	70.80	77.13	79.00	83.78	86.10	2.971	3.641	-0.197	-0.442	-0.401	-0.220
1997/12	15769	15769	57.034	56.424	38.08	38.00	57.28	53.30	73.50	75.35	9.131	10.400	-0.074	0.218	-1.071	-1.348
1998/03	14805	14805	55.839	56.073	37.82	36.25	58.78	59.40	70.45	72.10	8.044	9.660	-0.573	-0.617	-0.899	-0.922
1998/06	16342	16342	48.534	48.313	34.82	32.70	48.74	47.45	63.13	63.85	7.690	8.682	0.106	0.110	-1.205	-1.345
1998/09	16854	16854	36.514	35.416	31.96	30.65	36.16	35.20	43.62	43.55	2.045	2.348	1.016	0.787	0.999	0.496
1998/12	16612	16612	44.801	44.822	32.64	31.95	44.61	45.08	65.72	65.50	7.874	8.360	0.261	0.180	-0.765	-0.900
1999/03	16244	16244	64.647	65.921	56.54	56.00	63.88	65.70	74.80	78.00	4.220	5.032	0.460	0.375	-0.624	-0.543
1999/06	18953	18953	83.052	84.087	67.05	68.35	84.48	84.65	101.18	102.40	8.731	8.360	-0.190	-0.132	-0.948	-0.919
1999/09	19555	19555	111.112	110.699	93.06	94.45	112.53	111.00	125.36	126.55	6.433	6.298	-0.440	-0.193	-0.315	-0.140
1999/12	18652	18652	110.459	111.456	93.31	94.05	110.91	112.20	126.41	126.75	9.068	9.122	-0.105	-0.157	-1.369	-1.360
2000/03	17448	17448	117.663	119.128	100.75	101.50	118.35	120.00	131.44	134.60	6.078	6.762	-0.310	-0.224	-0.572	-0.684
2000/06	18516	18516	98.554	98.819	79.23	80.45	96.66	96.15	114.71	115.50	8.411	8.982	0.042	0.131	-1.152	-1.229
2000/09	21590	21590	95.219	95.707	77.22	77.05	93.37	94.30	109.38	110.10	7.606	7.662	0.045	0.039	-0.947	-0.817
2000/12	22970	22970	68.661	68.272	59.50	59.50	68.44	68.00	81.20	81.40	3.991	4.032	0.406	0.418	-0.280	-0.223
2001/03	18290	18290	72.579	72.361	62.26	61.30	73.28	73.20	79.47	79.90	3.964	4.169	-0.878	-0.926	-0.052	0.019
2001/06	21950	21950	70.629	70.693	60.96	60.95	71.97	72.25	79.00	79.10	5.028	5.047	-0.214	-0.213	-1.281	-1.273
2001/09	21955	21955	69.684	69.638	59.88	59.80	69.66	69.60	76.41	76.95	2.917	2.976	-0.294	-0.188	0.236	0.108
2001/12	22290	22290	70.006	69.619	57.02	56.55	67.28	66.15	89.80	90.00	8.969	9.374	0.386	0.421	-1.125	-1.156
2002/03	20831	20831	93.752	93.509	79.59	78.55	93.37	93.30	106.67	106.80	7.229	7.511	-0.151	-0.207	-0.727	-0.681
2002/06	21989	21989	108.492	108.785	99.37	99.15	108.33	108.65	118.58	119.30	4.447	4.605	0.090	0.082	-0.697	-0.672
2002/09	22341	22341	92.846	92.844	82.65	82.80	91.88	91.90	104.38	104.85	4.667	4.828	0.407	0.397	-0.486	-0.485
2002/12	22610	22610	84.942	84.751	72.44	71.50	84.46	84.25	93.68	93.65	4.340	4.487	-0.162	-0.157	-0.502	-0.521
2003/03	21530	21530	78.162	77.662	65.42	65.35	76.61	76.15	90.71	89.60	5.915	5.755	0.276	0.212	-0.644	-0.822
2003/06	21950	21950	75.670	75.742	65.30	65.20	76.34	76.50	84.34	84.40	4.511	4.643	-0.228	-0.261	-0.880	-0.920
2003/09	21950	21950	91.479	91.776	83.45	83.55	90.81	91.20	100.04	100.10	4.276	4.206	0.234	0.182	-0.946	-0.937
2003/12	22610	22610	99.202	99.576	88.27	88.60	100.30	100.75	106.54	106.90	4.452	4.488	-0.739	-0.754	-0.433	-0.420
2004/03	20810	20810	111.171	111.335	101.22	101.00	111.47	111.95	119.61	119.80	4.582	4.813	-0.285	-0.451	-0.927	-0.789
2004/06	21950	21950	111.003	111.255	92.77	92.85	112.62	113.15	122.64	123.15	7.485	7.835	-0.265	-0.293	-1.135	-1.181
2004/09	23390	23390	98.415	98.135	92.49	91.60	97.36	97.10	106.04	106.15	3.380	3.571	0.625	0.589	-0.709	-0.709
2004/12	22250	22250	110.489	110.607	103.26	102.90	110.66	110.85	115.64	115.95	2.703	2.869	-0.307	-0.393	-0.575	-0.373
2005/03	21530	21530	119.562	119.269	107.65	105.45	119.49	119.85	132.20	131.90	6.585	7.086	0.254	0.009	-1.147	-1.093
2005/09	23030	23030	137.265	137.508	126.07	126.30	138.91	139.05	149.56	149.55	6.434	6.297	-0.231	-0.222	-1.358	-1.347
2006/06	21950	21950	177.978	178.383	158.61	158.15	177.97	178.50	189.90	190.75	7.093	7.331	-0.034	-0.044	-1.052	-1.069
2006/09	24110	24110	167.547	167.951	153.89	154.45	168.09	168.60	177.22	177.60	5.722	5.856	-0.218	-0.237	-1.019	-1.045
2006/12	22250	22250	178.966	180.110	169.64	171.25	178.43	179.65	185.63	186.35	3.288	3.080	0.102	0.063	-0.694	-0.590
Overall	776662	776662	94.755	94.882	31.96	30.65	90.27	90.30	189.90	190.75	33.354	33.645	0.915	0.900	0.773	0.772

Index indicates the KOSPI 200 stock index.

Futures indicate the KOSPI 200 stock index futures.

Table 3. Descriptive statistics of the concordance correlation coefficients and the Pearson correlation coefficients, on a daily basis, for each futures contract and for the overall period of analysis

Contract	Type of coefficient	Observation		Mean		Minimum		Median		Maximum		Standard Deviation		Skewness		Kurtosis	
		C.C.C.	P.C.C.	C.C.C.	P.C.C.	C.C.C.	P.C.C.	C.C.C.	P.C.C.	C.C.C.	P.C.C.	C.C.C.	P.C.C.	C.C.C.	P.C.C.	C.C.C.	P.C.C.
1996/09	I.M. & F.M.	76	76	0.210	0.735	0.003	0.120	0.100	0.788	0.905	0.977	0.258	0.205	1.517	-1.056	1.291	0.678
	F.M. & F.T.	76	76	0.188	0.735	0.001	0.120	0.060	0.788	0.905	0.977	0.246	0.205	1.604	-1.056	1.672	0.678
1996/12	I.M. & F.M.	72	72	0.372	0.801	-0.005	-0.024	0.278	0.872	0.939	0.980	0.300	0.189	0.481	-2.167	-1.190	5.507
	F.M. & F.T.	72	72	0.356	0.801	-0.001	-0.024	0.259	0.872	0.939	0.980	0.312	0.189	0.518	-2.167	-1.246	5.507
1997/03	I.M. & F.M.	68	68	0.224	0.763	0.003	0.042	0.152	0.816	0.882	0.955	0.223	0.172	1.294	-1.749	1.072	4.084
	F.M. & F.T.	68	68	0.123	0.763	0.001	0.042	0.043	0.816	0.877	0.955	0.182	0.172	2.293	-1.749	5.048	4.084
1997/06	I.M. & F.M.	73	73	0.177	0.752	-0.016	-0.408	0.062	0.820	0.911	0.976	0.231	0.234	1.843	-2.405	2.847	7.957
	F.M. & F.T.	73	73	0.158	0.752	-0.004	-0.408	0.019	0.820	0.880	0.976	0.228	0.234	1.490	-2.405	1.142	7.957
1997/09	I.M. & F.M.	76	76	0.095	0.821	0.001	0.067	0.031	0.858	0.803	0.973	0.172	0.148	3.011	-2.358	8.629	8.545
	F.M. & F.T.	76	76	0.267	0.821	0.007	0.067	0.183	0.858	0.904	0.973	0.227	0.148	1.049	-2.358	0.210	8.545
1997/12	I.M. & F.M.	72	72	0.177	0.770	0.000	0.000	0.089	0.853	0.811	0.984	0.191	0.239	1.409	-1.995	1.606	3.337
	F.M. & F.T.	72	72	0.262	0.770	0.000	0.000	0.160	0.853	0.880	0.984	0.256	0.239	1.081	-1.995	0.135	3.337
1998/03	I.M. & F.M.	67	67	0.284	0.725	0.000	0.000	0.184	0.811	0.887	0.970	0.272	0.279	0.663	-1.726	-1.009	1.908
	F.M. & F.T.	67	67	0.338	0.725	0.000	0.000	0.225	0.811	0.936	0.970	0.318	0.279	0.505	-1.726	-1.313	1.908
1998/06	I.M. & F.M.	74	74	0.248	0.785	0.008	0.232	0.124	0.847	0.844	0.984	0.253	0.168	1.028	-1.112	-0.241	0.744
	F.M. & F.T.	74	74	0.204	0.785	0.004	0.232	0.105	0.847	0.905	0.984	0.233	0.168	1.474	-1.112	1.224	0.744
1998/09	I.M. & F.M.	76	76	0.172	0.789	0.005	0.194	0.074	0.826	0.894	0.979	0.221	0.154	1.826	-1.175	2.478	1.841
	F.M. & F.T.	76	76	0.097	0.789	0.003	0.194	0.037	0.826	0.869	0.979	0.157	0.154	2.838	-1.175	9.155	1.841
1998/12	I.M. & F.M.	74	74	0.461	0.850	0.021	0.431	0.496	0.877	0.972	0.977	0.318	0.107	0.002	-1.181	-1.543	1.844
	F.M. & F.T.	74	74	0.407	0.850	0.004	0.431	0.373	0.877	0.951	0.977	0.339	0.107	0.261	-1.181	-1.476	1.844
1999/03	I.M. & F.M.	54	54	0.349	0.872	0.006	0.472	0.275	0.907	0.937	0.982	0.287	0.114	0.551	-1.918	-1.016	3.928
	F.M. & F.T.	54	54	0.447	0.872	0.009	0.472	0.382	0.907	0.937	0.982	0.310	0.114	0.259	-1.918	-1.386	3.928
1999/06	I.M. & F.M.	63	63	0.345	0.890	0.020	0.567	0.289	0.913	0.948	0.992	0.270	0.084	0.727	-1.841	-0.587	4.459
	F.M. & F.T.	63	63	0.539	0.890	0.071	0.567	0.561	0.913	0.943	0.992	0.248	0.084	-0.178	-1.841	-0.997	4.459
1999/09	I.M. & F.M.	65	65	0.582	0.912	0.041	0.664	0.618	0.935	0.984	0.985	0.286	0.068	-0.412	-1.686	-1.136	3.103
	F.M. & F.T.	65	65	0.540	0.912	0.027	0.664	0.551	0.935	0.974	0.985	0.305	0.068	-0.191	-1.686	-1.476	3.103
1999/12	I.M. & F.M.	62	62	0.527	0.937	0.030	0.668	0.524	0.954	0.946	0.992	0.228	0.051	-0.023	-2.545	-0.850	11.297
	F.M. & F.T.	62	62	0.755	0.937	0.290	0.668	0.790	0.954	0.978	0.992	0.186	0.051	-0.708	-2.545	-0.444	11.297
2000/03	I.M. & F.M.	58	58	0.481	0.933	0.027	0.675	0.491	0.949	0.981	0.986	0.288	0.062	0.067	-2.344	-1.270	6.371
	F.M. & F.T.	58	58	0.849	0.933	0.348	0.675	0.898	0.949	0.981	0.986	0.137	0.062	-1.900	-2.344	4.071	6.371
2000/06	I.M. & F.M.	59	59	0.561	0.924	0.108	0.685	0.591	0.951	0.971	0.991	0.256	0.074	0.043	-2.048	-1.294	3.775
	F.M. & F.T.	59	59	0.549	0.924	0.070	0.685	0.583	0.951	0.968	0.991	0.277	0.074	-0.181	-2.048	-1.197	3.775
2000/09	I.M. & F.M.	60	60	0.580	0.942	0.100	0.753	0.622	0.965	0.968	0.994	0.240	0.056	-0.197	-1.847	-1.112	3.102
	F.M. & F.T.	60	60	0.676	0.942	0.019	0.753	0.890	0.965	0.989	0.994	0.328	0.056	-0.823	-1.847	-0.906	3.102
2000/12	I.M. & F.M.	64	64	0.690	0.939	0.106	0.526	0.809	0.956	0.976	0.992	0.259	0.066	-0.814	-4.231	-0.728	23.894
	F.M. & F.T.	64	64	0.409	0.939	0.043	0.526	0.360	0.956	0.977	0.992	0.274	0.066	0.551	-4.231	-0.748	23.894
2001/03	I.M. & F.M.	51	51	0.795	0.955	0.159	0.804	0.881	0.966	0.977	0.992	0.225	0.039	-1.633	-2.010	1.495	4.826
	F.M. & F.T.	51	51	0.554	0.955	0.040	0.804	0.604	0.966	0.978	0.992	0.293	0.039	-0.243	-2.010	-1.282	4.826
2001/06	I.M. & F.M.	61	61	0.847	0.954	0.414	0.832	0.896	0.964	0.988	0.993	0.140	0.036	-1.410	-1.738	1.354	2.890
	F.M. & F.T.	61	61	0.474	0.954	0.033	0.832	0.381	0.964	0.992	0.993	0.289	0.036	0.467	-1.738	-1.189	2.890
2001/09	I.M. & F.M.	61	61	0.701	0.941	0.187	0.748	0.762	0.956	0.979	0.992	0.220	0.051	-0.740	-1.987	-0.441	4.269

	F.M. & F.T.	61	61	0.357	0.941	0.022	0.748	0.224	0.956	0.931	0.992	0.251	0.051	0.717	-1.987	-0.789	4.269
2001/12	I.M. & F.M.	62	62	0.479	0.927	0.014	0.519	0.418	0.956	0.984	0.995	0.380	0.078	0.127	-2.730	-1.795	11.360
	F.M. & F.T.	62	62	0.385	0.927	0.008	0.519	0.125	0.956	0.988	0.995	0.405	0.078	0.553	-2.730	-1.545	11.360
2002/03	I.M. & F.M.	58	58	0.794	0.962	0.029	0.795	0.927	0.972	0.987	0.994	0.251	0.036	-1.615	-2.650	1.582	9.113
	F.M. & F.T.	58	58	0.484	0.962	0.011	0.795	0.454	0.972	0.991	0.994	0.300	0.036	0.219	-2.650	-1.162	9.113
2002/06	I.M. & F.M.	61	61	0.782	0.969	0.251	0.847	0.859	0.975	0.989	0.995	0.201	0.028	-1.113	-2.339	0.270	6.748
	F.M. & F.T.	61	61	0.659	0.969	0.113	0.847	0.710	0.975	0.988	0.995	0.275	0.028	-0.516	-2.339	-0.992	6.748
2002/09	I.M. & F.M.	62	62	0.888	0.973	0.441	0.854	0.914	0.983	0.991	0.997	0.108	0.026	-1.887	-2.161	4.402	5.972
	F.M. & F.T.	62	62	0.582	0.973	0.150	0.854	0.575	0.983	0.968	0.997	0.253	0.026	-0.098	-2.161	-1.096	5.972
2002/12	I.M. & F.M.	63	63	0.841	0.974	0.138	0.873	0.905	0.981	0.989	0.996	0.176	0.023	-1.945	-2.741	4.093	9.797
	F.M. & F.T.	63	63	0.506	0.974	0.051	0.873	0.454	0.981	0.988	0.996	0.293	0.023	0.313	-2.741	-1.172	9.797
2003/03	I.M. & F.M.	60	60	0.585	0.965	0.015	0.819	0.601	0.975	0.992	0.997	0.293	0.034	-0.246	-2.168	-1.143	5.661
	F.M. & F.T.	60	60	0.361	0.965	0.004	0.819	0.296	0.975	0.991	0.997	0.264	0.034	0.659	-2.168	-0.560	5.661
2003/06	I.M. & F.M.	61	61	0.838	0.970	0.275	0.884	0.910	0.977	0.991	0.996	0.163	0.024	-1.565	-1.545	2.241	2.266
	F.M. & F.T.	61	61	0.680	0.970	0.050	0.884	0.742	0.977	0.987	0.996	0.284	0.024	-0.698	-1.545	-0.759	2.266
2003/09	I.M. & F.M.	61	61	0.593	0.961	0.096	0.857	0.568	0.972	0.984	0.992	0.228	0.029	-0.157	-1.649	-0.718	2.562
	F.M. & F.T.	61	61	0.771	0.961	0.102	0.857	0.881	0.972	0.991	0.992	0.245	0.029	-1.294	-1.649	0.523	2.560
2003/12	I.M. & F.M.	63	63	0.653	0.975	0.172	0.852	0.705	0.981	0.990	0.997	0.220	0.025	-0.234	-2.859	-1.159	10.679
	F.M. & F.T.	63	63	0.808	0.975	0.078	0.852	0.910	0.981	0.991	0.997	0.218	0.025	-1.422	-2.855	1.341	10.635
2004/03	I.M. & F.M.	58	58	0.487	0.958	0.066	0.824	0.424	0.970	0.984	0.992	0.266	0.035	0.325	-1.732	-1.148	3.413
	F.M. & F.T.	58	58	0.653	0.956	0.019	0.824	0.779	0.970	0.986	0.992	0.333	0.039	-0.897	-1.832	-0.710	3.407
2004/06	I.M. & F.M.	61	61	0.634	0.972	0.166	0.895	0.686	0.981	0.991	0.997	0.277	0.025	-0.290	-1.504	-1.330	1.720
	F.M. & F.T.	61	61	0.716	0.972	0.201	0.895	0.752	0.981	0.989	0.997	0.221	0.025	-0.619	-1.507	-0.681	1.738
2004/09	I.M. & F.M.	65	65	0.746	0.966	0.108	0.686	0.853	0.979	0.993	0.997	0.253	0.043	-1.109	-4.533	-0.007	27.315
	F.M. & F.T.	65	65	0.441	0.966	0.044	0.686	0.366	0.979	0.991	0.997	0.269	0.043	0.626	-4.535	-0.754	27.326
2004/12	I.M. & F.M.	62	62	0.804	0.969	0.210	0.867	0.868	0.977	0.989	0.997	0.191	0.026	-1.535	-1.699	1.982	3.754
	F.M. & F.T.	62	62	0.688	0.969	0.080	0.867	0.775	0.977	0.991	0.997	0.269	0.026	-0.513	-1.707	-1.161	3.786
2005/03	I.M. & F.M.	60	60	0.529	0.956	0.018	0.819	0.527	0.963	0.983	0.998	0.327	0.036	-0.228	-1.793	-1.251	3.948
	F.M. & F.T.	60	60	0.582	0.956	0.010	0.819	0.688	0.963	0.983	0.998	0.349	0.036	-0.595	-1.805	-1.161	4.022
2005/09	I.M. & F.M.	64	64	0.705	0.955	0.078	0.827	0.748	0.970	0.989	0.995	0.228	0.041	-0.781	-1.716	-0.200	2.516
	F.M. & F.T.	64	64	0.576	0.955	0.035	0.827	0.588	0.970	0.968	0.995	0.289	0.041	-0.232	-1.703	-1.382	2.472
2006/06	I.M. & F.M.	61	61	0.679	0.966	0.112	0.797	0.702	0.971	0.991	0.994	0.252	0.034	-0.475	-2.929	-0.861	11.324
	F.M. & F.T.	61	61	0.601	0.965	0.064	0.797	0.716	0.971	0.985	0.994	0.310	0.034	-0.388	-2.885	-1.416	11.040
2006/09	I.M. & F.M.	67	67	0.639	0.950	0.121	0.733	0.699	0.970	0.989	0.996	0.251	0.052	-0.473	-1.988	-0.939	4.515
	F.M. & F.T.	67	67	0.539	0.950	0.051	0.733	0.543	0.970	0.989	0.996	0.322	0.052	-0.017	-1.988	-1.591	4.507
2006/12	I.M. & F.M.	62	62	0.210	0.926	0.015	0.644	0.135	0.955	0.990	0.998	0.233	0.074	2.119	-1.908	4.211	4.141
	F.M. & F.T.	62	62	0.597	0.926	0.073	0.643	0.660	0.955	0.997	0.998	0.261	0.075	-0.371	-1.911	-0.918	4.163
Overall	I.M. & F.M.	2497	2497	0.519	0.899	-0.016	-0.408	0.554	0.949	0.993	0.998	0.337	0.139	-0.130	-3.330	-1.473	15.010
	F.M. & F.T.	2497	2497	0.479	0.899	-0.004	-0.408	0.460	0.949	0.997	0.998	0.336	0.139	0.060	-3.329	-1.469	15.005

'C.C.C.' indicates the concordance correlation coefficient.
'P.C.C.' indicates the Pearson correlation coefficient.
'I.M. & F.M.' indicates the correlation coefficient between the KOSPI 200 stock index market price and its futures market price.
'F.M. & F.T.' indicates the correlation coefficient between the KOSPI 200 stock index futures market price and its futures theoretical price.

Table 4. Simple regression analyses on the concordance correlation coefficients and the Pearson correlation coefficients, on a daily basis, for each futures contract and for the overall period of analysis

Dependent variable			Concordance correlation coefficient								Pearson correlation coefficient						
Contract	Type of coefficient	No. of obs.	Intercept			Time to Maturity			Adj. Rsquare	No. of obs.	Intercept			Time to Maturity			Adj. Rsquare
			Par. Est.	T-value	P-value	Par. Est.	T-value	P-value			Par. Est.	T-value	P-value	Par. Est.	T-value	P-value	
1996/09	I.M. & F.M.	76	0.3211	5.68	<.0001	-0.0025	-2.28	0.0254	0.0531	76	0.8026	17.58	<.0001	-0.0015	-1.71	0.0912	0.0251
	F.M. & F.T.	76	0.4099	8.70	<.0001	-0.0049	-5.47	<.0001	0.2780	76	0.8026	17.58	<.0001	-0.0015	-1.71	0.0912	0.0251
1996/12	I.M. & F.M.	72	0.4360	6.33	<.0001	-0.0015	-1.09	0.2810	0.0025	72	0.8274	19.03	<.0001	-0.0006	-0.71	0.4830	-0.0071
	F.M. & F.T.	72	0.7201	14.01	<.0001	-0.0083	-8.26	<.0001	0.4861	72	0.8274	19.03	<.0001	-0.0006	-0.71	0.4830	-0.0071
1997/03	I.M. & F.M.	68	0.2718	5.26	<.0001	-0.0011	-1.08	0.2824	0.0026	68	0.7646	18.96	<.0001	0.0000	-0.04	0.9646	-0.0151
	F.M. & F.T.	68	0.2444	6.29	<.0001	-0.0028	-3.66	0.0005	0.1564	68	0.7646	18.96	<.0001	0.0000	-0.04	0.9646	-0.0151
1997/06	I.M. & F.M.	73	0.3836	8.35	<.0001	-0.0046	-5.22	<.0001	0.2672	73	0.8268	15.44	<.0001	-0.0017	-1.62	0.1101	0.0220
	F.M. & F.T.	73	0.4346	11.65	<.0001	-0.0061	-8.60	<.0001	0.5034	73	0.8268	15.44	<.0001	-0.0017	-1.62	0.1101	0.0220
1997/09	I.M. & F.M.	76	0.2436	7.27	<.0001	-0.0033	-5.17	<.0001	0.2552	76	0.8172	24.35	<.0001	0.0001	0.13	0.8947	-0.0133
	F.M. & F.T.	76	0.2198	4.29	<.0001	0.0011	1.08	0.2850	0.0021	76	0.8172	24.35	<.0001	0.0001	0.13	0.8947	-0.0133
1997/12	I.M. & F.M.	72	0.3096	7.66	<.0001	-0.0031	-3.83	0.0003	0.1612	72	0.7325	13.21	<.0001	0.0009	0.79	0.4330	-0.0054
	F.M. & F.T.	72	0.2401	4.03	0.0001	0.0005	0.42	0.6737	-0.0117	72	0.7325	13.21	<.0001	0.0009	0.79	0.4330	-0.0054
1998/03	I.M. & F.M.	67	0.5173	9.85	<.0001	-0.0056	-5.25	<.0001	0.2872	67	0.9298	16.37	<.0001	-0.0049	-4.26	<.0001	0.2062
	F.M. & F.T.	67	0.6298	10.61	<.0001	-0.0070	-5.82	<.0001	0.3321	67	0.9298	16.37	<.0001	-0.0049	-4.26	<.0001	0.2062
1998/06	I.M. & F.M.	74	0.1972	3.31	0.0015	0.0011	0.97	0.3329	-0.0007	74	0.8217	20.83	<.0001	-0.0008	-1.07	0.2899	0.0019
	F.M. & F.T.	74	0.0978	1.84	0.0701	0.0023	2.30	0.0241	0.0557	74	0.8217	20.83	<.0001	-0.0008	-1.07	0.2899	0.0019
1998/09	I.M. & F.M.	76	0.1904	3.79	0.0003	-0.0004	-0.43	0.6716	-0.0110	76	0.7441	21.63	<.0001	0.0010	1.50	0.1373	0.0165
	F.M. & F.T.	76	0.1735	5.07	<.0001	-0.0017	-2.59	0.0116	0.0706	76	0.7441	21.63	<.0001	0.0010	1.50	0.1373	0.0165
1998/12	I.M. & F.M.	74	0.6678	10.00	<.0001	-0.0047	-3.61	0.0006	0.1418	74	0.8649	35.55	<.0001	-0.0003	-0.71	0.4771	-0.0067
	F.M. & F.T.	74	0.7024	10.68	<.0001	-0.0067	-5.23	<.0001	0.2653	74	0.8649	35.55	<.0001	-0.0003	-0.71	0.4771	-0.0067
1999/03	I.M. & F.M.	54	0.5426	7.75	<.0001	-0.0044	-3.22	0.0022	0.1506	54	0.8937	29.64	<.0001	-0.0005	-0.84	0.4054	-0.0056
	F.M. & F.T.	54	0.6082	7.74	<.0001	-0.0037	-2.39	0.0204	0.0818	54	0.8937	29.64	<.0001	-0.0005	-0.84	0.4054	-0.0056
1999/06	I.M. & F.M.	63	0.6827	15.71	<.0001	-0.0077	-9.08	<.0001	0.5675	63	0.8921	42.86	<.0001	0.0000	-0.11	0.9155	-0.0162
	F.M. & F.T.	63	0.7121	12.87	<.0001	-0.0039	-3.66	0.0005	0.1665	63	0.8921	42.86	<.0001	0.0000	-0.11	0.9155	-0.0162
1999/09	I.M. & F.M.	65	0.6544	9.42	<.0001	-0.0016	-1.22	0.2281	0.0075	65	0.9052	54.31	<.0001	0.0001	0.45	0.6511	-0.0126
	F.M. & F.T.	65	0.5420	7.25	<.0001	0.0000	-0.03	0.9795	-0.0159	65	0.9052	54.31	<.0001	0.0001	0.45	0.6511	-0.0126
1999/12	I.M. & F.M.	62	0.7276	15.08	<.0001	-0.0046	-4.83	<.0001	0.2681	62	0.9382	73.52	<.0001	0.0000	-0.15	0.8837	-0.0163
	F.M. & F.T.	62	0.8368	18.65	<.0001	-0.0019	-2.13	0.0369	0.0551	62	0.9382	73.52	<.0001	0.0000	-0.15	0.8837	-0.0163
2000/03	I.M. & F.M.	58	0.8707	21.79	<.0001	-0.0090	-11.45	<.0001	0.6953	58	0.9573	62.81	<.0001	-0.0006	-1.87	0.0664	0.0421
	F.M. & F.T.	58	0.9206	28.00	<.0001	-0.0017	-2.54	0.0140	0.0871	58	0.9573	62.81	<.0001	-0.0006	-1.87	0.0664	0.0421
2000/06	I.M. & F.M.	59	0.6965	11.13	<.0001	-0.0030	-2.51	0.0148	0.0841	59	0.9352	49.09	<.0001	-0.0002	-0.68	0.5022	-0.0095
	F.M. & F.T.	59	0.5389	7.54	<.0001	0.0002	0.17	0.8646	-0.0170	59	0.9352	49.09	<.0001	-0.0002	-0.68	0.5022	-0.0095
2000/09	I.M. & F.M.	60	0.6901	10.94	<.0001	-0.0024	-1.98	0.0521	0.0473	60	0.9654	64.93	<.0001	-0.0005	-1.81	0.0758	0.0370
	F.M. & F.T.	60	1.1419	20.55	<.0001	-0.0100	-9.56	<.0001	0.6049	60	0.9654	64.93	<.0001	-0.0005	-1.81	0.0758	0.0370
2000/12	I.M. & F.M.	64	0.7028	11.03	<.0001	-0.0003	-0.24	0.8147	-0.0152	64	0.9492	58.53	<.0001	-0.0002	-0.71	0.4812	-0.0080
	F.M. & F.T.	64	0.6338	10.84	<.0001	-0.0051	-4.47	<.0001	0.2319	64	0.9492	58.53	<.0001	-0.0002	-0.71	0.4812	-0.0080
2001/03	I.M. & F.M.	51	0.9918	19.74	<.0001	-0.0051	-4.62	<.0001	0.2889	51	0.9680	94.57	<.0001	-0.0003	-1.54	0.1306	0.0265
	F.M. & F.T.	51	0.9390	21.51	<.0001	-0.0100	-10.40	<.0001	0.6818	51	0.9680	94.57	<.0001	-0.0003	-1.54	0.1306	0.0265
2001/06	I.M. & F.M.	61	0.8600	23.95	<.0001	-0.0003	-0.42	0.6795	-0.0140	61	0.9494	101.92	<.0001	0.0001	0.52	0.6027	-0.0123
	F.M. & F.T.	61	0.8625	18.92	<.0001	-0.0086	-9.85	<.0001	0.6156	61	0.9494	101.92	<.0001	0.0001	0.52	0.6027	-0.0123

2001/09	I.M. & F.M.	61	0.6534	11.39	<.0001	0.0010	0.96	0.3426	-0.0014	61	0.9398	69.81	<.0001	0.0000	0.11	0.9135	-0.0167
	F.M. & F.T.	61	0.5617	9.58	<.0001	-0.0045	-4.01	0.0002	0.2011	61	0.9398	69.81	<.0001	0.0000	0.11	0.9135	-0.0167
2001/12	I.M. & F.M.	62	0.8953	12.86	<.0001	-0.0097	-7.00	<.0001	0.4404	62	0.9783	55.43	<.0001	-0.0012	-3.39	0.0012	0.1467
	F.M. & F.T.	62	0.9176	15.57	<.0001	-0.0124	-10.58	<.0001	0.6454	62	0.9783	55.43	<.0001	-0.0012	-3.39	0.0012	0.1467
2002/03	I.M. & F.M.	58	0.9911	17.40	<.0001	-0.0045	-4.03	0.0002	0.2111	58	0.9668	104.12	<.0001	-0.0001	-0.67	0.5081	-0.0099
	F.M. & F.T.	58	0.8759	18.40	<.0001	-0.0089	-9.60	<.0001	0.6155	58	0.9668	104.12	<.0001	-0.0001	-0.67	0.5081	-0.0099
2002/06	I.M. & F.M.	61	0.8088	15.74	<.0001	-0.0006	-0.60	0.5511	-0.0108	61	0.9673	134.55	<.0001	0.0000	0.28	0.7793	-0.0156
	F.M. & F.T.	61	1.0466	26.53	<.0001	-0.0087	-11.36	<.0001	0.6811	61	0.9673	134.55	<.0001	0.0000	0.28	0.7793	-0.0156
2002/09	I.M. & F.M.	62	0.8904	33.19	<.0001	-0.0001	-0.11	0.9123	-0.0165	62	0.9670	148.97	<.0001	0.0001	0.99	0.3281	-0.0005
	F.M. & F.T.	62	0.8264	16.28	<.0001	-0.0056	-5.62	<.0001	0.3339	62	0.9670	148.97	<.0001	0.0001	0.99	0.3281	-0.0005
2002/12	I.M. & F.M.	63	0.9208	21.97	<.0001	-0.0018	-2.21	0.0305	0.0593	63	0.9814	179.13	<.0001	-0.0002	-1.57	0.1214	0.0231
	F.M. & F.T.	63	0.9059	22.19	<.0001	-0.0092	-11.42	<.0001	0.6762	63	0.9814	179.13	<.0001	-0.0002	-1.57	0.1214	0.0231
2003/03	I.M. & F.M.	60	0.7049	9.97	<.0001	-0.0028	-1.99	0.0508	0.0480	60	0.9579	114.87	<.0001	0.0002	0.98	0.3317	-0.0007
	F.M. & F.T.	60	0.6059	11.26	<.0001	-0.0058	-5.33	<.0001	0.3173	60	0.9579	114.87	<.0001	0.0002	0.98	0.3317	-0.0007
2003/06	I.M. & F.M.	61	0.8285	19.97	<.0001	0.0002	0.27	0.7917	-0.0157	61	0.9676	158.43	<.0001	0.0001	0.54	0.5901	-0.0119
	F.M. & F.T.	61	1.0684	25.05	<.0001	-0.0086	-10.55	<.0001	0.6475	61	0.9676	158.43	<.0001	0.0001	0.54	0.5901	-0.0119
2003/09	I.M. & F.M.	61	0.7367	13.64	<.0001	-0.0033	-3.09	0.0030	0.1250	61	0.9643	130.98	<.0001	-0.0001	-0.57	0.5691	-0.0113
	F.M. & F.T.	61	1.0779	25.70	<.0001	-0.0070	-8.48	<.0001	0.5414	61	0.9643	130.97	<.0001	-0.0001	-0.57	0.5702	-0.0114
2003/12	I.M. & F.M.	63	0.7037	13.02	<.0001	-0.0012	-1.09	0.2818	0.0029	63	0.9671	162.24	<.0001	0.0002	1.55	0.1257	0.0222
	F.M. & F.T.	63	0.9999	21.84	<.0001	-0.0044	-4.89	<.0001	0.2695	63	0.9672	162.34	<.0001	0.0002	1.55	0.1266	0.0221
2004/03	I.M. & F.M.	58	0.8027	17.65	<.0001	-0.0073	-8.15	<.0001	0.5344	58	0.9468	109.89	<.0001	0.0003	1.49	0.1411	0.0211
	F.M. & F.T.	58	0.9980	15.46	<.0001	-0.0080	-6.28	<.0001	0.4026	58	0.9500	97.99	<.0001	0.0001	0.74	0.4648	-0.0081
2004/06	I.M. & F.M.	61	0.9340	17.71	<.0001	-0.0068	-6.64	<.0001	0.4176	61	0.9785	160.65	<.0001	-0.0002	-1.31	0.1950	0.0118
	F.M. & F.T.	61	0.8506	16.51	<.0001	-0.0030	-3.06	0.0033	0.1222	61	0.9785	160.59	<.0001	-0.0002	-1.30	0.1990	0.0113
2004/09	I.M. & F.M.	65	0.6765	11.04	<.0001	0.0016	1.31	0.1936	0.0112	65	0.9467	92.41	<.0001	0.0004	2.17	0.0335	0.0550
	F.M. & F.T.	65	0.6532	11.23	<.0001	-0.0048	-4.24	<.0001	0.2099	65	0.9468	92.34	<.0001	0.0004	2.15	0.0358	0.0533
2004/12	I.M. & F.M.	62	0.9286	21.48	<.0001	-0.0029	-3.37	0.0013	0.1455	62	0.9727	152.38	<.0001	-0.0001	-0.65	0.5190	-0.0096
	F.M. & F.T.	62	0.9786	19.62	<.0001	-0.0067	-6.81	<.0001	0.4265	62	0.9728	152.83	<.0001	-0.0001	-0.70	0.4893	-0.0085
2005/03	I.M. & F.M.	60	0.9917	21.30	<.0001	-0.0102	-11.50	<.0001	0.6900	60	0.9494	101.52	<.0001	0.0001	0.82	0.4148	-0.0055
	F.M. & F.T.	60	0.8811	11.36	<.0001	-0.0066	-4.46	<.0001	0.2428	60	0.9499	101.85	<.0001	0.0001	0.75	0.4581	-0.0075
2005/09	I.M. & F.M.	64	0.9880	25.73	<.0001	-0.0063	-8.56	<.0001	0.5340	64	0.9650	95.37	<.0001	-0.0002	-1.17	0.2451	0.0059
	F.M. & F.T.	64	0.8795	15.70	<.0001	-0.0068	-6.29	<.0001	0.3798	64	0.9652	95.47	<.0001	-0.0002	-1.22	0.2286	0.0075
2006/06	I.M. & F.M.	61	0.8351	13.53	<.0001	-0.0034	-2.91	0.0051	0.1108	61	0.9693	109.26	<.0001	-0.0001	-0.47	0.6400	-0.0132
	F.M. & F.T.	61	1.0111	19.08	<.0001	-0.0089	-8.91	<.0001	0.5663	61	0.9696	108.95	<.0001	-0.0001	-0.54	0.5894	-0.0119
2006/09	I.M. & F.M.	67	0.4807	8.66	<.0001	0.0033	3.33	0.0014	0.1326	67	0.9390	76.78	<.0001	0.0002	1.05	0.2972	0.0016
	F.M. & F.T.	67	0.9123	16.55	<.0001	-0.0079	-7.89	<.0001	0.4812	67	0.9390	76.74	<.0001	0.0002	1.05	0.2965	0.0016
2006/12	I.M. & F.M.	62	0.3249	5.95	<.0001	-0.0027	-2.45	0.0170	0.0761	62	0.8966	50.39	<.0001	0.0007	1.93	0.0582	0.0428
	F.M. & F.T.	62	0.4844	7.80	<.0001	0.0026	2.12	0.0383	0.0541	62	0.8965	50.34	<.0001	0.0007	1.93	0.0581	0.0429
Overall	I.M. & F.M.	2497	0.6517	50.78	<.0001	-0.0030	-12.04	<.0001	0.0546	2497	0.9105	167.26	<.0001	-0.0003	-2.44	0.0146	0.0020
	F.M. & F.T.	2497	0.7048	58.53	<.0001	-0.0051	-21.78	<.0001	0.1594	2497	0.9106	167.29	<.0001	-0.0003	-2.48	0.0132	0.0021
Average	I.M. & F.M.	95	0.5873	16.45	<.0001	-0.0013	-1.94	0.0559	0.0284	95	0.8998	64.39	<.0001	0.0000	-0.15	0.8786	-0.0105
(Overall)	F.M. & F.T.	95	0.7147	22.13	<.0001	-0.0048	-8.15	<.0001	0.4104	95	0.8999	64.38	<.0001	0.0000	-0.16	0.8712	-0.0105

'No. of obs.', 'Par. Est.', and 'Adj. Rsquare' indicate the number of observations, parameter estimate, and Adjusted R-square, respectively.
'I.M. & F.M.' indicates the correlation coefficient between the KOSPI 200 stock index market price and its futures market price.
'F.M. & F.T.' indicates the correlation coefficient between the KOSPI 200 stock index futures market price and its futures theoretical price.

Table 5. Simple regression analyses on the concordance correlation coefficients and the Pearson correlation coefficients, on a daily basis, for each futures contract and for the overall period of analysis, except for cases that the number of futures contracts contained in each time to maturity is less than 20

Dependent variable			Concordance correlation coefficient								Pearson correlation coefficient						
Contract	Type of coefficient	No. of obs.	Intercept			Time to Maturity			Adj. Rsquare	No. of obs.	Intercept			Time to Maturity			Adj. Rsquare
			Par. Est.	T-value	P-value	Par. Est.	T-value	P-value			Par. Est.	T-value	P-value	Par. Est.	T-value	P-value	
1996/09	I.M. & F.M.	63	0.3561	5.91	<.0001	-0.0032	-2.73	0.0084	0.0940	63	0.8450	19.49	<.0001	-0.0017	-2.04	0.0459	0.0484
	F.M. & F.T.	63	0.4376	8.08	<.0001	-0.0052	-4.97	<.0001	0.2770	63	0.8450	19.49	<.0001	-0.0017	-2.04	0.0459	0.0484
1996/12	I.M. & F.M.	61	0.4432	5.93	<.0001	-0.0012	-0.79	0.4315	-0.0063	61	0.8327	20.38	<.0001	-0.0004	-0.53	0.5977	-0.0121
	F.M. & F.T.	61	0.7283	13.40	<.0001	-0.0084	-7.84	<.0001	0.5019	61	0.8327	20.38	<.0001	-0.0004	-0.53	0.5977	-0.0121
1997/03	I.M. & F.M.	58	0.2768	4.86	<.0001	-0.0008	-0.71	0.4788	-0.0087	58	0.7527	18.18	<.0001	0.0004	0.47	0.6397	-0.0138
	F.M. & F.T.	58	0.2563	5.85	<.0001	-0.0029	-3.23	0.0021	0.1417	58	0.7527	18.18	<.0001	0.0004	0.47	0.6397	-0.0138
1997/06	I.M. & F.M.	61	0.4014	7.48	<.0001	-0.0048	-4.67	<.0001	0.2574	61	0.8129	13.31	<.0001	-0.0014	-1.22	0.2256	0.0083
	F.M. & F.T.	61	0.4454	10.39	<.0001	-0.0062	-7.66	<.0001	0.4902	61	0.8129	13.31	<.0001	-0.0014	-1.22	0.2256	0.0083
1997/09	I.M. & F.M.	63	0.2658	6.85	<.0001	-0.0036	-4.85	<.0001	0.2667	63	0.8369	28.68	<.0001	0.0001	0.17	0.8650	-0.0159
	F.M. & F.T.	63	0.2364	4.09	0.0001	0.0010	0.87	0.3903	-0.0041	63	0.8369	28.68	<.0001	0.0001	0.17	0.8650	-0.0159
1997/12	I.M. & F.M.	59	0.3246	7.11	<.0001	-0.0033	-3.55	0.0008	0.1669	59	0.7301	13.10	<.0001	0.0012	1.10	0.2771	0.0035
	F.M. & F.T.	59	0.2594	3.88	0.0003	0.0004	0.26	0.7955	-0.0163	59	0.7301	13.10	<.0001	0.0012	1.10	0.2771	0.0035
1998/03	I.M. & F.M.	54	0.5484	9.27	<.0001	-0.0061	-4.96	<.0001	0.3081	54	0.9289	15.45	<.0001	-0.0049	-3.87	0.0003	0.2082
	F.M. & F.T.	54	0.6621	10.07	<.0001	-0.0076	-5.52	<.0001	0.3575	54	0.9289	15.45	<.0001	-0.0049	-3.87	0.0003	0.2082
1998/06	I.M. & F.M.	62	0.2245	3.44	0.0011	0.0008	0.65	0.5152	-0.0095	62	0.8337	19.49	<.0001	-0.0010	-1.24	0.2212	0.0086
	F.M. & F.T.	62	0.1073	1.98	0.0528	0.0021	2.03	0.0468	0.0486	62	0.8337	19.49	<.0001	-0.0010	-1.24	0.2212	0.0086
1998/09	I.M. & F.M.	64	0.2000	3.68	0.0005	-0.0005	-0.45	0.6575	-0.0129	64	0.7534	21.19	<.0001	0.0012	1.67	0.1006	0.0275
	F.M. & F.T.	64	0.1881	4.92	<.0001	-0.0019	-2.61	0.0114	0.0843	64	0.7534	21.19	<.0001	0.0012	1.67	0.1006	0.0275
1998/12	I.M. & F.M.	62	0.7046	9.69	<.0001	-0.0050	-3.53	0.0008	0.1580	62	0.8705	33.49	<.0001	-0.0001	-0.20	0.8390	-0.0160
	F.M. & F.T.	62	0.7406	10.19	<.0001	-0.0070	-4.97	<.0001	0.2799	62	0.8705	33.49	<.0001	-0.0001	-0.20	0.8390	-0.0160
1999/03	I.M. & F.M.	54	0.5426	7.75	<.0001	-0.0044	-3.22	0.0022	0.1506	54	0.8937	29.64	<.0001	-0.0005	-0.84	0.4054	-0.0056
	F.M. & F.T.	54	0.6082	7.74	<.0001	-0.0037	-2.39	0.0204	0.0818	54	0.8937	29.64	<.0001	-0.0005	-0.84	0.4054	-0.0056
1999/06	I.M. & F.M.	63	0.6827	15.71	<.0001	-0.0077	-9.08	<.0001	0.5675	63	0.8921	42.86	<.0001	0.0000	-0.11	0.9155	-0.0162
	F.M. & F.T.	63	0.7121	12.87	<.0001	-0.0039	-3.66	0.0005	0.1665	63	0.8921	42.86	<.0001	0.0000	-0.11	0.9155	-0.0162
1999/09	I.M. & F.M.	65	0.6544	9.42	<.0001	-0.0016	-1.22	0.2281	0.0075	65	0.9052	54.31	<.0001	0.0001	0.45	0.6511	-0.0126
	F.M. & F.T.	65	0.5420	7.25	<.0001	0.0000	-0.03	0.9795	-0.0159	65	0.9052	54.31	<.0001	0.0001	0.45	0.6511	-0.0126
1999/12	I.M. & F.M.	62	0.7276	15.08	<.0001	-0.0046	-4.83	<.0001	0.2681	62	0.9382	73.52	<.0001	0.0000	-0.15	0.8837	-0.0163
	F.M. & F.T.	62	0.8368	18.65	<.0001	-0.0019	-2.13	0.0369	0.0551	62	0.9382	73.52	<.0001	0.0000	-0.15	0.8837	-0.0163
2000/03	I.M. & F.M.	58	0.8707	21.79	<.0001	-0.0090	-11.45	<.0001	0.6953	58	0.9573	62.81	<.0001	-0.0006	-1.87	0.0664	0.0421
	F.M. & F.T.	58	0.9206	28.00	<.0001	-0.0017	-2.54	0.0140	0.0871	58	0.9573	62.81	<.0001	-0.0006	-1.87	0.0664	0.0421
2000/06	I.M. & F.M.	59	0.6965	11.13	<.0001	-0.0030	-2.51	0.0148	0.0841	59	0.9352	49.09	<.0001	-0.0002	-0.68	0.5022	-0.0095
	F.M. & F.T.	59	0.5389	7.54	<.0001	0.0002	0.17	0.8646	-0.0170	59	0.9352	49.09	<.0001	-0.0002	-0.68	0.5022	-0.0095
2000/09	I.M. & F.M.	60	0.6901	10.94	<.0001	-0.0024	-1.98	0.0521	0.0473	60	0.9654	64.93	<.0001	-0.0005	-1.81	0.0758	0.0370
	F.M. & F.T.	60	1.1419	20.55	<.0001	-0.0100	-9.56	<.0001	0.6049	60	0.9654	64.93	<.0001	-0.0005	-1.81	0.0758	0.0370
2000/12	I.M. & F.M.	64	0.7028	11.03	<.0001	-0.0003	-0.24	0.8147	-0.0152	64	0.9492	58.53	<.0001	-0.0002	-0.71	0.4812	-0.0080
	F.M. & F.T.	64	0.6338	10.84	<.0001	-0.0051	-4.47	<.0001	0.2319	64	0.9492	58.53	<.0001	-0.0002	-0.71	0.4812	-0.0080
2001/03	I.M. & F.M.	51	0.9918	19.74	<.0001	-0.0051	-4.62	<.0001	0.2889	51	0.9680	94.57	<.0001	-0.0003	-1.54	0.1306	0.0265
	F.M. & F.T.	51	0.9390	21.51	<.0001	-0.0100	-10.40	<.0001	0.6818	51	0.9680	94.57	<.0001	-0.0003	-1.54	0.1306	0.0265
2001/06	I.M. & F.M.	61	0.8600	23.95	<.0001	-0.0003	-0.42	0.6795	-0.0140	61	0.9494	101.92	<.0001	0.0001	0.52	0.6027	-0.0123
	F.M. & F.T.	61	0.8625	18.92	<.0001	-0.0086	-9.85	<.0001	0.6156	61	0.9494	101.92	<.0001	0.0001	0.52	0.6027	-0.0123

2001/09	I.M. & F.M.	61	0.6534	11.39	<.0001	0.0010	0.96	0.3426	-0.0014	61	0.9398	69.81	<.0001	0.0000	0.11	0.9135	-0.0167
	F.M. & F.T.	61	0.5617	9.58	<.0001	-0.0045	-4.01	0.0002	0.2011	61	0.9398	69.81	<.0001	0.0000	0.11	0.9135	-0.0167
2001/12	I.M. & F.M.	62	0.8953	12.86	<.0001	-0.0097	-7.00	<.0001	0.4404	62	0.9783	55.43	<.0001	-0.0012	-3.39	0.0012	0.1467
	F.M. & F.T.	62	0.9176	15.57	<.0001	-0.0124	-10.58	<.0001	0.6454	62	0.9783	55.43	<.0001	-0.0012	-3.39	0.0012	0.1467
2002/03	I.M. & F.M.	58	0.9911	17.40	<.0001	-0.0045	-4.03	0.0002	0.2111	58	0.9668	104.12	<.0001	-0.0001	-0.67	0.5081	-0.0099
	F.M. & F.T.	58	0.8759	18.40	<.0001	-0.0089	-9.60	<.0001	0.6155	58	0.9668	104.12	<.0001	-0.0001	-0.67	0.5081	-0.0099
2002/06	I.M. & F.M.	49	0.8427	16.52	<.0001	-0.0011	-1.05	0.3000	0.0020	49	0.9715	143.25	<.0001	0.0000	-0.10	0.9218	-0.0211
	F.M. & F.T.	49	1.0518	22.89	<.0001	-0.0089	-9.84	<.0001	0.6660	49	0.9715	143.25	<.0001	0.0000	-0.10	0.9218	-0.0211
2002/09	I.M. & F.M.	62	0.8904	33.19	<.0001	-0.0001	-0.11	0.9123	-0.0165	62	0.9670	148.97	<.0001	0.0001	0.99	0.3281	-0.0005
	F.M. & F.T.	62	0.8264	16.28	<.0001	-0.0056	-5.62	<.0001	0.3339	62	0.9670	148.97	<.0001	0.0001	0.99	0.3281	-0.0005
2002/12	I.M. & F.M.	63	0.9208	21.97	<.0001	-0.0018	-2.21	0.0305	0.0593	63	0.9814	179.13	<.0001	-0.0002	-1.57	0.1214	0.0231
	F.M. & F.T.	63	0.9059	22.19	<.0001	-0.0092	-11.42	<.0001	0.6762	63	0.9814	179.13	<.0001	-0.0002	-1.57	0.1214	0.0231
2003/03	I.M. & F.M.	60	0.7049	9.97	<.0001	-0.0028	-1.99	0.0508	0.0480	60	0.9579	114.87	<.0001	0.0002	0.98	0.3317	-0.0007
	F.M. & F.T.	60	0.6059	11.26	<.0001	-0.0058	-5.33	<.0001	0.3173	60	0.9579	114.87	<.0001	0.0002	0.98	0.3317	-0.0007
2003/06	I.M. & F.M.	61	0.8285	19.97	<.0001	0.0002	0.27	0.7917	-0.0157	61	0.9676	158.43	<.0001	0.0001	0.54	0.5901	-0.0119
	F.M. & F.T.	61	1.0684	25.05	<.0001	-0.0086	-10.55	<.0001	0.6475	61	0.9676	158.43	<.0001	0.0001	0.54	0.5901	-0.0119
2003/09	I.M. & F.M.	38	0.7071	10.06	<.0001	-0.0038	-2.70	0.0105	0.1452	38	0.9581	95.34	<.0001	-0.0001	-0.66	0.5108	-0.0153
	F.M. & F.T.	38	1.0798	21.36	<.0001	-0.0078	-7.71	<.0001	0.6123	38	0.9581	95.34	<.0001	-0.0001	-0.66	0.5116	-0.0154
2003/12	I.M. & F.M.	63	0.7037	13.02	<.0001	-0.0012	-1.09	0.2818	0.0029	63	0.9671	162.24	<.0001	0.0002	1.55	0.1257	0.0222
	F.M. & F.T.	63	0.9999	21.84	<.0001	-0.0044	-4.89	<.0001	0.2695	63	0.9672	162.34	<.0001	0.0002	1.55	0.1266	0.0221
2004/03	I.M. & F.M.	58	0.8027	17.65	<.0001	-0.0073	-8.15	<.0001	0.5344	58	0.9468	109.89	<.0001	0.0003	1.49	0.1411	0.0211
	F.M. & F.T.	58	0.9980	15.46	<.0001	-0.0080	-6.28	<.0001	0.4026	58	0.9500	97.99	<.0001	0.0001	0.74	0.4648	-0.0081
2004/06	I.M. & F.M.	61	0.9340	17.71	<.0001	-0.0068	-6.64	<.0001	0.4176	61	0.9785	160.65	<.0001	-0.0002	-1.31	0.1950	0.0118
	F.M. & F.T.	61	0.8506	16.51	<.0001	-0.0030	-3.06	0.0033	0.1222	61	0.9785	160.59	<.0001	-0.0002	-1.30	0.1990	0.0113
2004/09	I.M. & F.M.	65	0.6765	11.04	<.0001	0.0016	1.31	0.1936	0.0112	65	0.9467	92.41	<.0001	0.0004	2.17	0.0335	0.0550
	F.M. & F.T.	65	0.6532	11.23	<.0001	-0.0048	-4.24	<.0001	0.2099	65	0.9468	92.34	<.0001	0.0004	2.15	0.0358	0.0533
2004/12	I.M. & F.M.	62	0.9286	21.48	<.0001	-0.0029	-3.37	0.0013	0.1455	62	0.9727	152.38	<.0001	-0.0001	-0.65	0.5190	-0.0096
	F.M. & F.T.	62	0.9786	19.62	<.0001	-0.0067	-6.81	<.0001	0.4265	62	0.9728	152.83	<.0001	-0.0001	-0.70	0.4893	-0.0085
2005/03	I.M. & F.M.	60	0.9917	21.30	<.0001	-0.0102	-11.50	<.0001	0.6900	60	0.9494	101.52	<.0001	0.0001	0.82	0.4148	-0.0055
	F.M. & F.T.	60	0.8811	11.36	<.0001	-0.0066	-4.46	<.0001	0.2428	60	0.9499	101.85	<.0001	0.0001	0.75	0.4581	-0.0075
2005/09	I.M. & F.M.	64	0.9880	25.73	<.0001	-0.0063	-8.56	<.0001	0.5340	64	0.9650	95.37	<.0001	-0.0002	-1.17	0.2451	0.0059
	F.M. & F.T.	64	0.8795	15.70	<.0001	-0.0068	-6.29	<.0001	0.3798	64	0.9652	95.47	<.0001	-0.0002	-1.22	0.2286	0.0075
2006/06	I.M. & F.M.	61	0.8351	13.53	<.0001	-0.0034	-2.91	0.0051	0.1108	61	0.9693	109.26	<.0001	-0.0001	-0.47	0.6400	-0.0132
	F.M. & F.T.	61	1.0111	19.08	<.0001	-0.0089	-8.91	<.0001	0.5663	61	0.9696	108.95	<.0001	-0.0001	-0.54	0.5894	-0.0119
2006/09	I.M. & F.M.	62	0.4989	8.43	<.0001	0.0027	2.36	0.0218	0.0694	62	0.9413	71.87	<.0001	0.0002	0.59	0.5543	-0.0107
	F.M. & F.T.	62	0.9374	16.36	<.0001	-0.0087	-7.76	<.0001	0.4925	62	0.9413	71.83	<.0001	0.0002	0.60	0.5526	-0.0107
2006/12	I.M. & F.M.	62	0.3249	5.95	<.0001	-0.0027	-2.45	0.0170	0.0761	62	0.8966	50.39	<.0001	0.0007	1.93	0.0582	0.0428
	F.M. & F.T.	62	0.4844	7.80	<.0001	0.0026	2.12	0.0383	0.0541	62	0.8965	50.34	<.0001	0.0007	1.93	0.0581	0.0429
Overall	I.M. & F.M.	2336	0.6702	51.32	<.0001	-0.0031	-12.20	<.0001	0.0595	2336	0.9156	179.24	<.0001	-0.0002	-1.88	0.0604	0.0011
	F.M. & F.T.	2336	0.7182	58.56	<.0001	-0.0052	-21.59	<.0001	0.1661	2336	0.9158	179.26	<.0001	-0.0002	-1.92	0.0551	0.0011
Average	I.M. & F.M.	65	0.6690	49.67	<.0001	-0.0031	-11.82	<.0001	0.6842	65	0.9154	200.37	<.0001	-0.0002	-2.04	0.0455	0.0471
(Overall)	F.M. & F.T.	65	0.7174	70.50	<.0001	-0.0052	-26.17	<.0001	0.9144	65	0.9155	199.46	<.0001	-0.0002	-2.08	0.0420	0.0492

'No. of obs.', 'Par. Est.', and 'Adj. Rsquare' indicate the number of observations, parameter estimate, and Adjusted R-square, respectively.
'I.M. & F.M.' indicates the correlation coefficient between the KOSPI 200 stock index market price and its futures market price.
'F.M. & F.T.' indicates the correlation coefficient between the KOSPI 200 stock index futures market price and its futures theoretical price.