Target Overnight Call Rate and Stock Market Returns: Evidence From Korea

Tasa de Interés de Referencia y Retornos del Mercado Accionario: Evidencia en Corea

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RESUMEN

La presente investigación trata de contribuir al conocimiento de los operarios y los académicos sobre los efectos de los cambios de la tasa de interés de referencia en los retornos del mercado accionario en Corea para el período 2000-2007. Así, el estudio aplica la metodología de estudio de eventos con la finalidad de observar la reacción de los retornos del Índice de la Bolsa de Valores de Corea (KOSPI) ante las sorpresas de los anuncios de la política monetaria consistentes en cambiar o mantener la tasa de interés de referencia. El estudio se basa en la hipótesis de los mercados eficientes, indicando que el mercado reacciona ante las decisiones inesperadas del Comité de Política Monetaria (MPC). Asimismo, siguiendo los estudios de Kuttner (2000), se construye el componente sorpresa utilizando la tasa de interés de mercado. La evidencia muestra que en el corto plazo, los retornos del mercado tienen una fuerte relación negativa con los cambios inesperados de la tasa de interés de referencia.

Palabras clave: Retornos del mercado accionario, componente sorpresa, tasa de interés de referencia, tasa de interés de mercado

ABSTRACT

This research attempts to contribute to the practitioner and academic on the effect of target overnight call rate changes on stock market returns in Korea in the period 2000 - 2007. Thus, the paper applies event studies methodology in order to observe the reaction of Korea Composite Stock Price Index (KOSPI) returns to surprises in monetary policy announcements as regards to changes or maintenance in the target overnight call rate. The study is based on the efficient market hypothesis, indicating that the market reacts to unexpected decisions of the Monetary Policy Committee (MPC). Also, following the studies of Kuttner (2000), the paper constructs the surprise component by using realized overnight call rate. The evidence shows that in the short-run, market returns have strong negative relationship with unexpected changes in the target overnight call rate in Korea.

Key words: Stock market returns, Surprise component, Target overnight call rate, Realized overnight call rate.

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INTRODUCTION

When the President of the Federal Reserve in the United States, Ben Bernanke, announced a cut in the short-term interest rate on September 18, 2007, the investors cheered. Indeed, stock prices surged following the announcement, with the Dow finishing the day up more than 330 points or 2.5 percent. The Nasdaq rose 2.7 percent while the S&P 500 closed almost 3 percent higher (La Monica 2007). A similar phenomenon has been observed since the times of Alan Greenspan, who became famous by the cuts in the Federal Reserve's target interest rate in the United States so that after the ending of Greenspan's era the measures of his successor have also been followed with great expectation. After a reduction in 0.5 percent points in the target overnight call rates in September 2007, there were also cuts in October and December, given that the Federal Open Market Committee (FMOC) meets regularly to decide whether to cut, maintain or raise the target call rate. However, a few days before the meeting of December 11, 2007, Bernanke had declared a probability of a new cut in the target of those interest rates. Of course, the Federal Reserve cut the short-run target call rate, but the market responded conversely to the usual reaction given that investors considered the FED should have cut it more (Neirkik 2007). Those facts suggest that expectations play an important role in the market's response when the monetary authority announces the direction of monetary policy by changing or maintaining the target overnight call rate. In other words, surprises generate a reaction in the stock market while when the monetary announcement is predicted in a certain manner before the news date, the effects might not be the same. This could be explained taking into account the Efficient Market Hypothesis that argues stock prices reflect all the available information because new information is readily incorporated by the market as investors constantly revise their expectations on the future of the firms (Fama 1991, Malkiel 2003, Shanken and Smith 1996, and Bodie, Kane and Marcus 2005). Given that much of the literature has been devoted to study the case of the behavior of the U.S. Stock Market in changes in target federal funds rates, and considering that the structure of the Korean stock exchange differs from that of the U.S., the stock market price movements may be also different (Kwon, Shin, and Bacon 1997). Taking into account this concern of Kwon, Shin, and Bacon (1997), even when the Korean stock market is growing rapidly, the market capitalization is still much smaller than the U.S. market. Hence, the Korean stock market may be more subject to speculative activities, manipulations, and especially government interventions that could affect the market efficiency. In this regard, and due to the different perceptions investors could have, the question may arise: is it possible that the stock market in Korea responds to changes in the target call rate differently than the U.S. stock market? The present research is aimed at contrasting the empirical evidence provided until now, in order to discover whether and how stock market returns in the Korean Stock Market react to unanticipated changes in the target overnight call rate. In doing so, the methodology of event studies which consists of documenting interesting regularities in the response of stock prices to investment decisions, financing decisions, and changes in corporate control has been adopted (Fama 1991). In order to estimate the unexpected changes in the overnight call rate target, the present investigation utilizes Kuttner's (2000) methodological criteria consisting in deriving unanticipated changes in target overnight call rates from the difference between the announced target overnight call rate and the realized overnight call rate. Similar criteria was used by Bernanke and Kuttner (2003) in their event studies investigation when they studied the reaction of the U.S. stock market to monetary policy decisions given that it represents a natural way to differentiate unexpected from expected components of the Federal Reserve's announcements (Kuttner 2000). This research is limited to study the effects of monetary policy decision only when the Bank of Korea (BOK) has determined to change or maintain the target overnight call rate as an action to achieve the inflation target in the economy. The investigation considers the short-run effects of those decisions since 2000 given that it was in May 1999 when BOK shifted its monetary policy regime from money targeting to inflation targeting, and there is only statistical information since 2000. The long-run consequences of changes in target overnight call rate have not been considered.

Theoretical Support: Financial literature, as of Mishkin (1995), Thorbecke (1997), Bernanke and Kuttner (2003), Ehrmann and Fratzscher (2004), Blinder (1992), and Kashyap, Stein and Wilcox (1993), cited by Ehrmann and Fratzcher (2004), and Sohn and Eom (2006) establish a negative relationship between changes in the overnight call rate and stock prices. The evidence that will be presented in the literature review section will explain in depth the difference between expected and unexpected components. However, given that the market does not always react conversely to the direction of the change in the overnight call rate, as described before, it is necessary to introduce the meaning of Efficient Market Hypothesis and the rational expectations. By understanding these key concepts, it will be possible to understand why the market could react as in the case cited in the introductory section when in the U.S. market the overnight call rate was shortened and the market reacted negatively. First, Fama (1971), notes that "… a market in which firms can make production-investment decisions and investors can choose among the securities that represent ownership of a firm's activities under the assumption that security prices at any time 'fully' reflect all available information … is called 'efficient'." In other words, an efficient market lets investors make appropriate

investment decisions in such a way that they pay the price that they actually should pay, and the firm receives by its stocks the price that actually it should be worth (Ross, Westerfield and Jordan 2006). Thus, new information arrives every day, and the investors reassess the stock prices, that is to say based on the new information, the market participants revise their expectations regarding the future of the firm making the stock prices fluctuate (Ross, Westerfield and Jordan 2006). This way, it could be said that before new information comes up, the investors have an expectation that could be defined as the expected component of an announcement. This means the part of the announcement the market was able to predict. The other component of the announcement is the unexpected one. It is the part of the announcement that the market was not able to predict, and it is the one that really affects the stock price. In short, according to the Efficient Market Hypothesis, when the market realizes the significance of the new information it incorporates this information readily in the stock prices (Shapiro 2006). In the case of the present research, when the monetary authority announces policy decisions other than expected in regard to the overnight call rate, all the unexpected information (new information) is going to be incorporated in the equity prices. On the other hand, the market can interpret the information in different ways, thus depending on the circumstances of the news, it could be taken as positive or negative (McQueen and Roley 1993). Given that in an efficient market the announcements affect daily share price movements (McQueen and Roley 1993), a common model that links stock prices to information posits that stock prices equal the present discounted value of rationally forecasted future dividends. This model can be represented as

$$P_t = E\left[\sum_{\tau=1}^{\infty} \frac{D_{t+\tau}}{1+_t r_{t+\tau}} \Omega_t\right],$$

where

P_t = price of the stock at time t
$E[\,.\,|\,\Omega_t]$ = mathematical expectation conditional on information available at time t (Ω_t),
$D_{t+\tau}$ = is the dividend paid at time $t+\tau$, and
$_tr_{t+\tau}$ = is the stochastic discount factor for cash flows that occur at time $t+\tau$.

The announcements affect daily stock price movements if the new information revealed affects either expectations of future dividends or discounts rates or both (McQueen and Roley 1993). The new information is represented by the difference in the announced value on day t + 1 and the expected value as of day t (McQueen and Roley 1993). Consequently, the unanticipated component of an announcement on day t + 1 does not have correlation with information available on day t (McQueen and Roley 1993). The information set $_t$, includes past announcements of other economic variables, so announcement surprises are uncorrelated under rational expectations if they are made on different days (McQueen and Roley 1993). Combining daily stock-price changes with announcement surprises on different days allows us to isolate the effects of individual economic variables. Thus, when the Bank of Korea announces changes or maintenance of the target call rate, the expected component would be represented by $_t$; that is the available information in the day t, while the unanticipated component is represented by the difference between $_{t+1}$ - $_t$ that will affect $_tr_{t+}$. This way, price movements are affected by the movements in the new information that affects interest rates.

DATA AND METHODOLOGY

This section is devoted to introducing the data and methodology to be utilized with the purpose of determining whether and how the control of the target overnight call rate have affected the stock market returns. To do this, it has been considered pertinent to start with an overview on the two important organizations involved: the Korean Stock Exchange (KSE), and the Bank of Korea with its Monetary Policy Committee (MPC).

First, the KSE is a subdivision of the Korea Exchange (hereinafter KRX) that is the major exchange market in Korea (KRX 2008). In order to enhance user convenience, the KRX has consolidated the morning and afternoon sessions into a single session on May 22, 2000 (KRX 2007). Thus, the KRX operates the regular session and off-hours session, and to determine the opening price, the quotations are received from 08:00 to 15:00 (KRX 2007). As shown in Table 1, the off-hours session is divided into the pre-hours session from 7:30 to 8:30, and the after-hours session from 15:00 to 18:00 (KRX 2007). Trading days are from Monday to Friday and the market is closed on the following days and weekends (KRX 2007).

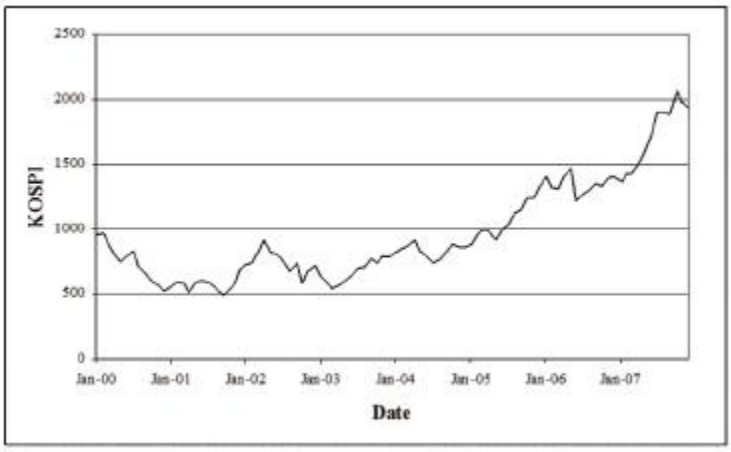
Table 1. Quotation Receiving Hours and Trading Hours - Korean Exchange

Trading Session	Quotation Receiving Hours	Trading Hours
Regular Session	8:00 ~15:00	9:00 ~15:00
Pre-hours Session	7:30 ~8:30	7:30 ~8:30
After-hours Session	15:00 ~18:00	15:10 ~18:00

Source: Korea Exchange (KRX). 2007. "Introduction to Securities Trading in Korea Exchange." Seoul: KRX.

The aforementioned information is particularly important considering that timing is also important when applying event studies methodology (Bernanke and Kuttner 2003). If the monetary policy decision were announced when the stock market had already closed, the effects on stock returns could be observed later and not on the day on which the monetary policy announcement was delayed. The index utilized to assess the KSE's market prices is the Korea Composite Stock Price Index (KOSPI), its base date being as of January 4, 1980, with a base index of 100 (KRX 2003). The KOSPI is a market value weighted index, composed of all common and preferred stocks listed on the KSE except for bond-type preferred stocks (KRX 2003). The index is adjusted to minimize the effects of corporate actions such as capital changes, new listings, delisting, mergers and acquisitions, and thereby reflects only price movements resulting from the market activities (KRX 2003). Figure 1 shows the behavior of KOSPI during the period of study 2000 - 2007.

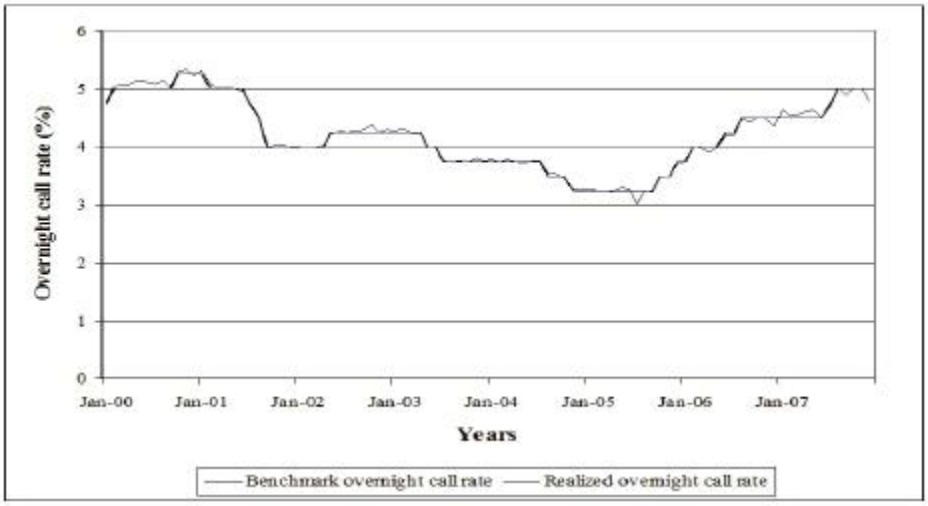
Figure 1 Korea Composite Stock Price Index (KOSPI): 2000 - 2007



Source: Bank of Korea (BOK). 2001, 2002, 2003, 2004, 2005, 2006, 2007. "Korea Composite Price Index." Seoul: BOK.

Second, the Bank of Korea (BOK) that was established on June 12, 1950 under the Bank of Korea Act is the institution responsible for price stability (BOK 2008). The Bank sets an inflation target every year in consultation with the government and draws up and publishes an operational plan including it for monetary policy (BOK 2008). In order to accomplish the yearly inflation target, since 1999 the BOK has announced monthly the target overnight call rate, which can be increased, decreased or maintained without variation (BOK 2008). It would be important to distinguish between targets and realized overnight call rate. The first one is the minimum set interest rate at which member banks should lend to one another, the second one is the actual interest rate at which member banks lend to one another. Unlike the target, the realized overnight call rate is registered at daily frequency as a result of the interaction among the depository institutions in the market for money. Figure 2 illustrates both interest rates. As can be seen, the target works as a benchmark for the overnight call rate. The sources of data are the web pages of KRX to obtain the data of KOSPI index, and the web page of BOK for the target call rate and realized call rate. The period of study contains 96 episodes of monetary policy decision between 2000 and 2007. Table 2 shows the number and nature of those announcements ranged from +0.25% to -0.5% changes.

Figure 2 Target Vs. Realized overnight call rate in Korea: 2000 – 2007



Source: BOK 2000-2007.

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Table 2 Overnight Call Rate Announcements in Korea: 2000 – 2007

Year	Monetary Policy Decision				Total
	+0.25%	0	-0.25%	-0.5%	
2000	2	10	0	0	12
2001	0	8	3	1	12
2002	1	11	0	0	12
2003	0	10	2	0	12
2004	0	10	2	0	12
2005	2	10	0	0	12
2006	3	9	0	0	12
2007	2	10	0	0	12
Total	10	78	7	1	**96**

The table above shows that changes in the overnight call rate target have not been frequent in Korea. Thus, of the 96 monetary policy decisions made, 10 of them consist in increasing by +0.25%, 7 announcements determined a decreasing in -0.25%, 1 decision consisted in a decreasing by -0.5%, totalizing just 18 changes in the call rate target. Also, there were 78 cases in which the MPC determined no changes in the interest rate target from 2000 to 2007. As Kuttner (2000) argues, the time at which the market realizes about the change in monetary policy is very important for event-study analysis given that according to this method the market reaction has to be observed when the fact (monetary policy decision) happens. This way, according to the timing provided in the BOK web page, it was detected that there were three delayed announcements between 2001 and 2003, that is to say in hours when the stock market had already closed trading. As Kuttner (2000) suggests, the way of adjusting is considering the monetary policy decision as given in the day after announcement. Thus, the adjustments were made as follows: the November 8, 2001 monetary policy announcement that was made at 4.11 p.m. was transferred as given on November 9, 2001; the February 7, 2002 announcement given at 3.36 p.m. was considered as given on February 8, 2002, and the March 6, 2003 monetary policy decision announced 5.46 p.m. was considered as given on March 7, 2003. Regarding the methodology, it is pertinent to recall that the previous section established the importance of distinguishing between expected and unexpected policy actions that is essential for discerning the effects of changes in the target overnight call rate on stock returns. Thus, as the purpose of the study is to analyze the effects of overnight call rate on the equity market returns and taking into account that asset prices would not respond only when the BOK surprises the stock market, but also to investors' revisions in expectations about future policy (which in turn may be driven by news about changing economic conditions), unexpected policy actions merely represent independent events which allow to discern more clearly the stock market's reaction to monetary policy (Bernanke and Kuttner 2003). This way, one convenient market-based way to identify unexpected overnight call rate changes was

introduced by Kuttner (2000) when studying the monetary policy surprises and interest rates in the U.S. market. According to this study the unexpected change for interest rates can be calculated as the change in the realized overnight call rate between the day the policy announcement is given, and the previous day of announcement. A similar concept was used by Bernanke and Kuttner (2003) when studying the effects of overnight call rate in the stock market returns.

The definition above mentioned can be expressed as follows:

$$\Delta i^{u} = (I_d - I_{d-1}) \quad (1)$$

Where

Δi^{u} = unexpected target rate change (surprise),
I_d = realized overnight call rate the day of monetary policy announcement,
I_{d-1} = realized overnight call rate the day before the announcement.

The expected component of the rate change is defined as the actual minus the surprise, or

Where

Δi^{e} = expected target rate change
Δi = target call rate change

Unlike Thorbecke's event-study approach, in this paper it is crucial to consider the factor surprise or unexpected changes in overnight call rate. Also, according to the theory stated in previous studies as of Mishkin (1995), Thorbecke (1997), Ehrmann and Fratzscher (2004), among others, stock returns are affected by monetary policy decisions; that is to say the behavior of stock market could be explained by the announcements of BOK regarding to changing or maintaining the call rate target. Thus, by definition, stock market returns could be named the dependent variable, while the changes in interest rate could be named the independent variable. On the other hand, to measure the impact of BOK policy on the stock market, the market's reaction to announcements of the overnight call rate on the day of the policy decision has to be calculated. However, it is necessary to clarify that the market could also react to the lack of change in the target, if a change had been anticipated (Bernanke and Kuttner 2003). This assertion is consistent with the Efficient Market Hypothesis that establishes prices of traded securities readily incorporate new information, that is to say the market reflects investors' expectations as soon as new information is available (Fama (1991), Shapiro (2006), and Bodie, Kane and Marcus (2005)) and react to surprises. Thus, if the market expected changes in the overnight call rate, and the BOK does not change it, that is the surprise to which the stock market reacts. (3)Taking into account that two expected and unexpected components have been distinguished as part of the announcement (Ross, Westerfield, and Jordan 2006), and following the study of Bernanke and Kuttner (2003), the target call rate change is broken down into the expected and surprise components. Thus, the regression that will be used here is

$$KOSPI_r = \alpha + \beta^{e}\Delta i_t^{e} + \beta^{u}\Delta i_t^{u} + \zeta \quad (3)$$

Where

$KOSPI_r$ = stock market return,
α = intercept,
β^{e} = coefficient for expected target rate change,
β^{u} = coefficient for unexpected target rate change,
Δi_{et} = expected target rate change,
Δ_{ut} = unexpected target rate change, and
ζ_t = error term.

Finally, in order to test if the Korean Stock Market reacts in the same way as asserted by the theory; the paper establishes the hypothesis as follows:

H_0: Market prices do not respond to unexpected changes in the target rate.
H_a: Market prices respond to unexpected changes in the target rate.

RESULTS AND DISCUSSION

As established from the beginning, according to the Efficient Market Hypothesis and in tune with the studies of Bernanke and Kuttner (2003), Ehrmann and Fratzscher (2004), among others, the announcements have two components; the expected, whereby the market should not react when the MPC announces the monetary policy decision, and the unexpected component or surprise, to which the market responds. In such a sense, in order to offer a first glance of the nature of surprises, it is necessary to discern first the unexpected component. After applying formula 1 to decompose the announcement of interest rate in surprises and non-surprises, the last ones were classified as positive surprises and negative surprises. The results are shown in Table 3.

Table 3 Positive and Negative Surprises at MPC Announcements: 2000 – 2007

Policy Decision on Target Call Rate	Positive Surprises		Negative Surprises		Total
	No.	Average	No.	Average	
+ 0.25%	10	0.223%	0	0%	10
0	28	0.030%	28	-0.041%	56
- 0.25%	0	0%	7	-0.240%	7
- 0.50%	0	0%	1	-0.510%	1
Total	38		36		74

Source: Data from KRX (2007) and BOK (2007).

As can be observed, there are a total of 74 announcements of the MPC on overnight call rate that imply surprises. It is pertinent to clarify that in the beginning, 96 events were recorded, but after the procedure mentioned above, summarized in Table 3, it was detected that 22 of them were not surprises; therefore, the difference between the realized overnight call rate on the day of policy announcement and the day before it is zero. It means that the market would have already anticipated the information regarding to the decision of the MPC, and this is why there was no surprise. Thus, the main analysis of the paper is focused on the 74 announcements that are surprises. Table 3 shows that of the 74 surprise cases, when the MPC announced an overnight call rate target increasing in 0.25%, 10 surprises were positive, its average being 0.223%; when the MPC announced a decrease in 0.25%, there were 7 negative surprises, their average being -0.24%; when the MPC announced no changes in the call rate target, there were 28 positive surprises with an average of 0.030%, and 28 negative surprises whose average was -0.041%. Finally when the MPC decided to decrease the call rate target in -0.5% the negative surprise was -0.51%. All those surprises indicate in averages the percentage change of the overnight call rate the market was therefore not able to anticipate when the Monetary Policy Committee decided to change or maintain the target call rate, and those are not the anticipated shifts transmitted to the equity market. It is also important to clarify the meaning of positive and negative surprises. A positive surprise indicates that the monetary policy decision has increased or decreased less than expected, or has not moved whereas the market expected a reduction in the overnight call rate target (Ehrmann and Fratzscher 2004). Conversely, a negative surprise implies that the policy decision has decreased or increased the interest rate less than expected, or has not moved whereas the market expected an increase in the interest rate target. For the present research, there were detected in total 38 positive surprises and 36 negative surprises.

Once all the details about selection of the information to be processed are specified, the first step is to calculate the Pearson's correlation coefficient in order to investigate if there is linear relationship, and how strong it is between the dependent variable that is the KOSPI return, and the two independent variables specified in the model: the expected and unexpected changes in interest rate. Thus, the formula to calculate the Pearson's correlation is:

$$r = \frac{S_{xy}}{S_x.S_y} = \frac{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x}).(y_j - \bar{y})}{S_x.S_y} \qquad (4)$$

Where:

S_{xy} = Is the covariance (X, Y), and

$S_x.S_y$ = Is the product of X anda Y standard deviations

r = Is the correlation coefficient that has to satisfy $-1 \leq r \leq 1$

The correlation matrix (Table 4) shows that there is a negative relationship between KOSPI returns and unexpected changes in the overnight call rate target being r = -0.215 with 5% of significance. It means that there is strong relationship between those two variables.

Table 4 Correlation matrix: KOSPI Returns vs. Expected and Unexpected Changes in the Overnight Call Rate Target

		KOSPI return	Unexpected change interest rate	Expected change interest rate
KOSPI return	Pearson Correlation	1	-0.215	-0.040
	p-value		0.066	0.736
	N	74	74	74
Unexpected change interest rate	Pearson Correlation	-0.215	1	-0.216
	p-value	0.066		0.064
	N	74	74	74
Expected change interest rate	Pearson Correlation	-0.040	-0.216	1
	p-value	0.736	0.064	
	N	74	74	74

Source: Data from KRX (2007) and BOK (2007).

In the case of the Pearson's correlation coefficient for KOSPI Vs. expected changes in the target overnight call rate, the coefficient shows a weak degree of association between those two variables of -0.040 with a significance of 74%, which means the probability to reject the hypothesis that there is a relationship between KOSPI returns and expected changes in interest rates is high. In order to determine if the unanticipated changes in overnight call rate affect stock market returns, the model specified in equation 3 is run twice; the first run includes only the 74 events of MPC announcements which were surprises for the market. In event study analysis, it is important to specify the cases were eliminated; in this investigation, the 22 remaining cases that there was not surprises were: April 6, 2000, January 11, 2001, October 11, 2001, June 5, 2002, September 12, 2002, January 9, 2003, September 9, 2003, October 9, 2003, September 9, 2004, December 9, 2004, February 15, 2005; April 7, 2002, May 12, 2005, June 9, 2005, August 11, 2005, November 10, 2005, January 12, 2006, March 9, 2006, May 11, 2006, September 7, 2006, November 9, 2006, and May 10, 2007. Second, in order to contrast with evidence from U.S. market and the Korean itself, a second regression is included, considering the 96 events regarding to changes or no changes in the target overnight call rate. The results of the regression in Table 5 show that KOSPI returns have strong negative relationship with unexpected changes in the target overnight call rate. Thus, the coefficient uβ= -2.65, indicates that 1 percentage point surprise increase in interest rates causes a decrease by -2.65 percent on one-day returns. Conversely, 1 percentage point surprise decrease in interest rate causes an increase by 2.65 percent on one-day returns. The t-statistic is significant with a level of confidence of 5% (p-value = 0.05). The model is accepted with 10 percent of confidence (Prob. F-statistic: 0.12). Also, the adjusted R^2 coefficient indicates that 2.7 percent of the variation in equity prices on the days that monetary policy decision is announced is associated with monetary policy that could be increasing, decreasing or maintaining the call rate target in Korea. These findings are consistent with the theory regarding to the direction of equity prices when changes in interest rate occur, that is to say the theory asserts a negative relationship between interest rate changes and stock returns (Mishkin 1995, and Thorbecke 1997). The results are also consistent with the investigations of Bernanke and Kuttner (2003), Ehrman and Fratzcher (2004) who also found strong relationship between unexpected changes in interest rates and stock prices. Likewise, the result is consistent with the study of Sohn and Eom (2006) who determined a strong negative relationship between unexpected changes in interest rate and equity prices by using intraday data.

Table 5 Response of KOSPI Returns to Overnight Call Rate Changes

Coefficient/Tests \ Regressor	Intercept	Unexpected Component	Expected Component
Value	-0.209	-2.65	-2.71
t-statistic	(-1.18)	(-1.98)	(-0.76)
p-value	0.23	0.05	0.44
Adjusted R^2 = 0.027			
Prob. F-Statistic = 0.12			
Multicollinearity (VIF)		1.049	1.049
Autocorrelation (Durbin-Watson) = 2.24			
White Heteroskedasticity (Prob- F) = 0.80			

Source: Data from BOK(2007), and KRX (2007).

results shown in Table 5 indicate the absence of multicollinearity given that the variance inflator factor (VIF) is lower than 10 for both components, therefore the collinearity between expected and unexpected components do not affect the precision of the model. In the same way, Durbin-Watson test (2.24) indicates the absence of autocorrelation while the White test of heteroskedasticity (F-statistic: 0.8) indicates that there is a high probability of accepting the existence of homoskedasticity, thus the probability of having heteroskedasticity is low. Following the analysis of the results shown in Table 5, it is noteworthy that the t-statistic for the estimator $_e\beta$ (p-value = 0.44) is not significant. It means that $_e\beta$= 0; therefore this finding indicates that expected changes in interest rates do not have influence in the stock market returns. This result is consistent with the Efficient Market Hypothesis, which asserts that the market does not respond to anticipated information given that this has already been incorporated and reflected in the equity prices. Having these results, it is necessary to declare formally the proof of hypothesis as follows,

H_0: $\beta^u = 0$, to satisfy the condition that stock prices do not respond to unexpected changes in the overnight call rate

H_a: $\beta^u \neq 0$, to satisfy the condition that stock prices respond to unexpected changes in the overnight call rate

The coefficient β^u is significantly different from zero at 5% level. Hence the null hypothesis H_0 is rejected and the alternative hypothesis H_a is accepted. Table 6 contains the results of different regressions when applying event-studies methodology. As a benchmark, column (a) reports the results from a simple regression of the CRSP value-weighted return on the raw change in the Fed funds rate in U.S. It shows returns on the raw change in the overnight call rate target,

$$H_t = \alpha + \beta \Delta i_t + \xi_t \qquad (5)$$

making no distinction between unexpected and expected changes; $_tH$represents the stock return, and i is the target funds rate. The response to the raw target rate changes is negative as expected according to the theory, but small and insignificant. Column (b) shows the U.S. market response when the target call rate change is broken down into the expected and surprise components considering the full sample (131 observations). Column (c) shows the evidence from Korea, when the full sample (96 events) was used. Column (d) reports the stock market response excluding no surprises (74 events). The outputs evidence interesting differences. For instance, in the case of the U.S. stock market, when the CRSP weighted index was regressed against the raw funds rate change, the coefficient just shown, the negative relationship between changes in interest rate and stock market returns, but the t-statistic was not significant, it would mean that the β =0. Thus, one could conclude that there would not be relationship between interest rates and stock market returns. Nevertheless, when Bernanke and Kuttner (2003) make the distinction of unexpected changes from expected changes in the interest rate, they found negative strong relationship between stock returns and unanticipated changes in interest rates. The results evidence a strong negative relationship between unexpected changes in interest rate and equity returns in the U.S. stock market.

Table 6 Comparison between the response of equity prices to changes in target overnight call rate in U.S. and Korea

Regressor	U.S. Stock market		Korea Stock Exchange	
	CRSP (a)	CRSP (b)	Full sample (c)	Excluding no surprises (d)
Intercept	0.23	0.12	-0.081	-0.209
t-statistic	(2.58)	(1.35)	(-0.52)	(-1.18)
ρ-value	N.A.	N.A.	0.59	0.23
Raw interest rate change	-0.61	N.A.	N.A.	N.A.
t-statistic	(1.06)	N.A.	N.A.	N.A.
ρ-value	N.A.	N.A.	N.A.	N.A.
Expected change	N.A.	1.04	-2.95	-2.71
t-statistic	N.A.	(2.17)	(-0.83)	(-0.76)
ρ-value	N.A.	N.A.	0.40	0.44
Unexpected change	N.A.	-4.68	-2.66	-2.65
t-statistic	N.A.	(-3.03)	(-1.99)	(-1.98)
ρ-value	N.A.	N.A.	0.049	0.051
Adjusted R-squared	0.007	0.171	0.022	0.027

Source: BOK (2007) and Bernanke and Kuttner (2003).

On the other hand, the results of column (c) and (d), referred to the Korean stock market show that, as in the U.S. market, distinguishing between expected and unexpected component permits capturing the real effect of the financial variable. In both cases including or excluding no surprises, the results are different; nevertheless by examining the explanatory power of adjusted R^2, it can be observed that excluding no surprises improves the model slightly. Also, by examining the adjusted R^2, it could be seen that, in days of monetary policy decisions, 17% of variability of stock prices is caused by changes in the Federal funds rate while in Korea 2.7% of variation in stock returns is the consequence of unexpected changes in interest target. The results of this investigation are similar to those obtained for Durhan (2002), Bernanke and Kuttner (2003), and Ehrmann and Fratzscher (2004) in the sense that when the monetary policy decision determines decreasing the short-run interest rate it produces an increase in equity prices, while when it increases the target the stock market in average responds conversely.

Finally, the results of the study would have two important implications. First, an increase in the overnight call rate could also raise the riskiness of stocks directly, for instance, by raising the interest costs or weakening the balance sheets of the firms (Bernanke and Kuttner 2003). Second, raising the interest reduces the willingness of stock investors to take the risk, for example by reducing expected income or wealth or increasing the probability of unemployment (Bernanke and Kuttner 2003). Conversely, lowering interest rates could reduce the cost of credit and benefit the cash flows of the firms. At the same time, it could encourage investors to participate in the stock market increasing their expected income.

CONCLUSION

By using regression analysis, and a sample of 74 monetary policy announcements that implied surprise, the study determined that there is a strong negative relationship between unexpected changes in the target overnight call rates and stock returns in Korea. This finding is consistent with the theory that establishes there is an inverse relationship between changes in interest rates and stock market returns, that is to say, increasing interest rates generates a decrease in the stock market returns, and decreasing interest rates triggers an increase in the stock market returns. The results also coincide with similar studies such as Bernanke and Kuttner (2003), and Ehrmann and Fratzcher (2004) realized in the U.S. by using event-studies methodology. The result of this paper is also consistent with the Efficient Market Hypothesis since the expected changes in target overnight call rates do not appear to affect equity prices. On the other hand the methodology proved to be powerful when distinguishing between expected and unexpected components given that through the separation of these two components, the study was able to discern the real effect of unexpected monetary policy decisions. Finally, the changes in interest rate could have implications on risk premium or in the firm's cash flows and could even affect the wealth of stock investors, and their willingness to participate in the stock market.

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