Effects of Disclosure Quality on Market Mispricing: Evidence from Derivative-Related Loss Announcements

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Abstract: Although previous research has suggested that the level of disclosure is positively related to stock market efficiency, it remains unclear whether an increase in the level of disclosure can facilitate price discovery regardless of the quality of information provided in the disclosure. We examine stock returns around 131 derivative-related loss announcements in the Korean stock market from March 2008 to June 2009 to study how disclosure quality might affect the manner in which newly disclosed information is incorporated into stock prices. To properly price derivative-related losses, investors need to differentiate 'over-hedged' firms from 'non-over-hedged' firms, because only those losses in excess of offsetting gains from underlying assets denominated in a foreign currency adversely affect overall profitability. We find that investors are likely to misprice derivative-related losses in non-over-hedged firms when information on the underlying foreign currency position is unavailable around the announcement of such losses. This implies that mechanically increasing the quantity of disclosures does not necessarily facilitate a more rational equity valuation, and thus suggests that policymakers should also consider the quality of information being provided when attempting to improve capital market efficiency by mandating more disclosures.

Keywords: disclosure quality, market mispricing, foreign currency, hedging

1. INTRODUCTION

It is well understood that investors require value-relevant information on a firm's future profitability and risks to assess its equity value correctly. However, information asymmetries and agency problems prevent managers from providing investors with value-relevant information in an effective manner. One solution to this problem is to

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require managers to fully disclose their private information. Given that an unbiased assessment of firms' equity value is a necessary condition for efficient allocation of economic resources, ways in which corporate disclosure regulations might reduce market mispricing (or enhance market efficiency) have been a topic of special interest among both academics and practitioners.

One of the main purposes of regulating corporate disclosure is to increase the amount of value-relevant information available to the public on a timely basis. However, if a disclosure provides low-quality incremental information, then it is likely to increase the level of noise, making it difficult for investors to assess the firm's profitability and risks accurately. In other words, an increase in the amount of information obtained by mandating more disclosures does not necessarily facilitate stock market efficiency. Given that some regulations on corporate disclosure focus more on increasing the quantity of information than on enhancing the quality, this is an important issue for policymakers as well as for investors and managers.

Although previous studies have generally suggested that the level of disclosure is positively related to stock market efficiency, it remains unclear whether an increase in the amount of information (regardless of its quality) can guarantee a better-functioning stock market. This is because such studies have not explicitly differentiated amount from quality when measuring the level of information provided in disclosures. Thus, the potential effect of disclosure quality on stock market efficiency beyond that of disclosure quantity is still an open empirical question. Our study fills this gap in the literature by providing a direct analysis of the relationship between disclosure quality and the market's mispricing of disclosed information.

We focus on the Korean stock market, which provides a unique empirical setting allowing us to differentiate clearly between high-quality disclosure and low-quality disclosure. Recently, Korean exporters hedged against foreign exchange risk using knock-in/knock-out (KIKO) option contracts (over-the-counter instruments). Some firms maintained an over-hedged position through their KIKO contracts in excess of their underlying foreign currency position and thus incurred enormous amounts of derivative-related losses when the Korean won depreciated sharply against the US dollar during the second half of 2008. The Korean regulations require a timely disclosure of such derivative-related losses within two business days upon recognition.

However, if firms with derivative-related losses are just hedging against the foreign exchange risk associated with their underlying export contracts or other assets denominated in a foreign currency, then such losses should be offset by corresponding gains from those contracts or assets. In other words, only the derivative-related losses from over-hedging in excess of the underlying assets actually result in net losses from transactions denominated in a foreign currency. Thus, negative impact on stock prices from derivative-related losses should only occur for over-hedged firms. Although investors need additional information on the amount of underlying export contracts or assets denominated in a foreign currency to differentiate over-hedged firms from non-over-hedged firms, such information is publicly available only through quarterly financial statements, not from the announcement of derivative-related losses itself.

Since firms are required to disclose derivative-related losses (but not the offsetting gains from underlying foreign currency position) immediately upon recognition,

such loss disclosure may occur well before the release of corresponding quarterly financial statements, which contain the information necessary for differentiating over-hedged firms from non-over-hedged firms. That is, for a firm that does not issue quarterly financial statements around the announcement of derivative-related losses, the investor may not have enough information with which to identify the firm's underlying foreign currency exposure, although the investor may well be aware of the amount of derivative-related losses.

We classify the announcement of derivative-related losses by firms issuing quarterly financial statements at approximately the same time as 'full disclosure' and that by firms issuing the statements at a later date as 'incomplete disclosure.' Both groups provide incremental information to the market in terms of the amount. However, since investors need information on a firm's underlying foreign exchange exposure as well as derivative-related losses to assess its overall profitability from transactions denominated in a foreign currency, we consider full (incomplete) disclosure to be high-(low-) quality disclosure.

We compare the stock market's responses to the full-disclosure and incomplete-disclosure groups following 131 derivative-related loss announcements in Korea from March 2008 to June 2009. Our results indicate that for the full-disclosure group, market's initial reactions to derivative-related losses are negative only for over-hedged firms, but not for non-over-hedged firms. In contrast, for the incomplete-disclosure group, investors' initial reactions are negative not only for over-hedged firms, but also for non-over-hedged firms. In fact, we do not observe noticeable differences between over- and non-over-hedged firms for the incomplete disclosure group around the initial loss disclosure. Moreover, within the incomplete disclosure group, we find that investors correct their mispricing of derivative-related losses for non-over-hedged firms when quarterly financial statements become available at a later date.

These results suggest that in the case of high-quality disclosure, that is, when investors have enough information to differentiate over-hedged firms from non-over-hedged firms, investors are able to assess correctly the impact of firms' derivative-related losses without any bias. However, in the case of low-quality disclosure, that is, when investors do not have sufficient information about underlying foreign currency exposure, investors are likely to misprice derivative-related losses. Thus, an increase in the amount of information may not necessarily facilitate a more rational assessment of firms' equity value. To the contrary, a simple increase in the amount of low-quality information might actually lead to greater market mispricing.

This study extends previous research demonstrating that an increase in the level of disclosure is likely to enhance stock market efficiency, and thus broadens our understanding of the effects of corporate disclosure on capital markets. More specifically, our study contributes to the literature by showing that disclosure quality is a prerequisite for efficient capital markets. This suggests that policymakers should seriously consider the quality of information provided in a disclosure when attempting to facilitate capital market efficiency by introducing a new form of mandatory disclosure.

The remainder of this paper is organized as follows: Section 2 provides a literature review and develops our key hypotheses. Section 3 describes the study's methodology and sample construction process. Section 4 presents the main empirical results, and Section 5 concludes the study.

2. BACKGROUND AND HYPOTHESES DEVELOPMENT

(i) Prior Research

Previous studies have suggested that corporate disclosure plays a critical role in capital markets (for a survey, see Healy and Palepu, 2001). In particular, corporate disclosure can reduce both 'lemons' and agency problems by facilitating the flow of information from firms to investors. Although a number of studies have examined corporate disclosure in a variety of contexts, the following review focuses on literature that specifically examines how increases in the level of information provided through disclosures — in terms of both quantity and quality — affect various capital market outcomes.

The consequences of an increase in disclosure level are often discussed in terms of improved stock liquidity, reduced cost of capital, increases in the number of analysts following and reduced mispricing (Botosan, 1997; Healy and Palepu, 2001; Botosan and Plumlee, 2002; and Lambert et al., 2007). Theory suggests that an increase in the level of disclosure can increase liquidity and reduce the cost of capital by reducing the degree of information asymmetry between informed and uninformed investors (Diamond and Verrecchia, 1991; and Kim and Verrecchia, 1994). Subsequent empirical studies provide supporting evidence. For example, Healy et al. (1999) find that firms with expanded voluntary disclosure experience substantial corresponding increases in stock prices unrelated to their current earnings performance. Botosan (1997) finds a negative relationship between the amount of voluntary disclosure and the cost of capital for firms that attract few analysts. Luez and Verrechia (2000) conduct a cross-sectional analysis using the bid-ask spread as a proxy for information asymmetry and find that firms committing to more strict disclosure environments such as international accounting standards (IAS) or US generally accepted accounting principles (GAAP) are more likely to show narrower bid-ask spreads than firms following German GAAP. Sheu et al. (2010) examine whether there is any significant variation in the market values of Taiwanese firms that exhibit different levels of transparency with respect to the disclosure of compensation practices. They find that only firms that choose to voluntarily disclose comprehensive information on their compensation practices are valued higher in the stock market.

A number of studies have examined disclosure quality and its implications for capital markets. Gelb and Zarowin (2002) find that firms with high disclosure ratings are more likely to show a stronger relationship between the stock price and current and future earnings than those with low disclosure ratings. Using Association for Investment Management and Research (AIMR) data, Lundholm and Myers (2002) find that the stock price is more likely to reflect future earnings for firms with high-quality disclosure than for those with low-quality disclosure. Gietzmann and Ireland (2005) construct a new measure of timely disclosure designed to capture quality rather than quantity of strategic disclosures, and find a negative relationship between disclosure and cost of capital for a sample of UK firms. Plumlee et al. (2008) examine the relationship between the quality of environmental disclosure and firm value, and report a similar negative relationship between the cost of capital and disclosure quality for firms in environmentally sensitive or electric power industries.

Several studies have examined the relationship between disclosure quality and mispricing in stock markets. For example, Sloan (1996) and Cheng et al. (2012) report

evidence of 'accrual anomaly,' that is, investors misprice securities by overvaluing (undervaluing) information in accruals (cash flows) for future earnings. Subsequent studies have evaluated this evidence by investigating the role of disclosure quality in investors' pricing of accounting information, focusing on the relationship between disclosure quality and market efficiency. Levi (2008) finds that mispricing can be mitigated when firms improve their disclosure practices by providing timely and robust information on their accruals.

Overall, previous research generally suggests that both higher disclosure quantity and better disclosure quality lead to a more efficient stock market. However, little is known about whether an increase in the quantity of information, regardless of its quality, results in a better-functioning stock market, since previous studies have not explicitly differentiated quantity from quality when measuring the disclosure level. The present study fills this gap in the previous literature by directly examining the extent to which interaction between disclosure quality and the level of disclosure shapes the market's mispricing of disclosed information. In the following subsection, we provide a review of KIKO option contracts and the disclosure environment of derivative-related losses in Korea, which forms the institutional background of our empirical test design.

(ii) The Disclosure Environment of Derivative-Related Losses in Korea and How KIKO Option Contracts Triggered Losses

Required disclosures for publicly traded firms in Korea mainly consist of the following three types: periodic disclosure, timely disclosure, and fair disclosure. Among these three types, timely disclosure requires firms to disclose immediately any important fact or managerial decision that could potentially affect firm value. Because Korea follows a civil law tradition under which written statutes and codes are more important than general principles such as fiduciary duty and fairness, timely disclosure entails a very long list of possible important facts or management decisions, ranging from security issues and takeovers to supply contracts and product recall events.[1]

One of the items on this list is related to the recognition of a sudden loss from some catastrophic event that exceeds a certain percentage of total assets or the book value of equity: fines or other forms of pecuniary regulatory sanctions, initiation of investigation for embezzlement or a breach of fiduciary duty, or derivative product transactions. Disclosure requirements on loss from derivative products were added to the list in 1996 in the aftermath of the 1995 collapse of the Baring Bank, caused by excessive speculative investment in futures contracts. More specifically, firms must disclose the amount of derivative-related losses within two business days (including the date of recognition) whenever it exceeds 5% of the book value of equity.[2] The content of such disclosure is highly standardized across firms because the regulators provide a detailed format (see the Appendix for an example).

Traditionally, Korean firms have been highly dependent on foreign trade and thus relied on conventional instruments such as forward contracts to hedge against foreign exchange risk. Recently, KIKO contracts between exporters and commercial banks emerged as one of the most commonly used financial derivatives for hedging against foreign exchange risk, particularly for small and medium-sized firms. KIKO contracts

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1 Periodic disclosure and fair disclosure are similar to those found in the United States.
2 The cutoff is reduced to 2.5% for large firms whose total assets are more than KRW 2 trillion (approximately USD 2 billion) as of the most recent fiscal year end.

typically involve writing (or selling) an out-of-the-money call option with a knock-in barrier and buying an in-the-money put option with a knock-out barrier. Both options have the same strike price which is slightly higher than the spot exchange rate. Because of the knock-in/knock-out clause, the call option is only effective when the exchange rate exceeds the knock-in threshold, whereas a put option is no longer valid when the exchange rate falls below the knock-out threshold. This feature provides a gain from this position when the exchange rate is between the knock-out barrier and the exercise price. When the exchange rate is lower than the knock-out barrier or falls between the exercise price and the knock-in barrier, the position breaks even. If the exchange rate exceeds the knock-in barrier, then the position incurs a loss.

If the short position in the call option does not exceed the underlying foreign-currency-denominated asset (i.e., exports), then the loss from the KIKO position when the exchange rate exceeds the knock-in barrier is exactly offset by gains from the underlying asset. However, many firms sold two (or more) call options per one put option bought. Since in-the-money put options are more expensive than out-of-the-money call options, banks recommended this position so that the net cost would be zero. Hence, firms that entered into these 'leveraged' KIKO contracts essentially became over-hedged.

The popularity of KIKO contracts in Korea was mainly due to the long-term appreciation of the Korean won against the US dollar from 2001 to 2007, during which time many Korean firms had difficulty exporting their products. With the long-term downward trend in the exchange rate, most foreign exchange experts predicted that the Korean won would remain strong and stable against the US dollar in the near future. Thus, KIKO contracts became an attractive hedging instrument, providing moderate gains from the overall position when the exchange rate moved within the knock-in and knock-out barriers. The volume of KIKO contracts increased sharply, and, according to the Korean Financial Supervisory Service, outstanding KIKO contracts amounted to USD 10.1 billion by the end of June 2008. Interestingly, contracts by over-hedged firms accounted for USD 3.1 billion, indicating that a substantial number of firms were in fact engaged in speculation, rather than hedging.

However, with the unanticipated sharp increase in the KRW/USD exchange rate in the second half of 2008, many Korean firms with KIKO contracts incurred enormous losses. The accumulated loss from KIKO contracts amounted to almost USD 10 billion for 2008. This led to serious financial distress for a number of Korean firms, many of which were subsequently delisted from the Korean stock market. As a result, the amount of outstanding KIKO contracts fell to USD 3.7 billion by the end of December 2008.[3]

According to Korea's regulation on timely disclosure, such losses must be disclosed within two business days. However, the standardized disclosure form does not provide any information on underlying foreign-currency-denominated assets that could potentially offset the losses from derivatives. Hence, investors must resort to quarterly financial statements (i.e., periodic disclosure) to infer information on underlying assets. Because derivative-related losses must be disclosed immediately, while information on underlying assets is available only through quarterly reports, there can be a gap between these two disclosure events. Although firms may voluntarily

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3 Because many firms faced the possibility of a forced delisting due to impaired capital, the regulatory authorities temporarily allowed a postponement of forced delisting in 2008 if the impaired capital was purely due to losses from KIKO positions.

disclose information on their underlying assets when disclosing derivative-related losses, we find no such cases in our sample.

Such an institutional environment provides a unique empirical setting that allows high-quality disclosure (i.e., derivative-related loss disclosure that coincides with the issuance of a quarterly financial report) to be distinguished from low-quality disclosure (i.e., derivative-related loss disclosure whose corresponding quarterly financial statements are not available until later). Because the amount of information on derivative-related losses is the same for both high-quality and low-quality disclosures, we can examine the effect of pure information quality, controlling for the quantity of information available. Given that rational investors are expected to punish only over-hedged firms (i.e., those engaged in speculation), our basic empirical strategy is to test whether the disclosure of KIKO losses in Korea enabled investors to impound such information into stock prices efficiently.

(iii) Hypotheses Development

To assess rationally the effect of derivative-related losses on the overall profitability of a firm and ultimately on equity valuation, investors need to know the firm's overall foreign exchange exposure, including both underlying foreign-currency-denominated assets and financial instruments used to hedge against them. This is because only the derivative-related losses by over-hedged firms, which are beyond the offsetting gains from underlying assets denominated in a foreign currency, have a negative effect on the firms' overall profitability. However, such information is not readily available from the announcement of derivative-related losses, but rather must be inferred from corresponding quarterly financial statements. That is, for firms announcing only derivative-related losses (i.e., corresponding quarterly financial statements are issued at a later date), investors cannot differentiate over-hedged firms from non-over-hedged firms. Under such circumstances, investors may respond negatively to derivative-related losses not only for over-hedged firms, but also for non-over-hedged firms. Thus, we propose our first hypothesis as follows:

> **H$_1$:** For 'incomplete-disclosure' firms that do not issue corresponding quarterly financial statements around the announcement of derivative-related losses, stock returns are negatively related to the amount of derivative-related losses for both over-hedged firms and non-over-hedged firms.

In contrast, for firms issuing corresponding quarterly financial statements around the announcement of derivative-related losses, investors can rationally distinguish over-hedged firms from non-over-hedged firms by using the additional information (i.e., information on the underlying foreign-currency-denominated assets) contained in the quarterly financial statements. In this case, we expect investors to respond negatively to the announcement of derivative-related losses only for over-hedged firms, but not for non-over-hedged firms. Thus, we propose our second hypothesis as follows:

> **H$_2$:** For 'full- disclosure' firms that issue corresponding quarterly financial statements around the announcement of derivative-related losses, stock returns are negatively related to the amount of derivative-related losses only for over-hedged firms, but not for non-over-hedged firms.

Finally, if investors respond negatively to derivative-related loss announcements even for non-over-hedged firms under incomplete disclosure, as outlined in the first hypothesis, then they may correct their mispricing when corresponding quarterly financial statements become available at a later date. More specifically, initially negative stock returns for non-over-hedged firms may rebound around the subsequent issue of corresponding quarterly financial statements. In this regard, we propose our third hypothesis as follows:

H₃: For non-over-hedged firms issuing corresponding quarterly financial statements at a later date, stock returns are positively related to the amount of derivative-related losses when such quarterly financial statements become publicly available.

3. METHODOLOGY

(i) Research Design

Our key empirical approach is to examine whether the market reacts differently to over-hedged and non-over-hedged firms depending on the information available at the time of the derivative-related loss disclosure. To identify over-hedged firms, we construct a *Hedge Ratio,* defined as the amount of derivative-related losses divided by the amount of offsetting gains from underlying foreign-currency-denominated assets (i.e., gains from foreign-currency-denominated transactions or translation of foreign-currency-denominated assets) for the corresponding quarter. We use this variable to capture the extent to which firms engage in over-hedging their underlying foreign exchange exposure, at least in the *ex post* sense. If a firm does not hedge against its underlying foreign-currency-denominated asset through financial derivatives, then the *Hedge Ratio* is 0. If it implements a perfect hedge such that its derivative-related losses are perfectly offset by its gains from the underlying assets, then the *Hedge Ratio* is 1. If its hedge exceeds its underlying foreign exchange exposure, then the *Hedge Ratio* is greater than 1. If it takes a position in financial derivatives without having any underlying assets denominated in a foreign currency, then the *Hedge Ratio* goes to infinity. Once we obtain this measure, we divide the sample firms into two groups: those that are over-hedged and those that are not over-hedged, where the cutoff is based on the sample median.[4]

To measure the market's response to the amount of derivative-related losses, we run the following regression:

$$\text{CAR}_i = b_0 + b_1 \ln(Loss_i) + b_2 \, Overhedge_i + b_3 \ln(Loss_i) \cdot Overhedge_i + e_i, \qquad (1)$$

where CAR_i is the three-day (from day -1 to $+1$) market-adjusted cumulative abnormal return of firm i around the derivative-related loss announcement, $Loss_i$ is the amount of derivative-related losses of firm i scaled by the book value of equity,

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4 Another alternative is to use 1 instead of the sample median as a cutoff. However, moderate deviation from 1 may be interpreted as a transient one-time event rather than a permanent shock. Unreported results based on this alternative cutoff suggest that investors do not distinguish between under-hedged firms and moderately over-hedged firms, consistent with our conjecture. Moreover, too few firms exhibit *Hedge Ratio* of less than 1 to implement a meaningful statistical comparison.

and *Overhedge$_i$* is a dummy variable coded as 1 if the *Hedge Ratio$_i$* exceeds the sample median and 0 otherwise.

To formally test H$_1$ and H$_2$, we run the regression separately for the 'full-disclosure' group (i.e., the group of firms whose corresponding quarterly financial statements are available around the derivative-related loss announcement) and for the 'incomplete-disclosure' group (i.e., the group of firms whose quarterly financial statements are only available at a later date).

For full-disclosure firms, we expect *Loss* to influence CAR only for over-hedged firms, because investors could rationally incorporate information from quarterly financial statements on gains from underlying assets denominated in a foreign currency. Hence, we expect b_1 to be insignificant and b_3 to be negative and significant.

However, for incomplete-disclosure firms, information on potential gains from underlying assets denominated in a foreign currency is not available at the time of the derivative-related loss announcement. Thus, investors cannot accurately distinguish between over-hedged and non-over-hedged firms, and we expect b_1 to be negative and significant and b_3 to be insignificant.

To test H$_3$, we calculate the seven-day (from day -3 to day $+3$) market-adjusted cumulative abnormal return for the 'incomplete-disclosure' group issuing corresponding quarterly financial statements at a later date where the event date is the issuing date of the quarterly financial statements, not the date of derivative-related loss announcements. We then regress this return on the explanatory variables in equation (1). We expect that if there is an initial overreaction to derivative-related losses for non-over-hedged firms due to insufficient information, then this overreaction should be corrected once quarterly financial statements become available. For over-hedged firms, however, there is no reason that the initial negative reaction should revert, since the original price drop correctly reflected over-hedging. Hence, we expect b_1 to be positive and significant, but the sum of b_1 and b_3 to be insignificant.

(ii) Data and Sample Construction

The sample consists of all publicly traded firms in Korea that disclosed their derivative-related losses from March 2008 to June 2009. This period overlaps with the development of the sub-prime mortgage crisis, during which there was a sharp depreciation of the Korean won against the US dollar. We collect the sample firms from the Korea Investors Network for Disclosure (KIND) system operated by the Korea Exchange (KRX), which provides the content of disclosures by firms listed on the KRX. The sample includes both Korea Composite Stock Price Index (KOSPI) and Korea Securities Dealers Automated Quotations (KOSDAQ) firms.

From this data set, we identify (1) the announcement date, (2) the amount of derivative-related losses, and (3) the ratio of derivative-related losses to the book value of equity (*Loss*) as of the end of the fiscal quarter immediately prior to the loss announcement date. We employ *Loss* to capture partial or incomplete information independent of the potential underlying assets denominated in a foreign currency. As explained in Section 2, a firm must disclose any loss from derivatives within two business days of its recognition once the loss exceeds 5% (2.5% for large firms) of the book value of equity.

We obtain the data on daily stock and index returns mainly from the Korea Securities Research Institute (KSRI), which provides stock return data comparable to

Table 1

Sample Construction

Number of all derivative-related loss disclosures	320
Less: Disclosures with corrections or amendments	(7)
	313
Less: Subsequent disclosures for each firm if it releases multiple disclosures	(171)
(Keep first disclosures for each firm)	142
Less: Disclosures without available stock return data	(7)
	135
Less: Disclosures without available corresponding quarterly report	(1)
	134
Less: Disclosures with problems in corresponding quarterly report	(2)
	132
Less: Disclosures without available previous quarterly report	(1)
Final sample	131

Notes:
This table provides a brief overview of the sample selection process. Disclosures of derivative-related losses from March 2008 and June 2009 were obtained from the Korea Investors Network for Disclosure (KIND) system operated by the Korea Exchange (KRX). Each line in the table explains the filtering criteria and the remaining number of observations at each step. In the third-to-last line, two cases were dropped because the reported amount of derivative-related profit or loss in the corresponding quarterly report was zero.

those provided by the Center for Research in Security Prices (CRSP) in the United States. We obtain 2009 returns (which were not available from the KSRI) from Fn-Guide, an alternative data vendor. Quarterly financial statements are obtained from the Korea Listed Companies Association (KLCA)'s Total Solution 2000 (TS2000). We use quarterly, not annual, financial statements because derivative-related losses are typically measured over a quarter in Korea.

As shown in Table 1, we originally start with 320 derivative-related loss announcements. Among these, 139 are made by KOSPI firms, and 181 by KOSDAQ firms. We then exclude those announcements that reflect trivial amendments to the original filings, leaving 313 announcements (138 by KOSPI firms and 175 by KOSDAQ firms). In cases where a firm reports multiple losses over the sample period, we consider only the first announcement, following conventions in event studies.[5] This leaves 142 announcements. Finally, we exclude those announcements lacking stock return data or accounting information.[6] The final sample consists of 131 derivative-related loss announcements made by the same number of unique firms.

Figure 1 reports the frequency of derivative-related loss announcements as well as the level of KRW/USD exchange rates for each calendar month during our sample period.[7] The figure clearly indicates a sharp depreciation of the Korean won following the onset of the global financial crisis starting from the second half of 2008. Incidences of derivative-related losses are highly correlated with the depreciation of the Korean

5 The results of an unreported analysis suggest that stock markets do not react to derivative-related loss announcements made after the first announcement.
6 We exclude 11 observations at this stage of the sample selection procedure for the following reasons: In seven cases, there were no data on stock returns; in two cases, no corresponding or previous quarterly reports were available; and in the remaining two cases, the reported amount of derivative-related profit or loss in the corresponding quarterly report was zero.
7 The exchange rates are obtained from Datastream.

Figure 1

Distribution of Derivative-Related Loss Announcements and KRW/USD Exchange
Rate Over Time
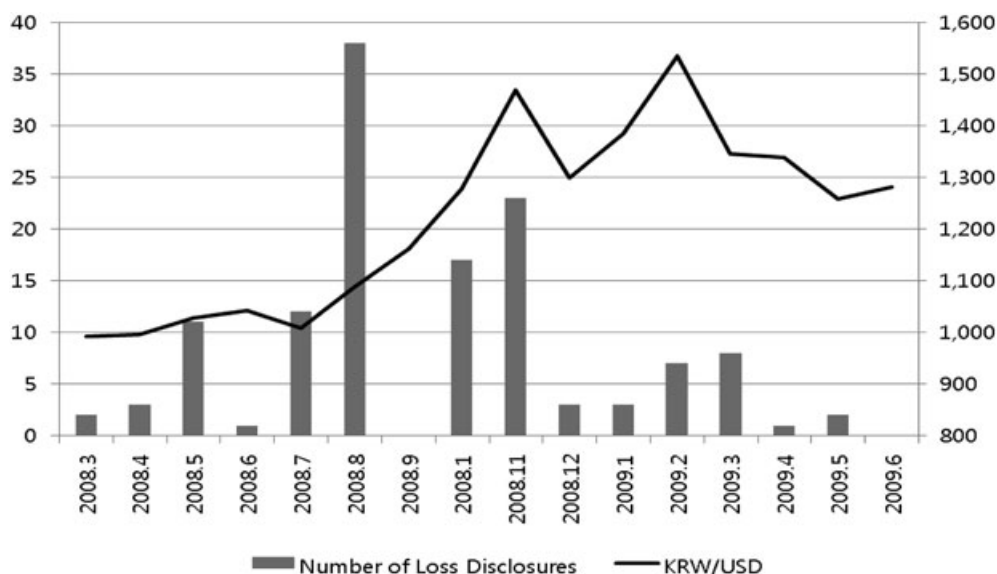
Notes:
This figure presents the distribution of derivative-related loss announcements, as well as the level of
KRW/USD exchange rate for each calendar month during the sample period from March 2008 to June
2009. The frequency of observations is depicted using bars (left vertical axis), and KRW/USD exchange
rates are presented as a line (right vertical axis).

won. For example, more than 70% of derivative-related loss announcements are
clustered during the second half of 2008.

4. EMPIRICAL RESULTS

(i) Descriptive Statistics

Panel A of Table 2 presents the descriptive statistics for the variables. The dependent
variable of interest is CAR over a three-day period (day −1 to day +1) around the
announcement of derivative-related losses.[8] Both the mean (−5.95%) and median
(−4.21%) stock returns indicate that these firms experience a substantial price drop
upon the disclosure of such losses, which is economically significant given the short
event window. The mean and median statistics for *Loss* (i.e., the amount of derivative-
related losses scaled by the book value of equity) show that the magnitudes are non-
trivial and there is a wide variation in the distribution of this variable. The mean values
for *Size* (i.e., total assets) and MV (i.e., market value of common shares outstanding)
are slightly above KRW 0.7 trillion and 0.6 trillion, respectively (roughly USD 0.7 and

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8 We subtract the sum of value-weighted market index return from the raw return measured over the three
days.

Table 2
Descriptive Statistics

Variable	Mean	Median	Std. Dev.	1%	5%	10%	25%	50%	75%	90%	95%	99%
Panel A: Full Sample (N = 131)												
CAR [−1,+1] (%)	−5.95%	−4.21%	8.52%	−29.61%	−20.35%	−17.15%	−11.42%	−4.21%	−1.06%	2.61%	6.40%	15.41%
Loss (%)	18.74%	11.90%	25.14%	3.08%	4.38%	5.33%	7.55%	11.90%	19.90%	33.34%	48.33%	129.10%
Size	719.43	141.31	2,560.10	15.48	30.23	46.36	78.10	141.31	277.20	722.06	2,575.60	18,444.00
MV	613.60	63.58	2,697.96	9.80	14.00	16.66	28.94	63.58	174.09	629.09	2,178.00	15,622.00
Hedge Ratio from corresponding quarterly report	17.01	2.71	119.93	0.20	0.48	0.65	1.35	2.71	6.41	14.31	29.13	97.68
Hedge Ratio from previous quarterly report	3.43	1.64	7.10	0.00	0.08	0.22	0.78	1.64	3.64	6.66	9.50	34.13
Difference between loss disclosure and quarterly report (calendar days)	13.69	7.00	18.74	−18.00	−1.00	0.00	0.00	7.00	25.00	41.00	49.00	59.00
Panel B: Incomplete-Disclosure Group (N = 72)												
CAR [−1,+1] (%)	−6.00%	−4.36%	7.95%	−29.61%	−21.67%	−15.42%	−9.59%	−4.36%	−1.37%	1.92%	6.19%	15.83%
Loss (%)	16.10%	11.90%	16.29%	3.08%	3.42%	5.65%	7.78%	11.90%	19.28%	25.40%	42.00%	124.20%
Size	855.29	126.96	3,174.60	15.28	29.57	45.15	70.28	126.96	249.81	651.98	2,405.20	19,079.00
MV	769.91	65.02	3,444.91	10.00	14.94	21.12	26.59	65.02	174.09	356.43	2,362.79	24,624.00
Hedge Ratio from corresponding quarterly report	6.44	2.43	13.31	0.20	0.47	0.62	1.35	2.44	5.39	9.43	27.62	89.85
Hedge Ratio from previous quarterly report	2.95	1.55	4.09	0.00	0.06	0.12	0.69	1.55	3.66	6.82	8.41	27.43
Difference between loss disclosure and quarterly report (calendar days)	25.83	20.00	16.84	5.00	7.00	7.00	11.50	20.00	38.00	44.00	55.00	90.00

Table 2 (Continued)

Variable	Mean	Median	Std. Dev.	1%	5%	10%	25%	50%	75%	90%	95%	99%
Around the Earnings Report Date (N = 61)												
CAR [−3, +3] (%)	−0.34%	0.39%	8.19%	−22.67%	−12.58%	−10.60%	−5.11%	0.39%	3.74%	10.12%	11.78%	23.78%
Quarterly Earnings Surprise (%)	6.86%	6.24%	14.29%	−45.93%	−12.08%	−7.71%	0.88%	6.24%	14.09%	23.85%	27.13%	43.44%
Panel C: Full-Disclosure Group (N = 59)												
CAR [−1, +1] (%)	−5.89%	−3.53%	9.24%	−36.96%	−19.62%	−18.78%	−12.31%	−3.53%	1.06%	5.18%	7.20%	15.41%
Loss (%)	21.97%	10.51%	32.74%	3.06%	4.83%	5.27%	6.60%	10.51%	23.56%	43.30%	97.76%	209.00%
Size	553.63	165.95	1,519.20	15.48	30.23	55.82	88.49	165.95	282.98	955.17	3,212.50	10,498.00
MV	425.51	61.45	1,341.97	5.91	12.71	15.21	29.32	61.45	183.47	735.00	2,178.00	7,827.00
Hedge Ratio from corresponding quarterly report	30.14	2.84	178.75	0.17	0.48	0.72	1.34	2.84	8.42	16.20	35.99	1,376.00
Quarterly Earnings Surprise (%)	16.33%	5.98%	43.98%	−22.66%	−12.43%	−7.85%	−0.98%	5.98%	18.85%	30.24%	83.70%	258.8%

Notes:
This table presents descriptive statistics for the sample firms. Panel A reports the results for the full sample, and Panels B and C report those for the incomplete-disclosure and full-disclosure groups, respectively. We define full-disclosure firms as those whose corresponding quarterly report was issued either prior to or no later than four days after the loss disclosure. Incomplete-disclosure firms are defined as those whose corresponding quarterly report was issued at least five days after the loss disclosure. CAR (−1, +1) is the three-day market-adjusted cumulative abnormal return measured around the announcement of derivative-related losses. *Loss* is calculated as the ratio of derivative-related losses to the book value of equity and is available in the loss disclosure. *Size* is defined as total assets in KRW billion. For full-disclosure firms, the numbers are from the corresponding quarterly reports, while for incomplete-disclosure firms, the numbers are from the previous quarterly reports. MV is the product of price per share and number of common shares outstanding (in KRW billion) in the month just before the loss disclosure. *Hedge Ratio* is calculated as the ratio of derivative-related losses to gains from foreign currency transactions or translation of foreign-currency-denominated assets. In Panels A and B, we report two measures of *Hedge Ratio*, those obtained from corresponding quarterly reports and those from previous quarterly reports. The difference between the loss disclosure and the quarterly report indicates how long it took for the corresponding quarterly report to be issued following a loss disclosure. In Panels B and C, we also report *Quarterly Earnings Surprise*, defined as the increase in net income before subtracting derivative-related losses over the same quarter a year earlier, scaled by the book value of equity. In Panel B, we also report CAR (−3, +3) around the release of the corresponding quarterly report when it became available for the incomplete-disclosure group.

0.6 billion). These numbers are largely similar to the corresponding numbers for all publicly traded firms in Korea.

To measure the extent to which derivative-related losses are offset by gains from underlying assets denominated in a foreign currency, we use the *Hedge Ratio*. The ideal approach would be to distinguish between over-hedged firms and non-over-hedged ones based on a contract-by-contract match between derivatives and underlying foreign-currency-denominated commercial transactions. However, because it would be technically infeasible to map derivative position with corresponding underlying asset one for one, we construct our alternative *Hedge Ratio* measure by scaling the realized value of losses (from derivative contracts) to gains (from foreign currency transactions or translation of foreign-currency-denominated assets). Because information on gains from the underlying foreign-currency-denominated assets is not available for some firms until later, we calculate two versions of the *Hedge Ratio*: one using gains reported in the corresponding quarterly statement, and the other using gains reported in the quarterly statement immediately prior to the corresponding quarter.[9] The second measure is designed to address the possibility that investors may be able to identify over-hedged firms based on information provided in previous quarterly statements.

The summary statistics for the two versions of the *Hedge Ratio* indicate that the averages of each *Hedge Ratio* far exceed unity, suggesting that most firms disclosing derivative-related losses are in fact over-hedged (at least in the *ex post* sense). Moreover, the distribution of *Hedge Ratio* exhibits extremely positive skewness, implying that some firms are heavily engaged in purely speculative activity with only a small amount of outstanding underlying assets denominated in a foreign currency.

In the next row and in Figure 2, we report the differences in the number of calendar days between the disclosure of derivative-related losses and the release of corresponding quarterly financial statements.[10] As shown in Figure 2, a relatively large number of derivative-related loss announcements were made on the same day as the quarterly financial statements. This reflects the fact that moderate levels of derivative-related losses are often recognized while preparing for the quarterly report. In some cases, quarterly financial reports are released before the disclosure of derivative-related losses. For such firms, investors could rationally infer gains from the underlying foreign-currency-denominated assets for the period during which the firms incurred derivative-related losses.[11] However, for more than half of the firms that disclosed derivative-related losses, corresponding quarterly financial statements (and thus gains from underlying foreign-currency-denominated assets) were issued after the derivative-related loss announcement. In such cases, investors might not have had access to the information necessary to evaluate the effect of changes in the exchange rate on firm value accurately.

Panels B and C of Table 2 report the summary statistics for the main variables separately for full-disclosure firms and incomplete-disclosure firms. We define

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9 We match a loss disclosure with its corresponding quarterly statement based on the amount of derivative-related loss reported in each announcement. All loss disclosures in our sample are matched with corresponding quarterly statements that report exactly the same amount of derivative-related loss.
10 Note that the corresponding quarterly report is not simply the one most adjacent to the loss disclosure in calendar time. This is because the mapping between two events is based on the exact amount of derivative-related loss reported in each announcement.
11 Because regulations require firms to disclose derivative-related loss within two business days, a difference of less than -2 actually implies a violation of this regulation, and it remains a puzzle why firms reflects such information in a quarterly report but not issue a separate loss disclosure.

Figure 2

Differences Between the Date of Loss Disclosure and the Release of the
Corresponding Quarterly Report
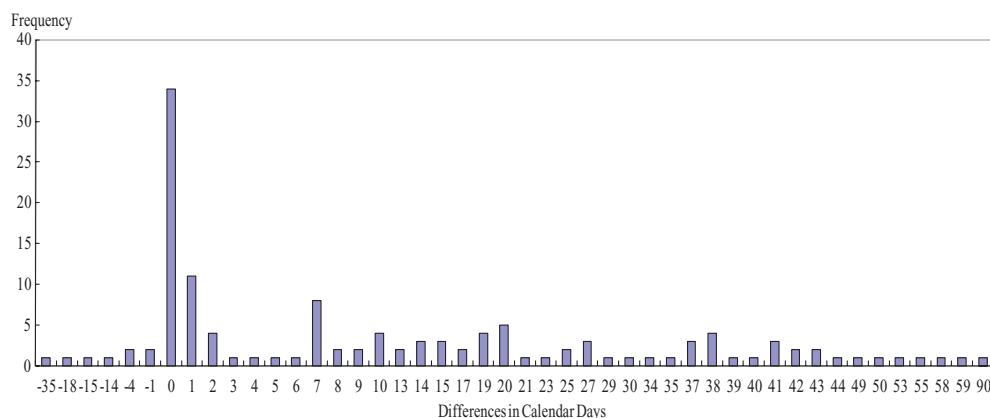
Notes:
This figure presents the distribution of differences in calendar dates between the date of derivative-related loss disclosure and the date of the public release of the corresponding quarterly report. Corresponding quarterly reports are identified by matching the exact amount of derivative-related loss reported in each announcement with those reported in the quarterly report. A positive difference implies that quarterly reports were issued after the loss disclosure. The difference in calendar days is presented on the horizontal axis, and the frequency of observations is depicted by bars on the vertical axis.

full-disclosure firms as those whose corresponding quarterly report was issued either prior to or no later than four days after the loss disclosure. Incomplete-disclosure firms are defined as those whose corresponding quarterly report was issued at least five days after the loss disclosure. We allow a four-day lag because there could have been some leakage of information before the actual release of quarterly financial statements.[12] A casual comparison suggests that the full-disclosure firms reported in Panel C of Table 2 exhibit higher average *Loss* and *Hedge Ratio* compared to the incomplete-disclosure group reported in Panel B.

Our final explanatory variable is the *Quarterly Earnings Surprise*, defined as the increase in net income, adjusted for derivative-related loss between current quarter and corresponding quarter in the previous fiscal year, scaled by book value of equity. That is, we add back derivative-related loss amount to net income for each fiscal quarter before calculating the earnings surprise to capture changes in earnings unrelated to increases in derivative-related losses. Since a substantial number of firms simultaneously report both derivative-related losses and quarterly financial statements, we control for a potential confounding effect from information contained in the quarterly earnings.

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12 According to the distribution provided in Figure 1, our baseline cutoff seems reasonable. Nevertheless, since this cutoff could still be considered arbitrary, we also employ different cutoff dates in the subsequent analysis as a robustness check.

(ii) Correlations between Variables

Table 3 presents univariate correlations between the main variables as well as the corresponding *p*-values. Panel A of Table 3 reports the results for the full sample, whereas Panels B and C show the results for incomplete-disclosure and full-disclosure firms, respectively. In Panel D of Table 3, we report a similar correlation table for the incomplete-disclosure firms where the event dates for measuring abnormal returns

Table 3
Correlations Between Variables

	ln (Loss)	ln (Hedge Ratio)	Quarterly Earnings Surprise
Panel A: Full Sample			
CAR [−1,+1]	−0.515***	−0.350***	
(*p*-value)	(0.000)	(0.000)	
ln (Loss)	–	0.334***	
(*p*-value)		(0.000)	
Panel B: Incomplete-Disclosure Group			
CAR [−1,+1]	−0.381***	−0.159	
(*p*-value)	(0.001)	(0.183)	
ln (Loss)	–	0.133	
(*p*-value)		(0.264)	
Panel C: Full-Disclosure Group			
CAR [−1,+1]	−0.626***	−0.512***	−0.363***
(*p*-value)	(0.000)	(0.000)	(0.005)
ln (Loss)	–	0.450***	0.508***
(*p*-value)		(0.000)	(0.000)
ln (Hedge Ratio)	–	–	0.287**
(*p*-value)			(0.028)
Panel D: Incomplete-Disclosure Group Around Corresponding Quarterly Report Disclosure			
CAR [−3,+3]	0.203	−0.022	−0.049
(*p*−value)	(0.118)	(0.865)	(0.708)
ln (Loss)	–	0.443***	0.281**
(*p*-value)		(0.000)	(0.028)
ln (Hedge Ratio)	–	–	−0.012
(*p*-value)			(0.925)

Notes:
*** and ** represent statistical significance at the 1% and 5% levels, respectively. This table presents the correlations across the dependent and explanatory variables. *p*-values are reported in parentheses. Panels A, B, and C report the results for the full sample, incomplete-disclosure group, and full-disclosure group, respectively, where CARs are market-adjusted cumulative abnormal returns measured around the derivative-related loss disclosure. We define full-disclosure firms as those whose corresponding quarterly report was issued either prior to or no later than four days after the loss disclosure. Incomplete-disclosure firms are defined as those whose corresponding quarterly report was issued at least five days after the loss disclosure. In Panel D, we report the results separately for the incomplete-disclosure group, where CARs are measured around the subsequent release of the corresponding quarterly report. *Loss* is calculated as the ratio of derivative-related losses to the book value of equity and is available in the loss disclosure. *Hedge Ratio* is calculated as the ratio of derivative-related losses to gains from foreign currency transactions or translation of foreign-currency-denominated assets. For the full-disclosure group, *Hedge Ratio* is calculated from corresponding quarterly reports, while it is based on previous quarterly reports for the incomplete-disclosure group. *Quarterly Earnings Surprise* is defined as the increase in net income before subtracting derivative-related losses over the same quarter a year earlier, scaled by the book value of equity.

are set to the release of quarterly reports instead of the loss disclosure. For the full-disclosure group, *Hedge Ratio* is based on the corresponding quarterly report, whereas for the incomplete-disclosure group, it is based on the previous quarterly report. The results indicate that stock returns are significantly negatively correlated with both *Loss* and *Hedge Ratio* for the full sample as well as for the full-disclosure firms in Panels A and C. In addition, *Loss* and *Hedge Ratio* are positively correlated in the full sample and within the full-disclosure firms. However, for the incomplete-disclosure firms reported in Panel B, *Hedge Ratio* shows no significant relationship with stock returns. This suggests that information provided in the previous quarterly report may be stale, and investors are not able to estimate correctly offsetting gains from underlying foreign-currency-denominated assets.

The results in Panel D of Table 3 indicate that stock returns for the incomplete-disclosure firms around the release of corresponding quarterly financial statements are positively related to previously disclosed derivative-related losses, although the relationship is not statistically significant. This implies that there may have been some overreaction to the amount of derivative-related losses at the time of the loss disclosure, and that some portion of that overreaction may be corrected once quarterly financial statements become available.

(iii) Analysis of Market Responses around Loss Disclosure: Univariate and Multivariate Analyses

To evaluate how the availability of information about the underlying foreign-currency-denominated assets may induce different market reactions, we further classify the sample firms into four groups based on two criteria: over-hedged/non-over-hedged firms[13] and full-disclosure/incomplete-disclosure firms (i.e., firms with corresponding quarterly financial statements at the time of loss disclosure and those without such statements, respectively). Table 4 presents the averages and *t*-statistics of CARs for each group as well as the differences in returns between each group.[14]

The results suggest that when quarterly financial statements (and hence information on potential gains from underlying foreign-currency-denominated assets reflected in gains from foreign currency transactions and translation) are not available, market participants are not able to fully distinguish between over-hedged and non-over-hedged firms. For example, investors respond negatively to both non-over-hedged and over-hedged firms within the incomplete-disclosure group, and the difference in returns between non-over-hedged and over-hedged firms is only marginally significant. However, for the full-disclosure group, investors do not respond to derivative-related losses for non-over-hedged firms, whereas their response is substantially negative for over-hedged firms. In fact, the difference in returns between non-over-hedged and over-hedged firms is much larger and more significant in the full-disclosure group. Moreover, the difference-in-difference estimator reported in the lower right cell is both economically and statistically significant. These results imply that investors rationally inferred potential gains from underlying foreign-currency-denominated assets when such information was available and used them to distinguish between non-over-hedged and over-hedged firms.

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13 The median *Hedge Ratio* used as the cutoff in distinguishing over- or non-over-hedged firms is 2.71.
14 *t*-statistics are based on cross-sectional standard errors.

Table 4
Disclosure Quality and Market Responses to Loss Announcements

	Non-Over-Hedged	Over-Hedged	Difference of CARs
Incomplete-disclosure group			
CAR [−1,+1]	−4.52%***	−7.67%***	3.15%*
t-statistic	(−3.85)	(−5.27)	(1.71)
N	38	34	–
Full-disclosure group			
CAR [−1,+1]	−1.19%	−10.15%***	8.96%***
t-statistic	(−1.01)	(−5.93)	(4.23)
N	28	31	–
Difference of CARs	−3.33%*	2.48%	5.81%***
	(−1.96)	(1.11)	(2.07)

Notes:
This table presents averages of market-adjusted cumulative abnormal returns (CARs) three days around derivative-related loss disclosures for four subgroups based on whether a firm is over-hedged or not and whether corresponding quarterly reports are available as of the loss disclosure or not. Full-disclosure firms are those whose corresponding quarterly report was issued either prior to or no later than four days after the loss disclosure. Incomplete-disclosure firms are those whose corresponding quarterly report was issued at least five days after the loss disclosure. Over-hedged firms are those whose *Hedge Ratio* is greater than or equal to the sample median, 2.71. *Hedge Ratio* is calculated as the ratio of derivative-related losses to gains from foreign currency transactions or translation of foreign-currency-denominated assets. For the full-disclosure group, *Hedge Ratio* is calculated from corresponding quarterly reports, while it is based on previous quarterly reports for the incomplete-disclosure group. We also report the differences in returns between the over-hedged and non-over-hedged groups as well as between full-disclosure and incomplete-disclosure firms. The lower-right corner cell reports the difference-in-difference estimator. *t*-statistics based on cross-sectional standard errors are reported in parentheses, and ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

In Table 5, we formally test H_1 and H_2 by estimating equation (1) in Section 3 separately for the incomplete- and full-disclosure groups. This specification explicitly considers how the magnitude of *Loss* affects stock returns differently for over-hedged and non-over-hedged firms. The dependent variable is the three-day market-adjusted CAR, and the independent variables are ln(*Loss*), a dummy for over-hedged firms, and an interaction term between these two variables. We first report the results for the full sample in the first two columns. In the following columns, we split the sample into incomplete- and full-disclosure groups and test the implications of H_1 and H_2, respectively.

The estimation results for the full sample in columns (1) and (2) indicate that investors respond strongly to the amount of derivative-related losses. In other words, investors simply react to the magnitude of the loss without fully considering whether the firm is over-hedged or non-over-hedged. However, this may well be driven by those firms whose corresponding information on potentially offsetting gains from underlying foreign-currency-denominated assets was unavailable at the time of the derivative-related loss disclosure.

In column (3), we estimate equation (1) for the incomplete-disclosure firms. The results indicate that investors again react to the magnitude of the loss, but not to whether the firm in question is over-hedged or non-over-hedged. This implies that when information on the underlying foreign-currency-denominated assets is

Table 5

The Effects of *Loss* and *Hedge Ratio* on Market Response by Disclosure Quality

Variable	Full Sample (1)	Full Sample (2)	Incomplete-Disclosure Group (3)	Full-Disclosure Group (4)	Full-Disclosure Group (5)	Full-Disclosure Group (6)
Intercept	0.101***	0.066	0.079	−0.013	−0.018	−0.035
	(4.14)	(1.65)	(1.45)	(−0.18)	(−0.26)	(−0.50)
ln (*Loss*)	−0.061***	−0.041**	−0.049**	0.000	0.004	0.002
	(−6.83)	(−2.50)	(−2.34)	(0.01)	(0.11)	(0.05)
Overhedge		0.020	−0.040	0.141	0.130	0.125
		(0.37)	(−0.52)	(1.66)	(1.50)	(1.44)
ln (*Loss*)*		−0.019	0.006	−0.073**	−0.070**	−0.067*
Overhedge		(−0.94)	(0.22)	(−2.12)	(−2.01)	(−1.91)
Quarterly					−0.016	−0.020
Earnings Surprise					(−0.61)	(−0.76)
Crisis Dummy						0.025
						(1.06)
Adj. R^2	0.260	0.278	0.131	0.427	0.421	0.422
N	131	131	72	59	59	59

Notes:
This table presents estimation results for the following baseline regression specification:
CAR $= b_0 + b_1 \ln(Loss) + b_2\,Overhedge + b_3 \ln(Loss) \cdot Overhedge + e$, where CAR is the three-day market-adjusted cumulative abnormal return around derivative-related loss disclosure, *Loss* is the ratio of derivative-related losses to the book value of equity, and *Overhedge* is a dummy variable set to one if *Hedge Ratio* is greater than or equal to the sample median, 2.71. *Hedge Ratio* is calculated as the ratio of derivative-related losses to gains from foreign currency transactions or translation of foreign-currency-denominated assets. For the full-disclosure group, *Hedge Ratio* is calculated from corresponding quarterly reports, while it is based on previous quarterly reports for the incomplete-disclosure group. *Quarterly Earnings Surprise* is defined as the increase in net income before subtracting derivative-related losses over the same quarter a year earlier, scaled by the book value of equity. *Crisis dummy* is set to one if the loss disclosure occurred during the second half of 2008. *t*-statistics are reported in parentheses, and ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively. Columns (1) and (2) report the results for the full sample, and column (3) reports those for the incomplete-disclosure group. The remaining columns present results for the full-disclosure group. Full-disclosure firms are those whose corresponding quarterly report was issued either prior to or no later than four days after the loss disclosure. Incomplete-disclosure firms are those whose corresponding quarterly report was issued at least five days after the loss disclosure.

unavailable, investors are not able to distinguish over-hedged firms from non-over-hedged firms, providing empirical support for H$_1$.

The remaining columns of Table 5 report the regression results for full-disclosure firms. In strict contrast to the results for the incomplete-disclosure group (as well as those for the full sample), the only explanatory variable that remains significant is the interaction term between ln(*Loss*) and the over-hedge dummy. This implies that for non-over-hedged firms, investors do not simply respond to large derivative-related losses. On the other hand, for over-hedged firms, ln(*Loss*) exhibits a significant negative relationship with the market's response, implying that the size of the loss matters. In unreported results, we include the difference in calendar dates between the two disclosure events as an additional control variable; however, this variable turns out to be insignificant.

Overall, these results indicate that when information on underlying contracts is available, investors rationally consider it in interpreting the effect of derivative-related

losses, consistent with H_2. However, when such information is not available, investors cannot distinguish between over-hedged and non-over-hedged firms, resulting in a pooling equilibrium in which all firms are considered to belong to the over-hedged group, providing empirical support for H_1.

The above results are consistent with the argument that investors make use of offsetting information on underlying foreign-currency-denominated assets, but only when such information is available. However, since quarterly reports are issued simultaneously with the loss announcement for the full-disclosure group, the event period returns may be confounded by additional information provided in financial statements. To account for this possibility, we control for *Quarterly Earnings Surprise* in column (5) of Table 5.[15] The results indicate that inclusion of this variable does not affect our main results.

Next, we examine whether the results are mainly driven by the global financial crisis in 2008. As depicted in Figure 1, there is a clear clustering of loss disclosures in the second half of 2008. In column (6) of Table 5, we include a dummy variable set to one if the loss disclosure occurred during the second half of 2008 and zero otherwise. The results again suggest that our main results are not affected by inclusion of this variable.[16]

Finally, we check for the possibility that our cutoff for distinguishing full-disclosure from incomplete-disclosure firms may have affected the results. Specifically, we conduct a series of sensitivity analyses by allowing the cutoff dates to vary from five days to four, three, or two days and re-estimate equation (1). In unreported tables, we find that the main empirical results remain robust to the variations in these cutoff dates. We have also attempted to exclude the two extreme observations depicted in Figure 2 (i.e., -35 and $+90$) and find that the results are unaffected. Taken together, these results suggest that our findings are mostly driven by the availability of information on whether a firm is over-hedged or non-over-hedged.

(iv) Return Reversals for Incomplete-Disclosure Firms

Thus far, the results for incomplete-disclosure firms indicate that market reactions to derivative-related loss disclosure are negative regardless of whether such losses are offset by gains from underlying foreign-currency-denominated assets. This suggests that investors might have overreacted to non-over-hedged firms due to inadequate information about the underlying foreign-currency-denominated assets at the time of the loss disclosure. However, when quarterly financial statements become available at a later date, investors might consider them and adjust stock prices accordingly. Specifically, if some part of negative stock returns reflects an overreaction to the magnitude of derivative-related losses, then we should observe a larger reversal in stock prices for firms with larger derivative-related losses (H_3).

Table 6 presents the results of this analysis. The dependent variable is the seven-day market-adjusted cumulative abnormal return around day zero, where the event is the release of the corresponding quarterly financial statements for the

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15 As explained in Section 4, our *Quarterly Earnings Surprise* measure is designed to exclude the effect from the derivative-related loss itself.
16 We also conduct a univariate comparison of CARs between the crisis period and non-crisis period and find no statistically significant difference in returns between the two periods.

Table 6

Return Reversals for Incomplete-Disclosure Group When Corresponding
Quarterly Report Becomes Available

Variable	Incomplete-Disclosure Group (1)	Incomplete-Disclosure Group (2)
Intercept	−0.130*	−0.139*
	(−1.83)	(−1.93)
ln (Loss)	0.051*	0.056*
	(1.73)	(1.88)
Overhedge	0.100	0.099
	(0.98)	(0.97)
ln (Loss)*	−0.039	−0.040
Overhedge	(−1.02)	(−1.04)
Quarterly		−0.069
Earnings Surprise		(−0.89)
Adj. R^2	0.058	0.072
N	61	61

Notes:
This table presents market response for the incomplete-disclosure group when the corresponding quarterly report becomes available at a later date. Specifically, we estimate the following specification for the incomplete-disclosure group only:
CAR $= b_0 + b_1 \ln(Loss) + b_2 Overhedge + b_3 \ln(Loss) \cdot Overhedge + e$, where CAR is the seven-day market-adjusted cumulative abnormal return around the subsequent release of the corresponding quarterly report. *Loss* is the ratio of derivative-related losses to the book value of equity, and *Overhedge* is a dummy variable set to one if *Hedge Ratio* is greater than or equal to the sample median, 2.71. *Hedge Ratio* is calculated as the ratio of derivative-related losses to gains from foreign currency transactions or translation of foreign-currency-denominated assets, and is based on corresponding quarterly reports. *Quarterly Earnings Surprise* is defined as the increase in net income before subtracting derivative-related losses over the same quarter a year earlier, scaled by the book value of equity. *t*-statistics are reported in parentheses, and * represents statistical significance at the 10% level.

incomplete-disclosure group.[17] In this analysis, *Hedge Ratio* is based on the corresponding quarterly report, since this information is now available to investors. In column (2), we additionally control for *Quarterly Earnings Surprise* as in Table 5. The results indicate a positive relationship between ln(*Loss*) and stock returns for the non-over-hedged group. In contrast, the return reversals are not statistically significant for the over-hedged group.[18] This implies that non-over-hedged firms that initially experience negative stock returns around the date of loss disclosure are likely to exhibit a reversal, that is, a correction of previous mispricing, when the corresponding quarterly financial statements become available, confirming predictions provided in H$_3$.[19]

5. CONCLUSION

This paper examines how investors respond to a new announcement about derivative-related losses when relevant information necessary to fully assess the impact of such

17 We use a seven-day window, not a three-day window, because reflecting all the information in earnings reports takes some time. However, the use of a three-day window produces qualitatively similar results.
18 Specifically, *p*-values for testing H$_0$: $b_1 + b_3 = 0$ are 0.64 in column (1) and 0.52 in column (2), respectively.
19 When we exclude the two extreme observations from Figure 2, statistical significance of the reversal is actually more pronounced. The results are also robust to the variations in the cutoff dates used to distinguish the full-disclosure and incomplete-disclosure groups.

losses on the firm's overall profitability is not available until at a later date. Our findings indicate that this incomplete disclosure actually exacerbates, rather than mitigates, investors' mispricing of derivative-related losses. This suggests that a simple increase in the quantity of disclosure without a corresponding improvement in disclosure quality does not necessarily facilitate price discovery.

Nevertheless, our findings are subject to the following caveats. First, we have implicitly assumed that *Quarterly Earnings Surprise* is a sufficient statistic to capture all other information to which investors react around event dates; however, some unknown factors that affect stock returns may exist, thereby biasing our inference. Second, our proxy for measuring the degree of over-hedging may suffer from measurement error. However, to the extent that this measurement error is random (and we have no reason to expect the error to be systematic), this would bias against documenting our results.

Finally, it remains a puzzle why managers of non-over-hedged firms do not disclose information about the underlying foreign currency position in conjunction with the derivative-related loss announcement. They could simply use the space provided for 'other relevant information for investment decisions' within the loss disclosure (see the Appendix) or issue a separate voluntary disclosure that contains detailed information about the underlying foreign-currency-denominated assets, which would prevent unnecessary negative market reaction. We conjecture that such lack of simultaneous disclosure may be due to insufficiencies in both (1) feasibility and (2) incentives.

Financial contracts used to hedge against underlying foreign currency positions from international commercial contracts are in general more clearly defined than underlying contracts themselves in terms of quantity, price, and delivery of the product. For example, a typical export contract allows quantities and unit prices to change after the initial contract is written for a variety of reasons. Moreover, the number of counter-parties and contracts themselves may well be larger in the underlying commercial contracts than in the financial contracts, which would further make it more difficult to identify any loss or gain from the former than from the latter. Given that the current requirement for disclosing derivative-related loss is too strict in terms of the deadline, it may not allow enough time for non-over-hedged firms to identify technically the overall status of underlying foreign-currency-denominated assets.

Moreover, even if the information on the underlying foreign currency position were concurrently identifiable without much time lag, managers of non-over-hedged firms may not have strong incentive to disclose both sets of information simultaneously. This is because they may well anticipate that the stock price of non-over-hedged firms would rebound soon around the release of the corresponding quarterly financial statements, as reported in Table 6. Given that the calendar date difference between the derivative-related loss announcement and the subsequent quarterly financial statement issuance is 25 days on average for the incomplete-disclosure group, managers of non-over-hedged firms may largely consider such mispricing to be a transitory phenomenon. If they have no plans to issue new stocks or to exercise or grant stock options during that period, they may not have a strong incentive to correct the mispricing of their stocks in advance of the subsequent release of quarterly financial statements.

Whether or not such an agency framework actually exists constitutes an important research question. Since this issue is beyond the scope of this study, however, we leave this question to future research. Despite the potential limitations, this study

extends previous research on the effects of corporate disclosure on capital markets by uncovering the important role of disclosure quality.

APPENDIX
Derivative-Related Loss Disclosure: An Example

Derivative-Related Transaction Loss		
1. Type of Derivative Transaction		Currency Forward (Option)
2. Details of the Loss	Loss Amount (in KRW)	3,468,308,864
	Book Value of Equity (in KRW)	26,215,554,679
	Loss Relative to the Book Value of Equity (%)	13.2
	Large Firm (yes/no)	No
3. Main Reason for the Loss		The transaction was made to hedge against exchange rate movements, but because of the unexpected appreciation of the USD against the KRW, we incurred derivative-related losses.
4. (Verification) Date of the Loss		May 13, 2008
5. Other relevant information for investment decisions		– The above loss includes valuation losses from currency options • Valuation losses from currency options: KRW 2,931,301,875 • Realized losses from currency options: KRW 537,006,989 – The above loss was incurred during the first quarter of 2008 – The above book value of equity is as of the end of 2007 *Related disclosure: None

Notes:
This table presents a translated version of a typical disclosure of derivative-related losses in Korea. The regulation requires firms to disclose the amount of derivative-related losses that exceed 5% (2.5% for large firms) of their book value of equity within two business days, including the date of recognition. Large firms are those whose total assets are more than KRW 2 trillion (approximately USD 2 billion) as of the most recent fiscal year end. The disclosure format is highly standardized, and virtually all firms use a very similar format except for the detailed numbers.

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