The information content of option volatility for credit default swap[1]

Hong- Bae Kim

<Abstract>

The growing academic literature highlights the information content of equity and currency options, and credit default swaps. Our findings will focus on a special role of option market information in explaining CDS spreads. Thus, we perform time-series regressions of CDS spreads on either implied or historical volatility of equity and currency markets using a broad sample of 1,570 daily observations for the period January 2006 to March 2012.

Using data on sovereign CDS spreads, stock, and currency options, this study examines the relation between CDS, currency, and equity option volatilities. It is necessary to investigate which market options enhance the explanation power for determinants of CDS spread, and whether implied volatilities dominate historical volatilities in the determinants of CDS spread.

Using time-series regressions, we find that currency market options enhance the explanation power for determinants of sovereign CDS spread, and that implied volatility dominates historical volatility in explaining CDS spreads. We find also the volatility skew of stock and currency options to be a significant determinant of CDS spreads. With this list of additional volatility variables included in the regressions, the explanation power of the time-series regressions has increased.

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* Division of Business Administration, Dong-Seo University., Busan 609-735, South Korea.
Email: rfctogether@gmail.com

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1. Introduction

Credit default swaps (hereinafter CDS) are a class of credit derivatives that provide a payoff equal to the loss-given-default on bonds or loans of a reference entity (obligor); they are triggered by credit events such as default, bankruptcy, failure to pay, or restructuring. CDS are similar to out-of-the-money put options in that both offer a low cost and effective protection against downside risk (Cao et al., 2010). Recently, sovereign CDS contracts have been actively traded in major emerging market economies.

The empirical studies related to the determinants of CDS spreads are usually based on the structure model (Ericsson et al., 2009; Zhang et al., 2009; Alexander and Kaeck, 2008; Chen, Tu, and Wang, 2008; Carr and Wu, 2007; Bystrom, 2006; Bakshi et al., 2006; Abid and Naifar, 2005; Zhang et al., 2005; Carr and Wu, 2005; Blanco et al., 2005; Pan and Singleton, 2005; Hull et al., 2004; Collin-Dufresne et al., 2001). As the structure model is often applied to price CDS, the factors in this approach have been empirically tested. The potential factors identified include firm-level equity risk, market-wide risk and return, interest level and slope, financial ratios, and rating information. In addition to the structure variables, it is particularly worthwhile to take into account the important role of equity and currency options' volatility in the determination of CDS spreads.

Particularly, a recent strand of literature has recognized the important role of option volatility in the determination of CDS spreads (e.g., Cao et al., 2010; Ericsson et al., 2009; Zhang et al., 2009; Carr and Wu, 2007). Considering that credit default swaps share similar payoff characteristics with out-of-the-money puts, we conduct a comprehensive analysis of the relation between CDS spreads and option volatility variables. The implied volatility is considered as an important explanatory variable for the time-series behavior of CDS spreads. Taking into consideration these points, this study uses data on sovereign CDS spreads and option markets to investigate the relation between CDS, implied, and historical volatilities of currency and equity markets. We can assume that sovereign CDS spreads and currency option implied (historical) volatilities each have a positive exposure to a country-specific risk factor.

Motivated by these considerations, this study examines the relation between CDS, currency, and equity return volatilities using data on sovereign CDS spreads, stock, and currency options. It is necessary to investigate which market options enhance the explanation power for determinants of CDS spread, and whether implied volatilities dominate historical volatilities in the determinants of CDS spread.

Overall, our findings will focus on a special role of option market information in

explaining the CDS spreads. Thus, we perform time-series regressions of CDS spreads on either implied or historical volatilities of equity and currency markets, using CDS and options data from a broad sample of 1,570 daily observations for the period January 2006 to March 2012. This study found put option-implied volatility dominates historical volatility in explaining the CDS spreads, and option volatility skew is an important determinant of CDS spread.

The rest of this paper is organized as follows: In Section 2, we summarize the extant literature. In Section 3, we define data sources and variables used in our study and report the summary statistics of variables. In Section 4, we conduct a regression-based analysis of the relation between the CDS and option markets. We conclude with Section 5.

2. Literature Review

2.1 CDS and option markets

A credit default swap is an agreement between two parties to exchange the credit risk of a reference entity. The buyer of the CDS is said to buy protection, has a similar credit risk position to selling a bond short and investing the proceeds in a risk-free asset, and usually pays a periodic fee. Conversely, the seller of the CDS is said to sell protection and will collect the periodic fee. Selling protection has a similar credit risk profile to maintaining a long position in a bond or a loan. If a credit event occurs, the compensation is to be paid by the protection seller to the buyer via either physical settlement (i.e., receiving the defaulted bond against payment of par) or cash settlement (i.e., paying the difference between par and the bond's recovery value), as specified in the contract. The premium paid by the protection buyer to the seller, often called "CDS spread," is quoted in basis points per annum of the contract's notional value, is usually paid quarterly, and is not based on any specific risk-free bond or benchmark interest rate. Therefore, a CDS is like a put option written on a bond, as the protection buyer is protected from losses incurred by a decline in the value of the bond as a result of a credit event.

Currency and stock index options are natural instruments for trading on currency and stock return volatilities. Considering that credit default swaps share similar payoff characteristics with certain types of options (e.g., out-of-the-money puts) in that both offer a low-cost and effective protection against downside risk, we will conduct a comprehensive analysis of the relation between CDS spreads and historical (implied)

volatilities of stock and currency (option) markets.

2.2 The relationship between CDS spread and equity option volatilities

We estimate a positive linkage between corporate CDS spreads and stock return volatilities (Bakshi et al., 2006; Altman et al., 2005; Carr and Wu, 2005; Wu and Zhang, 2005; Ericsson et al., 2004; Aunon-Nerin et al., 2002; Bangia et al., 2002; Collin-Dufresne et al., 2001; Bevan and Garzarelli, 2000; Frye, 2000; Pedrosa and Roll, 1998). Some research has demonstrated a strong relation between credit spreads and historical equity volatilities (Ericsson et al., 2009; Zhang et al., 2009; Campbell and Taksler, 2003). Ericsson et al. (2004) investigate the influence of leverage, historical volatility, and interest rates on single-firm CDS, concluding that all variables are important determinants of CDS spreads.

In contrast to them, Benkert (2004) found that implied volatility has a closer association with CDS spreads than does historical volatility. This is to be expected since, like CDS spreads, implied volatility is based on traders' expectations of the future, whereas historical volatility is based only on past equity returns. He found that option implied volatility has the strongest effect. Carol Alexander and Andreas Kaeck (2009) studied the iTraxx index changes' greater sensitivity to changes in implied volatility under volatile regimes, whereas it is the stock market returns that have the main influence on credit spreads in tranquil regimes. Carr and Wu (2005) and Cremers et al. (2004) show that corporate CDS spreads covary with both stock option implied volatilities and the slopes of the implied volatility plots against moneyness.[2] Kim et al. (2012) also found that implied volatility is associated with Korean sovereign CDS spreads.

Therefore, we will study the relation between CDS spreads and equity options market information, that is, we test implied volatility as an important explanatory variable for the time-series behavior of CDS spreads and investigate whether implied volatility dominates historical volatility in explaining the time-series (variation) of CDS spreads. Moreover, we will also consider the jump risk of equity option markets in the determinants of CDS spread. We adopt a negative jump measured by the slope of smirk of implied volatility in equity option markets, and test that an implied volatility skew is significant in explaining CDS spread.[3]

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[2] Cremers et al. (2008) estimate the relation between corporate bond yield spreads and option market variables. They adopt a panel regression approach.

[3] Jump risk of equity in the pricing of defaultable bonds can also be considered (Chen, Tu, and Wang, 2008). Some studies have developed various proxies to measure jump risk on the basis of either market or idiosyncratic information. Collin-Dufresne et al. (2001) find that an increase in a market's expected probability of a negative jump measured by changes in the slope of smirk of implied

3.2 The relationship between CDS spread and currency volatilities

The currency price, for example, the US dollar price of the local currency, is analogous to the stock price. Likewise, economic or political instability in a country worsens its credit quality and often leads to depreciation and heightened volatility in its currency. Such instability generates positive co-movements between sovereign CDS spreads, currency depreciation rates, and currency market volatility (Carr and Wu, 2007). When financial markets are operating efficiently, changes in the credit quality of a sovereign borrower should be reflected in the prices of sovereign CDS. When credit quality deteriorates, the currency devalues, CDS spread, and the volatility of the currency market rises due to the leverage effect. This analogy suggests a positive linkage between sovereign CDS spreads and currency market volatilities.

In the over-the-counter currency options market, when the implied volatility is plotted against some measure of moneyness at a fixed maturity, the average slope of the plot is positively related to the risk-neutral skewness of the currency return distribution. This slope is directly captured by risk reversal (RR) quotes, which measure the implied volatility difference between an out-of-the-money call option and an out-of-the-money put option at the same (absolute) delta. Likewise, sovereign CDS spreads can covary with both currency option implied volatilities and risk reversals. Moreover, we will also examine the way CDS spread changes are associated with the implied volatility plot's average curvature against moneyness (Butterfly). Therefore, we will also consider the jump risk of currency in determining the factors of CDS spread. Using a market-based measurement for jumps, we adopt a positive jump (i.e., RR and BF) measured by the slope of smirk of implied volatility in currency option markets

Therefore, we will test the relation between CDS spreads and currency option market information and show that currency option-implied volatility is an even more important determinant of sovereign CDS spreads than historical volatility in a currency market. We will test the effects of the jump risk in currency option markets on CDS spread. Overall, our findings will focus on a special role of option market information in explaining the CDS spreads and report the averages of the coefficients.

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volatility of S&P 500 future options enlarges the credit spreads. Zhang et al. (2005) also identify how the realized jumps of individual equity enhance the explanation power for determinants of CDS spread variations.

3. Data and Basic Statistics

3.1 Credit default swaps

We collect data on their sovereign CDS spreads, equity implied volatility, over-the-counter currency option quotes, and market level series. The quotes for CDS spreads are available with a 5-year tenure. The CDS composite spreads consist of daily observations for the period January 2006 to March 2012. We collect sovereign CDS spreads from a comprehensive database compiled by Bloomberg and the Markit Group.

3.2 Market-level returns and volatilities

We obtain KOSPI 200 daily indices and foreign exchange rates from Bloomberg. We calculate historical volatility measures with different estimation horizons, ranging from 1M to 3M trading days. The stock market return is the annualized 252-day average Kospi 200 index return. The currency market return is the annualized 252-day average FX rate return.

3.3 Equity options

We obtain options data from Bloomberg, which provides daily closing prices, open interest, and trading volume on exchange-listed equity options in the U.S. from 2001 to 2012. The 1M at-the-money put-implied volatility is interpolated from two put options, with strike prices straddling the KOSPI 200 price and maturities straddling 30 days. Ideally, we would like to extract a daily implied volatility from out-of-the-money puts for the purpose of CDS valuation. The value of such options is most sensitive to the left tail of the risk-neutral return distribution, as is the CDS spread. However, many series in our sample are not actively traded, deep out-of-the-money puts. Therefore, strictly for the purposes of the study, we use at-the-money puts for the determinants of CDS spread. The market implied volatility is taken as the at-the-money implied volatility of KOSPI 200 index put options.

Besides the daily implied volatility measure, we also compute an implied volatility skew, which is the difference between the implied volatility of an out-of-the-money put option with a strike-to-spot ratio closest to 0.9 and the implied volatility of

an at-the-money put option.[4] The market implied volatility skew is defined in the same way as the individual implied volatility skew, but uses KOSPI 200 index puts. The volatility skew is closely related to the skewness of the risk-neutral equity return distribution. We expect it to be positively related to the CDS spread. Especially, jump risk can enhance the explanatory power as one of the determinants in CDS. Therefore, we will also consider jump risk of equity in determining the factors of CDS spread. Using a market-based measurement for jumps, we adopt a negative jump measured by changes in the slope of smirk of implied volatility of KOSPI 200 Index put options.

3.4 Currency option

We collect data on options quotes on the Korean won against the US dollar. For over-the-counter currency options, the industry convention is to quote them in the form of delta-neutral straddle implied volatilities, 25-delta risk reversals, and 25-delta butterfly spreads at each maturity. The quotes for currency options are available in terms of ATM (delta-neutral straddle) implied volatilities, 25-delta risk reversals, and 25-delta butterfly spreads at two fixed maturities of one and three months, respectively.

A straddle is a portfolio of a call option and a put option on the same underlying currency with the same strike and time to maturity. This implied volatility quote is often referred to as the at-the-money implied volatility (ATMV). The 25-delta risk reversal (RR) quote measures the difference in Black–Scholes implied volatilities between a 25-delta call option and a 25-delta put option.

RR(risk reversals) =IV(25c)- IV(25p)

where 25c and 25p denote a 25-delta call and put, respectively. Hence, the risk reversal is a direct measure of the slope of the implied volatility plot against moneyness. The 25-delta butterfly spread (BF) measures the difference between the average implied volatility of the two 25-delta options and the delta-neutral straddle implied volatility.

BF=[IV(25c)- IV(25p)] /2 – ATMV

Hence, the butterfly spread measures the average curvature of the implied volatility

[4] Cao et al. (2010) used the difference between the implied volatility of an out-of-the-money put option with a strike-to-spot ratio closest to 0.92 and the implied volatility of an at-the-money put option, further divided by the difference in the strike-to-spot ratios of the two option contracts used.

plot against moneyness. For the model estimation of the relationship between sovereign CDS spreads and currency options, we convert the risk reversal and butterfly spread quotes into implied volatilities at the two deltas. Then, we use the Black–Scholes formula to convert the implied volatilities into out-of-the-money option prices. We try to determine whether the CDS spreads show strong contemporaneous correlations with both the ATM (delta-neutral straddle) implied volatilities and the risk reversals.

Combining all variables documented above, we arrive at a final sample of 1,570 series during the period from January 2006 to March 2012. We conduct time-series regressions of the CDS spread on volatility variables, controlling for other determinants of credit spreads used in the literature. However, we do not control the interest rate among macro variables, because the benchmark rate of the ROK bond is not fully applicable to the whole sample period.

Table 1 reports the summary statistics of level variables of 1570 sample series. The Sovereign CDS Spread is the daily five-year composite credit default swap spread; the average CDS spread is 109 basis points and shows positive skewness and kurtosis.

<Table 1> Summary Statistics

Level Variable	Mean	SD	Skew	Kurt	J-B Stat.
CDS 5yr	109.458	95.991	1.928	7.504	2300.9***
KOSPI 200	213.12	37.396	-.0025	2.207	41.293***
HV 1M	22.700	11.305	2.284	10.576	5120.59***
HV 3M	23.335	10.794	1.933	10.723	2138.92***
IV 1M	25.545	11.447	2.279	10.080	4638.36***
IV3M	25.616	9.989	2.378	10.989	5665.48***
Skew 1M	-6.415	2.199	-0.538	4.888	308.92***
Skew 3M	-3.134	1.625	1.404	18.602	16441.1***
Spot price	1092.35	140.785	0.718	3.155	136.676***
HV 1M	11.429	11.905	3.280	16.301	14390.70***
HV 3M	10.635	10.159	2.551	9.709	4647.67***
ATM IV 1M	13.303	10.998	2.669	11.606	6710.02***
IV 3M	12.713	8.749	1.966	7.840	2554.38***
RR 1M	2.558	3.319	2.766	13.803	9637.71***
RR 3M	3.189	3.739	2.173	9.773	4237.19***
BB 1M	0.584	0.461	2.240	9.008	3675.35***
BB 3M	0.717	0.538	1.772	6.588	1664.98***

Notes: *, **, *** imply rejection of the null hypothesis at the 10%, 5%, and 1% significance levels. For each variable, Table 1 reports the summary statistics of market variables of 1,570 sample series. CDS spread is the daily five-year composite credit default swap spread; market historical volatility is the 1M and 3M historical volatility of the KOSPI 200 index returns; implied volatility skew is the difference between the implied volatilities of OTM and ATM puts; market implied volatility skew is the implied volatility skew of KOSPI 200 put options; index

stock return is the 252-day average of KOSPI 200 index returns; market implied volatility is the 1M and 3M ATM implied volatility of KOSPI 200 put options. The currency options are quoted in terms of delta-neutral straddles, 25-delta risk reversals, and 25-delta butterfly spreads for Korean won and real prices per US dollar. The statistics are based on daily sampled data from January 2, 2002, to March 30, 2012 (1,570 observations for each series).

The fifth and ninth column in Table 1 report the summary statistics of the ATM implied volatility quotes of stock and currency market, with the estimates for both skewness and kurtosis being positive and relatively large for both markets. Among the stock ((FX) market volatility measures, the mean market-level implied volatility is 25.5% (13.0%), slightly higher than the mean market-level historical volatility of 23.0% (11.1%). The sixth and tenth column in Table 1 report the summary statistics on the KOSPI 200 put option's volatility skew and on the 25-delta risk reversals of the currency option. The mean risk reversals are positive, increasingly so as the option maturity increases. The positive risk reversal indicates that the risk-neutral distributions for Korean won returns on US dollar investments are positively skewed. Conversely, the dollar returns on investments in Korean won are negatively skewed. In contrast, the stock index's volatility skews are negative, increasingly so as the option maturity increases. The last column in Table 1 reports summary statistics on butterfly spreads. The average butterfly spreads are about half a percentage point for the Korean won 30-day and 0.71 percentage points for the 60-day.

In addition, to measure the correlation between the sovereign CDS market, stock, and currency option market, we report in Table 2 the cross-correlation estimates between the CDS spreads series and the stock and currency option volatility quotes. The CDS spreads show strong positive correlations with the positive volatility variables, but weak negative correlations with negative volatility skew in the stock market. The estimates between levels range from 0.6 to 0.9. Strong positive correlations are also observed between CDS spreads, risk reversals, and butterfly spreads, but the estimates are smaller than those between CDS spreads and implied volatilities. The cross-correlation between butterfly spreads and CDS spreads are strongly positive, indicating that the variation of butterfly spreads is very informative in explaining CDS spread.

<Table 2>

The correlation estimates between the CDS spreads and option volatility quotes

	CDS
KOSPI200	-0.3242
HV 1M	0.6497
HV 3M	0.7286
IV 1M	0.7302
IV 3M	0.7720
Skew 1M	-0.1461
Skew 3M	-0.4295
FX Spot	0.8941
HV 1M	0.8087
HV 3M	0.8637
IV 1M	0.8949
IV 3M	0.9306
RR 1M	0.7353
RR 3M	0.8411
BB 1M	0.8652
BB 3M	0.9011

4. Empirical Findings

Using a sovereign CDS with both CDS and options data, we conduct time-series regressions of the CDS spread on volatility variables of stock and currency option markets, controlling for macro market variables used in the literature (Cao, et al., 2010; Ericsson et al., 2009; Zhang et al., 2009; Alexander and Kaeck, 2009). We find that the effect of these macro control variables on the CDS spread is consistent with theoretical predictions. We also find the relationship between stock and CDS markets is negative, and the relationship between currency and CDS markets is positive.

In contrast to previous studies, our study will focus on the volatility variables of stock and currency option markets. To allow for the influence of market-level volatilities, we also include the stock market implied and historical volatilities, defined earlier from KOSPI 200 index puts and KOSPI 200 index returns, respectively. The currency option market's volatility variables are defined in the same way as the stock market volatility, but using USD-WON puts. This study employs the test regressions (Cao et al., 2010)

$$\mathrm{CDS}_t = \beta_0 + \beta_1 \text{Macro variables} + \ +\beta_2 \text{Market HV} + \beta_3 \mathrm{IV}_t + \beta_4 \text{Volatility Skew}_t \ + \varepsilon_t$$

The full regression model for sovereign CDS spread is therefore:

$$(1)\ CDS_t = \beta_0 + \beta_1\ KOSPI_t + \beta_2 HV\ kospi_t + \beta_3 IV\ kospi_t + \beta_4\ SK\ kospi_t + \beta_5\ SPOT_t + \beta_6\ HV\ spot_t + \beta_7\ IV\ spot_t + \beta_8\ RR\ spot_t + \beta_9 BB\ spot_t + \varepsilon_t$$

$$(2)\ CDS_t = \beta_0 + \beta_1\ KOSPI_t + \beta_2 HV\ kospi_t + \beta_3 IV\ kospi_t + \beta_4\ SK\ kospi_t + \beta_5\ SPOT_t + \beta_6\ HV\ spot_t + \beta_7\ IV\ spot_t + \beta_8\ RR\ spot_t + \varepsilon_t$$

$$(3)\ CDS_t = \beta_0 + \beta_1\ KOSPI_t + \beta_2 HV\ kospi_t + \beta_3 IV\ kospi_t + \beta_5\ SPOT_t + \beta_6\ HV\ spot_t + \beta_7\ IV\ spot_t + \varepsilon_t$$

$$(4)\ CDS_t = \beta_0 + \beta_1\ KOSPI_t + \beta_2 HV\ kospi_t + \beta_3 IV\ kospi_t + \beta_4\ SK\ kospi_t + \varepsilon_t$$

$$(5)\ CDS_t = \beta_0 + \beta_5\ SPOT_t + \beta_6\ HV\ spot_t + \beta_7\ IV\ spot_t + \beta_8\ RR\ spot_t + \varepsilon_t$$

$$(6)\ CDS_t = \beta_0 + \beta_1\ KOSPI_t + \beta_2 HV\ kospi_t + \beta_3 IV\ kospi_t + \beta_5\ SPOT + \beta_6\ HV\ spot + \beta_7\ IV\ spot + \epsilon_t$$

$$(7)\ CDS_t = \beta_0 + \beta_1\ KOSPI_t + \beta_2 HV\ kospi_t + \beta_3 IV\ kospi_t + \epsilon_t$$

$$(8)\ CDS_t = \beta_0 + \beta_1\ spot_t + \beta_2 HV\ spot_t + \beta_3 IV\ spot_t + \epsilon_t$$

$$(9)\ CDS_t = \beta_0 + \beta_1\ KOSPI_t + \beta_2 HV\ kospi_t + \epsilon_t$$

$$(10)\ CDS_t = \beta_0 + \beta_1\ KOSPI_t + \beta_2 IV\ kospi_t + \epsilon_t$$

$$(11)\ CDS_t = \beta_0 + \beta_1\ spot_t + \beta_2 HV\ spot_t + \epsilon_t$$

$$(12)\ CDS_t = \beta_0 + \beta_1\ spot_t + \beta_2 IV\ spot_t + \epsilon_t$$

In our benchmark regression, we include both the implied volatility (IV) and the historical volatility (HV), as well as additional control variables described in Section 2.

We first regress the CDS spread on the volatility skew of the FX and Equity markets; Table 3 shows the volatility skew of both markets to be a significant determinant of CDS spreads. We find also the volatility skew of stock and currency options to be a significant determinant of CDS spreads with controlling macro variables (Regression 4 and 5). Taken together, these results suggest that the volatility variables of option markets skew to explain Korean sovereign CDS spreads.[5] With this list of additional variables included in the regressions, the average R^2 of the time-series regressions has increased from 60.5% in Regression (10) to 93.7% in Regression(1).

[5] In this paper, we also examine the effect of lagged changes in the CDS indices. It is not econometrically warranted by the findings that CDS indices show a significant autocorrelation in their spread changes, so we do not capture this effect using lagged changes in CDS spreads as an additional explanatory variable. Further, the theory does not support the inclusion of lagged changes in CDS spreads.

< Table 3> Multivariate Regressions by Level

(Sample period: 2006/01/03~ 2012/03/31)

	(1)	(2)	(3)	(4)	(5).	(6)
Adj-R2	0.9370	0.9344	0.9284	0.6081	0.9006	0.9253
Constant	-330.800***	-335.411***	-384.107***	-143.87***	-181.29***	-394.638***
	(18.702)	(18.969)	(18.377)	(12.165)	(18.264)	(13.528)
KOSPI 200	0.011	0.024	-0.013	0.0239		0.033
	(0.024)	(0.024)	(0.022)	(0.042)		(0.020)
HV 1M	-1.262***	-1.340***	-1.446***	-4.020***		
	(0.237)	(0.242)	(0.243)	(0.450)		
HV3M	2.055***	2.048***	2.825***	1.318***		1.283***
	(0.296)	(0.309)	(0.298)	(0.482)		(0.207)
IV 1M	0.111	0.488*	0.524*	-1.868***		
	(0.273)	(0.275	(0.278)	(0.569)		
IV 3M	2.888***	2.449***	2.216***	10.822***		2.550***
	(0.340)	(0.341)	(0.339)	(0.011)		(0.711)
Skew 1M	-0.161	-0.243		-1.225		
	(0.314)	(0.320)		(0.684)		
Skew 3M	-1.141**	-1.050**		-15.638***		
	(0.500)	(0.508)		(1.026)		
Spot price	0.280***	0.281***	0.342***		0.188***	0.349***
	(0.019)	(0.0198)	(0.019)		(0.021)	(0.013)
HV 1M	1.157***	1.296***	0.597*		0.826***	-0.701***
	(0.337)	(0.344)	(0.349)		(0.374)	(0.283)
HV 3M	-3.902***	-4.833***	-2.694***		-2.711***	
	(0.426)	(0.418)	(0.384)		(0.431)	
IV 1M	0.668	0.549	-0.964		3.455***	
	(0.774)	(0.762)	(0.781)		(0.794)	
IV 3M	4.667***	4.533***	4.734***		3.448***	2.822***
	(1.123)	(1.088)	(1.122)		(1.231)	(0.364)
RR 1M	-14.348***	-15.203***			-21.962***	
	(1.445)	(1.396)			(1.622)	
RR 3M	14.218***	13.222***			20.600***	
	(1.634)	(1.584)			(1.786)	
BB 1M	-51.586***					
	(8.472)					
BB 3M	17.053**					
	(8.573)					

Notes: *, **, *** imply rejection of the null hypothesis at the 10%, 5%, and 1% significance levels.

Table 4 shows a time-series regression analysis of CDS spreads without controlling for volatility skew. We first analyze the determinants of CDS spreads using the historical and implied volatility of each market. When included alone in the regressions of the currency and stock market, historical and implied volatility can

explain 53%–60% and 87%–88% of the time series of the CDS spread, respectively (Regression 9 to 12). When both are included in the regressions, the average R^2 increases to 62.5% and 92.5% (Regression 7, 8, and 9).

We find the IV and HV volatility to be a significant determinant of CDS spreads without considering jump risk. Further demonstrating the importance of implied volatility, the magnitude of the implied volatility coefficient is about more than two times as large as that of the historical volatility coefficient (9.08 vs. 3.97 in Regression 7 of the stock market and 4.51 vs. 1.35 in Regression 8 of the currency market). The effect of historical volatility is largely subsumed by that of implied volatility.[6] Given the cross-sectional averages of the time-series standard deviations of implied volatility and the historical volatility of the currency market (12.71% and 10.63%, respectively), a one standard-deviation change in implied volatility causes a 50 basis point change in the CDS spread. In contrast, a one standard-deviation change in the 60-day historical volatility causes only a 14 basis point change in the CDS spread.

< Table 3> Multivariate Regressions by Level

(Sample period: 2006/01/03~ 2012/03/31)

	(7)	(8)	(9)	(10)	(11).	(12)
Adj-R2	0.6249	0.8884	0.5352	0.6054	0.8749	0.8874
Constant	-127.60*** (12.528)	-240.24*** (18.788)	-16.089 (12.325)	-122.93*** (12.662)	-356.11*** (9.658)	-234.85*** (18.824)
KOSPI 200	0.137 (0.044)		-0.109* (0.047)	0.123*** (0.045)		
HV 1M	-3.095*** (0.482)		1.185** (0.413)			
HV 3M	3.979*** (0.494)		8.925*** (0.455)			
IV 1M	-1.545 (0.604)*			-3.261*** (0.571)		
IV 3M	9.089*** (0.724)			11.283*** (0.661)		
Spot		0.246 (0.022)			0.381*** (0.009)	0.237*** (0.022)
HV 1M		-0.416 (0.385)			3.113*** (0.256)	-
HV 3M		1.358*** (0.339)			3.403*** (0.320)	
IV 1M		1.256				0.873

[6] However, this result is not robust up to the horizon of the historical volatility estimator.

	(0.814)	(0.717)
IV 3M	4.511***	5.721***
	(1.213)	(1.165)

Notes: *, **, *** imply rejection of the null hypothesis at the 10%, 5%, and 1% significance levels.

Overall, both the historical volatility and option-implied volatility at three-month maturity appear to explain a significant part of the CDS spread. When both are included in the same regression, it is generally the case that implied volatility dominates historical volatility in explaining the CDS spread.

5. Conclusion

The extant literature demonstrates a strong relation between credit spreads and historical equity volatilities. We focus instead on the relation between CDS spreads and option market information and show whether option-implied volatility is an even more important determinant of CDS spreads than equity historical volatility. Our motivation mainly derives from the growing academic literature highlighting the information content of equity and currency options, as well as credit default swaps. The natural extension of this idea is that option market information, such as implied volatility and volatility skew, can be useful to explain CDS spreads.

Motivated by these considerations, this study examines the relation between CDS, currency, and equity option volatilities, using data on sovereign CDS spreads, stock, and currency options. It is necessary to investigate which market options enhance the explanatory power for determinants of CDS spread, and whether implied volatilities dominate historical volatilities in the determinants of CDS spread.

Using time-series regressions, we find that currency market options enhance the explanatory power for determinants of sovereign CDS spread and that implied volatility dominates historical volatility in explaining CDS spreads; the coefficient of implied volatility is larger and more significant than the coefficient of historical volatility in our sample. We also find the volatility skew of stock and currency options to be a significant determinant of CDS spreads. With this list of additional volatility variables included in the regressions, the average R^2 of the time-series regressions has increased.

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