The Determinants of CDS Bid-Ask Spreads

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This study investigates the determinants of liquidity in the credit default swap (CDS) market. The article considers a range of possible factors influencing bid-ask spreads, including demand-supply pressure, inventory risk, and clientele effects. We find that demand-supply pressure, volatility, price clustering, and downgrade-watch status are positively related to bid-ask spreads. Wider bid-ask spreads are observed for less popular CDS maturities and for reference entities with weaker credit ratings. Notional amount is inversely related to bid-ask spreads. There is evidence of commonality in bid-ask spreads across the market. For speculative grade reference entities, CDS on sovereigns have wider bid-ask spreads than CDS on corporates. There is evidence that CDS bid-ask spreads are narrowing as the market matures.

As the credit derivatives market grows, credit default swaps (CDS) are increasingly being used as a tool for managing and trading credit risk. A CDS is a derivative contract with the potential for very flexible terms, such as maturity and restructuring clauses. A question which naturally follows is how market liquidity is affected by the lack of standardization arising from such variation in terms. As the market has matured, the literature has begun to focus on CDS market microstructure to complement the attention placed in most prior research on the pricing issues of these instruments. This article investigates the liquidity of the CDS market, with specific focus on how bid-ask spreads of individual CDS are affected by the features of the contracts.

The article is motivated by several factors. First, in fixed-income markets, a common and systematic source of bond pricing discrepancy arises because of the illiquidity of certain bonds. It is anticipated that liquidity affects CDS premiums because bonds are usually the underlying assets of CDS. Second, preliminary evidence suggests that some demand-supply imbalance exists in the CDS market that allegedly affects liquidity (Fitch, Inc. [2004a]). Third, the literature regarding the liquidity of the CDS market lags its development. Little is known about how factors, such as the number of reference entities quoted and the number of trades on a particular trading day, influence bid-ask spreads. It is also relevant to investigate whether *price clustering* has an impact on the bid-ask spreads (e.g., Christie and Schultz [1994]).[1] Finally, because literature exists on the liquidity of bonds (e.g., Chakravarty and Sarkar [1999] and Hong and Warga [2000]), it is of interest to identify whether the factors affecting bond bid-ask spreads also have an impact on CDS bid-ask spreads. The comparison of determinants of CDS bid-ask spreads and bond bid-ask spreads may offer explanations for any differences in the liquidity characteristics of the two markets.

Although there is no systematic academic research focusing on the liquidity of the CDS market, Fitch, Inc., [2004a] briefly addresses the status quo of the liquidity of the market by considering the growth in the number of reference entities quoted, overall trends in trading efficiency, trends in bid-ask spreads, and the degree to which liquidity and trading vary over time. The most closely related academic research is by Gunduz, Ludecke, and Uhrig-Homburg [2007], who compared liquidity in brokered and direct interdealer trading of CDS. Tang and Yan [2006] used liquidity as an explanatory variable for changes in CDS premiums but did not consider the determinants of CDS liquidity. Our study has a clearly different focus—analyzing the determinants of CDS liquidity proxied by bid-ask spreads. We examine a wide range of factors that influence CDS bid-ask spreads to provide insight into the behavior of CDS liquidity.

The article is organized as follows. The next section reviews the relevant literature on liquidity; the third section presents our methodology, the fourth section discusses our results and findings, and the last section concludes.

LITERATURE ON LIQUIDITY IN FIXED-INCOME MARKETS

O'Hara [1995] defined liquidity as the ability to trade a security quickly and with little cost. Practitioners define liquidity as the availability to investors of two-way markets in reasonable size over an extended period without undue disruptions or difficulties in establishing fair value. There are a range of proxies for the liquidity of fixed-income instruments, including yield or return spreads (Crabbe and Turner [1995]), volume (Alexander, Edwards, and Ferri [2000]), and bid-ask spread (Hong and Warga [2000]). Bid-ask spread is found by Fleming [2003] to be the best measure of liquidity.

One source of illiquidity is demand-supply pressure. It arises because not all buyers and sellers are present in the market all the time. For example, in the CDS market, the natural buyers tend to hedge their debt assets at times when credit conditions are bad, while the natural sellers tend to sell protection at times when credit conditions are good. Therefore, at certain times, natural buyers (sellers) cannot buy (sell) a financial asset quickly because the natural sellers (buyers) are not immediately available. Fitch, Inc., [2004a] finds that between 2002 and 2004 the CDS market was subject to a "structural imbalance" as the number of protection buyers often exceeded the number of protection sellers. If protection buyers constantly outstrip protection sellers, the former should be willing to bid a higher price, thus placing upward pressure on ask prices. The Fitch, Inc., [2004c and 2005] surveys showed that most respondents view "trading instrument" as the dominant use of CDS (i.e., the majority of market participants both buy and sell CDS).

Illiquidity may also arise from inventory risk. The demand-supply pressure gives rise to the potential for market making. Because market makers buy and sell assets to bridge the temporary gaps in natural buyers and sellers' needs, they should be compensated for bearing the risk of price movements that affect the value of their positions. The compensation may appear in the form of bid-ask spread (i.e., the greater the inventory risk, the wider the quoted bid-ask spread). Previous research suggests that the more volatile the price of a financial asset, the higher the inventory risk, which in turn leads to wider bid-ask spreads. Many authors find a positive relationship between the bid-ask spread and volatility (e.g., Hong and Warga [2000] and Kalimipalli and Warga [2002]).

Previous research in the fixed-income market suggests that bid-ask spreads widen when credit quality deteriorates, because a lower rating implies greater uncertainty in the future cash flows of the security and, therefore, higher price volatility. Chen, Lesmond, and Wei [2005] found that lower-rated U.S. corporate bonds are less liquid. De Jong and Driessen [2005] found that both U.S. and European lower-rated bonds are less liquid.

It follows that quoted bid-ask spreads may adjust to rating watches. Rating watches (or reviews) are opinions of the possible direction of rating movements over a short future time period. These are issued by rating agencies to mitigate the problem of achieving both rating stability and rating accuracy. Hamilton and Cantor [2005] found that the accuracy of Moody's ratings as default risk indicators is improved if rating watches are taken into consideration. They also found that when rating watches are taken into consideration the correlation between credit ratings and CDS premiums is stronger. It follows that a wider bid-ask spread may prevail for a CDS if the reference entity is on a watch list for a possible downgrade.

In the CDS market, risk may also be linked to maturity. Unlike the fixed-income market, however, where longer maturity is usually associated with reduced liquidity (see Garbade [1984], Amihud and Mendelson [1991], and Hong and Warga [2000]), the relationship between maturity and liquidity may not be monotonic. Meng and ap Gwilym [2007] found that maturities between 60 to 64 months were the most frequently used in the CDS market over the sample period. Therefore, we hypothesize that CDS with other maturities will have wider bid-ask spreads.

Restructuring clauses take different forms in CDS contracts, such as old restructuring and modified restructuring, and usually include distressed debt exchange as a credit event (see Fitch, Inc., [2004b]). According to the ISDA [1999] definition, restructuring is characterized in several ways: as a reduction in the rate or amount of interest payable, a reduction in the amount of principal, a postponement of interest or principal payment, a change in the seniority of the debt instrument, or a change in the currency composition of any payment. Due to the higher likelihood of a credit event occurring when restructuring clauses are present, CDS with restructuring clauses are expected to have higher risk than those without, which implies wider bid-ask spreads for the former.

A clientele effect is more pronounced in OTC markets than in exchange-based markets as traders may need time to find a counterparty to trade contracts that have specific terms. As the majority of debt securities in CDS contracts are senior, it may be more difficult for those who seek protection on their subordinated debt securities to find a counterparty. In addition, Fitch, Inc., [2005] found that sovereign reference entities account for only 6% of the CDS market. Therefore, it is of interest to investigate the liquidity of these two "minority" CDS categories.

The concept of commonality in liquidity, which is characterized by the co-movement of individual bid-ask spreads with the average for the wider market, is introduced for U.S. equities by Chordia, Roll, and Subrahmanyam [2000] and Hasbrouck and Seppi [2001]. Given that volume is a major factor in the inventory positions of market makers, variation in volume could cause co-movement in inventories that then leads to co-movement in bid-ask spreads and other liquidity measures.

Fitch, Inc., [2004a] found that between 2001 and 2004 the steady increase in the total number of unique reference entities quoted in the CDS market was accompanied by a narrowing of bid-ask spreads. This effectively implies a positive relationship between liquidity and the number of reference entities quoted in the market.

Thin trading leads to uncertainty in asset prices, while frequent trading reduces uncertainty in asset prices. Jones, Kaul, and Lipson [1994] found that the number of transactions signals the arrival of information which leads to less uncertainty in asset prices and stimulates greater liquidity.

Previous studies suggest a positive relation between liquidity and the size of bond issues. Hong and Warga [2000] found that larger bond issues are associated with narrower bid-ask spreads. The size of an order is expected to have a negative effect on prevailing bid-ask spreads, as traders tend to negotiate a better price for large orders.[2] In the CDS market, the final payoff of a CDS is linked to the notional amount of a contract; thus, it is natural to use the notional amount as a measure of the size of the order.

The literature reports that the level of price clustering has a positive relationship with bid-ask spreads. Christie and Schultz [1994] suggested that extreme price clustering at NASDAQ may have been due to dealers' implicit collusion to maintain wide spreads. Ap Gwilym, Clare, and Thomas [1998] found that price clustering at even prices leads to bid-ask spread clustering at even values.

DATA AND METHODOLOGY

The following section describes the data and methodology used in our study.

Data

Daily CDS market prices from July 7, 2003, to March 3, 2005, are obtained from CreditTrade, a leading broker in the credit derivatives market. The dataset contains two-way quoted prices (i.e., both bid prices and ask prices are quoted simultaneously), and one-way quoted prices (i.e., either bid or ask). In bid-ask spread calculations, we only use the two-way quoted prices. However, when considering demand and supply, we include the one-way quotes as well.

Data on CDS notional amount, maturity, currency, sovereign/corporate, restructuring clauses, and the rank of the underlying debt asset are intrinsic to the CreditTrade dataset. However, in this transactions dataset, each reference entity has limited time-series data. Although a reference entity may have multiple quoted prices on a single day, the features embedded in CDS contracts vary. The number of CDS on a given reference entity with exactly the same features throughout the sample period is limited. To address this, CDS benchmark prices from January 2003 to March 2005 are obtained from Mark-it, a leading service provider in the credit derivatives market.[3] The benchmark price of each reference entity is in U.S. dollars and senior-ranked and has a modified restructuring or no restructuring clause and a maturity of five years.

Credit ratings of CDS reference entities assigned by Moody's, Standard and Poor's (S&P), and FitchRatings (Fitch) are obtained from Financial Times Credit Ratings International.

Variables

Bid-ask spreads (in basis points) are calculated as the difference between ask prices and bid prices, using daily market prices. Bid-ask spread commonality is calculated as the daily cross-sectional average bid-ask spread of the total sample, excluding the reference entity for which the commonality is calculated:

$$Common_i = (bid\text{-}ask\ spread_1 + \cdots + bid\text{-}ask\ spread_h + bid\text{-}ask\ spread_j + \cdots + bid\text{-}ask\ spread_n)/(n-1)$$

The variables of rank, maturity, presence of a restructuring clause, notional amount, and the sovereign or corporate status of the reference entity are all inherent in the CreditTrade CDS dataset. The number of trades and number of reference entities quoted on each trading day are calculated from the dataset.

The degree of demand-supply imbalance is proxied by the absolute value of one minus the number of asks divided by the number of bids:

$$IMBAL = \left|1 - \frac{ask}{bid}\right|$$

where

$IMBAL$ = demand-supply imbalance
Ask = number of ask prices on that trading day
Bid = number of bid prices on that trading day.

Both two-way quoted prices and one-way quotes (bid or ask) appearing in the CreditTrade dataset are used to calculate this variable.

Volatility is estimated with CDS bid-ask prices from CreditTrade and CDS benchmark prices from Mark-it, as follows.[4] A working-day calendar is constructed from May 26, 2003, to March 3, 2005. This includes 30 days before July 7, 2003, which is the beginning of the CreditTrade market price dataset. The calendar is initially filled with benchmark prices from Mark-it. For any days with missing prices, midpoint prices from the CreditTrade data are used. Finally, for any days which have no prices from either source, the most recent price is used. Among 8,845 relevant prices in the sample used for volatility calculations, 54 prices are from CreditTrade's market prices and 104 prices are the most recent prices, with the remainder being benchmark prices from Mark-it. The midpoint prices from CreditTrade have a 0.97 correlation coefficient with the benchmark prices from Mark-it when both prices are available. Therefore, replacing missing benchmark prices with midpoint prices should not create significant bias.

The credit ratings of the selected reference entities are obtained from Financial Times Credit Ratings International. The average of S&P, Moody's, and Fitch ratings is used whenever available to reflect wider opinion in rating. If Fitch's ratings are not available, the average of S&P and Moody's is used. Each of the rating notches is assigned a numerical equivalent. For S&P and Fitch, AAA is 22 and D/SD is 1, and for Moody's, Aaa is 22 and C is 1 (see Exhibit 1). Hereafter, "higher ratings" refers to ratings associated with higher credit quality, and "lower ratings" refers to lower credit quality. Any nondirectional rating watches are ignored.

EXHIBIT 1
Numerical Equivalent of Credit Rating Notches

S&P		Moody's		Fitch	
AAA	22	Aaa	22	AAA	22
AA+	21	Aa1	21	AA+	21
AA	20	Aa2	20	AA	20
AA–	19	Aa3	19	AA–	19
A+	18	A1	18	A+	18
A	17	A2	17	A	17
A–	16	A3	16	A–	16
BBB+	15	Baa1	15	BBB+	15
BBB	14	Baa2	14	BBB	14
BBB–	13	Baa3	13	BBB–	13
BB+	12	Ba1	12	BB+	12
BB	11	Ba2	11	BB	11
BB–	10	Ba3	10	BB–	10
B+	9	B1	9	B+	9
B	8	B2	8	B	8
B–	7	B3	7	B–	7
CCC+	6	Caa1	6	CCC+	6
CCC	5	Caa2	5	CCC	5
CCC–	4	Caa3	4	CCC–	4
CC	3	Ca	3	CC	3
C	2			C	2
D/SD	1	C	1	DDD/DD/D	1

Reference entity–specific price clustering is calculated as the number of prices on a reference entity ending in either 5 or 0 on a given trading day, expressed as a percentage of the total number of prices of that reference entity on that trading day.[5]

$$\text{Clust} = \frac{\begin{array}{c}\text{number of bids ending in 5 or 0}\\ + \text{ number of asks ending in 5 or 0}\end{array}}{\begin{array}{c}\text{total number of bids}\\ + \text{ total number of asks}\end{array}}$$

Due to the difficulties just described in constructing a time series on a specific CDS contract, lags of bid-ask spreads are created as follows. For a specific CDS contract with all the quoted features, the bid-ask spread for the previous trading day is the mean bid-ask spread based on all CDS quotes on the same reference entity.

Models

First, generalized least squares (random effect) is used to estimate the following model for the 19 most frequently quoted reference entities. The reason for choosing this estimation method is that because of the large number of groups in the panel dataset, the number of observations in each group varies dramatically. Estimating a fixed effect for each group would not only create bias for groups with a limited number of observations, but also make it difficult to draw clear inferences. Model (1) follows:

$$\begin{aligned} Bid\text{-}ask_{it} = {} & \alpha + \beta_1 IMBAL_{it} + \beta_2 M_{under5y} \\ & + \beta_3 M_{above5y} + \beta_4 Vol'y_{it} + \beta_5 Rating_{it} \\ & + \beta_6 DG_i + \beta_7 NR_i + \beta_8 SOVER_i \\ & + \beta_9 Common_{it} + \beta_{10} Trades_t + \beta_{11} Entities_t \\ & + \beta_{12} Notional_{it} + \beta_{13} Clust_{it} + \beta_{14} D04 \\ & + \beta_{15} D05 + \beta_{16} LAG_{it} + v_i + \varepsilon_{it} \end{aligned}$$

IMBAL is the measure of reference entity–specific demand-supply imbalance and the expected sign is positive. $M_{under5y}$ and $M_{above5y}$ are dummy variables, which take the value 1 when maturity is under 60 months and above 64 months, respectively (see Meng and ap Gwilym [2007]), and 0 otherwise. The expected signs are positive. *Vol'y* is 30-day historical volatility of the CDS premium, and a positive sign is expected. *Rating* is the credit rating of the reference entity, and the expected sign is negative. *DG* is a dummy variable taking the value 1 if the reference entity is on the watch list for downgrade and 0 otherwise.[6] The expected sign is positive. *NR* is a dummy variable taking the value 1 if the CDS contract does not include restructuring clauses and 0 otherwise. The expected sign is negative. *SOVER* is a dummy variable taking the value 1 if the CDS is on a sovereign reference entity and 0 otherwise. Since sovereign reference entities only account for a small proportion of the total reference entities, they are assumed to be less liquid, and the expected sign is positive. *Common* is the bid-ask spread commonality, and the expected sign is positive. *Trades* is the total number of trades in a trading day. *Trades* signal the arrival of information, and therefore the expected sign is negative. *Entities* is the number of reference entities quoted on the day, and the expected sign is negative. *Notional* is the CDS notional amount, and the expected sign is negative. *Clust* is reference entity–specific price clustering, and the expected sign is positive. *D04* and *D05* are year dummies taking the value 1 if the observation is in 2004 or 2005, and 0 otherwise. Since there may be increasing participation in the market and bid-ask spreads may consequently narrow, negative signs are expected, and the coefficient of *D05* is expected to be greater than that of *D04*. *LAG* is the average bid-ask spreads of the previous trading day, and the expected sign is positive. The residual term v captures the random effect.

Second, generalized least squares (random effect) is used to estimate the following model, Model (2), for a larger sample, an investment-grade subsample, and a non-investment-grade subsample:

$$\begin{aligned} Bid\text{-}ask_{it} = {} & \alpha + \beta_1 IMBAL_{it} + \beta_2 M_{under5y} \\ & + \beta_3 M_{above5y} + \beta_4 Rating_{it} + \beta_5 DG_i \\ & + \beta_6 NR_i + \beta_7 SUB_i + \beta_8 SOVER_i \\ & + \beta_9 Common_{it} + \beta_{10} Trades_t + \beta_{11} Entities_t \\ & + \beta_{12} Notional_{it} + \beta_{13} Clust_{it} + \beta_{14} D04 \\ & + \beta_{15} D05 + \beta_{16} LAG_{it} + v_i + \varepsilon_{it} \end{aligned}$$

SUB is a dummy variable taking value 1 when the underlying debt asset of the CDS is subordinated and 0 otherwise.[7] The expected sign is positive. Volatility does not appear as an explanatory variable in this model, as will be explained in the next subsection. All other variables and expected signs are as for Model (1).

Reference Entity Selection

The empirical analyses in this article can be broadly divided into two parts. In the first part, Model (1) is estimated using a subsample of the whole dataset containing the most frequently quoted reference entities. In the second part, a larger sample is used to estimate Model (2). The analyses are subdivided for two reasons. First, volatility data can be directly estimated for the most frequently traded reference entities using the daily benchmark prices from Mark-it, but many reference entities in the larger sample have too few observations for reliably estimating historical volatility. Second, despite being unable to include a volatility measure, using the larger sample facilitates more general conclusions about the behavior of bid-ask spreads.

The CDS reference entities for Model (1) are chosen according to the following criteria: 1) reference entities must have two-way quotes on more than half of the trading days during the sample period (i.e., more than 205 trading days), and 2) CDS must be denominated in the U.S. dollar. These criteria result in 19 reference entities and 15,646 observations for Model (1). Exhibit 2 shows the industry distribution across the selected sample.

The CDS reference entities for Model (2) are selected according to the following criteria: 1) CDS must be denominated in the U.S. dollar; 2) each reference entity should have at least two two-way quotes observed during the sample period; and 3) both S&P and Moody's ratings should be available for the reference entities. Including the 19 reference entities already mentioned, 357 reference entities meet these criteria. The total number of observations in this larger sample is 33,980.

EXHIBIT 2

Industry Distribution of the 19 Most Frequently Quoted Reference Entities

Health Care	4
Sovereign	4
Telecommunications	4
Pharma/Biotech	3
Media	2
Food/Beverage	1
Manufacturing	1

The larger sample for Model (2) is divided into an investment-grade subsample and a noninvestment-grade subsample. Because the numerical equivalent for BBB–/Baa3, the lowest rating notch for investment grade, is 13 (see Exhibit 1), any reference entity with an average rating below 13 is classified as noninvestment grade, and the remaining are investment grade. According to this criterion, the former subsample has 9,851 observations and the latter subsample has 24,129 observations.

RESULTS AND INTERPRETATION

Exhibit 3 presents the descriptive statistics for the dependent and explanatory variables in Model (1). The bid-ask spreads have a wide range; however, the distribution is dense around the mean. Demand and supply is, on average, not balanced. In many cases, the imbalance is much higher than the average condition. The 30-day historical volatility is close to being normally distributed, except for being right-skewed. The average credit rating

EXHIBIT 3

Descriptive Statistics for Variables in Model (1)

	Bid–Ask	IMBAL	Vol'y	Rating	Common	Trades	Entities	Notional	Clust
Mean	21.34	0.24	17.58	12.67	17.69	15.26	52.46	4,758,596	0.47
Mode	10.00	0.00	20.46	14.33	19.53	10.00	35.00	5,000,000	0.00
Standard Deviation	24.20	0.24	17.61	3.05	6.82	8.44	18.96	999,111.7	0.30
Kurtosis	26.29	13.06	3.30	–0.60	12.98	0.16	–0.45	93.87	–1.14
Skewness	3.60	2.41	1.72	–0.28	2.28	0.71	0.43	3.01	0.03
Minimum	1	0	0.25	5	6.63	0	3	1,000,000	0
Maximum	400	3	101.80	18.5	83.82	40	113	25,000,000	1

bid-ask = bid-ask spreads; IMBAL = demand-supply imbalance; Vol'y = 30-day historical volatility; Rating = average credit rating; Common = commonality of liquidity; Trades = total number of trades on each trading day; Entities = number of reference entities quoted on each trading day; Notional = notional amount, in USD; Clust = level of price clustering; 15,646 observations.

of CDS reference entities is around BBB-/Baa3 (see Exhibit 1); however, many reference entities' ratings are well below this and none are above the AA-/Aa3 level. Statistics for the commonality of bid-ask spreads are similar to bid-ask spreads; however, the distribution is less dense around the mean, less skewed, and with a narrower range. The average number of trades per day is around 15, and the average number of reference entities quoted per day is about 52. The average notional amount is close to USD 5 million, which is the most frequently used notional amount during the period. The average level of price clustering is about 0.5, meaning that the number of quoted prices ending in 0 or 5 account for half of the total.

Exhibit 4 presents the regression results for Model (1). The demand-supply pressure bears a very significant positive coefficient, as predicted. This is consistent with the theory (e.g., Amihud, Mendelson, and Pedersen [2005]) that temporary imbalance in demand and supply gives rise to market makers who are compensated by bid-ask spread. On average, CDS with maturities under 60 months or above 64 months have wider bid-ask spreads than CDS with a maturity around five years. This is consistent with the hypothesis that the more frequently quoted maturities are more liquid. Volatility has a significant positive relation to bid-ask spreads, which is consistent with the literature for other markets (e.g., Hong and Warga [2000] and Kalimipalli and Warga [2002]). The credit ratings of CDS reference entities are inversely related to bid-ask spread (i.e., the higher the credit rating, or credit quality, the narrower the bid-ask spread). This is consistent with the hypothesis that CDS on reference entities with weak credit ratings have higher risk, which leads to wider bid-ask spreads. Downgrade watches have a positive effect on bid-ask spread (i.e., CDS reference entities that are on rating agencies' watch lists for downgrade have wider bid-ask spreads). No significant relationship is found between restructuring clause and bid-ask spread. No significant relationship is found between the type of CDS reference entity (i.e., sovereign or corporate) and bid-ask spread.

There is strong evidence of commonality in the liquidity of these 19 reference entities. The number of trades and the number of reference entities quoted on a given day do not have a significant effect on the bid-ask spread. There is a strongly significant inverse relationship between the CDS notional amount and bid-ask spread. This is consistent with the hypothesis that narrower bid-ask spreads prevail when the size of the order is larger. It is also consistent with Hong and Warga's [2000] findings

EXHIBIT 4

Determinants of Bid-Ask Spreads for Most Frequently Traded Reference Entities

$$Bid\text{-}ask_{it} = \alpha + \beta_1\, IMBAL_{it} + \beta_2\, M_{under5y} + \beta_3\, M_{above5y} + \beta_4 Vol'y_{it} + \beta_5 Rating_{it} + \beta_6 DG_i + \beta_7 NR_i + \beta_8 SOVER_i + \beta_9 Common_{it} + \beta_{10} Trades_t + \beta_{11} Entities_t + \beta_{12} Notional_{it} + \beta_{13} Clust_{it} + \beta_{14} D04 + \beta_{15} D05 + \beta_{16} LAG_{it} + v_i + \varepsilon_{it} \quad (1)$$

Constant	30.192[a] (14.37)
IMBAL	2.077[a] (3.83)
$M_{under5y}$	10.289[a] (23.45)
$M_{above5y}$	4.179[a] (6.59)
Vol'y	0.199[a] (17.72)
Rating	–1.479[a] (–13.12)
DG	1.101[a] (2.92)
NR	–0.239 (–0.12)
SOVER	–0.209 (–0.27)
Common	0.114[a] (5.69)
Trades	–0.014 (–0.91)
Entities	–0.004 (–0.52)
Notional*1,000,000	–0.997[a] (–6.90)
Clust	6.203[a] (10.95)
D04	–2.484[a] (–7.21)
D05	–5.862[a] (–9.21)
LAG	0.391[a] (41.83)
R^2	0.56
Observations	15646

Note: IMBAL is the measure of reference entity–specific demand-supply imbalance; $M_{under5y}$ and $M_{above5y}$ are maturity dummies; Vol'y is 30-day historical volatility of CDS premium; Rating is the credit ratings of reference entities; DG is a dummy variable for downgrade watches; NR is a dummy variable for CDS without any restructuring clauses; SOVER is a dummy variable for sovereign CDS; Common is the bid-ask spread commonality; Trades is the total number of trades of a trading day; Entities is the number of reference entities quoted in the day; Notional is the notional amount of CDS; Clust is reference entity specific price clustering; LAG is the average bid-ask spreads of the previous trading day; D04 and D05 are year dummies. The residual term v captures the random effect. [a] denotes significance at the 1% level, [b] denotes significance at the 5% level, and t-statistics are in parentheses.

that larger bond issues are associated with narrower bid-ask spreads. Price clustering has a very significant positive effect on bid-ask spread. This is consistent with the findings of Christie and Schultz [1994] and ap Gwilym, Clare, and Thomas [1998] that higher levels of price clustering lead to wider bid-ask spreads. The year dummies identify that bid-ask spreads are narrowing from the second half of 2003 to the first quarter of 2005, as expected with the maturing of the market. Finally, there is evidence of positive serial correlation in the bid-ask spreads. The overall goodness of fit of the model is 56%, which is very satisfactory for this type of dataset.

Exhibit 5 presents the descriptive statistics for dependent and explanatory variables in Model (2). Compared to the subsample of the 19 most frequently quoted reference entities, there are significant increases in the range of bid-ask spreads, credit ratings, and notional amount. The distributions of these variables are also denser around the mean. Notably, the mean bid-ask spread is narrower and the mean credit rating is higher (around BBB/Baa2).

Exhibit 6 presents the regression results for Model (2) using the larger sample, the investment-grade subsample, and the noninvestment-grade subsample. The demand -supply pressure bears a significant positive sign for all three samples, as predicted. The maturity dummy coefficients have positive signs, as expected, indicating that CDS with maturities around five years have narrower bid-ask spreads than CDS with other maturities. Credit ratings are significantly inversely related with bid-ask spreads for all the samples, as predicted. Downgrade watches have a positive relation to bid-ask spread in all cases, as predicted. On the whole, CDS without restructuring clauses have narrower bid-ask spreads than those with restructuring clauses, which differs from Model (1).[8] This is consistent with the hypothesis that CDS with restructuring clauses have higher risk which leads to wider bid-ask spreads. This effect is not significant, however, in the noninvestment-grade subsample, as in Model (1).

In general, CDS with subordinated underlying debt have wider bid-ask spreads. This is consistent with the hypothesis that CDS with subordinated underlying debt have higher associated risk. However, it is difficult to estimate the relation between the rank of the underlying debt and bid-ask spread when the larger sample is divided due to the limited number of CDS with subordinated debt in the noninvestment-grade subsample.[9] This rank dummy has a 0.72 correlation coefficient with the restructuring clause dummy in the investment-grade subsample. In general, CDS with sovereign reference entities have wider bid-ask spreads than CDS with corporate reference entities, as predicted. The effect, however, is restricted to the noninvestment-grade subsample.[10]

There is evidence that the liquidity of all CDS move together, as predicted (commonality). The number of trades on each trading day influences bid-ask spreads of the investment-grade subsample only. The positive coefficient means that for CDS with investment-grade reference entities, more trades lead to a wider bid-ask spread. This is inconsistent with the hypothesis that the number of trades signals arrival of information that leads to less uncertainty, thus

Exhibit 5
Descriptive Statistics for Variables in Model (2)

	Bid–Ask	IMBAL	Rating	Common	Trades	Entities	Notional	Clust
Mean	17.38	0.26	13.69	17.64	10.84	55.60	4,841,265.45	0.44
Mode	10.00	0.00	14.00	19.59	10.00	65.00	5,000,000	0.00
Standard Deviation	23.48	0.28	2.92	7.39	7.84	19.37	2,856,155.22	0.33
Kurtosis	145.90	20.61	0.62	17.40	1.34	–0.49	26,588.55	–1.19
Skewness	8.23	2.69	–0.16	2.94	1.19	0.37	153.54	0.21
Minimum	1	0	5	6.44	0	3	1,000,000	0
Maximum	625	7	22	87.23	40	113	500,000,000	1

Note: bid-ask = bid-ask spreads; IMBAL = demand-supply imbalance; Rating = average credit rating; Common = commonality of liquidity; Trades = total number of trades on each trading day; Entities = number of reference entities quoted on each trading day; Notional = notional amount, in USD; Clust = level of price clustering; 33,980 observations.

EXHIBIT 6
Determinants of Bid-Ask Spreads in Large Sample

$$Bid\text{-}ask_{it} = \alpha + \beta_1 IMBAL_{it} + \beta_2 M_{under5y} + \beta_3 M_{above5y} + \beta_4 Rating_{it} + \beta_5 DG_i + \beta_6 NR_i + \beta_7 SUB_i + \beta_8 SOVER_i + \beta_9 Common_{it} + \beta_{10} Trades_t + \beta_{11} Entities_t + \beta_{12} Notional_{it} + \beta_{13} Clust_{it} + \beta_{14} D04 + \beta_{15} D05 + \beta_{16} LAG_{it} + v_i + \varepsilon_{it} \quad (2)$$

	Full Sample	Investment	Non-Investment
Constant	28.224[a] (10.87)	11.012[a] (5.65)	66.183[a] (11.50)
IMBAL	1.516[a] (5.11)	1.211[a] (4.50)	2.295[a] (2.84)
$M_{under5y}$	9.065[a] (24.75)	6.803[a] (14.61)	10.372[a] (16.13)
$M_{above5y}$	3.617[a] (7.43)	4.018[a] (7.68)	3.403[a] (3.53)
Rating	−1.340[a] (−8.79)	−0.290[b] (−2.53)	−3.899[a] (−11.13)
DG	2.650[a] (10.33)	2.114[a] (9.23)	7.224[a] (8.63)
NR	−5.853[a] (−7.89)	−5.875[a] (−6.71)	−0.556 (−0.43)
SUB	6.729[a] (4.06)		
SOVER	10.286[a] (3.14)	−2.440[b] (−2.39)	52.818[a] (4.42)
Common	0.116[a] (9.67)	0.090[a] (8.44)	0.170[a] (4.67)
Trades	−0.008 (−0.64)	0.033[a] (2.78)	−0.034 (−1.16)
Entities	−0.003 (−0.56)	−0.002 (−0.48)	−0.009 (−0.83)
Notional*1,000,000	−0.084[a] (−2.77)	−0.033 (−1.40)	−1.240[a] (−5.94)
Clust	4.460[a] (14.41)	4.262[a] (15.99)	8.529[a] (8.49)
D04	−2.435[a] (−10.65)	−1.996[a] (−9.87)	−5.764[a] (−8.48)
D05	−5.421[a] (−12.84)	−2.871[a] (−7.12)	−9.707[a] (−9.39)
LAG	0.392[a] (59.02)	0.210[a] (21.95)	0.430[a] (38.11)
R^2	0.47	0.20	0.27
Observations	33980	24129	9851

Note: IMBAL is the measure of reference entity–specific demand-supply imbalance; $M_{under5y}$ and $M_{above5y}$ are maturity dummies; Rating is the credit ratings of reference entities; DG is a dummy variable for downgrade watches; NR is a dummy variable for CDS without any restructuring clauses; SUB is a dummy variable for CDS with subordinate underlying debt assets; SOVER is a dummy variable for sovereign CDS; Common is the bid-ask spread commonality; Trades is the total number of trades of a trading day; Entities is the number of reference entities quoted in the day; Notional is the notional amount of CDS; Clust is reference entity specific price clustering; LAG is the average bid-ask spreads of the previous trading day. The residual term v captures the random effect. [a]denotes significance at the 1% level, [b]denotes significance at the 5% level, and t-statistics are in parentheses.

causing bid-ask spreads to narrow. For all cases, the number of reference entities quoted on each trading day has a negative but insignificant relation with the bid-ask spreads. CDS notional amount is negatively linked to bid-ask spread, but this is not statistically significant for the investment-grade subsample. Price clustering is positively linked to bid-ask spread for all three samples, as predicted.

The bid-ask spread tends to narrow over time and this effect is more pronounced for CDS with noninvestment-grade reference entities. All three samples demonstrate positive serial correlation in the bid-ask spread. A key explanation for the lower R-squared value (46%) compared to Model (1) is that Model (2) is unable to include the historical volatility of CDS premiums, which was a significant determinant in Exhibit 4.

In general, some findings are consistent with Gunduz, Ludecke, and Uhrig-Homburg [2007]; for example, higher (stronger) credit ratings on reference entities are associated with narrower CDS bid-ask spreads. In extending the literature, we have also presented evidence of the effects on CDS bid-ask spreads of demand-supply imbalance, commonality, rating watchlist, trading activity, and price clustering.

CONCLUSION

This article investigates the determinants of CDS bid-ask spreads, focusing on a range of possible factors, which include demand-supply pressure, inventory risk, and clientele effects. The models generally find statistically significant coefficients whose signs correspond to prior hypotheses. We initially focus on the most frequently quoted reference entities because a volatility measure can be applied with these. We find that demand-supply pressure, volatility, and downgrade watches are positively related to bid-ask spreads. CDS with maturities around five years, which are most frequently observed, have narrower bid-ask spreads than CDS with other maturities. Notional amount and credit ratings are inversely related to bid-ask spread. Bid-ask spreads demonstrate commonality across the market, and they are declining over time as the CDS market matures. Price clustering is strongly positively related to bid-ask spread.

Further model estimation is considered with a larger sample of reference entities, and with investment-grade and noninvestment-grade subsamples. Here, we additionally find that CDS without restructuring clauses have narrower bid-ask spreads; however, this effect is only significant in the investment-grade subsample. In general, CDS with subordinated underlying debt have wider bid-ask spreads. CDS on speculative grade sovereign reference entities have wider bid-ask spreads than CDS on speculative grade corporate reference entities. On average, the bid-ask spreads for noninvestment-grade CDS narrowed more substantially than spreads for investment-grade CDS from the second half of 2003 to the first quarter of 2005.

The identification of determinants of CDS bid-ask spreads can inform pricing issues due to the important role played by liquidity in asset pricing. These findings also provide additional insights into the development and stability of the market, which should interest regulators and market participants.

ENDNOTES

[1]*Price clustering* refers to the observation of a concentration of quotes or trades at certain integer prices, or significantly greater than 50% of quotes or trades occurring at even-price fractions (ap Gwilym, Clare, and Thomas [1998]).

[2]Large buy-side or sell-side orders may signal private information and lead to poor liquidity. However, market makers who both buy and sell are generally assumed to be uninformed traders.

[3]These benchmark prices are used only for calculating volatility.

[4]Volatility for a given CDS reference entity on day t is calculated based on the standard deviation of returns for days $t-1$ to $t-30$. The 30-day historical volatility is the most commonly used historical volatility in fixed-income markets (Fabozzi [2001]).

[5]A two-way quote counts as one bid and one ask.

[6]The model could also have included a dummy variable for CDS whose underlying reference entities are on an upgrade watchlist. However, in the sample, there were a very limited number of observations with CDS reference entities on upgrade watches (145 versus 3,801 in the case of downgrade watches).

[7]This dummy variable is not in Model (1) due to the small number of CDS transactions in that subsample that have subordinate underlying debt.

[8]There are a total of 1,228 observations without restructuring clauses in the large sample, with 337 in the investment-grade subsample and 891 in the noninvestment-grade subsample.

[9]There are a total of 375 observations with subordinate features in the large sample, with 335 in the investment-grade subsample and 40 in the noninvestment grade subsample.

[10]There are a total of 3,773 sovereign observations in the large sample, with 860 in the investment-grade subsample and 2,913 in the noninvestment-grade subsample.

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