The Effects of Credit Default Swaps on Analyst Forecasting Properties

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This research studies the effect of credit default swaps (CDS), one of the most important financial innovations in recent times, on financial analysts' forecast characteristics. We examine whether and how the revelation of private information in the CDS market, which often leads to public information disclosure and price discovery in other markets, affects analysts' forecast characteristics. This research shows that analysts have more accurate and less dispersed cash flow forecasts for firms with CDS contracts. These findings are consistent with the predictions that financial analysts include the information revealed from the CDS market in their cash flow forecasts. Furthermore, we investigate the relation between CDS prices, CDS price changes, and analysts' forecast properties and find that CDS prices and their changes are associated with analysts' cash flow forecast accuracy and dispersion.

Keywords: credit default swaps, CDS prices, CDS initiation, CDS trading, analyst forecasting, accuracy, dispersion, cash flow forecast, financial institutions, private information, public information

INTRODUCTION

Credit default swaps (CDS) have been one of the major financial innovations in the financial markets in recent decades. A CDS contract is a credit derivative in which the CDS credit protection buyer makes periodic payments in exchange for protection against default or other credit events of a third-party borrower, called the reference entity, for a defined period. CDS market proponents argue that CDS improves market efficiency and increases market competition. Additionally, a CDS contract can serve as an essential information source for regulators and investors regarding the financial condition of the underlying reference entity. On the other hand, the major criticism of the CDS market is that large financial institutions, the main participants in the CDS market, use inside information from the reference entities in their trading activities (Acharya and Johnson, 2007, The Financial Times, 2006).

We examine whether and how the revelation of private information in the CDS market, which often leads to public information disclosure and price discovery in other markets, affects analyst cash flow forecast properties. Previous studies demonstrate that financial analysts are one of the most important information intermediaries in the capital markets. As financial analysts receive and process financial information for investors, financial analysts' outputs are determined to a large extent by investor demand for information in the presence of uncertainty (Brown et al. 2014).

A higher degree of information uncertainty is associated with a greater degree of analyst forecast revisions.[1] Generally, financial analysts are negatively affected by a higher degree of asymmetric information, so they seek new information sources to mitigate the information uncertainty and to provide more accurate forecasts. As the CDS market reveals incremental information about a reference entity based on the expectations of the CDS contract traders, while trading by informed traders results in the revelation of new information or non-public information through CDS pricing (Glantz, 2003, Acharya and Johnson, 2007, Whitehead, 2012), analysts may use these additional sources of information to provide more accurate cash flow forecasts.

We focus on analysts' cash flow forecast characteristics and utilize the relationship that exists between CDS prices and firm cash flows. Expected default risk, the major determinant of CDS prices or (risk) premium, is a function of future cash flow volatility (risk), level, and timing. Therefore, it seems plausible that financial analysts would infer private information transmitted by informed investor trading in the CDS market to update their estimates of future cash flows of the reference entity. Following Batta et al. (2016) and Subrahmanyam et al. (2014), we examine the relation between analysts' forecasting characteristics and CDS initiation. Subrahmanyam et al. (2014) indicate that the CDS initiation is positively related to a firm's credit rating, profit margin, leverage, and return volatility. We conjecture that having a CDS contract improves the analysts' information environment, so analysts can improve their forecasts by using this information and issue more accurate cash flow forecasts. We also conjecture that analysts can have less disagreement with this additional information. Using a full sample, we expect to find that analysts' accuracy is positively related to the CDS initiation.

Additionally, we examine the information flow from CDS prices and CDS price changes to financial analysts' forecast characteristics, such as accuracy and dispersion, as CDS prices and their changes reflect public and non-public information about the reference entity. Increases in CDS prices indicate that financial institutions have more negative news about the reference entity (Acharya and Johnson, 2007). Piotroski et al. (2005) show that insider trades reflect superior information about future cash flow realizations. Acharya and Johnson (2007) indicate that information flow from the CDS market to the stock market is significant when credit deterioration is high and, thus, CDS levels are high. Due to hedging activities in the CDS market, the information revelation from the CDS market to analysts should be greater when there is more negative news about the reference entity. Thus, analysts can improve forecast accuracy by using CDS prices and changes in prices, which typically provide more timely feedback on a firm's performance than the pricing of its public debt or equity securities as CDS reflect a substantial amount of private information transmitted by informed investor trading (Glantz, 2003, and Whitehead, 2012).

Consistent with our expectations, we find evidence that analysts make more accurate cash flow forecasts for a reference entity that has CDS contracts. We also find that analyst forecast dispersion decreases with the CDS initiation, which increases the cash flow information of reference entities, so financial analysts can benefit to provide more accurate forecasts. Thus, our results confirm that CDS contracts improve the information environment. To address any systematic differences between CDS and non-CDS firms, we use a matched sample to examine the relation between CDS initiation, forecast accuracy, and forecast dispersion. Results are similar to the full sample and consistent with our predictions. Overall, results confirm that the CDS market provides useful information about the reference entity, and analysts use this information in the cash flow forecasting process to improve the accuracy of their predictions.

Next, we examine how CDS prices and CDS price changes influence analyst forecast properties, given that some CDS firms have less volatile and lower level of CDS prices than other CDS firms do. We test whether CDS price levels and CDS price changes directly affect analyst forecast accuracy and dispersion. The results show that forecast accuracy is negatively related to CDS prices while forecast dispersion is positively related. The findings show that CDS prices and price changes are important indicators for financial analysts' cash flow forecast properties and when the CDS market prices the non-public information, financial analysts update their forecasts and provide more accurate and less dispersed outputs.

Our contribution to the literature is twofold. First, this paper shows that the information provided by the CDS market enhances financial analysts' forecasts. So far, studies have demonstrated that analysts use

information from the CDS market to report earnings forecasts. However, expected default risk, the major determinant of CDS prices, is a function of future *cash flow* level, volatility (risk), and timing. Therefore, it seems plausible that financial analysts would use private information transmitted by informed investor trading in the CDS market to update their *cash flow* forecasts. These findings support the argument that cash flow forecasts are not a naïve extension of earnings forecasts. This paper shows that analyst cash flow forecasts' accuracy increases and dispersion decreases when a CDS contract exists on a reference entity. In addition, this paper shows that CDS prices and changes in CDS prices also affect cash flow forecast accuracy and dispersion. This is particularly important because the information on CDS prices varies by firm. Thus, it is important to capture this variation as well as the impact of CDS on forecast accuracy and dispersion. We believe this is one of the first studies showing this relationship in the literature.

The remainder of the paper proceeds as follows: Section 2 develops testable hypotheses. Section 3 describes the data and empirical design, and Section 4 discusses the main results. Finally, Section 5 concludes.

HYPOTHESIS DEVELOPMENT

The dominant players in the CDS market are financial institutions that can access non-public information from reference entities through their lending activities.[2] Reference entities often provide material non-public and price-sensitive information in advance of public release to build a relationship with banks (Acharya and Johson, 2007; Standard and Poor's, 2007). The trading desks of large banks and financial institutions provide CDS price quotes for firms to which they have a loan exposure (Acharya and Johnson, 2007). Non-public information provided by reference entities to financial institutions would also be shared with analysts in the same bank/brokerage firm. According to Massa and Rehman (2008), Chinese walls prevent investment bankers from influencing analyst research reports and separate the investment banking from the brokerage. However, due to the absence of the Chinese walls in the CDS market, financial institutions trade on non-public information, and this information is also shared with brokerage, research, and other departments of the same institution. (The Economist, 2003; Financial Times, 2005; Standard and Poor's, 2007).

First, we examine the impact of the initiation of CDS contracts on analysts' cash flow forecasts. We focus on cash flow forecasts and their characteristics due to the fundamental relationship that exists between CDS prices and a firm's cash flows. The CDS market incorporates new information and sometimes non-public information more quickly than the stock and bond markets; therefore, analysts can use the information embedded in CDS contracts to increase their forecasting accuracy. Also, additional information would decrease the disagreement among financial analysts so that financial analysts will have less dispersed cash flow forecasting. Hence, we state the following hypotheses:

H1a: *Initiation of CDS contracts improves the accuracy of analysts' cash flow forecasts*

H1b: *Initiation of CDS contracts reduces the dispersion of analysts' cash flow forecasts*

Information uncertainty in the capital markets is negatively correlated with analyst forecast accuracy (Zhang, 2006). Analysts utilize several information sources to mitigate information uncertainty. Studies show that CDS prices impound various types of information about the reference entities, which mitigates information uncertainty in the capital markets. For instance, Ericsson et al. (2009) show that market volatility, firm leverage, and a 10-year T-bill rate explain a significant amount of variation in CDS prices. Batta (2011) finds that accounting information is priced in CDS. Shivakumar et al. (2011) investigate the credit market reaction to manager forecasts using CDS and document that CDS prices react to managerial forecasts. Callen et al. (2009) examine the impact of earnings on CDS pricing, finding that changes in earnings are correlated with CDS price changes. Thus, these studies show that public and private information are associated with CDS prices that are then used by financial analysts.

Information on CDS prices affects several markets, such as the bond market (Acharya and Johnson, 2007) and the stock market (Norden and Weber, 2004). Financial institutions use both their private information and information processing advantages to price CDS contracts. Glantz (2003) and Whitehead (2012) argue that changes in CDS pricing provide more timely information about firms' financial performance than the pricing of firms' bonds or equity securities. Also, from an investor's perspective, changes in CDS prices indicate that CDS traders have used non-public information (Standard and Poor's, 2007). Hull, Predescu, and White (2004) show that CDS prices anticipate credit rating downgrades. Moreover, Acharya and Johnson (2007) and Qiu and Yu (2012) show that CDS prices lead the equity market in price discovery. Acharya and Johnson (2007) show that there is information flow from the CDS market to the equity market; this flow is more significant when the reference entity has a higher number of bank relationships. Blanco et al. (2005) emphasize that price discovery is faster in the CDS market because it is the most convenient market for informed investors to trade credit risk. Thus, CDS prices and CDS price changes likely reflect such investors' expectations about the reference entity's financial condition.

We argue that CDS prices convey information about the distribution of the reference entity's future cash flow because the main concern for the CDS market participant is whether the reference entity sufficiently meets the underlying debt obligations. Specifically, CDS prices reflect the CDS market participants' assessment of the distribution of future cash flows of the reference entity. Thus, high CDS prices reflect that CDS contract participants expect low future cash flows, indicating the reference entity is riskier or may not be able to meet the underlying debt obligations. Also, high CDS prices increase the expected variance of a firm's future cash flows. The magnitude of price may have different implications on information flows; on average, high CDS prices influence forecast accuracy negatively and dispersion positively. We formalize these conjectures as follows:

H2a: *High CDS prices are negatively associated with the accuracy of analysts' cash flow forecasts*

H2b: *High CDS prices are positively associated with the dispersion of analysts' cash flow forecasts*

Next, we examine the information flow from changes in CDS prices to financial analysts' forecast characteristics, accuracy and dispersion based on public and non-public information about the reference entity. For example, an increase in CDS prices shows that financial institutions have more negative news about the reference entity (Acharya and Johnson, 2007, Gao et al, 2016). Prior literature has examined whether insiders use their superior future cash flow information in their trading strategies. Piotrosk et al. (2005) show that insider trades reflect superior information about future cash flow realization. Moreover, participants in the CDS market trade based on superior future cash flow information. Acharya and Johnson (2007) indicate that information flow from the CDS market to the stock market is greatest when credit deterioration is high, i.e., when CDS prices are high. Banks and financial institutions use their non-public information, such as timely financial disclosures, covenant compliance information, and financial projections, in their CDS pricing. Likewise, CDS price changes do not affect future cash flows per se, but they convey information about both the CDS credit protection buyer's and the CDS credit protection seller's assessment of the distribution of future cash flows. A significant movement in CDS prices without any corresponding news usually serves as an indication to market participants that informed traders have received information that is not yet public (Standard and Poor's, 2007). We argue that CDS price changes conveys additional information, and financial analysts use this information. The sign of price changes may have different implications on information flows; on average, the relation between the CDS price change and forecast accuracy would be negative. Likewise, CDS price change affects the analyst forecast dispersion positively; a higher CDS price change means higher uncertainty, resulting in a higher discrepancy among analysts due to the higher variation. Hence, we state the following hypotheses:

H3a: *Changes in CDS prices are negatively associated with the accuracy of analysts' cash flow forecast*

H3b: *Changes in CDS prices are positively associated with the dispersion of analysts' cash flow forecast*

SAMPLE SELECTION AND EMPIRICAL DESIGN

This study first investigates the impact of CDS initiation on analysts' cash flow forecasting properties. We use forecasting accuracy and dispersion as dependent variables and initiation of CDS contracts as a key independent variable. Also, we add control variables consistent with the literature. Second, we examine the relationship between CDS prices and CDS price changes and analysts' forecasting properties. In this second part, we use only firms with a traded CDS in order to investigate the information content of CDS prices and CDS price changes.

The data used in this study come from four main sources. First, we obtain CDS price data from Markit from 2001 to 2017, and we focus on this period only because of data availability. Markit database covers 921 North American CDS firms, and every CDS firm has a different CDS initiation date. Markit provides CDS data with a propriety firm identifier, so we match every CDS firm with I/B/E/S, CRSP, or COMPUSTAT data. Additionally, analyst forecast information is obtained from the I/B/E/S database. The I/B/E/S database provides monthly analysts' cash flow forecasts and there are 7044 firms during the period. The percentage of U.S. firms with cash flow forecasts has increased from 4% in 1993 to 54% in 2005.[3] Data on firm characteristics is obtained from COMPUSTAT and CRSP.

The literature typically uses 5-year CDS prices because they come from the most liquid contracts in the CDS market (for example, Batta et al., 2016, Hull et al, 2005). We use 5-year CDS prices, but as a robustness test, we also use CDS prices from 6-month to 30-year contracts. CDS prices are quoted in terms of credit spreads or the implied number of basis points that the credit protection seller receives from the credit protection buyer. We include all CDS quotes denominated in US dollars. We exclude subordinated class of contracts from the sample. Additionally, we use CDS contracts with modified restructuring (MR) clauses[4], which are the most widely traded contracts in the US market (Zhang et al. 2005). The Markit database provides CDS data with their original Red Code as a firm identifier. We match Markit Red Codes with CRSP Permnos to create a suitable firm identifier. Previous studies use daily changes in CDS prices (Ericsson et al. 2009), or weekly changes (Aunon-Nerin et al. 2002).

In the second part of this study, we focus on firms with traded CDS in order to examine the relation between CDS prices and analysts' forecasting properties by using the 719 CDS firms. In this sample, we have firms, which have cash flow forecasts, and CDS prices. We examine the impact of CDS initiation on analyst's cash flow forecasts properties after controlling for firm characteristics and market variables that are likely to be associated with. We employ a difference-in-difference design with quarterly observations in a panel data setting to examine the relation between CDS initiation and analyst forecast properties. The main variable of interest, CDS_dummy, captures the effect of CDS trading on analyst forecast properties. Additionally, we include firm control variables that have been shown to explain analyst behavior along with time and industry-fixed effects. We also cluster standard errors at the firm level. The model is as follows,

$$Accuracy\ (Dispersion) = \beta_0 + \beta_1 CDS\_dummy + \beta_2 \sum_{n=1}^{14} ControlVariables + \beta_3 \sum_{i=1}^{K} TimeFE + \sum_{i=1}^{K} IndustryFE + \varepsilon \quad (1)$$

where Accuracy (Dispersion) is defined following Lang and Lundholm, (1996), to measure analyst forecasts,

$$Accuracy = (-1) \times \frac{Median\ Estate - Actual}{Stock\ Price} \times 100 \quad (2)$$

Median estimate is the median estimate of analysts that are providing cash flow forecasts for the firm or reference entity. Actual is the current amount of cash flow for each firm quarter. The stock price is at the end of each firm quarter. Finally, we multiply the absolute forecast error by (-1), so higher values represent more accurate forecasts.

Additionally, following Hope (2002), we measure analyst forecast dispersion for each firm quarter by taking the standard deviation of analyst forecasts for each firm quarter:

$$Dispersion = \frac{Std(Analysts' forecasts)}{Stock\ Price} \times 100 \quad (3)$$

where Dispersion is the disagreements among financial analysts following each firm. Std_{it} (Analysts' forecast) and P_{it} are the standard deviation of cash flow forecasts and stock price for firm i at period t, respectively.

Following Saretto and Tookes (2013), we include industry-fixed effects to control for unobservable time-invariant differences between industries. Since CDS initiation happens at different times for different firms, both non-CDS firms and the subset of CDS firms for which initiation has not occurred can serve as the control group in the difference-in-difference.

We add several control variables that could affect forecast accuracy and dispersion through CDS initiation to address the potential omitted variable issue. Appendix 1 provides the definitions for all variables used in the empirical models. The control variables include *Size, Leverage, Profit_Margin, RE, Cash, Inv_Grade, ROA, MB, CAPEX, Working_CAP, PPE, Asset_Turnover*, and *RD*. Moreover, we add *Return_Vol, Cash_Surprise*, and *No_Analayst*. No_Analyst measures the number of analysts issuing cash flow forecasts within 90 days of the earnings announcements. Cash_Surprise is the absolute value of the difference between cash flows at quarters t and t-1, divided by stock price at the beginning of quarter t. All these control variables are suggested by previous literature (Batta et al., 2016; Govindaraj et al., 2017; Kim et al., 2018).

Next, we examine the association between the CDS price and CDS price changes and forecast properties. The main interested variable is CDS_price in the model (3) and CDS_price_change in model (4). CDS_price is the average CDS price three days before the cash flow information is released. CDS_price_change is the difference between CDS prices one day and three days before the cash flow information is released. Additionally, we add all the same control variables. The models are as follows,

$$Accuracy(Dispersion) = \beta_0 + \beta_1 CDS\_price + \beta_2 \sum_{n=1}^{14} ControlVariables + \sum_{i=1}^{K} TimeFE + \sum_{i=1}^{K} IndustryFE + \varepsilon \quad (4)$$

$$Accuracy(Dispersion) = \beta_0 + \beta_1 CDS\_Price\_Change + \beta_2 \sum_{n=1}^{14} ControlVariables + \sum_{n=1}^{14} ControlVariables + \beta_3 \sum_{i=1}^{K} TimeFE + \sum_{i=1}^{K} IndustryFE + \varepsilon \quad (5)$$

RESULTS

We first examine the effect of the CDS initiation on analysts' cash flow forecast accuracy and dispersion. Table 1 presents the full sample descriptive statistics for the variables of interest. The average (median) firm quarter in the sample has a cash flow forecast accuracy of 4% (1.5%). The standard deviation of cash flow forecasts is equal to 0.91%. The mean of Dispersion is 2.2%, and the standard deviation is 3.6. Only 25% of the firms in our sample have CDS prices. The firm- quarter in this sample is followed by 3.8 analysts.

Table 1, Panels B and C present the descriptive statistics for the CDS firm and non-CDS firm subsamples, respectively. The CDS subsample is relatively smaller than the non-CDS subsample. As shown in Panels B and C, CDS firms have both lower forecast accuracy and dispersion of the forecast. In Panel B, the mean of cash flow forecast accuracy is 2.9% for CDS firms, and in Panel C, the mean of cash flow forecast accuracy is 4.5% for non-CDS firms. Additionally, the mean of Dispersion is 1.7% for CDS firms and 2.4% for non-CDS firms. These univariate results suggest that CDS contracts reveal additional useful information about the reference entity to the markets. As expected, CDS firms are larger than non-CDS firms, have higher leverage and ROA, and are followed by more financial analysts.

TABLE 1
DESCRIPTIVE STATISTICS

Panel A: Full Sample

	N	Mean	Std. Dev.	p25	Median	p75
Accuracy	41501	-.041	.091	-.038	-.015	-.006
Dispersion	30700	.022	.036	.005	.011	.023
CDS_dummy	41501	.244	.429	0	0	0
Size	41501	8.233	1.619	7.15	8.191	9.329
ROA	41501	.012	.033	.004	.013	.025
Leverage	41501	.257	.197	.106	.237	.372
MtoB	41501	3.246	4.182	1.462	2.332	3.818
RD	41501	.007	.017	0	0	.008
Cash	41501	.092	.12	.006	.049	.132
Capex	41501	.335	.277	.099	.242	.555
PPE	41501	.456	.481	0	.298	.816
WorkCap	41501	.174	.199	.014	.132	.286
Profit Margin	41501	-.019	1.024	.021	.068	.135
RE	41501	.117	.704	0	.191	.395
Asset Turnover	41501	.239	.19	.11	.188	.306
Rating	41501	.617	.486	0	1	1
Inv Grade	41501	.433	.495	0	0	1
Cash_Surprise	41501	.049	.086	.008	.021	.05
RetVol	41501	.025	.017	.015	.021	.03
No Analyst	41501	3.838	3.984	1	3	4

Panel B: CDS Firms

	N	Mean	Std. Dev.	p25	Median	p75
Accuracy	10120	-.029	.061	-.031	-.013	-.005
Dispersion	8351	.017	.025	.005	.01	.02
CDS_dummy	10120	1	0	1	1	1
Size	10120	9.397	1.094	8.623	9.288	10.149
ROA	10120	.016	.021	.007	.015	.025
Leverage	10120	.277	.148	.173	.258	.368
MtoB	10120	3.317	3.777	1.642	2.464	3.718
RD	10120	.005	.01	0	0	.006
Cash	10120	.056	.069	0	.031	.085
Capex	10120	.346	.254	.131	.28	.557
PPE	10120	.531	.449	.083	.482	.887
WorkCap	10120	.12	.142	.003	.096	.213
Profit Margin	10120	.076	.19	.031	.072	.124
RE	10120	.274	.302	.098	.276	.438
Asset Turnover	10120	.263	.198	.131	.21	.328
Rating	10120	.985	.12	1	1	1
Inv Grade	10120	.851	.356	1	1	1
Cash_Surprise	10120	.04	.071	.007	.019	.044
RetVol	10120	.021	.014	.012	.017	.025
No Analyst	10120	4.409	4.571	2	3	5

Panel C: Non CDS Firms

	N	Mean	Std. Dev.	p25	Median	p75
Accuracy	31381	-.045	.099	-.04	-.016	-.006
Dispersion	22349	.024	.04	.005	.012	.025
Size	31381	7.858	1.583	6.774	7.76	8.771
ROA	31381	.011	.035	.003	.013	.025
Leverage	31381	.25	.21	.07	.226	.375
MtoB	31381	3.223	4.305	1.407	2.278	3.85
RD	31381	.008	.019	0	0	.009
Cash	31381	.103	.131	.009	.057	.151
Capex	31381	.331	.284	.09	.224	.555
PPE	31381	.432	.488	0	.243	.775
WorkCap	31381	.191	.211	.019	.147	.32
Profit Margin	31381	-.049	1.172	.017	.066	.139
RE	31381	.067	.785	0	.159	.371
Asset Turnover	31381	.231	.186	.105	.181	.297
Rating	31381	.499	.5	0	0	1
Inv Grade	31381	.298	.457	0	0	1
Cash_Surprise	31381	.052	.091	.008	.022	.053
RetVol	31381	.027	.017	.016	.022	.032
No Analyst	31381	3.654	3.757	1	2	4

Table 2 reports the Pearson correlation among variables in Table 1. Consistent with the argument that the correlation between CDS initiation and forecast accuracy is positively correlated, CDS contracts are negatively correlated with the forecasting dispersion, which means analysts disagreement regarding expected cash flows for a given firm decreases with CDS contracts. Consistent with the analysts forecasting literature, the number of analysts and ROA are positively (negatively) correlated with forecasting accuracy (dispersion).

Another important control variable in the analyst forecast literature is cash flow surprise, which is negatively (positively) correlated with forecast accuracy (dispersion), results that are consistent with the literature. Similarly, the number of analysts following is positively (negatively) correlated with forecast accuracy (dispersion).

TABLE 2
PEARSON CORRELATIONS MATRIX

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Accuracy	1.000								
Dispersion	-0.553***	1.000							
CDS_dummy	0.075***	-0.081***	1.000						
Size	0.068***	-0.041***	0.408***	1.000					
ROA	0.202***	-0.252***	0.063***	0.124***	1.000				
Leverage	-0.167***	0.194***	0.059***	0.168***	-0.175***	1.000			
MtoB	0.131***	-0.154***	0.010**	-0.060***	0.121***	-0.035***	1.000		
RD	0.038***	-0.046***	-0.088***	-0.242***	-0.264***	-0.190***	0.160***	1.000	
Cash	0.028***	-0.024***	-0.170***	-0.311***	-0.019***	-0.245***	0.136***	0.389***	1.000
Capex	-0.013***	0.088***	0.023***	0.055***	-0.028***	0.283***	-0.107***	-0.307***	-0.306***
PPE	-0.001	0.063***	0.088***	0.074***	-0.034***	0.214***	-0.075***	-0.218***	-0.231***
WorkCap	0.065***	-0.088***	-0.154***	-0.406***	0.060***	-0.420***	0.095***	0.420***	0.544***
Profit Margin	0.083***	-0.108***	0.052***	0.157***	0.542***	-0.060***	-0.026***	-0.309***	-0.133***
RE	0.108***	-0.133***	0.127***	0.241***	0.416***	-0.189***	0.016***	-0.430***	-0.186***
Asset Turnover	0.023***	-0.039***	0.073***	-0.129***	0.209***	-0.162***	0.082***	-0.100***	0.039***
Rating	0.035***	-0.014**	0.430***	0.604***	0.030***	0.336***	-0.053***	-0.248***	-0.311***
Inv Grade	0.145***	-0.155***	0.480***	0.631***	0.123***	0.047***	0.017***	-0.145***	-0.232***
Cash_Surprise	-0.503***	0.349***	-0.056***	-0.092***	-0.161***	0.162***	-0.120***	-0.031***	0.017***
RetVol	-0.309***	0.312***	-0.142***	-0.296***	-0.229***	0.021***	-0.080***	0.092***	0.116***
No Analyst	0.104***	-0.051***	0.081***	0.232***	0.026***	0.031***	-0.005	-0.112***	-0.113***

(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1.000								
0.723***	1.000							
-0.443***	-0.322***	1.000						
0.029***	0.018***	-0.113***	1.000					
0.034***	0.022***	-0.064***	0.344***	1.000				
-0.159***	-0.106***	0.154***	0.087***	0.115***	1.000			
0.117***	0.152***	-0.365***	0.088***	0.128***	-0.036***	1.000		
-0.001	0.062***	-0.261***	0.090***	0.206***	-0.012**	0.687***	1.000	
0.075***	0.058***	-0.034***	-0.072***	-0.141***	0.025***	-0.022***	-0.173***	1.000
0.015***	-0.017***	0.095***	-0.136***	-0.183***	0.006	-0.182***	-0.305***	0.206***
0.405***	0.354***	-0.179***	0.037***	0.065***	-0.171***	0.175***	0.154***	-0.042***

(19)	(20)
1.000	
-0.036***	1.000

Table 3, column 1 reports regression results on the effect of CDS initiation on analyst forecast accuracy, and column 2 reports regression results on the change of analyst forecast dispersion around the CDS initiation for the full sample. Consistent with Hypothesis 1a, the coefficient on CDS_dummy is statistically significant and positive (column 1), implying that CDS initiation provides additional information that can be used by analysts to provide more accurate cash flow forecasts. Consistent with Hypothesis 1b, the coefficient on CDS_dummy is statistically significant and negative (column 2), implying that the standard deviation among analysts' cash flow forecasts should decrease with CDS initiation. These results support Hypothesis 1 and suggest that the CDS market provides additional information that analysts can benefit from in their cash flow forecasts.

The coefficient results for the other control variables are consistent with previous literature (Hope, 2002 and Govindaraj et al., 2022). The number of analysts following a firm is positively (negatively) correlated with forecast accuracy (dispersion). Return volatility is negatively (positively) associated with forecast accuracy (dispersion), consistent with the argument that firms with higher certainty have higher volatility, which makes forecasting harder and increases disagreement among financial analysts. As expected, the association between cash surprise and forecast accuracy (dispersion) is negative (positive).

TABLE 3
THE RELATION BETWEEN CDS INITIATION AND ANALYST FORECAST PROPERTIES

VARIABLES	(1) Accuracy	(2) Dispersion
CDS_dummy	0.004***	-0.003***
	(2.342)	(-3.201)
Size	-0.002***	0.002***
	(-2.042)	(4.969)
ROA	0.228***	-0.174***
	(7.358)	(-10.421)
Leverage	-0.036***	0.020***
	(-6.553)	(6.407)
MtoB	0.001***	-0.001***
	(4.502)	(-6.926)
RD	0.115***	-0.064***
	(1.833)	(-2.100)
Cash	0.024***	0.003
	(3.341)	(0.917)
Capex	0.004	0.002
	(0.657)	(0.601)
PPE	0.000	0.001
	(0.157)	(0.666)
WorkCap	0.009	-0.005***
	(1.302)	(-1.770)
Profit_Margin	-0.000	0.000
	(-0.125)	(0.307)
RE	-0.004***	0.001
	(-1.981)	(1.072)
Asset_Turnover	0.006	0.004
	(1.060)	(1.195)
Rating	0.008***	-0.001
	(2.603)	(-0.394)

VARIABLES	(1) Accuracy	(2) Dispersion
Inv_Grade	0.000	-0.005***
	(0.069)	(-3.715)
Cash_Surprise	-0.445***	0.113***
	(-17.801)	(10.202)
RetVol	-1.151***	0.533***
	(-15.488)	(16.727)
No_Analyst	0.001***	-0.0003***
	(6.362)	(-2.979)
Constant	0.009	-0.010***
	(0.707)	(-1.843)
Observations	41,501	30,700
R-squared	0.343	0.268
Time FE	Yes	Yes
Industry FE	Yes	Yes

Next, we use propensity score matching to identify the treatment and control groups to address any systematic differences between CDS firms and non-CDS firms. Table 4 presents the regression results on the change of analyst forecast properties around the CDS initiation for the matched sample. Table 4, column 1 reports the regression result for forecast accuracy. As discussed in the hypothesis development section, the coefficient for CDS_dummy is positive. It is consistent with the argument that CDS initiation improves the firm's information environment, and analysts can benefit from the CDS contracts and provide more accurate cash flow forecasts. Additionally, Table 4, column 2 reports the regression result for forecast dispersion. The coefficient of the interested variable CDS_dummy is negative and statistically significant. It is also consistent with the argument that CDS initiation improves and clarifies the firm's information environment, and disagreement among analysts becomes smaller.

Additionally, for other control variables, we also find consistent results with previous literature. For instance, the number of analysts following is positively (negatively) correlated with forecast accuracy (dispersion), which is consistent with Chang et al. (2015). The coefficient of return volatility is negative in column 1, implying that it is hard for an analyst to provide accurate forecasts in a highly uncertain information environment. Consistent with Batta et al. (2015), investment grade is statistically and negatively related to forecasting dispersion. It implies that analysts have less disagreement with firms with less uncertainty.

TABLE 4
PROPENSITY SCORE MATCHING

Variable	Accuracy Coeff. Est.	p-value	Dispersion Coeff. Est.	p-value
CDS_dummy	0.00424***	(0.00144)	-0.00321***	(0.000812)
Size	-0.00142*	(0.000740)	0.00233***	(0.000397)
ROA	0.239***	(0.0322)	-0.178***	(0.0176)
Leverage	-0.0311***	(0.00547)	0.0185***	(0.00323)
MB	0.000798***	(0.000183)	-0.000568***	(8.79e-05)
RD	0.114*	(0.0665)	-0.0732**	(0.0304)
Cash	0.0165**	(0.00698)	0.00163	(0.00331)
CAPEX	0.0126*	(0.00678)	-0.00294	(0.00369)

Variable	Accuracy Coeff. Est.	p-value	Dispersion Coeff. Est.	p-value
PPE	-0.000522	(0.00292)	0.00145	(0.00140)
Working_CAP	0.0131***	(0.00492)	-0.00486*	(0.00292)
Profit_Margin	-0.000279	(0.00149)	7.57e-05	(0.000520)
RE	-0.00398**	(0.00198)	0.000620	(0.000611)
Asset_Turnover	-0.00425	(0.00519)	0.00935***	(0.00291)
Rating	0.00692**	(0.00281)	-0.000766	(0.00154)
Inv_Grade	-0.00109	(0.00241)	-0.00431***	(0.00125)
Cash_Surprise	-0.424***	(0.0258)	0.120***	(0.0121)
Return_Vol	-1.097***	(0.0795)	0.512***	(0.0323)
No_Analyst	0.00134***	(0.000235)	-0.000297***	(0.000104)
Constant	0.0407***	(0.00905)	-0.0132***	(0.00478)
Time FE	Yes		Yes	
Industry FE	Yes		Yes	
Observations	37,379		27,850	
R-squared	0.347		0.270	

Next, we examine the association between the CDS price and CDS price changes and forecast properties. The main interested variable is CDS_price in model (3) and CDS_price_change in model (4). We expect to find negative (positive) relation between CDS_price and forecast accuracy (dispersion). To examine whether the information provided by CDS prices varies among the CDS firms, we use the subsample that includes only CDS firms. Table 5 represents the regression results for forecast accuracy and dispersion. As expected from hypothesis 2a, CDS price is negatively related to forecasting accuracy. These results show that CDS price levels provide information about the distribution of future cash flows, and this information suggests that cash flow forecasts will become harder for firms with high CDS prices.

TABLE 5
THE RELATION BETWEEN CDS PRICES AND ANALYST FORECAST PROPERTIES

VARIABLES	(1) Accuracy	(2) Dispersion
CDS_price	-0.824***	0.367***
	(-6.291)	(5.291)
Size	-0.002***	0.002***
	(-1.713)	(2.438)
ROA	0.231***	-0.191***
	(2.878)	(-4.761)
Leverage	-0.010	0.005
	(-1.034)	(1.054)
MtoB	0.000***	-0.000***
	(2.369)	(-2.956)
RD	-0.081	0.059
	(-1.075)	(1.032)
Cash	0.026***	0.001
	(2.234)	(0.133)
Capex	0.008	-0.001
	(0.916)	(-0.208)

VARIABLES	(1) Accuracy	(2) Dispersion
PPE	-0.002	0.002***
	(-0.534)	(1.773)
WorkCap	0.003	-0.004
	(0.388)	(-1.196)
Profit_Margin	-0.004	0.007***
	(-0.549)	(2.458)
RE	-0.006	-0.001
	(-1.605)	(-0.381)
Asset_Turnover	-0.009***	0.008***
	(-1.730)	(2.675)
Rating	0.001	-0.001
	(0.060)	(-0.210)
Inv_Grade	-0.007	-0.001
	(-1.612)	(-0.344)
Cash_Surprise	-0.266***	0.064***
	(-6.846)	(4.846)
RetVol	-0.455***	0.207***
	(-4.263)	(4.657)
No_Analyst	0.001***	-0.000
	(2.486)	(-0.057)
Constant	0.024	-0.013***
	(1.546)	(-1.845)
Observations	10,120	8,351
R-squared	0.408	0.337
Time FE	Yes	Yes
Industry FE	Yes	Yes

Following Hypothesis 3, we examine the effect of CDS price changes on cash flow forecast properties. We examine whether the analyst forecast accuracy and dispersion change vary with CDS price changes. The variable of interest is CDS_price_change, and we expect to find a negative (positive) relation between CDS_price_change and forecast accuracy (dispersion). Table 6 presents the regression results for forecast accuracy and dispersion. Column 1, the regression coefficient of CDS_Price_Change is negative and statistically significant. The regression results show that CDS price changes negatively affect forecast accuracy.

CDS price change is positively related to forecasting dispersion. When the CDS price increases, the different opinions among analysts will rise.

TABLE 6
THE RELATION BETWEEN CDS PRICE CHANGES AND ANALYST FORECAST PROPERTIES

VARIABLES	(1) Accuracy	(2) Dispersion
CDS_price_change	-0.505***	0.131***
	(-5.482)	(2.018)
Size	-0.002	0.001***
	(-1.519)	(2.058)
ROA	0.292***	-0.214***
	(2.888)	(-4.673)
Leverage	-0.033***	0.016***
	(-3.035)	(2.455)
MtoB	0.001***	-0.000***
	(3.163)	(-3.544)
RD	-0.105	0.077
	(-1.048)	(1.110)
Cash	0.008	0.009
	(0.646)	(1.523)
Capex	0.001	0.001
	(0.060)	(0.296)
PPE	0.000	0.002
	(0.012)	(1.350)
WorkCap	0.001	-0.006
	(0.178)	(-1.556)
Profit_Margin	-0.005	0.008***
	(-0.504)	(2.600)
RE	-0.003	-0.001
	(-0.716)	(-0.439)
Asset_Turnover	-0.011***	0.009***
	(-2.065)	(3.100)
Rating	-0.013	0.006
	(-1.440)	(1.625)
Inv_Grade	0.009***	-0.008***
	(1.976)	(-3.991)
Cash_Surprise	-0.365***	0.098***
	(-7.485)	(5.925)
RetVol	-0.664***	0.318***
	(-5.334)	(5.815)
No_Analyst	0.001***	-0.000
	(2.241)	(-0.054)
Constant	0.027***	-0.013
	(1.711)	(-1.577)
Observations	10,120	8,351
R-squared	0.399	0.302
Time FE	Yes	Yes
Industry FE	Yes	Yes

While this paper uses 5-year CDS prices in every analysis to be consistent with the prior literature, we also use from 1-year CDS spreads to 10-year CDS spreads in order to examine the fluctuations in different spread maturities. Bhat et al. (2013,2014) also uses different CDS price maturities to investigate whether their results change across the CDS price maturities and find that their results do not change. However, accounting treatments are more likely to affect shorter CDS maturities, so the information revealed by CDS prices might be different between short-maturity CDS and long-maturity CDS. Therefore, we repeat the analysis by using different CDS maturities. The results do not vary across different CDS maturities. We find that 1-year to 10-year CDS initiations are positively (negatively) related to cash flow forecast accuracy (dispersion). Additionally, we use 1-year to 10-year CDS prices and price changes to repeat model 3 and model 4. The findings do not change, and all CDS maturities provide information about the distribution of future cash flows. Finally, we do not regress the same models using 6 months, 1-year, 2-year, and 4-year as observations are limited for these maturities.

CONCLUSION

The primary goal of this paper is to examine the information flow from the CDS market to the financial analysts' forecast characteristics. Previous research has analyzed the implications of the initiation of CDS contracts for analysts' earnings forecast characteristics (Batta et al. 2016). Using cash flow forecasts for the 2001- 2017 period, we first analyze the effect of the initiation of CDS contracts on analyst cash flow characteristics. Using forecast accuracy and dispersion as a proxy for analyst forecast characteristics, we find that initiation of CDS contracts improves analyst cash flow forecast accuracy and mitigates disagreements among analysts. These findings are consistent with the argument that the CDS market improves the information environment of the reference entity, and analysts can benefit from this additional information.

Next, having confirmed that the CDS market conveys additional information, which is decision-useful for financial analysts, we focus on firms with CDS contracts only. We examine how CDS prices and CDS price changes affect analyst forecast characteristics. The results indicate that the information revealed by CDS prices and CDS price changes vary among CDS firms and contribute to improve accuracy and reduce dispersion among analysts covering CDS firms. Additionally, we use several CDS contracts to confirm whether there is a change among the different CDS maturities, such as 1-year, 3-year, 7-year, and 10-year, from our sample using 5-year CDS prices. The results are consistent, thus using different CDS maturities does not change the main effect.

ENDNOTES

1. Zhang (2006) shows that greater information uncertainty predicts more positive forecast errors and subsequent forecast revisions following good news, and more negative forecast errors and subsequent forecast revisions following bad news.
2. A CDS contract is written on a specific firm, also known as reference entity that is not a part of the contract.
3. Call et al. 2009, provide more information about analyst cash flow forecasts.
4. Modified Restructuring (MR) is a credit event clause, which was introduced in the 2001 by ISDA Credit Derivatives Definitions ("The Restructuring Supplement"). Under modified restructuring clause, any restructuring is still defined as a credit event. However, the only difference is deliverable obligations. They are limited to those within 30 months of maturity. (Augustin et al, 2014).

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APPENDIX: VARIABLE DEFINITIONS

Variable	Definition
Accuracy	The absolute value of the difference between the actual EPS and the median of the last estimate given by analysts following a firm that were made within 90 calendar days of the earnings announcement, scaled by the price per share as of the end of the fiscal quarter.
Dispersion	The standard deviation of the last estimate given by analysts following a firm that was made within 90 calendar days of the earnings announcement, scaled by the price per share as of the end of the fiscal quarter.
CDS_dummy	A dummy variable equal to 1 if a firm has active CDS trading by quarter t, and 0 otherwise.
CDS_price	Daily composite five-year CDS premium in basis points.
CDS_price_change	Daily five-year CDS premium changes 3 days before the analyst forecasts.
Size	Size is defined as the natural logarithm of total assets (AT).
ROA	Net income before extraordinary items and discontinued operations (IBQ), scaled by beginning total assets (ATQ).
Leverage	The book value of debt (DLCQ þ 0.5 3 DLTTQ) divided by the sum of the book value of debt and the market value of equity.
MtoB	The book value of total assets minus the book value of equity plus the market value of equity as the numerator of the ratio and the book value of assets as the denominator (AT-CEQ + CSHO*PRCC_F)/AT.
RD	Research and development expense (XRD), scaled by operating expenses (XOPR) and divided by 4.
Cash	Cash and short-term investments (CHEQ), scaled by beginning total assets (ATQ)

Capex	Quarterly purchases of property, plant, and equipment (computed from CAPEXY), scaled by beginning total assets (ATQ)
PPE	Property, plant, and equipment (PPENTQ), scaled by beginning total assets (ATQ)
Work_Cap	Cash and short-term investments (CHEQ), inventory (INVTQ), net receivables (RECTQ), and other current assets (ACOQ), less accounts payable (APQ), debt in current liabilities (DLCQ), taxes payable (TXPQ), and other current liabilities (LCOQ), scaled by beginning total assets (ATQ).
Profit_Margin	Net income divided by sales.
RE	Retained earnings (REQ), scaled by beginning total assets (ATQ)
Asset_Turnover	Sales (SALEQ), scaled by beginning total assets (ATQ).
Rating	A dummy variable equal to 1 if a firm has an active long-term S&P issuer-level credit rating, and 0 otherwise
Inv_Grade	A dummy variable equal to 1 if a firm has a long-term S&P issuer-level credit rating above BBþ, and 0 otherwise.
Cash_Surprise	is the absolute value of the difference between cash flows at quarter t and t-1, divided by stock price at the beginning of quarter t.
Ret_Vol	The firm's standard deviation of monthly buy and hold stock return measured over time t.
No_Analyst	The number of analysts issuing estimates within 90 calendar days of the earnings announcement

All continuous variables are winsorized at the 1% level