Relationship between Bulgarian sovereign credit risk and accounting information

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Abstract: We examine the linkages between accounting information and credit default swap spread in Bulgaria. This paper employs a panel data approach including OLS model and VAR model. We use sovereign credit default swap spread data for the period reaching from the first quarter of 2009 to the fourth quarter of 2016. We apply 3 month Euribor rate as an indicator for risk- free rate. The final sample consists of twenty separate corporate entities from various industries in Bulgaria. The results reveal that accounting information is a relevant source of information to the credit markets. So we may conclude that accounting information is proved to provide incremental influence to the probability of default in Bulgaria. Moreover, CDS spreads has a significant relationship with other accounting and market variables.

Key-Words: - accounting information, sovereign CDS, panel data, capital markets

1 Introduction

Bulgarian capital market is a developing one and in the process of its development, people and investors should learn more about risk, credit risk management, and their relation to the rules of the listed companies and agencies. Many factors may provoke a change in stock prices: financial and monetary policies, macroeconomic conditions, investors' expectations and country's sovereign credit risk. According to Wang, Fu & Luo [36] enterprise stock price is a comprehensive reflection of the company's future profit. Accepting sovereign CDS spreads as measurements of investment expectations regarding the development of Bulgarian capital market, we review the role of accounting information in CDS pricing because the accounting data may help investors make the most effective decision. The aim will be accomplished by creating an empirical model, based on the theoretical ones, including a panel data approach, several accounting variables, which are expected to have an impact on CDS spreads.

Methodological and theoretical basis of the research can be formulated in the following sequence:

1. Theoretical analysis whose basis are the structural, reduced and the hybrid - form approaches and other research results in determining default and credit default spreads by accounting variables;
2. Development and implementation of practical econometric models. The analysis which reflects the quantitative results of the application of econometric methodology is based on the Method of least squares with dummy variable and VAR;

Restrictive conditions of this research are determined in the following aspects:

1. Time range-this research is restricted in the time interval from 1st January 2009 to 31th December 2016;

2. Methodological restrictions – they are set by the statistical properties of the researched data imposing the application of specific econometric tests and models giving opportunity for the reflection. The proposed and used methodology does not claim to be the only possible and applicable when inspecting and proving the research thesis of this study.
3. Place restrictions – the analysis and the inspection of the research thesis are concentrated on Bulgarian financial market.
4. Due to the aforementioned facts, conclusions drawn of this research do not engage processes and circumstances of other markets of the category of Bulgaria.

The paper is organized in the following way. The first section initiates with the introduction. Section 2 summarizes the literature review. Section 3 discusses the data and the research methods employed. Section 4 shows the main estimation results. The final section provides summary and conclusions.

2 Literature review

Understanding and defying determinants of credit spreads is vital for successful credit risk management by financial analysts, financial traders and economic policy makers. In the literature several methods which are focused on revealing determinants of credit default swap spreads are explored. We accept CDS as a financial instrument which is appropriate for effective management with credit risk. It exists researches that reveal that equity markets lead the CDS one in credit price discovery [21, 22, 31]. On the other hand accounting data and their relationship with equity market is explored. In their research Ball and Brown [4] examine whether stock prices respond to the news of financial statements. They conclude that markets react to information content provided by accounting data and it is useful for investors. Beaver, Clarke and Wright [6] prove that accounting data is an important informational source for equity investors. Their findings are in line with the Capital Asset Pricing Model (CAPM), namely: the greater abnormal return, the stronger stock price reaction. Another approach tries to explain the relationship between accounting data and its ability to predict default and bankruptcies [2, 23, 32]. Demirovic and Thomas [15] reveal that accounting measures are important instruments for measuring credit risk variance. Duffie and Lando [17] explore a model, by which they apply accounting information as a determinant in credit risk pricing. Their results are supported by the research results of Callen, Livnat and Segal [9] and Das, Hanouna and Sarin [12]. They prove that accounting data has a significant role in CDS pricing and the determine CDS premiums as measurements for credit risk.

Exploring the relationship between accounting area and CDS spreads is a topic which is gaining more attention. Chakravarty [10] proves that CDS prices are in a negative correlation with the optional accounting conservatism.

The literature proposes three approaches which explain pricing of credit risk: Structural approach used by Merton [8, 28, 29, 37]; Reduced approach [16, 26, 27] and a Hybrid approach.

The structural approach, used by Merton [29], Black and Cox [8], Longstaff and Schwarts [28] and Zhou [38], has defined default as an increasing function of leverage. O'Kane and Turmball [33], today's structural models are based on Merton's invented in 1974. For default estimation, Merton has used asset value and asset volatility. The Merton's model assumes that default occurs when the value of firm's assets decreases below the value of its debt. Dafult may occure at the maturity of the debt, so the reference entity may be either solvent or insolvent. Black and Cox [8] have developed a model, based on the structural approach. They determine default realization when the firm's assets fall below a threshold. According to structural approach default may be defined as a function of leverage, volatility, risk- free- rate and firm's assets. According to the conclusions of the structural model accounting information is not determining CDS pricing.On the other hand reduced form model defines default as an unexpected and unpredictable event. Jarrow and Turnbull [26], Jarrow et al [27] and Duffie and Singleton [16] consider that default is the result of a random jump process without a specific reason for it. According to reduces form models, credit spread may be considered as a function of the following variables: probability of default, recovery rate and risk- free asset's yield. Das [14], Das and Sundaram [13], Hull and White [25] consider that exogenously postulate the dynamics of probabilities of default. This means that earnings cannot influence directly on CDS pricing.

Some researchers consider that both structural and reduced approaches have failed to fully reveal all the credit spread variations. [11, 24]. The hybrid approach developed by Duffie and Lando [17], determines default as a function of the firm's capital structure and firm's asset value. Callen, Livnat and Segal [9] determine accounting information in the hybrid model as a quiet abstract because of the lack of specific accounting variables in the Duffie and Lando's model. However, Duffie and Lando conclude that their approach may be extended to accommodate other

variables for accounting information. The hybrid model determines accounting information transparency: earnings, cash flows as determinants of CDS pricing. Yu [37] and Duffie and Lando [17] reveal that accounting information is a relevant informational source for holders debt capital.

The regression approach of Collin- Dufresne et al. [11] tries to identify theoretical determinants of credit risk, either. It estimates bond yield spread by independent variables which measure corporate credit spread. Aunon- Nerin et al. [3], Benkert [7], Abid and Naifar [1], Ericsson [18], Batta [5] and Das et al. [12] investigate pricing CDS premium by a regression approach, either. Benkert [7] explore CDS pricing process by the following variables: earnings to sales, earnings to interest, leverage and volatility. He exposes that earning variables possess positive influence on CDS premiums.

3 Methodology and data

In this paper, we analyze the relation between accounting information and sovereign CDS in Bulgaria. We use data with quarterly frequency. The examined period is from 1st January 2009 to 31th December 2016.

3.1 Financial variables

- *CDS spreads* - sovereign credit default swap (CDS) spread is a variable denoted in Euro, obtained from Thomson Data Stream. After the financial crisis of 2007, it has been revealed the importance of debt markets for functioning of the financial system and the financing of public corporations. CDS spreads resemble to insurance premiums and it reflects market perception about risk of default or other „credit event" related to reference entity [19]. That is the main reason for choosing sovereign CDS within debt markets. In this paper we focus on the sovereign credit default swap market. In the case of sovereign CDS, the country's credit risk should be transferred between CDS buyers and CDS sellers. During the financial crisis and the sovereign debt crisis, many European countries have been under pressure to raise funds to finance fast growing fiscal deficits, so this provoked many investors to insure against losses on holding sovereign debt.
- *Risk- free rate* - According to Merton's model (structural approach), default is determined by risk- free rate. Risk- free rate, firm growth and the default probability are in a strong relationship. Increasing both variables- the risk- free rate and the firm growth-leads to reduction of the default probability. We have included risk- free rate as a credit default swap spread determinant not only because of stuctural approach, but because of Fontana and Scheicher's [20] research results. They explore its influence in highly distressed countries in Europe- just the same as ours- Bulgaria, Romania, Portugal, Italy, Ireland, Greece and Spain. We include risk- free rate as a control variable i.e. to regulate for time clustering in the data. Our regression model follows the one of Das et al. [12]. The risk- free rate is included as a proxy for macroeconomic environment. We apply 3 month Euribor rate as an indicator for risk- free rate. The Euro Inter Bank Offered Rate is the rate at which major European banks borrow funds from each other with maturity from one week to twelve months. The 3- month Euribor data is obtained from the database of the European Central Bank.

3.2 Accounting variables

This paper uses accounting variables for firm size, profitability, leverage, liquidity, asset utilization, consecutive losses and current asset utilization. Ratios and measures were chosen on the basis of their popularity in assessing credit worthiness in prior literature and on the availability of data. The accounting information was taken from the financial reports of the examined firms. Additionally, Bulgarian capital market requires its listed issuers to disclose detailed quarterly financial reports. Thus, all accounting data was acquired from the website of the Bulgarian stock exchange (BSE). Using the accounting information from the financial reports we calculate the following variables for each of the twenty analyzed Bulgarian companies:

- *Firm size* – it is the natural logarithm of the value of total assets. What is more, Vassalou and Xing [34] note that firm size is an important factor in the determination of a company's credit risk.
- *Leverage* – firms' leverage is measured as total liabilities divided by total assets. Basing on Merton's model [29], we imply that leverage ratio is one of the main determinants of the probability of default. Leverage is one of the variables that has been revealed to assure for financial distress to stock returns and volatilities. Logically, a higher value of leverage coefficient leads to an increased level of credit risk. Consequently, we expect that increased levels of leverage will be associated negatively with the CDS spreads. The

more levered the firm, the higher probability of default.

- *Liquidity* – we use the cash-to-assets ratio and current ratio to estimate the liquidity of the sample companies. The cash-to-assets ratio is the current value of marketable securities and cash, divided by the current liabilities. On the other hand, the current ratio is measured as current liabilities divided by current assets. Here, again, it is expected that liquidity has a negative coefficient in the OLS regression.
- *Profitability* – we calculate ROA (return on assets) and EBIT-margin (Earnings before interests and taxes divided by sales). The formula for the ROA is the following: Earnings / total assets. Das et al. [12] establish that return on assets is a statistically significant factor in the fluctuation in CDS spreads. Increase in profitability of a corporation should lead to reduction its credit risk, because of the fact that the increased profitability, the entity is wealthier and probability of default reduces its level.
- *Asset utilization* (SalesAssets) is calculated by dividing sales by total assets. Altman [2] finds that SalesAssets ratiois a very good measure in the valuation of bankruptcy probability combining with other accounting ratios.
- *Consecutive losses* – According to Ohlson [32], consecutive losses are measured as a dummy variable that receives the value one if net income was negative for the last two quarters and zero otherwise. James Ohlson [32] is acknowledged to be the first researcher to conduct a comprehensive study of bankruptcy using logit analysis.
- *Current asset utilization* (SalesCurrent) is measured as sales (WS.Sales) divided by current assets. This ratio is supposed to have a negative effect on the CDS spreads.

Table 1 summarizes the explanatory variables used in the regressions and displays the expected sign for the coefficients as well the type of data that is used.

Table 1. *Independent variables and their expected signs*

	Variables:	*Expected sign:*
Accounting Variables:	Lnsize	Negative -
	Leverage	Positive +
	Cash	Negative -
	Current	Negative -
	ROA	Negative -
	EBIT	Negative -
	SalesAssets	Negative -
	INTWO	Positive +
	SalesCurrent	Negative -
Control Variable:	Risk- free rate	Positive +

Source: Authors' classification based on previous researches.

We analyze 20 separate corporate entities from various industries in Bulgaria. All of the companies included in the sample are public firms that listed their common shares on the Bulgarian stock exchange (BSE). Additionally, stock indices SOFIX and BGBX40 are based on the market capitalization of the issues of common shares of the selected Bulgarian companies.

SOFIX constituents must meet certain minimum criteria for liquidity, market capitalization, free-float and number of shareholders. We examine firms from different sectors - for example: manufacturing, financial and insurance activities; accommodation and food service activities. Here we have to make two remarks. First, we have chosen exactly these twenty firms because all of the necessary accounting information is available for the whole examined post-crisis period that is from 2009 to 2016. Second, the analyzed companies are public ones and BSE requires its listed issuers to disclose detailed quarterly financial reports. What is more, the accounting data was collected and processed as of 15.08.2017.

Table 2 displays all companies included in the sample. Also, the specific sector and subsector of all examined firms are presented.

Table 2. *Sample companies*

Company name	*Sector*	*Subsector*	*Stock index*
Sopharma AD-Sofia	Manufacturing	Manufacture of basic pharmaceutical products and pharmaceutical preparations	SOFIX, BGBX40
Neochim AD-Dimitrovgrad	Manufacturing	Manufacture of chemicals and chemical products	SOFIX, BGBX40
Eurohold Bulgaria AD-Sofia	Financial and insurance activities	Financial service activities, except insurance and pension funding	SOFIX, BGBX40
Industrial Capital Holding AD-Sofia	Financial and insurance activities	Financial service activities, except insurance and pension funding	SOFIX, BGBX40
Bulgarian Real Estate Fund REIT-Sofia	Financial and insurance activities	Financial service activities,	SOFIX, BGBX40

		except insurance and pension funding	
Monbat AD-Sofia	Manufacturing	Manufacture of electrical equipment	SOFIX, BGBX40
M+S Hydraulic AD-Kazanlak	Manufacturing	Manufacture of machinery and equipment n.e.c.	SOFIX, BGBX40
Stara Planina Hold AD-Sofia	Financial and insurance activities	Financial service activities, except insurance and pension funding	SOFIX, BGBX40
Advance Terrafund REIT-Sofia	Financial and insurance activities	Financial service activities, except insurance and pension funding	SOFIX, BGBX40
Albena AD-Albena	Accommodation and food service activities	Food and beverage service activities	SOFIX, BGBX40
Chimimport AD-Sofia	Financial and insurance activities	Financial service activities, except insurance and pension funding	SOFIX, BGBX40
Holding Varna AD-Varna	Financial and insurance activities	Financial service activities, except insurance and pension funding	SOFIX, BGBX40
Alcomet AD-Shumen	Manufacturing	Manufacture of basic metals	SOFIX, BGBX40
Sopharma Properties REIT-Sofia	Financial and insurance activities	Financial service activities, except insurance and pension funding	BGBX40
Yuri Gagarin PLC-Plovdiv	Manufacturing	Printing of reproduction of recorded media	BGBX40
Billboard AD-Sofia	Manufacturing	Printing of reproduction of recorded media	BGBX40
Hydraulic Elements and Systems AD-Yambol	Manufacturing	Manufacture of machinery and equipment n.e.c.	BGBX40
Industrial Holding Bulgaria PLC-Sofia	Financial and insurance activities	Financial service activities, except insurance and pension funding	BGBX40
Elhim Iskra AD-Pazardzhik	Manufacturing	Manufacture of electrical equipment	BGBX40
Aktiv Properties REIT-Plovdiv	Financial and insurance activities	Financial service activities, except insurance and pension funding	BGBX40

Source: Authors' calculations

Notes: Table 2 displays all companies included in the sample and also the specific sector/subsector and the stock index which is based on the market capitalization of the issues of common shares of the examined firms (to 15.08.2017).

3.3 Panel Unit Root Test: Summary

The recent literature suggests that panel-based unit root tests have higher power than unit roots tests based on individual time series. We describe the panel unit root test by the following equation:

$$y_t = p_i y_{it-1} + x_{it}\delta_i + \varepsilon_{it} \qquad (1)$$

Where i=1,2…N cross- section units, which are observed over periods t=1.2…T_i; x_{it}- exogenous variables, including fixed effects or individual trends; p_i- autoregressive coefficient; ε_{it}- errors, which are assumed to be mututally independent idiosyncratic disturbance.

We may conclude that:

1. If $\vdots p_i \vdots < 1, y_i$ is considered to be trend stationary;
2. If $\vdots p_i \vdots = 1, then\ y_i$ contains a unit root. The null hypothesis assumes a common unit root process.

3.4 Vector Autoregressions (VARs)

The vector autoregression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. The VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system.

The mathematical representation of a VAR is the following equation:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + Bx_t + \varepsilon_t \qquad (2)$$

where y_t is a *k* vector of endogenous variables, x_t is a *d* vector of exogenous variables, $A_1,...,A_p$ and *B* are matrices of coefficients to be estimated, and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

Since only lagged values of the endogenous variables appear on the right-hand side of the equations, simultaneity is not an issue and OLS yields consistent estimates. Moreover, even though

the innovations ε_t may be contemporaneously correlated, OLS is efficient and equivalent to GLS since all equations have identical regressors.

3.5 Granger Causality in VAR

The VAR can be considered as a means of conducting causality tests, or more specifically Granger causality tests. Granger causality really implies a correlation between the current value of one variable and the past values of others, it does not mean changes in one variable cause changes in another. By using a F-test to jointly test for the significance of the lags on the explanatory variables, this in effect tests for 'Granger causality' between these variables. It is possible to have causality running from variable X to Y, but not Y to X; from Y to X, but not X to Y and from both Y to X and X to Y, although in this case interpretation of the relationship is difficult. The 'Granger causality' test can also be used as a test for whether a variable is exogenous i.e. if no variables in a model affect a particular variable it can be viewed as exogenous.

3.6 OLS Regression

Ordinary least squares regressionis the prevailing methodology used to test the hypotheses in this paper. The OLS regressions are defined as follows:

$$Y = \beta_1 + \beta_2 X_{2i} + ... + \beta_k X_{ki} + u_i \quad (3)$$

where X_2, X_3 and X_n are independent variables on which variable Y is dependent upon and u is the error term. The OLS regressi on isused to fit Y, X_2, X_3, …, X_k, in a sample of observations,the equation:

$$\hat{Y} = \beta_1 + \beta_2 X_{2i} + ... + \beta_k X_{ki} \quad (4)$$

Where the values of β_1, β_2, …, β_k are fitted into the model so that the sum of the residuals' squares is minimized. Thereby, the OLS regression provides a linear model to estimate the dependent variable Y.

4 Empirical results

The aim with this section is to test the relationship between the accounting information and the CDS spreads in Bulgaria and to explain how well accounting data performs in predicting sovereign default.

4.1 Stationary

Before proceeding to the regression models, we have applyed panel unit root test:Summary. The results indicate that for all of the panel time series level data are not stationary so we have to transform them into first difference. The first differences of the explored variables are trend-stationary so we may conclude that they are integrated in order one. For the estimation of the first diiference of the explored variables, we use the following equation:

$$FirstDiff = \frac{VarValue_{it}}{VarValue_{it-1}} \quad (5)$$

Where:

FirstDiff- the first difference of the explored variable;

$VarValue_{it}$ - the value of the explored variables for the i- th country at moment t;

$VarValue_{it-1}$- the value of the explored variable for the i- th country at the moment t-1.

4.2 OLS Regression model

Because of the fact that CDS prices may incorporate accounting information with a delay, we apply OLS regression by the following equation:

$$CDS_{it=} \alpha + \beta_1 Cash_{it-1} + \beta_2 Current_{it-1} + \beta_3 EBIT_{it-1} + \beta_4 Leverage_{it-1} + \beta_5 LNSIZE_{it-1} + \beta_6 Riskfreerate_{it-1} + \beta_7 ROA_{it-1} + \beta_8 SalesAssets_{it-1} + \beta_9 SalesCurrent_{it-1} + \beta_8 INTWO_{it-1} + \varepsilon_{it} \quad (6)$$

INTWO is a dummy variable that measure consecutive losses. It gets value equal to 1 if net income is negative for two consecutive quarters and its value equal to 0 otherwise.

Table 3. *Accounting variables as determinants of CDS spreads (Dependent variable CDS spreads)*

Variable:	*Expected sign:*	*Coefficient:*	*t- statistic:*	*p-value:*
C		2.429089	3.655254	0.0003
Cash(-1)	Negative	-0.912606	3.446432	0.0006
Current(-1)	Negative	-0.807334	-3.342060	0.0009
EBIT(-1)	Negative	0.001647	0.268314	0.7886
Leverage(-1)	Positive	-17.55491	-1.461979	0.1444
Lnsize(-1)	Negative	0.537354	0.226981	0.8205
Risk- free rate(-1)	Positive	17.43269	5.259675	0.0002
ROA (-1)	Negative	-12.51430	-0.808365	0.4193
SalesAssets(-1)	Negative	-6.833767	-3.750441	0.0002
SalesCurrent (-1)	Negative	-0.358336	-0.965268	0.3349

INTWO	Positive	0.767877	0.369102	0.7122
R- squared	0.073574			
Adjusted R- squared:	0.054782			
F-statistic	3.915239			
Probability	0.000038			

Source: Authors' calculations

The results in table 3 provide that accounting data is able to provide statistical significant influence on CDS spreads. However, the R- squared value denotes that the accounting variables included in the model account for 7.35% of the variance of the CDS spreads. It represents a relative low level of explanatory power. Furthermore four out of the model's 10 explanatory variables are significant at the 1 % level and the variables' predicted signs are in line with the variables' actual signs of the coefficients.

Cash and *Current* are measurements of the operational liquidity and they are statistical significant. Their coefficients have negative signs, just as we have expected. The results suggest that the increased levels of liquidity will associate negatively with the CDS spreads. This suppose that the higher liquidity, the lower probability of sovereign default. It may due to the fact that if the liquidity deteriorates, the risk is exposed to increase. Consequently, the investors require higher CDS spreads in order to be compensated for the less liquidity market.

The *Sales- to- Assets* is the ratio, which is statistically significant, either. It has strong negative influence on CDS pricing, namely- its coefficient's value is (-6.833767). Additionally Sivonen [35] has pointed out that sales- to assets ratio may be accepted as a measurement of the effective usage of firm's assets in order to create sale revenue. He determines it as an indicator of managerial effectiveness, so it should have negative connection with default. These results suggest that liquidity of the explored firms is an important accounting variable in determining default probability when that is combined with other accounting variables. This conclusion is supported by the empirical findings in prior literature [35]. According to Altman's model [2], when combined with other accounting variables, sales- to- assets ratio is a useful indicator in predicting default probability.

Risk- free- rate (Euribor 3m)-is the next statistically significant variable in the regression. Its sign is positive and its actual sign is in line with the predicted one. This is supported by CDS pricing theory, namely an increase in the risk- free rate results in higher CDS spreads. It means that sovereign CDS spreads of Bulgaria are sensitive to its macroeconomic conditions. Risk- free- rate (Euribor 3m) has a large positive effect on the Bulgarian CDS spreads. These explored positive relationship between CDS spreads and risk- free- rate is investigated by Mody [30]. A higher risk- free rate signals for more damaged global environment. Consequently it results into positive relationship between CDS and Euribor: the risk in the risk- free rate should be related to larger spreads on risky assets.

4.3 Vector autoregression model

VAR estimation results with 8 lags shows impacts of lagged variables on the others. Furthermore, we estimate the relationship between accounting information and CDS spread with a VAR model where optimal number of lags is found to be eight according to Akaike information criterion (table 4).

Table 4.*VAR Lag Order Selection Criteria*

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	-4825.941	NA	0.006737	26.21648	26.33306	26.26279
1	-4411.712	801.5162	0.001375	24.62716	26.02615*	25.18291
2	-4180.438	433.7170	0.000758	24.02947	26.71086	25.09465
3	-3755.809	771.0060	0.000147	22.38379	26.34758	23.95840
4	-3436.828	560.1625	5.06e-05	21.31072	26.55691	23.39476
5	-3043.420	667.4063	1.17e-05	19.83426	26.36285	22.42774
6	-2904.779	226.9354	1.08e-05	19.73864	27.54964	22.84155
7	-2468.890	687.5007	2.02e-06	18.03192	27.12532	21.64427
8	-2236.396	352.8368*	1.14e-06*	17.42762*	27.80342	21.54940*

Source: Authors' calculations.

4.3.1 VAR Model with CDS spreads as dependent variable

To examine the relation between accounting data and CDS spreads we apply VAR model. To start with we consider the VAR model with CDS as dependent variable. We can conclude that all the estimates (DCDS(1), DCDS(-2), DCDS(-3), DCDS(-4), DCDS(-5), DCDS(-6), DCDS(-7) and DCDS(-8)) are significant for the estimate for CDS spreads. Additionally, the overall explanatory power of the model is 95.63%. With other words, the dynamics of the CDS in the current moment could be explained with the dynamics of the CDS from the past periods. Considering the statistically significant T-statistics of DCASH(-1) with 2.70143we are allowed to talk about the existence of impacts on DCDS. Consequently, the statistically significant cash to assets ratio is further evidence on the variable's ability to explain CDS spreads.

When considering the VAR model with CDS spread as dependent variable and *Current ratio* as independent variable not much has changed. We find that current ratio from the previous period has an impact on the CDS spread in the current moment due to the statistically significant T-statistics of DCURRENT(-1) with (-3.70613).What is more, an extremely high current ratio can lead to the potential problems in the firms connecting with the firm's management that is not able to invest its surplus cash efficiently.

The VAR model includes two measures of profitability, EBIT and ROA. Based on our finding a negative relationship between DEBIT(-7) - the profitability variableand credit default swap spreads is discovered. R-squared of these variables shows that 0.956303 of changes in DCDS could be explained by these lagged values of indicators.On the other hand, return on assetsratio is one of the two independent variable that is not statistically significant - which further confirms that ROA do not have a significant influence on CDS spreads. Although increasing profitability is an encouraging sign of the company's business operations, the evidence implies that the return on a firm's assets is not of importance in default assessment.

Leverage (lev) in 8^{th} lag is statistically significant, carries a T-statistics -2.02592 and a large coefficient value of (-9.391035).Thus, in addition to statistical significance, this result has some economic significance. Additionally, Ericsson, Jacobs and Oviedo [18] suggest that leverage is perhaps the most relevant element in the probability of default.

On a similar note, firms' size, as measured by the natural logarithm of the value of total assets, influences CDS spreads. DLNSIZE(-4) has a large value of the coefficient (7.038916) and statistically significant T-statistics (2.16478) which leads to the conclusion that its impact on CDS spreads is noteworthy. These findings confirm that the credit markets consider larger firms as less likely to default.In fact, these results are in agreement with results obtained separated by Hillegeist and et. [23] and Vassalou and Xing (34).

Next, sales-to-assets variable (SalesAssets) is statistically significant in 1^{st}, 5^{th}, 6^{th}, 7^{th} and 8thlag considering VAR model.Consequently, the changes in credit default swap spreads could be explained bysales-to-assets variable due to the statistically significant T-statistics. The sales-to-assets ratio is a ratio that measures how well the firm is using its assets in order to make sales revenue. Thus it can be a sing of managerial efficiency and has logically a negative relationship with default. The obtained results confirm that liquidity is a significant variable in determining default probabilities.

In contrast, sales-to-current (SalesCurrent), which measures the current assets utilization rate, is the second independent variable that is not with statistically significant value at the VAR model. With other words, the dynamics ofsales-to-current ratio does not have impact on the dynamics of the CDSs.

Consecutive losses were measured with the dummy variable INTWO. Interesting, we find the existence of a relationship between CDS spreads and INTWO(-2) estimating the VAR model with CDS as dependent variable. Therefore dummy variable INTWO has a predictive power on the dynamics of the CDS.

Finally, statistically significant T-statistics of DRISKFREE(-1) with 7.24335, DRISKFREE(-3) with (-42.4450), DRISKFREE(-4) with 27.2471, DRISKFREE(-5) with (-11.6845), DRISKFREE(-6) with (-2.26299), DRISKFREE(-7) with 5.80420 and DRISKFREE(-8) with 3.55679 allow us to talk about the existence of impacts on DCDS. We find that risk-free rate has a predictive capability for the dynamics of CDS. What is more, it seems reasonable to assume that CDS spreads are really sensitive to macroeconomic conditions. What is more, the macroeconomic sensitivity seems to reduce the somewhat marginal impact of the risk free rate in the pricing of CDSs. Increase in the risk- free- rate increase the expected future growth of the firm causing the market to rely on a higher level of firm value. Consequently, this leads to decrease in the probability of default. The results from the VAR tests, namely the negative signs and influence of risk- free- rate in CDS pricing, are supported by the ones of Fontana and Scheicher [20].They reveal that the risk- free- rate possesses great significance on the highly unstable European economies. The lower interest rates are related to an unstable and weakening economy and it results in increasing credit spreads.

Table 5.*Granger test in VAR*

Dependent variable: DCDS				
Excluded	Chi-sq	df	Prob.	
DCASH	12.32134	8	0.1374	
DCURRENT	17.49588	8	0.0253	$Current \rightarrow CDS$
DEBIT	9.857707	8	0.2752	
DLEV	13.61149	8	0.0925	
DLNSIZE	13.70387	8	0.0898	
DRISKFREE	2897.273	8	0.0000	$Riskfreerate \rightarrow CDS$
DROA	7.471896	8	0.4867	
DSALESASSETS	164.7260	8	0.0000	$SalesAssets \rightarrow CDS$
DSALESCURRENT	32.46549	8	0.0001	$SalesCurrent \rightarrow CDS$

All	4764.546	72	0.0000	

Source: Authors' calculations.

The results from Granger test in autoregressive conditions are presented in table 5 and they confirm the results not only from VAR test, but the ones from OLS regression. We prove that CDS dynamics is influenced by current ratio, risk- free rate, sales assets and sales current at 5 % level of significance. All of the aforementioned accounting variables granger cause CDS in VAR.

4.3.2 VAR Model with CASH/ CURRENT/ EBIT/ LEV/ LNSIZE/ RISKFREE/ ROA/ SALESASSETS/ SALESCURRENT/ INTWO as dependent variable

The picture is different when considering the VAR model with CASH ratio as dependent variable.We see that DCDS does not influence the dynamics of DCashdue to the statistically insignificant values of T-statistics. We reach to identical results when the dependent variable is successively DEBIT, DLEV and DLNSIZE taking into account the statistically insignificant values of T-statistics. Here, we can assume that the changes in these variables could not be explained by CDS spread. In the third column, statistically significant T-statistics of DCDS(-8) with 2.29403 allow us to claim about the existence of impacts on DCURRENT. Therefore, the CDS dynamics can impact the current ratio which measures the liquidity. Further, we note that there is an influence not only from DRISKFREE to DCDS, but also vice versa. What is more, CDS is statistically significant in 2^{nd}, 3^{rd}, 4^{th}, 6^{th}, 7^{th} and 8^{th}lag considering VAR model. We find that the CDS spread dynamics have an impact on the profitability, measured by ROA ratio. Also, statistically significant T-statistics of DCDS(-2) with 2.49462, DCDS(-3) with -2.10856 and DCDS(-5) with 5.80677 is a proof of the existence of impacts on DSALESASSETS, measuring the asset utilization. Finally, the CDS can influence the current asset utilization and consecutive losses.

5 Conclusion and contributions

This paper contributes to prior literature in several ways. First of all, the research explores the relevance of accounting information to debt markets which has not been studied to a large extent.

Secondly, the prior researches on the relationship between credit risk literature and accounting data has concentrated on the U.S markets whereas our research is focused on Bulgarian markets.

To our knowledge this is the first paper which examines the relationship between accounting data and sovereign credit default swap spreads. We reveal that accounting data is a relevant source of information to the credit and debt markets. More precisely, it is proved that our accounting- based model designed to measure the relevance of accounting information in general is able to explain about 7 % of the variation in sovereign CDS spreads. So we may conclude that accounting information is proved to provide incremental influence to the probability of default in Bulgaria.

As a result, this study has shown that CDS spreads has a significant relationship with other accounting and market variables and VAR model is a useful model to make strategic forecasts by using lagged variables. All things considered, liquidity, profitability, leverage, size, risk-free rate, asset utilization and consecutive losses for the twenty Bulgarian firms have an impact on the dynamics of the credit default spread. This study finds convincing evidence that accounting information is a relevant source of information to the credit markets.

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