

SOVEREIGN SECURITY AND RISK MANAGEMENT BY CREDIT DEFAULT SWAPS

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Abstract: This paper explores the importance of credit default swap (CDS) as a tool for credit and sovereign risk management. We prove that although the explored countries are members of the EU, it is the autonomous monetary policy that matters. The increasing importance of the macroprudential approach for maintaining the sustainability of the financial system and the dynamics of CDS in European countries is revealed. Evidence for the existence of the "CDS paradox" phenomenon is proved. The relationship between the CDS and banking sector seems to be sustainable and it creates the prerequisites for the occurrence of "twin crisis" by transferring information flows and shocks from the banking system to the sovereign CDS and vice versa.

Key words: CDS spreads, risk management, sovereign risk, credit risk

1. INTRODUCTION

The occurrence of the global financial crisis and its reflection on European financial markets' stability has put credit default swaps (CDS) into a focus of attention. This paper is exploring the determinants of sovereign credit default swaps in eleven European countries for the following period: 2003- 2016. *This paper aims* to reveal the importance of CDS spreads as a tool for credit and sovereign risk management, defined by revealing their determinants. The aim will be accomplished by applying panel Vector Autoregressive Model and Ordinary Least Regression model, which include several macroeconomic and financial variables, that are expected to have an impact on CDS spreads. We reveal an evidence for the existence of the "CDS paradox" phenomenon. The relationship between the CDS and banking sector seems to create the prerequisites for the occurrence of "twin crisis".

2. LITERATURE REVIEW

Risk management is vital at the micro and macro-level. Article [1] has related the country's probability of default to its sovereign credit spread by exploring macroeconomic determinants. In his study, some of these country-specific determinants are considered as proxies for countries' ability to serve their debts.

A better understanding of the dynamics of sovereign credit spreads in a debt crisis is important because it is during the debt crisis that the sovereign credit spread is more concerned by the public [2]. Work [3] has explored the behavior and determinants of sovereign CDS in emerging markets and found out that CDS fluctuations may be caused by macroeconomic, political, and financial market developments. The overall characteristic of the recent financial crisis has attracted the interest of researchers who reveal the existence of a "CDS paradox": CDSs are derivatives that help for risk transferring, but they concentrate the overall risk due to the increased interconnections in the financial system [4].

It exists positive relationship between Debt/Gross domestic product (GDP) ratio and sovereign CDS spreads [5]. According to paper [6] and paper [7], the political risk may increase sovereign risk and the possibility of falling into state insolvency. Works [8] and [9] confirm these results by concluding that sovereign risk is influenced by the election results. The authors of paper [10] have explored the macroeconomic influence on sovereign and government default probability and his results reveal that inflation effects CDS spread variation. According to the authors of [11], the relationship between inflation and sovereign CDS is vague and non-categorical. and real interest rates requires compensation, which increases the spread of CDS. According to Merton's model (structural approach), the default is determined by the risk-free rate. Many authors [12, 13, 14], explore the mechanism of transferring a bank crisis into debt defining them as "twin crises".

3. METHODOLOGY AND DATA

In this research, we explore eleven European countries: France, Germany, Great Britain, Belgium, Bulgaria, Romania, Greece, Portugal, Ireland, Italy, and Spain. We divide the explored countries into three panels: *Panel 1*- Developed European Countries- it includes France, Germany, the UK, and Belgium; *Panel 2*- it includes Bulgaria and Romania. *Panel 3*- it includes Greece, Portugal, Ireland, Italy, and Spain (PIIGS). The data series are applied by their logged first difference to explore their rate of change. All of the explored variables indicate stationarity at level data. The study is based on evaluating linear regression equation through the method of least squared and it is included in the dummy variable equation. To conduct calculation the dummy variable takes two values - (0) for the pre-crisis and post-crisis periods and (1) for the crisis period. We apply an econometric equation with the following standard form:

$$CDS_{it} = \alpha + \beta_1 CPI_{it} + \beta_2 Debt/GDP_{it} + \beta_3 CA/GDP_{it} + \beta_4 LSMI_{it} + \beta_5 RFR_{it} + \beta_6 NPL_{it} + \beta_7 GFB_{it} + \beta_8 Pol.risk_{it} + \beta_9 (crisis\ 1/0) + \varepsilon_{it} \quad (1)$$

Vector Autoregression Model (VAR) estimates the contemporaneous relationship between the variables, but the VAR methodology is a procedure that gives useful insights for lagged links [15]. The mathematical representation of a VAR is:

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

Table 1. A list of the included variables in the econometric approach

The abbreviation of the explored variables	Variable:	Expected sign:
<i>CPI</i>	<i>Inflation(Consumer Price Index)</i>	<i>Positive +</i>
<i>Debt/ Gross domestic product (GDP)</i>	<i>Gross Consolidated Government Debt/Gross domestic product (GDP)</i>	<i>Positive +</i>
<i>CA/Gross domestic product (GDP)</i>	<i>Current Account/Gross domestic product (GDP)</i>	<i>Negative -</i>
<i>LSMI-Local stock market index</i>	<i>Corresponding Stock Index</i>	<i>Negative -</i>
<i>RFR</i>	<i>Risk- free rate</i>	<i>Negative -</i>
<i>NPL</i>	<i>Non- performing loans</i>	<i>Positive +</i>
<i>GFB</i>	<i>Government Fiscal balance</i>	<i>Negative -</i>
<i>Polrisk</i>	<i>Political risk</i>	<i>Negative -</i>

4. EMPIRICAL RESULTS

In Table 2 and Table 3 we reveal the results from the applied Ordinary Least Squares regression for developed countries. High inflation rates indicate economic instability, while low inflation rates are indicative of a robust monetary policy. The negative sign of RFR indicates that rising 3-m Euribor values may trigger an increase in interest rates, which corresponds to lower option prices and therefore a negative impact on the size of the sovereign credit risk. Lower interest rates indicate a weakening economy and thus lead to higher credit spreads. An increase in CA/GDP ratio reduces the dependence of countries on foreign savings, which reduces their external debt, default probability, and CDS.

In Table 2 the increase in the value of the Debt/GDP variable corresponds to an increase in the likelihood of a liquidity crisis, relying on the expectation that high levels of indebtedness significantly increase the probability of insolvency. Well-developed and functioning capital markets can stimulate economic growth and reduce CDS spreads. In a period of a financial and debt crisis, the positive influence of the following variables is increased: Inflation and Debt/GDP. The increase in their values, with the negative impact and consequences of the development of the financial crisis, increases the likelihood of the countries' insolvency.

Table 2. Results from Ordinary Least Squares Regression for Developed Countries with Dependent Variable- CDS and Dummy variable Crisis=1

Variable	Exp. sign	Coeff.	St. Error	t- statistics	p-value
<i>C</i>		1.259105	0.617479	2.039105	0.0006
<i>CPI</i>	Positive	0.511004	0.208877	2.446438	0.0021
<i>RFR</i>	Negative	-0.807334	0.241568	-3.342060	0.0009
<i>NPL</i>	Positive	0.825017	4.377398	0.188472	0.5728
<i>GFB</i>	Negative	-0.472681	0.558601	-0.846189	0.2759
<i>CA/GDP</i>	Positive	-0.138104	0.054671	-2.526071	0.0007
<i>Debt</i>	Positive	0.432069	0.082147	5.259675	0.0000
<i>Polrisk</i>	Negative	-0.470425	0.208272	-2.258704	0.0015
<i>LSMI</i>	Negative	-0.948024	0.246130	-3.851726	0.0000
<i>Crisis= 1</i>	Positive	2.82057	1.390709	2.028152	0.0053
<i>R- squared</i>	0.818427				
<i>Adjusted R-squared</i>	0.741835				

In Table 3 the negative sign of the crisis = 0 not only reduces the value of CDS spreads but also affects the dynamics of the other variables in the model. Dummy variable crisis=0 reduces the influence of the Debt/GDP ratio variable. Crisis=0 reduces inflation, either. From the results in Table 3, inflation and Debt/GDP have a positive impact on CDS spread, but their specificity of influence is neutralized by the impact of a stable or recovering economy.

Table 3. Results from Ordinary Least Squares Regression for Developed Countries with Dependent Variable-CDS and Dummy variable Crisis=0

Variable	Exp. Sign	Coeff.	St. Err	t statistic	p-value
<i>C</i>		3.028425	0.932253	3.248501	0.0001
<i>CPI</i>	Positive	0.511004	0.208877	2.446438	0.0021
<i>RFR</i>	Positive	-0.807334	0.241568	-3.342060	0.0009
<i>NPL</i>	Positive	0.825017	4.377398	0.188472	0.5728
<i>GFB</i>	Negative	0.472681	0.550860	0.846189	0.2759
<i>CA/GDP</i>	Negative	-0.138104	0.054671	-2.526071	0.0007
<i>Debt</i>	Positive	0.432069	0.082147	5.259675	0.0000
<i>Polrisk</i>	Negative	-0.470425	0.208272	-2.258704	0.0015
<i>LSMI</i>	Negative	-0.948024	0.240613	-3.851726	0.0000
<i>Crisis= 0</i>	Negative	-2.82057	1.390709	-2.028152	0.0053
<i>R- squared</i>	0.818427				
<i>Adj.Rsquared:</i>	0.741835				

Tables 4 and 5 reveal the results from Ordinary Least Squares for Panel 2. Dummy variable *Crisis* (*crisis=1/0*) is not statistically significant. This indicates that the financial crisis does not have a significant impact on the dynamics of

sovereign CDS spreads of non-euro area countries during the explored period. CDS is determined by the following statistically significant variables: RFR, NPL, political risk index, and LCMI.

Table 4. Results from Ordinary Least Squares Regression for Bulgaria and Romania with Dependent Variable-CDS and Dummy variable Crisis=1

Variable	Exp.Sign	Coefficient	St.Error	t-statistic	p-value
<i>C</i>		2.818502	0.699709	4.028105	0.0000
<i>CPI</i>	<i>Positive</i>	0.510681	0.333988	1.529042	0.5491
<i>RFR</i>	<i>Negative</i>	-0.250816	0.097571	-2.570613	0.0012
<i>NPL</i>	<i>Positive</i>	0.915802	0.193818	4.725061	0.0002
<i>GFB</i>	<i>Negative</i>	0.259101	0.507419	0.510625	0.6152
<i>CA/GDP</i>	<i>Negative</i>	-0.286705	0.223881	-1.280615	0.1028
<i>Debt</i>	<i>Positive</i>	1.206805	0.50416	0.481920	0.8436
<i>Polrisk</i>	<i>Negative</i>	-0.050612	0.020083	-2.520087	0.0004
<i>LSMI</i>	<i>Negative</i>	-0.095104	0.046188	-2.059046	0.0017
<i>Crisis=1</i>	<i>Positive</i>	0.008521	0.010323	0.825405	0.5805
R-squared	0.580281				
Adj.R-squared	0.571824				

Based on the results in Table 5, we can conclude that for non-euro area countries, capital markets can predict sovereign economic activity. The Political risk index has a weaker negative impact on sovereign CDS spreads for Bulgaria and Romania compared to the same interaction for developed countries from Panel 1. The difference may be explained by the fact that a more stable political system lessens significantly the probability of default. During this period, Germany and France have increased their political stability ratings by reducing the weight of corruption, increasing the business indicator, financial and commercial freedom, and increasing the justice level. Risk-free-rate is a statistically significant variable with a weight of its coefficient (-0.250816). This result confirms that lower interest rates alarm for a weakening and vulnerable economy which leads to higher and expanding credit spreads. The influence of the aforementioned variables is neutralized by the influence of the banking sector in Bulgaria and Romania.

Tables 6 and 7 reveal the results for Panel 3 countries. In Table 6 we reveal that the higher risk-free rate corresponds to an increase in the value of the CDS spread. As an explanation of these results, we can assume that a higher risk-free rate implies a more unfavorable global environment, and thus an increase in the risk-free interest rate would be associated with higher spreads of risky assets.

Table 5. Results from Ordinary Least Squares Regression for Bulgaria and Romania with Dependent Variable-CDS and Dummy variable Crisis=0

Variable	Exp. Sign	Coefficient	Standard Error	t- statistic	p-value
<i>C</i>		2.562904	1.229629	2.084291	0.0012
<i>CPI</i>	Positive	0.510681	0.333909	1.529042	0.5491
<i>RFR</i>	Negative	-0.250816	0.097571	-2.570613	0.0012
<i>NPL</i>	Positive	0.915802	0.193818	4.725061	0.0002
<i>GFB</i>	Negative	0.259101	0.507419	0.510625	0.6152
<i>CA/GDP</i>	Negative	-0.286705	0.223881	-1.280615	0.1028
<i>Debt</i>	Positive	1.206805	2.050416	0.481920	0.8436
<i>Polrisk</i>	Negative	-0.050612	0.020083	-2.520087	0.0004
<i>LSMI</i>	Negative	-0.095104	0.046188	-2.059046	0.0017
<i>Crisis=0</i>	Negative	-0.008521	0.010323	-0.825405	0.5805
R- squared	0.580281				
Adj. R- squared:	0.571824				

Table 6. Results from Ordinary Least Squares Regression for Panel 3 with Dependent Variable-CDS and Dummy variable Crisis=1

Variable	Exp. Sign	Coefficient	St. Err.	t- statistic	p-value
<i>C</i>		2.358105	0.779329	3.025816	0.0002
<i>CPI</i>	Positive	-0.751224	3.054770	-0.245918	0.6274
<i>RFR</i>	Negative	0.828647	0.172063	4.815942	0.0000
<i>NPL</i>	Positive	0.581674	0.151205	3.846915	0.0004
<i>GFB</i>	Negative	-0.581065	0.452080	-1.285315	0.2516
<i>CA/GDP</i>	Negative	0.594826	0.472801	1.258064	0.5174
<i>Debt</i>	Positive	2.029725	0.421419	4.816403	0.0000
<i>Polrisk</i>	Negative	3.705918	0.994206	0.061825	0.5291
<i>LSMI</i>	Negative	-0.805726	0.211012	-3.816402	0.0003
<i>Crisis=1</i>	Positive	1.658705	0.686177	2.417314	0.0001
R- squared	0.701857				
Adjusted R- squared:	0.628472				

Well-developed and functioning capital markets of euro area countries can stimulate economic growth and reduce CDS spreads. Political risk is a variable that is statistically significant for the PIIGS countries. As an explanation, we may consider the fact that the constructed index for measuring political risk is not a good measure and a presenter of the political situation in the “distressed” countries of the eurozone. The increase in the value of NPL causes an increase in the number of public funds which are needed to prevent a banking crisis, distortions in

credit distribution, worsening market confidence and slowing economic growth, directly corresponds to an increasing default probability. It may be accepted as a mechanism for transferring a banking crisis into a sovereign one, this is the so-called twin crisis mechanism

In Table 7 the coefficient value of crisis=0 reduces CDS spreads and influences the other significant variables in the regression. We should emphasize that crisis=0 fails to neutralize the effect of the Debt/GDP ratio. It may be summarized as even in a post-crisis recovery, the degree of indebtedness of the “distressed” eurozone countries has a strong impact on the risk of insolvency despite the rescue financial tranches to their economies. Capital markets and their effective functioning prove to be of major importance in achieving economic balance in the national economies of the euro area countries.

Table 7. Results from Ordinary Least Squares Regression for Panel 3 with Dependent Variable-CDS and Dummy variable Crisis=0

VARIABLE	EXP. SIGN	COEFFICIENT	ST. ERROR	T- STATISTIC	P- VALUE
<i>C</i>		1.508246	0.722599	2.087251	0.0009
<i>CPI</i>	<i>Positive</i>	-0.751224	3.054774	-0.245918	0.6274
<i>RFR</i>	<i>Negative</i>	0.828647	0.172063	4.815942	0.0000
<i>NPL</i>	<i>Positive</i>	0.581674	0.151205	3.846915	0.0004
<i>GFB</i>	<i>Negative</i>	-0.581065	0.045208	-1.285315	0.2516
<i>CA/GDP</i>	<i>Negative</i>	0.594826	0.472811	1.258064	0.5174
<i>Debt</i>	<i>Positive</i>	2.029725	0.421419	4.816403	0.0000
<i>Polrisk</i>	<i>Negative</i>	3.705918	0.594206	0.061825	0.5291
<i>LSMI</i>	<i>Negative</i>	-0.805726	0.211122	-3.816402	0.0003
<i>Crisis=0</i>	<i>Negative</i>	-1.658705	0.686177	-2.417314	0.0001
<i>R- squared</i>	0.701857				
<i>Adjusted R- squared:</i>	0.628472				

Based on the panel VAR approach, we aim to answer the following questions:
 1. Do CDS spreads affect the explored macroeconomic and financial variables? 2. Is there a similarity between the results of euro-area members and non-euro area country members? In Figure 1 and Figure 2, we reveal the significant relationships for the developed countries from Panel 1.

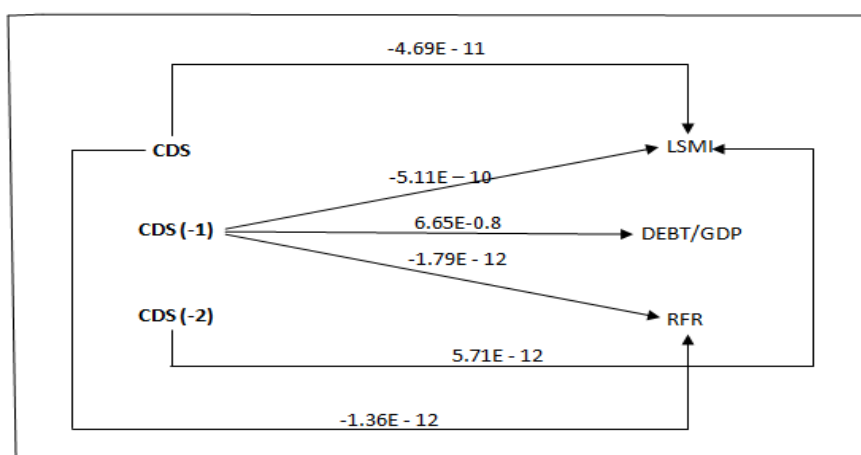


Fig. 1. Influence of CDS spreads to the other explored variables for developed countries

We observe a direct relationship between the CDS and Debt/GDP ratio. Lagged values prove that the high values of CDS correspond to an increase in the levels of indebtedness, i.e they strengthen the "fragility" of financial stability. This relationship helps to realize the "snowball effect". Through this significant direct proportional impact, we could identify CDS spreads as derivatives that would enhance the financial and liquidity problems of developed economies. An increase in the Debt/GDP ratio causes an increase in CDS and default probability. This may be explained by the presence of irregular distributed liquidity and a lack of regulatory and supervisory systems. CDS reduces RFR, thereby increase the "fragility" of countries' economic welfare. It is observed a persistent reverse proportional information relationship between capital markets and CDS and Fiscal balance and CDS. LSMI and Fiscal balance are financial variables that reduce credit and sovereign risk levels for developed countries in the euro area. The direct impact of inflation rates on the CDS of developed economies needs a period to turn into significant influence. In a long-lasting period, high inflation should increase CDS spreads and sovereign risk by increasing the cost of capital. Sovereign CDS spreads have a relatively strong and long-lasting relationship with the capital market dynamics of developed countries. The dynamics and volatility of capital markets lead to rapid incorporation of information flows from the financial derivatives market and a shift in the sign of the regression coefficient. We observe a sustainable transmission of information flows and shocks from the public sector to the private one.

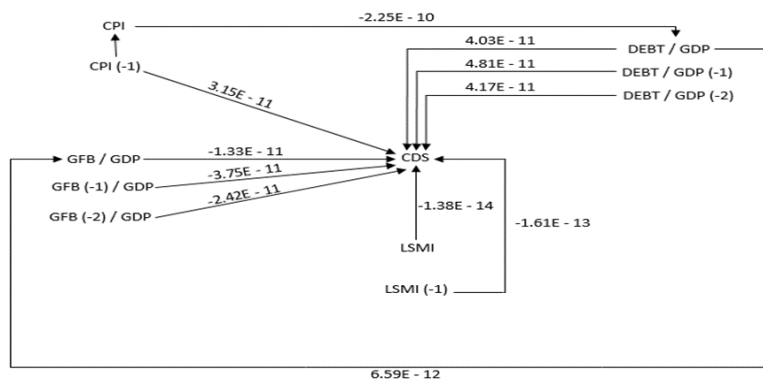


Fig. 2. Influence of the explored financial variables to CDS spreads for developed countries

In Figure 3 and Figure 4, we reveal the significant relationships between CDS and its determinants for the countries in Bulgaria and Romania.

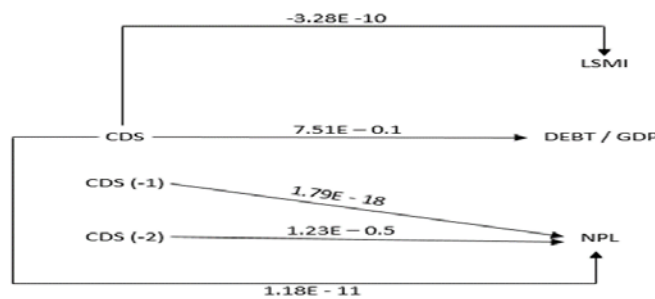


Fig. 3. Influence of CDS spreads to the other explored variables for Bulgaria and Romania

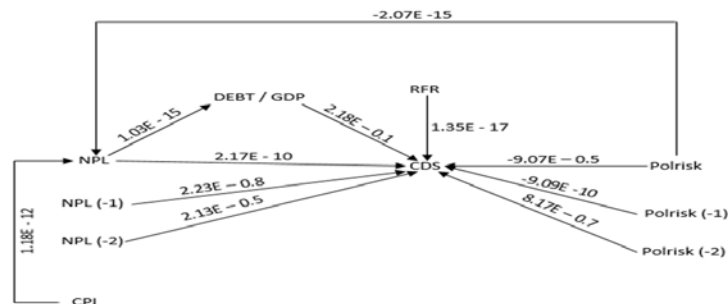


Fig. 4. Influence of the explored financial variables to CDS spreads for Bulgaria and Romania

Based on the exposed relationships, we report the existence of a permanent long-lasting direct relationship between (NPL) and CDS. According to the exposed results in Graph 3 and Graph 4, we observe a bilateral relationship between NPL and CDS as the influence of the banking sector to CDS is twice stronger than the influence of CDS on the banking sector. This transmission of information influences and shocks reveals a mechanism of transforming one type of financial crisis into another, namely from bank to sovereign crisis and vice-versa or the realization of the phenomenon of "twin crises". The stability of the political system influences both the public sector (CDS) and the private sector (NPL-banking sector). A variable that influences the CDS through the banking sector is inflation. It is revealed by the influence of CDS on Debt/GDP and LSMI.

In Figure 5 and Figure 6, we reveal the significant relationships between CDS and its determinants for the countries in Panel 3- "distressed Eurozone countries".

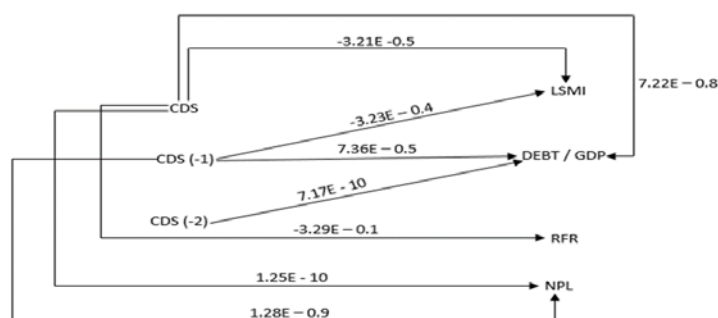


Fig. 5. Influence of CDS spreads to the other explored variables for "distressed" Eurozone countries in Panel 3

We report a significant positive effect on DEBT/GDP overall three-time lags. CDS dynamics may cause relatively significant difficulties in the ability of the sovereign to service its debt regardless of euro area membership. In contrast to the observed short-term impact in Panel 1 and Panel 2, here, (Panel 3-PIIGS), this trend remains significant in the long run. We report a transmission mechanism between sovereign CDS and the bank sector (NPL). Revealing a significant impact on capital markets, CDS influence on economic growth through their relationship with consumer confidence and business investment at a micro-level. In Figure 6 The variable DEBT/GDP has a permanent positive impact on the credit spreads dynamics. For the countries of Panel 3, we find a bilateral relation between Debt/GDP and CDS. Capital markets' dynamic is a significant factor, either. We may conclude that efficient and developed capital markets would neutralize the impact of increased sovereign indebtedness and reduce the default probability. Inflation (CPI) has an indirect impact on sovereign CDS spreads through a sustained direct impact on Debt/GDP and the NPL-banking sector.

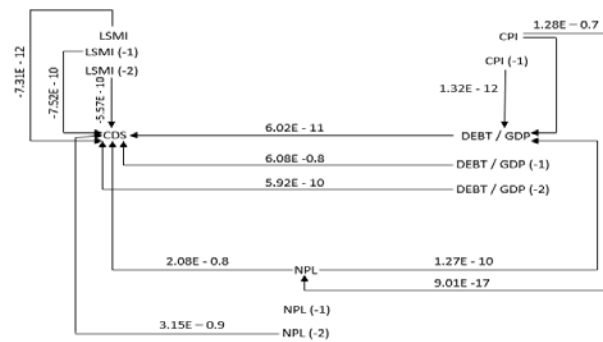


Fig. 6. Influence of the explored financial variables to CDS spreads for "distressed" Eurozone countries in Panel 3

5. CONCLUSION

In this research we establish that despite the proven similarities of sovereign CDS spread determinants in the member states of the European Union, there is a distinction between them according to their euro area membership, namely if they conduct an autonomous monetary policy. The separation of euro area members and non-euro area country members is confirmed. This conclusion is also supported by the implementation of heterogeneous regulatory policies in the explored countries. One of the main contributions of this research is that we reveal the increasing importance of the macroprudential approach for maintaining the sustainability of the financial system and the dynamics of CDS in European countries. Contrary to previous theoretical and empirical studies, we reveal a strong relation between CDS spreads, capital market dynamics, the stability of a political system, the balance of the banking sector. We prove that well-functioning and effective capital markets are factors that reduce default probability for all explored countries independent on their euro area membership. This dependence is complemented by the strong importance of debt indebtedness for Greece, Italy, Spain, Portugal, and Ireland and the important role of the stability of the banking system for Bulgaria and Romania. Based on this dependence, we prove evidence for the existence of the "CDS paradox" phenomenon, namely CDS, which is a credit derivative that creates and accumulates risks in the financial system additionally. CDS spreads reflect the existence of interaction on the line-stability of the banking system, economic growth, and default probability. This relationship proves to be long-term sustainable and creates the prerequisites for the emergence of "twin crisis" by transferring information flows and shocks from the banking system to the sovereign CDS and vice versa. It can be assumed that this type of direct and reverse links are at the core of the slowdown in economic growth in non-euro area countries, and in particular in Bulgaria and Romania.

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