Understanding Society

The relationship between CDS spreads and Macroeconomic factors of the Countries of the Eurozone

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Abstract

This thesis focusses on the relationship between CDS spreads and macroeconomic factors. The goal of the study is to identify the macroeconomic variables that influence sovereign risk and whether the CDS spread can be used as an alternative credit measurement. In order to study the relationship, OLS regression analysis is used. The study uses the CDS spreads of 15 countries of the Eurozone from 1/1/2010 until 31/12/2016 along the explanatory variables for every country. The analysis of the results concludes that there are variables that have statistical and economic strong effect on the CDS spreads, but also CDS spreads should be used as a credit proxy with caution by taking into consideration and other factors.

Contents

Introduction

At the end of the last decade the world's economy was shocked by the subprime mortgage crisis, which started when house prices started to decline in late 2006 leading to mortgage defaults and foreclosures and the devaluation of real estate related securities. A few years later Europe had to face a financial crisis dew to the breakdown of major financial institutions, high government external debt and rapidly rising bond yield spreads in government securities. Those two recent financial crisis have make many people skeptical about the use of Credit Ratings as a safe proxy for the credit risk that is linked to a sovereign entity or a company. For many, Credit ratings do not represent the true credit risk (Mora, 2016)[1]. The most representative example for the above statement is the bankruptcy of the American investment bank Lehman Brothers. This bank still had a very high credit rating right before it defaulted, even though there were indicators at that time that the credit risk attached to the bank had increased (Flanenery, Houston & Partnoy, 2010)[2]. Therefore, it is understandable that investors would need a new proxy that could adjust more accurately to the movements of the market and represent the credit risk of the underlying entity.

The new measurement of credit risk could be CDS, which is the most popular credit derivative(Hull, 2008)[3]. It is It is a contract that provides insurance against the risk of a default by particular company or sovereign entity. A CDS can be traded by two or more parties. The CDS buyer pays annually a fee to the CDS issuer until the maturity of the contract. These fees are called the spread of the CDS. The issuer of the CDS agrees, that in case of a credit event (failure to make a payment as it becomes due, a restructuring of debt, or a bankruptcy) of the issuer of the bond that corresponds to the CDS, he will pay the buyer a premium which is equal to the difference between the face value of the bond and the market value of the bond at the time of default along with interest payments which would have been made until the time to maturity if the issuer of the bond hadn't defaulted.

The spread of the CDS could represent the extra premium that investors are asking for investing in a more risky asset. Therefore, it could indicate the credit risk of a sovereign entity or a company.

The goal of this thesis is to find the factors that affect and in what magnitude the CDS spreads of the countries of the eurozone. The factors are macroeconomic variables and ratios that are used in previous research and determine the credit risk.

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[1] *Mora, N. (2006). Sovereign credit ratings: Guilty beyond reasonable doubt? Journal of Banking & Finance*

[2] *Flannery, M., Houston, J. and Partnoy, F. (2010). Credit default swap spreads as viable substitutes for credit ratings. University of Pennsylvania Law Review*

[3] *Hull, J. (2008). Options, Futures, and other Derivatives. New Jersey: Pearson Education*

Literature Review

This chapter links existing literature about sovereign credit risk to the research objective of this thesis.

In general, CDS are used as an insurance for the holder of a certain bond and as a result as a measurement of credit risk. This view is based on the current sovereign debt crisis but also on the subprime banking crisis of a few years ago. Credit rating agencies were unable to foresee this crisis. According, to Flannery, Partnoy and Houston (2010) CDS spreads changed faster than the credit ratings. In order, to come to this conclusion they used corporate CDS and compared them with corporate credit ratings for the period before the sub-prime crisis of 2008. They came with the result that CDS spread rose substantially for Lehman Brothers the time before the bankruptcy. Therefore, CDS provide more risk information and can lead to safer conclusions about the credit risk of companies (Flannery et al., 2010)[4]

In addition, CDS are market assessed indicators, while credit ratings are using historical qualitative and quantitative data and therefore are adjusted faster and more accurately to market conditions. Finally, CDS unlike other over the counter derivatives, who depend on interest rates, exchange rates, equity indices and commodity prices, are determined by the probability that a certain company or sovereign entity will default during a certain period of time. That is the reason why CDS spreads and Credit Ratings have similarities as they are both determined by the probability of default and therefore both can be used as a credit measurement.

We could also assume that credit risk is what lead sovereign entities to insolvency. Reinhart and Rogoff (2008) have indicated five conditions under which a sovereign entity can default. These conditions are the amount of external and domestic debt, crisis of the banking sector, rise of inflation and finally currency crushes (Reinhart & Rogoff, 2008)[5]. Furthermore, Avery. and Fisher (1992) find more factors that can affect the credit risk of a country, like the economic growth and relationships of an economy to external factors (Avery & Fisher, 1992)[6]. Moreover, Manasse, Roubini, and Schimmelpfennig (2003) conclude that factors like debt ratios measuring solvency and debt sustainability, measures of illiquidity or refinancing risk,

[4] Flannery, M., Houston, J. and Partnoy, F. (2010). Credit default swap spreads as viable substitutes for credit ratings. University of Pennsylvania Law Review

[5] Reinhart, C. and Rogoff, K. (2008). This time is different: Eight Centuries of Financial Folly. New Jersey: Princeton University Press

[6] Avery, R. and Fisher, E. (1992). Empirical Models of Debt Rescheduling with Sovereign Immunity. In: Solberg, R., Country Risk Analysis: A Handbook (pp 100-117). New York: Routledge.

measures of external debt (Manasse, Roubini & Schimmelpfennig, 2003)[7]. Mellios, and Paget-Blanc (2006) come to the same conclusion, that these macroeconomic variables affect the credit risk of a sovereign entity (Mellios & Paget-Blanc, 2006)[8]. In more detail Mellios and Paget-Blanc conclude that the variables that affect The CDS spreads are the per capita income, government income, real exchange rate changes and the inflation rate. Therefore, we can conclude that these macroeconomic factors are determinants of the CDS spreads.

The selected explanatory variables that affect the CDS spreads are the following:

TABLE I

TABLE I describes the explanatory variables that are going to be used in the research along with the expected sign of the coefficient according to the macroeconomic theory and previous research in the field of Credit Ratings, CDS spreads and Default Probabilities.

Variables	Theoretical Predictions
Risk-free Rate	**-**
Inflation Rate	**+**
Real Exchange Rate	**+**
Debt /GDP	**+**
Debt /Exports	**+**
GDP growth	**-**
Imports /GDP	**+**
Reserves /Debt	**-**
Reserves /Imports	**-**
Current Account/GDP	**+**
Risk Appetite	**-**

The Risk-free Rate has been used by Haque, Mark and Mathieson when they valuated political and economic variables in creditworthiness ratings, but also from Fontana and Scheicher in their analysis about the sovereign CDS in the Eurozone. When the Risk-free rate increases then the growth of a country increases as well and as a result the credit risk decreases (Fontana & Scheicher, 2010)[9]. The Risk-free rate should therefore be negatively related to CDS spreads.

[7] *Manasse, P., Roubini, N. and Schimmelpfennig, A. (2003). Predicting Sovereign Debt Crises. International Monetary Fund Working Paper 221*

[8] *Mellios, C. and Paget-Blanc, E. (2006). Which factors determine sovereign credit ratings? European Journal of Finance, 12 (4)*

[9] *Fontana, A. and Scheicher, M. (2010). An analysis of euro area sovereign CDS. European Central Bank Working Paper Series 1271*

Inflation has been used by Haque, Mark and Mathieson and by Mellios and Blanc in their research about the factors that determine sovereign Credit Ratings. Higher inflation rate lead to higher CDS spreads as it is a sign of economic instability while a lower inflation rate shows more stable monetary policies(Mellios & Paget-Blanc, 2006)[10].

The Real Exchange Rate has been used by Haque, Mark and Mathieson, by Mellios and Blanc and by Catao and Sutton in previous research. This ratio shows how competitive is a country in terms of international trade. When the exchange rate of a country is decreasing that means that the currency is becoming weaker and that the economic system is at risk as investments require higher risk premiums. Therefore, the relationship is going to be positive.

Debt /GDP has been used by Haque, Mark and Mathieson and it is positive correlated with the spreads, because as the debt of a country increases compared to the GDP then the risk of insolvency is imminent.

Debt /Exports has been used by Avery and Fisher and by Catao and Sutton. A higher Debt/Export ratio means that the country can pay back to its creditors a smaller portion of the external debt with their exports. This means that a nation has less capacity to service their debts, which should increase a country's credit risk and CDS spread.

GDP growth has been used in the past by Avery and Fisher, by Catao and Sutton and by Haque, Mark and Mathieson. The GDP growth is negative correlated with the CDS spread, because it is a sign of economic growth which means that the country will be able to pay back the debt and the reduce its credit risk.

Imports /GDP has been used by Avery and Fisher. The Imports /GDP ratio is an indicator of how open is an economy and therefore how susceptible to foreign credit shocks. The bigger the ratio the more the credit risk of a country, thus the relationship is positive (Avery & Fisher, 1992)[11].

Reserves /Debt has been used by Catao and Sutton. This ratio shows the ability of a country to pay back its debt. As the ratio increases this means that a country is in a better position to pay back its external debt using their official reserves from the treasury. This lowers a countries credit risk and thus this variable should have a negative relationship with the sovereign CDS spread (Catao & Sutton, 2002)[12].

Reserves /Imports has been used by Haque, Mark and Mathieson and by Mellios and Blanc. If this ratio is high, it means that there are more reserves available to service foreign obligations, leading to a better credit position and lower CDS spreads.

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[10] Mellios, C. and Paget-Blanc, E. (2006). Which factors determine sovereign credit ratings? European Journal of Finance, 12 (4)

[11] Avery, R. and Fisher, E. (1992). Empirical Models of Debt Rescheduling with Sovereign Immunity. In: Solberg, R., Country Risk Analysis: A Handbook (pp 100-117). New York: Routledge

[12] Catão, L. and Sutton, B. (2002). Sovereign defaults: the role of volatility. International Monetary Fund

Current Account /GDP has been used by Haque, Mark and Mathieson. A large Current Account deficit implies that a country is in need for constant external funding, which increases the credit risk of a country and as a result the CDS spreads.

Risk Appetite has been used by Fontana and Scheicher. An increasing Risk Appetite means that investors are becoming more willing to bear credit risks themselves. This should lower the demand of CDS spreads and thus its price. Because of this, the Risk Appetite variable has to be negatively related to the sovereign CDS spread.

In this research the main goal is to determine the macroeconomical ratios that affect the CDS spreads and therefore do not take into consideration other political and historical factors like the default history, the corruption index, the rule of law and the political stability within the countries of the eurozone.

Methodology

This chapter focusses in the methodology that is used to test the hypotheses.

The first hypothesis tests whether the macroeconomic factors (independent variables) have not a significant effect on the CDS spread for every country in the sample independently. The second hypothesis tests whether the macroeconomic factors have not a significant effect on the CDS spread for the aggregated sample of the countries.

By doing so the results of these hypotheses can be compared in order to see the difference the explanatory variables have for a specific country and for the whole sample of countries.

The sample consists of 11 independent variables for 15 countries of the Eurozone for the time period from 01/01/2010 until 31/12/2016. Estonia, Latvia and Lithuania are excluded from this research because they entered in the monetary union in the years 2011, 2014 and 2015 respectively.

Three of the explanatory variables, the Risk-free Rate, the Risk Appetite and the Real Exchange Rate are using daily data, while the rest of the explanatory variables are using quarterly data. Because of the difference in the frequency of the explanatory variables the regressions are also going to have data with the same frequencies. However, according to Andreou, Ghysels and Kourtellos the use of FLAT-LS, meaning the traditional Least Squares (LS) estimator that involves regression models with a flat aggregation scheme, is less efficient than the MIDAS regression models (MIxed DAta Sample). In any case the result of the economic and statistical significance of the regressions does not change in a way that the results can be misinterpreted (Andreou,Ghysels & Kourtellos, 2010)[13].

In order to test the hypotheses three regressions are used. In the first regression, the explanatory variables with the daily frequency are used.in the second the quarterly ratios that are relevant with the external debt of the countries. In the third regression, quarterly ratios are used that are relevant with the GDP and the growth of the economy.

$$CDS_t = \alpha + \beta 1\ Risk\text{-}free\ Rate_t + \beta 2\ Real\ Exchange\ Rate_t + \beta 3\ Risk\ Appetite_t + \upsilon \quad (1)$$

$$CDS_t = \alpha + \beta 1\ Debt/GDP_t + \beta 2\ Debt/Exports_t + \beta 3\ Reserves/Debt_t + \upsilon \quad (2)$$

$$CDS_t = \alpha + \beta 1\ GDP\ growth_t + \beta 2\ Inflation_t + \beta 3\ Imports/GDP_t + \beta 4\ Reserves/Imports_t + \beta 5\ Current\ Account/GDP_t\ \upsilon \quad (3)$$

[13] *Andreou, Elena & Eric Ghysels & Andros Kourtellos "Regression Models with Mixed Sampling Frequencies", Journal of Econometrics, 2010*

In order to test the first hypothesis all three regressions are done for each country of the sample, asthere are only time-series data. However, for the second hypothesis the regressions are done for the aggregated sample and therefore, there are panel data.

The model used in order to get the results of the regressions is the OLS method (Ordinary Least Squares). It is the most common method for calculating the unknown coefficients of linear regressions. The method minimizes the sum of the squares of the differences between the dependent and the independent variables. The regressions are done using the Stata software.

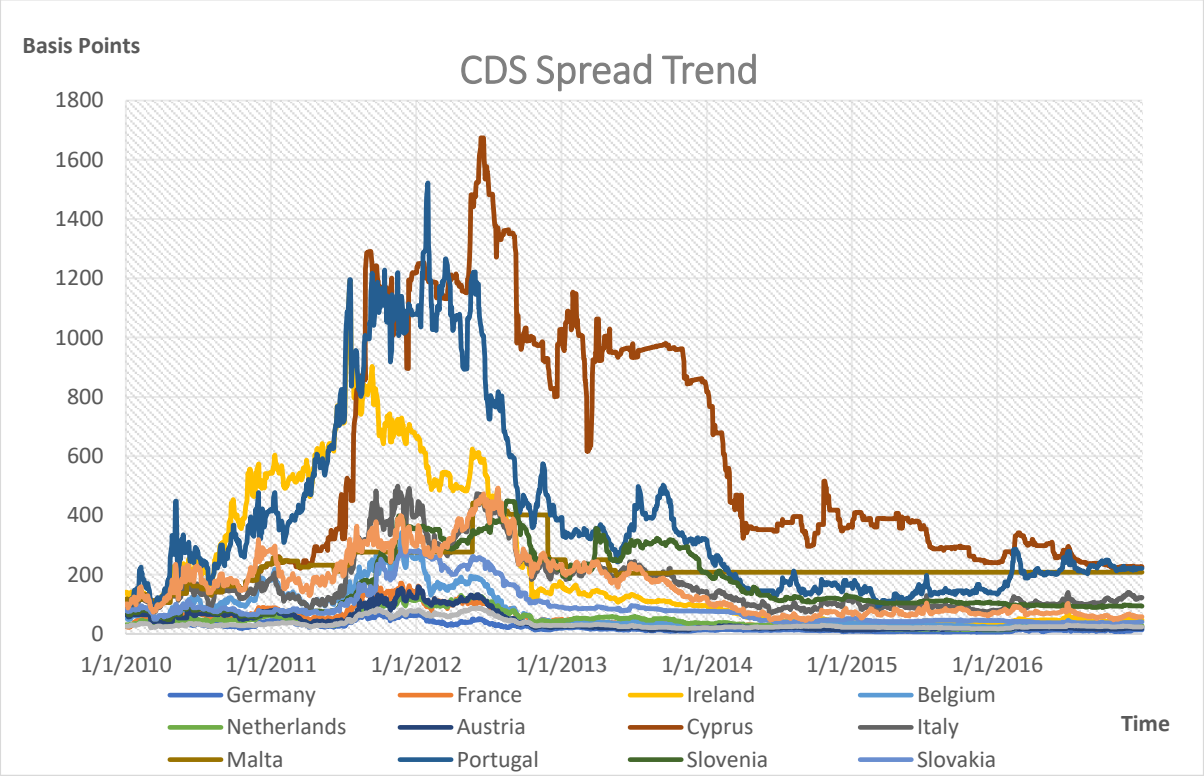
Data Description

The source of our research is the Thompson Datastream. Datastream has CDS quotes for all countries of our sample. CDS spreads based on a contract maturity of 5 years are selected to serve as dependent variables for this thesis. Spreads with this maturity are chosen since 5-year spreads are used the most for credit default swaps. In addition, all the independent variables are collected using Datastream for the same time period as discussed above. Also in order to create some variables it was necessary to calculate the ratios by distinct macroeconomic data. Most of these variables are quarterly data so that is what it was used in the research and is also a reason that more than one regressions are done.

The data that are used in the research can be analyzed statistically in order to understand the relationship among the variables more clearly. The different means and variances can be seen in FIGURE I for each sovereign entity for the time period between 2010 and 2016. It is clear from the graph that there are huge differences between the CDS spread of the sovereign entities. For example, the CDS spread of Cyprus is almost at 1800 basis points while that of Germany, Netherlands and Finland do not exceed the 50 basis points. Also, countries like Cyprus and Ireland who have the highest CDS spreads have also the most volatile ones. The spread of Greece changes a lot over time until 2012 when it was not adjusted anymore.

FIGURE I

Figure I illustrates the trend of the CDS spreads for the countries of the Eurozone from 1/1/2010 until 31/12/2016. From the graph the CDS spread of Greece as it exceeded the 10000 basis points making the graph difficult to interpret



The descriptive statistics for the countries of the eurozone can be seen in more detail in TABLE II where all important statistical information is presented. Looking at the respective means presented in this table, it shows that they differ a lot. One reason for this difference is the high maximum spreads for countries with higher means. Some entities the CDS spreads have gone up dramatically over 2011. The standard deviations reflect this increase as well. They are the highest for the countries that experienced a huge CDS increase. Countries like Greece, Cyprus, Ireland and Portugal had their spreads skyrocketed during that period due to their bad financial state and the danger of insolvency. The table also shows that the spreads of the nations are not symmetric. The skewness statistic indicates that that the CDS spreads are positively skewed for every sovereign entity, except for Greece. This means that the majority of the observations lies to the left of the mean, and that the distribution is skewed to the left. The kurtosis statistic measures the peaks of the CDS spreads and the weight in the tails of the distribution. For a normal distribution the kurtosis is three, but the kurtosis of the CDS spreads lies above this number for most countries. This means that the volatility of the CDS spreads is a result of infrequent and extreme deviations, something which can be attributed to the financial crisis of the countries of the Eurozone.

The respective correlations and covariances of the sovereign entities are analyzed in this section. This analysis is done to see what relationships exist among the CDS spreads of the respective Eurozone countries. The test results provide proof for the existence of spillover effects attached to CDS spreads, because the correlations and covariances are high and positive in most cases. In the Tables III and IV there are the correlations and covariances between the CDS spreads of the countries of the eurozone and what was stated above can be confirmed. Most countries have positive and high correlated spreads with the other countries of the Eurozone, while other have less correlated or even negative correlation. For example, the correlation between the spreads of Germany and France is 0.9225 whereas the Slovenia-Ireland relationship is 0.2785. it is worth mentioning that the spreads of Greece are negatively correlated with almost all the other countries apart from Malta and Cyprus, a country which invested in Greek risky bonds. Overall though, far more positive than negative correlations can be seen, thus acknowledging that CDS spreads of Eurozone countries tend to move in the same direction. Analyzing the covariances leads to the same conclusions. Table IV shows that although there are some negative covariances between the countries, most of them are positive. This table also shows that there are large differences in the sizes of the covariances, which can be explained to some extent by the existing variance inequality of the CDS spreads. Correlations prove that the Eurozone CDS spreads influence each other and that they indeed tend to move in the same direction.

Empirical Results

In this chapter the empirical results from the regressions that test the hypotheses are presented.

The first hypothesis tests whether the macroeconomic factors have not a significant effect on the CDS spread for every country in the sample independently. This hypothesis is tested by doing 3 regressions.

Table V presents the results of the regressions based on the daily adjusted explanatory variables. The P-values show that these variables have a very significant impact on the CDS spread of nearly all sovereign entities. The only variables that are not statistically significant are the Risk-free Rate of Cyprus and the Risk Appetite of Malta and the Real Exchange Rate of Italy. Concerning the sign of the coefficients the results are ambiguous as the three independent variables do not have the expected sign according to previous research. Firstly, the sign of the Risk Appetite is positive for all countries of the eurozone something that is incoherent with the research by Fontana and Scheicher, who argued that an increase in the Risk Appetite would make investors less risk averse and prone to invest in riskier CDS, resulting to the decrease of the spread (Fontana & Scheicher, 2010)[14]. Secondly, the Risk-free Rate has the expected negative sign for Greece, Cyprus and Slovenia. According to Fontana and Scheicher the Risk-free Rate is a sign of economic prosperity and reduces the spreads of the CDS. Finally, there are more mixed results concerning the Real Exchange Rate as 4 of the countries in the eurozone have the rational sign in their coefficients, as Mellios and Blanc had also concluded. Table V provides very strong evidence that both the Real Exchange Rate and the Risk-free Rate have a negative impact on the CDS spread for most of the countries. Concerning the Risk Appetite, it is clear the positive relationship with the CDS spreads for all the sovereign entities, however there is a huge difference in the magnitude of the effect for each country as Malta has a coefficient of 0.44 while Greece has a coefficient of 107.26. The same difference in magnitude can be observed and in the other two variables as Germany has a Risk-free Rate coefficient of 22.47, while Ireland has 455.21. concerning the Real Exchange Rate Netherlands has a coefficient of 10.75 and Cyprus 428.99.

It is also important to interpret the economic significance that the explanatory variables have on the CDS spreads. The Risk-free Rate even though has a positive sign for most countries has economic significance as a 1% increase can lead up to 138.83 increase in basis points for the spreads. However, in most cases the increase is on average 20 basis points. The Real Exchange Rate also has economic significance as an increase of 1 point will lead to a significant decrease for the spreads for most countries. However, according to Table V the Risk Appetite is the least economic significant variable as a 1 point increase in the variable will have very small increase

[14] *Fontana, A. and Scheicher, M. (2010). An analysis of euro area sovereign CDS. European Central Bank Working Paper Series 1271*

for the spreads. The only exception is the Greek CDS spread that will increase by 107.26 basis points.

Table VI describes the impact of the quarterly adjusted explanatory variables and more precisely those ratios that are based on the External Debt. The results are also mixed in this hypothesis as it is clear that the ratios are not statistically significant for all the countries. The Debt /GDP ratio is statistically significant for 8 countries. The Debt /Exports has statistical significance for 4 countries and the Reserves /Debt ratio is statistical significant for 9 countries, making it the most significant of all the ratios. Concerning the sign of the coefficients the Debt /GDP ratio has the rational sign for 6 countries (Haque, Mark & Mathieson, 1998)[15]. Also, the Debt /Exports ratio is positive but only for 7 countries (Avery & Fisher, 1992)[16]. The last ratio, Reserves /Debt, should be negative but only 6 countries verify the theory (Catao & Sutton, 2002)[17]. The difference in the sign of the coefficients could be justified by the discrepancies in the way that sovereign spreads adjust to the impact that these variables have on credit risk. There is also difference in the magnitude of the coefficients for each country. For example, the Debt /GDP ratio for Germany is -0.00188 while for Greece is 1328.6. For the other two ratios there are also differences in the size of the coefficients but without such a big magnitude in the difference.

Furthermore, Table VI provides information about the economic significance of the explanatory variables. The Debt/GDP ratio and the Reserves/Debt have very high economic significance as it is clear that an increase by 1 can lead to an increase or decrease, depending on the country, for a plethora of basis points for the spreads of almost all countries. However, the Debt/Exports ratio is not as economic significant as the other variables. Most countries have coefficients are significantly low, with only few exceptions of Ireland, Belgium, Malta and Portugal.

Table VII describes also the quarterly adjusted explanatory variables, that refer to the GDP ratios. As it happened with the previous table the results are also mixed as it can be concluded from the respective P-Values. The variable that has the most statistically significant impact on CDS spreads is the Inflation, as it is statistical significant for 12 of the 15 countries. The GDP growth, Reserves /Imports and the Current Account /GDP ratios are statistical significant for 2 countries while Imports /GDP is statistical significant for 4 countries. The sign of the coefficients is what was expected for most countries for each variable. The most significant variable, Inflation, is the one that has the expected sign for most of the cases as only Greece has a negative coefficient (Mellios & Paget-Blanc, 2006)[18]. The Imports /GDP ratio

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[15] Haque, N., Mark, N. and Mathieson, D. (1998). The relative importance of political and economic variables in creditworthiness ratings. International Monetary Fund Working Paper 46

[16] Avery, R. and Fisher, E. (1992). Empirical Models of Debt Rescheduling with Sovereign Immunity. In: Solberg, R., Country Risk Analysis: A Handbook (pp 100-117). New York: Routledge

[17] Catão, L. and Sutton, B. (2002). Sovereign defaults: the role of volatility. International Monetary Fund

[18] Mellios, C. and Paget-Blanc, E. (2006). Which factors determine sovereign credit ratings? European Journal of Finance, 12 (4)

(Avery & Fisher, 1992)[19] and the Current Account /GDP[20] (Haque et al., 1998) ratio have overall the expected positive sign for most of the countries as only five countries have a negative sign. The results are mixed for the other two variables as the GDP growth differs both in sign and in magnitude for the majority of the countries. Finally, the Reserves /Imports ratio has not the expected sign as most of the coefficients are positive instead of negative which would put the impact of this variable on the CDS spread into question(Mellios & Paget-Blanc, 2006)[21].

In this case according to Table VII all the explanatory variables seem to have economic significance as the coefficients are significantly high and can lead to big changes for the CDS spreads of all the countrie of the Eurozone.

The second hypothesis tests whether the macroeconomic factors have not a significant effect on the CDS spread for the aggregated sample of the countries

Table VIII shows the results of the second hypothesis concerning the impact on the CDS variability for the aggregated sample of Eurozone sovereign entities. The coefficients show the size of the impact of that certain variable and whether it positively or negatively influences the CDS spreads while the P-values in this table indicate whether a variable has a significant impact on the CDS spread or not. The variable is considered to have a significant impact on the CDS spreads if the P-value is lower than 0,05. According to the table 8 of the 11 variables have a P-Value lower than 0.05 and therefore the null hypothesis is rejected and the independent variables have a statistical significance for the CDS spreads. The variables who do not have a statistical significance are the Reserves/Debt, the Current Account/GDP and the GDP growth.

The next thing to consider is whether the variables who influence the CDS spread have coefficients of with the correct sign based on what is expected in theory. According to the theoretical predictions a total of 4 out of the 8 statistically significant variables have the expected sign. The variables with the rational coefficients are the Risk-free Rate, the Real Exchange Rate, the Debt/GDP and the Debt/Exports. The fact that these signs are correct indicates that the CDS spreads adjust correctly to the impact that changes for these variables have on the sovereign credit risk that is attached to a nation.

Concerning the economic significance it is clear that 10 out of 11 explanatory variables have a big economic significance as a change by 1 point for every variable is going to make the spreads of the CDS to change at big degree. The only variable with a weak economic significance is the Debt/GDP with a coefficient of 0.016.

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[19] Avery, R. and Fisher, E. (1992). Empirical Models of Debt Rescheduling with Sovereign Immunity. In: Solberg, R., Country Risk Analysis: A Handbook (pp 100-117). New York: Routledge

[20] Haque, N., Mark, N. and Mathieson, D. (1998). The relative importance of political and economic variables in creditworthiness ratings. International Monetary Fund Working Paper 46

[21] Mellios, C. and Paget-Blanc, E. (2006). Which factors determine sovereign credit ratings? European Journal of Finance, 12 (4)

Conclusion

In this chapter the results from the regressions are discussed and are drawn conclusions concerning the credibility of the CDS spreads as an alternative risk measurement to the Credit Ratings.

Combining the results of the regressions done on both the aggregated dataset and the individual countries, it can be concluded that there are five macro-economic variables for which its impact on credit risk is reflected by sovereign CDS spreads in general. These variables are the Inflation rate, the Current Account/GDP ratio, the Reserves/Debt ratio, the Risk-free Rate, and the Real Exchange Rate. For these variables, the CDS spreads adjust more quickly and accurately to the changes in sovereign credit risk that these variables cause.

These variables that are chosen to be important and have a strong impact on the CDS spreads must have the following criteria. They are statistically and economically significant and do not contradict the theoretical results of previous researches. That is the case for the aforementioned variables. Inflation for example, according to Table VII, fulfills those criteria in the majority of the cases. The only case where Inflation can be doubted is in the second hypothesis where the coefficient has a negative sign. The Current Account/GDP ratio has in most cases a positive sign, something which was expected, and a strong economic significance for the spreads (Table VII, Table VIII). The same could be told for the Reserves/Debt ratio as Table VI and Table VIII indicate a strong economic significance for the spreads. The Risk-free Rate is also important especially if Table VIII is taken into consideration where the strong and positive relationship with the CDS spreads is more than clear. Finally, the Real Exchange Rate is also important according to Table VI and Table VIII where it is clear that there is a strong economic significance and in most cases statistical significance. Therefore, these variables could be strong indicators for investors about the credit risk that a sovereign entity is bearing as they have a strong relationship with the CDS spreads.

The expected impact of the Debt/Export ratio, Debt/GDP ratio, Reserves/Imports ratio, Imports/GDP ratio and GDP Growth on the CDS spread is not proven by this paper. Results show that the impact of these variables is either insignificant or not rational.

It is also important to discuss about the Risk Appetite a variable that indicates the willingness of investors to take extra risk. As a result the relationship of Risk Appetite with the CDS spread would be negative as investors by being more willing to bear risk would not be interested in investing in CDS, leading to a reduce of the demand of the CDS and therefore its price. The above statement was also proved by Fontana and Scheicher. However, in this study the coefficients of the Risk Appetite for all the countries of the Eurozone are positive even though they are statistically significant. Thus, the empirical results contradict the theory of Fontana and Scheicher.

The reason behind the difference in the sign of the coefficient can be traced to other reasons.

CDS variation are to some extent be explained by non-credit risk related determinants. Two of these variables are the before-mentioned Risk Appetite and the CDS market liquidity. Because these variables are not statistically related to the credit risk of the respective sovereign entity, value changes for these variables can cause the CDS spreads to adjust wrong to changes in credit risk conditions. The impact that a rising Reserves/Debt ratio for example should have on the CDS spread can therefore be offset by a decrease in market liquidity or a lowered risk appetite. This can make it look like the Reserves/Debt ratio has a wrong impact on CDS spreads, even though this is not the case. This effect can of course also be caused by additional, unidentified variables that also influence sovereign CDS spreads.

The positive correlations and covariances, among the respective countries of the eurozone, CDS spreads. The CDS spreads tend to move in the same direction for most countries, excluding Greece. This means that sovereign spreads influence each other. In some situations the CDS spread of a nation might therefore increase dramatically, even though the credit position of the underlying entity remains relatively the same. This can affect the impact that some macro-economic variables have on the CDS spread of a sovereign.

Asymmetric information between countries and financial institutions that issue the CDS. Credit Default Swaps spreads depend on the probability that a particular organization or entity will default during a particular period of time. It is natural that some market participants have more information to estimate this probability than others. Therefore, financial institutions might not have the same information as the governments of the countries who enforce the economic policies. Maybe this is the reason that the Risk Appetite has a positive relationship with the CDS spread, as the probability of default cannot be interpreted correctly.

According to the results of all the tables it is clear that most of the independent variables have a relationship with the CDS spreads and therefore someone could think that the spreads could be used as a credit risk indicator. Nonetheless it is important to understand that CDS spreads are influenced also by other variables that are not taken into consideration in this study. One of the most important factors that determines the CDS spread is the default probability. More importantly it should be calculated by risk-neutral default probabilities, not real-world default probabilities. Risk-neutral default probabilities can be estimated from bond prices or asset swaps. However, in this study default probability is not taken into consideration.

Therefore, it is early to say whether using the CDS spreads is suitable credit risk proxy. According to the findings it is not false to use it as a credit risk indicator because the CDS spreads adjust correctly to some variables that influence the credit risk of the countries. However, investors should also be skeptical because other variables do not have the expected outcome and also because not all variables are identified.

To conclude this study offers many insights in the relationship between CDS spreads and macroeconomic factors for the countries of the Eurozone and offers useful information about CDS in general, a market which is relatively young and not monitored for many years, so that more studies can be done in the field.

Appendix

TABLE II

Table II illustrates the descriptive statistics for the CDS spreads of the countries of the Eurozone

	N	Mean	Median	Standard Deviationn	Variance	Skewness	Kyrtosis	Minimum	Maximum
Germany	1826	22.32	14.67	15.37	236.40	1.20	3.7	6.64	79.28
France	1826	50.72	37.92	33.53	1124.92	1.42	4.26	15.6	171.56
Greece	1826	11047.33	14904.36	6006.59	3.61e+07	-0.99	2.07	229.15	14911.74
Ireland	1826	228.86	112.59	242.22	58671.74	1.17	3.18	29.28	1191.15
Belgium	1826	74.08	37.83	64.96	4220.09	1.49	4.39	18.9	341.98
Netherlands	1826	44.82	37.09	28.39	806.015	1.30	3.96	13.57	133.84
Austria	1826	41.51	22.48	33.88	1148.36	1.36	3.80	12.18	159.23
Cyprus	1826	563.38	366.70	401.09	160875.1	0.76	2.19	106.4	1674.22
Italy	1826	171.83	125.41	101.85	10374.24	1.41	4.03	69.25	498.65
Malta	1826	227.18	208.61	64.82	4202.39	1.55	6.24	106.4	448.08
Portugal	1826	389	264.45	313.91	98539.74	1.47	4	73.1	1521.45
Slovenia	1826	167.86	112.62	102.53	10513.86	0.89	2.43	48	448.66
Slovakia	1826	89.33	75.14	63.09	3981.35	1.71	4.9	35.75	285.14
Spain	1826	163.14	138.65	104.06	10830.07	0.88	2.91	45.42	492.06
Finland	1826	32.72	26.23	16.81	282.74	1.8	5.06	17.53	87.23

TABLE III

Table III illustrates the correlations of the CDS spreads of the Eurozone

	Germany	France	Greece	Ireland	Belgium	Netherlands	Austria	Cyprus	Italy	Malta	Portugal	Slovenia	Slovakia	Spain	Finland
Germany	1.00														
France	0.92	1.00													
Greece	-0.62	-0.42	1.00												
Ireland	0.84	0.87	0.59	1.00											
Belgium	0.92	0.96	-0.53	0.9	1.00										
Netherlands	0.8	0.90	-0.19	0.73	0.83	1.00									
Austria	0.91	0.93	-0.48	0.81	0.94	0.88	1.00								
Cyprus	0.38	0.58	0.31	0.4	0.43	0.76	0.46	1.00							
Italy	0.71	0.86	-0.04	0.67	0.76	0.93	0.77	0.85	1.00						
Malta	0.28	0.46	0.29	0.41	0.37	0.56	0.36	0.73	0.68	1.00					
Portugal	0.76	0.88	-0.2	0.84	0.85	0.88	0.82	0.71	0.87	0.58	1.00				
Slovenia	0.28	0.48	0.36	0.27	0.33	0.71	0.38	0.93	0.8	0.68	0.62	1.00			
Slovakia	0.76	0.87	-0.13	0.7	0.81	0.95	0.87	0.77	0.92	0.6	0.9	0.74	1.00		
Spain	0.74	0.86	-0.24	0.77	0.78	0.91	0.79	0.75	0.92	0.66	0.85	0.68	0.86	1.00	
Finland	0.83	0.92	-0.2	0.77	0.87	0.92	0.91	0.67	0.89	0.59	0.9	0.56	0.92	0.83	1.00

Table IV

Table IV illustrates the covariances of the CDS spreads of the countries of the Eurozone

	Germany	France	Greece	Ireland	Belgium	Netherlands	Austria	Cyprus	Italy	Malta	Portugal	Slovenia	Slovakia	Spain	Finland
Germany	236.4														
France	475.7	1124.93													
Greece	-58143.1	-85543.7	3.6e+07												
Ireland	3157.26	7078.29	-859037	58671.7											
Belgium	928.12	2099.96	-207022	14282	4220.1										
Netherlands	352.16	864.17	-33635	5056.06	1546.85	806.01									
Austria	476.35	1060.72	-98571.8	6652.07	2070.01	852.4	1148.36								
Cyprus	2352.89	7855.79	754291	38892	11261.7	8750.44	6251.85	160875							
Italy	1119.93	2939.69	-28185	16637.5	5038.31	2706.72	2680.03	34988.7	10374.2						
Malta	283.12	1007.47	114032	6447.55	1558.06	1044.83	795.46	34988.7	4505.45	4202.39					
Portugal	3708.73	9310.33	-386143	64624.7	17378.1	7931.19	8798.32	90620.3	27981.5	11945.8	98539.7				
Slovenia	453.58	1680.82	223529	6917.79	2228.65	2082.88	1345.65	38570.5	8357.99	4551.93	20129	10513.9			
Slovakia	743.62	1861.42	-51484.7	10807.1	3338.7	1702.98	1872.15	19616.1	5931.08	2491.16	17986	4825.77	3981.35		
Spain	1191.84	3013.8	-155829	19645.8	5304.15	2697.63	2793.16	31702.3	9778.5	4516.97	27776.4	7349.09	5707.69	10830.1	
Finland	215.09	518.99	-20214.4	3160.98	958.18	442.66	519.95	4558.4	1527.78	645.9	4781.82	981.97	984.17	1469.12	282.74

TABLE V

First Regression

*This table presents evidence on how CDS spread respond to changes on the explanatory variables on the daily data for fifteen countries of the Eurozone. The dependent variable is the CDS spread while the three columns show the independent variables. The coefficients are presented in every column and in the parentheses the P-Values. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level correspondingly.*

	Risk-free Rate	Risk Appetite	Real Exchange Rate
Germany	22.47***	0.61***	-3.37**
	(0.000)	*(0.000)*	*(0.006)*
France	47.64***	1.45***	-13.96***
	*(*0.000*)*	*(0.000)*	*(0.000)*
Greece	-9924.3***	107.26***	5299.2***
	(0.000)	*(0.000)*	*(0.000)*
Ireland	455.21***	1.39**	-204.14***
	(0.000)	*(0.002)*	*(0.000)*
Belgium	121.19***	1.81***	-78.22***
	(0.000)	*(0.000)*	*(0.000)*
Netherlands	24.74***	0.98***	10.75**
	(0.000)	*(0.000)*	*(0.002)*
Austria	51.8***	1.21***	-22.32***
	(0.000)	*(0.000)*	*(0.000)*
Cyprus	-24.35	13.82***	428.99***
	(0.422)	*(0.000)*	*(0.000)*
Italy	81.27***	4.71***	-15.42
	(0.000)	*(0.000)*	*(0.251)*
Malta	29.98***	0.44	-41.30***
	(0.000)	*(0.151)*	*(0.000)*
Portugal	362.25***	11.67***	-39.42
	(0.000)	*(0.000)*	*(0.223)*
Slovenia	-27.07**	2.64***	134.87***
	(0.001)	*(0.000)*	*(0.000)*
Slovakia	83.09***	1.51***	-93***
	(0.000)	*(0.000)*	*(0.000)*
Spain	138.83***	1.14**	-69.26***
	(0.000)	*(0.002)*	*(0.000)*
Finland	19.58***	0.82***	-10.23***
	(0.000)	*(0.000)*	*(0.000)*

TABLE VI

Second Regression

This table presents evidence on how CDS spread respond to changes on the explanatory variables on the quarterly ratios relevant with the external debt for fifteen countries of the Eurozone. The dependent variable is the CDS spread while the three columns show the independent variables. The coefficients are presented in every column and in the parentheses the P-Values. ∗, ∗∗, and ∗∗∗ denote statistical significance at the 10%, 5%, and 1% level correspondingly.

	Debt /GDP	Debt /Exports	Reserves /Debt
Germany	-0.001	5.3	2805*
	(0.368)	*(0.084)*	*(0.012)*
France	14.92	-8.52	1342***
	(0.667)	*(0.319)*	*(0.000)*
Greece	1328.6***	-65.97	723167
	(0.000)	*(0.110)*	*(0.536)*
Ireland	-548.2**	182.1**	-18374
	(0.006)	*(0.003)*	*(0.268)*
Belgium	237.7*	-100.8*	7310.7**
	(0.010)	*(0.045)*	*(0.002)*
Netherlands	66.85	34.11	1646.7***
	(0.218)	*(0.307)*	*(0.000)*
Austria	-85.02*	3.05	2210**
	(0.017)	*(0.870)*	*(0.004)*
Cyprus	-701.9*	-5.74	-11931.4**
	(0.038)	*(0.814)*	*(0.006)*
Italy	-175.3*	-2.19	1542.1*
	(0.020)	*(0.885)*	*(0.020)*
Malta	828*	-116.7	58.45
	(0.014)	*(0.116)*	*(0.432)*
Portugal	194.1	-188.7**	-325.1
	(0.196)	*(0.010)*	*(0.909)*
Slovenia	-118.9	14.29	-8440.3***
	(0.667)	*(0.876)*	*(0.000)*
Slovakia	-181*	0.02	-1213.5
	(0.021)	*(0.618)*	*(0.101)*
Spain	-27.49	-40.51*	1150.3**
	(0.676)	*(0.043)*	*(0.007)*
Finland	-5.22	0.22	-3606.1
	(0.585)	*(0.920)*	*(0.159)*

TABLE VII

Third Regression

*This table presents evidence on how CDS spread respond to changes on the explanatory variables on the quarterly ratios relevant with the GDP for fifteen countries of the Eurozone. The dependent variable is the CDS spread while the five columns show the independent variables. The coefficients are presented in every column and in the parentheses the P-Values. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level correspondingly.*

	GDP growth	**Inflation**	***Imports /GDP***	***Reserves /Imports***	***Current Account /GDP***
Germany	695.3	16.69**	-55.92	66.67	196.1
	(0.155)	*(0.002)*	*(0.384)*	*(0.066)*	*(0.385)*
France	742.1	30.25***	1152.8*	63.54	610.0
	(0.555)	*(0.000)*	*(0.028)*	*(0.090)*	*(0.389)*
Greece	-734.1	-1320.8***	95998.8*	16147.4*	29846.7*
	(0.933)	*(0.000)*	*(0.012)*	*(0.026)*	*(0.019)*
Ireland	-158.6	165.1***	-1793.2**	-1042	-463
	(0.687)	*(0.000)*	*(0.006)*	*(0.246)*	*(0.058)*
Belgium	1659.4	37.1***	588.3	573.3	-54.09
	(0.699)	*(0.000)*	*(0.229)*	*(0.286)*	*(0.878)*
Netherlands	-602.5	11.87	403.3	413.5*	-404.5
	(0.583)	*(0.051)*	*(0.118)*	*(0.020)*	*(0.220)*
Austria	1915.3	25.99**	465.7	92.21	107.4
	(0.146)	*(0.002)*	*(0.320)*	*(0.396)*	*(0.655)*
Cyprus	-29054.5**	-5.61	731.2	694.7	167.8
	(0.002)	*(0.888)*	*(0.775)*	*(0.675)*	*(0.837)*
Italy	-6068.5	53.61**	-1081.3	50.52	485.5
	(0.146)	*(0.009)*	*(0.529)*	*(0.674)*	*(0.549)*
Malta	-	-	-	-	-
Portugal	-11500.2	179.3*	-6467*	-78.86	1129.2
	(0.138)	*(0.016)*	*(0.045)*	*(0.727)*	*(0.260)*
Slovenia	-23813.09	70.16*	539.6	-1004.6	1747.9*
	(0.252)	*(0.012)*	*(0.576)*	*(0.510)*	*(0.041)*
Slovakia	-5804.9	37.84*	16.73	355	-28.38
	(0.346)	*(0.016)*	*(0.373)*	*(0.294)*	*(0.856)*
Spain	-7778.3**	31.98*	-213	124	233
	(0.007)	*(0.027)*	*(0.870)*	*(0.261)*	*(0.707)*
Finland	-106.5	12.36***	323.7	108.6	-32.79
	(0.784)	*(0.001)*	*(0.306)*	*(0.086)*	*(0.809)*

TABLE VIII

*This table presents evidence on how CDS spread respond to changes on the explanatory variables on the daily data for fifteen countries of the Eurozone. The dependent variable is the CDS spread while the three columns show the independent variables. The coefficients are presented in every column and in the parentheses the P-Values. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level correspondingly.*

PANEL A: First Regression

	Coefficient	P-Value
Risk-free Rate	-954.74***	0.000
Risk Appetite	25.745***	0.000
Real Exchange Rate	1264.4***	0.000

PANEL B: Second Regression

	Coefficient	P-Value
DEBT/GDP	0.016	0.946
DEBT/EXPORTS	61.54***	0.011
RESERVES/DEBT	1189.47	0.454

PANEL C: Third Regression

	Coefficient	P-Value
GDP Growth	124.27	0.972
Inflation	-469.28***	0.000
IMPORTS/GDP	-180.39	0.493
RESERVES/IMPORTS	1007.5	0.191
CURRENT ACCOUNT/GDP	627.49	0.496

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