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SOVEREIGN DEBT
AND CREDIT RATING AGENCIES

Relating credit ratings to macroeconomic and political variables on EU sovereign bond yields

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PREFACE AND ACKNOWLEDGEMENTS

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ABSTRACT

A credit rating facilitates the trading of securities on a secondary market; it affects the interest rate that a security pays out, with higher ratings leading to lower interest rates. Whilst credit rating agencies have been up-and-running for almost a century, the value of credit ratings for securities has been widely questioned. Hundreds of billions of securities that were given the agencies' highest ratings were downgraded to junk during the financial crisis of 2007–08 and rating downgrades during the European sovereign debt crisis were blamed by EU officials for accelerating the plague. Given these disturbing facts, this research is based on the disputed role of credit rating agencies during the recent crisis that raises the question of whether sovereign bond yields can be affected not only by ratings but also by macroeconomic and political factors.

With this in mind, the present research aims to generate further knowledge concerning factors significantly affecting sovereign bond yields and, at the same time, to examine whether country ratings add to the ability of economic fundamentals of explaining / predicting sovereign bond yields. Given the ongoing economic crisis, the study brings the attention to European Union countries (members) to provide with insightful information regarding bond ratings' factors. As far as the empirical investigation is concerned the study examines a sample of 23 EU countries (members of EU-25 group) during recent years (2011-2015). In a nutshell, the findings of the study reveal that the factors discussed affect the predictions of sovereign bond yields considerably.

Keywords: sovereign bond yield; European Union; credit rating agencies; macroeconomic and political factors; sovereign debt;

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ABBREVIATIONS

BIS	Bank for International Settlements
ECB	European Central Bank
EU	European Union
GDP	Gross Domestic Product
GFS	Government Finance Statistics
IMF	International Monetary Fund
LCU	Local Currency Unit
SP	Standard and Poor's
SEC	Securities and Exchange Commission
USA	United States of America

CHAPTER I

Overview of the Research

1.1 Introduction

A country's creditworthiness has long stopped being a strictly internal affair. This mainly due to the fact that, nowadays, money and capital markets are integrated which means that risks and associated events that take place within a particular country immediately and greatly affect other countries' risks and related events. It then follows that properly assessing country-specific risks is actually a task of global interest. Some excellent examples come from oil crises during 1970s as well as from the more recent financial crisis that started in the US as sub-prime mortgage crisis and soon escalated into a global recession. With a market size of approximately 50 trillion dollars (in 2015) (Karakousis, 2015), estimating the country-specific risk of default is of vital importance for the global economy.

By nature, investing decisions and, hence, decisions regarding sovereign bonds are made based on estimations about future prospects that are usually formed after reviewing relevant information. In the case of sovereign debt, many types and sources of relevant information are available but both the amount and the complexity of such information make it extremely difficult, if not impossible, for no qualified people to assess it to their best interest. This task has, for many years, been the job of credit rating agencies. A priori, these agencies are thought of as having the skills to come up with objective judgements about a country's creditworthiness or, inversely, risk. However, their estimates have recently been highly questioned mainly because of the agencies' inability to foresee the occurrence of events that, more or less, led to the financial crisis (more specifically: the real estate bubble in the US). There has also been a discussion around the role of credit rating agencies and, more specifically, their motives and concerns when stating their opinion on a country's risk.

1.2 Aim and Research Question

This study aims at combining both streams of literature to provide with relevant empirical evidence. In more detail, its scope is to reveal factors significantly affecting sovereign bond yields and, at the same time, to examine whether country ratings, as announced by the three major agencies worldwide, add to the ability of macroeconomic and political factors of explaining / predicting sovereign bond yields. Taking this overall aim into account, the research questions have been formed accordingly:

- *Firstly, do macroeconomic and political variables affect the performance of sovereign bond yields?*
- *And secondly, does the addition of credit ratings increase the effect of macroeconomic and political variables to sovereign bond yields?*

The study attempts to provide significant information regarding bond ratings' factors after the recent crisis by focusing on the EU members-states. Similar studies have been conducted in the past regarding not only EU countries, e.g. Arezki et al. (2011), but also other countries as well, e.g. Correa et al. (2012). The study's findings are expected to assist both academics and practitioners assess a country's risk and understand the way investors formulate their expectations regarding sovereign debt.

1.3 Structure of the Study

The present study is organized as follows. Chapter I constitutes a brief introduction to the issue discussed and states the aim and objectives of the research. Chapter II develops the topic's theoretical background regarding credit rating agencies and sovereign debt risk and reviews relevant empirical evidence so far reported in the international literature. Chapter III consists of the methodology of the empirical investigation, namely the modelling procedure, variables and data collection. Chapter IV continues with the empirical study itself and the findings of the research. Finally, Chapter V concludes and offers some recommendations for further research.

CHAPTER II

Theoretical Background

2.1 Credit Rating Agencies

2.1.1 Historical Evolution

Credit rating agencies are private organizations (business) and, most often, they are organized as capital companies. As with any other privately held organization within capitalistic economic regimes, their major objective is to maximize their economic profits or the benefits provided to their owners'. Their job is to offer consulting regarding the borrowing ability of an entity (company or sovereign).

The history of credit scoring started in the USA 100 years ago at the same time with the construction of the country's railways. This project required mass amount of finance that had to be found outside governmental funds. Hence, excessive governmental borrowing became a first order priority in order for the railway project to become reality.

At that time, John Moody which was considered one of the most reliable financial analysts, spotted the problem (the excessive need for financing) and established the first credit rating agency in 1909[1]. This was the moment that the now famous ratings like "AAA", "BBB" (see Appendix A, pp. 34-35) and so on were first introduced to denoted the lowest possible risk (AAA) as well as higher ones. Except for the railway project reported above, other major projects were financed through loans or stock issuance after Moody's company provided for creditworthiness "scores" (mines, construction of ships to mention few). What these ratings achieved can be simply summarized into the following phrase: "capital mobility" (capital providers that, otherwise, would hesitate to finance projects they were not aware of, felt comfortably to do so based on reliable analytics, aka "ratings"). However, although securities (bonds and stocks) were initially issued to finance major projects, speculation made its appearance as well. Market information included in credit ratings quickly became both scarce and desirable and gradually evolved in some kind of "commodity". In 1916, it was Standard Statistics' (nowadays known as Standard and Poor's or "S&P") turn to enter the market of credit scoring. Fitch followed in 1924. At the present moment, the companies control almost 95% of the international credit

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[1] It must be mentioned that Moody's was not the first organization to provide with business related information that could be used to rate companies' creditworthiness. Poor's American Railroad Journal was published for the first time in mid-1850 and provided information about railways in USA. By 1880, the journal already had 5.000 subscribers. Reuters was established in 1851. Despite both sources of information being older than Moody's, their purpose was not to explicitly deal with creditworthiness and this is why Moody's is thought of as the first credit rating agency.

scoring market altogether (Kolmer, 2008). Frost (2007) reports that the rest 5% is controlled by 130-150 agencies based on data regarding the year 2000.

From a historical perspective, the evolution of credit rating agencies can be divided into three phases, the first one dating until the Securities and Exchange Commission (SEC) was established in 1993-1934. The main element of this phase was the complete absence of regulation / supervision regarding the credit scoring market. The second phase can be thought of as ending in 1975, the year of the American New Deal, while the third one encompasses the most recent decades and still goes on (BIS, 2005). A different approach regarding the classification of agencies' evolution would call for setting the second phase's starting point in 1970 when agencies changed their income generating policy. To be more precise, until that time, credit rating agencies were paid by the lenders instead of borrowers which is the actual status quo[2].

2.1.2 Functioning

Uncertainty (risk) and pay-off lie in the heart of Finance as they are the two ingredients of "value" or "wealth" (higher uncertainty means less value as lower pay-off does; by contrast, lower uncertainty and higher pay-off mean higher value / wealth). When making lending decisions, lenders want to be sure (to the highest possible degree) about their borrowers' creditworthiness. Within this context, lenders use a variety of mechanisms to eliminate the possibility of suffering losses, collateral and restrictive contractual terms being the most popular ones. Except for this kind of action, lenders have also the choice to consult "specialists" on their borrowers' creditworthiness and this is exactly what credit rating agencies do for living: they combine various sources and types of relevant information to provide "ratings" or, in simpler terms, to estimate a specific level of credit risk. According to Cantor and Packer (1996) and Afonso et al. (2007), credit rating agencies base their country risk estimates on the following information:

- Gross Domestic Product (GDP) cycle
- GDP
- Trade balance
- External balance
- External debt
- Economic growth
- Inflation
- History of default

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[2] We must, however, point out that credit rating agencies may still make money from borrowers in some cases, e.g. subscription revenues (except for when sovereign issue debt).

- Currency reserves
- Governmental effectiveness

Ratings are expressed with letters on a predefined scale that differs among different agencies although not to a very extended degree. Ratings are also accompanied by comments that, generally, regard the borrower's future prospects called "credit outlook" (Frost, 2007). According to Caprio and Klingebiel (2003), the most popular rating scale is that used by S&P. Appendix A reports on S&P's "Long-Term Issue Credit Ratings" which is just one of the various rating scales the company uses (similar scales are used by the rest of the rating agencies). Readers can be fully informed of S&P's scale on the company's website[3].

Ratings are the outcome of economic (as well as other kind of) information, asumptions, and analytical techniques / tools. In some cases, rating agencies state the conditions under which a particualr rating could change (Frost, 2007). At this point, a note on the appropriate use of ratings should be made. As Remolova et al. (2008) note, ratings are a measure of one's ability and willingness to repay their debts. They do capture analysts' opinion on economic and / or financial risk but they are not designed to predict the exact time of default or measure the default's exact size.

2.1.3 Explanatory Theories, Role, and Impact

Credit rating agencies owe their existence to the information asymmetry between borrowers and lenders. In short, "information asymmetry" means that the aforementioned parties have unequal information regarding the credibility or creditworthiness of the borrower. By nature, borrowers know much more about their own credibility than their lenders do (White, 2010). Hence, lenders have an explicit interest in credit rating of their borrowers in terms of making wiser investing decisions (BIS, 2003). Kerwer (2005) also notes that borrowers can be equally interested in their credit rating. This interest comes from the borrowers' willingness to be "judged" based on objective information. To a certain degree, credit rating agencies assure that relevant procedures are appropriate and, by consequence, borrowers' creditworthiness is approached in a better way (in terms of objectivity) compared to the respective outcomes that could possibly come up if lenders estimated their borrower's creditworthiness their own. Consequently, as Duffie (2007) says, credit rating agencies act as intermediates between lenders and borrowers (equivalently between investors and investees). Within this context, investors receive vast amount of information and credit rating agencies are there to support them in terms of handling it, i.e. to make things easier for investors.

It could easily be stated that due to the technological progress and improvement of the quality of the available information, the role of credit rating agencies would nowadays be weaker. However,

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[3] https://www.standardandpoors.com/en_US/web/guest/article/-/view/sourceId/504352.

the opposite happens. Kolmer (2008) reports that people have the option to invest their money in places far away from where they live to protect themselves from country specific risk. This means that investors have to take into account information they are not familiar with and, by extension, they may find it difficult to make decisions based on accurate and promptly available information. Furthermore, financial investments have become extremely complicated for simple investors to understand. The author also points out that recent scandals further enhanced the importance / necessity of credit rating agencies to prevent billion dollar losses. The above comments suggest that credit rating agencies are highly involved with capital mobility. Taking into account the mass amounts of money that circulate the international market on a daily basis, the role of credit rating agencies has nowadays become very important and, as De Grauwe (2008) notes, these companies are among the major players of the international capital and money market. Kerwer (2005) calls them "market regulators" while Boot et al. (2006) note that credit rating agencies assist in the creation of balance and well-functioning of the global financial system.

Justensen (2009) reports that ratings above BBB (BB or higher) are considered investment grades in the sense that creditworthiness is considerably high and risk is low. Ratings thus play an important role for the definition of borrowing cost or the required return of investors (in the case of stock issuance). All other things equal, lower rates are associated with lower risk and eventually higher costs (interest rates / required return). On one part, lower rates can also lead to other problems for the rated entity. In some cases, institutional investors pose restrictions regarding the securities they invest in. Relevant experience implies that investments rated less than "BBB" are not chosen by institutional investors. Given the importance of such investors for the global financing market, it is very easy to understand the importance of credit rating agencies. Higher rates, on the other part, provide rated entities with an extra negotiating tool: the lower the risk associated with their operations in the future, the lower the return they are willing to provide their finance providers, all other things equal.

According to Spanou (2008), the role of credit rating agencies is to help markets become more efficient by improving transparency, diffusing information to investors, and decreasing investing risks. Similarly, they offer some entities (basically start-ups) the ability to seek capital that would otherwise be impossible to find for many reasons, such as the lack of trust towards entities for which no information regarding their credit history exists. Gibson (2004) points out that credit ratings agencies can serve as means to indirectly signal classified information. As the author explains, entities may use credit rating agencies to signal confidential information that would otherwise be impossible to announce to the public. This is based on the fact that credit rating agencies have no obligation to explicitly reveal information used to form their estimates and this means that confidential information can be embodied in the rating without being revealed.

Although credit rating agencies, as well as every "consultant", base their estimates on information that is or, normally, could become available to lenders (especially in present times – see above), it is the consultant's experience and skills that add to the information's value. Otherwise stated,

it is not only about the information considered but also the ability to extract the maximum possible value from that information's assessment. Although consultants have or are thought to possess superior analytical skills when compared to lenders, subjectivity cannot be a priori excluded. This is due to the fact that different receivers react differently to the exact same message depending on their system and incentives regarding the message's decoding[4]. By consequence, reliability is a matter of not only the information used but also of the rater's ability to deal with it. Sinclair (1999) notes that ratings affect both borrowers / investees and lenders / investors but Kerwer (2005) reports that, although this is true, the former are affected more than the latter. Investors do not pay for ratings and are the receivers of someone's judgement (in this case judgement consists of the credit score). A change in a particular rating would mean that investors have to decide about whether to start, continue, or end their investment. Except for extreme cases, like Enron's, where ratings completely fail to capture the rated party's creditworthiness thus leading to billions of dollars lost, investors are not severely affect by credit scores. By contrast, investees (or borrowers) are the ones that suffer the cost of rating procedures and the indirect effects of credit scoring. Under certain conditions, lowering a company's credit score could lead to a complete lack of financing and whatever comes up with it (restructuring, layoffs etc). As Adams et al. (1999) report, credit rating agencies have the tendency to lower sovereigns' ratings during financial crises thus making it very difficult for countries to recover. Such behavior leaves no space for immediate action that could possibly help limit negative effects at least in the short-run. Except for this, ratings do not recover until austerity measures are imposed to signal decisive action towards turnaround[5].

2.1.4 Criticism of Reliability

Credit rating agencies have been severely criticized throughout the years and even more recently. According to Becker and Milbourn (2009), credit rating agencies were repeatedly proved incapable of altering ratings to signal forthcoming sovereign crisis and when they did, crisis was already there. Thus, their delayed action did nothing more than make things worse. As the authors report, credit rating

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[4] Take for example a very simple situation where someone hears the phrase "it will rain" during a weather forecast. After hearing this, some people may simply go out for a walk (taking no precautionary measures) while others may choose to take an umbrella before leaving home. Young persons would probably choose the first given that the have limited experience of assessing the informational content of the "it will rain" phrase. By contrast, elderly people have much more experience regarding decoding messages like the one reported above and simply know that "rain" means "umbrella". Except for this, they have stronger incentives to act in a proactive way since rain may be more harmful to them (than it could with regards to younger people).

[5] Greece is a representative example of this.

agencies failed to foresee crises in Mexico (in 1994), Asia (in 1997), Russia (in 1998), and Brazil (in 1998). Corporate failures were also not signaled by credit rating agencies. Enron and Worldcom's bankruptcies in early 2000's are among the most popular cases. Some authors, see for example Meijer and Saar (2008) as well as Krugman (2009), claim that credit rating agencies could (but did not) prevent investors and other involved groups, from suffering substantial losses. However, Frost (2007) points out that Enron's complicated structure made it difficult not only for credit rating agencies but also for most analysts to realize the imminent bankruptcy. More recently, credit rating agencies also failed to provide with early warning signals for the forthcoming subprime mortgage crisis in USA.

Criticism against credit rating agencies concentrates on data and methodology used to provide with estimates (Gullo and Lustgarten, 2012). Some critics support the view that quantitative models may provide with more accurate ratings if compared with those used by rating agencies which are both quantitative and qualitative in nature. As Meijer and Saar (2008) note, models used by rating agencies suffer from lack of historical data regarding certain products rated. Another stream of criticism focuses on the inability of ratings to provide with symmetric information as some studies show that investors react more intensively to ratings' downgrading than upgrading (Hand et al., 1992). According to Meijer and Saaf (2008), credit rating agencies face serious conflicting interests given that their core object consists of providing consulting to entities that are being rated by them.

There is also another body of literature claiming that the major problem with credit rating agencies has to do with the system / context in which they operate. More precisely, it is claimed that the private character of credit scoring suffers by nature from deficiencies. Instead of allowing for-profit organizations to assess the creditworthiness of companies and sovereigns, credit scoring should be done by state agencies or, alternatively, by not-for-profit organizations. Additionally, efforts to regulate the credit scoring market have been led by parties related to and / or influenced by credit rating agencies themselves. Another "systemic" deficiency has to do with lobbying on behalf of credit rating agencies that largely comes from their long-term relationship with the financial industry in the US (Bordo, 2008).

Apart from passing the right of credit scoring to private companies, the financial system made things even worse by imposing ratings in a variety of cases. To mention a few, participants in the US capital market are required to be rated by at least two rating agencies since 1970. US institutional investors, such as banks and insurance companies, are allowed to invest solely in securities that are rated "investment grade". Before issuing any debt, US corporations should first receive a credit scoring. Similar treatment of credit scoring can be found in other cases too. The Bank of International Settlements (BIS) established by central banks worldwide has been traditionally, though implicitly, in favor of credit rating agencies given its suggestion for bank securities to be rated by one of the three credit rating agencies. In cases where rating is "non-investment grade", banks must issue new capital. Similarly, the Basel Committee suggests that computations regarding banks' equity should be based solely on reliable assets (as implied by their credit scoring). Basel II further reinforced the role of credit rating agencies

with regards to the computation of bank capital requirements (Hellenic Bank Association, 2010). The European Union and European Central Bank base member states rating on ratings provided by the three largest agencies. According to Kammas (2008), any country could possibly be faced with the inability to access money markets. Basel III is also directed towards reinforcing the role of credit rating agencies (White, 2010).

The case of Enron as well as other ones, led to the Sarbanes-Oxley Act (in 2002) that emphasized among others the need to monitor action taken by credit rating agencies. The Credit Rating Agency Reform Act (voted in 2006) underlined once again the need for transparency, responsibility, competition etc. Under the new Act, credit ratings agencies must follow a predefined procedure to register with SEC. Since then, only 7 agencies successfully completed the relevant process. However, the agencies' "triopoly" was not affected at all since the three large players continued to control 97% of the international credit rating market (Becker and Milbourn, 2009).

2.2. Factors Explaining Governmental Bond Yields

2.2.1 Description of Governmental Bonds

Bond markets are generally known as markets of "fixed interest" of "fixed income" and constitute a significant part of the capital market globally. The last two decades bond markets have become extremely complicated after the introduction of new investing products. Governmental bonds are issued by countries (sovereigns) are generally considered low, or even zero, risk investments as investors do not expect a country to default or go bankrupt (Choudhry, 2010).

Bond prices are usually expressed as "X $ per 100 nominal units" terms which are translated as follows: if a bond's price is 98$, this means that investors must pay 98$ monetary units for every 100$ of face value. Bonds are valued based on four factors: a) face value, b) coupon, c) number of periods until maturity, and d) risk. In particular, a bond's value equals the discounted value of all its future cash flows (coupons and face value) until it expires or is liquidated for any given reason[6] (Stafford Johnson, 2004). The most commonly used measure of bond yield is the yield to maturity that is the compounded return realized by investors under the assumption that the bond is held to maturity (or any other type of liquidation; see last footnote). Because daily changes in bond yields are not extreme, the term "basis points" is used to describe them. Basis points (often abbreviated as "bps") show the absolute change in a bond's yield as follows: 1 bps is equal to 1/100 of 1%. For example, if bond yields increase by 50 bps,

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[6] Bonds are not always kept until they mature. There are several reasons for this. For example, some bonds are callable (can be liquidated) before they mature. In this case, maturity (face) value is replaced by the value at which the bond is called in order to value it.

this means that the increase is 50/100 of 1% = 0.5% or 0.005. Thus, if bond yields before the change are 2% (or 0.02), they will become 2% + 0.5% = 2.5% (or 0.025 = 0.02 + 0.5*0.01). Very often, "bond spreads" or simply "spreads" are used instead of bond yields. Spread is equal to the difference between a bond's yield and the risk-free rate, i.e. the rate achieved by investment of zero risk. In the case of governmental bonds, spread is defined as the difference between a country's bond yield and another country's one, the second country assumed as being of the lowest risk. To explain, if the spread between Greek and German bonds is 50 bps, this means the Greek bonds' yield is higher than that of German bonds by 0.5% (= 50/100 * 1%).

2.2.2 Factors Affecting Governmental Bond Yields as Evidenced by Existing Research

Governmental bond yields are affected by three major groups of factors. First, there are macroeconomic variables, such as the governmental deficit, next are the investors' expectations, and finally there are also factors relating to creditworthiness. Alesina and Perotti (1996) note that the most significant role is played by the first group of factors given that these variable significantly affect the rest of bond yield determinants. Among the most commonly reported factors, we may include GDP growth rate, fiscal deficit, trade balance, and governmental debt. Liquidity is also a major factor because it captures a country's short-term ability to repay its debts (Sapountzoglou and Pentotis, 2009). Given that sovereign debt can be issued at a different currency than that of the issuer (e.g. Greece issues bonds that are paid in $), currency reserves may also be important in predicting bond yields. Since currency reserves are affected, among other factors, by exports, this variable can also be a determinant. Other factors include investors' risk aversion that describes the sensitivity of investors towards risk and its changes (Barrios et al. 2009).

Governmental deficit can be defined as the part of governmental expenditure financed by debt. From the investor's perspective, a large deficit can have dual interpretation; first, that the government is unable to control its expenditures or, alternatively, that the government is unable to generate revenues to pay for its expenditure. In any case, the larger the deficit, the larger a country's risk is expected to be. Deficit is usually expressed in % GDP terms to avoid comparisons among countries of different size. Thus, a 50% deficit means that the deficit equals half the country's GDP (in $). Some authors claim that instead of deficit the "expected deficit" should be considered as a factor of yields because, by nature, investors base their choices on future rather than current conditions. Nickel et al. (2009) found a positive relation between yields and deficits. Similar evidence is reported by Laubach (2009) while Thomas and Wu (2009) found that a decrease in GDP by 1% increases yields because it increases the ratio of deficit to GDP. Akitoby and Stratmann (2006) support the view that it would be more accurate to study the ingredients of deficits instead of deficits alone. As the authors explain, a change in deficit can be the outcome of other changes, each of which is perceived differently by investors. For example, investors

are expected to react differently between expenditure cuts and tax imposition although both actions lead to the same result (decrease in deficit). It is expected that expenditure cuts can, under certain conditions, promote an economy's future growth because they give the government the ability to decrease taxes in the future, thus making its country more attractive to investors.

Like governmental deficit, governmental debt is usually expressed in % GDP terms but other definitions have been used, see Edwards (1985) who used Gross National Income. As with deficit, expected debt could be a better predictor of bond yields compared to the current one. Debt acts in a similar way with deficit in what regards bond yields. In simple terms, a positive relation is expected between debt and yields. This is normal considering that governmental debt is the outcome of cumulative deficits. Conway and Orr (2000) emphasize the fact that the starting point of debt is also expected to play an important role when changes in debt are considered. As the authors explain, between two countries suffering the same change in debt, the country with the highest debt before the change is expected to suffer the highest increase in bond yield, because investors weight higher increases in already high debt levels. Baldacci and Kumar (2010) prove that, although the relationship between debt and yield is positive, its magnitude depends on debt level. More precisely, the relationship is stronger in lower debt levels. Akitoby and Stratmann (2006) also found a positive relationship between the "debt to GDP" ratio and yields.

Growth rate is expected to act to the opposite direction when compared to deficit and debt. Hence, we expect a negative relation between growth rate and yield. Although changes in a country's GDP per se do not tell too many things, they result in changes in both the ratio of deficit to GDP as well as that of debt to GDP. Consequently, when GDP increases the "deficit to GDP" and "debt to GDP" decrease leading yields down. Growth rate has been found to be the third most important predictor of bond yields in the study of Oya (2001) among 5 ones.

Trade deficit and its components is generally expected to be positively related to bond yields (the higher the deficit, the higher the risk, and, subsequently, the higher the yield). Equivalently, exports are expected to be the same but imports are expected to be positively related to bond yields. The underlying cause for this relation is that the higher the trade deficit the higher the governmental deficit that must be used to finance the gap between imports and exports (the so called "twin deficits" assumption). Another way to consider part of trade deficit is to examine the ratio of exports to a country's debt. This is mostly a measure of political (in)dependence rather than a measure of economic prosperity despite the obvious relation between the two variables. Trade deficit is also related to currency reserves and, as will be mentioned later, currency reserves are negatively related to bond yields. Given that, trade deficit is negatively related to currency reserves but positively related to bond yields. However, the fact that the "debt to exports" (or its inverse) ratio is at least partially included in other measures, e.g. when deficit and the debt to GDP are examined, makes it an insignificant factor of bond yields as in Nickel et al. (2009). Nevertheless, we must note that this insignificance is plausible when the information content

of the relation between exports and debt is already captured by other variables[7].

The ratio of currency reserves to debt may also be a determinant of bond yields provided that the country has outstanding debt that must be paid in different currency. This ratio is expected to be negatively related to bond yields since higher currency reserves mean more enhanced ability to repay debts in different currencies. Furthermore, this ratio captures a country's ability to import goods and services without suffering increases in its current debt position. Currency reserves are also expressed in % GDP terms and are also expected to be negatively related to bond yields since higher values of currency reserves, as expressed here, imply higher level of liquidity. Edwards (1985) found that, in open emerging markets, the ratio of currency reserves to GDP is significantly and negatively related to bond yields and among their most important determinants. In a more recent study, Rowland and Torres (2004) found a simultaneous and significant relation between bond yields and GDP growth (negative coefficient), Debt / GDP (positive coefficient), and Exports / GDP (negative coefficient). It is then obvious that empirical findings may contradict theoretical assumptions in this case.

Inflation is, according to Baldacci et al. (2008), expected to be positively related to bond yields because it is negatively related to growth. As the authors note, higher inflation leads to lower growth and this is why inflation is expected to be positively related to bond yields (since lower growth, because of higher inflation, means higher bond yields). Akitoby and Stratmann (2006) found a positive relation between inflation and bond yields that seems to be robust after changing the number of variables included in either model (3 models containing 6, 7, and 8 variables are estimated).

Political (in)stability is also a major component of bond yields although some could argue that its effect is only indirect since it is already included in economic variables (Moser, 2007). However, as we shall show below, there are cases where the political situation seems to play an important role even in the presence of significant economic variables. Eaton and Gersovitz (1981) make an interesting distinction between political ability and intention with regard to decisions relating to a country's debt. What the authors emphasize the most is that governmental policy is differently perceived by investors when decisions are the outcome of intentional action or simple lack of capabilities. Aizenman and Powell (1998) add to this that the lack of a powerful decision center with respect to a country's finances may result in an inadequate level of revenues and, consequently, increased debt. Furthermore, we must not forget that political instability is translated into higher uncertainty which, by definition means increased risk and required return. Moser (2007) found that political changes and, more precisely, changes in people dealing with a country's economic policy are perceived by market participants as changes in government's willingness to repay its debt. Similar evidence is reported by Ganapolsky and

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[7] This is exactly the case in Nickel et al. (2009) given that the authors also examine trade deficit, GDP growth, and the ratio of currency reserves to imports, among other factors. Nevertheless, the authors find a positive relation between bond yields and the ratio of debt to exports.

Schmukler (2001) that note the increase in Argentina's bond yields after the announcement of Domingo Cavallo's replacement (the then country's minister of finance). Despite the evidenced effect of policy variables on bond yields, Moser (2007) points out that these effects are only expected to be significant when changes in political conditions are unexpected which means they provide with new information not yet accounted for by bond yields. To explain, a surprise of political nature (e.g. an unexpected change in government) increases the risk associated with sovereign debt and, consequently, bond yields. In his study, a significant and positive relationship between political changes and bond yields is found but the corresponding effect is rather limited when compared to the one regarding most of the other independent variables.

CHAPTER III
Methodology of the Research

3.1 Scope, Assumptions, and Modelling

The scope of the present empirical analysis is double. First, we aim at revealing whether sovereign bond yields depend on the macroeconomic and political variables reviewed in the last section of the previous chapter. We do so in order to compare our results to existing ones. Second, we aim at checking if the inclusion of credit ratings increases the explanatory power of macroeconomic and political variables. If yes, then we may conclude that the role of credit agencies is justified since, in this case, it will be evidenced that these agencies have the ability to assess differently (than markets) economic and political information which means that they contribute in creating higher quality information.

To model our investigation, some assumptions are necessary. By nature, bond yields (as well as any other investment's yield) are formulated based on investors' expectations. Normally, these expectations are re-formulated every time new information becomes available. We then assume that sovereign bond yields in year "t" depend on year's "t-1" economic and political factors. We think that this assumption is reasonable since the announcement of information on a country's economy and politics requires time for editing purposes. For example, a country's 2016 GDP will normally be announced in 2016 because authorities need time to collect and edit the respective data. Consequently, we assume that economic and political factors in year "t-1" relate to a country's bond yields in "t", hence the following panel date linear regression model: Yield in "t" = a + b*Economic and Political factors in year "t-1" + error term. To investigate whether credit ratings affect bond yields, we add to this model as independent variable ratings in year "t" which means we assume a simultaneous effect of ratings on bond yields. We think that this assumption is reasonable if one thinks that markets react or, at least, are expected to react instantly to the announcement of ratings. Consequently, the model becomes: Yield in "t" = a + b*Economic and Political factors in year "t-1" + Ratings in year "t" + error term. As it will be noted in the next section, we use ratings from the three major agencies. Consequently, the role of ratings will be investigated separately for each agency which means we will estimate three models to check the role of rating and a total of four models for the whole analysis.

63.2 Variables and Data Collection

The macroeconomic and political variables are similar to those reviewed in the last section of the

previous chapter. Data on these variables were downloaded from Worldbank's website (http://www.worldbank.org/). The variables (6 economic and 2 political) considered are described as follows (bold letters are used to denote abbreviations that will be used in the remainder of the study). Annual data are used (if not otherwise reported).

- **Deficit** is measured with the variable "Cash surplus/deficit (% of GDP)". Cash surplus or deficit is revenue (including grants) minus expense, minus net acquisition of nonfinancial assets. In the 1986 GFS manual nonfinancial assets were included under revenue and expenditure in gross terms. This cash surplus or deficit is closest to the earlier overall budget balance (still missing is lending minus repayments, which are now a financing item under net acquisition of financial assets).

- **Trade** (deficit) is measured with the variable "External balance on goods and services (% of GDP)". External balance on goods and services (formerly resource balance) equals exports of goods and services minus imports of goods and services (previously nonfactor services).

- **Inflation** is measured with the variable "Inflation, consumer prices (annual %)". Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.

- **Debt** is measured with the variable "Central government debt, total (% of GDP)". Debt is the entire stock of direct government fixed-term contractual obligations to others outstanding on a particular date. It includes domestic and foreign liabilities such as currency and money deposits, securities other than shares, and loans. It is the gross amount of government liabilities reduced by the amount of equity and financial derivatives held by the government. Because debt is a stock rather than a flow, it is measured as of a given date, usually the last day of the fiscal year.

- **Growth** is measured with the variable "GDP growth (annual %)". Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

- **Reserves** are measured with the ratio of the variables "Central government debt, total (current LCU[8])" and "Total reserves (includes gold, current US$)". Debt is the entire stock of direct government fixed-term contractual obligations to others outstanding on a particular date. It includes domestic and foreign liabilities such as currency and money deposits, securities other than shares, and loans. It is the gross amount of government liabilities reduced by the amount

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[8] Local currency unit (in our case: euro)

of equity and financial derivatives held by the government. Because debt is a stock rather than a flow, it is measured as of a given date, usually the last day of the fiscal year. Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. The gold component of these reserves is valued at year-end (December 31) London prices. Data are in current U.S. dollars.

- **Effectiveness** is measured with the variable "Government Effectiveness: Estimate". Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.

- **Stability** is measured with the variable "Political Stability and Absence of Violence/Terrorism: Estimate". Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.

All independent variables are lagged (one year) for the reasons previously explained.

Bond yields (denoted **Yield**) are expressed in percentage units, e.g. a bond yield of 2.5 equals 2.5%. Annual yields were downloaded from the European Central Bank website (https://www.ecb.europa.eu/home/html/index.en.html) that reports annual yields on a monthly basis. Because bond yield factors are measured on an annual basis, annual bond yields are computed as the arithmetic mean of all available data point for a particular year.

Finally, ratings were downloaded from the Thompson Reuters website (http://thomsonreuters.com/en.html). As reported in the previous chapter, credit rating agencies assign letters to level of creditworthiness. To be included in our analysis, each letter was turned into a number based on the minimum and maximum value that the respective rating agency uses (21 for Moody's and Fitch and 22 for Standard and Poor's). Lower numbers show higher (better) ratings. Ratings are denoted **Moody**, **Fitch**, and **SP**, accordingly.

Data on bond yields and ratings come from the years 2015, 2014, 2013, and 2012. Consequently, data on macroeconomic and political factors come from the years 2014, 2013, 2012, and 2011. We must also note that there are cases with missing data; this is why the number of observations will be reported in every step. However, Estonia is completely dropped from further analysis because no data on bond yields were reported by the European Central Bank. Malta was also left outside our analysis because of missing data on macroeconomic and political factors. Accordingly, our analysis regards the rest 23 of

the EU-25 countries.

Based on the above, the following models will be estimated:

- Basic

$$Yield_t = Deficit_{t-1} + Trade_{t-1} + Inflation_{t-1} + Debt_{t-1} + Growth_{t-1} + Reserves_{t-1} + Effectiveness_{t-1} + Stability_{t-1} + e$$

- Extended

$$Yield_t = Deficit_{t-1} + Trade_{t-1} + Inflation_{t-1} + Debt_{t-1} + Growth_{t-1} + Reserves_{t-1} + Effectiveness_{t-1} + Stability_{t-1} + Moody_t + e$$

$$Yield_t = Deficit_{t-1} + Trade_{t-1} + Inflation_{t-1} + Debt_{t-1} + Growth_{t-1} + Reserves_{t-1} + Effectiveness_{t-1} + Stability_{t-1} + Fitch_t + e$$

$$Yield_t = Deficit_{t-1} + Trade_{t-1} + Inflation_{t-1} + Debt_{t-1} + Growth_{t-1} + Reserves_{t-1} + Effectiveness_{t-1} + Stability_{t-1} + SP_t + e$$

CHAPTER IV

Findings and Data Analysis

4.1 Descriptive Statistics

The number of cases, average, median, and standard deviation for the full data set are reported on the next table.

Table 1

Annual descriptive statistics (full data set)

	Yield	Moody	Fitch	SP	Deficit	Trade	Inflation	Debt	Growth	Reserves	Effectiveness	Stability
2011												
Valid	0	0	0	0	23	23	23	22	23	22	23	23
Missing	23	23	23	23	0	0	0	1	0	1	0	0
Mean					-4.31	2.42	3.20	69.65	70	41.09	1.26	.80
Median					-3.64	-.25	3.29	62.13	1.97	10.61	1.37	.93
St.Dev.					3.20	8.18	.80	28.83	3.03	110.38	.54	.39
2012												
Valid	23	23	23	23	23	23	23	22	23	22	23	23
Missing	0	0	0	0	0	0	0	1	0	1	0	0
Mean	4.90	15.57	17.38	17.11	-3.71	3.57	2.67	79.98	-.63	46.56	1.25	.80
Median	4.55	16.00	18.00	17.50	-3.48	1.46	2.60	75.99	-.29	10.78	1.33	.90
St.Dev.	4.53	5.61	4.70	4.84	2.77	7.60	.91	38.32	2.46	127.54	.52	.40
2013												
Valid	23	23	23	23	20	23	23	19	23	19	23	23
Missing	0	0	0	0	3	0	0	4	0	4	0	0
Mean	3.63	15.31	17.14	16.96	-3.33	4.76	1.09	90.59	.21	54.79	1.25	.82
Median	3.19	16.00	18.	17.00	-2.68	3.01	1.22	88.58	.30	14.80	1.35	.92
St.Dev.	2.12	5.85	4.89	5.06	2.84	7.99	.87	40.50	2.24	138.43	.49	.39
2014												
Valid	23	16	16	16	19	23	23	0	23	0	23	23
Missing	0	7	7	7	4	0	0	23	0	23	0	0
Mean	2.63	15.37	17.28	16.66	-2.85	4.82	.27		1.72		1.25	.81
Median	2.14	17.25	19.00	17.00	-2.63	2.91	.24		1.60		1.15	.79
St.Dev.	1.52	6.21	5.14	4.90	2.65	7.72	.72		1.72		.48	.34
2015												
Valid	23	16	16	16	0	0	0	0	0	0	0	0
Missing	0	7	7	7	23	23	23	23	23	23	23	23
Mean	1.77	15.69	17.25	17.06								
Median	.96	17.50	19.00	18.50								

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St.Dev.   2.00   5.70   4.96   5.08

With regard to bond yield, we note a decreasing trend after 2012 to 2015 based on both average and median values as stated in Table 1. However, ratings show almost no change irrespective of the measure (average or mean) or the agency considered. In general, ratings are around the values of 15-17 which can be translated into high risk (or "high speculative area). For example, average Moody's rating in 2015 is 15.7 which is very close to "B3". Given that ratings fail to capture the decreasing trend in bond yields, we find preliminary evidence of the inability of credit rating agencies to fully explain bond yields. As for the rest of the variables, we note an increasing trend in "Deficit", "Debt", "Reserves" and a decreasing trend in "Inflation". "Trade" and "Growth" show a mixed picture. Political variables may be considered stable. Given that both variables take values from -2.5 to 2.5, it is concluded that "Effectiveness" and "Stability" are higher than average.

4.2 Regression Analysis – Basic model

Before estimating the basic model, the Pearson correlation coefficients were computed to check whether linear regression is suitable for the analysis. Readers should have in mind that bond yields are measured in year "t" while the rest of variables in year "t-1".

Table 2

Correlation coefficients between bond yields and macroeconomic – political factors

		Yield	Deficit	Trade	Inflation	Debt	Growth	Reserves	Effectiveness
Yield	Pearson	1							
	Significance								
	N	92							
Deficit	Pearson	-.592**	1						
	Significance	.000							
	N	85	85						
Trade	Pearson	-.313**	.308**	1					
	Significance	.002	.004						
	N	92	85	92					
Inflation	Pearson	.252*	-.025	-.078	1				
	Significance	.015	.821	.462					
	N	92	85	92	92				
Debt	Pearson	.423**	-.710**	-.227	-.300*	1			
	Significance	.001	.000	.073	.017				
	N	63	63	63	63	63			
Growth	Pearson	-.527**	.447**	.216*	.041	-.584**	1		

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	Significance	.000	.000	.038	.695	.000			
	N	92	85	92	92	63	92		
Reserves	Pearson	.195	-.164	.195	.181	.177	-.014	1	
	Significance	.126	.198	.126	.156	.165	.911		
	N	63	63	63	63	63	63	63	
Effectiveness	Pearson	-.508**	.343**	.307**	.003	-.322*	.108	-.261*	1
	Significance	.000	.001	.003	.980	.010	.303	.039	
	N	92	85	92	92	63	92	63	92
Stability	Pearson	-.524**	.560**	.501**	.090	-.562**	.354**	-.053	.554**
	Significance	.000	.000	.000	.394	.000	.001	.679	.000
	N	92	85	92	92	63	92	63	92

* statistically significant at the 5% level

** statistically significant at the 1% level

As indicated by the table above, bond yields are significantly correlated with all independent variables except for "Reserves". However, we must be cautious with the extent of correlation because no coefficient can be considered high enough: all absolute values are less than 0.6. As for the independent variables, we note that there are significant correlations but not in all cases. Furthermore, the extent of correlation is generally low (except for the pair of "Debt" and "Deficit") and, thus, we may expect weak effect from collinearity in the basic regression model. Findings regarding the basic model of regression are reported on the following table (table 3).

Table 3

Regression analysis – Basic model

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.84[a]	.70	.66	1.89	1.53

a. Predictors: (Constant), Stability, Reserves, Inflation, Growth, Trade, Deficit, Effectiveness, Debt

b. Dependent Variable: Yield

ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
	Regression	447.34	8	55.92	15.73	.00[b]
1	Residual	191.94	54	3.55		
	Total	639.34	62			

a. Dependent Variable: Yield

b. Predictors: (Constant), Stability, Reserves, Inflation, Growth, Trade, Deficit, Effectiveness, Debt

Coefficients[a]

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Collinearity Statistics

	B	Std. Error	Beta			Tolerance	VIF
(Constant)	5.37	1.49		3.61	.00		
Deficit	-.52	.13	-.47	-4.06	.000	.41	2.43
Trade	-.06	.04	-.14	-1.51	.14	.68	1.47
Inflation	.51	.22	.20	2.29	.03	.73	1.36
Debt	-.03	.01	-.30	-2.27	.03	.32	3.11
Growth	-.60	.11	-.52	-5.45	.00	.62	1.62
Reserves	.00	.00	.07	.86	.39	.76	1.31
Effectiveness	-1.86	.59	-.30	-3.15	.00	.59	1.68
Stability	-.04	.94	-.00	-.04	.97	.41	2.46

a. Dependent Variable: Yield

The basic model (as described in Table 3, pp. 20-21) explains 70% of bond yield variation as R-squared indicates. With respect to residuals' independence, we note that the value of the Durbin-Watson statistic is between the range of 1.5 and 2.5 which means residuals are independent to each other. There is also no significant sign of multicollinearity because the values of tolerance are high enough than the conventional minimum level of 0.1 or 0.2 and, in the same way, variance inflation factors are lower enough than the maximum value of 10 which is frequently considered as threshold. The model is also statistically significant as implied by the p-value of F-statistic (which is less than 5%). Turning to bond yield determinants, we note that "Deficit", "Inflation", "Debt", "Growth" and "Effectiveness" are significant predictors of bond yield. All significant factors are negatively related to bond yields except for "inflation" that is positively related to the dependent variable. Among significant factors, the standardized coefficients show the most important ones are "Growth", "Deficit", "Effectiveness", "Debt", and "Inflation".

4.3 Regression Analysis – Extended models

We begin our analysis by reporting correlation coefficients among all variables considered by extended models. Because correlations between bond yields and macroeconomic and political factors have already been examined in the previous section, our focus here is on correlations between bond yields and ratings and between ratings and macroeconomic and political factors.

Table 4

Correlation coefficients between bond yields, macroeconomic – political factors, and ratings

		Yield	Moody	Fitch	SP	Deficit	Trade	Inflation	Debt	Growth	Reserves	Effecti-veness
Yield	Pearson	1										
	Sig.											

			Moody	Fitch	SP	Deficit	Trade	Inflation	Debt	Growth	Reserves	Effectiveness
	N	92										
Moody	Pearson	-.760**	1									
	Sig.	.000										
	N	78	78									
Fitch	Pearson	-.752**	.985**	1								
	Sig.	.000	.000					"				
	N	78	78	78								
SP	Pearson	-.731**	.965**	.977**	1							
	Sig.	.000	.000	.000								
	N	78	78	78	78							
Deficit	Pearson	-.592**	.646**	.619**	.577**	1						
	Sig.	.000	.000	.000	.000							
	N	85	76	76	76	85						
Trade	Pearson	-.313**	.290**	.306**	.330**	.308**	1					
	Sig.	.002	.010	.006	.003	.004						
	N	92	78	78	78	85	92					
Inflation	Pearson	.252*	.178	.158	.145	-.025	-.078	1				
	Sig.	.015	.120	.166	.205	.821	.462					
	N	92	78	78	78	85	92	92				
Debt	Pearson	.423**	-.653**	-.594**	-.588**	-.710**	-.227	-.300*	1			
	Sig.	.001	.000	.000	.000	.000	.073	.017				
	N	63	58	58	58	63	63	63	63			
Growth	Pearson	-.527**	.504**	.468**	.462**	.447**	.216*	.041	-.584**	1		
	Sig.	.000	.000	.000	.000	.000	.038	.695	.000			
	N	92	78	78	78	85	92	92	63	92		
Reserves	Pearson	.195	-.213	-.255	-.256	-.164	.195	.181	.177	-.014	1	
	Sig.	.126	.108	.053	.053	.198	.126	.156	.165	.911		
	N	63	58	58	58	63	63	63	63	63	63	
Effecti-Veness	Pearson	-.508**	.662**	.702**	.706**	.343**	.307**	.003	-.322*	.108	-.261*	1
	Sig.	.000	.000	.000	.000	.001	.003	.980	.010	.303	.039	
	N	92	78	78	78	85	92	92	63	92	63	92
Stability	Pearson	-.524**	.629**	.631**	.637**	.560**	.501**	.090	-.562**	.354**	-.053	.554**
	Sig.	.000	.000	.000	.000	.000	.000	.394	.000	.001	.679	.000
	N	92	78	78	78	85	92	92	63	92	63	92

* statistically significant at the 5% level

** statistically significant at the 1% level

With respect to the correlation between bond yields and ratings, Table 4 indicates a significant and high enough correlation, the corresponding coefficients being -0.76, -0.75, and –0.73 for Moody's, Fitch, and Standard and Poor's, respectively. Based on these values, we expect Standard and Poor's ratings to be a weaker predictor of bond yields compared to Moody's and Fitch ratings although not to a very extended degree. As expected, ratings are significantly and to a very high degree correlated to

each other (the correlation coefficients take values from 0.965 to 0.985). From this evidence, we suspect similar results for all regression analysis of extended models because of the very high correlation among the three variables of ratings. As far as correlations between ratings and macroeconomic and political factors are concerned, the overall image is identical for all ratings. To be more accurate, all ratings are significantly correlated to "deficit", "trade", "debt", "growth", "effectiveness", and "stability". Interestingly, correlation coefficients between ratings and political factors are higher than those between ratings and economic variables. The following table reports regression analysis for the first extended model (independent variables include macroeconomic and political factors and Moody's ratings).

Table 5

Regression analysis – Extended model with Moody's ratings

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.89[a]	.80	.76	1.61	1.82

a. Predictors: (Constant), Moody, Inflation, Trade, Reserves, Growth, Deficit, Effectiveness, Stability, Debt

b. Dependent Variable: Yield

ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
	Regression	502.26	9	55.81	21.50	.00[b]
1	Residual	124.58	48	2.59		
	Total	626.84	57			

a. Dependent Variable: Yield

b. Predictors: (Constant), Moody, Inflation, Trade, Reserves, Growth, Deficit, Effectiveness, Stability, Debt

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	8.92	1.68		5.31	.00		
Deficit	-.37	.11	-.33	-3.21	.00	.39	2.58
Trade	-.05	.03	-.12	-1.45	.15	.65	1.54
Inflation	.63	.24	.23	2.64	.01	.55	1.83
Debt	-.03	.01	-.35	-2.86	.01	.28	3.58
1 Growth	-.44	.10	-.38	-4.33	.00	.55	1.82
Reserves	.00	.00	.01	.16	.88	.70	1.43
Effectiveness	-.43	.61	-.07	-.70	.49	.45	2.21
Stability	.45	.83	.06	.54	.59	.39	2.56
Moody	-.33	.07	-.58	-4.92	.00	.30	3.38

a. Dependent Variable: Yield

The extended model including "Moody" (see Table 5 above) explains 80% of bond yield variation as R-squared indicates. The increase of variability explained from 70% (see results for the basic model) to 80% indicates that ratings offer information not accounted for by macroeconomic and political factors alone. The standard error of estimate (root mean square error) decreases from 1.89 to 1.61 and this is additional evidence of the extended model's improved exploratory power. With respect to residuals' independence, we note that the value of Durbin-Watson statistic is 1.82 and between the range of 1.5 and 2.5 which means residuals are independent to each other. There is also no significant sign of multicollinearity because the values of tolerance are higher than the conventional minimum level of 0.1 or 0.2 and, in the same way, variance inflation factors are lower than the maximum value of 10 which is frequently considered as threshold. The model is also statistically significant as implied by the p-value of F-statistic (which is less than 5%). Turning to bond yield determinants, we note that "Deficit", "Inflation", "Debt", "Growth", and "Moody" are all (except for "Inflation") significantly and negatively related. Among significant factors, the standardized coefficients show the most important ones are "Moody", "Growth", "Debt", "Deficit", and "Inflation". Compared to the corresponding basic model, the inclusion of "Moody" leaves out of the significant predictors group "Effectiveness" and this can be explained by the strong correlation between these two variables. It must also be noted that the inclusion of "Moody" does not affect the direction of relationship between bond yields and their determinants. By contrast, in the presence of "Moody", "Debt" becomes more significant than "Deficit" although the difference between their standardized coefficients is minimal (-.332 versus -.348).

The following table (table 6) reports regression analysis for the first extended model (independent variables include macroeconomic and political factors and Fitch ratings).

Table 6

Regression analysis – Extended model with Fitch ratings

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.89[a]	.80	.76	1.62	1.80

a. Predictors: (Constant), Fitch, Inflation, Trade, Reserves, Growth, Deficit, Effectiveness, Stability, Debt

b. Dependent Variable: Yield

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	500,16	9	55,57	21,06	,00[b]
	Residual	126,68	48	2,64		
	Total	626,84	57			

a. Dependent Variable: Yield

b. Predictors: (Constant), Fitch, Inflation, Trade, Reserves, Growth, Deficit, Effectiveness, Stability, Debt

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	9.66	1.78		5.42	.00		
	Deficit	-.39	.11	-.35	-3.37	.00	.39	2.55
	Trade	-.04	.04	-.10	-1.26	.21	.65	1.54
	Inflation	.66	.24	.24	2.74	.01	.55	1.83
	Debt	-.03	.01	-.30	-2.46	.02	.28	3.51
	Growth	-.45	.10	-.39	-4.49	.00	.56	1.79
	Reserves	-.00	.00	-.02	-.22	.82	.69	1.45
	Effectiveness	-.17	.64	-.03	-.27	.79	.41	2.43
	Stability	.46	.84	.06	.55	.59	.39	2.57
	Fitch	-.39	.08	-.57	-4.80	.00	.30	3.37

a. Dependent Variable: Yield

The extended model including "Fitch" explains 80% of bond yield variation as R-squared indicates. The increase of variability explained from 70% (see results for the basic model, pp.19-21) to 80% indicates that ratings offer information not accounted for by macroeconomic and political factors alone. Another sign of increased exploratory power is the decrease in root mean square error from 1.89 (basic model) to 1.62 (extended model including "Fitch"). With respect to residuals' independence, we note that the value of Durbin-Watson statistic is 1.8 and between the range of 1.5 and 2.5 which means residuals are independent to each other. There is also no noteworthy sign of multicollinearity because the values of tolerance are higher enough than the conventional minimum level of 0.1 or 0.2 and, in the same way, variance inflation factors are lower than the maximum value of 10, which is frequently considered as threshold. The model is also statistically significant as understood by the p-value of F-statistic (which is less than 5%). Turning to bond yield determinants, we observe that "Deficit", "Inflation", "Debt", "Growth", and "Fitch" are all (except for "Inflation") significantly and negatively related. Among significant factors, the standardized coefficients show that the most important ones are "Fitch", "Growth", "Debt", "Deficit", and "Inflation". In comparison to the corresponding basic model, the inclusion of "Fitch" leaves out of the significant predictors group "Effectiveness" and this can be justified by the strong correlation between these two variables. It must also be mentioned that the inclusion of "Fitch" does not influence the direction of relationship between bond yields and their determinants.

The following table (Table 7) represents regression analysis for the first extended model (independent variables include macroeconomic and political factors and Standard and Poor's ratings).

Table 7

Regression analysis – Extended model with Standard and Poor's ratings

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.88^a	.78	.74	1.69	1.90

a. Predictors: (Constant), SP, Inflation, Trade, Reserves, Deficit, Growth, Effectiveness, Stability, Debt

b. Dependent Variable: Yield

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	489.94	9	54.44	19.09	.00^b
1	Residual	136.89	48	2.85		
	Total	626.84	57			

a. Dependent Variable: Yield

b. Predictors: (Constant), SP, Inflation, Trade, Reserves, Deficit, Growth, Effectiveness, Stability, Debt

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	8.89	1.81		4.92	.00		
Deficit	-.44	.12	-.40	-3.76	.00	.40	2.47
Trade	-.04	.04	-.10	-1.16	.25	.65	1.54
Inflation	.64	.25	.23	2.58	.01	.55	1.83
Debt	-.03	.01	-.32	-2.51	.02	.28	3.54
1 Growth	-.48	.10	-.41	-4.62	.00	.57	1.76
Reserves	.00	.00	-.01	-.16	.87	.69	1.45
Effectiveness	-.40	.66	-.06	-.60	.55	.42	2.36
Stability	.44	.87	.05	.51	.61	.39	2.57
SP	-.33	.08	-.50	-4.21	.00	.32	3.11

a. Dependent Variable: Yield

The extended model including "SP" explains 78% of bond yield variation as R-squared indicates. The increase of variability explained from 70% (see results for the basic model) to 78% indicates that ratings offer information not accounted for by macroeconomic and political factors alone. The improved exploratory power is also evidenced by the decrease in root mean square error from 1.89 (basic model) to 1.69 (extended model including "SP"). With regard to residuals' independence, we report that the value of Durbin-Watson statistic is 1.9 and between the range of 1.5 and 2.5 which means residuals are independent to each other. It should be also mentioned that there is no significant indication of multicollinearity as the values of tolerance are higher than the conventional minimum level of 0.1 or 0.2

and, similarly, variance inflation factors are lower than the maximum value of 10 which is frequently considered as threshold. The model is also statistically significant as inferred by the p-value of F-statistic (which is less than 5%). Concerning the bond yield determinants, we remark that "Deficit", "Inflation", "Debt", "Growth", and "SP" are all (except for "Inflation") significantly and negatively related. In addition to that, among significant factors, the standardized coefficients show the most important ones are "SP", "Growth", "Deficit", "Debt", and "Inflation". Going back to the corresponding basic model (pp.19-21), the inclusion of "SP" leaves out of the significant predictors group the parameter "Effectiveness", as it also occurred in the extended models of "Moody" and "Fitch". This can be clarified once the correlation between these variables is taken into account. It must also be stated that the addition of "SP" does not affect the direction of relationship between bond yields and their determinants.

In overall, we note that the "best" (in terms of exploratory power) extended model is the one including "Moody". This model has the highest r-squared (80% versus 70% of the basic model, 80% of the extended model including "Fitch", and 78% of the extended model including "SP") and the lowest root mean square (1.61 versus 1.89 of the basic model, 1.62 of the extended model including "Fitch", and 1.69 of the extended model including "SP").

CHAPTER V
Conclusions and Suggestions for Future Research

The central focus of this study was given to the relation between sovereign bond yields and two sources of relevant information, namely the most commonly used macroeconomic and political factors and the credit ratings. Recent literature suggests that bond yields may be explained by some factors, however there is a debate, both at the theoretical and empirical level, around not only the ability of credit rating agencies to provide with useful estimates regarding the creditworthiness of countries but also their role within this specific context. The main findings of this study are summarized as follows.

Credit rating agencies exist for almost a century. Based on what this study reported, it can be said that the market for credit rating agencies is highly concentrated, the three largest corporations controlling almost 98% of it. Another interesting point is that any effort towards regulating the corresponding market has proved to be insufficient, if not totally absent. On the one hand, there exists incidence of strong lobbying on behalf of credit rating agencies to prevent any serious effort. Additionally, the legal / supervisory context regarding these businesses has inherent flows that prevent any interested party from significantly regulating the market of credit rating agencies. Not many things can be done to change a vast amount of regulations demanding the consultation of credit rating agencies. With respect to sovereign bond yields, theory seems to be in almost full accordance with what has to do with the factors most significantly affecting yields. According to the relevant evidence reviewed here, a country's deficit, debt, growth, trade deficit, currency reserves, inflation, and political stability are among the most commonly reported factors of sovereign bond yields. The empirical analysis conducted here for 23 EU countries during recent years (2011-2015) confirmed the significant role of most of these factors in predicting sovereign bond yields. More interestingly, we conclude that the inclusion of credit ratings provided by the three major agencies significantly increases the predictive ability of the aforementioned factors by approximately 10 percentage units (from 70% to 80%). This means that credit rating agency have a unique way of capturing risk-related information regarding sovereign debt. In other words, their role is, according to our results, at least sufficiently justified.

The present study is nothing less but an additional effort to complement existing literature. However, there are some limitations, most of them of technical nature, that should be reported. First of all, missing data lead us to base our analysis on panel data and this choice has the apparent risk of losing valuable information that could alter our conclusions. To be more specific, it is possible that annual regressions would reveal a different set of bond yields' significant factors. Another limitation, also due to missing data, has to do with the limited time span examined here that, if increased, could lead to different findings or, at least, enhance the ability to generalize the ones reported here. Finally, it would be very interesting to check whether the relation between sovereign bond yields and their determinants

changes across different levels of risk. To make myself clear, some factors may prove more important than others in predicting bond yields at lower levels of risk than in higher ones. If dealt with, the aforementioned limitations could serve as a starting point for future research on the topic examined here and allow researchers built upon the findings of this study.

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APPENDICES

Appendix A

Rating	Description
AAA	An obligation rated 'AAA' has the highest rating assigned by S&P Global Ratings. The obligor's capacity to meet its financial commitment on the obligation is extremely strong.
AA	An obligation rated 'AA' differs from the highest-rated obligations only to a small degree. The obligor's capacity to meet its financial commitment on the obligation is very strong.
A	An obligation rated 'A' is somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions than obligations in higher-rated categories. However, the obligor's capacity to meet its financial commitment on the obligation is still strong.
BBB	An obligation rated 'BBB' exhibits adequate protection parameters. However, adverse economic conditions or changing circumstances are more likely to lead to a weakened capacity of the obligor to meet its financial commitment on the obligation. BB; B; CCC; CC; and CObligations rated 'BB', 'B', 'CCC', 'CC', and 'C' are regarded as having significant speculative characteristics. 'BB' indicates the least degree of speculation and 'C' the highest. While such obligations will likely have some quality and protective characteristics, these may be outweighed by large uncertainties or major exposures to adverse conditions.
BB	An obligation rated 'BB' is less vulnerable to nonpayment than other speculative issues. However, it faces major ongoing uncertainties or exposure to adverse business, financial, or economic conditions which could lead to the obligor's inadequate capacity to meet its financial commitment on the obligation.
B	An obligation rated 'B' is more vulnerable to nonpayment than obligations rated 'BB', but the obligor currently has the capacity to meet its financial commitment on the obligation. Adverse business, financial, or economic conditions will likely impair the obligor's capacity or willingness to meet its financial commitment on the obligation.
CCC	An obligation rated 'CCC' is currently vulnerable to nonpayment, and is dependent upon favorable business, financial, and economic conditions for the obligor to meet its financial commitment on the obligation. In the event of adverse business, financial, or economic conditions, the obligor is not likely to have the capacity to meet its financial commitment on the obligation.

CC	An obligation rated 'CC' is currently highly vulnerable to nonpayment. The 'CC' rating is used when a default has not yet occurred, but S&P Global Ratings expects default to be a virtual certainty, regardless of the anticipated time to default.
C	An obligation rated 'C' is currently highly vulnerable to nonpayment, and the obligation is expected to have lower relative seniority or lower ultimate recovery compared to obligations that are rated higher.
D	An obligation rated 'D' is in default or in breach of an imputed promise. For non-hybrid capital instruments, the 'D' rating category is used when payments on an obligation are not made on the date due, unless S&P Global Ratings believes that such payments will be made within five business days in the absence of a stated grace period or within the earlier of the stated grace period or 30 calendar days. The 'D' rating also will be used upon the filing of a bankruptcy petition or the taking of similar action and where default on an obligation is a virtual certainty, for example due to automatic stay provisions. An obligation's rating is lowered to 'D' if it is subject to a distressed exchange offer.
NR	This indicates that no rating has been requested, or that there is insufficient information on which to base a rating, or that S&P Global Ratings does not rate a particular obligation as a matter of policy