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# MEASURING THE EFFECT OF GOVERNMENT ESG PERFORMANCE ON SOVEREIGN BORROWING COST

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# Measuring the effect of countries' ESG performance on their sovereign borrowing costs*

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**Abstract**

We examine whether the extra-financial performance of countries on environmental, social and governance (ESG) factors matters for sovereign bonds markets. Using a panel regression model over a data set with 23 OECD countries, we show that ESG ratings significantly decrease government bond spreads. Moreover, we find that the impact of ESG ratings on the cost of sovereign borrowing is more pronounced in bonds of shorter maturities.

**Keywords:** Extra-financial ratings, ESG performance, Government bond spreads.
**JEL Classification**: G11, F34

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# 1 Introduction

With only a few exceptions, the existing literature is focused on the link between *corporate bonds* and ESG factors (Oikonomou et al., 2012; Bauer and Hann, 2011; El Ghoul et al., 2011; Bauer et al., 2009; Godfrey et al., 2009). Relatively little is known about how sovereign bond spreads are affected by environmental, social and governance concerns. One of the rare studies in this area (Moret and Sagnier, 2013) compares the total return of bonds issued by countries with high ESG scores (based on CO2 emissions per capita, the UNs Human Development Index and other governance, social and environmental features) against a group with low ESG scores. The authors find that bonds issued by the countries with high ESG scores outperform those issued by countries with lower scores. An empirical framework describing the ESG ratings of 78 countries for 2007 measured against the Fitch ratings, conducted by MSCI (2011), documents a strong correlation between ESG factors and subsequent rating downgrades. The study shows that countries with the largest discrepancies between financial performance and ESG rankings are the most likely to be downgraded in subsequent years.

Our paper examines the relationship between the extra-financial characteristics of countries and the costs of their sovereign bonds. We consider these bonds at different maturities (two, five and 10 years) because their costs may differ according to the time horizon (Afonso et al., 2012).

We therefore state two working hypotheses.

**Hypothesis H1:** Higher ESG ratings are associated with lower borrowing costs.

**Hypothesis H2:** The positive effect of ESG ratings on borrowing costs decreases with bonds maturities.

These two hypotheses are tested (using an instrumental variables fixed-effect panel regression) over a data set of 23 countries from 2007 to 2012. We contribute to the empirical literature on sovereign risk in two ways. First, we provide evidence that the ESG performance of countries may impact sovereign bond markets. Second, we shed light on a new class of country risk, ESG risk. Hence, extra-financial analysis which assesses this class of risk may convey important signals about a country's future credit risk.

The remainder of this paper is structured as follows. Section 2 is devoted to the literature review. Section 3 describes the data and variables. Section 4 presents the econometric model, while section 5 gives the results. Section 6 concludes.

# 2 Literature review

A common measure of a country's borrowing cost in international capital markets is its yield spread, which is defined as a market's measure of a country's risk of default. Prior literature has argued that three types of potential determinants affect spreads (Attinasi et al., 2009; Manganelli and Wolswijk, 2009; Afonso et al., 2012): (1) A country's creditworthiness as

reflected by its fiscal and macroeconomic position, the so-called credit risk (Ardagna et al., 2004; Afonso et al., 2012); (2) Liquidity risk, i.e. the size and depth of the government's bond market (Gòmez-Puig, 2006; Beber et al., 2008); and (3) International risk aversion, i.e. investor sentiment towards this class of assets for each country (Codogno et al., 2003; Barrios et al., 2009). Some researchers argue that in recent years, the weight of country specific factors (i.e. country credit risk) has increased compared to the weights of liquidity factors (Barrios et al., 2009; Codogno et al., 2003; Mody, 2009) and international factors (Haugh et al., 2009; Barrios et al., 2009; Spencer and Liu, 2013).

From this perspective, an increasing number of studies now point out the role of macroeconomic conditions as explanatory variables of credit default risk. These studies try to explain sovereign bond spreads by examining, for instance, the debt burden of countries (Bernoth et al., 2012; Bernoth and Erdogan, 2012), openness and the terms of trade (Eichler and Maltritz, 2013; Maltritz, 2012), and fiscal variables (Gruber and Kamin, 2012). Although the evidence in this literature clearly suggests some empirical regularities, the debate on the stable and significant determinants of sovereign bond spreads is far from settled.

An extension of these studies is the identification of country specific financial health as a determinant of sovereign bond spreads (Mody, 2009; Sgherri and Zoli, 2009; Barrios et al., 2009; Bellas et al., 2010). Mody (2009) for instance finds that financial sector vulnerabilities (measured by the ratio of the country's financial sector to the overall equity index) are strongly correlated with spread changes in Euro area countries. He shows that the rescue of Bear Stearns in March 2008 marked a turning point. Thereafter, a differentiation in sovereign spreads across Eurozone countries emerged, caused mainly by differences in the prospects of the domestic financial sectors. The differences widened in September 2008 (when Lehman Brothers failed), as some countries paid an increased penalty for high public debt to GDP ratios. Following this line, De Bruyckere et al. (2013) present evidence in favor of interdependencies between the creditworthiness of sovereign countries and the vulnerability of banks. Analyzing the risk spillovers between banks and countries and vice versa in Europe during the period 2006-2011, the authors show that bilateral exposures between banks and sovereign countries are relatively large and likely to induce risk spillovers.

Earlier researchers have also examined the effect of country political indicators on the risk premia paid by governments relative to the benchmark government bond. Citron and Nickelsburg (1987) observe that political instability is an important determinant of the probability of default. They construct an indicator of political instability that measures the number of changes in government - accompanied by changes in policy - taking place within the previous five years. They find that, on top of various macroeconomic indicators, their measure of political instability has a significantly positive effect on the default probability. Brewer and Rivoli (1990) confirm these results by using regime instability, which is proxied by the changes in the head of government. Erb et al. (1996) present evidence showing the significant performance of long strategies for bonds issued by governments with decreasing political risk, and short strategies for bonds from governments with increasing political risk. The political determinants of sovereign bond yield spreads have been of particular interest to researchers. For example, Ebner (2009) documents significant differences in government

bond spreads in Central and Eastern Europe during crisis and non-crisis periods, with political instability or uncertainty explaining the rise in spreads during crisis periods. Matei and Chaptea (2012) show in a panel of observations for 25 EU countries from 2003 to 2010 that a country's political risk perception is a significant predictor of sovereign spreads. They also find that by looking at social and political factors, investors can build up a picture of a country and better gauge the risks of investment. Eichler (2013) observes for a sample of emerging countries that sovereign bond yield spreads are affected by a nation's political system. In particular, he observes that countries with parliamentary systems (as opposed to presidential) face higher sovereign yield spreads. He also notes that improving the quality of governance helps to reduce sovereign bond yield spreads.

Connolly (2007) investigates the links between sovereign bond spreads and corruption. He finds that Transparency International's Corruption Perception Index downgraded the creditworthiness of sovereign bonds by diverting loan proceeds from productive projects to less productive ones, if not to offshore accounts. This suggests that efforts to make underwriting sovereign bonds more transparent and less corrupt would improve credit ratings and by implication lower the cost of sovereign borrowing. This is supported by Ciocchini et al. (2003), who observe that countries perceived as more corrupt have to pay higher yields when issuing bonds. Their study combines data on bonds traded in the global market with survey data on corruption compiled by Transparency International. Similar findings are obtained by another study (Union Investment, 2012): countries whose bond yields rose the most during the Euro crisis, including Greece, Spain, Portugal and Italy, experienced the largest increase in their Corruption Perception Index between 2007 and 2012.

Margaretic and Pouget (2014) find that the Environmental Performance Index (EPI) enables a better assessment of the expected value and the volatility of sovereign bond spreads in emerging markets. Similarly, investigating the implications of different indicators of sustainability performance of investment funds, Scholtens (2010) observes that the performance of Dutch government bond funds differs according to the environmental indicator. He suggests that funds should be very transparent and straightforward about their non-financial performance.

# 3 Data and the determinants of Vigeo ESG ratings

## 3.1 Data

Our data set includes observations of 23 OECD countries from 2007 to 2012. It is constructed from four sources:

- *The Vigeo sustainability country rating database*: Vigeo is the leading extra-financial rating agency in the European Union. From the Vigeo sustainability country rating database, we extract information about our main independent variable, the environmental, social and governance (ESG) rating of our 23 countries.

- *The Thomson-Reuters Datastream database*: We extract from this data set information concerning the yield on sovereign bonds for our 23 countries (and the US) and the Standard & Poor's (S&P) ratings.

- *The World Bank database*: We extract two types of information from this database. First, we take information concerning our control variables (GDP growth rate, inflation rate, gross debt to GDP ratio, country fiscal balance to imports, reserves to imports ratio, and trade openness ratio defined by imports and exports to GDP). Second, we extract information about 15 variables used in our robustness analysis: Electricity generation, CO2 emissions, Forest rents per GDP, Protected areas as a percentage of national land area, Social expenditure per GDP, Female to male labor force participation rate, Health expenditure per GDP, R&D expenditure per GDP, Human Development Index, Regulatory quality, Rule of law, Government effectiveness, Political stability, Voice and accountability, and Corruption control.

- *The ISO database:* We extract from this database our instrumental variable, the number of ISO 14001 certified firms in each of our 23 countries.

### 3.2 The main independent variable: Vigeo country ESG ratings

Vigeo has assessed the sustainability performance of more than 170 countries from the analysis of more than 130 indicators (selected from international conventions and standards such as the following: the Millennium Development Goals[1], Agenda 21[2], the International Labour Organization conventions, the United Nations Charters and Treaties, and the OECD Guiding Principles for risk and ESG performance related to Environmental Protection, Social Protection and Solidarity, and the Rule of Law and Governance (see table 1).

[1]These eight goals were established in 2000 by 189 countries as targets to be achieved by 2015.

[2]Agenda 21 on sustainable development was adopted by 179 countries in 1992 at the UN Earth Summit in Rio de Janeiro.

Table 1: Dimensions of Vigeo Country ESG Ratings

| | |
|---|---|
| **Environmental responsibility** | |
| Participation in International conventions | Air<br>Biodiversity<br>Water<br>Land<br>Information systems |
| Air emissions | Climate change<br>Ozone layer protection<br>Local and regional air quality |
| Water | Measure of water withdrawal |
| Biodiversity | Percentage of threatened species<br>Percentage of protected areas |
| Land use | Proportion of land covered by forest<br>Changes in the proportion of forest |
| Environmental pressure | Nuclear waste<br>Energy consumption measures |
| **Institutional responsibility** | |
| Human rights | Respect, protection and promotion of human rights<br>Respect, protection and promotion of labor rights |
| Democratic institutions | Political freedom and stability measures<br>Control of corruption measures<br>Independence of justice measures<br>Market regulation measures<br>Press freedom measures |
| **Social responsibility and solidarity** | |
| Social protection | Inequality measures<br>Total unemployment<br>Youth unemployment |
| Education | Public education expenditure<br>Primary school education enrollment<br>Secondary school education enrollment |
| Health | Public health expenditure<br>Mortality (Infant mortality, life expectancy)<br>HIV/AIDS prevalence rate<br>Tuberculosis prevalence and death rates |
| Gender Equality | Gender equality<br>Gender empowerment index |
| Development aid | Development aid measures |
| Safety policy | Participation in international conventions |

Vigeo gathers only official data from institutions such as the World Bank, the United Nations Development Program, the United Nations Environment Program, the United Nations Office on Drugs and Crime, the United Nations Childrens Emergency Fund, the Food and Agriculture Organization, the United Nations Conference on Trade and Development, the United Nations Department for Disarmament Affairs, the International Labour Institute, the Organisation for Economic Co-operation and Development, the Office of the High Commissioner for Human Rights, Coface, Amnesty International, Transparency International, Freedom House, and Reporters without Borders.

Three annual ratings (the Environmental Responsibility Rating-ERR, the Social Responsibility and Solidarity Rating-SRSR, and the Institutional Responsibility Rating-IRR) are calculated by Vigeo, as well as a composite index. For each rating, Vigeo has selected several criteria representing either commitments or quantitative realizations. For each criterion, countries are rated on a scale ranging from 0 to 100 (the best grade). For the commitment criteria, i.e. the signature and ratification of treaties and conventions, the grade is as follows: 0 if the country has not signed, 50 if the country has signed but has not ratified, and 100 if the country has signed and ratified. For the quantitative criteria, a score is computed following the decile method: the 10 per cent of worst-performing countries obtain a score of 10, and so on. Vigeo ranks not only levels but also trends computed as variation rates between the first and the last available values. More precisely, if a country's trend lies in the top 20 percent, then it benefits from a premium of 10 points for the criterion at stake; if the country exhibits a negative trend, it gets a 10-point penalty. The three annual ratings (ERR, SRSR, IRR) are weighted averages of scores. The ESG global index is an equally-weighted average of these three ratings. The advantage of using these Vigeo ratings comes from the wide spectrum of criteria taken into account.

Table 2 (below) reports the descriptive statistics concerning the average Vigeo ESG ratings from 2007 to 2012 for the 23 countries. The figures show a clear discrimination between good and bad performers with respect to ESG criteria. For instance, the Scandinavian countries (Denmark, Finland, Norway, and Sweden) obtain the best scores, and when looking at the dispersion (standard-deviation) of each country's ESG ratings over the period 2007-2012, one can note that this dispersion ranges from 0.28 (Portugal) to 3.18 (Iceland).

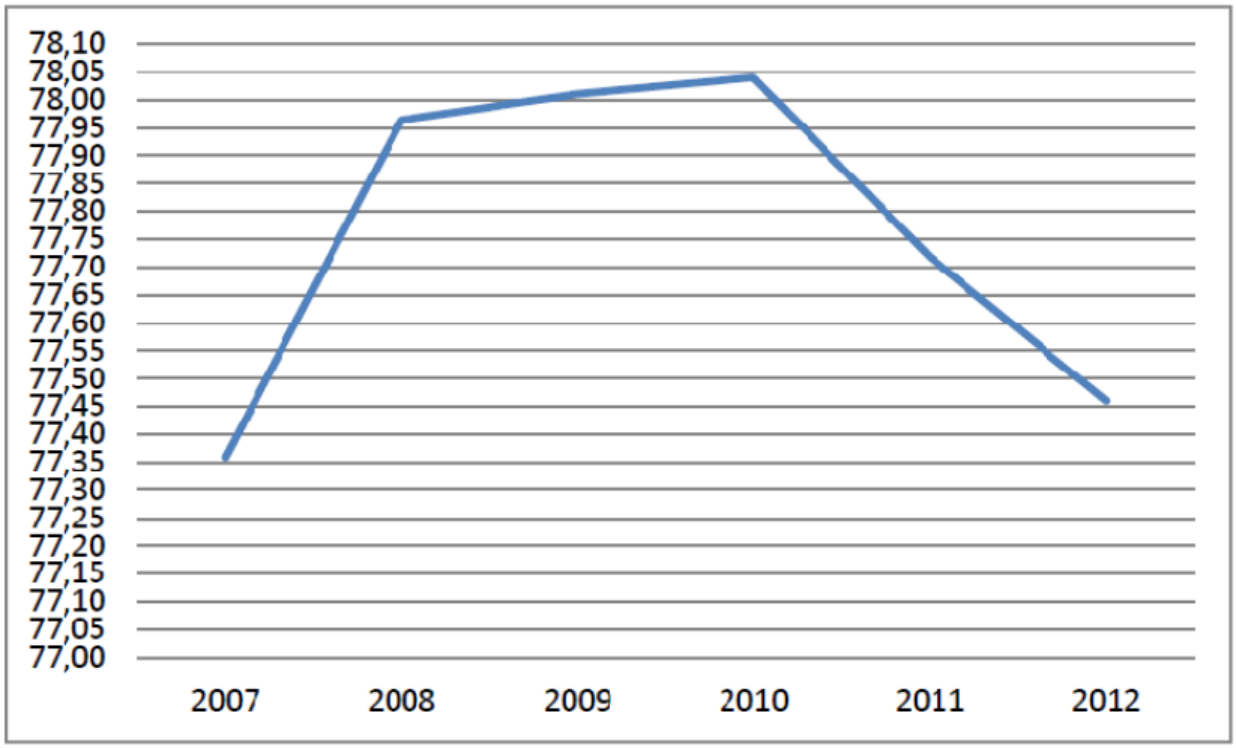
Table 2: Vigeo ESG country rating over the period 2007-2012

| **Country** | Vigeo ESG rating | St.Dev. | Min | Max |
|---|---|---|---|---|
| Australia | 75.15[(a)] | 1.48 | 73.90 | 77.94 |
| Austria | 79.13 | 0.82 | 78.80 | 80.71 |
| Belgium | 75.79 | 0.85 | 74.55 | 77.12 |
| Canada | 71.87 | 1.00 | 70.59 | 73.24 |
| Czech Republic | 79.90 | 1.75 | 77.82 | 82.12 |
| Denmark | 81.92 | 0.52 | 81.19 | 82.57 |
| Finland | 83 | 0.41 | 82.51 | 83.66 |
| France | 78.18 | 0.83 | 76.99 | 79.12 |
| Germany | 79.41 | 1.29 | 77.64 | 81.09 |
| Iceland | 77.88 | 3.18 | 73.81 | 81.3 |
| Ireland | 77.23 | 0.95 | 75.66 | 78.34 |
| Italy | 72.37 | 0.99 | 70.67 | 73.6 |
| Japan | 71.46 | 2.71 | 67.4 | 75.24 |
| Korea | 68.71 | 1.54 | 67.21 | 71.52 |
| Netherlands | 80.46 | 0.75 | 79.67 | 81.82 |
| New Zealand | 74.69 | 1.91 | 71.5 | 77.03 |
| Norway | 86.96 | 1.30 | 85.05 | 88.71 |
| Poland | 78.07 | 0.81 | 77.03 | 79.23 |
| Portugal | 71.04 | 0.28 | 70.69 | 71.34 |
| Spain | 75.15 | 0.85 | 73.85 | 75.96 |
| Sweden | 86.50 | 0.67 | 85.2 | 87.07 |
| Switzerland | 81.91 | 0.68 | 80.85 | 83 |
| United Kingdom | 80.99 | 0.55 | 80.6 | 82.07 |

[(a)] = Mean Vigeo ESG rating for Australia over the period 2007-2012.

Regarding Figure 1, which plots Vigeo ESG average rating for all countries over the period 2007-2012, we notice three phases. Firstly, the average rating for all countries increases between 2007 and 2008. Secondly this average rating continues to increase between 2008 and 2010 but at a more moderate rate. Finally, it decreases from 2010 to 2012.

Figure 1: Average Vigeo ESG ratings for all countries over the period 2007-2012




### 3.3 The dependent variable: Sovereign borrowing cost

As a measure of sovereign borrowing cost, we use the bond yield spread of government. The spread is defined as the difference between the interest rate the government pays on its external US dollar-denominated debt and the rate offered by the US Treasury on a debt of comparable maturity (Hilscher and Nosbusch, 2010). More precisely, we consider yield on sovereign bonds of the considered country minus yield on US sovereign bonds, both values being taken at the end of year, from the yield curve for a fixed maturity. The yield on the benchmark US Bond is then treated as the "risk-free" rate or the numeraire over which each country's spreads are computed. We choose three comparable maturities: two years, five years and 10 years.

Table 3 presents the distribution of mean bond spread by Vigeo ESG rating per country over the period 2007-2012. It reveals two features. Firstly, it is obvious that countries well rated on ESG criteria have low sovereign bond yield spreads. Secondly, for the bulk of countries, longer maturity is associated with lower bond spreads.

Table 3: Mean bond spreads by Vigeo ESG ratings, per country over the period 2007-2012

| | | Bond spreads | | |
|---|---|---|---|---|
| **Country** | Vigeo ESG rating | two years | five years | 10 years |
| Australia | 75.15 | 3.146 | 2.592 | 1.946 |
| Austria | 79.13 | 0.693 | 0.706 | 0.551 |
| Belgium | 75.79 | 0.912 | 0.932 | 0.848 |
| Canada | 71.87 | 0.647 | 0.364 | 0.028 |
| Czech Republic | 79.90 | 1.297 | 1.104 | 0.901 |
| Denmark | 81.92 | 0.662 | 0.326 | 0.091 |
| Finland | 83 | 0.366 | 0.308 | 0.276 |
| France | 78.18 | 0.345 | 0.090 | -0.039 |
| Germany | 79.41 | 0.492 | 0.478 | 0.489 |
| Iceland | 77.88 | 6.473 | 5.642 | 4.985 |
| Ireland | 77.23 | 3.169 | 3.106 | 3.181 |
| Italy | 72.37 | 2.117 | 2.132 | 2.073 |
| Japan | 71.46 | -0.730 | -1.350 | -1.688 |
| Korea | 68.71 | 2.864 | 2.303 | 1.659 |
| Netherlands | 80.46 | 0.291 | 0.296 | 0.220 |
| New Zealand | 74.69 | 3.155 | 2.797 | 2.245 |
| Norway | 86.96 | 1.348 | 0.958 | 0.600 |
| Poland | 78.07 | 3.910 | 3.363 | 2.720 |
| Portugal | 71.04 | 4.220 | 4.593 | 3.794 |
| Spain | 75.15 | 1.920 | 2.038 | 1.840 |
| Sweden | 86.50 | 0.809 | 0.472 | -0.068 |
| Switzerland | 81.91 | -0.252 | -0.663 | -1.131 |
| United Kingdom | 80.99 | 0.395 | 0.441 | 0.307 |

### 3.4 The control variables

In order to control for countries' economic characteristics, our analysis includes variables based on previous studies (Attinasi et al., 2009; Mody, 2009; Barbosa and Costa, 2010; Afonso et al., 2012; D'Agostino and Ehrmann, 2013; Matei and Chaptea, 2012). We use seven country specific controls:

1. *The GDP growth rate.* Research on the sustainability of a country's debt reveal that growing economies are more able to fulfil their financial obligations than stagnating economies (Bernoth et al., 2012). We expect therefore a negative link between the GDP growth rate and the spread of sovereign bonds.

2. *Inflation rate.* This reveals sustainable monetary and exchange rate policies. Higher price differentials point to structural problems in a government's finances. When the government appears unable or unwilling to pay for current budgetary expenses through taxes or debt issuance, it must resort to inflationary money finance. Public dissatisfaction with inflation may in turn lead to political instability (Cantor and Packer, 1996),

which could put upward pressure on government bond yields and thus the spreads could widen. We expect therefore a positive link between the inflation rate and sovereign bonds spread.

3. *Gross debt to GDP ratio.* Higher levels of debt are expected to increase the default risk and, as a consequence, the yield spreads (Schuknecht et al., 2009).

4. *Fiscal balance to GDP ratio.* Governments running larger fiscal deficits are considered less creditworthy and thus amplify the default risk (Attinasi et al., 2009; Sgherri and Zoli, 2009; Gruber and Kamin, 2012). From this standpoint we may expect an increasing fiscal balance to GDP ratio to lower the yield spread. However, another view is that an increasing fiscal balance to GDP ratio may increase the yield spread. If agents are forward looking, there may be some Ricardian equivalence, with private savings increasing, as fiscal deficits increase, in anticipation of future tax hikes to fulfill the intertemporal budget constraint. This may reduce the impact on bond yields. In other words, lower fiscal deficits may increase sovereign bonds spread Baldacci and Kumar (2010).

5. *Reserves to imports ratio.* This ratio is a liquidity ratio measuring the access to credit relative to national reserves. According to the literature (Cartapanis, 2002), this ratio is also a good indicator for the capacity of economies and central banks to face speculative attacks. A higher ratio can decrease investors' confidence in the economy and this could be a sign of a banking crisis followed by a flight to quality. In turn, we may expect a positive relationship between the reserves to imports ratio and sovereign bonds spread.

6. *Trade openness.* It is measured here by the ratio sum of exports and imports to GDP. The literature (Ferrucci, 2003) shows that country openness plays an important role in explaining economies' costs of borrowing, as the penalty for sovereign default is higher in terms of capital reversion in an open rather than a closed economy. The higher this ratio, the greater is the ability of countries to generate the required trade surpluses in order to refinance the present stock of debt or to finance new debt. We thus expect a negative relationship between trade openness and sovereign bonds spread.

7. *Sovereign credit ratings.* This captures the government's supposed ability to meet its financial commitments. We measure it here by the S&P rating, which has been transformed into a numerical variable, ranging from 1 (BB) to 11 (AAA). According to the literature (Afonso et al., 2012), sovereign credit ratings are a determinant of sovereign borrowing costs: higher sovereign ratings are associated with lower borrowing costs.

Table 4 includes the mean-distribution of our control variables.

Table 4: Mean-Distribution of all variables

| **Variable** | **Mean** | **St.Dev.** | **Min** | **Max** |
|---|---|---|---|---|
| Government Bond spread | | | | |
| two-year maturity | 1.66 | 2.31 | -2.32 | 15.25 |
| five-year maturity | 1.43 | 2.21 | -2.41 | 16.14 |
| 10-year maturity | 1.12 | 1.94 | -2.54 | 11.68 |
| Vigeo ESG rating[(a)] | 77.75 | 4.85 | 67.21 | 88.71 |
| $\Delta GDP/GDP$[(b)] | 0.93 | 2.89 | -8.54 | 6.78 |
| $\Delta P/P$[(c)] | 2.33 | 1.94 | -2.75 | 12.40 |
| $G.GV.Debt/GDP$[(d)] | 66.02 | 41.53 | -1.00 | 236.56 |
| $Fis./GDP$[(e)] | -2.64 | 5.72 | -30.94 | 18.78 |
| $Reserves/Imports$[(f)] | 2.93 | 3.36 | 0.03 | 18.25 |
| $X + M/GDP$[(g)] | 85.54 | 36.43 | 25.02 | 188.9 |
| $S\&P$[(h)] | 9.10 | 2.61 | 1 | 11 |

[(a)] = Our variable of interest: ESG country rating.
[(b)] = GDP growth.
[(c)] = Inflation rate.
[(d)] = Gross debt to GDP ratio.
[(e)] = Country's fiscal balance to GDP.
[(f)] = Ratio of reserves to imports.
[(g)] = Trade openness ratio.
[(h)] = Standard & Poor's: Numerical variable assigning 1 to BB, 2 to BB+ and so on through 11 to AAA.

Table 5 presents the correlation matrix for our independent variables. We can note that the correlation coefficients are not very high. This implies that our estimates will not suffer from high colinearity between independent variables. As expected (Novethic, 2010), we find a positive correlation (0.41) between the extra-financial rating (assessed by the Vigeo ESG rating) and the financial rating (assessed by the S&P rating). Even if this figure is significant (at 1%), it is not high. This suggests (Mora, 2006; Flannery et al., 2010) that financial ratings (like the S&P rating) do not cover all aspects that explain governments' financial credibility. Hence, using both the S&P rating and Vigeo ESG rating within the same regression is accurate.

Table 5: Pearson correlation matrix

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Vigeo ESG rating | 1 | | | | | | | |
| 2 | $\Delta GDP/GDP$ | -0.04 | 1 | | | | | | |
| 3 | $\Delta P/P$ | -0.005 | 0.15* | 1 | | | | | |
| 4 | $G.GV.Debt/GDP$ | -0.32*** | -0.23*** | -0.2** | 1 | | | | |
| 5 | $Fis./GDP$ | 0.35*** | 0.3*** | 0.17** | -0.39*** | 1 | | | |
| 6 | $Reserves/Imports$ | -0.24** | 0.008 | -0.053 | 0.45*** | 0.08 | 1 | | |
| 7 | $X+M/GDP$ | 0.23*** | 0.01 | 0.01 | -0.11 | -0.05 | -0.34*** | 1 | |
| 8 | $S\&P$ | 0.41***[(a)] | 0.02 | -0.29*** | -0.26*** | 0.28*** | -0.17** | -0.03 | 1 |

[(a)] = Correlation coefficient between the S&P rating and the Vigeo ESG rating.

***,**,* significant respectively at 1%, 5%, 10%.

# 4 Estimating the effect of ESG ratings on countries' borrowing costs

## 4.1 Fixed effects model

Our data set is a panel data set that includes a group of 23 countries observed over a period of six years. In order to take advantage of the structure of our data set, which includes both a country dimension and a time dimension, we use a panel regression.

$$SPREAD_{it} = \beta_0 + \beta_1(VigeoESG)_{it} + \beta_2(\tfrac{\Delta GDP}{GDP})_{it} + \beta_3(\tfrac{\Delta P}{P})_{it} + \beta_4(\tfrac{G.GV.Debt}{GDP})_{it} + \beta_5(\tfrac{Fis}{GDP})_{it} + \beta_6(\tfrac{Reserves}{Import})_{it} + \beta_7(\tfrac{X+M}{GDP})_{it} + \beta_8(S\&P)_{it} + \alpha_i + \lambda_t + u_{it} \quad (1)$$

where $i = 1$ to n (the number of countries) and $t = 1$ to T (the number of periods). The independent variables are respectively as follows: $VigeoESG$, the sustainability country rating which is our variable of interest; $\Delta GDP/GDP$, the GDP growth rate; $\Delta P/P$, the inflation rate; $G.GV.Debt/GDP$, the gross debt to GDP ratio; $Fis/GDP$, the country's fiscal balance to GDP; $Reserves/Imports$, the ratio of reserves to imports; $(X+M)/GDP$, the trade openness ratio; and S&P, the Standard & Poor's based numerical variable assigning 1 to BB rating, 2 to BB+, $\cdots$, 11 to AAA. The dependent variable $SPREAD_{it}$ is the government bond spreads. In order to check whether the effect of the Vigeo ESG rating depends on the bonds' maturities (see hypothesis H2), we estimate our econometric model for three maturities: two-years, five-years and 10-years bond spreads.

The residuals are $\varepsilon_{it} = \alpha_i + \lambda_t + u_{it}$ where $\alpha_i$ represents the (unobserved) country specific effect, $\lambda_t$ represents the (unobserved) time specific effect, and $u_{it}$ represents a random error term with $Var(u_{it}) = \sigma_u^2$ and $E(u_{it}) = 0$ whatever $i$, $t$. The country specific effect $\alpha_i$ allows

us to take into account unobservable variables that are specific to the country $i$ and time-invariant; while the time specific effect $\lambda_t$ permits us to take into account unobservable shocks that affect all countries indifferently. We use a (country and time) fixed effects panel model where $\alpha_i$ and $\lambda_t$ are supposed to be certain. As a consequence, in a fixed effects model, the $\alpha_i$ and $\lambda_t$ are (in addition to the parameters $\beta_0 \cdots \beta_8$) to be estimated. In order to identify the model, only $n-1$ of the $\alpha_i$, $i = 1 \cdots n$ and $T-1$ of the $\lambda_t$, $t = 1 \cdots T$, are included in the regression. Our choice of a fixed effects model seems to be correct since the test for the non-existence of fixed effects rejects the null hypothesis and concludes with the existence of both country and time specific effects.

### 4.2 Endogeneity issue

However, one may wonder whether the Vigeo ESG rating is endogeneous. Endogeneity can be the consequence of two main mechanisms: unobserved heterogeneity (omitted variables) and simultaneity.

Unobservables, such as the abilities and preferences of the incumbent political administration, are likely to affect government ESG behavior (Eichholtz et al., 2012) but also government bond spreads (Santiso, 2003; Moser, 2007). Since these variables are not included in the regression, they will be *de facto* in the residuals $\varepsilon_{it}$. As a consequence, the Vigeo ESG rating will be correlated to the residuals $\varepsilon_{it}$. However, since such abilities and preferences can be seen as relatively constant over our period of time (2007-2012), they are already taken into account in the country fixed effects. In other words, $\varepsilon_{it} = \alpha_i + \lambda_t + u_{it}$ and the Vigeo ESG rating may be correlated with the $\alpha_i$, not with the $u_{it}$. Since the $\alpha_i$ are fixed, they are explanatory variables of the model. Hence their eventual correlation with the Vigeo ESG rating will have no influence on the estimates of the parameters (except if this correlation is very high). Likewise, variables such as country wealth are taken into account in the country fixed-effects. Concerning the simultaneity issue, the question is whether the sovereign debt cost also affects the Vigeo ESG rating.

In order to take into account the potential endogeneity of the Vigeo ESG rating, we instrument it with the number of ISO 14001 certified firms within the country[3] using the methodology of Wooldridge (2005):

1. For each time period $t$, we estimate the model:

$$VigeoESG_i = a_0 + a_1(ISO)_i + a_2(\tfrac{\Delta GDP}{GDP})_i + a_3(\tfrac{\Delta P}{P})_i + a_4(\tfrac{G.GV.Debt}{GDP})_i + a_5(\tfrac{Fis}{GDP})_i + a_6(\tfrac{Reserves}{Import})_i + a_7(\tfrac{X+M}{GDP})_i + a_8(S\&P)_i + v_i \quad (2)$$

   where $v_i$ represents a random error and $ISO_i$ is the number of ISO 14001 certified firms within the country $i$.

2. Obtain the fitted values of $VigeoESG_{it}$.

[3]The usual tests of instrument validity have, of course, been conducted.

3. In model (1), replace $VigeoESG_{it}$ by its fitted values obtained in step 2. Then estimates the resulting model.

### 4.3 The informational contents of the Vigeo ESG ratings

In this part we conduct a robustness check of the informational content of the Vigeo ESG rating. Like its US counterpart KLD, Vigeo allows researchers to use its databases but does not provide the formula it uses in order to obtain its ESG country ratings from the criteria in table 1. We conduct the following actions to ascertain the informational contents of the Vigeo ESG rating:

(a) We estimate the part of the Vigeo ESG rating that is explained by variables [4] like Electricity generation, CO2 emissions, Forest rents per GDP, Protected areas as a percentage of national land area, Social expenditure per GDP, Female to male labor force participation rate, Health expenditure per GDP, R&D expenditure per GDP, Human Development Index, Regulatory quality, Rule of law, Government effectiveness, Political stability, Voice and accountability, and Corruption control. Let us called this variable, **Explained Vigeo ESG rating**[5]. It is technically the predicted value of the Vigeo ESG rating, when running for each time period $t$, an OLS regression where the dependent variable is the Vigeo ESG rating and the independent variables are as follows: Electricity generation, CO2 emissions, Forest rents per GDP, Protected areas as a percentage of national land area, Social expenditure per GDP, Female to male labor force participation rate, Health expenditure per GDP, R&D expenditure per GDP, Human Development Index, Regulatory quality, Rule of law, Government effectiveness, Political stability, Voice and accountability, and Corruption control.

(b) We estimate an instrumental variable fixed effects panel regression using the **Explained Vigeo ESG rating** as the main independent variable. Of course, in this regression, the **Explained Vigeo ESG rating** has been also instrumented using the number of ISO 14001 certified firms within the country.

(c) If the parameter estimate associated with the Vigeo ESG rating (see table 6) is close to the parameter estimate associated with **Explained Vigeo ESG rating**, then one can conclude that the informational content of the Vigeo ESG rating is good.

## 5 Results and discussion

The results of the instrumental variables panel regressions are presented in Table 6. The coefficient associated with the Vigeo ESG rating is negative and significant. Thus, in accordance with our hypothesis H1, we find a negative correlation between the countries' socially

[4] Such variables are used by rating agencies like KLD, CoreRatings, Deminor, Oekom. For an overview see SustainAbility &Mistra (2004). See also (Hesse, 2006; Bassen et al., 2006; Margaretic and Pouget, 2014; Martynova and Renneboog, 2010).

[5] This variable has exactly the same mean value (77.75) as the Vigeo ESG rating, with a standard-error of 4.61, a minimal value of 66.94, and a maximal value of 87.21.

responsible performances and the sovereign borrowing cost (defined by the government bonds spread). It seems therefore that countries displaying higher ESG indicators are rewarded by lower sovereign borrowing costs. The results are economically relevant in the sense that they could matter to both investors and national policy makers. Indeed, ESG ratings could play a role in assessing risk and its location and distribution in the financial system. By facilitating investment decisions, ESG assessments can help investors in achieving a balance in the risk return profile and at the same time assist countries in accessing capital at a low cost (Kohut and Beeching, 2013; Drut, 2010; Connolly, 2007).

Regarding bonds maturity, the result is qualitatively the same regardless of whether the models are estimated with spreads of two years, five years or 10 years. However the magnitude of the coefficients decreases (in absolute value) with the bond maturities: respectively -0.215 for two-year bond spreads, -0.179 for five-year bond spreads and -0.104 when considering 10-year bond spreads. This is also in accordance with hypothesis H2 and is in line with previous studies findings that the financial effects of qualitative factors are more likely in the short run. For instance, Bellas et al. (2010) find that, in the short run, financial fragility is a more important determinant of spreads than fundamental indicators. According to these authors, the short-term coefficient of the financial stress index appears to be highly significant in all estimations, while the short-term coefficients of fundamental variables are less robust. Particularly in the long run, sovereign bond spreads are primarily determined by debt and debt-related variables, trade openness, and a set of risk-free rates. In the short run, the degree of political risk, corruption, and financial stability in a country play the key role in the valuation of sovereign debt. According to Zoli (2005) and Baig et al. (2006), fiscal policy actions and announcements move bond markets in the short run.

Concerning our control variables, Inflation rate and Reserves to Imports ratio increase sovereign borrowing costs, while S&P credit ratings, Gross debt to GDP ratio and the Fiscal balance to GDP ratio lower borrowing costs. However, GDP growth rate and Trade openness (defined by the ratio of Exports and Imports to GDP) seem to play no role in bond spreads.

Table 6: Instrumental variables panel regression of bond spreads (with country and time fixed effects)

| | Bond Spreads | | |
|---|---|---|---|
| | 2 two years | 5 five years | 10 years |
| Intercept | 24.107*** | 22.91*** | 15.912*** |
| | (7.316)[s] | (6.602) | (4.811) |
| Instrumented Vigeo ESG rating[a] | -0.215** | -0.179* | -0.104* |
| | (0.092) | (0.083) | (0.061) |
| $\Delta GDP/GDP$[b] | -0.025 | -0.049 | -0.008 |
| | (0.097) | (0.088) | (0.064) |
| $\Delta P/P$[c] | 0.376*** | 0.237** | 0.136* |
| | (0.122) | (0.110) | (0.080) |
| $G.GV.Debt/GDP$[d] | -0.025* | -0.022* | -0.011 |
| | (0.014) | (0.013) | (0.009) |
| $Fis./GDP$[e] | -0.02** | -0.018** | -0.012** |
| | (0.008) | (0.007) | (0.005) |
| $Reserves/Imports$[f] | 0.627*** | 0.541*** | 0.364*** |
| | (0.143) | (0.129) | (0.094) |
| $X+M/GDP$[g] | -0.025 | -0.021 | -0.011 |
| | (0.017) | (0.015) | (0.011) |
| $S\&P$[h] | -0.611*** | -0.655*** | -0.637** |
| | (0.168) | (0.151) | (0.11) |
| $R^2$ | 70.04 | 73.9 | 82.03 |
| F-Test for no fixed effects | 2.86*** | 3.3*** | 4.65*** |

***,**,* significant respectively at 1%, 5%, 10%

[a] = Instrumented by the number of ISO 14001 certified firms.
[b] = GDP growth.
[c] = Inflation rate.
[d] = Gross debt to GDP ratio.
[e] = Country's fiscal balance to GDP.
[f] = Ratio of reserves to imports.
[g] = Trade openness ratio.
[h] = Standard & Poor's: Numerical variable assigning 1 to BB, 2 to BB+ and so on through 11 to AAA.

[s] = Standard-error.

Table 7 shows that the informational contents of the Vigeo ESG rating are actually very good. Indeed, the coefficients associated with Explained Vigeo ESG rating in table 7 and those associated with Vigeo ESG rating in table 6 are close. For instance, for bonds with two-year maturity, the coefficients are $-0.210$ and $-0.215$ respectively.

Table 7: Instrumental variables panel regression of bond spreads (with country and time fixed effects) using Explained Vigeo ESG rating as main independent variable

| | Bond Spreads | | |
|---|---|---|---|
| | 2 two years | 5 five years | 10 years |
| Intercept | 23.156*** | 23.215*** | 15.911*** |
| | (7.335)[s] | (6.591) | (4.809) |
| Instrumented Explained Vigeo ESG rating [a][a'] | -0.210** | -0.191** | -0.108* |
| | (0.096) | (0.098) | (0.063) |
| $\Delta GDP/GDP$[b] | -0.024 | -0.054 | -0.01 |
| | (0.098) | (0.088) | (0.064) |
| $\Delta P/P$[c] | 0.391*** | 0.263** | 0.15* |
| | (0.126) | (0.113) | (0.082) |
| $G.GV.Debt/GDP$[d] | -0.02 | -0.018 | -0.009 |
| | (0.014) | (0.013) | (0.009) |
| $Fis./GDP$[e] | -0.019** | -0.017** | -0.011** |
| | (0.008) | (0.007) | (0.005) |
| $Reserves/Imports$[f] | 0.599*** | 0.515*** | 0.349*** |
| | (0.144) | (0.129) | (0.094) |
| $X+M/GDP$[g] | -0.025 | -0.022 | -0.012 |
| | (0.017) | (0.015) | (0.011) |
| $S\&P$[h] | -0.508*** | -0.631*** | -0.625** |
| | (0.172) | (0.154) | (0.112) |
| $R^2$ | 70.26 | 73.96 | 82.03 |
| F-Test for no fixed effects | 2.87*** | 3.34*** | 4.66*** |

***,**,* significant at 1%, 5%, 10% respectively

[a] Explained Vigeo ESG rating = The part of Vigeo ESG rating explained by: Electricity generation, CO2 emissions, Forest rents per GDP, Protected areas as a percentage of national land area, Social expenditure per GDP, Female to male labor force participation rate, Health expenditure per GDP, R&D expenditure per GDP, Human Development Index, Regulatory quality, Rule of law, Government effectiveness, Political stability, Voice and accountability, and Corruption control.
[a'] Instrumented by the number of ISO 14001 certified firms.
[b] = GDP growth.
[c] = Inflation rate.
[d] = Gross debt to GDP ratio.
[e] = Country's fiscal balance to GDP.
[f] = Ratio of reserves to imports.
[g] = Trade openness ratio.
[h] = Standard & Poor's: Numerical variable assigning 1 to BB, 2 to BB+ and so on through 11 to AAA.
[s] = Standard-error.

# 6 Conclusion

Sustainability has been gaining momentum in recent years at the country level, if not within the academic finance community. This paper contributes to the literature by examining the impact of government ESG performance on public debt using sovereign bond spreads as the vehicle for measuring the cost of sovereign borrowing. To do so, we have collected information

concerning several quantitative and qualitative variables for 23 OECD countries, from 2007 to 2012. We have used Vigeo sustainability country ratings to assess the ESG performance of those countries. With this panel data, we have aimed at measuring empirically the effect of extra-financial ratings on government bond spreads. Our results show that high ESG ratings are associated with low borrowing costs. We also find that the impact of ESG indicators on the costs of sovereign borrowings is more pronounced in bonds of shorter maturities. Hence, extra-financial ratings play, from the standpoint of investors, an important role in assessing risk in the financial system.

However the risk assessment story is not the only one that could explain why high ESG ratings are associated with low borrowing costs for countries. For instance, one may argue, in an analogy with the literature on intrinsic motivation (Frey, 1997; Benabou and Tirole, 2003; Besley and Ghatak, 2005), that some values-oriented investors accept to be paid a lower risk premium from ESG-oriented countries. This happens not only because of their common values, but also because the alignment of objectives of both parties will reduce the monitoring cost of investors. Another explanation of the link between ESG ratings and countries' borrowing costs can be found (remembering that the environment is one dimension of ESG) in the EE-IS-LM model (Heyes, 2000; Sim, 2006; Decker and Woher, 2012). According to this model, an upgrading of environmental standards is beneficial in the long run for economic growth (and hence reduces the yield spread).

Our paper suggests some directions for future research. One direction could be to extend our analysis over more time periods; another could be to focus on emerging economies and developing countries, where the sovereign bond markets are different.

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