Corporate Social Responsibility in Risk Management
Empirical evidence of cross-continental deviations

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"Für augenblicklichen Gewinn verkaufe ich die Zukunft nicht."[1]

Werner von Siemens

[1] engl.: I refuse to sell the future for momentary gain.

Johannes Grebler

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This dissertation is submitted to the graduate faculty at the University of Regensburg to obtain the degree 'Doktor der Wirtschaftswissenschaft'.

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List of Abbreviations

2SPS	Two-stage predictor substitution
2SLS	Two-stage least squares
AAA	Rating grades of Standard&Poor's (in descending order)
AA	
A	
BBB	
BB	
B	
CCC	
CC	
C	
bps	Basis points
CAPEX	Capital expense
CAPM	Capital asset pricing model
CEO	Chief executive officer
CFP	Corporate financial performance
CMA	Conservative minus aggressive portfolio
CSP	Corporate social performance
CSR	Corporate social responsibility
D	Default
ES	Equal weighted score of environmental and social performance
ENV	Environmental performance score
FE	Fixed effect
FTSE	Financial Times Stock Exchange
GDP	Gross domestic product
HML	High minus low portfolio
IV	Instrumental variables (approach)
KLD	Kinder Lydenberg Domini
ML	Maximum likelihood (estimation)
MSCI	Morgan Stanley Capital International
NBS	National business systems
NGO	Non-governmental organization
NYSE	New York Stock Exchange
OLS	Ordinary least squares
R&D	Research & development
RMW	Robust minus weak portfolio

ROA	Return on assets
S&P	Standard&Poor's
SOC	Social performance score
SEC	U.S. Securities and Exchange Commission
SMB	Small minus big portfolio
TR	Thomson Reuters
TRBC	Thomson Reuters Business Classification
TRD	Thomson Reuters Datastream
UNFCCC	United Nations Framework Convention on Climate Change
U.S.	United States of America
VIF	Variance inflation factor
WEF	World Economic Forum
WMW	Wilcoxon-Mann-Whitney test

Chapter 1

Introduction

The importance of corporate social responsibility (CSR) has been steadily increasing during recent years in the areas of society, finance, and science. With respect to climate protection as an example, public perception reached a high point in several countries worldwide triggered by student protests in 2019-2020. Similarly, sustainability topics are more and more embraced in the finance area, e.g., asset managers correspond progressively to sustainability topics as prominently described by BlackRock CEO Larry Fink in his 2020 letter to CEOs about fundamental reshaping of finance stemming from climate change. Scientific research has traditionally taken into account the broader perception of CSR, referring to social aspects in addition to environmental concerns. Until recently, there were only few points of contact between CSR and financial risk management seeking to identify, measure, predict, and control risks. Profound risk management is critical for the business success of a company requiring continuous improvements of the referring approaches. In this context, the question arises of whether CSR contributes to improvements in risk management.

CSR can be conceptually measured through corporate social performance (CSP). There is no mutually agreed-upon definition for either CSR or for CSP (Griffin, 2000; Van Beurden and Gössling, 2008). According to Oikonomou et al. (2014), CSP includes the relationship of the stakeholders beyond non-financial aspects of corporate strategy. Usually CSP includes corporate environmental and corporate social performance (El Ghoul et al., 2017, 2016). Prominent data providers for CSP are Kinder Lydenberg Domini (KLD), FTSE4Good, Dow Jones, and Asset4. They distinguish themselves in ways such as their measurement approach, transparency, and international coverage. KLD data are used in the majority of studies although KLD is limited in regional coverage to the U.S., publishes only general information about their approach and is methodologicaly limited to measuring strengths and concerns.

Goss and Roberts (2011) point out two opposing views about how CSP can affect firms, namely the risk mitigation view and the over-investment view. The risk mitigation view reveals firms with high CSP exposed to lower risk *ceteris paribus* compared to firms with lower CSP. The positive effects of CSP on firms can be illustrated in many different ways, for example, with respect to protection against reputation and regulatory risk (Bauer and Hann, 2010), the opportunity to hire better qualified employees (Turban and Greening, 1997), and to prevent danger stemming from principal-agency-conflicts (Oikonomou et al., 2014). The contrary view revealing CSP as over-investment, however, perceives CSP as a waste of scarce resources, meaning that financial benefits cannot outweigh reflected cost. Although there is also empirical evidence for that view, it is less widespread (cf. Frooman et al., 2008; Brammer and Millington, 2008; Cornell and Shapiro, 1987; Aupperle et al., 1985).

A relationship between CSP and corporate risk is conceivable, e.g., in the context of empirical evidence for CSP and financing cost. Overall, high CSP tends to be related to lower financing cost (Goss and Roberts, 2011; Dhaliwal et al., 2011; El Ghoul et al., 2011; Lee et al., 2009; Orlitzky, 2008) and higher firm value (Margolis et al., 2007; Servaes and Tamayo, 2013). More narrowly, instead of overall CSP, the relationship to financing cost was also shown for environmental performance (Schneider, 2011; Sharfman and Fernando, 2008) and for social performance (Chen et al., 2011). Usually low credit risk is associated with low cost of debt while low systematic risk is associated with low cost of equity. Therefore, it is conceivable that CSP could be an underlying influence factor for both financing costs and aspects of corporate risk.

Moreover, CSP seems to be positively related to corporate financial performance (CFP) (Kang et al., 2016; Von Arx and Ziegler, 2014) based on sustainable future cash flows although it has to be noted that Halbritter and Dorfleitner (2015) find no evidence of such an association. In a meta-study, Orlitzky et al. (2003) find a positive relationship between CSP and CFP in the majority of studies. CFP again is, e.g., related to credit risk (Standard&Poor's, 2013). Hence, the link between CSP and credit risk seems plausible. Also, high CSP firms are exposed to lower idiosyncratic risk corresponding to higher CFP (Orlitzky et al., 2003). Moreover, stock returns of firms with high CSP were higher during the financial crisis of 2008-2009 (Lins et al., 2017), implying the risk mitigation view of CSP with respect to systematic risk. All these associations may indicate that CSP can also be linked to aspects of corporate risk.

The relationship between CSP and a variety of risk aspects has already been subject to previous empirical research. Attig et al. (2013), Jiraporn et al. (2014), and Stellner et al. (2015) analyze the impact of CSP on credit risk, including findings for overall strong effects in North America. Utz (2018) focuses on CSP and idiosyncratic risk as well as on crash risk, finding empirical evidence of the risk mitigation view in the U.S., Japan, and Europe, while for the over-investment view in Asia-Pacific. Albuquerque et al. (2018) confirm the risk mitigation view of CSP on systematic risk for U.S. firms. Sassen et al. (2016) provide the referring evidence for European firms.

With respect to regional differences, different levels in both CSP itself and in the impact of CSP on risk aspects can be recogniced. For example, CSP seems to be higher in Europe than in the U.S. Explanations may include legal origin in terms of common law in Northern America versus civil law in Europe, the deviating institutional and political set-up, the level of economic development, the historic tendency to liberal democracy, and the perception of stakeholders (Liang and Renneboog, 2017; Doh and Guay, 2006; Cai et al., 2016; Welford, 2005; Maignan, 2001). The stakeholder perception especially seems to follow the ideologies of Lodge (1990). The majority of European countries are defined by the communitarian ideology, pursuing common long-term goals. In contrast, e.g., the U.S. is assigned to the individualistic ideology, thereby pursuing rather individual short-term improvements. Moreover, the motivation of firms to attend to CSP differs between Europe and the U.S. depending on firm size and financial performance (Sotorrío and Sánchez, 2008). CSP in the U.S. tends to be ingrained in society while CSP is more state-oriented in Europe. Historically, CSP has been driven more by concrete corporate policies and programs that contribute to social concerns in the U.S. Instead the contribution to social concerns in dimensions of values, norms, and rules dominates in Europe. Increases in CSP in Europe over the last decades are motivated by benefits for corporate engagement provided from the European Union (Matten and Moon, 2008). For further regional variations, the international evidence on the link between CSP and idiosyncratic risk of Utz (2018) can be referred to as the risk mitigation view in the U.S., Japan, and Europe contrasts with the over-investment view in Asia. From this viewpoint, it seems plausible that the relationship between CSP and some types of risk can possibly vary across regions in an international context.

The main objective of this dissertation is to present, from an international perspective, the impact of CSR on various risk aspects of credit and equity markets, and thus close existing gaps in literature. This dissertation is based on three research papers. The first research paper addresses the measurement of both explanatory power and prediction quality improvements of credit ratings through CSP. This study extends first empirical evidence by a more profound data base, allowing to expand the analysis consistently on North America and Europe, adding out-of-sample prediction measures and further overcoming methodological limitations of previous research. The second research paper focuses on the causal relationship between CSP and credit ratings, and aims to identify the drivers among CSP components. The methodological approach is based on an established credit risk model and the instrumental variable approach to mitigate endogeneity and identify causalities. Finally, the third research paper addresses the systematic equity risk as measured by the

Capital Asset Pricing Model (CAPM) in terms of a comparison of North America, Europe, Japan, and Asia-Pacific and by identifying the granular drivers inside CSP. Again, the instrumental variable approach is applied to mitigate endogeneity and identify causalities.

The impact of corporate social and environmental performance on credit rating prediction: North America versus Europe

The first research paper of this dissertation focuses on CSP and credit ratings and integrates into the rare literature in this area. Jiraporn et al. (2014) analyze the relationship between CSP and credit ratings for firms in the U.S., and Stellner et al. (2015) analyze the same relationship for firms in Europe. However, the findings of both studies are inconsistent. While Jiraporn et al. (2014) find empirical evidence for a signficant impact of CSP, Stellner et al. (2015) find none. It remains to be clarified if these differing results are caused by differences in methodology, in type as well as the granularity of CSP measurement, or in the regional focus. Moreover, the actual improvements of rating prediction quality induced by CSP have yet to be quantified. This study closes these gaps by applying a consistent, established credit risk model to an international dataset, by separating consideration of the social and environmental performance and by comparing of out-of-sample predictions with actual occurred ratings.

The sample is based on Standard&Poor's (S&P) long-term counterparty ratings of North American and European firms that are matched with CSP scores from Asset4 and a variety of control variables. Financial firms are excluded based on the Thomson Reuters Business Classification (TRBC). These credit ratings reflect the obligors' creditworthiness over a long-term time horizon (greater than one year). A company's overall CSP is defined by the average of its environmental and social performance, according to El Ghoul et al. (2017), Ioannou and Serafeim (2012), and Luo et al. (2015). The used annual CSP measures of Asset4 are methodologically more sophisticated and more transparent compared to other providers, e.g., KLD (Chatterji and Levine, 2006). They can be interpreted as measures for sustainable business models (Ioannou and Serafeim, 2012; Chatterji et al., 2016; Humphrey et al., 2012). In order to test for out-of-sample prediction quality, the dataset is divided into two panels. The first panel includes the years from 2003 to 2013 and is used to estimate the coefficients of this model. In a second step, these estimation results are employed to calculate out-of-sample predictions based on the remaining dataset covering the years from 2014-2017. Furthermore, regional differences are elaborated based on separate regional subsamples for both North America and Europe.

The methodological approach is derived from the ordered probit model used by Kaplan and Urwitz (1979). Modifications and further developments were also used in many other studies in the context of credit risk (e.g., Dimitrov et al., 2015; Baghai et al., 2014; Alp, 2013; Jiang et al., 2012; Becker and Milbourn, 2011). The model estimation is based on the maximum likelihood method (Venables and Ripley, 2002; McKelvey and Zavoina, 1975). Time-fixed effects and standard errors clustered on firm level are included to consider the panel structure of the sample. In ordered choice models, marginal effects cannot be directly derived from only the coefficients due to the link function. For that reason, marginal effects at means of control variables are calculated (cf. Greene, 2011). Prediction quality is then measured by means of Somers'D (Somers, 1962; Newson, 2001) that considers the association between actual occurred and estimated credit ratings. Finally, the Wilcoxon-Mann-Whitney (Bauer, 1972; Hollander et al., 2013) test is used to statistically prove for significant increases in prediction quality through CSP.

Findings confirm the risk mitigation view on CSP. Empirical evidence claims an impact of overall CSP on credit ratings of firms located in North America reflected by both increased explanatory power and by increased prediction quality (by 0.8%). These results confirm and extend the findings of Jiraporn et al. (2014). Indeed, in Europe overall CSP has no significant effect, but social performance has a significant positive impact in contradiction to Stellner et al. (2015), who find no impact of CSP. Differing results for North America and Europe are possibly due to their geographical, social, and political environment that is reflected in their CSP scores. On average, CSP scores in North America are lower than in Europe and expose greater variance.

The social and environmental drivers of corporate credit ratings: international evidence

In the first research paper included in this dissertation, described above, out-of-sample prediction quality improves significantly in the North America sample if environmental and social performance measures are integrated into an established credit risk model. So far, there is research only about identifying driving components of social and environmental performance for the U.S., and this research suffers potentially from endogeneity (e.g., Oikonomou et al., 2014) or deficiencies in modeling credit risk (e.g., Attig et al., 2013; Bauer et al., 2009; Jiraporn et al., 2014). One very likely source of endogeneity is the reverse causality problem in the relationship between CSP and credit ratings. On one side, there is a commonly assumed positive effect of CSP on credit ratings. On the other side, high CSP firms tend to pay lower financing costs and can increase investments into CSP due to the savings. Taking into account all of the described aspects, it is unclear what the social and environmental drivers are. The presented study provides a consistent international analysis of the impact of social and environmental components of CSP on credit ratings based on an instrumental variable approach in order to identify causal relationships and mitigate endogeneity.

Due to the applied instrumental variable approach, the dataset includes the average CSP level of firms located in the same area and measures for the political, labor, education, and cultural environment ascribed to the so-called 'national business systems' (NBS) (Whitley, 1999). These variables meet the requirements of instruments due to their shown relationship to a firm's CSP (Jiraporn et al., 2014; Ioannou and Serafeim, 2012), but obviously, they have no direct impact on credit ratings. The main sample includes S&P long-term counterparty ratings as dependent variable as well as Asset4 CSP scores and a set of well documented controls as independent variables. Financial firms are excluded based on the TRBC. In addition to environmental and social performance, the CSP measures contain their components level as well. The environmental score includes measures for resource reduction, emission reduction, and product innovation. The social score reflects the efforts in customer/product responsibility, community aspects, human rights, diversity, employee training and development, health and safety, and employment quality. The sample includes credit ratings from 2003 till 2018. Asset4 provides granular-level CSP measures for firms worldwide, thereby allowing for a consistent analysis for North America, Europe, and Asia.

The chosen methodological approach follows a two-stage predictor substitution (2SPS). As a specialized form of the instrumental variable approach for ordered choice models, it is supposed to mitigate endogenity and to identify causality in the relationship between CSP and credit ratings. In the first stage, CSP scores are regressed on instruments and control variables fitted by an ordinary least squares (OLS) estimation. Instruments include the country CSP average (Jiraporn et al., 2014) and categories of the NBS (Whitley, 1999) such as political system, labor and education system, and the cultural system (Ioannou and Serafeim, 2012). In the second stage, credit ratings are regressed on estimated CSP and the same control variables from the first stage in an established ordered probit model (cf. Kaplan and Urwitz, 1979; Dimitrov et al., 2015; Baghai et al., 2014; Alp, 2013; Jiang et al., 2012; Becker and Milbourn, 2011) as in the previous described research paper included in this dissertation. Again, the likelihood estimation of coefficients of the ordered choice model follows Venables and Ripley (2002) and McKelvey and Zavoina (1975).

Emprirical evidence of this study confirms the overall impact of CSP on credit ratings in terms of a causal relationship. With respect to single components of CSP, environmental innovation has the most distinct impact of all aspects reflected in environmental performance. This is true for North America, Europe, and Asia. In social categories, diversity matters most for firms located in North America and Europe, but not in Asia, probably because of cultural differences. The risk mitigation view applies for all significant CSP variables; however, the magnitude differs depending on the region as can be seen with negative effects of diversity in Asia compared to positive effects in North America and Europe.

Corporate social responsibility and systematic risk: international evidence

There is already first empirical evidence for the impact of CSP on systematic risk provided by Albuquerque et al. (2018) for the U.S. and by Sassen et al. (2016) for Europe. Both studies are based on systematic risk estimated by the CAPM of Sharpe (1964), Lintner (1975), and Mossin (1966). However, the literature cannot answer whether there are regional differences in the link between CSP and systematic risk due to several inconsistencies in their approach; it also does not identify the components of CSP that concretely drive this relationship. Furthermore, it remains unclear if the findings of Albuquerque et al. (2018) and Sassen et al. (2016) are robust to alternative measures of CSP and of systematic risk. The presented study closes these gaps by the consistent contemplation of regional differences in an international dataset including transparent CSP measures of Asset4. Alternatively to the CAPM, the five-factor model of Fama and French (2015) and the international CAPM (Fama and French, 2012) are used to calculate systematic risk. In order to identify causal relationships and to mitigate endogeneity, the instrumental variable approach is applied.

The dataset comprises publicly traded firms with available Asset4 scores from the regions North America, Europe, Japan, and Asia-Pacific following the classification of Fama and French (2012). Financial firms are excluded based on the TRBC. The used instumental variable approach requires instrumental variables for CSP in addition to conventional control variables. While instrumental variables are required to explain CSP, they may not have a direct impact on credit ratings. Selected instruments include the average CSP level of firms located in the same area and measures for the political, labor, education, and cultural environment with reference to their explanation of CSP (Jiraporn et al., 2014; Ioannou and Serafeim, 2012). To calculate systematic risk (the dependent variable of the main analysis of this study) weekly stock returns, market returns, and three-months, country-specific, risk-free rates are used. CSP is considered on both an overall and a more granular level. The latter includes emission reduction, environmental innovation, resources reduction, product responsibility, community, human rights, diversity, and employees.

In a pre-step, before consolidating the dataset of the main analysis, systematic risk is calculated in form of the market beta from the CAPM of Sharpe (1964), Lintner (1975), and Mossin (1966). As before in the context of credit risk, also the relationship between CSR and systematic risk is expected to be highly endogenous. For that reason, the instrumental variable approach is applied to measure the exogenous impact of CSP on systematic risk. In the first stage, the respective CSP factor is regressed on the instruments described above in addition to control variables. In the second stage, systematic risk is regressed on estimated CSP and the same control variables from the first stage. In order to prove for the robustness of results, systematic risk is estimated instead of the CAPM by the five-factor model of Fama and French (2015) and the international CAPM (Fama and French, 2012).

This study provides empirical evidence on the impact of CSP on systematic risk in North America, Europe, Asia-Pacific, and Japan. As high CSP tends to correlate with low systematic risk, the risk mitigation applies. The impact of CSP is most distinct in North America, and in descending order weaker but still significant in Europe, Asia-Pacific, and Japan. With respect to single components of CSP, each one shows influence, but the magnitude varies. Identified main drivers include product responsibility in North America and Japan, and employees in Europe while environmental innovation is most distinct in Asia-Pacific. Remaining CSP components appear less dominant. These findings are robust also when systemtatic risk is calculated based on the five-factor model of Fama and French (2015) and the international CAPM (Fama and French, 2012).

Contribution of this dissertation

This dissertation aims to clarify the relationship between CSP and various risk types occurring at credit and equity markets in the framework of explorative empirical studies. It focuses on credit ratings as a measure of creditworthiness as well as on systematic firm risk. In particular, starting from the current state in the literature, this work closes identified gaps and hence delivers important research insights as well as implications for applied risk management.

This dissertation contributes to the literature in the area of CSP and risk in several ways. Starting from inconsistent approaches and findings, studies of Jiraporn et al. (2014) based on U.S. firms, and Stellner et al. (2015) based on European firms are consolidated with respect to their regional focus. The approach includes both regional differences in separated panels for North America as well as for Europe. Compared to other studies using, e.g., MSCI-KLD data, the applied scores of Asset4 are based on a more transparent methodology and advanced approach (Chatterji and Levine, 2006). Also, the scores are internationally available, thereby enabling a consistent comparison of different regions. Moreover, actual improvements of credit rating prediction quality through CSP has not been quantified in the literature yet. This gap is closed by a two-stage approach that allows testing for out-of-sample prediction quality. While our model is estimated in the first step based on a subsample, out-of-sample prediction of credit ratings is then calculated in the second step on the remaining sample. The prediction quality is then measured by opposing actual occurred and predicted ratings.

After finding strong empirical evidence for the impact of CSP on credit ratings, the respective driving components of CSP are left to be identified. Again, the transparent and methodologically advanced CSP measures of Asset4 are used, but on a more granular level. Environmental performance includes the dimensions of emission reduction, product innovation, and resource reduction, while social performance comprises product responsibility, community, human rights, diversity, employment quality, health, and training. The availability of Asset4 scores enables the span of this analysis across North America, Europe, and Asia. Especially for this causal analysis of drivers, mitigating endogeneity derived from reverse causality between CSP and credit ratings is crucial. Additionally, current state-of-the-art in credit risk modeling needs to be accounted for. Previous studies fail to meet at least one of these requirements. Hence the 2SPS estimation as an adequate form of instrumental variable approach for nonlinear models is used in this context for the first time in literature. In the first stage, CSP variables are regressed on instruments and control variables. Also new to the literature is the selection of NBS categories involving the political, labor, education, and cultural system according to Whitley (1999) and the CSP of surrounding firms according to Jiraporn et al. (2014) as instruments. These variables qualify as instruments due to their shown relation to CSP but, obviously, none to credit ratings. In the second stage, the credit risk model as applied in many studies before (e.g., Dimitrov et al., 2015; Baghai et al., 2014; Alp, 2013; Jiang et al., 2012; Becker and Milbourn, 2011; Kaplan and Urwitz, 1979) meet the requirements of state-of-the-art credit risk modeling.

Previous literature (Albuquerque et al., 2018; Sassen et al., 2016) cannot answer if the impact of CSP on systematic risk is exposed to regional differences in an international context, and the driving components of CSP are not identified yet. Moreover, it remains unclear whether previous results are robust to alternative measures for CSP and systematic risk. This analysis closes this gap in the literature by analyzing the impact of Asset4 CSP measures on a more granular level based on a worldwide sample. Robustness checks include the five-factor model of Fama and French (2015) and the international CAPM (Fama and French, 2012) to estimate the systematic risk. Also, since the relationship between CSP and systematic risk is assumed to be highly exposed to endogeneity, again, the instrumental variable approach is used based on previously described instruments. This setup is used for the first time in literature in the context of systematic risk.

In the context of various data providers for CSP measures, Asset4 stands out due to its transparency and sophisticated approach. Hence, all presented studies are based on CSP measures of Asset4. In contrast, the rare works on CSP and risk use predominantly CSP measures from KLD. To a great extent, this presented study can confirm the previous literature in a few intersections, concluding that in this context, results are robust even if the data provider changes. However, due to transparency and linked interpretability, Asset4 CSP measures are still to be prioritized.

The presented findings on CSP and credit risk provide a meaningful closing of gaps in the literature as well as implications for practice, particularly for debt issuers, debt holders, and investors. Primarily debt holders profit from higher accuracy in their improved credit risk models through CSP in two ways. On one side, overestimation of risk is prevented.

When prices are set too high because actual not existent risk is covered, investors may price them out of the market and lose investment opportunities. Also the underestimation of risk is prevented. Economic losses may occur when risks that were not considered in the pricing become material. The benefits of identifying the CSP impact drivers on credit ratings are reflected in default risk (proxied by credit ratings). With improved credit ratings, cost of debt may be lower. For example, BBB-rated North American firms that increase their overall CSP score by one standard deviation may experience, on average, savings of 14.5 basis points in that context. Because good ratings tend to be associated with lower financing cost, firms can target investments into CSP more efficiently after driving CSP components are identified in this study. Finally, increased performance in product innovation appear to have the highest impact on credit ratings in North America, Europe, and Asia. Diversity as a social driver is only distinct in North America and Europe, but not in Asia.

Respective empirical results about CSP and systematic risk provide valuable insights for capital allocation, investment valuation, and portfolio selection. The cost of equity is largely determined by systematic risk (Albuquerque et al., 2018) and hence can be lowered through increasing CSP on bases of the presented results. Again, lower cost of equity leads to a greater variety on investment opportunities, as it is crucial for their valuation. Portfolio selection is usually based on total risk stemming from both systematic and idiosyncratic risk. As systematic risk cannot be mitigated through diversification, identifying the impactful components of CSP to lower systematic risk are even more important.

Chapter 2

The impact of corporate social and environmental performance on credit rating prediction: North America versus Europe

This chapter is based on a joint work with Gregor Dorfleitner (University of Regensburg) and Sebastian Utz (University of St. Gallen). The article has been submitted to the *Journal of Risk* and was accepted for publication. The final version may differ due to editorial changes.

Abstract We quantify the extent to which the quality of credit rating predictions improves by integrating measures of corporate social performance (CSP) in an established credit risk model. Our analysis provides comprehensive evidence of the comparative informational advantage of considering CSP in predicting credit ratings of North American and European firms. In the North American sample, both environmental and social performance have an explanatory impact. The out-of-sample prediction quality improves by more than 0.8%. By contrast, only social performance increases the explanatory power in the European sample; environmental performance does not. Overall, we show that CSP is a relevant variable for predicting credit ratings. In general, our findings support the risk mitigation view of CSP, indicating that firms with high CSP are less risky and thus have better credit ratings. However, the quality of the relationship depends on the socioeconomic and cultural environment as well, as can be seen from the differing results in North America and Europe.

Keywords credit risk · credit ratings prediction · corporate social performance · risk mitigation

JEL Classification G12 · G24 · M14

2.1 Introduction

This paper analyzes whether, how and the extent to which the prediction quality of a firm's credit rating improves by integrating its corporate social performance (CSP) into the forecasting model. To capture regional differences, we analyze two samples of firm-level data, one including North American firms and one including European firms. We unify the work of Jiraporn et al. (2014) for North America and Stellner et al. (2015) for Europe by providing a framework in which results for the two regions can credibly be compared in an established credit risk model. We use CSP measures of the globally available Asset4 framework and investigate the impact of these CSP measures on both the explanation and the prediction of credit ratings. We capture region-specific differences by estimating models for North America and Europe separately in a first step and for a merged data set in a second step. In particular, we apply a two-stage approach with an estimation of credit risk models, including CSP variables in the first stage and an out-of-sample analysis using the estimate of the first stage to predict the credit ratings in a second stage. Finally, we measure the prediction quality by comparing predicted and actual credit ratings. In North America, both the environmental and social CSP show an explanatory impact on credit ratings, while only the social CSP is relevant in Europe. Further, we find the prediction power of the credit risk model improved when using CSP scores for the North American sample, while we document no improvement in the European sample.

In theory, corporate social responsibility – which we repeatedly address in this paper through the narrower yet measurable concept of CSP – can coexist with both better and worse credit ratings, provided there is evidence of an impact. According to Goss and Roberts (2011), there are two contrary views for the impact of CSP: the risk-mitigation view and the overinvestment view. According to the risk-mitigation view, a firm with high CSP faces lower risks than a firm with a low CSP if all other aspects of these firms are comparable. High CSP protects firms from legal, reputational and regulatory risks (Bauer and Hann, 2010), allows firms to hire better qualified employees (Turban and Greening, 1997), and lowers agency risks (Oikonomou et al., 2014). The opposite (overinvestment) view regards investments in CSP as a waste of scarce resources. An increase in fixed costs related to sustainable investments in CSP increases the volatility of earnings and thus the default risk (Frooman et al., 2008). Except for the environmental score in Europe, credit ratings are significantly positively correlated with the CSP scores, and thus our findings are consistent with the risk-mitigation view.

Whether CSP adds informational power to the explanation of credit ratings has been the subject of two studies, namely Jiraporn et al. (2014), analyzing North America, and Stellner et al. (2015), analyzing Europe. The evidence these studies provide is inconsistent, which could be due to either the different methodological designs or the differing regional focus of their samples. More precisely, Stellner et al. (2015) show that CSP has no impact on credit ratings of European firms while Jiraporn et al. (2014) conclude that CSP does have an impact on credit ratings of North American firms. Nevertheless, these results are inappropriate for concluding that regional differences exist since both studies used different model specifications and concepts for measuring CSP (data providers Asset4 and Kinder Lydenberg Domini (KLD), respectively). In particular, Asset4 and KLD CSP data shows major differences even after adjustment for different CSP definitions (Chatterji et al., 2016; Dorfleitner et al., 2015). Asset4 provides a comprehensive calculation of the scores based on more than 750 indicators, which are ordinal or metric, unlike KLD, which only uses a binary rating system to reflect CSP strengths and concerns for U.S. firms (Humphrey et al., 2012). We use the CSP measures of Asset4 due to their global coverage, which allows for the consistent estimation of a well-established credit risk model for North American and European firms. The major limitation of the existing studies in the CSP–credit rating context concerns the retrospective contemplation by measuring the correlation of credit ratings and lagged CSP, which lacks out-of-sample predictions. In our study, we predict the next period's credit rating based on all available information at a certain point in time. Finally, the prediction quality is determined by comparing actual and predicted credit ratings.

Our data set includes Standard&Poor's (S&P) counterparty ratings matched with Asset4 CSP scores and a set of control variables. We estimate several versions of an established ordered probit credit risk model, which can handle rating migrations. To be specific, we estimate one baseline model without CSP factors and three CSP models for each sample (i.e., the North American sample, the European sample and the merged sample comprising both), resulting in a total of twelve model specifications. The three CSP model specifications comprise one aggregated CSP measure model, a model specification with a score for the environmental dimension of CSP and a model specification with a score for the social dimension of CSP. The in-sample period for determining the models' coefficients ranges from 2003 to 2013 for credit ratings. Subsequently, we predict credit ratings on the data set covering the years 2014-17. This two-step process ensures that only the available level of information is used to predict the following periods' credit ratings.

We find that the integration of all of our measures for CSP in the credit risk model increases the explanatory power in the North American sample. The quality of out-of-sample credit rating predictions is improved by 0.8%. For European firms, only the social dimension of CSP shows a significant (positive) correlation with credit ratings. The prediction quality experiences no improvement. Distinct findings for North America and Europe result from the geographical, social and political environments of the two regions, which are reflected in the Asset4 scores. The average level of CSP scores of North American firms is lower, and their variance is higher, than that of European firms. This pattern is one possible reason for CSP scores having a higher explanatory power in predicting credit ratings in North America, since the explanatory variables show a certain degree of variance there. In a nutshell, CSP has an impact on credit ratings in both regions, although to a different extent. For North America, our findings are consistent with those of Jiraporn et al. (2014), while our results suggest contrasting implications to those of Stellner et al. (2015).

Our findings reveal valuable insights for researchers, debt holders and debt issuers. Based on our approach of incorporating CSP into credit risk models, we find that debt holders experience greater accuracy in their credit rating predictions if they include CSP factors as explanatory variables in their credit risk models. With this higher prediction power, they profit twofold by preventing misjudgments: in the case of overestimation of risk, they could lose business due to excessive price-setting, while in the case of underestimation of risk, the applied pricing might not cover the anticipated risk. The latter leads to immediate losses in the risk-adjusted performance measurement and material losses when risks become imminent. Finally, debt issuers can improve their credit rating prediction, and hence their cost of debt, by increasing their CSP. For instance, an increase in the aggregated CSP score by one standard deviation for a BBB-rated North American firm results in average savings of 14.5 basis points (bps).

The remainder of this paper is organized as follows. We review the related literature and discuss theoretical concepts in Section 2.2. Section 2.3 describes the data set, and Section 2.4 introduces the methodology employed. Section 2.5 presents the empirical results, Section 2.6 discusses the findings and Section 2.7 gives an overview of the robustness tests. Finally, Section 2.8 states our conclusions.

2.2 Theoretical considerations

Our study considers two streams of the literature: the impact of CSP on credit ratings and the regional differences regarding the attitude of firms toward CSP.

2.2.1 The impact of CSP on credit ratings

From a theoretical perspective, there is an indirect link between CSP and credit ratings in the context of financing cost and corporate financial performance (CFP).

First, previous studies (Goss and Roberts, 2011; Dhaliwal et al., 2011; El Ghoul et al., 2011) suggest that firms with high CSP have lower financing costs in terms of both cost of equity and cost of debt. As creditworthiness is negatively related to interest rates payable on debt (Kisgen, 2006), we expect to observe a positive relationship between CSP and credit ratings based on this consideration. From this perspective, CSP can be seen as an underlying factor, having an impact on both financing cost and credit ratings. Concerning single CSP pillars, there exists a negative relationship between CSP and financing cost for environmental performance (Schneider, 2011; Sharfman and Fernando, 2008) and for social performance (Chen et al., 2011).

Second, a similar argument considers CFP as opposed to financing costs. CSP is positively related to CFP (Dorfleitner et al., 2018; Kang et al., 2016; Von Arx and Ziegler, 2014) in the sense of sustainable future cashflows. Further, CFP is positively related to creditworthiness (Standard&Poor's, 2013). Finally, firms with a high CSP tend to have a lower idiosyncratic risk due to the risk-mitigation effect of CSP, which corresponds to both lower financing costs and a higher CFP (Orlitzky, 2008). Therefore, we expect a positive relationship between CSP and creditworthiness.

By reexamining the different pillars of CSP, we can expose the underlying mechanisms. Firms with a low level of environmental performance face legal, reputational, and regulatory risks (Bauer and Hann, 2010). Moreover, a good social performance allows firms to hire better qualified employees, who are a key factor in future success (Turban and Greening, 1997). It should be noted that a contrasting view (the overinvestment view) exists, according to which CSP lowers CFP when costs exceed additional positive returns (Aupperle et al., 1985; Brammer and Millington, 2008; Cornell and Shapiro, 1987). However, there is less supporting evidence for this view.

From an empirical perspective, a few studies examine the impact of CSP on credit ratings by approaching an ordered-response credit risk model and show that CSP is positively related to (good) credit ratings. Stellner et al. (2015) find no significant relationship between CSP and credit ratings in the eurozone based on the Asset4 equal-weighted rating score. However, high (low) CSP results in better credit ratings if the country's sustainability performance is high (low). Jiraporn et al. (2014) use the KLD composite score and find that the CSP policies of U.S. firms are affected by those of other firms in the same three-digit zip code area. Firms with high CSP have better credit ratings. A deeper look at single dimensions of CSP by utilizing KLD data shows that U.S. firms with high environmental and social performance have better credit ratings (Attig et al., 2013; Bauer and Hann, 2010; Bauer et al., 2009; Oikonomou et al., 2014).

Although there exists empirical evidence on the general CSP–credit rating link, it is still not clear whether CSP has an impact on prediction quality. In addition, there is no consistent evidence on the question of whether the impact of CSP on credit ratings depends on regional differences, a matter we will treat in the next subsection.

2.2.2 CSP in North America and Europe

In general, CSP is higher in Europe than North America. This is true at least for the United States, as the dominant country in our North America sample. Various explanations for the differences between both regions include the legal origin (common law in North America versus civil law in Europe), the divergent institutional and political setups, the level of economic development, the historic tendency toward liberal democracy and the perception of stakeholders (Cai et al., 2016; Doh and Guay, 2006; Liang and Renneboog, 2017; Maignan, 2001; Welford, 2005).

In particular, the stakeholder perception is linked to the differing ideologies as defined by Lodge (1990). European countries are more closely tied to a communitarian ideology, which means that they tend to pursue the goal of common, long-term goods. Conversely, the United States tends to adopt an individualistic ideology, implying that individual, short-term improvements are pursued instead. The motivation of the companies to act in a socially responsible way differs between the two regions, depending on firm size and financial performance (Sotorrío and Sánchez, 2008).

CSP in the United States is more ingrained in society, while CSP in Europe appears to be more state-oriented. Historically, CSP in the United States has been driven by concrete corporate policies and programs that contribute to social concerns, while in Europe the contribution to social concerns predominantly occurs in the context of values, norms and rules. According to Matten and Moon (2008), the rise of CSP in Europe in recent decades has been the result of incentives for corporate engagement provided by the European Union.

Empirical evidence shows that North America's CSP only exceeds Europe's with respect to rare aspects such as business communication (Maignan and Ralston, 2002); in terms of most aspects and measurement concepts, CSP is higher in Europe. We expect the regional differences in the CSP level to have an impact on credit ratings and their predictions in this study.

2.3 Data

We match the S&P credit ratings of North American and European counterparties from Compustat with the ratings universe of the sustainability rating agency Asset4, provided by Thomson Reuters Datastream. Moreover, we use firm-year financial and accounting data from Datastream and Worldscope to control for well-documented influencing factors on credit risk. Financial counterparties are excluded based on the economic sector level of Thomson Reuters Business Classification. Our final data set comprises a panel of 724 North American firms (5393 firm-year observations) and 218 European firms (1712 firm-year observations). Both the North American panel and the European panel follow the region classification of Fama and French (2012).[1]

2.3.1 S&P Credit ratings and Asset4 CSP scores

We use S&P long-term borrower credit ratings, reflecting the obligors' creditworthiness over a long time horizon (greater than one year) as the independent variable. The S&P issuer credit rating is defined as the current assessment of an obligor's overall financial capacity to serve its debt, i.e., its creditworthiness. The rating grades comprise AAA, AA, A, BBB, BB, B, CCC, CC and D, where D is assigned to obligors that are overdue in either their interest or their capital payments. Credit ratings of BBB or better are often referred to as "investment" grade, while credit ratings below this threshold are often called "noninvestment" or "speculative" grade. Vazza and Kraemer (2017) give a detailed description of the rating methodology.

We capture a company's overall CSP (which we refer to as ES in the following), i.e., the average of its environmental performance and social performance, following the methods of El Ghoul et al. (2017), Ioannou and Serafeim (2012) and Luo et al. (2015): we use the ES score and the score of each of the two pillars from the Asset4 database, i.e., the environmental (ENV score and the social (SOC) score.[2] The ENV and SOC scores measure corporate activities along environmental and social dimensions. The environmental score evaluates a firm's "impact on living and nonliving natural systems, including the air, land, and water, as well as complete ecosystems" (Thomson Reuters, 2011). For instance, this measure captures resource reduction, emission reduction and product innovation benefiting the environment. The social score measures the ability of a firm to "generate trust and loyalty with its workforce, customers and society" through investment in customer/ product responsibility, community, human rights, diversity, employee training and development, health and safety, and employment quality (Thomson Reuters, 2011). We calculate the ES score as the average of the ENV and SOC scores, respectively. This ES score represents the aggregated performance of a firm according to the environmental and social dimensions in a particular year.

Asset4 publishes scores that act as external measures for sustainable business models (Chatterji et al., 2016; Humphrey et al., 2012; Ioannou and Serafeim, 2012). These scores are based on publicly available and traceable information, eg, websites; United States Securities and Exchange Commission (SEC) filings such as forms 10-K, DEF 14A and

[1] The North American panel comprises the United States and Canada, while the European panel comprises Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom, according to the FTSE Country Segment classification.

[2] Some studies also consider a third score, i.e., the corporate governance score. However, we follow the definition of the studies mentioned above to determine our measures for CSP.

10-Q; sustainability reports; media sources; and nongovernmental organization reports. To guarantee a high level of ratings integrity, every data point is cross-checked by at least one additional analyst and by further analyses through statistical tools. Therefore, using the Asset4 scores eliminates, as far as possible, weaknesses such as the lack of transparency in the KLD, FTSE4Good and Dow Jones rating approaches (Chatterji and Levine, 2006). Accordingly, Asset4 evaluates more than 750 individual data points. Every data point matches a single question concerning the fulfillment of a specific item according to environmental, social, economic and governance issues. The information from the answers is aggregated in several stages to indicators, to pillars and finally to the average CSP rating. The scores are updated on an annual basis and range from 0 to 100, with a higher score indicating a higher level of CSP. The rating universe of Asset4 even includes a firm after a bankruptcy, a merger or another cause of delisting. Thus, the data set is free from survivorship bias.

Table 2.1: Details on control variables

Variable	Definition
Interest coverage	Earnings before interest and taxes divided by interest expense on debt. Negative values of this ratio are floored at zero. Any 3-year average above 100 is capped at 100. The nonlinear form of interest coverage in this model is taken into account by categorizing the ratio according to the interval of (0-5) in sub-variable A, (5-10) in sub-variable B, (10-20) in sub-variable C, and (20-100) in sub-variable D.
Operating margin	3-year averages of operating income divided by net sales or revenues
Long term debt leverage	3-year averages of long-term debt divided by total capital
Total debt leverage	3-year averages of the sum of long-term and short-term debt (including current portion of long-term debt) divided by the sum of total capital and short-term debt
Market capitalization	Percentile of the referring company's market capitalization among those of NYSE listed companies
Idiosyncratic risk	Root mean squared error from a regression of a company's stock returns with the local market index returns as a benchmark. The regression made for each firm at the time horizon of one year is based on daily stock, respectively index returns. At least 50 observations per year are required to be made available for this calculation.
Beta - systematic risk	Market model beta from the above described market model regression to calculate idiosyncratic risk
Dividend payer	Dummy variable which takes 1 if a company has positive dividends per share in the referring year and 0 otherwise
Market-to-book	Ordinary (common) equity divided by the balance sheet value of the ordinary (common) equity in the company
Retained earnings	Retained earnings divided by total assets. Retained earnings reflect the accumulated after-tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve account.
Capital expenditures	Capital expenditures divided by last year's total assets
Cash balances	Sum of cash and short-term investments divided by total assets
Tangibility	Net property, plant and equipment (gross property, plant, and equipment less accumulated reserves for depreciation, depletion, and amortization) divided by total assets.

Description of control variables. Source: Worldscope and Thomson Reuters Datastream.

2.3.2 Control variables

To capture the well-documented effects of predicting credit ratings, we control for several variables. We provide a detailed description of all of these variables in Table 2.1.

Following Standard&Poor's (2013) and Merton (1974), we include three-year averages of the operating margin, the long-term debt, the total debt and the interest coverage ratios. The interest coverage ratio is transformed, as suggested by Blume et al. (1998). Since negative values can be caused either by low interest payments or by high negative earnings, the magnitude of negative values for interest coverage is not meaningful, and therefore we set these values to zero. The distribution of the interest coverage ratio is heavily skewed, and the marginal effect of changes may be small if interest coverage is already at a high level. Accordingly, we cap the three-year average at 100. To capture the nonlinear shape of interest coverage C_{it} for a company i in year t, we apply the decomposition to four subvariables, c_{it}^A, c_{it}^B, c_{it}^C, c_{it}^D, as defined by Table 2.2.

TABLE 2.2: Definitions of the subvariables

	c_{it}^A	c_{it}^B	c_{it}^C	c_{it}^D
if $C_{it} \in [0, 5)$	C_{it}	0	0	0
if $C_{it} \in [5, 10)$	5	$C_{it} - 5$	0	0
if $C_{it} \in [10, 20)$	5	5	$C_{it} - 10$	0
if $C_{it} \in [20, 100]$	5	5	10	$C_{it} - 20$

Further, we also include market capitalization, because bigger firms tend to have superior credit ratings (Altman et al., 1977) and because Asset4 scores show a market cap dependence (Ioannou and Serafeim, 2012). Moreover, since all claims on assets must earn the same compensation per unit of risk (Merton, 1974; Campbell et al., 2008; Friewald et al., 2014), we also control for systematic risk (market model beta) and idiosyncratic risk. In addition, the dividend policy of a firm has an impact on credit risk (Hoberg and Prabhala, 2009). As profitable firms are less likely to default, we expect a positive correlation between the market-to-book ratio and credit ratings and, thus include the market-to-book ratio (Pástor and Pietro, 2003). Following DeAngelo et al. (2006), retained earnings are a proxy of a company's life-cycle phase. Mature, stable firms generally observe better ratings (Fons, 1994). Thus, we also include retained earnings as a control. In addition, Tang (2009) finds that upgraded firms have more capital expenditure than downgraded firms. Hence, we expect a positive correlation between capital expenditure and credit ratings.

Moreover, firms with a weak credit risk profile tend to have precautionary savings (Acharya et al., 2012), which is why we also use the cash balance as a control. Rampini and Viswanathan (2013) have documented the impact of tangibility on credit risk.

Further, Bangia et al. (2002) find evidence that S&P credit ratings change pro-cyclically.

Hence, we control for business-cycle effects as represented by the gross domestic product (GDP) growth rate. We further use year dummies to control for remaining systematic effects (Elton et al., 2001). We follow Dimitrov et al. (2015) in that our main models, like the standard model in the literature, come without industry fixed effects. Our underlying idea assumes the industry-specific influence factors so far considered in the other controls. However, we consider industry effects in our robustness checks in Section 2.7.

2.3.3 Descriptive statistics

We lag the ES variables and controls by one period compared with the credit ratings. The estimation set contains credit ratings covering the years from 2003 through 2013 and independent variables between 2002 and 2012. Out-of-sample predictions for credit ratings in the period 2014-17 are based on independent variables from 2013 to 2016. Table 2.3 presents the descriptive statistics of the credit rating variable, sorted by region (North America versus Europe) and subperiod (2003-13 versus 2014-17). Rating class BBB shows the largest number of observations in both regions.

TABLE 2.3: Rating distribution

		North America			Europe		
	Period	Total	UG	DG	Total	UG	DG
AAA	I	49	4	0	6	1	0
	II	7	3	0	0	0	0
AA	I	109	12	0	92	12	0
	II	32	2	0	9	3	0
A	I	906	61	6	443	45	1
	II	265	28	2	123	13	0
BBB	I	1600	62	46	535	35	18
	II	599	33	11	204	6	5
BB	I	850	54	63	142	8	16
	II	462	34	17	73	6	5
B	I	257	5	48	35	1	8
	I	208	11	31	38	1	3
C	II	14	0	5	5	0	2
	I	35	0	8	7	0	1
Total	I	3785	198	168	1258	102	45
	II	1608	111	69	454	29	14
# firms		724			218		

"UG" stands for "Upgrade" and "DG" stands for "Downgrade". The table shows credit ratings from 2003 to 2013 (period I) for the coefficient estimation and from 2014 to 2017 (period II) for the out-of-sample prediction. Independent variables are lagged by one year compared with the credit ratings. We use S&P long-term borrower credit ratings reflecting the obligors' creditworthiness over a long time horizon (greater than one year).

Both mean and median ES, ENV and SOC scores are lower in North America than in Europe (see Table 2.4), indicating a weaker overall CSP. The standard deviation in the ES, ENV and SOC scores is higher in North America than in Europe. Thus, the CSP shows greater variability in North America than in Europe. The measures for CSP follow

TABLE 2.4: Descriptive statistics for the Asset4 scores and control variables for the North American and European samples of explanatory variables

(a) Asset4 variables

		North America					Europe				
	Period	Mean	25%	Median	75%	SD	Mean	25%	Median	75%	SD
ES score (%)	I	51.516	24.120	48.850	80.090	28.093	81.668	75.840	88.440	92.979	15.778
	II	57.699	32.270	60.333	84.480	27.458	85.885	84.907	91.410	93.653	13.237
ENV score (%)	I	50.538	18.820	48.070	82.850	31.098	81.390	76.817	89.805	93.287	17.912
	II	56.660	26.307	61.740	87.862	30.464	85.989	84.867	91.965	93.990	14.280
SOC score (%)	I	52.437	25.210	51.790	80.820	28.726	82.024	74.972	89.075	94.648	17.024
	II	58.673	34.505	63.615	84.347	27.642	85.722	85.177	91.155	94.138	14.363

(b) Control variables

		North America					Europe				
Interest coverage (%)	I	11.108	2.640	5.510	12.080	16.972	8.668	2.870	4.920	8.588	13.388
	II	8.648	1.800	4.290	9.592	14.894	8.160	1.820	4.285	8.325	14.108
Operating margin (%)	I	13.805	7.410	12.320	19.010	8.518	11.924	5.332	10.490	16.398	8.055
	II	13.259	6.397	11.870	18.605	8.801	10.830	4.500	8.550	15.428	8.154
Long-term debt (%)	I	39.532	24.970	37.430	51.680	19.200	39.736	26.797	38.610	51.028	16.842
	II	46.004	31.887	44.665	57.555	19.497	41.544	28.895	38.995	53.940	16.364
Total debt (%)	I	42.702	28.110	40.720	55.230	19.013	45.764	33.315	44.535	57.545	16.103
	II	48.518	33.778	47.400	60.540	19.518	46.829	33.733	44.515	59.460	15.818

Table continues on next page.

TABLE 2.4 continued

(a) Asset4 variables											
		North America					Europe				
	Period	Mean	25%	Median	75%	SD	Mean	25%	Median	75%	SD
Size (US$ billions)	I	18.141	3.407	6.993	16.525	36.779	26.484	5.466	11.166	28.862	39.369
	II	21.981	2.924	7.774	20.054	45.205	27.660	5.379	13.592	31.325	38.744
Beta	I	1.057	0.732	1.011	1.320	0.412	0.936	0.689	0.904	1.161	0.330
	II	1.143	0.850	1.089	1.394	0.412	0.978	0.784	0.966	1.145	0.284
Idiosyncratic risk (%)	I	1.677	1.116	1.500	2.038	0.743	1.477	1.063	1.325	1.758	0.564
	II	1.632	1.031	1.373	1.980	0.807	1.376	0.947	1.175	1.611	0.575
Dividend payer (%)	I	0.755	1.000	1.000	1.000	0.430	0.910	1.000	1.000	1.000	0.286
	II	0.727	0.000	1.000	1.000	0.446	0.833	1.000	1.000	1.000	0.374
Market/book (%)	I	2.768	1.430	2.180	3.450	1.961	2.342	1.260	1.960	3.050	1.425
	II	2.867	1.330	2.170	3.572	2.260	2.113	1.040	1.655	2.820	1.436
Retained earnings (%)	I	0.259	0.094	0.258	0.425	0.256	0.163	0.046	0.143	0.275	0.165
	II	0.207	0.009	0.195	0.405	0.293	0.206	0.076	0.198	0.348	0.180
Capital expense (%)	I	5.136	2.510	4.550	7.630	3.058	5.076	2.910	4.680	6.928	2.673
	II	5.105	2.290	4.400	7.940	3.145	4.342	2.433	3.725	5.860	2.473
Cash holdings (%)	I	0.090	0.023	0.063	0.137	0.081	0.093	0.046	0.078	0.124	0.060
	II	0.086	0.024	0.064	0.132	0.076	0.106	0.063	0.097	0.137	0.059
Tangibility (%)	I	0.358	0.143	0.296	0.557	0.247	0.326	0.164	0.312	0.470	0.194
	II	0.386	0.129	0.319	0.651	0.280	0.309	0.144	0.272	0.479	0.196
GDP growth (%)	I	0.016	0.016	0.023	0.029	0.018	0.012	0.002	0.017	0.026	0.022
	II	0.022	0.018	0.022	0.025	0.005	0.014	0.008	0.014	0.022	0.011
# observations	I	3785					1258				
	II	1608					454				

Our sample is divided into the estimation period 2002-12 (period I) and the out-of-sample prediction period 2013-16 (period II).

left-skewed distributions. A reason for this may be the fact that companies with weak CSP ratings are less likely to provide the data required to obtain an ES rating. Hence, the proportion of weakly performing companies in the database is less than in the basic population, causing this skewness.

The most significant regional difference in descriptive statistics is that the mean size of firms in the European sample is bigger than in North America. This difference can be explained by the wider availability of credit ratings of smaller firms in North America. Moreover, the macroeconomic situation measured by the GDP growth rate shows a high degree of deviation. While the level of GDP growth in the estimation period and the out-of-sample period in North America is 1.6% and 2.2%, respectively, the respective numbers in Europe are 0.4% and 0.8% lower.

2.4 Methodology

Based on the approach of Kaplan and Urwitz (1979), its continuation by Blume et al. (1998), and its application in many studies (see, for example, Dimitrov et al., 2015; Baghai et al., 2014; Alp, 2013; Jiang et al., 2012; Becker and Milbourn, 2011), we estimate a threshold model based on an unobserved linking variable y^*_{it}, which represents the creditworthiness of a firm i for a year t,

$$y^*_{it} = \boldsymbol{x'_{i,t-1}}\boldsymbol{\beta} + \epsilon_{it}, \tag{2.1}$$

where $\boldsymbol{x}_{i,t-1}$ represents the vector of observed explanatory variables of firm i in year $t-1$, and $\boldsymbol{\beta}$ is a vector of slope coefficients. The variable R_{it} is the rating category of firm i in year t. The linking variable y^*_{it} is continuous and its range comprises the set of real numbers. In our study, we consider seven different levels of credit ratings (i.e., AAA, AA, A, BBB, BB, B and C). $R_{it} = 7$ if in year t firm i has a rating of AAA, $R_{it} = 6$ if AA, $R_{it} = 5$ if A, $R_{it} = 4$ if BBB, $R_{it} = 3$ if BB, $R_{it} = 2$ if B and $R_{it} = 1$ if C. Thus, the first stage of our estimation maps the credit ratings into a partition of the unobserved linking variable y^*_{it} as follows:

$$\text{if} \quad y^*_{it} \in [\mu_{j-1}, \mu_j), \text{then} \;\; R_{it} = j \;\; \text{for} \;\; j = 1, ..., 7, \tag{2.2}$$

where μ_j are partition points independent of time t and $\mu_0 := -\infty$ and $\mu_7 := \infty$. Thresholds are not given ex ante but instead determined in the statistical procedure of estimating the model.

Following the assumption that ϵ_{it} is normally and independently distributed with a mean of 0 and a variance of 1, which is ensured in the estimation procedure, we calculate the probabilities for the different rating classes (given $\boldsymbol{x}_{t-1}$) according to:

$$P(R_{it} = j|\boldsymbol{x}_{i,t-1}) = \Phi(\mu_j - \boldsymbol{x'_{i,t-1}}\boldsymbol{\beta}) - \Phi(\mu_{j-1} - \boldsymbol{x'_{i,t-1}}\boldsymbol{\beta}),\ j = 1, ..., 7. \qquad (2.3)$$

Table 2.5: Overview of the estimated model specifications

		Regional models		Merged
Variable category	Variable	Base	CSP	CSP
CSP variables	Asset4 score		x_0	x_0
	Interaction North America & Asset4 score			x_1
Region variable	North America dummy			x_2
Control variables	Interest coverage A	x_1	x_1	x_3
	Interest coverage B	x_2	x_2	x_4
	Interest coverage C	x_3	x_3	x_5
	Interest coverage D	x_4	x_4	x_6
	Operating margin	x_5	x_5	x_7
	Long-term debt	x_6	x_6	x_8
	Total debt	x_7	x_7	x_9
	Market capitalisation	x_8	x_8	x_{10}
	Beta	x_9	x_9	x_{11}
	Idiosyncratic risk	x_{10}	x_{10}	x_{12}
	Dividend payer dummy	x_{11}	x_{11}	x_{13}
	Market/book	x_{12}	x_{12}	x_{14}
	Retained earnings	x_{13}	x_{13}	x_{15}
	Capital expense	x_{14}	x_{14}	x_{16}
	Cash balance	x_{15}	x_{15}	x_{17}
	Tangibility	x_{16}	x_{16}	x_{18}
	GDP growth	x_{17}	x_{17}	x_{19}
	Dummy for year 1 (following years analog)	x_{18}	x_{18}	x_{20}
Boundaries	Lower boundary for rating AAA	μ_6	μ_6	μ_6
	Lower boundary for rating AA	μ_5	μ_5	μ_5
	Lower boundary for rating A	μ_4	μ_4	μ_4
	Lower boundary for rating BBB	μ_3	μ_3	μ_3
	Lower boundary for rating BB	μ_2	μ_2	μ_2
	Lower boundary for rating B	μ_1	μ_1	μ_1
Output	Linear predictor	y^*	y^*	y^*
	Rating class	R	R	R

The CSP models for isolated estimation of the regions North America and Europe include Asset4 and control variables, while the base model includes only controls between their independent variables. The boundaries required to assign rating classes, depending on the linear predictor, are the output of the regression. The Asset4 score represents the equal-weighted ES rating, the ENV score or the SOC score.

We use the panel structure of the data for the model estimation. Both a certain rating (i.e., a realization of R_{it}) and realizations of the input variables are ascribed to each company for each year during the observation period. To represent the state of information when predictions for the following period are calculated, all influence factors are lagged by one period. Table 2.5 provides an overview of the input factors, boundaries and outputs of the estimated models. We estimate models for the North American and European samples as well as their merged dataset. We focus on three different specifications of the CSP model:

the ES model, the ENV model and the SOC model. Each variant includes the corresponding Asset4 score, as indicated by their name plus control variables. In the merged estimation, a region dummy and an interaction term between the region and CSP are also considered. The estimation is carried out by utilizing the maximum likelihood method referring to ordered probit models (Venables and Ripley, 2002; McKelvey and Zavoina, 1975). To account for the panel structure, we pool the observations and cluster standard errors on the firm level, which is appropriate for short panels. Wald p-values are calculated following the approach of Huber (1967) to reveal coefficient significance. Moreover, we include estimated thresholds for the various rating levels and the McFadden R^2 goodness-of-fit statistics. As the link function in ordered probit models limits the interpretation of the estimated coefficients, we also calculate marginal effects at the means to capture the impact of a marginal change in the ES score on the credit rating prediction, all other things being equal. The calculation is based on all independent variables being fixed at their means. To computationally derive the marginal effects, we follow Greene (2011).[3] One objective of credit portfolio models is to predict future credit ratings appropriately. To determine the quality of the credit rating prediction of our model specifications, we calculate the Somers's D values as a measure of the correlation between actual and predicted ratings.[4]

[3]Let $\boldsymbol{x}$ be the matrix of the independent variables. Then, the marginal effects give an indication of the extent to which the probability of a firm being assigned to a certain rating class changes based on the first derivative of the probabilities in (3.4).

$$\begin{aligned}
\frac{\partial P(R_{it}=1|\boldsymbol{x}_{i,t-1})}{\partial \boldsymbol{x}_{i,t-1}} &= -\phi\left(\mu_1-\boldsymbol{x}'_{i,t-1}\boldsymbol{\beta}\right)\boldsymbol{\beta}\\
\frac{\partial P(R_{it}=j|\boldsymbol{x}_{i,t-1})}{\partial \boldsymbol{x}_{i,t-1}} &= \left[\phi\left(\mu_{j-1}-\boldsymbol{x}'_{i,t-1}\boldsymbol{\beta}\right)-\phi\left(\mu_j-\boldsymbol{x}'_{it}\boldsymbol{\beta}\right)\right]\boldsymbol{\beta}, \forall j \in \{2,3,4,5,6\}\\
\frac{\partial P(R_{it}=7|\boldsymbol{x}_{i,t-1})}{\partial \boldsymbol{x}_{i,t-1}} &= \phi\left(\mu_6-\boldsymbol{x}'_{i,t-1}\boldsymbol{\beta}\right)\boldsymbol{\beta}
\end{aligned}$$

[4]According to Somers (1962), D is a measure of ordinal association. For actual ratings Z and predicted ratings Y, Newson (2001) defines Somers's D as following:

$$D_{YZ} = \frac{\tau(Z,Y)}{\tau(Z,Z)} \tag{2.4}$$

with Kendall rank correlation coefficient τ:

$$\tau = \frac{N_C - N_D}{n(n-1)/2} \tag{2.5}$$

Kendall's τ is calculated by taking the difference of the number of concordant pairs N_C and the number of discordant pairs N_D as well as the sample size n. Two pairs (z_i, y_i) and (z_j, y_j) are called concordant if the ranks of both elements agree, e.g., as $z_i > z_j$ and $y_i > y_j$, or if $z_i < z_j$ and $y_i < y_j$. By contrast, two pairs are determined as being discordant if $z_i > z_j$ and $y_i < y_j$ or if $z_i < z_j$ and $y_i > y_j$. Somers's D can take values from -1 (only disagreeing pairs) to $+1$ (only agreeing pairs). In this context of measuring how predicted and actual credit ratings are associated, the Somers's D value of $+1$ expresses the optimal case in which all predictions are actually confirmed.

TABLE 2.6: Estimation results of the ordered probit model for the North American and European data sets covering the years 2003-13

	North America				Europe				Merged		
	Base	ES	ENV	SOC	Base	ES	ENV	SOC	ES	ENV	SOC
Coefficients											
Asset4 variable		0.014***	0.011***	0.012***		0.015***	0.006	0.018***	0.010***	0.005*	0.012***
Asset4 × North Am.									0.003	0.006**	0.001
North Am. dummy									−0.632**	−0.879***	−0.460
Interest coverage A	0.209***	0.212***	0.213***	0.210***	0.286***	0.294***	0.289***	0.296***	0.239***	0.239***	0.236***
Interest coverage B	0.045	0.053*	0.051*	0.053*	0.065	0.061	0.061	0.068	0.052**	0.050**	0.054**
Interest coverage C	0.078***	0.084***	0.082***	0.083***	0.103***	0.109***	0.105***	0.111***	0.088***	0.086***	0.088***
Interest coverage D	0.005	0.005	0.005	0.005	−0.012	−0.013*	−0.012*	−0.013*	0.002	0.002	0.002
Operating margin	0.000	0.008	0.007	0.006	0.031***	0.035***	0.033***	0.034***	0.014***	0.013***	0.012***
Long-term debt	−0.050***	−0.044***	−0.045***	−0.045***	0.000	0.002	0.001	0.001	−0.024***	−0.024***	−0.025***
Total debt	0.030**	0.024**	0.024**	0.025**	−0.017	−0.019	−0.018	−0.018	0.005	0.005	0.006
Size	0.074***	0.060***	0.063***	0.061***	0.079***	0.070***	0.075***	0.069***	0.059***	0.062***	0.059***
Beta	−0.179	−0.189*	−0.201*	−0.173	−1.518***	−1.524***	−1.510***	−1.561***	−0.473***	−0.483***	−0.467***
Idiosyncratic risk	−1.646***	−1.631***	−1.619***	−1.647***	−1.499***	−1.515***	−1.509***	−1.502***	−1.578***	−1.568***	−1.587***
Dividend payer	1.080***	0.998***	1.006***	1.017***	1.204***	1.176***	1.190***	1.168***	0.989***	0.996***	1.007***
Market/book	0.090***	0.081***	0.084***	0.081***	0.089*	0.090*	0.091*	0.082	0.082***	0.085***	0.081***
Retained earnings	1.493***	1.481***	1.506***	1.456***	1.675***	1.572***	1.614***	1.606***	1.479***	1.511***	1.462***
Capital expense	−0.016	−0.010	−0.010	−0.013	−0.002	0.001	−0.001	0.003	−0.016	−0.016	−0.019

Table continues on next page.

TABLE 2.6 continued

	North America				Europe				Merged		
	Base	ES	ENV	SOC	Base	ES	ENV	SOC	ES	ENV	SOC
Coefficients (continued)											
Capital expense	−0.016	−0.010	−0.010	−0.013	−0.002	0.001	−0.001	0.003	−0.016	−0.016	−0.019
Cash holdings	−0.345	−0.866	−0.862	−0.703	1.182	0.934	1.100	0.834	−0.378	−0.353	−0.267
Tangibility	0.337	0.182	0.155	0.264	1.463***	1.315***	1.397***	1.296***	0.560***	0.547**	0.637***
GDP growth	5.681***	0.841***	1.036***	2.186***	19.238***	20.911***	19.851***	21.326***	8.534***	7.733***	8.760***
Time dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lower boundaries											
AAA|AA	12.488	12.208	12.284	12.212	14.388	14.854	14.541	15.045	11.988	11.805	12.110
AA|A	10.957	10.638	10.721	10.647	10.861	11.313	11.012	11.490	10.014	9.837	10.141
A|BBB	7.584	7.171	7.261	7.203	7.502	7.935	7.649	8.095	6.658	6.489	6.797
BBB|BB	3.924	3.435	3.539	3.476	3.640	4.047	3.781	4.187	2.960	2.802	3.105
BB|B	0.431	−0.058	0.052	−0.025	0.323	0.727	0.464	0.860	−0.505	−0.654	−0.369
B|C	−4.065	−4.490	−4.401	−4.453	−2.714	−2.277	−2.557	−2.156	−4.655	−4.825	−4.516
Goodness-of-fit											
McFadden R^2	0.367	0.375	0.374	0.373	0.334	0.337	0.335	0.340	0.362	0.361	0.361
# Observations	3785	3785	3785	3785	1258	1258	1258	1258	5043	5043	5043

Estimation is carried out by utilizing the maximum likelihood method referring to ordered probit models. Coefficients of all variables are displayed, including the significance level, marked by asterisks. They are regarded as being statistically significant at a level of 1% (***), 5% (**), or 10% (*) when the p-value is below these levels. The lower boundaries of the rating categories corresponding to those in Section 2.4 are also displayed.

2.5 Empirical tests

Table 2.6 reports the results of the regional and the merged models. The estimation window for credit ratings in all of these probit models ranges from 2003 to 2013.

For the North American sample, each of the three CSP measures has a significantly positive coefficient. Thus, all else being equal, firms with a high level of CSP in the significant specifications have a higher probability of obtaining better credit ratings than firms with a low level of CSP. In the European sample, only the two specifications of the model with the ES and SOC scores show significance of the respective CSP measure at a 1% level. The ENV pillar provides no significant explanatory benefit for Europe in contrast to North America. The control variables display reasonable signs in the regressions consistent with the findings of the literature cited in Section 2.3.2. To rule out the regionally different relations between CSP and credit ratings, we also provide a merged model of the North American and the European sample with an interaction term between region and CSP. The interpretation of the interaction effect is more difficult, as the marginal effect can even be of opposite sign (Karaca-Mandic et al., 2012; Ai and Norton, 2003). The results of our merged estimation are consistent with the isolated regional estimations. ES and SOC scores are relevant at the same level in both regions, as the coefficients of CSP scores are significant, while the interaction term between North America and CSP scores is not. The ENV score, in contrast, is only relevant in North America, as we document no significant coefficient for ENV in general but a significant interaction term between the North America dummy and the ENV score.

As the interpretation of coefficients is limited in terms of their magnitude, we estimate the marginal effect on the credit rating prediction of a change in the CSP scores and present the results in Table 2.7. For North America, we observe significant marginal effects for all three CSP scores. The lower and upper triangular matrixes for each score in Table 2.7 show a clear pattern, indicating that an increase in CSP scores significantly increases the probability of firms receiving a higher rating level and reduces the probability of the firms experiencing a rating downgrade. In particular, the marginal effects represent the difference in predicted probabilities for each rating class if, all else being equal, the mean CSP scores increase by 1%.

A detailed consideration of the diagonals shows that firms which are currently rated in rating levels AAA, AA or A also show a significantly higher probability of being classified at the current rating level again, while it is less likely for firms which are currently rated in rating level BBB or worse to remain at the current rating level if the respective score is increased. For the ES measure, for instance, the predicted probability of an A-rated North American firm remaining in the A-rating category is 0.277% higher for a firm that has a 1% higher ES score than for a firm that is otherwise identical regarding the levels of the

Table 2.7: Marginal effects at means based on the estimation for panels North America and Europe covering the years from 2003 to 2013

	North America						
	AAA	AA	A	BBB	BB	B	C
ES							
AAA	1.321***	1.840***	−2.517***	−0.627***	−0.016***	−0.001***	0.000**
AA	0.691***	1.595***	−1.044***	−1.205***	−0.035***	−0.001***	0.000**
A	0.118***	0.413***	2.771***	−3.074***	−0.221***	−0.007***	0.000**
BBB	0.016***	0.062***	1.718***	−0.440***	−1.304***	−0.051***	−0.001***
BB	0.001***	0.004***	0.137***	2.749***	−2.085***	−0.795***	−0.011***
B	0.000***	0.000***	0.013***	0.501***	2.791***	−3.189***	−0.117***
C	0.001***	0.002***	0.074***	2.038***	−0.766***	−1.328***	−0.020***
ENV							
AAA	1.035***	1.474***	−1.973***	−0.522***	−0.014***	0.000***	0.000**
AA	0.552***	1.269***	−0.812***	−0.979***	−0.029***	−0.001***	0.000**
A	0.096***	0.334***	2.214***	−2.459***	−0.179***	−0.006***	0.000**
BBB	0.013***	0.050***	1.374***	−0.336***	−1.058***	−0.042***	0.000***
BB	0.001***	0.003***	0.113***	2.213***	−1.689***	−0.632***	−0.008***
B	0.000***	0.000***	0.010***	0.399***	2.243***	−2.561***	−0.093***
C	0.000***	0.002***	0.061***	1.642***	−0.628***	−1.061***	−0.016***
SOC							
AAA	1.178***	1.625***	−2.222***	−0.566***	−0.015***	0.000***	0.000**
AA	0.607***	1.401***	−0.874***	−1.100***	−0.033***	−0.001***	0.000**
A	0.107***	0.370***	2.454***	−2.725***	−0.199***	−0.006***	0.000**
BBB	0.015***	0.056***	1.531***	−0.400***	−1.157***	−0.045***	−0.001***
BB	0.001***	0.003***	0.122***	2.434***	−1.850***	−0.701***	−0.010***
B	0.000***	0.000***	0.012***	0.445***	2.469***	−2.823***	−0.103***
C	0.000***	0.002***	0.066***	1.805***	−0.684***	−1.171***	−0.018***
	Europe						
	AAA	AA	A	BBB	BB	B	C
ES							
AAA	1.785*	0.080	−1.778***	−0.085**	−0.002*	0.000	0.000
AA	0.145*	2.668***	−1.621***	−1.163***	−0.028***	−0.001**	0.000
A	0.026*	0.775***	2.568***	−3.206***	−0.157***	−0.006**	0.000
BBB	0.004*	0.141***	2.439***	−1.693***	−0.854***	−0.035**	−0.002
BB	0.000*	0.010**	0.274***	3.385***	−3.168***	−0.475***	−0.027*
B	0.000	0.001**	0.019**	0.846**	2.473***	−2.968***	−0.372*
C	0.000*	0.005**	0.149***	3.157***	−2.425***	−0.837***	−0.050*
ENV							
AAA	0.663	0.094	−0.720	−0.036	−0.001	0.000	0.000
AA	0.057	1.028	−0.616	−0.457	−0.011	0.000	0.000
A	0.010	0.300	0.997	−1.243	−0.063	−0.002	0.000
BBB	0.002	0.056	0.948	−0.658	−0.333	−0.014	−0.001
BB	0.000	0.004	0.110	1.305	−1.229	−0.181	−0.010
B	0.000	0.000	0.008	0.323	0.968	−1.155	−0.144
C	0.000	0.002	0.059	1.224	−0.946	−0.321	−0.019
SOC							
AAA	2.228**	−0.009	−2.119***	−0.098**	−0.002**	0.000	0.000
AA	0.176**	3.274***	−2.014***	−1.401***	−0.033***	−0.001**	0.000
A	0.031**	0.944***	3.136***	−3.918***	−0.187***	−0.007**	0.000
BBB	0.005**	0.168***	2.979***	−2.074***	−1.034***	−0.042***	−0.002*
BB	0.000*	0.011***	0.325***	4.157***	−3.873***	−0.588***	−0.033*
B	0.000*	0.001**	0.023**	1.006***	3.092***	−3.660***	−0.462**
C	0.000*	0.006***	0.176***	3.849***	−2.934***	−1.036***	−0.061*

The marginal effects are listed in per mill and show the impact of an increase in the ES scores by one percentage point, all else being equal, on the predicted probabilities of occurrence for the various rating classes. The row sum for each panel is zero since the sum of the predicted probabilities across all rating classes equals one, and changes in probabilities hence equal zero. Coefficients are marked as significant at a level of 1% (***), 5% (**), or 10% (*) when the *p*-value is below these levels.

control variables. The probability of a BBB-rated firm obtaining a rating upgrade increases by 0.330% per 1% ES score (equaling the sum of probabilities to obtain the AAA, AA, or A grade). In terms of absolute values, this emerges as an average saving of approximately US$ 1.45 concerning Basel III economic capital per loan nominal of US$ 1000 based on the ES score's change by one standard deviation (i.e., a saving of 14.5bps).[5]

For the European sample, the results for the ES score reveal that firms with a higher score have, all else being equal, a higher probability of remaining in the current credit rating class (firms with current credit ratings AAA, AA or A) or an increased probability of a rating migration into a better credit rating class (firms across all current credit ratings). European firms with a current credit rating of BBB, BB, B or C are less likely to remain in the current credit rating class. For instance, firms with a current credit rating of BBB exhibit a decrease by 0.169% in the probability of remaining in credit rating BBB and a decrease by 0.085% in the probability of experiencing a downgrade by one notch to noninvestment grade, as well as an increase by 0.244% in the probability of experiencing an upgrade to level A.

Table 2.8: Somers's D values for panels of North America and Europe for predictions in the period 2014-17

	North America			Europe		
	WMW p-value	Somers's D	Delta	WMW p-value	Somers's D	Delta
Base model		0.5968			0.5695	
ES model	0.0001	0.6050	0.0082	0.9778	0.5705	0.0010
ENV model	0.0005	0.6048	0.0080	0.9530	0.5705	0.0009
SOC model	0.0001	0.6027	0.0059	0.9396	0.5703	0.0008
# observations	1608			454		

We use Somers's D to measure the correlation between predicted ratings and actual ratings. D can take values from 1 to C1, where the latter is the optimal case in which all predictions are confirmed. We show the differences between ES models' Somers's D and those of the base models in order to illustrate the improvement ascribed to CSP. The Wilcoxon-Mann-Whitney (WMW) test provides p-values to evaluate whether the probabilities of correct predictions are significantly higher in the CSP models than in the benchmark model.

Table 2.8 shows the results of the analysis of the prediction quality. A positive value in the Delta column indicates that incorporating the respective CSP scores into the baseline model increases the prediction quality. For instance, considering the ES score in our credit risk model increases the Somers's D of the North American sample by 0.82%. We apply the Wilcoxon-Mann-Whitney (WMW) test on the probabilities that the actual credit rating is predicted and find a p-value of 0.01%, indicating that the increase is different from zero. For the two single pillar scores, we also find reasonable increases in Somers's D. In

[5] This calculation is based on the internal ratings-based approach for general corporates described in Basel Committee on Banking Supervision (2017) on the time horizon of one year. We assume the loss given default (LGD) rate to be 40%, analogously to the supervisory LGD for unsecured corporate exposure, which refers to the foundation approach. The required probabilities of default are provided by U.S. average historic one-year corporate rating transition rates (1981-2016) according to Vazza and Kraemer (2017).

particular for the ENV score, the increases of 0.80% in Somers's D are higher than for the SOC model (with 0.59%). In the European sample, none of the CSP models shows any relevant improvement in Somers's D compared with the base model. Following the improvement in prediction quality for North American ES and SOC and the significant coefficients for both measures for both regions, we would expect similar results in Europe, but we find lower ones. This deviation may depend on the different CSP distributions among firms in these regions. According to Table 2.3, the mean ES score is 51.5%, lower in North America than the European sample with 81.7%. Its standard deviation of 28.1% is higher than its counterpart, 15.8%, in Europe. The median of 88.4%, compared with the lower mean, indicates an ES distribution for Europe that is skewed to the left. The SOC distribution is similar. In order to explain regional deviations in the predictive performance, the variability of the single CSP dimensions requires further considerations which we present in the following section.

2.6 Discussion

As the ES score is an aggregation over the dimensions of ENV and SOC, we next take a more thorough look at the effects of these two dimensions.

2.6.1 Environmental regulation and credit ratings

We find that the environmental performance has explanatory power for credit ratings in North America. Firms with good environmental performance are more likely to be rewarded with a better credit rating (Tables 2.6 to 2.7). The prediction quality also increases by 0.8% (Table 2.8). In contrast, there is no observable relevance of environmental performance for Europe (Tables 2.6 to 2.8). To explain the observed difference, we consider the structure of the ENV score. It consists of three categories: resource reduction, emission reduction and product innovation. Geological conditions may influence the awareness of resource and emission reduction. North America is endowed with an abundance of natural resources. In contrast, Europe lacks such a variety of commodities. As a result, the necessity to use resources economically is higher in Europe. Further differences exist in the legislation of the two regions. Environmental regulations are weaker in the United States than in European countries such as Denmark and Sweden (Johnstone et al., 2012). The Kyoto Protocol of 1997 is an example of the willingness to accept binding environmental protection agreements. It states a reduction goal of 8% for greenhouse gases for the European community, but less (7%) for the United States, which has, however, never ratified it (UNFCCC, 1998). The United States has not yet adopted the Doha Amendment to the Kyoto Protocol. The different geographical and political circumstances between North America and Europe are reflected in the different average ENV scores. Dorfleitner et al. (2018) show that, for the United States, high ENV scores can predict positive earnings surprises in later periods, which can partly explain the positive effect on creditworthiness that we find for North America. Finally, firms in North America have a higher degree of freedom to differentiate themselves from their peers regarding environmental issues compared with Europe, which results in explanatory and prediction power improvements only for North America.

2.6.2 The benefits of social politics

In the credit rating regressions (Tables 2.6), the coefficient for social performance is significant in both North America and Europe at a 1% level. Moreover, analysis of the marginal effects reveals a distinct increase in the probability of both regions either maintaining their current rating or even migrating to a better rating class (Table 2.7). As firms profit from high CSP by being able to hire better qualified employees (Turban and Greening, 1997), it seems intuitive that this is true in both North America and Europe. Besides improvements in explanatory power, good social performance in North America results in significantly better credit rating predictions; the implied increase in prediction quality amounts to 0.6%, while in Europe it is only 0.1% (Table 2.8). Although prediction quality improves only in North America, we can confirm the impact of social performance for the European sample based on the coefficient estimation and the marginal effects. The relevance of the different prediction qualities in SOC score for North America and Europe is underpinned by the varying score levels in the two regions. Referring to the descriptive statistics of our sample, the SOC score in North America is distinctly lower than it is in Europe (58.7 versus 85.7), while the variance is higher (standard deviation 27.6 versus 14.4). The literature has, up to now, identified differences between both regions regarding many aspects of the SOC score, such as employment quality, health and safety, training and development, diversity and opportunity, community and product responsibility. An important indicator is the social expense of a country: the United States and Canada spent 19.2% and 17.0% of their GDP in 2014, respectively. European countries such as France and Germany tend toward a higher level of expenditure (31.9% and 25.8%, respectively; see OECD (2016)). Unlike Europe (Matten and Moon, 2008), North America, and the United States in particular, lacks a comprehensive labor market policy, as well as labor unions with strong negotiating power (Du Caju et al., 2009), proper employment protection and mandatory health protection (Pfeffer, 2010). Further, the World Economic Forum WEF (2017) gender gap report, which analyzes the emancipation of women and men regarding economic participation and opportunity, educational attainment, health and survival, and political empowerment, shows that the United States ranked forty-ninth (worldwide), while many European countries do better (such as Germany, ranked twelfth). Strategies for human rights protection are more common in Europe than in North America

(Welford, 2005). Firms in North America have a higher degree of freedom to differentiate themselves from their peers concerning social issues. Further, the diversification of the European firms in terms of social performance decreased between the in-sample period and the out-of-sample period (standard deviation 17.0 versus 14.4). The high basic level and decreasing variability of social scores in Europe have led to a certain degree of similarity between firms, which explains the insignificant results in our prediction models despite their increased explanatory power.

2.7 Robustness checks

This section contains several robustness checks to rule out the fact that our results may be driven by our methodological framework, the sample selection, a missing data bias, a local bias or a time bias.

We analyze whether the general risk level of firms affects the impact of CSP ratings on credit ratings and cluster firms into an investment-grade group and a non-investment-grade (speculative) group. The marginal effects in Table 2.7 show that the impact of CSP on credit rating predictions differs across rating classes. The better the initial rating class of a firm is, the lower the conditional probability by which an increase in the ES score predicts a better credit rating (except for rating class C). The results for single pillars (ENV and SOC) show similar patterns to the ES results. In Europe, we also find evidence comparable to North America for the SOC score, which alone appears significant there. Also, previous studies show differences between the impact of CSP on the cluster of investment-grade ratings and non-investment-grade ratings. In the United States, for specific CSP factors (such as the percentage of independent directors from the corporate governance dimension), the significance of the impact on credit ratings diminishes when restricting the sample to investment-grade bonds only (Ashbaugh-Skaife et al., 2006). Therefore, we reestimate our models based on the investment-grade subsample of our analysis. Tables 2.9 and 2.10 contain the results. The levels of significance in the investment-grade subset decrease, certainly to some extent due to the smaller number of observations. We document the improvements in prediction quality in North America that are lacking compared with the full sample (Panel A of Table 2.10), while the improvement from the entire sample is 0.82% (see Table 2.8).

Since endogenous CSP ratings may generate reverse causality issues, we replace the firm ES ratings by industry-based ES rating ranks and rerun our analyses. Table 2.11 presents an overview of the industry classes of our data. The absolute range of possible CSP activities can vary across industries; to address systematic differences across industries, we follow Utz (2018) and modify the Asset4 CSP ratings. First, firms in each industry are ranked by their Asset4 score. Second, we assign to each firm its percentile score within

TABLE 2.9: Robustness of model coefficients

Model	Coefficient	Base	ES	ENV	SOC
Panel A: Models including only investment grade					
Panel North America	Asset4 coefficient		0.001	0.002	−0.001
Panel Europe	Asset4 coefficient		0.011	0.004	0.012*
Merged estimation	Asset4 coefficient		0.007	0.004	0.006
	Asset4 * North America		−0.005	−0.002	−0.006
	North America	−0.687***	−0.214	−0.485	−0.183
	# observations	3726			
Panel B: Models with Asset4 industry percentiles					
Panel North America	Asset4 coefficient		0.024***	0.017***	0.023***
Panel Europe	Asset4 coefficient		0.027***	0.011	0.036***
Merged estimation	Asset4 coefficient		−0.016**	−0.024***	−0.003
	Asset4 * North America		0.018***	0.018***	0.013***
	North America	−0.655***	−1.848***	−1.888***	−1.433***
	# observations	5043			
Panel C: Models with Asset4 industry percentiles excl. utilies					
Panel North America	Asset4 coefficient		0.031***	0.024***	0.030***
Panel Europe	Asset4 coefficient		0.016	0.003	0.025**
Merged estimation	Asset4 coefficient		−0.018**	−0.022***	−0.009
	Asset4 * North America		0.020***	0.018***	0.016***
	North America	−0.500***	−1.824***	−1.719***	−1.513***
	# observations	4505			
Panel D: Models with industry fixed effects					
Panel North America	Asset4 coefficient		0.013***	0.010***	0.011***
Panel Europe	Asset4 coefficient		0.015***	0.007	0.017***
Merged estimation	Asset4 coefficient		0.007**	0.003	0.008**
	Asset4 * North America		0.007*	0.007**	0.005
	North America	−0.522***	−0.767***	−0.900***	−0.631**
	# observations	5043			
Panel E: Models with industry fixed effects excl. utilities					
Panel North America	Asset4 coefficient		0.015***	0.011***	0.013***
Panel Europe	Asset4 coefficient		0.007	0.000	0.012**
Merged estimation	Asset4 coefficient		0.003	0.001	0.004
	Asset4 * North America		0.012***	0.011***	0.010***
	North America	−0.352***	−0.965***	−0.984***	−0.836***
	# observations	4505			
Panel F: Models with controls imputed					
Panel North America	Asset4 coefficient		0.014***	0.012***	0.012***
Panel Europe	Asset4 coefficient		0.013***	0.004	0.017***
Merged estimation	Asset4 coefficient		0.010***	0.004*	0.011***
	Asset4 * North America		0.004	0.007***	0.001
	North America	−0.659***	−0.704***	−0.976***	−0.474*
	# observations	5409			
Panel G: Models with the North American observations restricted to U.S.					
Panel North America	Asset4 coefficient		0.013***	0.010***	0.012***
Merged estimation	Asset4 coefficient		0.010***	0.004	0.011***
	Asset4 * North America		0.004	0.007**	0.002
	North America	−0.667***	−0.709**	−0.952***	−0.524*
	# observations	4701			
Panel H: Models with shorter estimation period 2002-2012 and longer prediction period 2013-2016					
Panel North America	Asset4 coefficient		0.014***	0.011***	0.012***
Panel Europe	Asset4 coefficient		0.013***	0.005	0.015***
Merged estimation	Asset4 coefficient		0.011***	0.006**	0.011***
	Asset4 * North America		0.003	0.005*	0.001
	North America	−0.633***	−0.572**	−0.784***	−0.452
	# observations	4501			
Panel I: Models with shorter estimation period 2002-2011 and longer prediction period 2012-2016					
Panel North America	Asset4 coefficient		0.014***	0.012***	0.012***
Panel Europe	Asset4 coefficient		0.012**	0.005	0.014***
Merged estimation	Asset4 coefficient		0.011***	0.007**	0.011***
	Asset4 * North America		0.002	0.004	0.000
	North America	−0.596***	−0.480	−0.707***	−0.370
	# observations	3958			

This table displays the estimation results of the ordered probit models in the discussion section for the panels of North America and Europe. Estimation is carried out by utilizing the maximum likelihood method referring to ordered probit models. Coefficients of all variables are displayed including the significance level marked by stars. Coefficients are regarded as being significant on the level of 1% ***, 5%, ** or 10% * if the p-value is below these levels. The Hosmer-Lemeshow Test and MacFadden R^2 are calculated in order to evaluate the models' goodness of fit. High p-values indicate a sufficient fit because the null hypothesis stating that the model's fit cannot be rejected. MacFadden R^2 can take values between 0 and 1 while the latter indicates perfect model fit.

Table 2.10: Robustness of Somers' D

	North America			Europe		
	WMW p-Value	Somers's D	Delta	WMW p-Value	Somers's D	Delta
Panel A: Models including only investment grade						
Base Model		0.3715			0.4180	
ES model	0.4415	0.3714	−0.0001	1.0000	0.4133	−0.0048
ENV model	0.2200	0.3716	0.0002	1.0000	0.4168	−0.0012
SOC model	0.2158	0.3716	0.0001	0.9999	0.4118	−0.0062
# observations	888			335		
Panel B: Models with Asset4 industry percentiles						
Base Model		0.5968			0.5695	
ES model	0.0005	0.6008	0.0040	0.9981	0.5691	−0.0005
ENV model	0.0165	0.6002	0.0034	0.9950	0.5698	0.0003
SOC model	0.0000	0.6002	0.0034	0.9877	0.5683	−0.0012
# observations	1608			454		
Panel C: Models with Asset4 industry percentiles excl. utilities						
Base Model		0.6267			0.6278	
ES model	0.0001	0.6336	0.0069	1.0000	0.6273	−0.0005
ENV model	0.0048	0.6328	0.0061	0.9996	0.6278	0.0001
SOC model	0.0000	0.6325	0.0058	0.9997	0.6264	−0.0014
# observations	1480			388		
Panel D: Models with industry fixed effects						
Base Model		0.6157			0.5935	
ES model	0.0002	0.6221	0.0064	1.0000	0.5922	−0.0013
ENV model	0.0053	0.6214	0.0057	0.9999	0.5935	0.0001
SOC model	0.0001	0.6208	0.0051	0.9997	0.5916	−0.0019
# observations	1608			454		
Panel E: Models with industry fixed effects excl. utilities						
Base Model		0.6339			0.6379	
ES model	0.0001	0.6425	0.0086	1.0000	0.6374	−0.0004
ENV model	0.0038	0.6416	0.0077	0.9978	0.6379	0.0000
SOC model	0.0000	0.6408	0.0069	0.9998	0.6365	−0.0014
# observations	1480			388		
Panel F: Models with controls imputed						
Base Model		0.5903			0.5672	
ES model	0.0000	0.5995	0.0092	0.9983	0.5672	−0.0001
ENV model	0.0001	0.5999	0.0095	0.9876	0.5676	0.0003
SOC model	0.0000	0.5965	0.0062	0.9871	0.5669	−0.0004
# observations	1698			485		
Panel G: Models with the North American observations restricted to U.S.						
Base Model		0.5590				
ES model	0.0000	0.5687	0.0097			
ENV model	0.0000	0.5693	0.0103			
SOC model	0.0003	0.5661	0.0071			
# observations	1406					
Panel H: Models with shorter estimation period 2002-2012 and longer prediction period 2013-2016						
Base Model		0.5938			0.5759	
ES model	0.0000	0.6019	0.0081	0.1640	0.5757	−0.0001
ENV model	0.0000	0.6018	0.0080	0.4880	0.5760	0.0002
SOC model	0.0000	0.5995	0.0057	0.0175	0.5761	0.0002
# observations	2024			580		
Panel I: Models with shorter estimation period 2002-2011 and longer prediction period 2012-2016						
Base Model		0.5915			0.5591	
ES model	0.0007	0.5998	0.0082	0.7589	0.5579	−0.0012
ENV model	0.0041	0.5998	0.0083	0.9585	0.5587	−0.0004
SOC model	0.0003	0.5973	0.0057	0.1433	0.5584	−0.0007
# observations	2441			706		

This table reports on Somers's D values as a measure of the correlation between predicted ratings and actual ratings for panels of North America and Europe covering the years from 2014 to 2017 (if not explicitly noted otherwise). Somers's D is used in order to measure the correlation between predicted ratings and actual ratings. It can take values from -1 to $+1$ while the latter is the optimal case in which all predictions are actually confirmed. We display differences between ES models' Somers's D and those of the base models in order to exhibit the improvement ascribed to CSP.

Table 2.11: Overview of industry classes in the sample

	North America		Europe	
	2003-2013	2014-2017	2003-2013	2014-2017
Basic materials	271	163	152	67
Consumer goods	520	234	112	56
Consumer services	680	256	184	53
Healthcare	317	103	57	16
Oil and gas	478	272	58	36
Technology	279	99	35	9
Utilities	330	128	208	66
Telecommunications	109	33	100	34
Industry	801	320	352	117
Total	3785	1608	1258	454

This table reports on industry classes. Although we follow Dimitrov et al. (2015) by omitting explicit industry effects, we cover this topic in the discussion section. We run two respective models. The first model includes the rank percentiles of the Asset4 score within each industry while the second includes industry fixed effects.

the respective industry. Hence, the best CSP performing firm in each industry holds a value of 1 and the lowest CSP performing firm holds a value of 0. Overall, the credit-rating explanation quality in terms of the significance of explanatory variables remains the same (see Table 2.9) and thus the implications are compatible with our main results. The Somers's D improvement has a lower magnitude (see Table 2.10). However, the decrease compared with the standard case amounts only to 0.13% for ES when we exclude utilities, since the model cannot capture all the relevant effects of this industry class. The results show that the loss of information (the original distance between firms concerning their CSP ratings) results in a smaller improvement in the prediction quality.

Further, we also check the robustness by adding industry fixed effects, which the standard model in the literature does not contain (Dimitrov et al., 2015). The coefficient significance levels for North America and Europe remain unchanged. The Somers's D values decrease at first glance but remain comparable if we again exclude utilities (see Table 2.10).

We capture a possible effect in the results of excluded observations due to the lack of control variables data. Instead of discarding these observations, we substitute the missing values with the mean, according to the mean imputation method (Schafer, 1997). When rerunning our regressions, we find the same significance of the Asset4 scores (see Table 2.9) and even higher Somers's D improvements (see Table 2.10).

Next, we restrict our North American sample (5393 observations) to a U.S. sample (4849 observations) under the assumption that the underlying drivers for credit rating predictions are more homogeneous inside the domestic market compared with the region. Again, we observe no relevant changes in the significance of the CSP scores (see Table 2.9). The impact of CSP on the credit-rating prediction quality even increases, to 1.0% for ENV and 0.7% for SOC (see Table 2.10).

Moreover, we check the robustness of results according to changes in the observation period for the parameter estimation panel and the prediction data set. The main results rely on a period covering observations between 2003 and 2013, while the prediction data set includes observations from 2014 to 2017. To increase the number of observations in the prediction data set, we reduce the years considered in the estimation data set in favor of the prediction data set. We choose an estimation data set lasting until 2011 and 2012 with a prediction data set commencing accordingly in 2012 and 2013, respectively. Overall, there is no major difference in the significance of the scores (see Table 2.9) and the improvement in credit-rating prediction quality by considering CSP (see Table 2.10).

Finally, we check whether multicollinearity impairs our regressions for all main regressions and robustness checks. In all the regional regressions, the variance inflation factor (VIF) of the CSP variable is below 1.63, which implies that we do not have a multicollinearity problem. Naturally, the VIF values are higher in the merged sample because the interaction term is strongly correlated with the CSP score, as are most observations for North America. However, as this regression is only there to capture the significance of the difference between Europe and North America, this does not compromise the validity of our results.

2.8 Conclusion

One central question in the finance literature addresses the prediction quality of credit ratings (Blume et al., 1998; Kisgen, 2006). CSP is an additional informational proxy for factors that reduce firm risk, as shown in several studies (see, for example, Kim et al., 2014; Utz, 2018). Therefore, we investigate whether, how and the extent to which the integration of CSP measures in credit rating predictions improves their quality. The relationship between CSP and credit ratings is significantly positive in North America, i.e., high CSP performance goes along with better credit ratings. In addition, out-of-sample predictions are improved by 0.8%. In Europe, the social score adds informational power to a basic prediction model, while the environmental performance does not. In general, the differing regional impact of the environmental performance is presumably due to regional differences in both economic areas, such as stronger existing legal and cultural frameworks. To embed our results in a theoretical framework, our findings show supporting evidence of the risk mitigation view of high CSP.

We resolve the contrary results of earlier studies by generating comparable findings for an international sample consisting of North America and Europe. Our results are based on a consistent identification of the explanatory power and the quantification of the prediction quality of CSP dimensions for both regions. In particular, our study builds on the findings of Stellner et al. (2015) with an analysis of the single performance of the environmental and social dimensions as well as their aggregate. While Stellner et al. (2015) show that (aggregated) CSP has no impact on the credit ratings of European firms, we ascertain that the social performance is a significant explanatory factor for credit ratings. Moreover, we confirm the findings of Jiraporn et al. (2014) that North American firms with high CSP obtain better credit ratings, although our study uses the methodologically more sophisticated Asset4 scores (see Humphrey et al., 2012). We complement this study by quantifying the improvement of the prediction quality, in particular, by 0.8 percentage points for North America; this is economically significant, as there is less economic capital required. Overall, we find supporting evidence for the impact of CSP performance on credit ratings being independent of the sustainability rating agency in North America and Europe.

Since the country level of CSP is important in the relationship between CSP and creditworthiness (Stellner et al., 2015), future research may extend our study to different regions. This extension is particularly interesting since Utz (2018) finds evidence for crash risk such that – consistent with our results – the risk mitigation view holds in North America and Europe; however the overinvestment hypothesis applies in the Asia-Pacific region. As this study focuses rather on the technical effects for credit risk models, a further extension of this research could be to dig deeper into the economic channels through which the observed effects causally emerge.

Chapter 3

The social and environmental drivers of corporate credit ratings: international evidence

This chapter is based on a joint work with Gregor Dorfleitner (University of Regensburg). The article has been submitted to the journal *Business Research* and was accepted for publication. The final version may differ due to editorial changes.

Abstract We provide evidence of the exogenous impact of environmental and social performance components on credit ratings in North America, Europe, and Asia. In particular, the product innovation dimension is clearly identified as being the dominating driver of credit ratings within the environmental performance in every subsample region. In the social performance dimension, the extent of diversity is a main driver for firms in North America and Europe, but due to cultural reasons, not in Asia. Our results show that the risk mitigation view holds for all significant corporate social or environmental performance variables, but the magnitude of impact differs regionally.

Keywords Credit Risk · Credit Ratings · Asset4 · CSP · CSR · Sustainability

JEL Classification G12 · G24 · M14

3.1 Introduction

We identify the single dimensions of corporate social and environmental performance which have an impact on credit ratings. Our analysis differs from earlier studies through the joint use of more sophisticated and transparent corporate social performance (CSP)[1] measures of Asset4, the identification of the affecting CSP components, the regional differentiation in an international dataset (North America, Europe, and Asia), and the use of an instrumental variables approach in conjunction with commonly employed credit risk models. It is our approach in particular that allows us to provide clearer indications of a causal relationship in terms of how CSP components impact credit ratings, as opposed to the common approaches revealing only correlational relationships.

Dorfleitner et al. (2020) find that out-of-sample prediction quality improves by more than 0.8% in their North America sample if environmental and social performance measures are integrated into an established credit risk model. However, a detailed analysis of the underlying drivers within the social and environmental performance is only available for the U.S. and suffers from a potential exposure to endogeneity (e.g., Oikonomou et al., 2014) or rather simplistic credit risk modeling (e.g., Attig et al., 2013). Endogeneity, in terms of the reverse causality problem, is crucial to the analysis of the relationship between CSP and credit ratings. On the one hand, CSP is commonly expected to have a positive impact on credit ratings. On the other hand, though, the opposite direction of impact is also conceivable, in the way that firms with better credit ratings save financing costs and are therefore able to increase their spending on CSP. Most studies on this topic use lagged independent variables to deal with the endogeneity problem, which is the first step, but nonetheless appears not to be insufficient. Some (e.g., Bauer et al., 2009; Jiraporn et al., 2014) estimate a two-stage least squares (2SLS) model, which is generally appropriate for reducing endogeneity, but this approach does not meet the standards of current literature on credit risk because credit ratings need to be considered as categorical, and the employed OLS estimation is unable to model this. As a consequence, an international analysis with an adequate credit risk model and a sufficient approach to identify relevant CSP aspects which have a causal impact on credit ratings is still lacking in the literature.

We fill this gap by applying the analysis to both CSP in general and its components in an international dataset including Asset4 CSP measures based on the two-stage predictor substitution (2SPS) with an established credit risk model in the second stage. Asset4 CSP measures are internationally available on a granular level, allowing us to drive our analysis consistently for North America, Europe, and Asia. The environmental performance

[1] The term 'corporate social performance' (CSP), as usually used in literature, includes both, the social and the environmental dimension (cf. Ioannou and Serafeim, 2012). For that reason, we refer to CSP in case of the overall CSP performance throughout the paper while referring to either the social or environmental dimension is denoted as social or environmental performance.

comprises measures for emission reduction, product innovation, and resource reduction, while the social performance dimension spans the categories product responsibility, community, human rights, diversity respectively equal opportunities, employment quality, health, and training. Asset4 scores are, compared to other providers such as e.g., MSCI-KLD, methodologically superior, and more transparent (Chatterji and Levine, 2006). Concerning established credit risk models, endogeneity can be mitigated through the two-stage predictor substitution (2SPS), which is an implementation of the instrumental variable approach for nonlinear models. In the first stage, we regress the CSP scores on instruments such as the average CSP level of firms located in the same area (Jiraporn et al., 2014) and measures for so-called 'national business systems' (NBS) (Whitley, 1999) in terms of the political, the labor, education, and the cultural system according to Ioannou and Serafeim (2012) as well as on further control variables. All instruments have an impact on CSP as shown in the above studies, but obviously have no direct impact on credit ratings. Hence they qualify as instruments. Finally, in the second stage, credit ratings are regressed on the CSP estimate of the first stage. We choose the ordered choice model as introduced by Kaplan and Urwitz (1979) and as applied in many studies (e.g., Dimitrov et al., 2015; Baghai et al., 2014; Alp, 2013; Jiang et al., 2012; Becker and Milbourn, 2011; Blume et al., 1998).

We show that within the environmental performance, the innovation dimension has the most significant impact on credit ratings. This is true for North America, Europe, and Asia. However, the magnitude of the effect differs between these regions. The impact of social performance in North America and Europe is mainly driven by diversity while no social aspects are relevant for Asia. Our findings are important for real-world decision makers as they enable the identification of those CSP dimensions, that have an impact on credit ratings. As the positive link between selected CSP components and credit ratings indicates a lower default risk of firms with high CSP levels, practitioners may profit from this knowledge through a more precise evaluation of credit risk and the resulting incentives to act. Also, as better credit ratings are associated with lower financing costs, our results help to target investments efficiently, leading to cost savings. Particular investments in environmental product innovation are far more impactful than those for emission and resource reduction. Likewise, among the social dimensions, diversity, and employment quality are to be prioritized in investment decisions.

The remainder of the paper is organized as follows. We review the related literature and consider theory in Section 3.2. Section 3.3 describes our international data set and Section 3.4 introduces the employed instumental variable and ordered probit methodology. Section 3.5 presents the empirical results followed by Section 3.6 with robustness tests. Finally, Section 3.7 concludes.

3.2 Theoretical considerations

A recent stream in literature analyzes the relationship between CSP and credit ratings. Dorfleitner et al. (2020), Stellner et al. (2015), Jiraporn et al. (2014), Oikonomou et al. (2014), Attig et al. (2013), Bauer and Hann (2010), Bauer et al. (2009), and Frooman et al. (2008) all contribute important insights to the prevailing positive link between CSP and credit ratings. However, the combination of a state of the art credit risk model and an econometrical framework to identify causal relationships rather than simple correlations has not yet been pursued.

In theory, there are two possible relationships between CSP and credit ratings. The overinvestment view regards CSP as being a waste of scarce resources, but there is little evidence of this perspective. In contrast, the risk mitigation view is based on the idea that sustainable companies face lower risks.

For U.S. firms, Oikonomou et al. (2014), Attig et al. (2013), Bauer and Hann (2010), and Frooman et al. (2008) find a strong positive link between the KLD environment score and credit ratings. Dorfleitner et al. (2020) report an improved prediction quality in their North America sample if they consider environmental performance in their model. Environmental practices affect the solvency of borrowing firms by determining their exposure to potentially costly legal, reputational, and regulatory risks according to Bauer and Hann (2010). Following the correlation-based evidence of the above mentioned previous studies, we also conjecture a causal impact of (some of) the components of environmental performance on credit ratings. More concrete, we expect at least one of the environmental performance dimensions of emission reduction, resource reduction, and environmental innovation to have a positive impact on credit ratings.

Bauer et al. (2009) have already evidenced a positive relationship between the social pillar of CSP and credit ratings. Dorfleitner et al. (2020) report an improved prediction quality for North America, regarding a model that considers social performance. Through the breakdown into individual components, Attig et al. (2013) find that KLD social strengths and concerns correlate with credit ratings of U.S. firms and that the individual components of CSP related to primary stakeholder management (i.e., community relations, diversity, and employee relations) matter most in explaining a firm's creditworthiness. Oikonomou et al. (2014) identify a similar relationship for community, employment, environment, and product safety. The positive link between CSP components and creditworthiness appears plausible especially for employee relations, as these are associated with greater productivity, higher profitability, higher firm value, and superior shareholder returns (e.g., Huselid, 1995; Prennushi et al., 1997; Ichniowski and Shaw, 1999; Edmans, 2011). Bauer et al. (2009) argue that employee relations affect bondholders through their influence on firm risk. Thus firms with sound and competitive employment practices can enhance their capacity to generate higher and more stable cash flows while simultaneously preempting or mitigating the harmful behavior of dissatisfied employees. In contrast, poor employee relations can limit firms' access to human capital, lead to the exit of valuable employees, increase both litigation and reputation risks, and raise transaction costs. Hence, we also expect a causal impact of (some of) the components of social performance on credit ratings. More narrowly, at least one of the social performance dimensions of product responsibility, community, human rights, diversity, employment quality, health, or training performance is expected to have a positive impact on credit ratings.

For the impact of CSP on some types of risk, it was already shown that this relationship varies regionally, e.g., Utz (2018) finds evidence for the risk mitigation view on the impact of CSP on idiosyncratic risk while the overinvestment view seems to apply in Asia-Pacific. Some previous research on the relationship between CSP and credit ratings is provided for both North America and Europe. Jiraporn et al. (2014) find that the CSP policies of U.S. firms are affected by CSP. Firms with high CSP have better credit ratings, i.e., by 4.5% for a one standard deviation change in the CSP level. In contrast, Stellner et al. (2015) find no relevance of Asset4's overall CSP rating for credit ratings regarding Europe. Dorfleitner et al. (2020) also confirm regional deviations between North America and Europe in the explanation and prediction quality of credit ratings through CSP. While social performance is a predictor for credit ratings in both North America and Europe, this is only the case for environmental performance in North America in their setting. Given there is an impact, we expect the effect of environmental and social performance categories on credit ratings to differ regionally.

TABLE 3.1: Rating distribution

	North America			Europe			Asia		
Rating	Total	Upgr.	Downgr.	Total	Upgr.	Downgr.	Total	Upgr.	Downgr.
AAA	52	0	0	9	0	0	5	0	0
AA	131	4	6	70	1	2	158	2	1
A	841	30	9	375	17	11	277	11	9
BBB	1918	57	57	715	18	37	278	7	9
BB	1293	60	69	231	9	27	84	3	3
B	432	15	60	80	4	12	14	1	6
CCC	34	1	14	13	1	7	4	0	2
CC	2	0	2	3	0	3	0	0	0
D	6	0	6	4	0	4	3	0	3
Total	4709	167	223	1500	50	103	823	24	33

This table reports on the total number of firms and observations per rating class including the partial quantity of rating upgrades and downgrades compared with the previous period for the entire sample. We use S&P long-term borrower credit ratings reflecting the obligor's creditworthiness over a long-term time horizon (greater than one year).

TABLE 3.2: Descriptive statistics for the Asset4 scores, instruments and control variables for the North American, European, and Asian samples of explanatory variables.

	North America					Europe					Asia				
	Mean	SD	25%	Med.	75%	Mean	SD	25%	Med.	75%	Mean	SD	25%	Med.	75%
CSP variables															
CSP score	54.04	28.74	25.45	54.67	82.84	81.63	17.21	76.10	89.46	93.56	70.08	26.45	57.69	81.67	90.11
Environm. score	53.02	31.59	19.28	53.09	86.14	80.77	19.34	75.59	90.30	93.66	74.47	27.35	65.64	89.01	93.43
Social score	55.03	29.05	26.78	58.10	82.88	82.51	17.55	77.02	90.22	94.71	65.71	28.87	45.89	77.76	89.08
Emission score	52.28	31.84	18.81	52.03	86.00	81.35	19.52	78.54	90.33	93.84	74.04	27.72	60.40	88.89	93.80
Env. inno. score	50.52	30.84	21.92	40.24	83.43	71.89	29.32	48.36	87.32	95.71	70.71	28.99	45.75	83.52	95.78
Resources score	53.58	32.18	19.63	57.58	87.23	79.31	17.95	73.12	87.50	91.95	70.84	26.79	58.34	82.86	90.88
Prod. resp. score	53.33	28.14	28.44	49.71	82.45	72.10	25.43	52.39	84.13	94.07	59.61	30.35	35.04	62.24	89.56
Comm. score	56.33	29.26	28.91	60.02	84.28	70.32	23.69	55.16	78.95	90.41	64.83	28.25	46.70	74.24	88.68
Hum. rights score	53.68	32.54	22.13	37.43	90.79	76.48	26.98	57.73	92.07	94.71	61.88	30.16	30.26	66.33	93.16
Diversity score	54.19	28.69	24.79	52.96	84.24	75.74	24.13	61.20	88.08	94.61	63.22	34.01	23.89	83.30	92.23
Employm. score	53.12	29.51	23.67	54.41	82.11	74.07	23.20	58.78	84.05	93.06	52.44	28.58	26.41	52.26	80.06
Health score	53.22	29.83	26.18	49.24	84.67	75.68	23.61	56.89	87.42	96.32	58.89	29.27	31.60	61.46	88.92
Training score	48.99	30.46	18.45	49.57	79.86	80.09	16.41	75.07	86.40	91.80	63.34	27.77	41.55	75.06	85.72
Instruments															
∅ CSP score*	54.01	4.96	52.15	55.82	56.99	81.12	8.40	76.41	82.46	86.91	70.03	15.50	62.60	70.17	83.37
∅ Environm. score*	53.01	5.11	50.34	54.54	56.69	80.30	9.21	74.18	81.80	86.83	74.39	17.16	70.55	77.65	88.13
∅ Social score*	55.01	4.99	53.99	57.13	57.32	81.94	8.67	77.30	83.27	87.59	65.66	14.91	59.04	65.03	78.94
∅ Emission score*	52.28	5.61	49.33	53.18	55.08	80.95	9.09	76.86	81.73	86.52	73.96	17.77	67.90	79.07	88.57
∅ Env. inno. score*	50.53	3.90	49.80	51.38	53.74	71.85	13.90	59.69	73.93	82.17	70.64	17.33	62.17	72.07	83.92
∅ Resources score*	53.57	5.66	50.18	55.80	57.29	78.81	8.60	74.69	79.52	84.26	70.83	15.32	67.39	71.92	82.54
∅ Prod. resp. score*	53.24	3.27	52.99	53.94	55.14	71.86	13.22	62.12	73.15	82.80	59.59	12.89	54.24	63.15	66.53
∅ Comm. score*	56.26	4.71	54.81	56.52	57.89	70.04	10.68	65.20	72.28	75.99	64.74	13.03	57.93	64.44	75.88
∅ Hum. rights score*	53.71	6.33	47.17	57.76	58.96	76.33	12.36	70.03	77.64	85.09	61.81	17.16	51.22	59.94	80.14
∅ Diversity score*	54.15	4.17	54.13	54.71	56.73	75.44	12.23	69.82	76.57	84.17	63.24	20.52	46.29	62.77	85.62
∅ Employm. score*	53.07	7.01	53.55	55.44	56.38	73.71	10.70	69.24	75.15	80.04	52.41	14.61	37.80	49.63	66.75
∅ Health score*	53.19	4.43	52.72	54.00	54.14	75.36	9.70	71.35	74.84	80.89	58.84	11.92	50.07	57.65	65.71
∅ Training score*	49.04	5.01	46.75	51.30	52.29	79.36	9.36	74.42	82.45	85.38	63.36	11.00	55.29	63.15	70.86
Regulatory framew.	17.33	1.10	17.00	17.00	17.00	16.52	10.12	12.00	14.00	20.00	29.97	13.36	24.00	37.00	37.00
Anti-self-dealing	0.65	0.00	0.65	0.65	0.65	0.50	0.27	0.28	0.38	0.95	0.62	0.20	0.50	0.50	0.58
Corruption	0.67	0.05	0.68	0.68	0.68	0.84	0.86	0.54	0.54	0.73	0.78	0.86	0.72	0.72	0.72
Political orientation	94.73	28.10	103.13	103.13	103.13	26.05	43.48	0.31	0.34	99.76	19.81	39.97	0.01	0.01	0.01
Union density	13.46	4.88	12.00	12.00	12.00	27.01	17.68	19.50	22.20	28.80	20.66	5.39	19.20	19.20	20.10
Skilled labor	6.12	0.10	6.09	6.09	6.09	6.26	0.48	5.78	6.30	6.46	5.13	0.95	4.50	4.50	6.06
Power distance	39.92	0.27	40.00	40.00	40.00	44.12	14.07	35.00	35.00	57.00	59.42	10.59	54.00	54.00	68.00
Individualism	90.10	3.02	91.00	91.00	91.00	73.85	11.82	68.00	71.00	89.00	39.42	10.44	25.00	46.00	46.00

*Country average

Table continues on next page.

TABLE 3.2 continued

	North America					Europe					Asia				
	Mean	SD	25%	Med.	75%	Mean	SD	25%	Med.	75%	Mean	SD	25%	Med.	75%
Control variables															
Interest coverage	11.97	19.52	2.48	5.57	12.20	9.04	14.19	2.85	5.27	9.54	23.35	29.16	4.87	11.32	26.89
Operating margin	13.61	8.64	7.04	12.32	18.99	12.41	9.04	5.64	10.23	16.66	10.83	8.65	4.66	7.76	14.43
Total debt	45.52	20.72	30.55	42.99	58.18	46.64	16.85	33.48	45.91	58.34	37.58	19.20	23.02	37.01	51.94
Size (USDm)	20.34	46.62	2.83	6.57	17.49	25.90	35.81	4.94	11.46	31.72	20.50	29.67	6.13	11.69	24.38
Beta	0.56	0.49	0.15	0.45	0.89	0.55	0.48	0.16	0.44	0.91	0.59	0.48	0.16	0.49	1.00
Idiosyncratic risk	2.03	1.15	1.28	1.81	2.66	1.96	1.15	1.21	1.70	2.47	1.92	0.93	1.24	1.67	2.37
Dividend payer	0.71	0.45	0.00	1.00	1.00	0.88	0.33	1.00	1.00	1.00	0.96	0.19	1.00	1.00	1.00
Market/Book	3.00	2.22	1.48	2.32	3.74	2.61	2.04	1.25	2.02	3.18	1.68	0.78	1.08	1.48	2.02
Retained earnings	0.25	0.30	0.06	0.24	0.44	0.19	0.19	0.06	0.18	0.33	0.29	0.16	0.17	0.27	0.39
Capital expenditure	4.86	3.03	2.26	4.20	7.21	4.45	2.69	2.26	3.84	6.07	5.40	2.83	3.10	5.14	7.50
Cash holdings	0.11	0.11	0.03	0.07	0.15	0.10	0.08	0.05	0.08	0.13	0.13	0.10	0.06	0.10	0.17
Tangibility	0.34	0.26	0.11	0.26	0.55	0.31	0.20	0.13	0.28	0.46	0.35	0.19	0.19	0.32	0.48
R&D	0.02	0.04	0.00	0.00	0.02	0.02	0.03	0.00	0.00	0.02	0.02	0.03	0.00	0.01	0.03
GDP growth	0.02	0.01	0.02	0.02	0.03	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.02
N			4709					1500					823		

This table reports descriptive statistics for the Asset scores, the instrumental variables, and control variables in our sample covering the period from 2002 until 2018.

3.3 Data

Our sample includes S&P credit ratings, Asset4 CSP measures, and some instrumental and control variables. After excluding financial firms based on the Thomson Reuters Business Classification (TRBC), the final data set encompasses 1,212 firms with 7,032 firm-year observations. Tables 3.1 and 3.2 present descriptive statistics of the credit rating variable, respectively, of the Asset4 scores, the instruments, and the control variables. The regional classification into North America, Europe, and Asia is described in Table 3.3.

TABLE 3.3: Country structure of regional panels

Continent	Countries	Observations	Firms
North America	Canada, United States of America	4709	813
Europe	Belgium, Swiss, Germany, Denmark, Spain, Finland, France, Great Britain, Greece, Italy, Netherlands, Norway, Portugal, Sweden	1500	224
Asia	Hong Kong, India, Japan, Malaysia, Singapore, Taiwan	823	175
Total		7032	1212

This table reports the breakdown of our data panel on regions and countries which are the base for our panel selection when analyzing regional differences.

The dependent variable of the second stage regression is the long-term borrower credit rating of S&P. These credit ratings reflect the creditworthiness of a borrower for a time horizon of at least one year. The referring rating grades comprise AAA, AA, A, BBB, BB, B, CCC, CC, and D. The default category D is assigned when obligors are overdue for their required payments. Vazza and Kraemer (2017) provide further information on the rating methodology.

Asset4 publishes annual corporate social and environmental performance scores, which can be interpreted as being external measures for sustainable business models (Ioannou and Serafeim, 2012; Chatterji et al., 2016; Humphrey et al., 2012). The scores include information from publicly available sources such as websites, SEC filings such as 10-K, DEF 14A, and 10-Q, sustainability reports, media sources, and NGO reports. The methodology is based on more than 700 questions about the fulfillment of a specific sustainable topic. Each question results in one data point. These pieces of information are aggregated to categories, which again are condensed to pillars. The approach of Asset4 allows us to overcome weaknesses of the KLD, FTSE4Good, and Dow Jones-rating approaches such as lack of transparency (Chatterji and Levine, 2006) as far as possible. Following El Ghoul et al. (2017), we also derive the overall CSP performance from aggregating the environmental and social pillars. The final scores range from zero to 100 percent with high levels reflecting high CSP. The distribution of Asset4 scores may be skewed as the required information to assign a rating is easier to obtain from larger and high-CSP companies as badly performing firms are unlikely to provide the necessary information. As a consequence, we include size and a large set of further control variables in our models. The data is free from survivorship bias as post-bankruptcies, mergers, and other causes of de-listings are accounted for and the corresponding stocks are retained in the sample. A detailed description of the CSP scores is displayed in Table 3.4.

Our first instrument for CSP is selected based on the study by Jiraporn et al. (2014), who ascertain that the CSP policy of surrounding firms to have an impact on firm CSP performance. Thus we apply the average CSP score of all (available) surrounding firms within the same country. Second, a further set on instruments is included, namely the drivers for CSP in terms of "national business systems" (NBS) according to Whitley (1999), such as the political, labor, education, and the cultural systems. The theoretical NBS category political system is measured with the aid of a regulations index, an anti-self-dealing index, an absence-of-corruption index, and an index for left/center political orientation. The education and labor system is modeled by union density and a skilled labor index while the cultural system involves indices for power distance and individualism. A detailed description of the variables of each NBS category is presented in Table 3.5.

We add further control variables based on previous research. Following Standard&Poor's (2013) and Merton (1974), we include the three-year averages of the operating margin, the total debt, and the interest coverage ratios. The interest coverage ratio is transformed as suggested by Blume et al. (1998). We set negative values to zero because these could be due to low interest payments or high negative earnings, while both explanations have a contradictory impact on credit ratings. By assuming decreasing marginal effects for high levels of interest coverage, we cap the three-year average at 100. To model a non-linear shape, we transform the interest coverage C_{it} of a company i in year t into four subvariables c_{it}^A, c_{it}^B, c_{it}^C, c_{it}^D acording to:

	c_{it}^A	c_{it}^B	c_{it}^C	c_{it}^D
if $C_{it} \in [0, 5)$	C_{it}	0	0	0
if $C_{it} \in [5, 10)$	5	$C_{it} - 5$	0	0
if $C_{it} \in [10, 20)$	5	5	$C_{it} - 10$	0
if $C_{it} \in [20, 100)$	5	5	10	$C_{it} - 20$.

Table 3.4: Details on CSP variables

Variable	Definition
Emission	The emission reduction category measures a company's management commitment and effectiveness toward reducing environmental emission in the production and operational processes. It reflects a company's capacity to reduce air emissions (greenhouse gases, F-gases, ozone-depleting substances, NOx and SOx, etc.), waste, hazardous waste, water discharges, spills, or its impacts on biodiversity and to partner environmental organisations to reduce the environmental impact of the company in the local or broader community. - Source: Thomson Reuters Datastream, Mnemonic ENER.
Env. inno.	The product innovation category measures a company's management commitment and effectiveness toward supporting the research and development of eco-efficient products or services. It reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed, dematerialized products with extended durability. - Source: Thomson Reuters Datastream; Mnemonic ENPI.
Resources	The resource reduction category measures a company's management commitment and effectiveness toward achieving an efficient use of natural resources in the production process. It reflects a company's capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management. - Source: Thomson Reuters Datastream; Mnemonic ENRR.
Prod. resp.	The customer/product responsibility category measures a company's management commitment and effectiveness toward creating value-added products and services upholding the customer's security. It reflects a company's capacity to maintain its license to operate by producing quality goods and services integrating the customer's health and safety, and preserving its integrity and privacy, also through accurate product information and labelling. - Source: Thomson Reuters Datastream; Mnemonic SOPR.
Comm.	The community category measures a company's management commitment and effectiveness toward maintaining the company's reputation within the general community (local, national, and global). It reflects a company's capacity to maintain its license to operate by being a good citizen (donations of cash, goods or staff time, etc.), protecting public health (avoidance of industrial accidents, etc.), and respecting business ethics (avoiding bribery and corruption, etc.). - Source: Thomson Reuters Datastream; Mnemonic SOCO.
Hum. rights	The human rights category measures a company's management commitment and effectiveness towards respecting the fundamental human rights conventions. It reflects a company's capacity to maintain its license to operate by guaranteeing the freedom of association and excluding child, forced or compulsory labor. - Source: Thomson Reuters Datastream; Mnemonic SOHR.
Diversity	The diversity and opportunity category measures a company's management commitment and effectiveness towards maintaining diversity and equal opportunities in its workforce. It reflects a company's capacity to increase its workforce loyalty and productivity by promoting an effective life-work balance, a family friendly environment and equal opportunities regardless of gender, age, ethnicity, religion or sexual orientation. - Source: Thomson Reuters Datastream; Mnemonic SODO.
Employm.	The employment quality category measures a company's management commitment and effectiveness towards providing high-quality employment benefits and job conditions. It reflects a company's capacity to increase its workforce loyalty and productivity by distributing rewarding and fair employment benefits, and by focusing on long-term employment growth and stability by promoting from within, avoiding layoffs, and maintaining relations with trade unions. - Source: Thomson Reuters Datastream; Mnemonic SOEQ.

Table continues on next page.

TABLE 3.4 continued

Variable	Definition
Health	The health & safety category measures a company's management commitment and effectiveness towards providing a healthy and safe workplace. It reflects a company's capacity to increase its workforce loyalty and productivity by integrating into its day-to-day operations a concern for the physical and mental health, well-being, and stress level of all employees. - Source: Thomson Reuters Datastream; Mnemonic SOHS.
Training	The training and development category measures a company's management commitment and effectiveness towards providing training and development (education) for its workforce. It reflects a company's capacity to increase its intellectual capital, workforce loyalty, and productivity by developing the workforce's skills, competences, employability, and careers in an entrepreneurial environment. - Source: Thomson Reuters Datastream; Mnemonic SOTD.

This table presents the description of our selection on Asset4 CSP measures. Source: Thomson Reuters (2011).

TABLE 3.5: Details on employed instruments

NBS category	Variable	Definition
Political system	Regulatory framework	Strengths of laws that encourage competition in the country (measured as of 2017). - Source: IMD World Competitiveness Report 2017
	Anti-self-dealing index	The extent to which laws restrict insider trading (measured as of 2001). - Source: La Porta et al. (2006)
	Corruption	Inverse corruption score (measured as average of 1996-2017). - Source: World Bank
	Political orientation	The extent to which both the Chief Executive and the largest party in Congress are politically left respectively central (measured as proportion of the time period 1928-1995). - Source: Botero et al. (2004)
Education and labor system	Union density	The proportion of union members of all employees based on administrative and survey data (measured as average as of 2002-2017). - Source: OECD and J.Visser, ICTWSS database (Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts)
	Skilled labor	The extent to which skilled labor is available in a country (measured as of 2017). - Source: IMD World Competitiveness Report 2017
Cultural system	Power distance	The degree of acceptance for inequality in the distribution of power inside organisations and institutions (measured as of 1973). - Source: Hofstede et al. (2010); Hofstede (2001)
	Individualism	The extent of including individuals into groups (measured as of 1973). - Source:Hofstede et al. (2010); Hofstede (2001)

This table provides an overview of the NBS categories (Whitley, 1999) and their variables, which we select as instruments for use during the first stage of our 2SPS regressions based on the work of Ioannou and Serafeim (2012).

TABLE 3.6: Details on control variables

Variable	Definition
Interest coverage	Earnings before interest and taxes divided by interest expense on debt (3-year averages; floored at 0; capped at 100). To model the nonlinear shape of the interest coverage ratio, the interval of (0-5) is assigned to sub-variable A, (5-10) to sub-variable B, (10-20) to sub-variable C, and (20-100) to sub-variable D. - Source: Thomson Reuters Datastream; Mnemonic WC08291.
Operating margin	The ratio of operating income and net sales or revenues (3-year averages). - Source: Thomson Reuters Datastream; Mnemonics WC08316.
Total debt	The ratio of long-term plus short-term debt and total capital plus short-term debt (3-year averages). - Source: Thomson Reuters Datastream; Mnemonic WC08221.
Size	The percentile of the market capitalization among those of companies listed at the New York Stock Exchange (NYSE). - Source: Thomson Reuters Datastream; Mnemonic WC07210.
Idiosyncratic risk	The root mean squared error of a market model estimation based on daily stock and local market index returns within the time horizon of one year if at least 50 observations are available. - Source: Thomson Reuters Datastream; Mnemonics X(LI), X(RI).
Beta	The systematic risk beta of the market model as described for the calculation of idiosyncratic risk. - Source: Thomson Reuters Datastream; Mnemonics X(LI), X(RI).
Dividend payer	Positive dividends per share indicated by a dummy variable. - Source: Thomson Reuters Datastream; Mnemonic WC05101.
Market/Book	The ratio of common equity and its balance sheet value. - Source: Thomson Reuters Datastream; Mnemonic MTBV.
Research and development	All costs related to the development of new processes, techniques, applications, and products that are intended for commercial exploitation. Missing values are replaced by zero. - Source: Thomson Reuters Datastream; Mnemonics WC01201, WC02999.
Retained earnings	The ratio of accumulated earnings after tax that have not been paid as dividends or allocated to allowances and total assets. - Source: Thomson Reuters Datastream; Mnemonics WC03495, WC02999.
Capital expenditures	The ratio of capital expenditures and total assets. - Source: Thomson Reuters Datastream; Mnemonics WC08416, WC02999.
Cash holdings	The ratio of cash plus short-term investments and total assets. - Source: Thomson Reuters Datastream; Mnemonics WC02001, WC02999.
Tangibility	The ratio of net property, plant, and equipment and total assets. - Source: Thomson Reuters Datastream; Mnemonics WC02501, WC02999.
GDP growth	The growth rate of the gross domestic product (GDP) per year. - Source: Thomson Reuters Datastream; Mnemonic GDP..D (in combination with the two letter country code).

This table describes used control variables that are firm-specific except for GDP growth. All of them are delivered by Worldscope and Thomson Reuters Datastream.

We control for firm size for two reasons. On the one hand, larger companies are less likely to default (Altman et al., 1977). On the other hand, the CSP scores are likely to be skewed with respect to firm size. Referring to Blume et al. (1998), we also control for systematic risk (market model beta) as well as idiosyncratic risk. The firms' willingness to pay dividends can also be an indicator of credit risk (Hoberg and Prabhala, 2009). Furthermore, firms with a high market-to-book ratio may be less likely to default (Pástor and Pietro, 2003). Retained earnings are used to proxy a company's life cycle phase (DeAngelo et al., 2006), whereas established companies tend to have better ratings (Fons, 1994). Additionally, capital expenditure has been evidenced to influence credit risk (Tang, 2009). We include cash among the controls because firms in distress tend to hold precautionary savings (Acharya et al., 2012). Furthermore, tangibility may have an impact on credit risk (Rampini and Viswanathan, 2013). As S&P credit ratings appear to change at least to some extent pro-cyclically, the gross domestic product (GDP) growth rate is employed to model the business cycle. A detailed description of the above control variables is presented in Table 3.6. Time fixed effects are intended to catch all remaining systematic effects (Elton et al., 2001). Finally, we also control for industry-fixed effects. An overview of industries is delineated in Table 3.7.

TABLE 3.7: Overview of industry classes in the sample

Industry Class	Observations	Industry Class	Observations
Basic materials	624	Oil and gas	569
Consumer goods	1050	Technology	527
Consumer services	1169	Telecommunications	213
Healthcare	539	Utilities	677
Industry	1664	Total	7032

This table reports on industry classes according to the economic sector level of Thomson Reuters Business Classification (TRBC). Financial firms are excluded.

In order to control for multicollinearity, we calculate variance inflation factors (VIF) for overall CSP scores, instruments, and control variables. If necessary, input variables are discarded in a selection process in order to maintain only VIFs below 10 indicating sufficient low exposure to multicollinearity. The variable 'individualism' is discarded in that process for the combined dataset of all three regions. An estimation based on the full set of instruments is presented in the robustness checks.

3.4 Methodology

As CSP and credit ratings are likely to be highly endogenous, our analysis is based on the instrumental variable approach in order to mitigate the bias due to the endogeneity of the input variables. Thus in the first stage, we regress the respective CSP factor on selected instruments and controls. All factors that can explain variation in CSP but do not affect credit ratings qualify as instruments.

The first stage regression includes the CSP measure $x_{i,t-1}$ as a dependent variable, and instrument variables $\boldsymbol{z}_{i,t-1}$ and controls $\boldsymbol{c}_{i,t-1}$ as explanatory (vectorial) variables with referring coefficients vectors $\boldsymbol{\beta}_z$ and $\boldsymbol{\beta}_c$ as described by:

$$x_{i,t-1} = \boldsymbol{z}'_{i,t-1}\boldsymbol{\beta}_z + \boldsymbol{c}'_{i,t-1}\boldsymbol{\beta}_c + \epsilon_{1,i,t} \tag{3.1}$$

This estimation is based on OLS. In order to account for the panel structure of our data, we include time-fixed effects among the controls and clustering of standard errors at the firm level.

The second stage regression is based on a model that was initially introduced by Kaplan and Urwitz (1979) and further developed by (e..g. Blume et al., 1998). This model is applied in many studies (e.g., Dimitrov et al., 2015; Baghai et al., 2014; Alp, 2013; Jiang et al., 2012; Becker and Milbourn, 2011). Our threshold model is based on an unobserved linking variable y^*_{it}, which represents the creditworthiness of a firm i and year t and calculates

$$y^*_{it} = \hat{x}_{i,t-1}\beta_{\hat{x}} + \boldsymbol{c}'_{i,t-1}\boldsymbol{\beta}_c + \epsilon_{2,i,t} \tag{3.2}$$

where $\hat{x}_{i,t-1}$ is the CSP estimate of the first stage and $\boldsymbol{c}_{i,t-1}$ represents the vector of observed explanatory variables of firm i in the year $t-1$. Accordingly, $\beta_{\hat{x}}$ is the CSP coefficient while $\boldsymbol{\beta}_c$ is a vector of coefficients for control variables. The linking variable y^*_{it} is continuous and its range comprises the set of real numbers. In our study, we consider nine different levels of credit ratings (i.e., AAA, AA, A, BBB, BB, B, CCC, C, and D). The variable R_{it} defines the rating category of firm i and year t. It takes the value 9 if firm i has a rating of AAA, 8 if AA, 7 if A, 6 if BBB, 5 if BB, 4 if B, 3 if CCC, 2 if CC and 1 if D in year t. Thus the first stage of our estimation maps the credit ratings into a partition of the unobserved linking variable y^*_{it} as follows:

$$R_{it} = \begin{cases} 9 & \text{if} \quad y^*_{it} \in [\mu_8, \mu_9) \quad (AAA) \\ 8 & \text{if} \quad y^*_{it} \in [\mu_7, \mu_8) \quad (AA) \\ 7 & \text{if} \quad y^*_{it} \in [\mu_6, \mu_7) \quad (A) \\ 6 & \text{if} \quad y^*_{it} \in [\mu_5, \mu_6) \quad (BBB) \\ 5 & \text{if} \quad y^*_{it} \in [\mu_4, \mu_5) \quad (BB) \\ 4 & \text{if} \quad y^*_{it} \in [\mu_3, \mu_4) \quad (B) \\ 3 & \text{if} \quad y^*_{it} \in [\mu_2, \mu_3) \quad (CCC) \\ 2 & \text{if} \quad y^*_{it} \in [\mu_1, \mu_2) \quad (C) \\ 1 & \text{if} \quad y^*_{it} \in (\mu_0, \mu_1) \quad (D), \end{cases} \tag{3.3}$$

where $\mu_1, \ldots, \mu_8$ are partition points independent of time t while $\mu_0 = -\infty$ and $\mu_9 = \infty$. Thresholds are not given ex-ante but instead determined in the statistical estimation procedure. The assumption that ϵ_{it} is normally and independently distributed with a mean of 0 and a variance of 1 is ensured in the estimation. We obtain a certain rating (i.e., a realization of R_{it}) and a realization of the input variables for each company and each year during the observation period.[2] The explanatory variables are lagged by one period in order to model the status of information at the time of prediction. Table 3.8 provides an overview of the input factors, boundaries, and outputs of the estimated models.

Following the assumption that $\epsilon_{2,i,t,}$ is normally and independently distributed with a mean of 0 and a variance of 1 and given $\hat{x}_{i,t-1}$ and $\boldsymbol{c_{i,t-1}}$, the probability of assignment to a specific rating class can be calculated according to:

$$P(R_{it} = j | \hat{x}_{i,t-1}, \boldsymbol{c}_{i,t-1}) = \Phi(\mu_j - \hat{x}_{i,t-1}\beta_{\hat{x}} + \boldsymbol{c_{i,t-1}\beta_c}) - \Phi(\mu_{j-1} - \hat{x}_{i,t-1}\beta_{\hat{x}} + \boldsymbol{c_{i,t-1}\beta_c}) \tag{3.4}$$

with $j = 1, ..., 9$, $\mu_0 = -\infty$ and $\mu_9 = \infty$.

3.5 Empirical tests

To test our hypotheses, we estimate a total of thirteen different model specifications. Starting with a model of overall CSP, two further models include the environmental or

[2]The main purpose of lagging the variables is to enable a prediction of credit ratings through a function of explaining variables at the end of year $t-1$. The specification of a lag of one year is frequently used in studies on CSP (e.g., Oikonomou et al., 2014; Attig et al., 2013) while we cannot find any references for benefits of lags of higher order in the literature (cf., Baghai et al., 2014). In the case of our data, which are characterized by short time series in a large cross section, lags of higher order would lower the estimation quality as we would lose a large number of observations. For these reasons, we choose the standard specification of only including a lag of one period.

Table 3.8: Overview of the estimated model specifications

		Stage 1	Stage 2
Dependent variable		CSP score	Credit rating
CSP variables	CSP score estimate		$\hat{x}_0$
Instruments	Country average of CSP score	x_1	
	Regulatory framework	x_2	
	Anti-self-dealing	x_3	
	Corruption	x_4	
	Political orientation	x_5	
	Union density	x_6	
	Skilled labor	x_7	
	Power distance	x_8	
	Individualism	x_9	
Control variables	Interest coverage A	x_{10}	x_1
	Interest coverage B	x_{11}	x_2
	Interest coverage C	x_{12}	x_3
	Interest coverage D	x_{13}	x_4
	Operating margin	x_{14}	x_5
	Total debt	x_{15}	x_6
	Size	x_{16}	x_7
	Beta	x_{17}	x_8
	Idiosyncratic risk	x_{18}	x_9
	Dividend payer dummy	x_{19}	x_{10}
	Market/book	x_{20}	x_{11}
	Retained earnings	x_{21}	x_{12}
	Capital expenditure	x_{22}	x_{13}
	Cash holdings	x_{23}	x_{14}
	Tangibility	x_{24}	x_{15}
	R&D	x_{25}	x_{16}
	GDP growth	x_{26}	x_{17}
	Dummy for North America	x_{27}	x_{18}
	Dummy for Asia	x_{28}	x_{19}
	Dummy for year 1	x_{29}	x_{20}
	(following years analogue)		
Boundaries	Lower Boundary for rating AAA		μ_8
	Lower boundary for rating AA		μ_7
	Lower boundary for rating A		μ_6
	Lower boundary for rating BBB		μ_5
	Lower boundary for rating BB		μ_4
	Lower boundary for rating B		μ_3
	Lower boundary for rating CCC		μ_2
	Lower boundary for rating CC		μ_1
Output	CSP score estimate (becomes input for stage 2)	$\hat{x}_0$	
	Linear predictor		y^*
	Rating class		R

This table gives an overview of both stages of our estimated models. The first stage includes instruments and control variables to estimate CSP scores as dependent variables. The second stage includes the estimate of the referring CSP score and the same control variables from the first stage with credit ratings as the dependent variable. The estimation results contain also boundaries needed to assign rating classes based on the linear predictor.

the social pillar respectively. Further models focus on each of the components contained in the pillars respectively. Concerning environmental performance, we estimate models for *emission*, *environmental innovation*, and *resources*. Referring to social performance, additional models include *product responsibility*, *community*, *human rights*, *diversity*, *employment quality*, *health*, and *training*. All of these models are estimated on the pooled dataset of North America, Europe, and Asia in two stages based on the 2SPS approach.

Each model considers one CSP score as a dependent variable in the first stage regressed on instrumental and control variables. The corresponding second step includes the credit rating as the dependent variable with both the CSP estimate and the same controls from the first stage as independent variables. The regression results for both stages of all models are presented in Table 3.9. Moreover, we test for weak instruments in the first stage and report adjusted R^2 values as goodness-of-fit measures for both stages of every model.

3.5.1 The impact of CSP and its components

The first stage regression results for the overall CSP, the environment, and the social model in our pooled sample of North America, Europe, and Asia show that some of our instruments are significant and hence add an important explanation to the CSP scores. The test on weak instruments delivers p-values close to zero, implying that the null hypothesis of weak instruments can be rejected. In the second stage, we find coefficients of overall CSP in all three regions to be positive and significant on a 1% level. The sign indicates that strong CSP performance tends to be linked to better credit ratings. Thus increases of firm CSP also tend to go along with credit rating improvements. Hence, these results confirm the risk mitigation view. By implementing the argument of Galema et al. (2008) that aggregating multiple categories of CSP may hide confounding effects among the single components of corporate social and environmental performance, we focus on CSP components in the following.

When targeting the environmental category level of Asset4 CSP scores, we find that all environmental categories (*emission*, *environmental innovation*, and *resources*) are relevant. A consideration of the most distinct result regarding environmental innovation raises the question of why conventional control variables such as R&D expenses cannot catch the effect. First, we argue that CSP aims to measure future long-term development while the accounting ratios included in controls represent solely the status quo. Second, CSP also catches intangible assets which are likely not (fully) reflected in accounting ratios. Previous research reveals some reasons for the potential relationship between environmental innovation and firm performance. Environmental innovation may increase efficiency and hence decrease total material cost (Porter and Van der Linde, 1995). Additionally, businesses can gain competitive advantages through green product and green process innovation (Chen et al., 2006). Moreover, Kammerer (2009) argues that product innovation also increases the customer benefits and thereby also the demand. Furthermore, a positive impact on the market performance is confirmed by Pujari (2006), including reputation among the potential drivers of this (Eiadat et al., 2008).

Next, we analyze which single categories of the social performance dimension drive the impact on credit ratings. Our findings show a significant positive impact of *health* and

TABLE 3.9: Instrumental variable estimation of coefficients and boundaries for the global panel

	Ov. CSP		Environm.		Social		Emission		Env. inno.		Resources	
Stage	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
Dependent Variable	Ov. CSP	Cr. Rat.	Environm.	Cr. Rat.	Social	Cr. Rat.	Emission	Cr. Rat.	Env. inno.	Cr. Rat.	Resources	Cr. Rat.
Coefficients												
$\widehat{CSP}$		0.040***		0.044***		0.032**		0.038***		0.069***		0.038***
Intercept	−31.250**		−17.871		−37.630***		−8.656		2.384		−8.752	
Dummy North Am.	−11.405***	0.522	−11.419***	0.574*	−12.635***	0.354	−11.450***	0.541*	−9.530***	0.722***	−12.229***	0.415
Dummy Asia	−20.021***	1.310***	−16.589***	1.187***	−24.717***	1.309***	−18.419***	1.135***	−9.784**	1.289***	−18.822***	1.128***
CSP cou. av.	0.175***		0.135*		0.162**		0.164**		0.094		0.061	
Regulatory framework	0.222**		0.184*		0.268***		0.102		0.076		0.264***	
Anti self-dealing	19.017***		16.106**		21.584***		21.752***		−1.174		15.588**	
Corruption	−1.814**		−2.048**		−1.735**		−2.215**		−1.262		−1.536	
Political orientation	−0.101***		−0.115***		−0.092***		−0.156***		−0.048		−0.108***	
Union density	0.038		0.033		0.041		0.008		0.028		0.074	
Skilled labor	0.018		−0.962		0.542		−3.287*		−0.267		−1.383	
Power distance	0.078		0.028		0.127		−0.013		0.029		0.063	
Individualism	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Interest coverage A	−0.707*	0.379***	−0.898**	0.389***	−0.501	0.367***	−1.057**	0.390***	−0.116	0.355***	−1.097**	0.390***
Interest coverage B	0.383	0.029	0.535	0.019	0.236	0.039	0.293	0.030	0.876*	−0.020	0.137	0.038
Interest coverage C	−0.126	0.055***	−0.040	0.051***	−0.214	0.058***	−0.063	0.051***	0.283	0.030	−0.072	0.052***
Interest coverage D	0.056*	0.000	0.032	0.001	0.082**	0.000	0.031	0.001	0.021	0.001	0.024	0.001
Operating margin	−0.456***	0.024**	−0.491***	0.028***	−0.427***	0.018*	−0.352***	0.020**	−0.651***	0.054***	−0.370***	0.020**
Total debt	0.128***	−0.023***	0.159***	−0.025***	0.098***	−0.021***	0.149***	−0.024***	0.184***	−0.031***	0.110***	−0.023***
Size	0.915***	0.059***	0.905***	0.056***	0.931***	0.066***	0.918***	0.061***	0.676***	0.048***	0.877***	0.063***
Beta	0.624	−0.004	0.995	−0.026	0.284	0.017	1.291	−0.029	1.010	−0.066	0.523	0.000
Idiosyncratic risk	0.371	−0.032	0.271	−0.028	0.471	−0.033	0.171	−0.022	0.350	−0.041	0.188	−0.024
Dividend payer	7.836***	1.213***	9.302***	1.118***	6.311***	1.341***	8.083***	1.209***	7.535***	1.022***	8.870***	1.196***
Market/book	−0.166	0.079***	−0.148	0.081***	−0.201	0.076***	0.018	0.074***	−0.582*	0.120***	−0.026	0.074***
Retained earnings	9.258***	1.529***	7.910**	1.583***	10.841***	1.528***	8.572***	1.627***	6.259*	1.451***	7.445**	1.624***
Capital expenditure	−0.375	−0.044*	−0.366	−0.043*	−0.405*	−0.046*	−0.371	−0.044*	−0.098	−0.053**	−0.348	−0.045*
Cash holdings	9.519*	−1.415**	14.188**	−1.608**	5.020	−1.227*	17.673***	−1.626**	7.906	−1.530**	11.881*	−1.463**
Tangibility	15.816***	0.434	20.065***	0.168	11.827***	0.738	26.417***	0.014	4.645	0.787**	18.477***	0.364
R&D	97.620***	−0.706	123.231***	−2.291	72.413***	1.079	92.413***	−0.504	178.260***	−9.441***	90.222***	−0.260
GDP growth	−173.837***	0.774***	−193.196***	3.549***	−157.392***	−3.022***	−148.760***	1.134***	−189.804***	9.472***	−134.427***	−0.769***
Time dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lower boundaries												
AAA|AA		17.025		17.023		17.015		16.876		17.723		17.217
AA|A		14.755		14.750		14.748		14.601		15.447		14.947
A|BBB		12.088		12.081		12.085		11.927		12.776		12.280
BBB|BB		8.489		8.476		8.490		8.320		9.173		8.680
BB|B		4.793		4.779		4.796		4.618		5.474		4.984
B|CCC		1.075		1.055		1.085		0.893		1.748		1.266
CCC|CC		−0.470		−0.492		−0.458		−0.656		0.199		−0.281
CC|D		−0.816		−0.839		−0.805		−1.003		−0.147		−0.627
Weak instruments	0.000		0.000		0.000		0.000		0.100		0.000	
R^2	0.505	0.364	0.478	0.365	0.457	0.364	0.476	0.365	0.386	0.365	0.401	0.364
N	7032		7032		7032		7032		7032		7032	

Table continues on next page.

TABLE 3.9 continued

	Prod. resp.		Comm.		Hum. rights		Diversity		Employm.		Health		Training	
Stage	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
Dependent Variable	Prod. resp.	Cr. Rat.	Comm.	Cr. Rat.	Hum. rights	Cr. Rat.	Diversity	Cr. Rat.	Employm.	Cr. Rat.	Health	Cr. Rat.	Training	Cr. Rat.
Coefficients														
$\widehat{CSP}$		0.015		0.020		0.016		0.046***		−0.017		0.033*		0.011
Intercept	28.154*		−30.982**		−10.844		13.486		−76.749***		−2.778		−17.999	
Dummy North Am.	−14.028***	−0.067	−3.537*	−0.143	−12.531***	−0.013	−10.763***	0.380	−9.913***	−0.581*	−12.081***	0.316	−23.028***	−0.001
Dummy Asia	−28.248***	0.910***	−14.870***	0.852***	−23.288***	0.996**	−24.244***	1.369***	−18.272***	0.326	−23.882***	1.323***	−23.953***	0.903**
CSP cou. av.	−0.083		0.099		0.151**		0.114*		0.184***		0.062		−0.020	
Regulatory framework	0.524***		0.262***		0.502***		0.194		0.164		−0.124		0.192**	
Anti self-dealing	−6.102		38.338***		3.995		13.312**		21.630***		20.287***		13.702*	
Corruption	−2.591**		−1.053		−2.573*		−0.647		−0.995		−0.140		−1.126	
Political orientation	0.000		−0.153***		−0.003		−0.093**		−0.065*		−0.102***		−0.063*	
Union density	0.124		−0.097		0.207**		−0.064		0.024		0.020		0.029	
Skilled labor	−0.457		0.604		0.772		−5.429**		6.132***		−1.235		2.033	
Power distance	0.464***		−0.097		0.113		0.016		0.085		0.187		0.196**	
Individualism	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Interest coverage A	0.241	0.347***	−0.323	0.359***	−0.504	0.358***	−0.826**	0.386***	−0.293	0.347***	−0.271	0.363***	−1.085**	0.365***
Interest coverage B	0.219	0.043	0.260	0.042	0.687	0.034	0.700*	0.008	−0.528	0.034	−0.282	0.056	0.367	0.043
Interest coverage C	−0.061	0.052***	−0.321	0.057***	−0.271	0.054***	−0.372*	0.064***	−0.127	0.047**	0.038	0.051***	0.052	0.050***
Interest coverage D	0.007	0.002	0.058*	0.001	0.043	0.002	0.099***	−0.002	0.089**	0.004	0.082*	0.000	0.046	0.002
Operating margin	−0.407***	0.012	−0.340***	0.011	−0.497***	0.014	−0.276***	0.021**	−0.128*	0.005	−0.251***	0.012	−0.386***	0.009
Total debt	−0.015	−0.018***	0.057	−0.019***	0.098**	−0.020***	0.111***	−0.025***	0.040	−0.018***	0.117***	−0.022***	0.104***	−0.019***
Size	0.352***	0.090***	0.777***	0.080***	0.666***	0.084***	0.877***	0.055***	0.756***	0.107***	0.676***	0.073***	0.823***	0.086***
Beta	0.106	0.022	0.528	0.021	−1.036	0.043	0.744	−0.009	2.051*	0.063	0.967	−0.005	−0.126	0.028
Idiosyncratic risk	−0.110	−0.019	0.170	−0.023	0.585	−0.029	0.317	−0.028	−0.207	−0.025	0.598	−0.040	0.482	−0.027
Dividend payer	2.765*	1.522***	7.476***	1.387***	7.618***	1.438***	4.378***	1.335***	3.084**	1.626***	6.305***	1.337***	1.996	1.538***
Market/book	0.518*	0.064**	0.093	0.066**	−0.507	0.078***	−0.126	0.085***	−0.170	0.068**	−0.342	0.079***	−0.334	0.073***
Retained earnings	7.716**	1.699***	9.854***	1.656***	15.001***	1.570***	7.068**	1.580***	11.719***	1.974***	3.074	1.773***	10.796***	1.689***
Capital expenditure	−0.127	−0.059**	−0.330	−0.051**	−0.106	−0.057**	−0.794***	−0.024	−0.215	−0.063**	−0.290	−0.049**	−0.306	−0.056**
Cash holdings	−6.625	−0.981	6.190	−1.196*	8.323	−1.171*	6.941	−1.248**	−0.365	−1.032	7.966	−1.385**	5.798	−1.163*
Tangibility	−1.240	1.210***	10.940**	0.877**	−4.934	1.231***	11.267**	0.564	11.018***	1.383***	17.985***	0.545	11.297**	1.044**
R&D	65.165**	2.379	26.905	2.809	86.311***	1.780	72.942***	−0.422	26.741	3.517	80.501***	0.918	28.129	3.074
GDP growth	−56.132	−7.453***	−149.072***	−6.073***	−35.191	−7.954***	−167.035***	7.052***	−187.798***	−11.729***	−98.888**	−7.766***	−72.218*	−9.344***
Time dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Lower boundaries														
AAA|AA		17.776		16.923		17.496		16.948		17.285		17.352		17.172
AA|A		15.511		14.656		15.231		14.673		15.018		15.087		14.907
A|BBB		12.850		11.991		12.569		11.998		12.353		12.424		12.245
BBB|BB		9.260		8.401		8.982		8.393		8.768		8.830		8.659
BB|B		5.565		4.708		5.288		4.683		5.067		5.137		4.966
B|CCC		1.859		1.000		1.582		0.953		1.363		1.432		1.264
CCC|CC		0.314		−0.542		0.037		−0.604		−0.184		−0.107		−0.278
CC|D		−0.032		−0.888		−0.310		−0.952		−0.532		−0.454		−0.624
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.002		0.001	
R^2	0.238	0.363	0.285	0.363	0.324	0.363	0.370	0.365	0.309	0.363	0.329	0.363	0.359	0.363
N	7032		7032		7032		7032		7032		7032		7032	

This table displays the estimation results of both stages of the instrumental variable approach for each CSP impact score. Coefficients of all variables are displayed including the significance level marked by asterisks. They are considered significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. The lower boundaries of the rating categories according to Sec. 3.4 are also displayed.

diversity, while the latter is more important in terms of significance. A considerable number of empirical studies identifies a positive relationship between gender diversity in the boardroom and firm performance for North America (Carter et al., 2003; Erhardt et al., 2003; Miller and del Carmen Triana, 2009) and European countries (Campbell and Mínguez-Vera, 2008; Reguera-Alvarado et al., 2017; Lückerath-Rovers, 2013). A similarly positive relationship can be formulated between gender diversity in management and firm performance if moderated by a firm's strategic orientation and the organizational culture (Dwyer et al., 2003). Contrasting views (e.g., Adams and Ferreira, 2009; Marinova et al., 2016) exist but are less widespread. Possible explanations include the conjecture that diversity may help in decision processes by introducing other perspectives and information and additionally a different assessment of risk (Gul et al., 2011). Moreover, a diverse mindset within firms helps to catch up with business and society trends of the customer base and attract talented personnel (Li and Chen, 2018).

3.5.2 The region matters

Tables 3.10 to 3.12 show the second stage results for separate estimations on the panels of North America, Europe, and Asia.[3] When focusing on North America, we find all dimensions (*emission*, *environmental innovation*, *resources*, *product responsibility*, *community*, *human rights*, *diversity*, *employment quality*, *health*, and *training*) to be positively significant. Concerning Europe, we find the dimensions *environmental innovation* and *diversity* to be significantly positively related to credit ratings. The measures *community* and *training* are weakly significant on a 10% level and the first reveals a negative sign. Coefficients in the Asia subsample are significant in the dimensions of *emission*, *environmental innovation*, and *resources*. Among the social categories, no dimension is significant. Except for the *community* category in Europe, all significant CSP coefficients show positive signs indicating the positive link between the referring CSP scores and credit ratings. Our results once more generally support the risk mitigation view.

As the link function in our model limits the interpretability of the CSP impact, marginal effects (at means of the controls) according to Greene (2011) are calculated. In the Tables 3.16 to 3.18 one can observe the practical implications of our results. Predominantly, we see increases of the probability to obtain a better rating class if the CSP score is significant and is increased by 1% point (ceteris paribus). At the same time, the probability to obtain a worse rating class decreases. For example, the probability of an actual BBB rated North American counterparty to upgrade to an A rating increases by 0.43% points if the overall CSP score increases by 1% point under otherwise identical circumstances, while the probability of a downgrade to BBB decreases by 0.48%.

[3] Referring first stage estimation results are presented in Tables 3.13 to 3.15.

TABLE 3.10: Second stage regression results for panel North America

	Ov. CSP	Environm.	Social	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employm.	Health	Training
Coefficients													
$\widehat{CSP}$	0.039**	0.036**	0.042**	0.030**	0.079***	0.037**	0.076**	0.034**	0.088***	0.067**	0.044**	0.050**	0.063**
CSR country average	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Interest coverage A	0.362***	0.364***	0.359***	0.357***	0.327***	0.378***	0.308***	0.337***	0.359***	0.404***	0.351***	0.342***	0.418***
Interest coverage B	−0.002	−0.007	0.004	0.003	−0.039	0.006	−0.040	0.006	−0.031	−0.027	0.037	0.060	−0.011
Interest coverage C	0.070***	0.062***	0.078***	0.066***	0.024	0.065***	0.086***	0.076***	0.073***	0.102***	0.075***	0.050**	0.068***
Interest coverage D	−0.002	−0.001	−0.004	−0.002	0.000	−0.001	−0.001	−0.002	−0.002	−0.008	−0.004	−0.002	−0.004
Operating margin	0.030**	0.029**	0.030**	0.023**	0.057***	0.026**	0.043**	0.024**	0.053***	0.026**	0.017*	0.026**	0.041**
Total debt	−0.024***	−0.025***	−0.023***	−0.024***	−0.035***	−0.023***	−0.022***	−0.021***	−0.029***	−0.027***	−0.020***	−0.024***	−0.025***
Size	0.054***	0.057***	0.051**	0.062***	0.043***	0.056***	0.061***	0.064***	0.034**	0.034	0.057***	0.056***	0.036
Beta	0.023	0.005	0.042	0.007	−0.047	0.014	0.111	0.031	0.097	−0.010	−0.019	0.005	0.047
Idiosyncratic risk	0.055	0.065	0.045	0.070	0.054	0.061	0.086	0.066	0.038	0.026	0.070	0.021	0.036
Dividend payer	1.259***	1.228***	1.300***	1.317***	0.929***	1.247***	1.349***	1.333***	0.825***	1.211***	1.473***	1.224***	1.474***
Market/book	0.075**	0.074**	0.078**	0.068**	0.098***	0.073**	0.074**	0.065**	0.132***	0.059*	0.073**	0.081***	0.082***
Retained earnings	1.627***	1.726***	1.511***	1.788***	1.493***	1.710***	1.458***	1.639***	0.820**	1.446***	1.407***	1.848***	1.185**
Capital expenditure	−0.043	−0.044	−0.042	−0.044	−0.056*	−0.044	−0.064**	−0.046	−0.079**	0.000	−0.056*	−0.044	−0.019
Cash holdings	−1.446*	−1.586**	−1.292*	−1.744**	−1.682**	−1.485*	−0.557	−1.196	−1.845**	−1.670**	−1.224*	−1.600**	−1.433*
Tangibility	−0.012	−0.148	0.151	−0.238	0.315	−0.125	1.218**	0.195	1.089**	−0.017	0.258	−0.243	−0.440
R&D	−2.842	−3.321	−2.263	−1.612	−10.330***	−2.658	−4.475	−0.286	−7.665***	−3.477	−0.662	−2.584	−1.125
Time dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lower boundaries													
AAA|AA	15.346	15.386	15.301	15.306	15.762	15.713	18.829	15.767	17.252	14.784	14.927	15.961	15.390
AA|A	13.815	13.855	13.770	13.774	14.231	14.182	17.298	14.236	15.721	13.253	13.396	14.430	13.858
A|BBB	11.060	11.100	11.015	11.020	11.476	11.428	14.544	11.481	12.966	10.498	10.642	11.675	11.104
BBB|BB	7.499	7.539	7.454	7.458	7.915	7.866	10.982	7.920	9.405	6.937	7.080	8.114	7.542
BB|B	3.682	3.721	3.637	3.641	4.097	4.049	7.165	4.103	5.588	3.119	3.263	4.296	3.725
B|CCC	−0.465	−0.426	−0.510	−0.506	−0.050	−0.098	3.018	−0.044	1.440	−1.028	−0.884	0.149	−0.422
CCC|CC	−2.333	−2.293	−2.378	−2.374	−1.918	−1.966	1.150	−1.912	−0.427	−2.896	−2.752	−1.719	−2.290
CC|D	−2.636	−2.596	−2.681	−2.678	−2.221	−2.269	0.847	−2.215	−0.730	−3.199	−3.055	−2.022	−2.593
Weak instruments	0.000	0.000	0.000	0.000	0.060	0.000	0.003	0.000	0.115	0.008	0.000	0.000	0.021
R^2	0.370	0.370	0.370	0.370	0.370	0.370	0.370	0.370	0.370	0.370	0.370	0.370	0.370
N	4709	4709	4709	4709	4709	4709	4709	4709	4709	4709	4709	4709	4709

This table displays the estimation results of the second stage of the instrumental variable approach for each CSP impact score in the North America sample. Coefficients of all variables are displayed including the significance level marked by asterisks. They are regarded as being significant on the level of 1% (***), 5% (**) or 10% (*) when the *p*-value is below these levels. The lower boundaries of the rating categories according to Sec. 3.4 are also displayed.

TABLE 3.11: Second stage regression results for panel Europe

	Ov. CSP	Environm.	Social	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employm.	Health	Training
Coefficients													
$\widehat{CSP}$	0.059	0.078**	0.017	0.042	0.061***	0.020	0.016	−0.040*	−0.041	0.078***	−0.001	0.004	0.067*
Interest coverage A	0.422***	0.424***	0.423***	0.446***	0.417***	0.419***	0.412***	0.426***	0.398***	0.424***	0.424***	0.423***	0.453***
Interest coverage B	0.152**	0.123	0.163**	0.145*	0.098	0.164**	0.186**	0.157**	0.160**	0.116	0.160**	0.160**	0.147*
Interest coverage C	0.048	0.042	0.054	0.051	0.032	0.049	0.051	0.043	0.059	0.059	0.055	0.054	0.027
Interest coverage D	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.004	0.004	0.001	0.001	0.003
Operating margin	0.027	0.046**	0.009	0.020	0.058***	0.011	0.011	−0.002	−0.012	0.029*	0.004	0.004	0.012
Total debt	−0.014*	−0.013*	−0.016**	−0.015*	−0.016**	−0.016**	−0.015**	−0.021***	−0.024***	−0.018**	−0.017**	−0.017**	−0.014*
Size	0.071**	0.060**	0.096***	0.082***	0.059***	0.096***	0.099***	0.121***	0.130***	0.051**	0.105***	0.103***	0.078***
Beta	−0.117	−0.165	−0.078	−0.129	−0.194	−0.076	−0.082	−0.087	−0.151	−0.110	−0.067	−0.068	−0.124
Idiosyncratic risk	−0.241**	−0.269**	−0.235**	−0.252**	−0.274***	−0.239**	−0.237**	−0.254**	−0.202*	−0.169	−0.242**	−0.238**	−0.257**
Dividend payer	1.210***	1.166***	1.257***	1.262***	1.307***	1.248***	1.311***	1.550***	1.351***	1.142***	1.282***	1.289***	1.285***
Market/book	0.134***	0.139***	0.142***	0.130**	0.189***	0.144***	0.123**	0.188***	0.170***	0.162***	0.148***	0.150***	0.182***
Retained earnings	0.861	0.928	0.779	0.633	1.023	0.836	0.813	0.731	1.165	1.064	0.758	0.772	0.894
Capital expenditure	0.017	0.022	0.009	0.006	0.053	0.003	0.006	−0.013	−0.026	0.062	0.004	0.004	−0.007
Cash holdings	0.368	−0.128	1.148	0.954	0.164	1.020	1.389	2.821*	2.460	0.669	1.432	1.385	0.398
Tangibility	−0.515	−0.992	−0.078	−0.602	−0.638	−0.045	0.068	0.175	−0.095	−1.092	0.055	0.025	0.421
R&D	7.146	2.931	10.006	7.294	−6.141***	9.821	10.557	8.425	11.190	5.074	10.183	9.764	10.710
GDP growth	10.269***	15.221***	3.043***	5.682***	12.380***	4.282***	3.332***	−1.434***	−1.934***	17.233***	0.780	1.244*	9.929***
Time dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lower boundaries													
AAA|AA	22.226	22.892	20.788	21.769	21.081	21.030	21.069	19.281	18.458	21.235	20.210	20.329	23.701
AA|A	19.367	20.027	17.943	18.922	18.212	18.189	18.220	16.442	15.624	18.378	17.373	17.490	20.843
A|BBB	16.131	16.789	14.708	15.693	14.951	14.955	14.980	13.203	12.375	15.102	14.138	14.256	17.596
BBB|BB	11.793	12.432	10.383	11.356	10.559	10.630	10.649	8.852	8.041	10.714	9.813	9.930	13.247
BB|B	8.289	8.912	6.884	7.849	7.017	7.125	7.141	5.315	4.537	7.213	6.311	6.428	9.747
B|CCC	4.876	5.474	3.488	4.448	3.535	3.727	3.736	1.889	1.123	3.740	2.916	3.035	6.279
CCC|CC	3.585	4.186	2.192	3.159	2.234	2.433	2.436	0.591	−0.193	2.389	1.619	1.740	4.960
CC|D	2.982	3.587	1.585	2.554	1.636	1.827	1.832	−0.011	−0.804	1.772	1.012	1.133	4.355
Weak instruments	0.160	0.310	0.112	0.360	0.009	0.140	0.000	0.002	0.090	0.037	0.422	0.004	0.000
R^2	0.392	0.394	0.392	0.392	0.398	0.392	0.392	0.394	0.393	0.397	0.391	0.391	0.394
N	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500

This table displays the estimation results of the second stage of the instrumental variable approach for each CSP impact score in the Europe sample. Coefficients of all variables are displayed including the significance level marked by asterisks. They are regarded as being significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. The lower boundaries of the rating categories according to Sec. 3.4 are also displayed.

TABLE 3.12: Second stage regression results for panel Asia

	Ov. CSP	Environm.	Social	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employm.	Health	Training
Coefficients													
$\widehat{CSP}$	0.028	0.024*	0.025	0.017	0.065***	0.019	0.020	0.014	0.016	0.024	−0.011	0.018	−0.010
CSR country average													
Interest coverage A	0.369**	0.385***	0.361**	0.386***	0.312**	0.406***	0.374**	0.398***	0.423***	0.376**	0.411***	0.379**	0.427***
Interest coverage B	−0.032	−0.026	−0.026	0.000	−0.086	−0.016	−0.012	−0.003	−0.021	−0.011	0.034	−0.010	0.042
Interest coverage C	0.049	0.053	0.043	0.045	0.078**	0.047	0.041	0.044	0.050	0.038	0.042	0.058	0.038
Interest coverage D	−0.004	−0.003	−0.004	−0.002	−0.004	−0.003	0.000	−0.002	−0.004	−0.007	−0.001	−0.006	0.000
Operating margin	0.004	0.002	0.005	0.000	0.024	0.001	0.007	0.000	0.007	0.011	0.003	0.004	0.001
Total debt	−0.056***	−0.057***	−0.054***	−0.054***	−0.061***	−0.056***	−0.046***	−0.051***	−0.053***	−0.057***	−0.051***	−0.050***	−0.046***
Size	0.117***	0.121***	0.117***	0.129***	0.090***	0.125***	0.140***	0.130***	0.130***	0.115***	0.149***	0.130***	0.150***
Beta	0.029	0.021	0.046	0.032	−0.025	0.052	−0.026	0.056	0.106	0.068	0.137	0.051	0.049
Idiosyncratic risk	−0.135	−0.117	−0.148	−0.109	−0.185	−0.104	−0.122	−0.128	−0.115	−0.098	−0.090	−0.126	−0.080
Dividend payer	2.500*	2.502*	2.503*	2.611*	2.404	2.465*	2.648*	2.511*	2.303	2.679*	2.542*	2.337	2.507*
Market/book	−0.677***	−0.671***	−0.702***	−0.679***	−0.533***	−0.724***	−0.781***	−0.711***	−0.740***	−0.662***	−0.773***	−0.762***	−0.785***
Retained earnings	3.312**	3.182**	3.370**	2.948**	4.203***	3.144**	3.194**	3.151**	3.101**	3.186**	2.688	3.146**	2.836**
Capital expenditure	−0.160***	−0.159***	−0.159***	−0.157***	−0.198***	−0.152***	−0.155***	−0.159***	−0.145**	−0.151***	−0.156**	−0.150**	−0.140**
Cash holdings	−2.717	−2.991	−2.385	−2.727	−3.492*	−2.799	−2.087	−2.672	−2.200	−2.284	−2.764	−2.636	−2.469
Tangibility	4.848***	4.801***	4.895***	4.718***	5.445***	4.776***	4.526***	4.944***	5.002***	4.712***	4.682***	4.276***	4.751***
R&D	−1.791***	−2.175***	−0.146	0.433***	−17.725***	−0.204	−0.292	3.302	1.262	−0.888	4.612	2.896	5.215
GDP growth	−30.499***	−26.679***	−35.914***	−29.986***	−2.610***	−32.930***	−35.913***	−37.023***	−33.464***	−31.486***	−36.219***	−37.608***	−36.836***
Time dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lower boundaries													
AAA|AA	19.942	20.435	19.579	20.682	20.521	20.317	21.392	20.343	20.405	19.543	20.773	20.070	21.061
AA|A	15.078	15.573	14.714	15.821	15.628	15.460	16.514	15.485	15.541	14.681	15.919	15.211	16.202
A|BBB	11.904	12.401	11.537	12.649	12.425	12.290	13.331	12.312	12.366	11.509	12.747	12.032	13.025
BBB|BB	7.955	8.455	7.591	8.702	8.486	8.347	9.382	8.369	8.427	7.529	8.810	8.099	9.098
BB|B	4.280	4.784	3.926	5.029	4.831	4.685	5.725	4.713	4.768	3.816	5.169	4.463	5.466
B|CCC	1.218	1.709	0.894	1.960	1.779	1.607	2.767	1.668	1.690	0.721	2.087	1.444	2.389
CCC|CC	−0.861	−0.380	−1.166	−0.125	−0.264	−0.481	0.698	−0.394	−0.397	−1.387	0.012	−0.594	0.326
CC|D	−0.862	−0.380	−1.166	−0.126	−0.264	−0.481	0.698	−0.396	−0.398	−1.387	0.012	−0.596	0.326
Weak instruments	0.001	0.002	0.006	0.000	0.124	0.006	0.000	0.000	0.000	0.000	0.130	0.006	0.080
R^2	0.407	0.407	0.407	0.407	0.409	0.407	0.408	0.407	0.407	0.409	0.406	0.406	0.406
N	823	823	823	823	823	823	823	823	823	823	823	823	823

This table displays the estimation results of the second stage of the instrumental variable approach for each CSP impact score in the Asia sample. Coefficients of all variables are displayed including the significance level marked by asterisks. They are regarded as being significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. The lower boundaries of the rating categories according to Sec. 3.4 are also displayed.

TABLE 3.13: First stage regression results for panel North America

	Ov. CSP	Environm.	Social	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employm.	Health	Training
Coefficients													
Intercept	−23.276***	−23.946***	−22.884***	−31.443***	−6.299	−14.551**	33.676***	−14.295**	11.335	−21.880***	−30.079***	−5.951	−13.753**
Political orientation	−0.149***	−0.160***	−0.139***	−0.192***	−0.074*	−0.156***	−0.076***	−0.170***	−0.066	−0.086***	−0.132***	−0.117***	−0.092**
Interest coverage A	−0.939**	−1.060*	−0.804*	−1.032*	−0.015	−1.410**	0.226	−0.333	−0.382	−1.163**	−0.574	−0.332	−1.467***
Interest coverage B	0.147	0.297	−0.009	0.032	0.550	−0.051	0.567	−0.067	0.397	0.458	−0.741	−1.118**	0.239
Interest coverage C	−0.104	0.096	−0.298	−0.011	0.524*	0.011	−0.274	−0.299	−0.080	−0.543*	−0.205	0.304	−0.038
Interest coverage D	0.041	0.007	0.074*	0.024	−0.010	0.001	0.005	0.045	0.019	0.105**	0.074	0.030	0.055
Operating margin	−0.504***	−0.535***	−0.482***	−0.429***	−0.600***	−0.436***	−0.435***	−0.403***	−0.497***	−0.244**	−0.167*	−0.317***	−0.501***
Total debt	0.152***	0.187***	0.118***	0.189***	0.217***	0.126***	0.053	0.093**	0.123**	0.129***	0.052	0.132***	0.106**
Size	1.028***	1.016***	1.046***	1.056***	0.648***	1.014***	0.435***	0.894***	0.684***	0.901***	0.842***	0.759***	0.930***
Beta	0.379	0.891	−0.107	1.031	1.080	0.645	−0.959	0.208	−0.671	0.715	1.284	0.667	−0.148
Idiosyncratic risk	0.515	0.299	0.730	0.170	0.274	0.401	−0.140	0.269	0.427	0.742	0.131	1.096*	0.618
Dividend payer	8.395***	9.890***	6.879***	8.944***	8.380***	9.117***	3.119*	7.424***	8.681***	5.589***	2.592	7.303***	1.794
Market/book	−0.213	−0.182	−0.261	−0.014	−0.390	−0.167	−0.084	0.053	−0.743**	0.114	−0.136	−0.289	−0.245
Retained earnings	10.940***	9.047**	13.040***	8.833**	7.150*	9.240***	7.817**	12.166***	14.068***	9.052***	14.667***	4.165	13.804***
Capital expenditure	−0.616**	−0.638*	−0.608**	−0.758**	−0.136	−0.622*	−0.043	−0.608**	0.135	−0.990***	−0.258	−0.462	−0.760**
Cash holdings	7.950	12.379	3.756	20.125**	6.950	9.362	−7.573	1.762	8.084	7.941	2.007	9.341	4.713
Tangibility	19.869***	25.111***	14.714***	33.177***	5.731	23.839***	−5.916	16.676***	−3.682	11.623**	11.499**	20.277***	19.110***
R&D	98.526***	119.169***	78.435**	86.700**	144.280***	98.253***	71.776**	37.902	98.805***	66.691**	37.881	72.300**	33.874
GDP growth	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Time dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Weak instruments	0.000	0.000	0.000	0.000	0.060	0.000	0.003	0.000	0.115	0.008	0.000	0.000	0.021
R^2	0.448	0.413	0.410	0.418	0.314	0.352	0.214	0.310	0.280	0.308	0.274	0.322	0.262
N	4709	4709	4709	4709	4709	4709	4709	4709	4709	4709	4709	4709	4709

This table displays the estimation results of the first stage of the instrumental variable approach for each CSP impact score in the North America panel. The second stage is reported in section 3.5.2. Coefficients of all variables are displayed including the significance level marked by asterisks. They are regarded as being significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. The lower boundaries of the rating categories according to Sec. 3.4 are also displayed.

TABLE 3.14: First stage regression results for panel Europe

	Ov. CSP	Environm.	Social	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employm.	Health	Training
Coefficients													
Intercept	19.575	12.715	31.175	42.046*	−53.920	42.661**	120.410***	9.519	10.485	46.773	8.995	42.035	41.664**
CSR country average	−0.053	−0.117	−0.031	−0.143*	−0.166*	−0.132	−0.187**	−0.280***	−0.063	−0.191**	−0.110	−0.195**	−0.138*
Regulatory framework	0.057	0.117	0.004	−0.069	0.517	0.002	−0.197	0.233	0.100	0.316	0.109	−0.658***	0.468***
Anti self-dealing	1.752	−3.001	5.821	2.961	−21.102**	−0.344	−12.878*	28.803***	9.843	−4.246	3.634	14.768**	−7.000*
Corruption	−0.149	−1.054	0.548	−0.067	−4.914	1.128	4.521**	−0.342	0.588	−2.581	1.123	4.306*	−3.502*
Union density	0.048	0.094	−0.004	0.046	0.238*	0.074	0.018	−0.113	0.184*	−0.048	−0.051	−0.115	0.072
Skilled labor	1.444	2.262	0.561	1.097	3.611	0.595	−5.470*	6.015**	3.511	−5.276	0.530	2.716	−0.434
Power distance	0.176**	0.202**	0.151*	0.144*	0.342**	0.145*	0.354***	−0.060	0.201*	0.124	0.063	0.169	0.191***
Individualism	−0.037	0.040	−0.112	−0.112	0.466***	−0.089	−0.424***	−0.203	−0.114	0.107	−0.062	−0.294***	0.155*
Interest coverage A	−0.062	−0.143	0.026	−0.527	−0.163	0.027	0.147	0.282	−0.780	0.150	0.719	0.345	−0.594
Interest coverage B	0.194	0.559	−0.085	0.406	1.163	−0.112	−1.585**	−0.020	0.004	0.594	−0.170	0.222	0.280
Interest coverage C	0.184	0.236	0.106	0.137	0.499	0.353	0.366	−0.292	0.138	−0.022	−0.363	0.476	0.448*
Interest coverage D	0.009	0.005	0.015	0.023	−0.008	−0.034	0.014	0.024	0.099	−0.054	0.140***	−0.070	−0.029
Operating margin	−0.401***	−0.540***	−0.280***	−0.402***	−0.840***	−0.307***	−0.335**	−0.273**	−0.456***	−0.325**	−0.104	−0.122	−0.082
Total debt	−0.051	−0.026	−0.076	−0.042	0.023	−0.052	−0.129	−0.123*	−0.135	−0.018	−0.024	0.023	−0.059
Size	0.573***	0.590***	0.547***	0.547***	0.767***	0.488***	0.365***	0.378***	0.661***	0.662***	0.419***	0.470***	0.395***
Beta	0.775	1.025	0.650	1.346	1.404	0.337	−0.676	0.946	−1.490	0.655	3.248	0.048	0.801
Idiosyncratic risk	−0.031	0.328	−0.402	0.204	0.594	−0.182	−0.475	−0.323	0.971	−1.064	−1.070	−0.888	0.107
Dividend payer	1.731	2.337	1.545	0.814	1.189	2.225	−0.020	5.854*	1.757	1.525	3.976	−2.057	0.501
Market/book	0.346	0.233	0.446	0.434	−0.381	0.339	2.520***	0.550	0.351	0.069	0.180	−0.482	−0.186
Retained earnings	0.624	0.332	1.395	5.376	−0.640	−2.360	1.714	−1.499	10.031	−0.301	−3.531	1.753	0.470
Capital expenditure	−0.364	−0.340	−0.481	−0.124	−0.956*	−0.049	−0.780*	−0.353	−0.723	−1.091*	−0.005	−0.315	−0.062
Cash holdings	17.807**	19.916**	16.727**	10.230	23.633	22.209**	5.940	31.671**	25.870*	14.190	−10.724	6.013	18.768**
Tangibility	10.794*	14.678*	8.269	15.806*	14.830	5.449	6.368	−0.848	−4.501	17.815*	21.325***	3.854	−2.880
R&D	59.895*	97.150***	26.059	71.754*	273.861***	14.775	−14.689	−13.985	9.589	88.379	−6.061	135.060**	3.622
GDP growth	−98.903**	−136.019***	−62.564	−99.273*	−131.479	−101.008*	69.976	−35.386	15.482	−224.664***	−113.689	−50.685	−93.949*
Time dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Weak instruments	0.160	0.310	0.112	0.360	0.009	0.140	0.000	0.002	0.090	0.037	0.422	0.004	0.000
R^2	0.437	0.429	0.361	0.365	0.406	0.303	0.251	0.196	0.293	0.339	0.231	0.259	0.280
N	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500

This table displays the estimation results of the first stage of the instrumental variable approach for each CSP impact score in the Europe panel. The second stage is reported in section 3.5.2. Coefficients of all variables are displayed including the significance level marked by asterisks. They are regarded as being significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. The lower boundaries of the rating categories according to Sec. 3.4 are also displayed.

TABLE 3.15: First stage regression results for panel Asia

	Ov. CSP	Environm.	Social	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employm.	Health	Training
Coefficients													
Intercept	−18.853	−6.364	−27.039	9.217	−0.749	−18.994	82.363***	3.641	−13.335	−39.581	9.310	−20.580	1.438
CSR country average	0.040	0.010	−0.026	−0.014	0.163	−0.109	−0.633***	−0.223	0.057	0.190	0.027	−0.461***	−0.443***
Regulatory framework	0.272	0.369**	0.242	0.553***	−0.054	0.514***	0.745***	0.450***	0.452**	0.341	−0.364**	0.243	−0.044
Corruption	−0.900	−1.039	−0.751	−0.971	−1.973	0.490	−3.106**	1.797	−2.882*	0.772	−3.106*	3.623**	−0.458
Union density	−0.564	−0.362	−0.800**	−0.623*	−0.524	0.022	−1.287***	−1.029***	−0.422	−0.786	−0.581	−0.014	−0.731*
Interest coverage A	1.772	1.447	2.158	2.007	1.618	0.669	2.582*	0.893	−0.054	1.564	0.029	1.754	1.541
Interest coverage B	2.068**	1.955**	2.140**	1.395	1.878**	1.955**	1.769	2.254**	2.689**	1.435	0.742	2.177**	1.281
Interest coverage C	−0.271	−0.497	−0.032	−0.225	−0.585	−0.375	0.130	−0.088	−0.653	0.219	0.215	−0.931*	0.004
Interest coverage D	0.078	0.045	0.112*	0.016	0.034	0.063	−0.080	0.029	0.125	0.208***	0.051	0.268***	0.060
Operating margin	−0.129	−0.040	−0.228	0.113	−0.419*	0.069	−0.444**	0.004	−0.329	−0.356	0.082	−0.128	−0.013
Total debt	0.105	0.168	0.037	0.072	0.103	0.240**	−0.380**	−0.025	0.008	0.051	−0.132	0.063	0.254*
Size	0.875***	0.799***	0.962***	0.722***	0.790***	0.789***	0.094	0.822***	0.658***	1.064***	0.755***	0.595***	0.941***
Beta	1.748	2.275	1.340	2.663	1.756	1.063	5.401*	1.447	−1.727	0.000	6.283*	1.763	−2.317
Idiosyncratic risk	1.499	1.163	1.904	1.256	0.781	1.079	1.218	2.294	1.297	0.783	−0.031	1.432	2.092
Dividend payer	−1.065	−1.504	−0.845	−8.679	1.233	0.406	−9.946	−1.227	9.888	−9.322	2.910	10.512	−2.045
Market/book	−2.570	−3.531*	−1.756	−4.665**	−2.693	−2.435	0.900	−3.245	−1.106	−3.083	0.149	−0.626	−1.767
Retained earnings	−23.759*	−19.319	−28.457**	−14.975	−24.920*	−17.234	−26.391	−28.758*	−21.882	−26.177*	−21.655	−12.370	−11.858
Capital expenditure	0.021	0.112	−0.089	0.033	0.325	0.126	−0.295	0.256	−0.690	−0.309	−1.002	0.141	0.773
Cash holdings	13.454	25.022	1.694	20.470	22.328	16.636	−9.986	18.083	−9.972	−3.591	−17.905	5.800	9.632
Tangibility	3.896	4.037	4.003	10.750	−1.749	1.531	21.824	−1.906	−4.852	7.833	−10.331	31.452**	−13.154
R&D	189.006***	230.004***	151.300**	183.260***	322.650***	207.690***	193.795**	46.100	136.451	161.037**	32.543	95.522	81.380
GDP growth	−209.588**	−393.821***	−60.013	−408.751***	−395.080***	−249.452***	−102.799	−108.918	−142.871	−153.630	153.696	−128.524	45.023
Time dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Weak instruments	0.001	0.002	0.006	0.000	0.124	0.006	0.000	0.000	0.000	0.000	0.130	0.006	0.080
R^2	0.518	0.540	0.440	0.527	0.491	0.489	0.310	0.368	0.359	0.466	0.352	0.300	0.324
N	823	823	823	823	823	823	823	823	823	823	823	823	823

This table displays the estimation results of the first stage of the instrumental variable approach for each CSP impact score in the Asia panel. The second stage is reported in section 3.5.2. Coefficients of all variables are displayed including the significance level marked by asterisks. They are regarded as being significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. The lower boundaries of the rating categories according to Sec. 3.4 are also displayed.

TABLE 3.16: Marginal effects for panel North America

	predicted								
	AAA	AA	A	BBB	BB	B	CCC	CC	D
Overall CSP									
AAA	2.602***	4.980***	−2.559***	−4.826***	−0.192***	−0.004***	0.000	0.000***	0.000**
AA	1.507***	3.803***	1.977***	−6.928***	−0.351***	−0.008***	0.000	0.000***	0.000**
A	0.508***	1.633***	7.634***	−8.694***	−1.056***	−0.025***	0.000	0.000***	0.000**
BBB	0.087***	0.307***	4.288***	0.294	−4.825***	−0.148***	0.000	−0.002***	0.000**
BB	0.006***	0.020***	0.369***	7.242***	−5.527***	−2.071***	−0.002	−0.032***	−0.004**
B	0.000***	0.001***	0.021***	0.725***	9.006***	−9.092***	−0.027	−0.556***	−0.078**
CCC	0.000***	0.000***	0.003***	0.107***	3.841***	−0.140	−0.182	−3.096***	−0.533**
CC	0.000***	0.000***	0.003***	0.112***	3.992***	−0.445	−0.173	−2.982***	−0.507**
D	0.000***	0.000***	0.001***	0.033***	1.410***	6.503***	−0.507	−5.822***	−1.617**
Environment									
AAA	2.419***	4.630***	−2.379***	−4.487***	−0.178***	−0.004***	0.000	0.000***	0.000**
AA	1.401***	3.536***	1.838***	−6.441***	−0.326***	−0.007***	0.000	0.000***	0.000**
A	0.473***	1.518***	7.098***	−8.083***	−0.982***	−0.023***	0.000	0.000***	0.000**
BBB	0.080***	0.286***	3.986***	0.273	−4.486***	−0.137***	0.000	−0.002***	0.000**
BB	0.005***	0.019***	0.343***	6.733***	−5.139***	−1.926***	−0.001	−0.029***	−0.004**
B	0.000***	0.001***	0.019***	0.674***	8.373***	−8.453***	−0.025	−0.517***	−0.072**
CCC	0.000***	0.000***	0.003***	0.099***	3.571***	−0.130	−0.169	−2.878***	−0.496**
CC	0.000***	0.000***	0.003***	0.104***	3.711***	−0.413	−0.161	−2.772***	−0.472**
D	0.000***	0.000***	0.001***	0.031***	1.311***	6.046***	−0.471	−5.413***	−1.504**
Social									
AAA	2.778***	5.315***	−2.732***	−5.152***	−0.205***	−0.005***	0.000	0.000***	0.000**
AA	1.608***	4.060***	2.111***	−7.396***	−0.375***	−0.008***	0.000	0.000***	0.000**
A	0.543***	1.743***	8.149***	−9.281***	−1.127***	−0.026***	0.000	0.000***	0.000**
BBB	0.092***	0.328***	4.577***	0.314	−5.151***	−0.158***	0.000	−0.002***	0.000**
BB	0.006***	0.021***	0.394***	7.730***	−5.900***	−2.211***	−0.002	−0.034***	−0.005**
B	0.000***	0.001***	0.022***	0.774***	9.613***	−9.705***	−0.029	−0.593***	−0.083**
CCC	0.000***	0.000***	0.003***	0.114***	4.100***	−0.149	−0.194	−3.305***	−0.569**
CC	0.000***	0.000***	0.003***	0.120***	4.261***	−0.475	−0.185	−3.183***	−0.542**
D	0.000***	0.000***	0.001***	0.036***	1.505***	6.942***	−0.541	−6.215***	−1.727**
Emission									
AAA	2.013***	3.853***	−1.980***	−3.734***	−0.148***	−0.003***	0.000	0.000***	0.000**
AA	1.166***	2.943***	1.530***	−5.360***	−0.271***	−0.006***	0.000	0.000***	0.000**
A	0.393***	1.263***	5.907***	−6.727***	−0.817***	−0.019***	0.000	0.000***	0.000**
BBB	0.067***	0.238***	3.317***	0.227	−3.733***	−0.114***	0.000	−0.002***	0.000**
BB	0.004***	0.016***	0.285***	5.603***	−4.276***	−1.603***	−0.001	−0.024***	−0.003**
B	0.000***	0.001***	0.016***	0.561***	6.968***	−7.034***	−0.021	−0.430***	−0.060**
CCC	0.000***	0.000***	0.002***	0.083***	2.972***	−0.108	−0.141	−2.396***	−0.412**
CC	0.000***	0.000***	0.002***	0.087***	3.088***	−0.343	−0.134	−2.307***	−0.392**
D	0.000***	0.000***	0.001***	0.026***	1.091***	5.032***	−0.394	−4.505***	−1.251**
Environmental innovation									
AAA	5.230***	10.008***	−5.144***	−9.700***	−0.385***	−0.009***	0.000	0.000***	0.000**
AA	3.028***	7.644***	3.973***	−13.924***	−0.705***	−0.016***	0.000	0.000***	0.000**
A	1.022***	3.282***	15.344***	−17.474***	−2.122***	−0.050***	0.000	−0.001***	0.000**
BBB	0.174***	0.617***	8.617***	0.591	−9.698***	−0.297***	0.000	−0.004***	−0.001**
BB	0.011***	0.040***	0.741***	14.554***	−11.108***	−4.163***	−0.003	−0.064***	−0.009**
B	0.001***	0.002***	0.041***	1.457***	18.100***	−18.273***	−0.055	−1.117***	−0.156**
CCC	0.000***	0.000***	0.006***	0.215***	7.719***	−0.281	−0.365	−6.223***	−1.071**
CC	0.000***	0.000***	0.006***	0.226***	8.022***	−0.893	−0.348	−5.993***	−1.020**
D	0.000***	0.000***	0.002***	0.067***	2.833***	13.071***	−1.019	−11.703***	−3.250**
Resources									
AAA	2.484***	4.754***	−2.443***	−4.608***	−0.183***	−0.004***	0.000	0.000***	0.000**
AA	1.439***	3.631***	1.888***	−6.615***	−0.335***	−0.008***	0.000	0.000***	0.000**
A	0.485***	1.559***	7.289***	−8.301***	−1.008***	−0.024***	0.000	0.000***	0.000**
BBB	0.083***	0.293***	4.094***	0.281	−4.607***	−0.141***	0.000	−0.002***	0.000**
BB	0.005***	0.019***	0.352***	6.914***	−5.277***	−1.978***	−0.001	−0.030***	−0.004**
B	0.000***	0.001***	0.020***	0.692***	8.598***	−8.681***	−0.026	−0.531***	−0.074**
CCC	0.000***	0.000***	0.003***	0.102***	3.667***	−0.134	−0.174	−2.956***	−0.509**
CC	0.000***	0.000***	0.003***	0.107***	3.811***	−0.425	−0.166	−2.847***	−0.485**
D	0.000***	0.000***	0.001***	0.032***	1.346***	6.209***	−0.484	−5.559***	−1.544**
Product responsibility									
AAA	5.083***	9.727***	−5.000***	−9.428***	−0.374***	−0.008***	0.000	0.000***	0.000**
AA	2.944***	7.429***	3.862***	−13.534***	−0.685***	−0.015***	0.000	0.000***	0.000**
A	0.993***	3.190***	14.913***	−16.984***	−2.063***	−0.048***	0.000	−0.001***	0.000**
BBB	0.169***	0.600***	8.376***	0.573	−9.425***	−0.288***	0.000	−0.004***	−0.001**
BB	0.011***	0.039***	0.720***	14.146***	−10.797***	−4.046***	−0.003	−0.062***	−0.008**
B	0.001***	0.002***	0.040***	1.416***	17.592***	−17.761***	−0.054	−1.086***	−0.152**
CCC	0.000***	0.000***	0.006***	0.209***	7.504***	−0.275	−0.355	−6.047***	−1.041**
CC	0.000***	0.000***	0.006***	0.220***	7.797***	−0.869	−0.339	−5.824***	−0.991**
D	0.000***	0.000***	0.002***	0.065***	2.754***	12.703***	−0.991	−11.374***	−3.159**

Table continues on next page.

TABLE 3.16 continued

	predicted								
	AAA	AA	A	BBB	BB	B	CCC	CC	D
Community									
AAA	2.278***	4.359***	−2.240***	−4.225***	−0.168***	−0.004***	0.000	0.000***	0.000**
AA	1.319***	3.329***	1.731***	−6.065***	−0.307***	−0.007***	0.000	0.000***	0.000**
A	0.445***	1.429***	6.683***	−7.611***	−0.924***	−0.022***	0.000	0.000***	0.000**
BBB	0.076***	0.269***	3.753***	0.257	−4.224***	−0.129***	0.000	−0.002***	0.000**
BB	0.005***	0.018***	0.323***	6.339***	−4.838***	−1.813***	−0.001	−0.028***	−0.004**
B	0.000***	0.001***	0.018***	0.635***	7.883***	−7.959***	−0.024	−0.487***	−0.068**
CCC	0.000***	0.000***	0.003***	0.094***	3.363***	−0.123	−0.159	−2.710***	−0.467**
CC	0.000***	0.000***	0.003***	0.098***	3.494***	−0.390	−0.152	−2.610***	−0.444**
D	0.000***	0.000***	0.001***	0.029***	1.234***	5.692***	−0.444	−5.097***	−1.416**
Human rights									
AAA	5.842***	11.181***	−5.747***	−10.836***	−0.430***	−0.010***	0.000	0.000***	0.000**
AA	3.383***	8.539***	4.439***	−15.555***	−0.788***	−0.018***	0.000	0.000***	0.000**
A	1.141***	3.666***	17.141***	−19.521***	−2.371***	−0.056***	0.000	−0.001***	0.000**
BBB	0.194***	0.690***	9.627***	0.660	−10.834***	−0.332***	0.000	−0.005***	−0.001**
BB	0.012***	0.045***	0.828***	16.259***	−12.410***	−4.651***	−0.003	−0.071***	−0.010**
B	0.001***	0.002***	0.046***	1.628***	20.221***	−20.414***	−0.062	−1.248***	−0.175**
CCC	0.000***	0.000***	0.007***	0.240***	8.624***	−0.314	−0.408	−6.952***	−1.197**
CC	0.000***	0.000***	0.007***	0.252***	8.962***	−0.998	−0.389	−6.695***	−1.139**
D	0.000***	0.000***	0.002***	0.075***	3.165***	14.602***	−1.139	−13.073***	−3.631**
Diversity									
AAA	4.479***	8.571***	−4.405***	−8.307***	−0.330***	−0.007***	0.000	0.000***	0.000**
AA	2.594***	6.546***	3.403***	−11.925***	−0.604***	−0.014***	0.000	0.000***	0.000**
A	0.875***	2.810***	13.140***	−14.965***	−1.818***	−0.043***	0.000	−0.001***	0.000**
BBB	0.149***	0.529***	7.380***	0.505	−8.305***	−0.254***	0.000	−0.003***	0.000**
BB	0.010***	0.034***	0.635***	12.465***	−9.514***	−3.565***	−0.003	−0.054***	−0.007**
B	0.001***	0.002***	0.036***	1.248***	15.501***	−15.649***	−0.047	−0.957***	−0.134**
CCC	0.000***	0.000***	0.005***	0.184***	6.612***	−0.241	−0.312	−5.329***	−0.918**
CC	0.000***	0.000***	0.005***	0.193***	6.871***	−0.766	−0.298	−5.132***	−0.874**
D	0.000***	0.000***	0.002***	0.057***	2.427***	11.193***	−0.872	−10.023***	−2.784**
Employment									
AAA	2.940***	5.624***	−2.890***	−5.452***	−0.217***	−0.005***	0.000	0.000***	0.000**
AA	1.702***	4.295***	2.234***	−7.826***	−0.396***	−0.009***	0.000	0.000***	0.000**
A	0.574***	1.844***	8.623***	−9.820***	−1.193***	−0.028***	0.000	0.000***	0.000**
BBB	0.098***	0.347***	4.843***	0.332	−5.450***	−0.167***	0.000	−0.002***	0.000**
BB	0.006***	0.023***	0.417***	8.180***	−6.243***	−2.340***	−0.002	−0.036***	−0.005**
B	0.000***	0.001***	0.023***	0.819***	10.172***	−10.269***	−0.031	−0.628***	−0.088**
CCC	0.000***	0.000***	0.003***	0.121***	4.339***	−0.159	−0.205	−3.497***	−0.602**
CC	0.000***	0.000***	0.003***	0.127***	4.509***	−0.503	−0.196	−3.368***	−0.573**
D	0.000***	0.000***	0.001***	0.038***	1.593***	7.345***	−0.573	−6.577***	−1.827**
Health									
AAA	3.309***	6.334***	−3.256***	−6.138***	−0.244***	−0.005***	0.000	0.000***	0.000**
AA	1.916***	4.837***	2.514***	−8.811***	−0.446***	−0.010***	0.000	0.000***	0.000**
A	0.647***	2.077***	9.710***	−11.058***	−1.343***	−0.031***	0.000	0.000***	0.000**
BBB	0.110***	0.391***	5.454***	0.373	−6.137***	−0.188***	0.000	−0.003***	0.000**
BB	0.007***	0.025***	0.469***	9.210***	−7.030***	−2.634***	−0.002	−0.040***	−0.005**
B	0.000***	0.001***	0.026***	0.922***	11.454***	−11.564***	−0.035	−0.707***	−0.099**
CCC	0.000***	0.000***	0.004***	0.136***	4.885***	−0.179	−0.231	−3.937***	−0.678**
CC	0.000***	0.000***	0.004***	0.143***	5.077***	−0.567	−0.221	−3.792***	−0.645**
D	0.000***	0.000***	0.001***	0.042***	1.793***	8.270***	−0.645	−7.405***	−2.056**
Training									
AAA	4.195***	8.030***	−4.127***	−7.782***	−0.309***	−0.007***	0.000	0.000***	0.000**
AA	2.429***	6.132***	3.188***	−11.171***	−0.566***	−0.013***	0.000	0.000***	0.000**
A	0.820***	2.633***	12.310***	−14.020***	−1.703***	−0.040***	0.000	−0.001***	0.000**
BBB	0.140***	0.495***	6.914***	0.474	−7.780***	−0.238***	0.000	−0.003***	0.000**
BB	0.009***	0.032***	0.595***	11.677***	−8.912***	−3.340***	−0.002	−0.051***	−0.007**
B	0.000***	0.002***	0.033***	1.169***	14.522***	−14.660***	−0.044	−0.896***	−0.125**
CCC	0.000***	0.000***	0.005***	0.172***	6.194***	−0.225	−0.293	−4.993***	−0.860**
CC	0.000***	0.000***	0.005***	0.181***	6.436***	−0.717	−0.280	−4.808***	−0.818**
D	0.000***	0.000***	0.001***	0.054***	2.273***	10.487***	−0.818	−9.389***	−2.608**

This table displays marginal effects at means for panel America. The marginal effects of the CSP describe the impact on the predicted probabilities per actual accured rating class if the CSP impact score increases ceteris paribus by one percentage point. Displayed effects in rows must sum up to zero because they are changes to probabilities summing up to 100%. Marginal effects are shown in per mille and are regarded as significant on the level of 1% (***), 5% (**) or 10% (*) when the *p*-value is below these levels.

TABLE 3.17: Marginal effects for panel Europe

	predicted								
	AAA	AA	A	BBB	BB	B	CCC	CC	D
Overall CSP									
AAA	3.285*	11.511**	−12.804***	−1.964**	−0.027*	−0.001	0.000	0.000	0.000
AA	1.269**	10.705**	−7.040**	−4.856***	−0.075**	−0.002*	0.000	0.000	0.000
A	0.201*	2.942**	11.067***	−13.706***	−0.488**	−0.015**	0.000	0.000*	0.000
BBB	0.022*	0.363**	6.891***	−3.293**	−3.845**	−0.134**	−0.001	−0.003*	−0.001
BB	0.001*	0.021**	0.544**	13.946***	−12.304***	−2.130**	−0.010	−0.057*	−0.012
B	0.000	0.001*	0.015**	1.134**	13.099***	−11.602**	−0.348	−1.868**	−0.432
CCC	0.000	0.001	0.024*	1.756*	13.030***	−13.081**	−0.223	−1.233**	−0.274
CC	0.000	0.000*	0.003*	0.254**	6.326**	2.335	−1.380	−5.652**	−1.886*
D	0.000	0.000	0.002	0.141*	3.954**	8.112**	−2.147	−6.829**	−3.233
Environment									
AAA	4.338*	15.131***	−16.876***	−2.558**	−0.035**	−0.001*	0.000	0.000	0.000
AA	1.668**	14.118***	−9.325***	−6.360***	−0.097***	−0.003**	0.000	0.000*	0.000
A	0.266**	3.911***	14.475***	−18.009***	−0.623***	−0.019**	0.000	0.000*	0.000
BBB	0.029**	0.469***	8.980***	−4.249***	−5.050***	−0.173***	−0.001	−0.004**	−0.001
BB	0.002**	0.028***	0.704***	18.371***	−16.244***	−2.761***	−0.012	−0.072**	−0.015
B	0.000*	0.001**	0.019***	1.436***	17.211***	−15.185***	−0.457	−2.452***	−0.572*
CCC	0.000	0.001*	0.030**	2.264**	17.204***	−17.264***	−0.288	−1.592**	−0.356
CC	0.000	0.000**	0.004**	0.311**	7.991***	3.670	−1.863	−7.540***	−2.574*
D	0.000	0.000*	0.002*	0.187**	5.295***	10.284**	−2.740	−8.913***	−4.116
Social									
AAA	0.950	3.265	−3.649	−0.559	−0.008	0.000	0.000	0.000	0.000
AA	0.361	3.027	−1.965	−1.401	−0.022	−0.001	0.000	0.000	0.000
A	0.058	0.831	3.168	−3.909	−0.142	−0.004	0.000	0.000	0.000
BBB	0.007	0.104	1.978	−0.952	−1.098	−0.038	0.000	−0.001	0.000
BB	0.000	0.006	0.157	3.972	−3.505	−0.608	−0.003	−0.017	−0.003
B	0.000	0.000	0.004	0.328	3.736	−3.311	−0.100	−0.536	−0.123
CCC	0.000	0.000	0.007	0.480	3.737	−3.700	−0.068	−0.374	−0.083
CC	0.000	0.000	0.001	0.072	1.784	0.731	−0.403	−1.637	−0.549
D	0.000	0.000	0.000	0.038	1.076	2.464	−0.642	−1.964	−0.973
Emission									
AAA	2.352	7.986	−8.956	−1.362	−0.019	−0.001	0.000	0.000	0.000
AA	0.878	7.409	−4.754	−3.477	−0.054	−0.002	0.000	0.000	0.000
A	0.143	2.062	7.736	−9.587	−0.343	−0.010	0.000	0.000	0.000
BBB	0.016	0.256	4.829	−2.318	−2.686	−0.093	0.000	−0.002	0.000
BB	0.001	0.015	0.382	9.751	−8.611	−1.482	−0.007	−0.040	−0.008
B	0.000	0.000	0.010	0.792	9.163	−8.099	−0.246	−1.316	−0.305
CCC	0.000	0.001	0.016	1.197	9.148	−9.111	−0.162	−0.890	−0.198
CC	0.000	0.000	0.002	0.181	4.490	1.528	−0.962	−3.931	−1.308
D	0.000	0.000	0.001	0.094	2.647	6.015	−1.571	−4.797	−2.389
Environmental innovation									
AAA	3.149**	12.064***	−13.088***	−2.097***	−0.027**	−0.001*	0.000	0.000	0.000
AA	1.311***	11.068***	−7.488***	−4.819***	−0.070***	−0.002**	0.000	0.000*	0.000
A	0.205**	3.040***	11.240***	−14.010***	−0.461***	−0.014***	0.000	0.000*	0.000
BBB	0.021**	0.349***	6.890***	−3.223***	−3.903***	−0.131***	−0.001	−0.003**	−0.001
BB	0.001**	0.020***	0.529***	14.339***	−12.697***	−2.120***	−0.009	−0.053**	−0.011*
B	0.000*	0.001**	0.013***	1.069***	13.384***	−11.794***	−0.345	−1.893***	−0.434*
CCC	0.000*	0.001**	0.019**	1.524***	13.646***	−13.294***	−0.241	−1.355**	−0.300
CC	0.000*	0.000**	0.002**	0.188***	5.195***	5.067*	−1.666	−6.416***	−2.370*
D	0.000	0.000*	0.002*	0.144**	4.160***	7.697**	−2.034*	−6.938***	−3.031*
Resources									
AAA	1.105	3.774	−4.223	−0.646	−0.009	0.000	0.000	0.000	0.000
AA	0.419	3.498	−2.263	−1.627	−0.026	−0.001	0.000	0.000	0.000
A	0.067	0.966	3.658	−4.521	−0.164	−0.005	0.000	0.000	0.000
BBB	0.008	0.121	2.287	−1.096	−1.273	−0.044	0.000	−0.001	0.000
BB	0.000	0.007	0.182	4.598	−4.064	−0.698	−0.003	−0.019	−0.004
B	0.000	0.000	0.005	0.376	4.325	−3.828	−0.116	−0.620	−0.143
CCC	0.000	0.000	0.008	0.562	4.317	−4.293	−0.077	−0.424	−0.094
CC	0.000	0.000	0.001	0.083	2.071	0.831	−0.465	−1.888	−0.633
D	0.000	0.000	0.001	0.044	1.253	2.830	−0.739	−2.269	−1.120
Product responsibilty									
AAA	0.859	3.047*	−3.373*	−0.525	−0.007	0.000	0.000	0.000	0.000
AA	0.342	2.833*	−1.890	−1.265*	−0.020*	−0.001*	0.000	0.000	0.000
A	0.053	0.775*	2.919*	−3.613*	−0.129*	−0.004*	0.000	0.000	0.000
BBB	0.006	0.095*	1.821*	−0.867*	−1.019*	−0.035*	0.000	−0.001	0.000
BB	0.000	0.006*	0.144*	3.676*	−3.244*	−0.561*	−0.003	−0.015*	−0.003
B	0.000	0.000	0.004*	0.304*	3.467*	−3.087*	−0.090	−0.488*	−0.111
CCC	0.000	0.000	0.007	0.488	3.401*	−3.463*	−0.056	−0.310*	−0.068
CC	0.000	0.000	0.001	0.069	1.707	0.541	−0.356	−1.480*	−0.482
D	0.000	0.000	0.000	0.038	1.057	2.116*	−0.562	−1.808*	−0.840

Table continues on next page.

TABLE 3.17 continued

	predicted								
	AAA	AA	A	BBB	BB	B	CCC	CC	D
Community									
AAA	−2.212*	−7.910***	8.719***	1.384**	0.019**	0.001*	0.000	0.000	0.000
AA	−0.855**	−7.198***	4.594***	3.404***	0.053***	0.002**	0.000	0.000	0.000
A	−0.142**	−2.029***	−7.504***	9.341***	0.324***	0.010**	0.000	0.000*	0.000
BBB	−0.015**	−0.244***	−4.671***	2.211***	2.628***	0.089***	0.000	0.002*	0.000
BB	−0.001**	−0.014***	−0.364***	−9.524***	8.429***	1.423***	0.006	0.038**	0.008
B	0.000*	0.000**	−0.010**	−0.740***	−8.956***	7.895***	0.237	1.281**	0.294*
CCC	0.000	−0.001*	−0.016**	−1.232**	−8.842***	8.990***	0.141	0.788**	0.173
CC	0.000	0.000**	−0.002**	−0.145***	−3.875***	−2.591	1.044	4.117**	1.452*
D	0.000	0.000*	−0.001*	−0.091**	−2.634**	−5.679**	1.478	4.694**	2.233
Human rights									
AAA	−2.402	−7.749**	8.853**	1.280*	0.018*	0.001	0.000	0.000	0.000
AA	−0.884*	−7.308**	4.803**	3.335**	0.052**	0.002*	0.000	0.000	0.000
A	−0.139*	−1.982**	−7.666**	9.437**	0.340**	0.010*	0.000	0.000	0.000
BBB	−0.016*	−0.248**	−4.773**	2.307**	2.635**	0.092**	0.000	0.002	0.000
BB	−0.001	−0.015**	−0.375**	−9.585**	8.453**	1.468**	0.007	0.040*	0.008
B	0.000	0.000*	−0.011*	−0.793**	−9.029**	8.043**	0.232	1.276*	0.282
CCC	0.000	0.000*	−0.012**	−0.930**	−9.136**	8.542**	0.197	1.100	0.239
CC	0.000	0.000*	−0.002*	−0.154**	−3.960**	−2.505	1.039	4.169*	1.413
D	0.000	0.000	−0.001*	−0.084*	−2.409**	−6.377*	1.610	4.817**	2.445
Diversity									
AAA	4.085**	15.441***	−16.836***	−2.654***	−0.035**	−0.001*	0.000	0.000	0.000
AA	1.714***	14.221***	−9.772***	−6.071***	−0.089***	−0.003**	0.000	0.000*	0.000
A	0.263**	3.850***	14.470***	−17.972***	−0.593***	−0.018***	0.000	0.000*	0.000
BBB	0.027**	0.445***	8.905***	−4.209***	−4.988***	−0.174***	−0.001	−0.004**	−0.001
BB	0.002**	0.025***	0.676***	18.377***	−16.130***	−2.851***	−0.012	−0.073**	−0.014*
B	0.000*	0.001**	0.020***	1.559***	17.336***	−15.737***	−0.399	−2.301***	−0.479*
CCC	0.000*	0.000**	0.013**	1.072***	15.962***	−12.548***	−0.578	−3.221**	−0.701
CC	0.000*	0.000**	0.004**	0.300***	7.647***	4.204	−1.842	−7.872***	−2.441*
D	0.000	0.000*	0.002**	0.164**	4.667***	11.700***	−2.896*	−9.399***	−4.238*
Employment									
AAA	−0.052	−0.177	0.199	0.030	0.000	0.000	0.000	0.000	0.000
AA	−0.020	−0.164	0.106	0.077	0.001	0.000	0.000	0.000	0.000
A	−0.003	−0.045	−0.172	0.213	0.008	0.000	0.000	0.000	0.000
BBB	0.000	−0.006	−0.108	0.052	0.060	0.002	0.000	0.000	0.000
BB	0.000	0.000	−0.009	−0.216	0.191	0.033	0.000	0.001	0.000
B	0.000	0.000	0.000	−0.018	−0.203	0.180	0.005	0.029	0.007
CCC	0.000	0.000	0.000	−0.026	−0.204	0.201	0.004	0.021	0.005
CC	0.000	0.000	0.000	−0.004	−0.095	−0.044	0.022	0.090	0.031
D	0.000	0.000	0.000	−0.002	−0.058	−0.137	0.035	0.107	0.054
Health									
AAA	0.225	0.762	−0.855	−0.130	−0.002	0.000	0.000	0.000	0.000
AA	0.084	0.706	−0.455	−0.330	−0.005	0.000	0.000	0.000	0.000
A	0.014	0.194	0.742	−0.916	−0.033	−0.001	0.000	0.000	0.000
BBB	0.002	0.024	0.464	−0.223	−0.257	−0.009	0.000	0.000	0.000
BB	0.000	0.001	0.037	0.930	−0.821	−0.142	−0.001	−0.004	−0.001
B	0.000	0.000	0.001	0.076	0.875	−0.774	−0.023	−0.126	−0.029
CCC	0.000	0.000	0.002	0.112	0.875	−0.866	−0.016	−0.088	−0.019
CC	0.000	0.000	0.000	0.017	0.416	0.177	−0.095	−0.385	−0.130
D	0.000	0.000	0.000	0.009	0.248	0.588	−0.153	−0.460	−0.232
Training									
AAA	3.565*	13.246***	−14.467***	−2.311**	−0.032**	−0.001*	0.000	0.000	0.000
AA	1.480**	12.263***	−8.327***	−5.332***	−0.082***	−0.002**	0.000	0.000*	0.000
A	0.228**	3.337***	12.511***	−15.517***	−0.542***	−0.017**	0.000	0.000*	0.000
BBB	0.025**	0.403***	7.772***	−3.680***	−4.361***	−0.153***	−0.001	−0.004*	−0.001
BB	0.001**	0.024***	0.614***	15.831***	−13.966***	−2.420***	−0.010	−0.062**	−0.012
B	0.000*	0.001**	0.017**	1.298***	14.865***	−13.343***	−0.363	−2.027**	−0.448*
CCC	0.000*	0.001**	0.017**	1.327**	14.906***	−13.472***	−0.356	−1.986*	−0.438
CC	0.000	0.000**	0.003**	0.242***	6.256***	4.422	−1.700	−6.882***	−2.340*
D	0.000	0.000*	0.002*	0.164*	4.549**	8.700**	−2.283	−7.784***	−3.349

This table displays marginal effects at means for panel Europe. The marginal effects of the CSP describe the impact on the predicted probabilities per actual accured rating class if the CSP impact score increases ceteris paribus by one percentage point. Displayed effects in rows must sum up to zero because they are changes to probabilities summing up to 100%. Marginal effects are shown in per mille and are regarded as significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels.

TABLE 3.18: Marginal effects for panel Asia

	predicted								
	AAA	AA	A	BBB	BB	B	CCC	CC	D
Overall CSP									
AAA	0.630	4.449*	−4.717**	−0.354	−0.007	0.000	0.000	0.000	0.000
AA	0.326*	6.223**	−5.853**	−0.682**	−0.014**	0.000	0.000	0.000	0.000
A	0.031*	3.040**	1.691**	−4.612**	−0.146**	−0.004*	0.000	0.000	0.000
BBB	0.002*	0.288**	4.198**	−2.704**	−1.732**	−0.050*	−0.002	0.000	0.000
BB	0.000	0.025**	0.562**	6.264**	−6.274**	−0.550*	−0.025	0.000	−0.004
B	0.000	0.001	0.032	1.493	4.129	−5.153*	−0.438	0.000	−0.065
CCC	0.000	0.000	0.000	0.011	0.425	4.851*	0.063	−0.001	−5.349
D	0.000	0.000	0.000	0.014	0.522	5.273*	−1.016	−0.001**	−4.792
m Environment									
AAA	0.572	3.888*	−4.145**	−0.309	−0.006	0.000	0.000	0.000	0.000
AA	0.291*	5.524**	−5.196**	−0.606**	−0.012**	0.000	0.000	0.000	0.000
A	0.028*	2.696***	1.513**	−4.103**	−0.131**	−0.003*	0.000	0.000	0.000
BBB	0.002*	0.257***	3.734***	−2.409***	−1.539**	−0.044*	−0.002	0.000	0.000
BB	0.000	0.023**	0.502**	5.560**	−5.570**	−0.490**	−0.022	0.000	−0.003
B	0.000	0.001	0.029	1.335	3.650	−4.576*	−0.384	0.000	−0.056
CCC	0.000	0.000	0.000	0.010	0.367	4.284*	0.103	0.000	−4.764
D	0.000	0.000	0.000	0.012	0.447	4.649**	−0.815	0.000**	−4.293
Social									
AAA	0.586	3.957	−4.224*	−0.312	−0.006	0.000	0.000	0.000	0.000
AA	0.295	5.651**	−5.315**	−0.619**	−0.013*	0.000	0.000	0.000	0.000
A	0.028	2.760**	1.526*	−4.178**	−0.133*	−0.003	0.000	0.000	0.000
BBB	0.002	0.261**	3.807**	−2.444*	−1.578*	−0.046	−0.002	0.000	0.000
BB	0.000	0.023*	0.516**	5.675*	−5.690*	−0.499	−0.023	0.000	−0.003
B	0.000	0.001	0.029	1.366	3.737	−4.663	−0.408	0.000	−0.062
CCC	0.000	0.000	0.000	0.011	0.405	4.431	0.005	−0.002	−4.850
D	0.000	0.000	0.000	0.013	0.500	4.812*	−0.989	−0.002*	−4.334
Emission									
AAA	0.386	2.654	−2.825*	−0.211	−0.004	0.000	0.000	0.000	0.000
AA	0.197	3.753*	−3.530*	−0.412**	−0.008*	0.000	0.000	0.000	0.000
A	0.019	1.832*	1.028*	−2.787*	−0.089*	−0.002	0.000	0.000	0.000
BBB	0.001	0.175**	2.535**	−1.635**	−1.044*	−0.030*	−0.001	0.000	0.000
BB	0.000	0.015**	0.340**	3.778*	−3.784*	−0.333*	−0.015	0.000	−0.002
B	0.000	0.001	0.019	0.904	2.486	−3.109	−0.263	0.000	−0.039
CCC	0.000	0.000	0.000	0.007	0.252	2.914	0.061	−0.001	−3.233
D	0.000	0.000	0.000	0.008	0.306	3.159*	−0.557	−0.001*	−2.915
Envionmental innovation									
AAA	1.536	9.996**	−10.757***	−0.759**	−0.015	0.000	0.000	0.000	0.000
AA	0.752**	14.626***	−13.797***	−1.548***	−0.031***	−0.001*	0.000	0.000	0.000
A	0.071*	7.145***	3.809***	−10.678***	−0.338***	−0.009*	0.000	0.000	0.000
BBB	0.005*	0.652***	9.829***	−6.210***	−4.149***	−0.122**	−0.005	0.000	−0.001
BB	0.000*	0.060***	1.373***	14.649***	−14.733***	−1.284***	−0.058	0.000	−0.009
B	0.000	0.003	0.079	3.638	9.473	−12.019**	−1.016	0.000	−0.157
CCC	0.000	0.000	0.001	0.028	1.053	11.622**	−0.177	−0.001*	−12.526
D	0.000	0.000	0.001	0.041	1.501	13.124***	−4.424	−0.001***	−10.242
Resources									
AAA	0.467	2.958	−3.186	−0.234	−0.005	0.000	0.000	0.000	0.000
AA	0.228	4.329	−4.070	−0.477	−0.010	0.000	0.000	0.000	0.000
A	0.022	2.111	1.192	−3.219	−0.103	−0.003	0.000	0.000	0.000
BBB	0.002	0.202	2.925	−1.885	−1.207	−0.035	−0.001	0.000	0.000
BB	0.000	0.018	0.397	4.349	−4.360	−0.385	−0.017	0.000	−0.002
B	0.000	0.001	0.023	1.054	2.851	−3.585	−0.300	0.000	−0.044
CCC	0.000	0.000	0.000	0.008	0.286	3.352	0.091	−0.001	−3.736
D	0.000	0.000	0.000	0.009	0.344	3.625	−0.590	−0.001	−3.388
Product responsibility									
AAA	0.479	3.027	−3.267	−0.235	−0.005	0.000	0.000	0.000	0.000
AA	0.233	4.461*	−4.203*	−0.482*	−0.010*	0.000	0.000	0.000	0.000
A	0.022	2.169*	1.228*	−3.312*	−0.105*	−0.003	0.000	0.000	0.000
BBB	0.002	0.206*	3.022*	−1.950*	−1.241*	−0.036	−0.002	0.000	0.000
BB	0.000	0.018*	0.406*	4.496*	−4.500*	−0.398	−0.020	0.000	−0.003
B	0.000	0.001	0.024	1.134	2.823	−3.600	−0.332	0.000	−0.050
CCC	0.000	0.000	0.000	0.009	0.338	3.453	0.057	0.000	−3.857
D	0.000	0.000	0.000	0.010	0.376	3.614	−0.349	0.000	−3.651

Table continues on next page.

TABLE 3.18 continued

	predicted								
	AAA	AA	A	BBB	BB	B	CCC	CC	D
Community									
AAA	0.334	2.140	−2.302	−0.169	−0.003	0.000	0.000	0.000	0.000
AA	0.163	3.121	−2.933	−0.344	−0.007	0.000	0.000	0.000	0.000
A	0.016	1.525	0.843	−2.308	−0.074	−0.002	0.000	0.000	0.000
BBB	0.001	0.144	2.098	−1.341	−0.875	−0.026	−0.001	0.000	0.000
BB	0.000	0.013	0.288	3.127	−3.137	−0.276	−0.013	0.000	−0.002
B	0.000	0.001	0.016	0.758	2.062	−2.580	−0.223	0.000	−0.034
CCC	0.000	0.000	0.000	0.006	0.220	2.446	0.004	−0.002	−2.674
D	0.000	0.000	0.000	0.007	0.274	2.664	−0.564	−0.002	−2.379
Human rights									
AAA	0.395	2.548	−2.739	−0.200	−0.004	0.000	0.000	0.000	0.000
AA	0.195	3.707	−3.488	−0.405	−0.008	0.000	0.000	0.000	0.000
A	0.018	1.809	1.012	−2.749	−0.088	−0.002	0.000	0.000	0.000
BBB	0.001	0.172	2.509	−1.614	−1.037	−0.030	−0.001	0.000	0.000
BB	0.000	0.015	0.342	3.723	−3.735	−0.329	−0.015	0.000	−0.002
B	0.000	0.001	0.020	0.909	2.429	−3.066	−0.255	0.000	−0.038
CCC	0.000	0.000	0.000	0.007	0.246	2.877	0.069	−0.001	−3.197
D	0.000	0.000	0.000	0.008	0.301	3.130	−0.570	−0.001	−2.869
Diversity									
AAA	0.471	4.261	−4.369*	−0.357	−0.007	0.000	0.000	0.000	0.000
AA	0.283*	5.383**	−5.063**	−0.591**	−0.012**	0.000	0.000	0.000	0.000
A	0.027*	2.634**	1.460**	−3.995**	−0.123**	−0.003*	0.000	0.000	0.000
BBB	0.002*	0.247**	3.607**	−2.337**	−1.477**	−0.041*	−0.002	0.000	0.000
BB	0.000*	0.021**	0.457***	5.464**	−5.444**	−0.474**	−0.021	0.000	−0.003
B	0.000	0.001	0.025	1.237	3.655	−4.491*	−0.373	0.000	−0.054
CCC	0.000	0.000	0.000	0.009	0.354	4.197*	0.021	−0.002	−4.580
D	0.000	0.000	0.000	0.011	0.423	4.520*	−0.790	−0.002**	−4.163
Employment									
AAA	−0.281	−1.629	1.780	0.127	0.003	0.000	0.000	0.000	0.000
AA	−0.130	−2.481	2.332	0.274	0.006	0.000	0.000	0.000	0.000
A	−0.013	−1.210	−0.675	1.837	0.059	0.002	0.000	0.000	0.000
BBB	−0.001	−0.115	−1.672	1.070	0.696	0.021	0.001	0.000	0.000
BB	0.000	−0.011	−0.232	−2.480	2.491	0.221	0.010	0.000	0.001
B	0.000	−0.001	−0.013	−0.611	−1.629	2.057	0.171	0.000	0.026
CCC	0.000	0.000	0.000	−0.005	−0.165	−1.934	−0.032	0.001	2.135
D	0.000	0.000	0.000	−0.006	−0.202	−2.096	0.379	0.001	1.923
Health									
AAA	0.472	2.545	−2.817	−0.196	−0.004	0.000	0.000	0.000	0.000
AA	0.210	4.022	−3.782	−0.441	−0.009	0.000	0.000	0.000	0.000
A	0.020	1.958	1.091	−2.971	−0.096	−0.002	0.000	0.000	0.000
BBB	0.001	0.186	2.713	−1.734	−1.130	−0.034	−0.002	0.000	0.000
BB	0.000	0.017	0.381	4.012	−4.035	−0.356	−0.017	0.000	−0.002
B	0.000	0.001	0.022	0.994	2.640	−3.316	−0.294	0.000	−0.046
CCC	0.000	0.000	0.000	0.008	0.291	3.145	0.044	−0.002	−3.485
D	0.000	0.000	0.000	0.010	0.356	3.406	−0.636	−0.002	−3.134
Training									
AAA	−0.255	−1.419	1.562	0.110	0.002	0.000	0.000	0.000	0.000
AA	−0.116	−2.211	2.079	0.243	0.005	0.000	0.000	0.000	0.000
A	−0.011	−1.079	−0.595	1.631	0.053	0.001	0.000	0.000	0.000
BBB	−0.001	−0.102	−1.491	0.951	0.624	0.019	0.001	0.000	0.000
BB	0.000	−0.010	−0.212	−2.201	2.217	0.196	0.009	0.000	0.001
B	0.000	−0.001	−0.012	−0.549	−1.445	1.831	0.153	0.000	0.023
CCC	0.000	0.000	0.000	−0.004	−0.151	−1.738	−0.001	0.000	1.894
D	0.000	0.000	0.000	−0.005	−0.184	−1.878	0.359	0.000	1.707

This table displays marginal effects at means for panel Asia. The marginal effects of the CSP describe the impact on the predicted probabilities per actual accured rating class if the CSP impact score increases ceteris paribus by one percentage point. Displayed effects in rows must sum up to zero because they are changes to probabilities summing up to 100%. Marginal effects are shown in per mille and are regarded as significant on the level of 1% (***), 5% (**) or 10% (*) when the *p*-value is below these levels.

In general, we support the argumentation of Attig et al. (2013) that CSP helps to generate intangible assets such as reputation and relationships with stakeholders, which again improve a firm's competitiveness (Orlitzky et al., 2003). This may explain the relevance of all CSP scores in North America. The same argumentation may apply also for Europe. However, besides *environmental innovation* and *diversity* no further CSP component is significant on the 1% level, which is likely caused by the comparably high mean levels and low variation of CSP of European firms. For example, *emission* exhibits a higher mean of 81.3% and a lower standard deviation of 19.5% when compared to the mean (52.3%) and standard deviation (31.8%) of North American companies. As a result, European firms can differentiate less from each other through *emission* reduction. In contrast, *environmental innovation* shows a higher standard deviation (29.3%) and turns out to be significant. In the case of *diversity*, the pressure of the market seems so strong that smaller variation suffices for a significant impact. In the Asia panel, not even *diversity* is significant, although obtaining the most intensive effects among social components in Europe and North America - likely due to cultural reasons. Previous literature has provided similar implications for Asia by finding limiting or reducing the effects of diversity aspects on firm performance. Based on a sample of Asian countries (Hong Kong, South Korea, Malaysia, and Singapore), Low et al. (2015) primarily find a positive effect of the numbers of female board directors on firm performance, although it is substantially reduced in countries with higher female economic participation and empowerment likely due to tokenism. Li and Chen (2018) only find a positive relationship between board gender diversity and firm performance for Chinese firms if they do not exceed a critical size. Darmadi (2011) even found a negative relationship between the diversity of board members and financial performance for Indonesia.

When comparing our results with those of earlier studies on credit risk, we find accordance with Jiraporn et al. (2014) in the sense that overall CSP has a positive impact on credit ratings in North America. Stellner et al. (2015) do not find such a relationship for their Europe sample. In contrast, we find a significant positive impact of both overall CSP and some of its components. In agreement with Oikonomou et al. (2014), product characteristics are relevant in this context. Further, we identify the workforce categories of employment quality and diversity as being drivers inside the workforce pillar. We can confirm the first empirical evidence of Attig et al. (2013), being that CSP strengths and concerns related to primary stakeholder management (i.e. community relations, diversity, employee relations, environmental performance, and product characteristics) are linked to credit ratings and extend their work in terms of causality and a more sophisticated CSP measurement approach respectively.

3.6 Robustness checks

We prove the robustness of our results concerning the specification of instruments in the first stage, to the period selection, missing data, and the relevance of environmental sensitive industries. Regression coefficients of CSP variables are presented in Tables 3.19 and 3.20. At first, we address the average CSP performance of surrounding firms used as an instrument based on the research of Jiraporn et al. (2014). While in the standard analysis, the average CSP for the U.S. is calculated based on the country level, we demonstrate the robustness of our results when surrounding firms are defined as located in the same state. All results remain almost unchanged. Also, in the main analysis, instruments and controls are subject to a selection process based on VIFs. To proof the robustness of our results for the entire sample, we include the individualism variable, which was discarded in the selection process. Referring to the three regional panels, we replace one instrument in each. Again, we derive similar results to our main findings.

During recent years there have been several changes in the political alignment of some countries. E.g., since 2017, U.S. climate politics have shifted from renewable energies back to a stronger focus on fossil fuels. Hence we analyze whether our findings are subject to any development in recent years. We run estimations with a sample reduced by observations of the most recent year in the sample, and also the same for the second and the third recent year. As a result, we see no substantial deviations in the CSP effects for any of those time variations in the sample. In this context, we also address the case of missing data. After matching the final dataset, each combination of credit rating, CSP, and control variables per time and company is dismissed if any data value relating to these variables is missing. In order to measure the impact of the missing control variables' data, we implement a mean imputation according to Schafer (1997). Instead of discarding missing observations, we substitute them by the mean. Again, the corresponding estimations support our main result.

As the industry appears to be significant in terms of the impact of environmental CSP dimensions (Khan et al., 2016), we additionally analyze the impact of the industry through an interaction of CSP with a dummy variable expressing whether a firm belongs to the "NAICs Codes of Environmental Sensitive Industries" published by the U.S. Small Business Administration. In our sample, we find no evidence that the impact is stronger there.

3.7 Conclusion

While the corresponding literature has researched the general impact of overall CSP on credit risk, the identification of the actual drivers on a lower aggregation level of CSP has so

TABLE 3.19: Robustness checks concerning instruments

	Ov. CSP		Environm.		Social		Emission		Env. inno.		Resources	
Stage	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
Dependent Variable	Ov. CSP	Cr. Rat.	Environm.	Cr. Rat.	Social	Cr. Rat.	Emission	Cr. Rat.	Env. inno.	Cr. Rat.	Resources	Cr. Rat.
U.S. average CSP on state level												
$\widehat{CSP}$		0.040***		0.044***		0.032**		0.038***		0.069***		0.038***
Intercept	−31.250**		−17.871		−37.630***		−8.656		2.384		−8.752	
Dummy North Am.	−11.405***	0.522	−11.419***	0.574*	−12.635***	0.354	−11.450***	0.541*	−9.530***	0.722***	−12.229***	0.415
Dummy Asia	−20.021***	1.310***	−16.589***	1.187***	−24.717***	1.309***	−18.419***	1.135***	−9.784**	1.289***	−18.822***	1.128***
Weak Instruments	0.000		0.000		0.000		0.000		0.109		0.000	
R^2	0.505	0.364	0.478	0.365	0.457	0.364	0.476	0.365	0.386	0.365	0.401	0.364
N	7032		7032		7032		7032		7032		7032	
All instruments included (Individualism added)												
$\widehat{CSP}$		0.044***		0.048***		0.034**		0.041***		0.071***		0.041***
Intercept	−45.776***		−39.546**		−46.232***		−31.345		−31.759		−22.800	
Dummy North Am.	−12.550***	0.608*	−13.540***	0.665**	−13.081***	0.417	−13.369***	0.610**	−13.125***	0.726***	−13.252***	0.487
Dummy Asia	−15.213***	1.373***	−8.741**	1.249***	−22.067***	1.349***	−10.658**	1.175***	4.101	1.327***	−14.151***	1.168***
Weak instruments	0.000		0.000		0.000		0.000		0.010		0.000	
R^2	0.507	0.365	0.480	0.366	0.458	0.364	0.478	0.366	0.390	0.366	0.402	0.365
N	7032		7032		7032		7032		7032		7032	
North America sample including the anti-self-dealing index as instrument												
$\widehat{CSP}$		0.039**		0.036**		0.042**		0.030**		0.079***		0.037**
Intercept	951.611***		1024.607***		890.375***		1228.816***		478.812*		1006.511***	
Weak instruments	0.000		0.000		0.000		0.000		0.060		0.000	
R^2	0.448	0.370	0.413	0.370	0.410	0.370	0.418	0.370	0.314	0.370	0.352	0.370
N	4709		4709		4709		4709		4709		4709	
Europe sample including the political orientation as instrument												
$\widehat{CSP}$		0.071		0.097***		0.017		0.048		0.070***		0.019
Intercept	31.653***		31.273**		36.173***		51.097***		−25.451		48.718***	
Weak instruments	0.150		0.449		0.114		0.328		0.053		0.114	
R^2	0.436	0.393	0.428	0.395	0.362	0.392	0.365	0.392	0.405	0.399	0.304	0.392
N	1500		1500		1500		1500		1500		1500	
Asia sample including the power distance as instrument												
$\widehat{CSP}$		0.019		0.037**		−0.013		0.020		0.099***		0.040*
Intercept	−40.934*		1.348		−68.981***		−3.906		25.556		1.491	
Weak instruments	0.003		0.004		0.010		0.000		0.073		0.004	
R^2	0.522	0.416	0.545	0.417	0.445	0.415	0.528	0.416	0.503	0.421	0.498	0.417
N	823		823		823		823		823		823	

Table continues on next page.

TABLE 3.19 continued

	Prod. resp.		Comm.		Hum. rights		Diversity		Employm.		Health		Training	
Stage	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
Dependent Var.	Prod. resp.	Cr. Rat.	Comm.	Cr. Rat.	Hum. rights	Cr. Rat.	Diversity	Cr. Rat.	Employm.	Cr. Rat.	Health	Cr. Rat.	Training	Cr. Rat.
U.S. average CSP on state level														
$\widehat{CSP}$		0.015		0.020		0.016		0.046***		−0.017		0.033*		0.011
Intercept	28.154*		−30.982**		−10.844		13.486		−76.749***		−2.778		−17.999	
Dummy North Am.	-14.028***	−0.067	−3.537*	−0.143	−12.531***	−0.013	−10.763***	0.380	−9.913***	−0.581*	−12.081***	0.316	−23.028***	−0.001
Dummy Asia	-28.248***	0.910***	−14.870***	0.852***	−23.288***	0.996**	−24.244***	1.369***	−18.272***	0.326	−23.882***	1.323***	−23.953***	0.903**
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.002		0.001	
R^2	0.238	0.363	0.285	0.363	0.324	0.363	0.370	0.365	0.309	0.363	0.329	0.363	0.359	0.363
N	7032		7032		7032		7032		7032		7032		7032	
All instruments included (Individualism added)														
$\widehat{CSP}$		0.011		0.023*		0.022		0.048***		−0.024		0.036*		0.013
Intercept	42.988**		−47.238***		−27.420		−6.875		−55.929***		−11.284		−22.951	
Dummy North Am.	-13.357***	−0.102	−4.543*	−0.103	−14.516***	0.128	−11.989***	0.417*	−8.905***	−0.659**	−12.534***	0.387	−23.147***	0.057
Dummy Asia	-32.921***	0.833***	−9.604	0.861***	−17.002***	1.095***	−17.750***	1.414***	−25.605***	0.158	−21.191***	1.370***	−22.657***	0.922*
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.004		0.001	
R^2	0.238	0.363	0.286	0.364	0.324	0.363	0.372	0.366	0.310	0.364	0.329	0.364	0.361	0.363
N	7032		7032		7032		7032		7032		7032		7032	
North America sample including the anti-self-dealing index as instrument														
$\widehat{CSP}$		0.076**		0.034**		0.088***		0.067**		0.044**		0.050**		0.063**
Intercept	532.946***		1099.437***		445.579		544.423**		833.028***		760.514***		590.837**	
Weak instruments	0.003		0.000		0.115		0.008		0.000		0.000		0.021	
R^2	0.214	0.370	0.310	0.370	0.280	0.370	0.308	0.370	0.274	0.370	0.322	0.370	0.262	0.370
N	4709		4709		4709		4709		4709		4709		4709	
Europe sample including the political orientation as instrument														
$\widehat{CSP}$		0.011		−0.040		−0.036		0.070**		0.010		0.008		0.067*
Intercept	78.308***		54.605***		39.176**		3.771		12.839		62.697***		37.887***	
Weak instruments	0.000		0.009		0.161		0.051		0.385		0.004		0.000	
R^2	0.249	0.392	0.190	0.394	0.292	0.392	0.335	0.395	0.231	0.391	0.258	0.391	0.280	0.394
N	1500		1500		1500		1500		1500		1500		1500	
Asia sample including the power distance as instrument														
$\widehat{CSP}$		−0.003		−0.013		0.021		0.025		−0.081*		0.036		0.000
Intercept	25.018		−54.099***		5.099		−55.807**		−37.575*		13.693		−39.659*	
Weak instruments	0.000		0.002		0.001		0.002		0.117		0.000		0.038	
R^2	0.312	0.415	0.366	0.416	0.363	0.416	0.467	0.417	0.362	0.421	0.316	0.417	0.334	0.418
N	823		823		823		823		823		823		823	

This table displays the estimation results of our robustness checks referring to both stages of the instrumental variable approach for each CSP impact score. Coefficients of all variables are displayed including the significance level marked by asterisks. They are regarded as being significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. The lower boundaries of the rating categories according to Sec. 3.4 are also displayed.

TABLE 3.20: Robustness checks concerning time and industry selection

	Ov. CSP		Environm.		Social		Emission		Env. inno.		Resources	
Stage Dependent Variable	Stage 1 Ov. CSP	Stage 2 Cr. Rat.	Stage 1 Environm.	Stage 2 Cr. Rat.	Stage 1 Social	Stage 2 Cr. Rat.	Stage 1 Emission	Stage 2 Cr. Rat.	Stage 1 Env. inno.	Stage 2 Cr. Rat.	Stage 1 Resources	Stage 2 Cr. Rat.
Subset till 2018												
$\widehat{CSP}$		0.040***		0.043***		0.031*		0.038***		0.065***		0.037**
Intercept	−31.370**		−19.509		−36.185**		−8.251		4.695		−12.128	
Dummy North Am.	−11.161***	0.493	−11.100***	0.551*	−12.410***	0.321	−10.941***	0.530*	−9.643***	0.653***	−12.083***	0.392
Dummy Asia	−19.937***	1.272***	−16.489***	1.155***	−24.628***	1.263***	−18.028***	1.108***	−10.058**	1.231***	−18.738***	1.094***
Weak instruments	0.000		0.000		0.000		0.000		0.113		0.000	
R^2	0.506	0.363	0.478	0.363	0.459	0.362	0.475	0.364	0.385	0.363	0.404	0.363
N	6887		6887		6887		6887		6887		6887	
Subset till 2017												
$\widehat{CSP}$		0.044***		0.047***		0.035**		0.040***		0.066***		0.041***
Intercept	−29.561*		−17.317		−35.599**		−8.281		4.280		−8.870	
Dummy North Am.	−12.785***	0.524	−12.412***	0.548*	−14.155***	0.350	−11.159***	0.484	−10.986***	0.585***	−13.303***	0.399
Dummy Asia	−21.923***	1.337***	−18.358***	1.184***	−26.733***	1.336***	−19.247***	1.095***	−11.692**	1.224***	−20.569***	1.124***
Weak instruments	0.000		0.000		0.000		0.000		0.141		0.000	
R^2	0.504	0.354	0.477	0.354	0.456	0.353	0.473	0.355	0.383	0.354	0.406	0.354
N	6050		6050		6050		6050		6050		6050	
Subset till 2016												
$\widehat{CSP}$		0.051***		0.049***		0.044**		0.039***		0.064***		0.044***
Intercept	−30.040		−16.775		−37.723**		−7.879		0.959		−10.201	
Dummy North Am.	−14.356***	0.564	−13.563***	0.490	−15.949***	0.452	−11.241***	0.375	−12.157***	0.441**	−13.840***	0.372
Dummy Asia	−23.547***	1.408***	−19.905***	1.161***	−28.463***	1.492***	−19.726***	1.020***	−13.540***	1.165***	−21.322***	1.112***
Weak instruments	0		0		0		0		0.013		0	
R^2	0.497	0.345	0.471	0.346	0.446	0.344	0.465	0.346	0.376	0.345	0.406	0.345
N	5214		5214		5214		5214		5214		5214	
Imputted input variables												
$\widehat{CSP}$		0.033**		0.038***		0.020		0.035***		0.048***		0.034**
Intercept	−28.430**		−18.411		−35.395***		−13.464		5.127		−10.578	
Dummy North Am.	−12.647***	0.229	−11.860***	0.326	−14.407***	−0.052	−11.701***	0.310	−10.279***	0.261	−12.705***	0.200
Dummy Asia	−20.014***	1.242***	−17.263***	1.171***	−24.156***	1.108***	−17.767***	1.122***	−13.227***	1.158***	−18.100***	1.113***
Weak instruments	0.000		0.000		0.000		0.000		0.024		0.000	
R^2	0.482	0.348	0.455	0.349	0.433	0.348	0.449	0.349	0.376	0.349	0.379	0.348
N	11879		11879		11879		11879		11879		11879	
Interaction between CSP and environmental sensitive industries included												
$\widehat{CSP}$		0.040***		0.043***		0.032**		0.037***		0.069***		0.037**
Interaction $\widehat{CSP}$ & env. sens.		0.003		0.003		0.002		0.004		0.002		0.004
Intercept	−30.795**		−17.518		−37.065***		−8.119		2.627		−8.577	
Dummy North Am.	−11.463***	0.529	−11.467***	0.576*	−12.700***	0.367	−11.534***	0.540*	−9.563***	0.730***	−12.246***	0.416
Dummy Asia	−20.150***	1.320***	−16.682***	1.195***	−24.875***	1.326***	−18.529***	1.142***	−9.875**	1.298***	−18.900***	1.136***
Weak instruments	0.000		0.000		0.000		0.000		0.104		0.000	
R^2	0.506	0.364	0.478	0.365	0.459	0.364	0.476	0.366	0.387	0.365	0.401	0.365
N	7032		7032		7032		7032		7032		7032	

Table continues on next page

TABLE 3.20 continued

	Prod. resp.		Comm.		Hum. rights		Diversity		Employm.		Health		Training	
Stage Dependent Var.	Stage 1 Prod. resp.	Stage 2 Cr. Rat.	Stage 1 Comm.	Stage 2 Cr. Rat.	Stage 1 Hum. rights	Stage 2 Cr. Rat.	Stage 1 Diversity	Stage 2 Cr. Rat.	Stage 1 Employm.	Stage 2 Cr. Rat.	Stage 1 Health	Stage 2 Cr. Rat.	Stage 1 Training	Stage 2 Cr. Rat.
Subset till 2018														
$\widehat{CSP}$		0.013		0.020		0.014		0.045***		−0.018		0.032		0.013
Intercept	24.795		−25.823*		−18.750		15.698		−60.364***		−3.146		−16.327	
Dummy North Am.	−14.002***	−0.108	−3.307	−0.163	−12.399***	−0.060	−10.209***	0.355	−10.654***	−0.619**	−11.714***	0.282	−22.638***	0.028
Dummy Asia	−28.070***	0.853***	−14.843***	0.820***	−23.247***	0.929**	−23.697***	1.332***	−19.324***	0.259	−23.468***	1.275***	−23.638***	0.901**
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.001		0.001	
R^2	0.239	0.362	0.283	0.362	0.328	0.362	0.372	0.364	0.300	0.362	0.331	0.362	0.364	0.361
N	6887		6887		6887		6887		6887		6887		6887	
Subset till 2017														
$\widehat{CSP}$		0.017		0.021		0.019		0.048***		−0.025*		0.028		0.015
Intercept	21.787		−24.667*		−27.185		14.822		−62.117***		−0.623		−18.583	
Dummy North Am.	−14.648***	−0.113	−3.979*	−0.221	−12.716***	−0.040	−10.911***	0.318	−11.369***	−0.790**	−12.889***	0.151	−23.894***	0.001
Dummy Asia	−29.185***	0.865***	−15.823***	0.800***	−24.520***	0.979**	−24.773***	1.330***	−19.470***	0.047	−25.035***	1.185**	−25.786***	0.890*
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.007		0.000	
R^2	0.237	0.352	0.267	0.353	0.331	0.352	0.365	0.355	0.292	0.353	0.330	0.352	0.361	0.352
N	6050		6050		6050		6050		6050		6050		6050	
Subset till 2016														
$\widehat{CSP}$		0.026*		0.024		0.023		0.052***		−0.029*		0.030		0.022
Intercept	27.835		−17.269		−41.055**		16.338		−64.058***		−2.951		−13.069	
Dummy North Am.	−15.403***	−0.060	−4.828**	−0.294	−13.667***	−0.045	−12.338***	0.253	−12.992***	−0.937***	−14.359***	0.131	−27.274***	0.132
Dummy Asia	−30.934***	0.961***	−15.744***	0.776***	−25.637***	0.996**	−25.406***	1.292***	−20.635***	−0.126	−27.305***	1.226**	−29.408***	1.010**
Weak instruments	0.000		0.000		0.000		0.001		0.000		0.074		0.000	
R^2	0.228	0.344	0.243	0.344	0.329	0.344	0.351	0.346	0.276	0.344	0.327	0.343	0.356	0.343
N	5214		5214		5214		5214		5214		5214		5214	
Imputted input variables														
$\widehat{CSP}$		−0.004		0.013		−0.001		0.033***		−0.010		0.012		0.006
Intercept	26.230*		−31.706***		−4.031		−2.906		−67.318***		−19.590		−18.772*	
Dummy North Am.	−14.702***	−0.534**	−4.418**	−0.372**	−13.449***	−0.506	−7.764***	0.006	−11.631***	−0.642**	−13.401***	−0.251	−24.207***	−0.324
Dummy Asia	−24.820***	0.658**	−13.392***	0.807***	−20.085***	0.679*	−18.151***	1.191***	−18.643***	0.486	−24.487***	0.944**	−23.588***	0.812*
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.000		0.000	
R^2	0.225	0.348	0.255	0.348	0.320	0.348	0.331	0.349	0.282	0.348	0.312	0.348	0.357	0.348
N	11879		11879		11879		11879		11879		11879		11879	
Interaction between CSP and environmental sensitive industries included														
$\widehat{CSP}$		0.015		0.020		0.016		0.047***		−0.017		0.032		0.013
Interaction $\widehat{CSP}$ & env. sens.		0.004		0.005		0.002		0.000		0.000		0.007		0.002
Intercept	29.460*		−30.205**		−10.321		13.639		−76.362***		−2.338		−17.918	
Dummy North Am.	−14.232***	−0.062	−3.652*	−0.140	−12.608***	−0.004	−10.783***	0.386	−9.856***	−0.581*	−12.145***	0.327	−22.881***	0.049
Dummy Asia	−28.578***	0.923***	−15.064***	0.861***	−23.409***	1.013**	−24.288***	1.382***	−18.281***	0.337	−24.000***	1.345***	−24.003***	0.945**
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.002		0.000	
R^2	0.240	0.363	0.286	0.364	0.324	0.363	0.370	0.366	0.309	0.363	0.329	0.364	0.362	0.363
N	7032		7032		7032		7032		7032		7032		7032	

This table displays the estimation results of our robustness checks referring to both stages of the instrumental variable approach for each CSP impact score. Coefficients of all variables are displayed including the significance level marked by asterisks. They are regarded as being significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. The lower boundaries of the rating categories according to Sec. 3.4 are also displayed.

far not been addressed adequately. We supplement earlier studies by using CSP measures based on the more sophisticated and more transparent methodology of Asset4. Moreover, international data coverage allows us to analyze (and compare) the three regions of North America, Europe, and Asia with a consistent methodology and data set. Compared with the majority of previous studies, our analysis focuses on single components of CSP. We account for the requirements of both the consideration of endogeneity regarding the impact of CSP on credit ratings and recent credit risk modeling by applying the instrumental variable approach in terms of the two-stage predictor substitution with an established credit risk model in the second stage. This approach allows us in particular to provide clearer indications of a causal relationship in terms of how CSP components impact credit ratings in contrast to the common approaches, which only reveal correlational relationships.

We initially estimate the impact of overall CSP on credit ratings to confirm the findings of the previous literature. Then we investigate which of the CSP dimensions can improve the quality of credit rating predictions. Each of the three environmental categories has a significant positive impact while environmental innovation is most distinct. As part of social performance, measures for community and diversity (involving equal opportunities) are significant. With respect to differences between North America, Europe, and Asia, the impact of social performance is driven by the extent of diversity only in North America and Europe, which has no impact in Asia and is likely due to cultural reasons. Product innovation is still the determining driver within the environmental performance of all regions.

The identification of the drivers of impact for CSP on credit ratings has important implications for practice. Some of the CSP dimensions generally act in a risk-mitigating manner in terms of default risk, for which credit ratings are a proxy. From this point of view, investments in CSP are not a waste of resources. Moreover, because better credit ratings are associated with lower financing costs, our results help to target investments in CSP for the purpose of referring cost reductions efficiently. In particular investments in product innovation and diversity appear to have the highest impact.

With the identification of these CSP components that lead to lower credit risk, our analysis shows that some, but not all aspects of CSP produce favorable effects beyond a philanthropic rationale. However, as a limitation, it has to be noted that real-world causality in the context of this relationship can only be proven by means of natural or quasi-experiments, therefore confirming the necessity for continued research in the future.

Chapter 4

Corporate social responsibility and systematic risk: international evidence

This chapter is based on a joint work with Gregor Dorfleitner (University of Regensburg). The article has been submitted to the *Journal of Risk Finance* and is under review at submission of this thesis.

Abstract *Design/methodology/approach* - This study focuses on the impact of corporate social responsibility on systematic firm risk in an international sample. We measure corporate social performance (CSP) emerging from a company's social responsibility efforts by utilizing a CSP rating framework that covers a variety of dimensions. The instrumental variable approach is applied to mitigate endogeneity and identify causal relationships.

Purpose - This paper aims to close gaps in the current literature according to whether there are differences regarding the relationship between CSP and systematic risk when diverse regions of the world are considered, and what the respective drivers for this relationship are. Furthermore, it tests the robustness to alternative measures for CSP and systematic risk.

Findings - The impact of overall CSP on systematic risk is most distinct for North American firms and, in descending order, weaker in Europe, Asia-Pacific, and Japan. Risk mitigation applies across all four regions. However, the magnitude of impact differs. While the most critical drivers in North America and Japan include product responsibility, Europe is affected most by the employees category and Asia-Pacific by environmental innovation.

Practical implications - Our findings help firms to control their cost of equity and investors may identify low-risk stocks by considering certain aspects of CSP.

Originality/value - This study distinguishes itself from previous literature addressing the connection between systematic risk and CSP by focusing on regional differences in an international sample, using the very transparent CSP measures of Asset4, identifying underlying impact drivers, and testing for robustness to alternative measures of systematic risk.

Keywords beta · systematic risk · corporate social responsibility · sustainability

JEL Classification G12 · M14

4.1 Introduction

Current literature cannot answer whether the impact of corporate social performance (CSP) on systematic risk differs across diverse regions of the world, and what the respective drivers for this relationship are. We provide empirical evidence of the impact of CSP on systematic risk in an international sample comprising firms in North America, Europe, Japan, and the Asia-Pacific region. Our notion of systematic risk is based on the capital asset pricing model (CAPM) of Sharpe (1964), Lintner (1975), and Mossin (1966). This study distinguishes itself from previous literature addressing the connection between systematic risk and CSP in four ways: 1) it focuses on regional differences in an international sample; 2) it uses the very transparent CSP measures of Asset4; 3) it identifies underlying impact drivers; and 4) it investigates whether these results are robust to alternative measures of systematic risk developed from the five-factor asset pricing model of Fama and French (2015) and the international CAPM. As a result, we find a strong risk mitigation effect in North America and in Europe and, to a lesser extent in Japan and Asia-Pacific. Although the magnitude of impact differs, identified drivers include emission reduction, environmental innovation, resource reduction, product responsibility, community, human rights, diversity, and employees.

While the risk mitigation view assumes that firms profit from investments in CSP through lower risk, the over-investment view claims that these investments must are sunk costs without any further benefits (Goss and Roberts, 2011). The impact of CSP on corporate risk is the object of current research. Recent examples are studies focussing on credit risk (cf. Attig et al., 2013; Stellner et al., 2015; Jiraporn et al., 2014), idiosyncratic and crash risk (cf. Utz, 2018; Kim et al., 2014; Lee and Faff, 2009), and systematic risk (cf. Albuquerque et al., 2018; Sassen et al., 2016).

Although there is some initial empirical evidence concerning the impact of CSP on systematic risk for the U.S. (Albuquerque et al., 2018), and Europe (Sassen et al., 2016), the current literature cannot answer whether there are differences regarding this relationship when diverse regions of the world are considered, and what the respective drivers for this relationship are. Furthermore, it is not clear whether the existing results, which are based on the previously mentioned CAPM, are robust to alternative measures for CSP and systematic risk. Our analysis closes this gap in the literature by analyzing the impact of Asset4 CSP measures on a more granular level based on a world-wide sample. Robustness checks include the five-factor model of Fama and French (2015) and the international CAPM (Fama and French, 2012) to estimate the systematic risk. As the measures for CSP are expected to be highly endogenous, we apply an instrumental variable approach with a large set of control variables and time, industry, and country fixed effects to endogenize the CSP measures. Instruments include CSP country averages (Jiraporn et al., 2014) and relevant categories of the National Business Systems (NBS) classification (Ioannou and Serafeim, 2012; Whitley, 1999).

Finally, we find a negative relationship between CSP and systematic risk in North America, Europe, Japan, and Asia-Pacific, indicating that high CSP has a tendency to be connected to low systematic risk and vice versa. Thus there is evidence for the risk mitigation hypothesis independently of the region. The impact of CSP is strongest in North America, followed by Europe, Asia-Pacific, and Japan. We see that this pattern is driven mainly by the contribution of all CSP components but to a varying extent. Product responsibility is most important in North America and Japan, employees in Europe, and environmental innovation in Asia-Pacific.

Our findings on the international empirical evidence of CSP impact on systematic risk also have implications for practice, as the systematic risk of a firm is the major component when it comes to determining the cost of equity. Also, investors may identify low risk stocks by considering certain aspects of CSP.

The remainder of the paper is organized as follows. We start with some theoretical considerations about the relationship between CSP and systematic risk in Section 4.2. Section 4.3 describes the global data set, and Section 4.4 introduces the employed instrumental variable methodology. Section 4.5 presents the empirical results for both the entire sample and each region. Finally, Section 4.6 concludes including practical implications for capital allocation, investment valuation, and portfolio selection.

4.2 Theoretical considerations

In the literature, two opposite views have emerged from examining whether firms benefit from investments in CSP, namely the risk mitigation view and the over-investment view (Goss and Roberts, 2011). In particular, there is evidence that firms profit from sustainable future cash flows (Kang et al., 2016; Dorfleitner et al., 2018; Von Arx and Ziegler, 2014) and abnormal returns (Flammer, 2015), especially in consumer-oriented industries (Dimson et al., 2015). Stock returns of high CSP firms may be comparably higher even during a financial crisis, as documented for the financial crisis of 2008/2009 by Lins et al. (2017), which implies that CSP can contribute to mitigating risk. In a meta-study, Orlitzky et al. (2003) find a positive relationship between ESG and CFP in the majority of studies. Referring to firm value, Margolis et al. (2007), in a meta-study comprising the evidence of 35 years, find, on average, a small, positive effect. Servaes and Tamayo (2013) provide evidence for a positive impact of CSP on firm value for firms with high levels of customer awareness. Bauer and Hann (2010) examine the risk related to environmental performance and find that unsustainable firms can be endangered regarding reputation, legal, and regulatory risks. Firms with an excellent performance in social categories may hire talented employees more easily, which is crucial to economic success (Turban and Greening, 1997). For completeness, we note that there is also evidence of the over-investment view, albeit less comprehensive (cf. Brammer and Millington, 2008; Cornell and Shapiro, 1987; Aupperle et al., 1985).

The relationship between CSP and a variety of risk aspects has already been subject to previous empirical research. Attig et al. (2013) and Jiraporn et al. (2014) analyze the impact of CSP on credit risk and find strong effects in North America. Utz (2018) finds evidence of the risk mitigation view of CSP for idiosyncratic and crash risk in the U.S., Japan, and Europe, while the over-investment view applies to Asia-Pacific. Furthermore, high CSP appears to be consistent with a lower cost of equity (Goss and Roberts, 2011; Dhaliwal et al., 2011; El Ghoul et al., 2011; Lee et al., 2009; Orlitzky, 2008).

Referring to the relationship between CSP and systematic risk, Albuquerque et al. (2018) find a clear risk-mitigating impact of CSP for firms located in the U.S. Their analysis is methodologically based on the overall CSP measurement of KLD, the CAPM to calculate systematic risk, and an instrumental variable approach to confirm the relationship between both. Besides the empirical aspects, they largely contribute to the literature by deducing an industry equilibrium model in which firms have the option to choose a sustainable or unsustainable production method as part of their product differentiation. Sassen et al. (2016) provide some preliminary evidence on systematic risk for European firms based on Asset4 CSP measures, however, do not use an instrumental variable approach. From the previous literature in the context of CSP affecting corporate performance, cost of equity, and various types of risk, we can clearly formulate the expectation that CSP is negatively related to systematic risk, even for companies outside the U.S. and regardless of how CSP is measured.

To formulate an expectation on regional variations in the relationship between CSP and systematic risk, we consider the international evidence on different levels of CSP and on the link between CSP and other types of risk. For idiosyncratic and credit risk, it is already known that the relation with CSP varies across regions, while CSP itself also varies (cf. Utz (2018) for the case of idiosyncratic risk and Dorfleitner et al. (2020) for the case of credit risk). Although credit risk, idiosyncratic risk, and systematic risk are different concepts in general, they are still loosely related.[1] Thus, it is plausible to expect that also the relationship of CSP and systematic risk could differ across regions, given that there is an impact.

[1] One linking concept is the financial leverage of the firm, as credit risk (Merton, 1974), idiosyncratic risk (Brandt et al., 2010), and systematic risk (Hamada, 1972) are influenced by the financial leverage. Generally, the risk management of a company includes a simultaneous consideration of all three kinds of risk.

TABLE 4.1: Country structure of regional panels

Region	Countries	#Observations	#Firms
North America	Canada, United States of America	8327	2029
Europe	Belgium, Switzerland, Germany, Denmark, Spain, Finland, France, Greece, Great Britain, Italy, Netherlands, Norway Portugal, Sweden	5393	824
Japan	Japan	2219	291
Asia-Pacific	Australia, Hong Kong, India, Malaysia, New Zealand, Singapore, Taiwan	2787	656
Total		18726	3800

This table presents the mapping of countries to the regions of North America, Europe, Japan, and Asia-Pacific as well as the respective numbers of observations. We analyze the impact of CSP on credit risk based on the three regional panels and consider country fixed effects among the control variables.

4.3 Data

We analyze the relationship between the annual CSP measures of Asset4 and annual measures for systematic risk for the regions of North America, Europe, Japan, and Asia-Pacific. Table 4.1 shows the distribution of the sample based on 3800 companies across regions. In the pre-step, we employ a dataset of weekly stock returns, market returns, and three-months risk-free rates on the country level to estimate the systematic risk of one year.[2] Table 4.2 presents an overview of the utilized data sources in this step. In the following step, the main regressions are based on a yearly panel dataset, including the systematic risk measures from the pre-step matched with CSP measures, instruments, and control variables. The observation period ranges from 2003 to 2018 for the dependent variable systematic risk and from 2002 to 2017 for the explanatory variables due to a lag of one period. The sample includes all publicly traded firms from the regions of North America, Europe, Japan, and Asia-Pacific as defined by Fama and French (2012) for which Asset4 scores are available.

In our analysis, systematic risk is proxied by the market index beta coefficient of the capital asset pricing model (CAPM) (cf. Albuquerque et al., 2018). The distribution of estimated alphas and betas is displayed in Table 4.3. The predominant share of alphas is not significantly different from zero. For this reason, we focus on the beta only in the following. The mean beta of North America is the highest of all regions, and Europe is lowest while Japan and Asia-Pacific rank in-between.

We choose the annually updated CSP scores of Asset4 provided by Thomson Reuters for our analysis because of their excellent reputation, transparency, and international availability.

[2]While Albuquerque et al. (2018) use daily stock returns within one year to calculate the systematic risk, we refrain from doing so due to autocorrelation issues. We use weekly returns to solve this issue as for monthly returns too few data points result, given the estimation window of one year, which is necessary due to the frequency of the explanatory data in the main regressions.

TABLE 4.2: Data sources of the market models

Source Country	Region	CAPM Local index TR Datastream TDS Mnemonic	Interest rate TR Datastream TDS Mnemonic	Fama French 5 Factor Model Factors Online Data Library of K. French Reference	International CAPM Global index Online Data Library of K. French Reference
Australia	Asia-Pacific	PCH#(X(LI), 1W)	ADBR090	Fama/French Asia-Pacific ex. Japan 5 Factors Daily	Global Factors
Belgium	Europe	PCH#(X(LI), 1W)	EIBOR3M	Fama/French Europe 5 Factors Daily	Global Factors
Canada	North America	PCH#(X(LI), 1W)	CDN3MTB	Fama/French North America 5 Factors Daily	Global Factors
Denmark	Europe	PCH#(X(LI), 1W)	DNREPOR	Fama/French Europe 5 Factors Daily	Global Factors
Finland	Europe	PCH#(X(LI), 1W)	EIBOR3M	Fama/French Europe 5 Factors Daily	Global Factors
France	Europe	PCH#(X(LI), 1W)	EIBOR3M	Fama/French Europe 5 Factors Daily	Global Factors
Germany	Europe	PCH#(X(LI), 1W)	EIBOR3M	Fama/French Europe 5 Factors Daily	Global Factors
Great Britain	Europe	PCH#(X(LI), 1W)	TRUK3MT	Fama/French Europe 5 Factors Daily	Global Factors
Greece	Europe	PCH#(X(LI), 1W)	EIBOR3M	Fama/French Europe 5 Factors Daily	Global Factors
Hong Kong	Asia-Pacific	PCH#(X(LI), 1W)	LTRHKBMK	Fama/French Asia-Pacific ex. Japan 5 Factors Daily	Global Factors
India	Asia-Pacific	PCH#(X(LI), 1W)	INTB91D	Fama/French Asia-Pacific ex. Japan 5 Factors Daily	Global Factors
Italy	Europe	PCH#(X(LI), 1W)	EIBOR3M	Fama/French Europe 5 Factors Daily	Global Factors
Japan	Japan	PCH#(X(LI), 1W)	LTRJPBMK	Fama/French Japan 5 Factors Daily	Global Factors
Malaysia	Asia-Pacific	PCH#(X(LI), 1W)	MYTBB04	Fama/French Asia-Pacific ex. Japan 5 Factors Daily	Global Factors
Netherlands	Europe	PCH#(X(LI), 1W)	EIBOR3M	Fama/French Europe 5 Factors Daily	Global Factors
New Zealand	Asia-Pacific	PCH#(X(LI), 1W)	NZTBL3M	Fama/French Asia-Pacific ex. Japan 5 Factors Daily	Global Factors
Norway	Europe	PCH#(X(LI), 1W)	NWIBK3M	Fama/French Europe 5 Factors Daily	Global Factors
Portugal	Europe	PCH#(X(LI), 1W)	EIBOR3M	Fama/French Europe 5 Factors Daily	Global Factors
Singapore	Asia-Pacific	PCH#(X(LI), 1W)	SNGTB3M	Fama/French Asia-Pacific ex. Japan 5 Factors Daily	Global Factors
Spain	Europe	PCH#(X(LI), 1W)	EIBOR3M	Fama/French Europe 5 Factors Daily	Global Factors
Sweden	Europe	PCH#(X(LI), 1W)	SDREPM	Fama/French Europe 5 Factors Daily	Global Factors
Swiss	Europe	PCH#(X(LI), 1W)	SWLOMBD	Fama/French Europe 5 Factors Daily	Global Factors
Taiwan	Asia-Pacific	PCH#(X(LI), 1W)	TAMM90D	Fama/French Asia-Pacific ex. Japan 5 Factors Daily	Global Factors
United States of America	North America	PCH#(X(LI), 1W)	USTBL3M	Fama/French North America 5 Factors Daily	Global Factors

This table displays the data sources of our market models that are used to calculate the systematic risk.

TABLE 4.3: Distribution of firms' alpha and market beta coefficients

	Distribution of coefficient				Distribution of p-values					thereof %-share of
	25%-Qu.	75%-Qu.	Mean	SD	25%-Qu.	75%-Qu.	Mean	SD	#Obs.	p-value < 5%
North America										
$\widehat{\alpha}$ (%)	-0.209	0.402	0.089	0.558	0.216	0.729	0.476	0.294	8327	7
$\widehat{\beta}$	0.732	1.411	1.101	0.517	0.000	0.003	0.032	0.115	8327	90
Europe										
$\widehat{\alpha}$ (%)	-0.150	0.471	0.145	0.558	0.186	0.707	0.451	0.296	5393	9
$\widehat{\beta}$	0.647	1.196	0.929	0.424	0.000	0.004	0.042	0.138	5393	87
Japan										
$\widehat{\alpha}$ (%)	-0.156	0.404	0.133	0.462	0.265	0.764	0.513	0.291	2219	5
$\widehat{\beta}$	0.767	1.271	1.014	0.367	0.000	0.000	0.012	0.074	2219	96
Asia-Pacific										
$\widehat{\alpha}$ (%)	-0.312	0.419	0.029	0.678	0.202	0.719	0.461	0.296	2787	8
$\widehat{\beta}$	0.607	1.286	0.953	0.522	0.000	0.027	0.076	0.187	2787	79

This table reports descriptive statistics for the distribution of estimated yearly firm CAPM alphas and market betas based on weekly data covering the period from 2003 till 2018 per region. The betas are our proxy for systematic risk and are hence included as the dependent variable in the second stage of our 2SLS estimation. Provided p-Values are based on the Newey-West estimator.

While the popular MSCI-KLD database is only available for the U.S., Asset4 scores are available for firms on a global basis. The reputation of these scores has been demonstrated in several studies (e.g., Stellner et al., 2015). Compared with KLD, FTSE4Good, and Dow Jones, CSP measures of Asset4 provide more transparency (Chatterji and Levine, 2006). Based on publicly available sources such as websites, SEC filings such as 10-K, DEF 14A, 10-Q, sustainability reports, media sources, and NGO reports, Asset4 evaluates more than 750 individual questions leading to a data point in each case. The information is then aggregated to more than 250 key performance indicators. These are again condensed to 18 categories for the aggregated pillars of environmental, social, economic sustainability, and corporate governance performance. Following major studies in this area (cf. El Ghoul et al., 2017; Ioannou and Serafeim, 2012; Luo et al., 2015), we refrain from using the economic sustainability and the corporate governance scores to adhere to a narrow and clear definition of CSP and utilize the average of the environment and social scores to determine the *overall* CSP. The category level of social scores is matched to categories of product responsibility, community, human rights, diversity, and employees as in Attig et al. (2013). The environmental performance is marked by three categories, namely emission reduction, environmental innovation, and resource reduction as in Dorfleitner et al. (2018). Details of the CSP variables are also provided in Table 4.4.

Table 4.4: Details on CSP variables

Variable	Definition
Emissions	The emission reduction category measures a company's management commitment and effectiveness towards reducing environmental emission in the production and operational processes. It reflects a company's capacity to reduce air emissions (greenhouse gases, F-gases, ozone-depleting substances, NOx, and SOx, etc.), waste, hazardous waste, water discharges, spills or its impacts on biodiversity and to partner with environmental organisations to reduce the environmental impact of the company in the local or broader community. - Source: Thomson Reuters Datastream, Mnemonic ENER.
Environmental innovation	The product innovation category measures a company's management commitment and effectiveness towards supporting the research and development of eco-efficient products or services. It reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed, dematerialized products with extended durability. - Source: Thomson Reuters Datastream; Mnemonic ENPI.
Resources	The resource reduction category measures a company's management commitment and effectiveness towards achieving an efficient use of natural resources in the production process. It reflects a company's capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management. - Source: Thomson Reuters Datastream; Mnemonic ENRR.
Product responsibility	The customer/product responsibility category measures a company's management commitment and effectiveness towards creating value-added products and services upholding the customer's security. It reflects a company's capacity to maintain its license to operate by producing quality goods and services integrating the customer's health and safety, and preserving its integrity and privacy also through accurate product information and labelling. - Source: Thomson Reuters Datastream; Mnemonic SOPR.
Community	The society/community category measures a company's management commitment and effectiveness towards maintaining the company's reputation within the general community (local, national, and global). It reflects a company's capacity to maintain its license to operate by being a good citizen (donations of cash, goods or staff time, etc.), protecting public health (avoidance of industrial accidents, etc.), and respecting business ethics (avoiding bribery and corruption, etc.). - Source: Thomson Reuters Datastream; Mnemonic SOCO.
Human rights	The society/human rights category measures a company's management commitment and effectiveness towards respecting the fundamental human rights conventions. It reflects a company's capacity to maintain its license to operate by guaranteeing the freedom of association and excluding child, forced or compulsory labour. - Source: Thomson Reuters Datastream; Mnemonic SOHR.
Diversity	The workforce/diversity and opportunity category measures a company's management commitment and effectiveness towards maintaining diversity and equal opportunities in its workforce. It reflects a company's capacity to increase its workforce loyalty and productivity by promoting a sufficient life-work balance, a family-friendly environment, and equal opportunities regardless of gender, age, ethnicity, religion or sexual orientation. - Source: Thomson Reuters Datastream; Mnemonic SODO.

Table continues on next page.

TABLE 4.4 continued

Variable	Definition
Employees	This category includes employment quality, health/safety, and training and development. The workforce/employment quality category measures both a company's management commitment and its effectiveness towards providing high-quality employment benefits and job conditions. It reflects a company's capacity to increase its workforce loyalty and productivity by distributing rewarding and fair employment benefits, and by focusing on long-term employment growth and stability by promoting from within, avoiding lay-offs, and maintaining relations with trade unions. The workforce/health & safety category measures a company's management commitment and effectiveness towards providing a healthy and safe workplace. It reflects a company's capacity to increase its workforce loyalty and productivity by integrating into its day-to-day operations a concern for the physical and mental health, well-being, and stress level of all employees. The workforce/training and development category measures a company's management commitment and effectiveness towards providing training and development (education) for its workforce. It reflects a company's capacity to increase its intellectual capital, workforce loyalty, and productivity by developing the workforce's skills, competencies, employability, and careers in an entrepreneurial environment. - Source: Thomson Reuters Datastream; Mnemonics SOEQ, SOHS, and SOTD.

This table presents detailed information about the CSP variables that we used as provided by Thomson Reuters (2011).

Table 4.5 provides descriptive statistics for the employed CSP variables, their instruments, and control variables for the four regional panels. The set of variables displays substantial differences across the regions. Note that the mean of overall CSP ranks highest in Europe (64%), lowest in North America, and Asia-Pacific (43% both), while Japan (58%) is in-between. Details of the instrument variables are provided in Table 4.6.

Analogous to Albuquerque et al. (2018), we control for several other explanatory variables (see Table 4.7). An influence on credit risk has been evidenced for leverage, size, and earnings variability (Beaver et al., 1970) and for research and development (R&D) expenditures (McAlister et al., 2007). As there are indications that diversified firms have higher betas than undiversified firms (Melicher and Rush, 1973), we proxy this effect by the number of secondary 3-digit ISIC codes that Datastream provides besides the primary industry code. As firms retaining higher cash appear to face higher systematic risk (Palazzo, 2012), we include cash holdings as a variable. Because there is evidence that firms' operating leverage levels are related to their financial performance (Novy-Marx, 2010), we include the referring variable. The impact of capital expense on systematic risk is documented by Lev (1974). Thus we control for this variable also. We also include industry-fixed effects based on the classification of Fama and French.[3] An overview of industries in the sample is provided in Table 4.8. Additionally, we control for country- and time-fixed effects. All time-dependent explanatory variables are lagged by one year.

[3]The classification into ten industries based on firm SIC codes was obtained from the website http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html.

TABLE 4.5: Descriptive statistics of independent variables

	North America				Europe				Japan				Asia-Pacific			
	25%-Qu.	Mean	75%-Qu.	SD	25%-Qu.	Mean	75%-Qu.	SD	25%-Qu.	Mean	75%-Qu.	SD	25%-Qu.	Mean	75%-Qu.	SD
Overall CSP score	0.17	0.43	0.69	0.29	0.43	0.64	0.88	0.27	0.25	0.58	0.87	0.31	0.17	0.43	0.67	0.27
Emission score	0.15	0.41	0.72	0.31	0.36	0.64	0.90	0.29	0.29	0.65	0.93	0.32	0.16	0.42	0.70	0.29
Env. inno. score	0.20	0.42	0.67	0.29	0.23	0.56	0.91	0.32	0.27	0.65	0.95	0.32	0.19	0.40	0.63	0.28
Resources score	0.13	0.43	0.76	0.32	0.40	0.64	0.89	0.28	0.25	0.59	0.88	0.32	0.14	0.44	0.75	0.30
Prod. resp. score	0.20	0.46	0.72	0.29	0.28	0.57	0.87	0.31	0.31	0.58	0.91	0.32	0.15	0.43	0.68	0.30
Community score	0.15	0.46	0.76	0.31	0.29	0.56	0.85	0.30	0.23	0.55	0.84	0.32	0.16	0.45	0.74	0.30
Hum. rights score	0.20	0.45	0.84	0.30	0.25	0.60	0.93	0.32	0.24	0.51	0.88	0.29	0.19	0.37	0.54	0.26
Diversity score	0.23	0.46	0.73	0.28	0.27	0.58	0.89	0.31	0.11	0.54	0.90	0.36	0.14	0.45	0.74	0.31
Employees score	0.22	0.43	0.62	0.24	0.47	0.63	0.82	0.22	0.18	0.43	0.64	0.25	0.27	0.48	0.67	0.24
Regulat. framew.	17.00	17.57	17.00	1.40	12.00	15.52	16.00	9.81	37.00	37.00	37.00	0.00	6.00	12.86	11.00	8.82
Anti-self-dealing	0.65	0.65	0.65	0.00	0.33	0.58	0.95	0.30	0.50	0.50	0.50	0.00	0.76	0.80	0.96	0.14
Abs. of corruption	0.68	0.66	0.68	0.06	0.54	0.79	0.68	0.88	0.72	0.72	0.72	0.00	0.52	0.88	0.58	1.04
Political orient.	103.13	88.51	103.13	35.83	0.31	36.22	99.76	47.71	0.01	0.01	0.01	0.00	0.35	29.31	101.38	45.65
Union density	12.00	14.54	12.00	6.23	21.30	31.23	33.60	18.22	19.20	19.20	19.20	0.00	22.70	24.69	23.00	7.74
Skilled labour	6.09	6.14	6.09	0.13	5.78	6.21	6.42	0.52	4.50	4.50	4.50	0.00	6.30	6.36	6.74	0.28
Power distance	40.00	39.86	40.00	0.35	35.00	40.56	50.00	13.64	54.00	54.00	54.00	0.00	36.00	53.98	68.00	19.48
Individualism	91.00	89.43	91.00	3.85	68.00	74.71	89.00	13.68	46.00	46.00	46.00	0.00	25.00	54.37	90.00	33.57
Operating leverage	-0.24	-0.04	0.01	0.49	-0.23	-0.07	0.02	0.39	-0.14	-0.08	-0.02	0.15	-0.27	1.48	0.07	9.91
R&D	0.00	0.02	0.02	0.05	0.00	0.01	0.01	0.03	0.00	0.02	0.03	0.03	0.00	0.01	0.00	0.03
Leverage	1.26	13.27	13.07	26.65	1.01	14.78	15.50	27.32	0.00	0.03	0.04	0.04	0.06	13.09	7.63	32.25
CAPEX	2.01	6.13	7.63	6.64	1.85	5.11	6.57	5.11	2.21	4.82	6.46	3.64	1.52	6.57	8.21	8.20
Cash	0.03	0.14	0.19	0.16	0.04	0.12	0.15	0.12	0.06	0.15	0.20	0.13	0.06	0.17	0.22	0.15
Size	14.50	15.42	16.27	1.39	14.22	15.13	15.98	1.39	14.63	15.35	16.01	1.03	13.37	14.35	15.53	1.62
Earnings variab.	0.01	0.04	0.07	0.07	0.02	0.04	0.06	0.06	0.01	0.03	0.04	0.03	0.02	0.03	0.07	0.11
Diversification	1.00	2.72	4.00	2.07	1.00	3.35	5.00	2.34	3.00	4.81	7.00	2.23	1.00	3.25	5.00	2.31
ROA	0.07	0.12	0.17	0.12	0.07	0.12	0.16	0.10	0.06	0.10	0.13	0.06	0.05	0.09	0.16	0.15
GDP growth	0.02	0.02	0.03	0.02	0.00	0.01	0.03	0.03	0.00	0.00	0.02	0.02	0.02	0.03	0.04	0.02
#Obs.	8327				5393				2219				2787			

This table reports descriptive statistics (mean, standard deviation SD, 25%, and 75% quantiles) of CSP variables, their instruments, and controls for our panels North America, Europe, Japan, and Asia-Pacific. CSP variables are used as a dependent variable, while instruments and controls are explanatory variables in the first stage. Finally, the second stage considers systematic risk as the dependent variable with the CSP estimate from the first stage and, once more, the same controls as independent variables.

Table 4.6: Details on employed instruments

Variable	Definition
Country average CSP score (%)	Mean Asset4 CSP Score of all surrounding firms in the same country (measured each year) - Source: Thomson Reuters Datastream.
Regulatory framework	Measure for how laws facilitate the competition in the country (measured as of 2017) - Source: IMD World Competitiveness Report 2017.
Anti-self-dealing index	How laws restrict the self-dealing of insiders (measured as of 2001) - Source: La Porta et al. (2006).
Absence of corruption	Inverse of average corruption score during the period 1996-2017 - Source: World Bank.
Political orientation	Subset in percentage of years from 1928 to 1995 when both chief executive and largest party in Congress were left or center oriented - Source: Botero et al. (2004).
Union density	Quantity of union members divided by the total number of employess as the average from years 2002 to 2017 based on administrative and survey data - Source: OECD and J.Visser, ICTWSS database (Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts).
Skilled labour	Index for the availability of a qualified workforce in a country (measured as of 2017) - Source: IMD World Competitiveness Report 2017.
Power distance	The social acceptance and expectation of unequal power distribution (measured as of 1973) - Source: Hofstede et al. (2010), Hofstede (2001).
Individualism	The extent of integration of individuals into groups (measured as of 1973) - Source: Hofstede et al. (2010), Hofstede (2001).

This table gives an overview of the instruments that we used in the first stage of our 2SLS estimations based on Jiraporn et al. (2014) and Ioannou and Serafeim (2012).

Table 4.7: Details on control variables

Variable	Definition
Operating leverage	Growth of operating expenses divided by the increase in total sales. Both operating expense and total sales are predicted based on the geometric growth rate. - Source: Thomson Reuters Datastream; Mnemonics WC01249, DWSL.
R&D	Sum of all direct and indirect costs for the purpose of research, creation and development of new processes, techniques, applications, and products for commercial use divided by total assets. Missing values are replaced by zero. - Source: Thomson Reuters Datastream; Mnemonics WC01201, WC02999.
Leverage	Long-term debt to total assets ratio. - Source: Thomson Reuters Datastream; Mnemonics WC08216, WC02999.
CAPEX	Capital expenditures divided by total assets. - Source: Thomson Reuters Datastream; Mnemonic WC08416.
CAPEX	Capital expenditures divided by total assets. - Source: Thomson Reuters Datastream; Mnemonic WC08416.

Table continues on next page.

TABLE 4.7 continued

Variable	Definition
Cash	Sum of cash and short-term investments divided by total assets. - Source: Thomson Reuters Datastream; Mnemonics WC02001, WC02999.
Size	Logarithm of market capitalization in USD. - Source: Thomson Reuters Datastream; Mnemonic WC07210.
Earnings variab.	Standard deviation of net income before extra items/preferred dividends of the previous five years over total assets. - Source: Thomson Reuters Datastream; Mnemonics WC01551, WC02999.
Diversification	The number of four-digit ISIC codes. - Source: Thomson Reuters Datastream; Mnemonics WC07021-8.
ROA	Earnings before interest, taxes, and depreciation over total assets. - Source: Thomson Reuters Datastream; Mnemonics WC18198, WC02999.
GDP growth	The annual growth rate of the gross domestic product. - Source: Thomson Reuters Datastream; Mnemonic GDP..D (in combination with the two letter country code).

This table presents details on the used control variables provided by Thomson Reuters Datastream.

TABLE 4.8: Overview on industry classes in the sample

Industry class	North America	Europe	Japan	Asia-Pacific
Consumer non-durables	461	536	164	160
Consumer durables - cars, TVs, furniture, household appliances	220	131	126	59
Manufacturing - machinery, trucks, planes, chemicals, off furn, paper	1105	933	595	324
Oil, gas, and coal extraction and products	720	253	41	201
Business equipment - computers, software, and electronic equipment	1347	437	355	348
Telephone and television transmission	236	227	52	115
Wholesale, retail, and some services (laundries, repair)	798	644	206	275
Healthcare, medical equipment, and drugs	681	304	97	90
Utilities	532	257	72	125
Other	2227	1671	511	1090
Total	8327	5393	2219	2787

This table reports on the number of observations per industry class, according to Fama and French, per region. We include firm fixed effects among the controls in both stages of our 2SLS estimation.

4.4 Methodology

We aim to measure the impact of CSP on systematic firm risk. The systematic risk of stock i is estimated based on its weekly returns $r_{i,s}$ according to the formula:

$$r_{i,s} - r_s = \alpha_i + \beta_i(r_{M,s} - r_s) + \epsilon_{i,s}\,, \tag{4.1}$$

where $s = 1, \ldots, 52$ describes the week of observation, r_s the risk-free rate, and $r_{M,s}$ the market index return on the same week s. Finally, the systematic risk of firm i in the respective year is found by the estimated value of β_i. Both alphas and betas are tested for significance based on the Newey-West estimator (Newey and West, 1986).

The measurement of the impact of CSP on systematic risk is based on two-stage least squares (2SLS) estimations, which implement an instrumental variable approach to overcome the endogeneity of the CSP measures. The ordinary least squares (OLS) regression in the first stage includes one respective CSP measure $x_{i,t-1}$ as the dependent variable, e.g., the resources CSP model consists of the resources CSP measure. Furthermore, the model considers a vector of instrument variables $\boldsymbol{z}_{i,t-1}$ (e.g., the average country CSP performance) and a vector of control variables $\boldsymbol{c}_{i,t-1}$ (including time-fixed and country-fixed effects and industry dummies) as explanatory variables:

$$x_{i,t-1} = \boldsymbol{z}_{i,t-1}\boldsymbol{\gamma}_z + \boldsymbol{c}_{i,t-1}\boldsymbol{\gamma}_{c1} + \epsilon_{1,i,t-1}. \tag{4.2}$$

To account for the panel structure of our (yearly) data, standard errors are clustered on the firm level. In the second stage, we regress systematic risk on the CSP estimates of stage one $\hat{x}_{i,t-1}$ as well as the same control variables vectors $\boldsymbol{c_{i,t-1}}$:

$$\hat{\beta}_{i,t} = \hat{x}_{i,t-1}\gamma_x + \boldsymbol{c}_{i,t-1}\boldsymbol{\gamma}_{c2} + \epsilon_{2,i,t}. \tag{4.3}$$

Again we use OLS estimations with clustered standard errors on the firm level. All explanatory variables are lagged by one period.

4.5 Empirical tests

To commence, we analyze the impact of overall CSP on systematic risk followed by the breakdown into single CSP components. We then analyze the effect of integrating non-linear CSP terms into our model because some arguments favor a convex relationship between CSP and risk (Utz, 2018). Subsequently, we examine the robustness of our results.

4.5.1 Varied impact of overall CSP across regions

Table 4.9 provides the result of regressing systematic firm risk on overall CSP for North America, Europe, Japan, and Asia-Pacific based on 2SLS. The first (second) of each regional pair columns displays the first (second) stage regression. Additionally, we provide a test on weak instruments (low p-values indicate strong instruments) and R^2 values to measure model fit.

The estimations reveal a substantial impact of overall CSP on systematic risk on a significance level of 1% in the North American and European samples. However, the effect

TABLE 4.9: Two-stages least squares estimation results based on overall CSP

	North America		Europe		Japan		Asia-Pacific	
	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	S tage 2
$\widehat{CSP}$		−2.28***		−1.16***		−0.29**		−0.47**
CSP country average	−0.94***		−0.05		−2.97***		0.14	
Regulatory framework			−0.06***				0.00	
Anti self-dealing			0.09				−0.18	
Abs. of corruption			0.53***				0.05***	
Political orientation			−0.43				0.00***	
Union density			0.00				−0.01**	
Skilled labour			−0.11***				0.03	
Power distance			0.01***				−0.01***	
Individualism			0.00				0.00	
Operating leverage	−0.03***	−0.03	−0.03***	−0.02	0.18***	0.00	0.00***	0.00
R&D	0.48***	1.16***	0.53**	0.66**	3.21***	1.35*	−0.24	−0.45
Leverage	0.00***	0.00***	0.00	0.00	−0.12	0.10	0.00***	0.00
CAPEX	0.00***	0.00**	0.00	0.00	0.01*	0.00	0.00**	0.01***
Cash	−0.20***	−0.06	−0.18***	−0.04	−0.20**	−0.05	−0.18***	0.13
Size	0.06***	0.16***	0.08***	0.13***	0.13***	0.08***	0.09***	0.09***
Earnings variability	0.04	−0.79***	−0.15	−0.62***	−1.55***	−2.30***	−0.30***	0.20
Diversification	0.02***	0.04***	0.01***	0.02***	0.02***	0.01	0.00	0.01**
ROA	−0.07*	−0.60***	−0.04	−0.40***	0.00	−0.55**	−0.03	−0.10
GDP Growth (%)	−8.79***	−10.14***	0.08	−0.80*	22.44***	−3.71	0.88***	2.59***
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y			Y	Y
Weak Instruments	0.000		0.000		0.000		0.000	
R^2	0.337	0.191	0.383	0.166	0.495	0.254	0.341	0.121
#Obs.	8327		5393		2219		2787	

This table provides 2SLS estimation results for overall CSP in North America, Europe, Japan, and Asia-Pacific. The dependent variable of the first stage is the CSP scores, which are regressed on instruments and controls. In the second stage, the CSP estimates comprised by the first stage are beside controls included among the independent variables to explain systematic risk as the dependent variable. The selection of control variables remains the same at both stages. The first and second stages are shown in the first and second column of each panel. Coefficients are marked as significant on the level of 1% (***), 5% (**) or 10% (*) when that the p-value is below these levels. We test for weak instruments in the null hypothesis, which can be rejected when shown p-values are below our significance levels. R^2 values indicate the model fit.

in Japan and Asia-Pacific is less pronounced but still significant on a 5% level. The sign of each CSP coefficient is negative, suggesting that an increase of overall CSP tends to correlate with a decrease in systematic risk. Thus the risk mitigation view is supported throughout all regions. Although all these coefficients are sufficiently significant and reveal negative signs, their impact differs according to the area. The effect is most potent in North America, half as strong in Europe, and in descending order weaker in Asia-Pacific and Japan. In all estimation sets, we include the average country CSP performance (Jiraporn et al., 2014) in stage one, which appears to be highly significant in all regions except Europe. For Europe and Asia-Pacific, we include further instruments (anti-self-dealing index, absence of corruption, political orientation, union density, skilled labor, power distance, and individualism) according to Ioannou and Serafeim (2012) as these regions include several countries with a heterogeneous orientation towards CSP. We test the results of Table 4.9 for multicollinearity based on the variance inflation factors (VIF); Table 4.10 thus presents the results of an estimation after variable selection so that only those with VIF below 10 are contained. Discarded instruments appear as non-significant when they are included in the model. The goodness of fit in terms of R^2 in both estimations is almost identical. For completeness, all instruments are included in further calculations. All control variables show reasonable signs within the expected range.

Our analysis mainly extends the valuable work of Albuquerque et al. (2018) in terms of international evidence. The analysis of the impact of overall CSP on systematic risk for firms located in North America forms the intersection between the research of Albuquerque et al. (2018) and ours. Although following a different CSP measurement approach, we find similar significant empirical evidence of the risk-mitigating effect of CSP on systematic risk. Thus, the CSP measurement concept appears to have no impact upon the findings of a negative relationship. The analysis of Sassen et al. (2016) also finds an overall impact of CSP on systematic risk for European firms. However, their more granular results are less reliable due to potential endogeneity problems.

Our findings suggest that returns of high CSP firms are less affected by systematic risk, from which one can deduce that these firms could also participate less in the positive long-term performance of the market. However, several studies find a positive relationship between CSP and corporate financial performance (CFP) (e.g., Kang et al., 2016; Von Arx and Ziegler, 2014). As a reconciliation of both effects, we consider the idea that high CSP firms can possibly retain their industry-specific level of returns (such as high expected returns, e.g., for technology firms, lower expected returns, e.g., for suppliers), while lowering their market beta. If such an effect is in place, then lower systematic risk can accompany positive abnormal returns in terms of a positive α in (4.5).

Table 4.10: Two-stages least squares estimation based on overall CSP after instrument selection according to VIFs

	North America		Europe		Japan		Asia-Pacific	
	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
$\widehat{CSP}$		−2.28***		−1.17***		−0.29**		−0.51**
CSP country average	−0.94***				−2.97***			
Regulatory framework			−0.04***					
Abs. of corruption			1.51***				−2.85***	
Union density							0.04***	
Skilled labour			−0.21***					
Operating leverage	−0.03***	−0.03	−0.03***	−0.02	0.18***	0.00	0.00***	0.00
R&D	0.48***	1.16***	0.53**	0.67**	3.21***	1.35*	−0.24	−0.46
Leverage	0.00***	0.00***	0.00	0.00	−0.12	0.10	0.00***	0.00
CAPEX	0.00***	0.00**	0.00	0.00	0.01*	0.00	0.00*	0.01***
Cash	−0.20***	−0.06	−0.18***	−0.04	−0.20**	−0.05	−0.18***	0.12
Size	0.06***	0.16***	0.08***	0.13***	0.13***	0.08***	0.09***	0.09***
Earnings variability	0.04	−0.79***	−0.15	−0.62***	−1.55***	−2.30***	−0.30***	0.19
Diversification	0.02***	0.04***	0.01***	0.02***	0.02***	0.01	0.00	0.01**
ROA	−0.07*	−0.60***	−0.04	−0.40***	0.00	−0.55**	−0.03	−0.10
GDP Growth (%)	−8.79***	−10.14***	0.08	−0.80*	22.44***	−3.71	1.00***	2.59***
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y			Y	Y
Weak Instruments	0.000		0.000		0.000		0.000	
R^2	0.337	0.191	0.383	0.166	0.495	0.254	0.340	0.121
#Obs.	8327		5393		2219		2787	

This table provides 2SLS estimation results for overall CSP in North America, Europe, Japan, and Asia-Pacific after instruments were selected to confirm with variance inflation factors (VIF) below ten. The dependent variable of the first stage is the CSP scores, which are regressed on instruments and controls. In the second stage, the CSP estimates comprised by the first stage are beside controls included among the independent variables to explain systematic risk as the dependent variable. The selection of control variables remains the same at both stages. The first and second stages are shown in the first and second column of each panel. Coefficients are marked as significant on the level of 1% (***), 5% (**) or 10% (*) when that the p-value is below these levels. We test for weak instruments in the null hypothesis, which can be rejected when shown p-values are below our significance levels. R^2 values indicate the model fit.

4.5.2 Identifying the Drivers of Risk Mitigation

In the following, we extend the analysis from overall CSP to single components of CSP. Following Attig et al. (2013), we choose the categories of product responsibility, community, human rights, diversity, and employees and add emission reduction, environmental innovation, and resource reduction instead of only the aggregated environmental pillar based on Dorfleitner et al. (2018). In reference to the model specification, the overall CSP from the estimations in section 4.5.1 is now replaced by one of these categories, resulting in eight further 2SLS regression sets for each region. Tables 4.11 and 4.14 present individual stand-alone estimation results on the North America, Europe, Japan, and Asia-Pacific samples respectively.

In North America, all CSP components unanimously reveal a strong significance on a 1% level. The same is true for Europe except for the product responsibility category, which is significant on a 5% level. Japan indicates a significant influence of all CSP components on a level of 5%. Asia-Pacific reveals significant strong effects for the employees category (1%), followed by emission, environmental innovation, community, and diversity. Like the coefficients for overall CSP, all coefficients of CSP components show negative signs in all regional panels, thus, the risk mitigation view is confirmed for all cases of our analysis. However, considerable variations manifest themselves in the impact contribution of the single CSP components. In North America and Japan, the product responsibility category has by far the most definite impact compared with the other CSP components. Possible explanations include that, in these markets, customers show more appreciation for product reliability (as mirrored, e.g., by the high number of product liability lawsuits in the U.S. and the corresponding legal opinion of strong consumer protection according to Goodden (2009)). At the same time, social or environmental aspects are more attractive elsewhere. In Europe, employees appear to be decisive. Environmental innovation turns out to be the most driving component in Asia-Pacific, possibly because firms' ecological protection standards have been enhanced by globalization (Chapple and Moon, 2005) and thus might have become increasingly important for economic success. By comparing the coefficients' magnitude of each CSP component between the regions, we recognize a similarity to the findings on the overall CSP. The effect is strongest in North America and weaker in Europe, Asia-Pacific, and Japan in descending order. Following the credit-risk argumentation of Attig et al. (2013), the impact could ultimately rely on what is socially desired, and this appears to be different for each of our regions. Although North America and Europe appear to be comparable when referring to cultural aspects, the impact of CSP is stronger in North America. This difference seems plausible because the lower mean level and higher standard deviation level may allow North American firms to distinguish themselves positively from one another while the CSP distribution in Europe is less widespread on a high level. In

TABLE 4.11: Two-stages least squares estimation results based on CSP components for North America

CSP Impact Variable	Emission		Env. inno.		Resources		Prod. resp.		Community		Hum. rights		Diversity		Employees	
Stage	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
North America																
$\widehat{CSP}$		−1.95***		−3.08***		−1.77***		−12.53***		−4.60***		−2.77***		−3.72***		−4.38***
CSP country average	0.00***		0.00***		0.00***		0.00***		0.00***		0.00***		0.00***		0.00***	
Operating leverage	−0.03***	−0.02	−0.02***	−0.01	−0.04***	−0.03	−0.02***	−0.25***	−0.03***	−0.10***	−0.02***	−0.02	−0.03***	−0.07***	−0.02***	−0.03*
R&D	0.39**	0.87***	0.70***	2.21***	0.38**	0.75***	0.25	3.17***	0.17	0.92***	0.29*	0.86***	0.37**	1.43***	0.21*	1.08***
Leverage	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	−0.01***	0.00***	0.00***	0.00**	0.00***	0.00***	0.00***	0.00***	0.00***
CAPEX	0.00***	0.00	0.00***	0.00**	0.00***	0.00	0.00***	−0.04***	0.00***	−0.01***	0.00***	0.00	−0.01***	−0.01***	0.00***	−0.01***
Cash	−0.16***	0.08	−0.13***	−0.02	−0.20***	0.05	−0.17***	−1.80***	−0.19***	−0.49***	−0.12***	0.05	−0.11***	−0.05	−0.15***	−0.27***
Size	0.07***	0.16***	0.05***	0.16***	0.07***	0.14***	0.03***	0.37***	0.06***	0.28***	0.05***	0.15***	0.06***	0.24***	0.05***	0.25***
Earnings variability	−0.12	−1.10***	0.17**	−0.42**	−0.12	−1.11***	0.16*	1.11***	0.05	−0.62***	0.10	−0.66***	0.12	−0.46***	0.03	−0.69***
Diversification	0.01***	0.03***	0.02***	0.05***	0.01***	0.03***	0.01**	0.10***	0.01***	0.06***	0.01***	0.04***	0.01***	0.05***	0.01***	0.06***
ROA	−0.08*	−0.58***	−0.10**	−0.71***	−0.08*	−0.58***	−0.05	−1.09***	−0.06	−0.71***	−0.04	−0.52***	−0.10**	−0.80***	−0.02	−0.51***
GDP Growth (%)	−7.70***	−6.11***	−5.61***	−8.53***	−7.72***	−4.86***	−3.23***	−31.28***	−7.65***	−25.18***	−2.59***	−1.65	−7.89***	−18.93***	−6.01***	−17.07***
Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.000		0.000		0.000	
R^2	0.295	0.188	0.287	0.196	0.273	0.188	0.230	0.197	0.230	0.195	0.237	0.190	0.228	0.196	0.282	0.195
#Obs.	8327		8327		8327		8327		8327		8327		8327		8327	

This table presents both stages of 2SLS estimation results for models including CSP components based on the North America sample. Coefficients are marked as significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. We test for weak instruments in the null hypothesis, which can be rejected when shown that p-values are below our significance levels. R^2 values indicate the model fit.

Table 4.12: Two-stages least squares estimation results based on CSP components for Europe

CSP Impact Variable	Emission		Env. inno.		Resources		Prod. resp.		Community		Hum. rights		Diversity		Employees	
Stage	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
Europe																
$\widehat{CSP}$		−1.02***		−1.09***		−1.15***		−1.05**		−1.44***		−1.15***		−1.06***		−2.06***
CSP country average	0.00***		0.00***		0.00***		0.00***		0.00***		0.00***		0.00***		0.00***	
Regulatory Framework	−0.06***		−0.03***		−0.06***		−0.05***		−0.05***		−0.05***		−0.06***		−0.04***	
Anti self-dealing	0.09		−0.30		−0.18		0.43		0.15		0.16		0.52		0.00	
Abs. of corruption	0.49***		0.33***		0.54***		0.38***		0.43***		0.48***		0.61***		0.33***	
Political orientation	−0.57		−0.49		−0.85**		−0.29		−0.27		−0.14		0.20		−0.32	
Union density	0.00		0.00		0.00		0.00		0.00		0.00		−0.01**		0.00	
Skilled labour	−0.10***		−0.06**		−0.10***		−0.08***		−0.08***		−0.11***		−0.13***		−0.04**	
Power distance	0.01***		0.00		0.01***		0.02***		0.01***		0.01***		0.01**		0.01***	
Individualism	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
Operating leverage	−0.04***	−0.03	−0.02*	−0.01	−0.04***	−0.03*	−0.01	0.00	−0.02	−0.01	0.00	0.01	−0.04***	−0.03	−0.03**	−0.04**
R&D	0.40	0.46	1.09***	1.24***	0.53**	0.66**	0.48**	0.57	−0.02	0.01	0.22	0.27	0.64**	0.70**	0.21	0.48
Leverage	0.00	0.00	0.00	0.00*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAPEX	0.00*	0.00*	0.00	0.00	0.00	0.00	0.00*	0.00	0.00	0.00	0.00	0.00	0.00**	0.00	0.00	0.00
Cash	−0.25***	−0.08	−0.18***	−0.01	−0.23***	−0.08	−0.10	0.08	−0.06	0.10	−0.03	0.14*	−0.01	0.17*	−0.10**	−0.03
Size	0.09***	0.13***	0.07***	0.12***	0.08***	0.12***	0.05***	0.09***	0.08***	0.15***	0.08***	0.13***	0.08***	0.12***	0.06***	0.16***
Earnings variability	−0.19	−0.65***	−0.24*	−0.71***	−0.06	−0.52**	−0.10	−0.58***	0.02	−0.42**	0.02	−0.44**	−0.07	−0.53***	−0.19**	−0.85***
Diversification	0.01*	0.02***	0.02***	0.03***	0.01**	0.02***	0.01***	0.02***	0.01***	0.03***	0.01***	0.03***	0.01***	0.02***	0.01***	0.03***
ROA	−0.08	−0.44***	−0.13*	−0.50***	−0.11	−0.48***	0.08	−0.27**	0.07	−0.26**	−0.11	−0.49***	−0.09	−0.45***	0.06	−0.23**
GDP growth (%)	0.30	−0.63	−0.30	−1.18**	0.16	−0.71	0.38*	−0.62	0.34	−0.40	−0.07	−1.00**	−0.42*	−1.38***	−0.02	−0.97**
Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.000		0.000		0.000	
R^2	0.310	0.166	0.340	0.166	0.269	0.166	0.229	0.165	0.253	0.166	0.291	0.166	0.317	0.167	0.311	0.166
#Obs.	5393		5393		5393		5393		5393		5393		5393		5393	

This table presents both stages of 2SLS estimation results for models including CSP components based on the Europe sample. Coefficients are marked as significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. We test for weak instruments in the null hypothesis, which can be rejected when shown that p-values are below our significance levels. R^2 values indicate the model fit.

Table 4.13: Two-stages least squares estimation results based on CSP components for Japan

CSP Impact Variable	Emission		Env. inno.		Resources		Prod. resp.		Community		Hum. rights		Diversity		Employees	
Stage	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
Japan																
$\widehat{CSP}$		−0.41**		−0.49**		−0.31**		−0.69**		−0.37**		−0.27**		−0.19**		−0.33**
CSP country average	0.00***		0.00***		0.00***		0.00***		0.00***		0.00***		0.00***		0.00***	
Operating leverage	0.15**	0.01	0.15***	0.03	0.15**	0.00	0.22***	0.11	0.22***	0.03	0.14**	−0.01	0.21***	−0.01	0.12**	−0.01
R&D	3.07***	1.68*	2.40***	1.61*	3.00***	1.36*	2.37***	2.08**	2.37***	1.31*	1.60**	0.86	3.11***	1.02	2.72***	1.34*
Leverage	−0.41	−0.03	−0.12	0.08	0.07	0.15	−0.26	−0.06	−0.39	−0.01	0.14	0.18	−0.03	0.13	0.22	0.20
CAPEX	0.01***	0.00	0.01*	0.00	0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash	−0.18*	−0.06	−0.22**	−0.10	−0.13	−0.03	−0.12	−0.07	−0.18	−0.06	−0.21**	−0.05	−0.23*	−0.03	−0.11	−0.03
Size	0.11***	0.08***	0.09***	0.08***	0.13***	0.08***	0.05***	0.07***	0.11***	0.08***	0.13***	0.07***	0.17***	0.07***	0.11***	0.07***
Earnings variability	−1.45***	−2.45***	−1.82***	−2.75***	−1.71***	−2.39***	−1.47**	−2.87***	−1.08*	−2.26***	−1.43***	−2.25***	−1.31**	−2.10***	−0.51	−2.02***
Diversification	0.02***	0.01	0.02***	0.01*	0.01	0.01	0.02**	0.02**	0.02***	0.01	0.02***	0.01	0.01	0.01	0.01**	0.01
ROA	−0.13	−0.60**	0.13	−0.48*	−0.06	−0.57**	0.29	−0.35	−0.04	−0.56**	−0.01	−0.55**	−0.06	−0.56**	−0.12	−0.59**
GDP growth (%)	5.89**	−3.72	14.15***	−1.71	13.03***	−3.92	22.90***	1.31	18.89***	−2.02	29.18***	−3.39	30.51***	−3.78	19.60***	−4.19
Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.000		0.000		0.000	
R^2	0.446	0.254	0.421	0.254	0.439	0.254	0.257	0.254	0.330	0.254	0.334	0.254	0.394	0.254	0.410	0.254
#Obs.	2219		2219		2219		2219		2219		2219		2219		2219	

This table presents both stages of 2SLS estimation results for models including CSP components based on the Japan sample. Coefficients are marked as significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. We test for weak instruments in the null hypothesis, which can be rejected when shown that p-values are below our significance levels. R^2 values indicate the model fit.

TABLE 4.14: Two-stages least squares estimation results based on CSP components for Asia-Pacific

CSP Impact Variable	Emission		Env. inno.		Resources		Prod. resp.		Community		Hum. rights		Diversity		Employees	
Stage	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
Asia-pacific																
$\widehat{CSP}$		−0.35**		−1.09**		−0.29*		−0.25		−0.65**		−0.41		−0.43**		−0.94***
CSP country average	0.00***		0.00***		0.00***		0.00***		0.00***		0.00***		0.00***		0.00***	
Regulatory framework	0.00		0.00		0.00		0.01***		0.01***		−0.01**		0.00		0.00*	
Anti self-dealing	−0.06		0.93		−0.75		−0.02		0.95*		−1.55***		−0.20		0.27	
Abs. of corruption	0.05**		−0.01		0.07***		0.07***		0.04**		0.07***		0.04**		0.02*	
Political orientation	0.00***		0.00		0.00***		0.00***		0.00***		0.00**		0.00***		0.00	
Union density	−0.01**		0.01**		−0.02***		−0.01		0.00		−0.02***		−0.02***		0.00	
Skilled labour	0.00		−0.19**		0.14		0.20**		−0.12		0.33**		0.08		−0.08	
Power distance	−0.01***		0.00		−0.01***		−0.01***		−0.01***		−0.01***		−0.01***		0.00**	
Individualism	0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00	
Operating leverage	0.00***	0.00	0.00***	0.00	0.00	0.00	0.00***	0.00	0.00***	0.00	0.00	0.00	0.00	0.00	0.00***	0.00
R&D	−0.85**	−0.63	0.35	0.05	−0.30	−0.42	0.32	−0.24	−0.12	−0.42	−0.63	−0.58	−0.52	−0.56	0.00	−0.35
Leverage	0.00***	0.00	0.00*	0.00	0.00***	0.00	0.00*	0.00	0.00**	0.00	0.00	0.00	0.00	0.00	0.00**	0.00
CAPEX	0.00	0.01***	0.00***	0.01**	0.00	0.01***	0.00**	0.01***	0.00	0.01***	0.00	0.01***	0.00**	0.01***	0.00	0.01***
Cash	−0.17***	0.16*	−0.16***	0.05	−0.16***	0.18*	−0.24***	0.17	−0.14**	0.12	−0.09*	0.19**	−0.09	0.18**	−0.12**	0.10
Size	0.08***	0.08***	0.06***	0.11***	0.09***	0.08***	0.03***	0.07***	0.08***	0.10***	0.06***	0.08***	0.07***	0.08***	0.07***	0.11***
Earnings variability	−0.44***	0.19	−0.18**	0.15	−0.25***	0.26	−0.04	0.30*	−0.26***	0.17	−0.08	0.30*	−0.25***	0.23	−0.27***	0.11
Diversification	−0.01	0.01*	0.01	0.02***	−0.01	0.01*	0.00	0.01**	0.00	0.01**	0.00	0.01**	0.00	0.02**	0.00	0.02**
ROA	0.01	−0.08	−0.13***	−0.22*	−0.05	−0.10	0.01	−0.09	0.02	−0.07	−0.07*	−0.12	0.04	−0.07	0.01	−0.07
GDP growth (%)	0.64*	2.52***	0.97***	3.10***	1.13***	2.75***	0.97**	2.63***	−0.33	1.86**	0.89***	2.99***	−0.04	2.08***	0.75**	2.51***
Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Weak instruments	0.000		0.000		0.000		0.000		0.000		0.000		0.000		0.000	
R^2	0.292	0.120	0.254	0.121	0.307	0.120	0.216	0.119	0.264	0.121	0.207	0.119	0.334	0.121	0.283	0.122
#Obs.	2787		2787		2787		2787		2787		2787		2787		2787	

This table presents both stages of 2SLS estimation results for models including CSP components based on the Asia-Pacific sample. Coefficients are marked as significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. We test for weak instruments in the null hypothesis, which can be rejected when shown that p-values are below our significance levels. R^2 values indicate the model fit.

Japan and Asia-Pacific, CSP is apparently not as meaningful as in Western countries. When comparing our results with the findings of Utz (2018), who explores idiosyncratic risk, we perceive a certain level of consistency in terms of confirmation of the risk mitigation view in North America, Europe, and Japan. However, the over-investment hypothesis in Asia-Pacific, as found for idiosyncratic risk, cannot be observed for systematic risk. Compared with the findings of Attig et al. (2013) on credit risk, which find relevance of the employees, diversity, product responsibility, community, and environment categories, we also find human rights and hence all categories relevant. We apply their argument, which states that those CSP dimensions that are socially desired and related to the primary stakeholders have an impact, remains true. The explanation of (Attig et al., 2013) states that the CSP components improve the quality of firm information, mitigate agency cost, and express their ethical standards. This reasoning could also apply here.

4.5.3 The incremental contribution of CSP components

Utz (2018) identifies several reasons for a non-linear relationship between CSP and idiosyncratic risk. For example, one possible explanation of these can be derived from the work of McWilliams and Siegel (2001) who conclude the existence of an optimal level of CSP, implying that higher or lower levels lead to more disadvantages and fewer advantages. As these kind of considerations could also apply in our context, we consider the same for systematic risk. Thus, a squared CSP term $\hat{x}_{i,t-1}^2$ is integrated into our second stage models in addition to the linear term $\hat{x}_{i,t-1}$ yielding:

$$\hat{\beta}_i = \hat{x}_{i,t-1}\gamma_{\hat{x}} + \hat{x}_{i,t-1}^2\gamma_{\hat{x}^2} + \boldsymbol{c_{i,t-1}\gamma_{c2}} + \epsilon_{2,i,t} \tag{4.4}$$

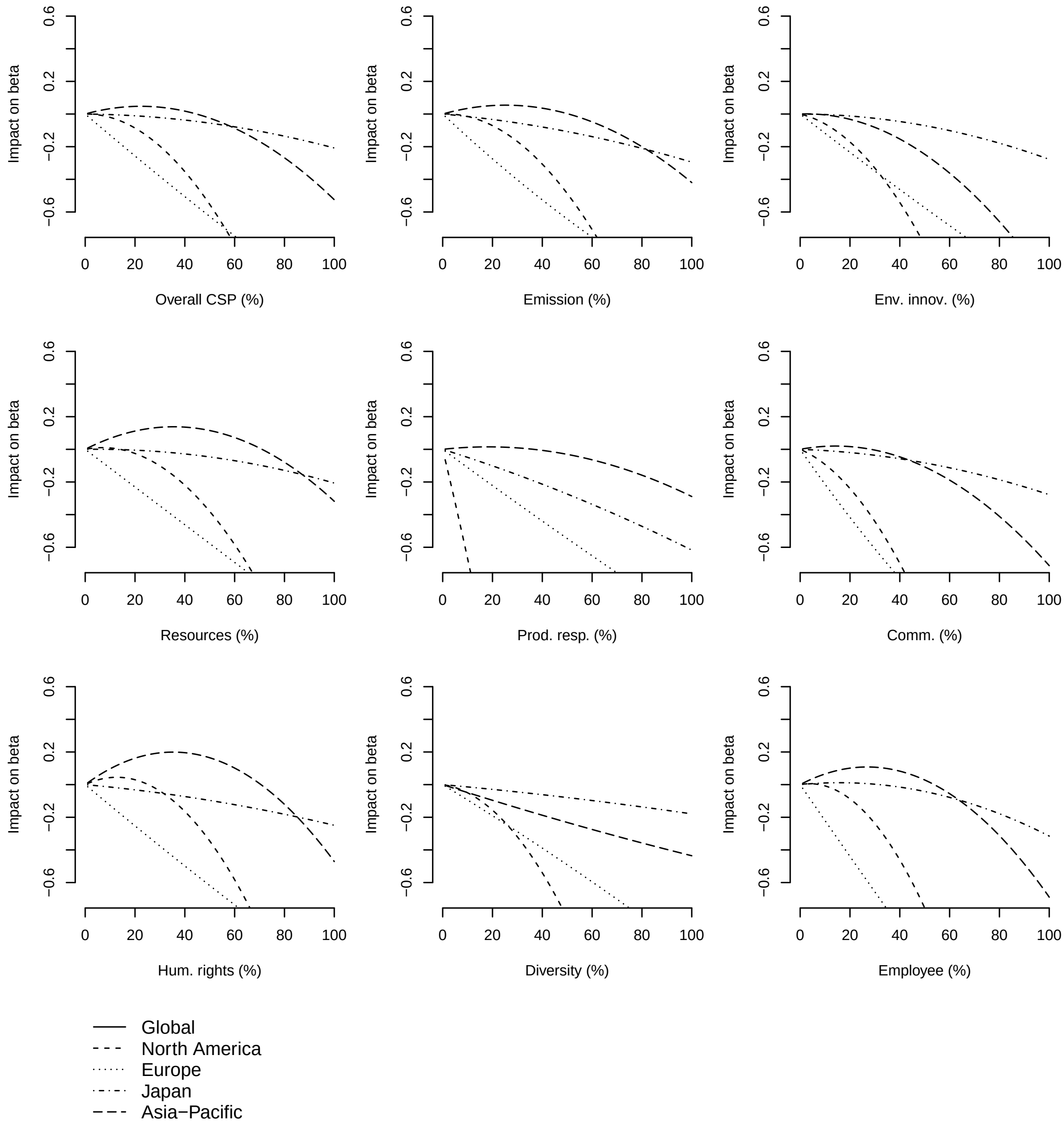
Table 4.15 presents the coefficients for both linear and squared CSP measures. For each region, all coefficients of linear and squared CSP show significance on a 1% level, while the model fit measured by R^2 is on a comparable high level. Although the coefficients in Table 4.15 generally imply inverted U-shaped relationships in form of a parabola in all four regions, the economic significance in our context depends on the location of the vertex (location between 0 and 100). Indeed, we observe that this shape is *only* considerably dominant in Asia-Pacific for the emission, resources, human rights, and employees categories as shown in Figure 4.1. We conclude that, in Asia-Pacific, the over-investment view pertains for low levels of CSP, thereby suggesting that increases in CSP lead to higher systematic risk. For higher levels of CSP, the risk mitigation view holds. For all other regions and CSP categories, the systematic risk simply decreases over the level of CSP.

TABLE 4.15: Two-stages least squares estimation results of non-linear model

	Overall CSP	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employees
North America									
$\widehat{CSP}$	0.02***	0.06***	−0.36***	0.30***	−6.35***	−0.65***	0.71***	−0.22***	0.28***
$\widehat{CSP}^2$	−2.26***	−2.06***	−2.49***	−2.11***	−3.39***	−2.73***	−2.80***	−2.84***	−3.58***
R^2	0.21	0.21	0.21	0.21	0.22	0.22	0.21	0.22	0.22
# observations	8327	8327	8327	8327	8327	8327	8327	8327	8327
Europe									
$\widehat{CSP}$	−1.31***	−1.43***	−1.19***	−1.16***	−1.12***	−2.19***	−1.28***	−0.93***	−2.22***
$\widehat{CSP}^2$	0.10***	0.29***	0.08***	0.00***	0.06***	0.53***	0.09***	−0.10***	0.09***
R^2	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
# observations	5393	5393	5393	5393	5393	5393	5393	5393	5393
Japan									
$\widehat{CSP}$	−0.02***	−0.13***	−0.01***	0.02***	−0.48***	−0.05***	−0.14***	−0.14***	0.15***
$\widehat{CSP}^2$	−0.19***	−0.16***	−0.27***	−0.23***	−0.14***	−0.22***	−0.11***	−0.04***	−0.46***
R^2	0.25	0.25	0.26	0.26	0.25	0.25	0.25	0.25	0.26
# observations	2219	2219	2219	2219	2219	2219	2219	2219	2219
Asia-Pacific									
$\widehat{CSP}$	0.42***	0.43***	0.06***	0.78***	0.17***	0.28***	1.13***	−0.49***	0.80***
$\widehat{CSP}^2$	−0.95***	−0.85***	−1.10***	−1.10***	−0.46***	−1.00***	−1.60***	0.06***	−1.49***
R^2	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13
# observations	2787	2787	2787	2787	2787	2787	2787	2787	2787

This table reports on 2SLS regression results for the CSP estimate and the squared CSP estimate of our non-linear model concerning both overall CSP and its components in the regions of North America, Europe, Japan, and Asia-Pacific. Coefficients are marked as significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. R^2 values measure the fit of each model. The panel size is provided in terms of the number of observations.

FIGURE 4.1: Incremental impact of overall CSP and its components on beta



This set of plots shows the incremental impact of CSP on firm beta based on models including both a linear CSP and a squared CSP measure. Each of the plots considers one CSP category, such as overall CSP or single categories (e.g., emission), and shows a separated line for each of the four regions.

4.5.4 Robustness checks

We apply robustness checks in each step of our analysis: in the regression aimed at measuring systematic risk as well as in the first and second stage of measuring the exogenous impact of CSP on systematic risk based on the 2SLS estimation.

While our main analysis is based on beta factors calculated by the CAPM, we conduct the same analysis based on the five-factor asset pricing model of Fama and French (2015). The latter considers the market return $r_{m,t}$ over the risk-free rate $r_{f,t}$ analogous to the CAPM and other factors regarding the stock size small minus big, SMB), value and growth (high minus low, HML), operating profitability (robust minus weak, RMW), and investment attitude (conservative minus aggressive, CMA) for day t are included, resulting in the following regression.

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i} SMB_t + \beta_{3,i} HML_t + \beta_{4,i} RMW_t + \beta_{5,i} CMA_t + \epsilon_{i,t} \tag{4.5}$$

With betas according to this approach, the findings of our main analysis are confirmed in large parts, which can be seen in Table 4.16. In North America and Europe, again, overall CSP and all components are significant for the market factor. The same is true for Asia-Pacific except for the diversity category. There are no significant effects in Japan.

The results prove also robust if the beta is derived from the international CAPM (Fama and French, 2012) as seen in Table 4.17. In contrast to the employed variant of the CAPM, the international CAPM uses a single market index (we use the same dataset as described by Fama and French (2012)) instead of local market indices.

Next, we replace the CSP country average as an instrumental variable in the North American panel by the average CSP on the *state* level as another robustness check. Again, all CSP coefficients remain significant on a 1% level. Further robustness checks address both the first and second stages of the main 2SLS regressions by adding additional control variables derived from previous research concerning CSP and credit risk. As there is consensus that all claims on assets should earn the same compensation per unit of risk (Merton, 1974; Campbell et al., 2008; Friewald et al., 2014), these variables may also matter for systematic risk. In particular, established companies tend to have better ratings (Fons, 1994), expressing lower risk. Hence we add the retained earnings to total assets ratio as it can be used to proxy a company's life cycle phase (DeAngelo et al., 2006). Furthermore, we include tangibility (proxied by power, plant, and equipment divided by total assets), the market-to-book ratio and a dividend dummy (1 if the firms paid dividends in the respective year, 0 otherwise) as there is empirical evidence of an impact of these variables on credit-risk (Rampini and Viswanathan, 2013; Pástor and Pietro, 2003; Hoberg and Prabhala, 2009). Table 4.18 presents the coefficients and significance levels. None of these modifications lead to significantly different results compared to our primary analysis.

TABLE 4.16: Effect of overall CSP and its components on market beta derived from the Fama French 5 Factor Model

Beta	Overall CSP	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employees
North America									
$\widehat{CSP}$	−0.67***	−0.55***	−1.33***	−0.53***	−4.57***	−1.41***	−1.54***	−1.09***	−1.50***
resp. R^2	0.02	0.02	0.03	0.02	0.03	0.02	0.04	0.02	0.02
# observations	7037	7037	7037	7037	7037	7037	7037	7037	7037
Europe									
$\widehat{CSP}$	−0.70***	−0.65***	−0.92***	−0.77***	−0.29	−0.92***	−1.01***	−0.79***	−1.08***
resp. R^2	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
# observations	4180	4180	4180	4180	4180	4180	4180	4180	4180
Japan									
$\widehat{CSP}$	−0.40	−0.54	−0.86	−0.43	−2.88	−0.79	−0.33	−0.28	−0.38
resp. R^2	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
# observations	1202	1202	1202	1202	1202	1202	1202	1202	1202
Asia-Pacific									
$\widehat{CSP}$	−0.49**	−0.36*	−1.46***	−0.43***	−0.99**	−0.49**	−0.82***	−0.31	−0.83***
resp. R^2	0.16	0.15	0.16	0.16	0.16	0.15	0.16	0.15	0.16
# observations	1995	1995	1995	1995	1995	1995	1995	1995	1995

This table presents 2SLS coefficient results for the estimated CSP variable based on the Fama French five-factor model per overall CSP or its components, and per region. The estimation is based on daily stock and factor returns. Betas above the significance level of 10% were excluded to reduce noise. CSP Coefficients are marked as significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels.

TABLE 4.17: Effect of overall CSP and its components on market beta derived from the international CAPM

Beta	Overall CSP	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employees
North America									
$\widehat{CSP}$	−1.78***	−1.11***	−3.55***	−1.31***	−13.78***	−2.79***	−3.42***	−3.32***	−2.75***
resp. R^2	0.18	0.17	0.21	0.18	0.20	0.18	0.20	0.19	0.18
# observations	8327	8327	8327	8327	8327	8327	8327	8327	8327
Europe									
$\widehat{CSP}$	−1.64***	−1.49***	−1.72***	−1.64***	−1.39**	−2.00***	−1.51***	−1.27***	−3.20***
resp. R^2	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
# observations	5392	5392	5392	5392	5392	5392	5392	5392	5392
Japan									
$\widehat{CSP}$	−0.23	−0.33	−0.38	−0.25	−0.55	−0.31	−0.23	−0.15	−0.27
resp. R^2	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
# observations	2219	2219	2219	2219	2219	2219	2219	2219	2219
Asia-Pacific									
$\widehat{CSP}$	−0.82***	−0.68***	−2.75***	−0.53***	−0.87*	−1.22***	−0.41	−0.80***	−1.26***
resp. R^2	0.16	0.15	0.16	0.15	0.15	0.16	0.15	0.16	0.16
# observations	2776	2776	2776	2776	2776	2776	2776	2776	2776

This table presents 2SLS coefficient results for the estimated CSP variable based on the international CAPM model per overall CSP or its components, and per region. The estimation is based on weekly stock and factor returns. Betas above the significance level of 10% were excluded to reduce noise. CSP Coefficients are marked as significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels.

TABLE 4.18: Two-stages least squares estimation results for CSP estimates of robustness checks

	#Obs.	Overall CSP	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employees
North America										
CSP state avg.	8327	−2.28***	−1.95***	−3.08***	−1.77***	−12.53***	−4.6***	−2.77***	−3.72***	−4.38***
resp. R^2		0.19	0.19	0.2	0.19	0.2	0.19	0.19	0.2	0.2
incl. tangibility	8327	−2.28***	−1.96***	−3.02***	−1.77***	−11.74***	−4.69***	−2.70***	−3.67***	−4.43***
resp. R^2		0.19	0.19	0.20	0.19	0.20	0.20	0.19	0.20	0.20
incl. ret. earn.	8290	−2.29***	−1.85***	−3.08***	−1.72***	−13.61***	−5.08***	−2.96***	−3.85***	−4.36***
resp. R^2		0.19	0.19	0.20	0.19	0.20	0.20	0.19	0.20	0.20
incl. market/book	8243	−2.24***	−1.94***	−3.02***	−1.75***	−11.29***	−4.46***	−2.75***	−3.60***	−4.29***
resp. R^2		0.19	0.19	0.20	0.19	0.20	0.20	0.19	0.20	0.20
incl. dividends	8327	−2.31***	−1.95***	−3.16***	−1.78***	−14.06***	−4.73***	−2.78***	−3.80***	−4.43***
resp. R^2		0.20	0.20	0.20	0.20	0.21	0.20	0.20	0.21	0.21
incl. env. sensitive ind.	8327	−2.17***	−1.78***	−3.01***	−1.67***	−12.40***	−4.21***	−2.74***	−3.56***	−4.16***
CSP - env. sensitive ind. intersection		−0.36**	−0.40**	−0.31*	−0.28*	−0.43**	−0.48***	−0.16	−0.46**	−0.48**
resp. R^2		0.19	0.19	0.20	0.19	0.20	0.20	0.19	0.20	0.20
Europe										
incl. tangibility	5393	−1.16***	−1.02***	−1.09***	−1.16***	−1.04**	−1.45***	−1.16***	−1.08***	−2.08***
resp. R^2		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
incl. ret. Earn.	5388	−1.17***	−1.03***	−1.10***	−1.16***	−1.06**	−1.46***	−1.15***	−1.06***	−2.09***
resp. R^2		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
incl. market/book	5340	−1.13***	−1.02***	−1.09***	−1.13***	−1.04**	−1.43***	−1.13***	−1.02***	−1.98***
resp. R^2		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
incl. dividends	5393	−1.01***	−0.88***	−0.94***	−1.01***	−0.89**	−1.25***	−0.99***	−0.91***	−1.76***
resp. R^2		0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
incl. env. sensitive ind.	5393	−1.19***	−1.05***	−1.10***	−1.20***	−1.10**	−1.47***	−1.20***	−1.09***	−2.10***
CSP - env. sensitive ind. intersection		0.17	0.19	0.08	0.23	0.25	0.14	0.29*	0.15	0.13
resp. R^2		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17

Table continues on next page.

Table 4.18 continued

	#Obs.	Overall CSP	Emission	Env. inno.	Resources	Prod. resp.	Comm.	Hum. rights	Diversity	Employees
Japan										
incl. tangibility	2219	−0.35***	−0.49***	−0.60***	−0.37***	−0.77***	−0.45***	−0.34***	−0.23***	−0.40***
resp. R^2		0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
incl. ret. earn.	2219	−0.36***	−0.50***	−0.61***	−0.37***	−0.83***	−0.47***	−0.35***	−0.24***	−0.42***
resp. R^2		0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
incl. market/book	2218	−0.27**	−0.36**	−0.44**	−0.29**	−0.60**	−0.34**	−0.28**	−0.19**	−0.32**
resp. R^2		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
incl. dividends	2219	−0.31**	−0.43**	−0.53**	−0.34**	−0.78***	−0.41**	−0.31**	−0.21**	−0.37***
resp. R^2		0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
incl. env. sensitive ind.	2219	−0.32**	−0.46**	−0.53**	−0.35**	−0.75**	−0.42**	−0.33**	−0.22**	−0.37**
CSP - env. sensitive ind. intersection		0.16	0.18	0.17	0.15	0.17	0.25	0.22	0.17	0.20
resp. R^2		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Asia-Pacific										
incl. tangibility	2787	−0.49**	−0.38**	−1.11**	−0.32**	−0.18	−0.65**	−0.46*	−0.44**	−0.95***
resp. R^2		0.13	0.12	0.13	0.12	0.12	0.13	0.12	0.13	0.13
incl. ret. earn.	2787	−0.50***	−0.38**	−1.11**	−0.32**	−0.26	−0.67***	−0.47*	−0.46**	−0.95***
resp. R^2		0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13
incl. market/book	2778	−0.44**	−0.33**	−1.00**	−0.27*	−0.26	−0.61**	−0.38	−0.41**	−0.87***
resp. R^2		0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
incl. dividends	2787	−0.44**	−0.32*	−1.01**	−0.27*	−0.23	−0.62**	−0.38	−0.40**	−0.89***
resp. R^2		0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
incl. env. sensitive ind.	2787	−0.44**	−0.32*	−0.99*	−0.25	−0.22	−0.64**	−0.27	−0.54***	−0.92***
CSP - env. sensitive ind. intersection		−0.22	−0.26	−0.64**	−0.34	−0.35	−0.07	−0.60	1.13***	−0.21
resp. R^2		0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.12

This table reports on 2SLS regression results for the CSP estimates of our robustness checks. Coefficients are marked as significant on the level of 1% (***), 5% (**) or 10% (*) when the p-value is below these levels. R^2 values and the number of observations is provided to enable comparability.

Finally, we include an interaction term between CSP and a dummy for industries included in "NAICS Codes of Environmental Sensitive Industries" published by the U.S. Small Business Administration as the environmental sensitivity of the industry appears to matter (Sassen et al., 2016; Khan et al., 2016). In all cases, the CSP term's significance is independent of including an interaction term. However, in some cases, the impact of CSP is stronger in environmental sensitive industries.

4.6 Conclusion

The primary purpose of this paper is to provide a consistent analysis of the impact of CSP on systematic firm risk in an international sample comprising 3800 companies. This paper extends the three recent studies of Albuquerque et al. (2018), Sassen et al. (2016), and Utz (2018) on the relationship between CSP and systematic, respectively idiosyncratic firm risk. Our study contributes to the existing literature in several ways as it is the first analysis in the context of systematic risk based on the transparent CSP measures of Asset4 and also the first to identify single CSP drivers in an international sample based on the instrumental variable approach and various measures for systematic risk (by the CAPM, the five-factor asset pricing model of Fama and French, and the international CAPM).

Our results show that high CSP tends to be consistent with low systematic risk in North America, Europe, Asia-Pacific, and Japan. Thus, risk mitigation applies across all of these regions. We find the impact of overall CSP performance to be most influential for firms located in North America, and in descending order weaker but still significant in Europe, Asia-Pacific, and Japan. Generally, all CSP components show an impact on systematic risk albeit to a varying extent. The impact is mainly driven by product responsibility aspects in North America and Japan, and employees in Europe. Environmental innovation is the main driver in Asia-Pacific. Effects of other CSP categories are less dominant.

When comparing our results to previous literature, we can confirm the first empirical evidence of Albuquerque et al. (2018) for the U.S. With our improved methodological approach, we also find evidence for the workforce measure in Europe while Sassen et al. (2016) do not. For systematic risk, the risk mitigation view holds in each of the four regions, which is only partially consistent with Utz (2018), who finds evidence of the over-investment hypothesis in Asia-Pacific in the context of idiosyncratic risk. Our results imply that high CSP firms face reduced systematic risk but also may lose stock market performance due to their lower participation in the overall positive market trend in the long run.

Furthermore, our findings reveal several implications for capital allocation, investment valuation, and portfolio selection. As firm beta is a crucial determinant for their cost of equity (Albuquerque et al., 2018), firms can lower it through investing in CSP. Also, a lower cost of equity results in a better valuation of investment opportunities as future cash flows can be discounted at a lower rate. The overall portfolio selection considers the total risk of a portfolio, within which systematic risk is a substantial part because, unlike idiosyncratic risk, it cannot be eliminated through diversification. Thus, investors may identify low risk stocks by considering certain aspects of CSP.

Chapter 5

Conclusion

This dissertation critically examines the impact of CSR on firms' credit and systematic risk with respect to regional differences in an international context. Existing gaps in the current literature are closed by applying consistent international evidence on the impact of CSP and its single driving components on credit and systematic risk based on adequate methodological approaches to mitigate endogeneity and to identify causal relationships. In summary, there is strong empirical evidence for the impact of CSP on both credit and systematic risk that is driven by its components to an internationally differing magnitude.

With respect to credit risk, this dissertation finds a significant impact of CSP on credit ratings, thereby helping to improve both their explanation and prediction quality. High CSP tends to be associated with better credit ratings, indicating that the risk mitigation view of CSR holds. However, the magnitude of impact is more distinct in North America than in Europe. Differences are likely to result from geographical, social, and political environment in these regions. A focus on more granular aspects of overall environmental or social performance yields the identification of environmental product innovation and diversity as driving forces in North America and Europe. For Asia, only product innovation is relevant while diversity is not, likely due to cultural differences. In terms of systematic risk, a high level of CSP tends to be associated with low risk. Hence the risk mitigation hypothesis seems to hold true analogous to credit risk. The impact of CSP on systematic risk differs regionally, being strongest in North America, followed by Europe, Japan, and hardly existent in Asia-Pacific. Also, the driving CSP components differ regionally, including product responsibility in North America and Japan, and employees in Europe while environmental innovation is most significant in Asia-Pacific. Hence, environmental innovation appears above all meaningful for both credit and systematic risk for Asian firms.

The main contribution of this dissertation is to close remaining gaps in literature referring to an consistent international evidence on the impact of CSP and its single driving components on risk based on adequate methodological approaches to mitigate endogeneity in the model estimations, and finally to identify causal relationships between CSP and apects of risk. In terms of credit risk, the quantification of the predicition quality improvements through CSP is also new to the literature. The direct comparison to yet-published studies is possible in few intersections. Previous literature can be partly confirmed and partly refuted. The found risk mitigation view of CSP on credit risk for all regions in this dissertation is consistent to Jiraporn et al. (2014) in the context of the U.S. but not to Stellner et al. (2015), who find no impact of CSP in Europe. For systematic risk, the risk mitigation view is consistent to Albuquerque et al. (2018) and Sassen et al. (2016). The international analysis of Utz (2018) with respect to the relationship between CSP and idiosyncratic risk supports the risk mitigation view in the U.S., Japan, and Europe, which is consistent to this disseration. However, he finds over-investment view for Asia while this disseration suggests the risk mitigation view for both credit risk and systematic risk exceptionless for all regions.

The findings of this dissertation with respect to an impact of CSP aspects on credit risk have several implications for practice since they can be applied to optimize risk models through considering CSP as an explaining variable. They help to integrate the CSP drivers to assessments of credit risk and thus allow management of this kind of risk. In the perspective of an investor, both the overestimation and the underestimation of credit risk triggers wrong management decisions. Actual economic losses can be a consequence. When risks are overestimated, the risk adjusted pricing seems to be less profitable and usually leads to discarding economic reasonable investment opportunities. Otherwise, when risks are underestimated, greater losses than expected may occur with risks materializing. Through the link between credit risk and financing cost, the findings help to understand that investments into CSP can lower the cost of debt. It was shown, that not all aspects of CSP have the same impact, but environmental innovation and diversity are most distinct in this manner for firms in North America in Europe. Only environmental innovation is relevant for Asian firms. Hence, risk-mitigating effects of CSP can evidently be maximized by targeting these aspects of CSP.

Other findings impact the understanding of the effect of CSP on systematic risk; providing relevant insight about the cost of equity as systematic risk is a crucial determinant. Product responsibility in North America and Japan, and employees in Europe while environmental innovation in Asia-Pacific is most significant in explaining systematic risk. Hence these aspects are expected to be highly relevant for cost of equity, too. Besides referring to cost of equity, patterns like capital allocation, investment valuation, and portfolio selection may also be affected by CSP. Usually, lower cost of equity leads to higher expected profits from investment opportunities as future cash flows are subject to weaker discounting in the valuation. Although portfolio selection in this manner is ordinarily based on various risk aspects, systematic risk is most meaningful, because it cannot be mitigated through diversification compared to idiosyncratic risk.

A special importance of these results could emerge regarding banks and other financial institutions. Due to their system relevance for national economies, financial institutions are usually regulated in many aspects to secure stability of the financial sector. Increased quality of risk management helps to reduce individual uncertainty in financial institutions' planning and thus can contribute overall to stabilize the financial sector as a whole. In the context of the results of this dissertation on how risk models can be improved, regulators should demand measures of CSP in risk management to improve accuracy especially for credit risk prediction quality. In addition to the desired stabilization of the financial sector, referring obligations could enhance the transparency about enviromental and social concerns of firms. As a consequence, increases in CSP could be stimulated as firms might be concerned about their reputations.

This dissertation may stimulate future research about CSP and risks in some aspects because results refer to causality between CSP and aspects of risk. However, as a limitation, it has to be noted that real-world causality in the context of this relationship can only be proven by means of natural or quasi-experiments, thereby confirming the necessity for continued research in the future. Moreover, this dissertation approaches the analysis on a portfolio basis. Future research may also focus on individual firms and their individual impact of CSP. Matching procedures (e.g., propensity score matching) could help to compare firms in different regions based on observable characteristics. Because of the findings of this dissertation regarding a relationship between CSP and credit or systematic risk, significant relateionships between CSP and further aspects of corporate risk (e.g., liquidity risk) are conceivable. Future research may extend the literature in this direction.

In the context of these findings and stimulated future research, the importance of CSR may continue to grow during the following years in the areas of society, finance, and science. Yet in context of strong societal engagement for sustainability as, e.g. the climate movement, it might be uncontroversal that at least some parts of society expect long-term benefits from CSR. This dissertation extends the first empirical evidence on financial impact of CSP in terms of risk mitigation that is linked to firms' decreasing financing cost. With the identification of single CSP components that lead to lower credit risk and systematic risk, the provided analysis shows that some, but not all aspects, of CSP are relevant in this context. As described, these results are important for both research and practice. Finally, this dissertation finds international empirical evidence that CSP produces favorable financial effects beyond a philanthropic rationale.

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