The relationship between firm complexity and corporate social responsibility: International evidence from 2010–2019

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Abstract
Extant research on the relationship between firm complexity and corporate social responsibility (CSR) is limited to employing size variables as indicators for firm complexity. Following a contingency approach and to fit the multidimensional nature of CSR, in this study we define complexity as the structural complexity of a firm. To answer the question of whether firm complexity influences CSR, we study firms included in the major world stock indices for a 10-year period by means of a fixed-effects regression. Findings generally suggest a higher level of CSR in more complex firms. A more detailed analysis of complexity points toward a significant positive influence of the vertical, functional, and occupational dimensions of complexity but finds no link between spatial differentiation and CSR. This research represents the first empirical study that examines the relationship between CSR and structural complexity beyond a simplistic proxy of size.

KEYWORDS
CSR, ESG performance, firm complexity, structural complexity

1 | INTRODUCTION

Corporate social responsibility (CSR) has been widely researched from various perspectives. One stream of research is the effect of firm complexity on CSR, which suggests that more complex firms require more complex reporting and management practices (Chenhall, 2003; Luo et al., 2017; Marano & Kostova, 2016). Firm complexity, however, is a theoretical construct that cannot be directly observed in an empirical setting (Loughran & McDonald, 2020). Thus, manifest data needs to function as a proxy for the underlying construct. Generally, the construct of firm complexity has been represented by the proxy firm size (e.g., number of employees or amount of assets). While some studies are explicit about their intent to use size as a proxy for complexity, many others only imply a relationship. Drempetic et al. (2019) examine the influence of firm size on the Environmental, Social, and Governance (ESG) rating of a firm and find significant positive results. This is in line with research suggesting that large firms possess characteristics that foster CSR (Udayasankar, 2008). Firm size appears to be positively connected to implementation (Darnall et al., 2010) as well as to reporting of CSR (Gallo & Christensen, 2011).

However, we contend that size is not synonymous with complexity: it is, in fact, only one possible proxy for complexity and ignoring this insight evokes two problems. On the one hand, the validity of using size as a proxy for complexity is threatened by the fact that researchers also use size as a proxy for various other constructs, or deny size a theory-based effect on CSR by employing it as a control variable only. For instance, size is the most common control variable (van Beurden & Gössling, 2008) when testing the relationship between CSR and corporate financial performance (CFP) (e.g., Friede et al., 2015; van Beurden & Gössling, 2008; Widyawati, 2020). At the same time, existing literature generally neglects the explicit theoretical connection between firm size and CSR (Wickert et al., 2016). This is quite problematic because, without a theoretical explanation for adding size to models, every reader can offer their own (possibly...
contradictory) interpretation of what the relationship between size and CSR means on a theoretical level. On the other hand, extant research on CSR has yet to offer any alternative measurable proxies for complexity. This may be because size is readily available from most databases, and thus very convenient for researchers to use. But if other measures were available, we would be better able to corroborate the size-complexity relationship, and possibly even have more suitable proxies to use.

This study aims to enrich our understanding of firm complexity and its relation to CSR by proposing and testing alternative proxies of complexity beyond size. We pose the research question: How are different proxies of firm complexity related to CSR?

To this end, we carry out an archival study. CSR is a multi-dimensional construct (Capelle-Blancard & Petit, 2017) which requires a proxy that matches the examined firm characteristics (Josefy et al., 2015; Kimberly, 1976). We define firm complexity in terms of structural complexity, and not by common firm size definitions. We examine 1515 companies listed in the major world stock indices over a period of 10 years, from 2010 until 2019, by means of a fixed-effects regression analysis. Such a broad sample over such an extensive period is unaffected by most of the effects of the global financial crisis. We investigate complexity along the sub-dimensions of vertical, functional, occupational, and spatial differentiation (Blau, 1970) and explore its joint and separate influence(s) on CSR.

Our findings suggest a positive significant relationship between firm complexity and CSR. We find a significant, positive influence on CSR of the joint complexity proxy and all dimensions separately except the spatial differentiation. This indicates that vertical, functional, and occupational differentiation is associated with increased CSR. In contrast, spatial differentiation seems to have no influence. We offer several conjectures why this is.

2 | THEORETICAL FOUNDATION AND HYPOTHESES DEVELOPMENT

2.1 | A contingency and rational choice theoretical perspective

The positive relation between CSR and firm complexity is generally proposed by contingency theory in connection with rational choice theory. This research defines firm complexity in terms of structural complexity. Thus, the hypothesis development relates to the positive connection between these two constructs.

Assuming a firm’s decision to follow the rational choice theory when facing a set of alternatives is a rational one, it will choose the alternative with the maximum expected utility (Sahlin, 2012). The evaluation is carried out by ranking the different alternatives along with the preferences and values (Grüne-Yanoff, 2012). Thus, rationally deciding firms strive to establish an optimal, utility-maximizing, level of CSR.

Contingency theory considers firms as open systems with no generally valid optimal structure (Burkert et al., 2014). Accordingly, there is no general optimal level of CSR. Contingency theory argues that such levels depend on the context in which the firms operate (Chenhall, 2003). Matching the specific circumstances with the specific aspects of a firm, in this case with an appropriate level of CSR, results in a condition of fit (Otley, 2016; Otley, 1980).

A contingency view of CSR is adopted in some parts of the literature (Husted, 2000). CSR has been described in line with contingency theory as dependent on the context (Schreck & Raithel, 2018), which is determined by external factors as well as by the internal structure and processes of a firm (Chenhall, 2003; Udayasankar, 2008). Larger firms are considerably more visible than their smaller counterparts (Gallo & Christensen, 2011) and this increased visibility results in a more complex environment which is then addressed by more complex management systems leading to increased CSR. Firms that are more complex are associated with a more advanced structure which is manifested in operations that are even more complex (Schreck & Raithel, 2018). In addition to higher scales of operation, larger complex firms have access to substantially more resources (Hörisch et al., 2015). Resource scarcity is a constraint faced by less complex firms and is expected to influence their CSR (Darnall et al., 2010). The resource slack enjoyed by larger firms relates to financial and human capital (Gallo & Christensen, 2011) as well as to resource knowledge (Hörisch et al., 2015).

The proxy ‘firm size’ has several well-researched problems. First, there is a general difficulty when researching firm size: how to define it. Do you use the number of employees, total assets, market capitalization or something else? The literature suggests a lack of interchangeability of different firm size proxies such as total revenue or number of employees (Al-Khazali & Zoubi, 2011). Second, there are heterogeneous definitions of size in the extant literature on the relationship between size and CSR (e.g., D’Amato & Falivene, 2019; Kolk & Pinske, 2009). Third, research tends to employ one-dimensional size proxies to express firm complexity and these eventually fail to fully account for the multi-dimensional character of complexity (Lamboglia et al., 2018; Obeng et al., 2020; Yeh et al., 2020). Fourth, size per se might have an endogeneity bias: depending on the value-creation and production process, firms may be heavily reliant on material assets or a high number of employees (Chenhall & Moers, 2007; Johnson et al., 2008). Firms actively choose capital or labor-intensive processes to reflect different rationales (such as automation or taking advantage of economies of scale); therefore, size does not necessarily reflect differences in complexity but rather in business models. Fifth, size measures might relate to future rather than past states of the firms. Applying market capitalization as another possible firm size proxy can be associated with comparable concerns. A high market capitalization is much more a reflection of the high expectations and growth opportunities of a company in the future than it is a statement on current firm complexity (Dang et al., 2018).

More evolved structures and processes and a higher resource availability facilitate implementing and reporting CSR. Thus, CSR is significantly easier and less cost-intensive for more complex firms (Schreck & Raithel, 2018). As these firms can benefit from economies of scale (Wickert et al., 2016), firm complexity and CSR are assumed to be positively connected.
2.2 | CSR and firm complexity measurement

In this paper, CSR covers both CSP and reporting. This is in line with Wickert et al. (2016) who describe the extent to which a firm implements and communicates CSR.

Firm complexity is the second key construct of this study. The recent prevalence of firm complexity in management literature highlights its importance for research. The need to choose the right proxy to describe firm complexity intensifies due to the lack of interchangeability of different firm size proxies (Josefy et al., 2015). The literature indicates that the relationship between firm size proxies such as total assets, total sales, market capitalization or the number of employees, is unstable and that the degree of correlation varies depending on the context (Al-Khazali & Zoubi, 2011). The previously accepted interchangeable use of firm size proxies is questionable as different proxies supposedly describe different dimensions of size, and therefore have different implications for research (Dang et al., 2018).

Depending on the firm characteristics being researched, different conceptualizations of complexity are appropriate. In an early contribution to firm size literature, Kimberly (1976, p. 592) states that “different aspects of size are primarily relevant for different kinds of organizational problems and hence related to different dimensions of organizational structure”. As our study examines the link between firm complexity and CSR, the definition of complexity needs to address the multidimensional nature of CSR (Capelle-Blancard & Petit, 2017). Therefore, we define firm complexity in terms of structural complexity. Applying structural complexity is supported by literature that describes complexity as a “key interrelated construct” (Josefy et al., 2015, p. 746), being strongly connected to and showing a significant positive correlation with firm size (Milet et al., 1977).

Structural complexity entails differentiation along the vertical, functional, occupational, and spatial dimensions in line with Blau (1970) and Damanpour (1996). Vertical differentiation describes the hierarchical structure of a firm and the respective number of hierarchy levels (McKendall & Wagner, 1997), whereas functional differentiation relates to the divisional structure expressed by the number of divisions or sections (Blau, 1970). A wide range of occupational specialties inside a firm can be associated with differentiation along the occupational dimension (Damanpour, 1996) while the geographical distribution of a firm represents spatial differentiation (McKendall & Wagner, 1997).

2.3 | Hypotheses development: The relationship between firm complexity and CSR

As extant literature tends to employ firm size to measure complexity, and firm size is an integral part of firm complexity (Milet et al., 1977), we start our argument by drawing on literature on firm size proxies.

Overall, extant research suggests a positive link between complexity and CSR. A higher level of CSR is found for larger firms in a study by Drempetic et al. (2019) who examine the influence of firm size on the ESG score, defining size by various common proxies such as the number of employees, total assets, total revenue, and market capitalization: a positive link is found for all size approaches. This is supported by research that connects large firm size with CSR (Udayasankar, 2008). Some studies, however, differentiate between CSR performance or implementation on the one hand and CSR reporting on the other. CSR implementation is more likely to be achieved by large firms than by their smaller counterparts (Hörisch et al., 2015). In addition, smaller firms are less closely associated with the adoption of environmental practices as a further element of CSR implementation (Darnall et al., 2010). This is in line with research that confirms the positive relationship between firm size and CSR disclosure: larger firms are more likely to incorporate CSR reporting (Gallo & Christensen, 2011). Similar findings are provided by Schreck and Raithel (2018) who generally report higher levels of CSR disclosure for larger firms but describe the relation as nonlinear with decreasing incentives to report for very large firms.

The positive link between CSR implementation and firm size was not, however, confirmed by Baumann-Pauly et al. (2013) or Wickert et al. (2016), although they do suggest a positive size-reporting link. They argue that smaller firms have relative cost advantages for the implementation of CSR while large firms possess characteristics that make CSR reporting relatively less costly. Yet, testing for firm size per se has little theoretical underpinning; rather, studies tend to imply between the lines that firm size represents higher, theoretical constructs discussed above, such as resource slack, and complexity.

The only explicit link in the literature between the concept of complexity and CSR is research on the influence of external complexity or complexity of the environment on CSR (Luo et al., 2017; Marano & Kostova, 2016). Schneider et al. (2017) connect this external dimension of complexity to the internal, firm complexity that the present study focuses on. Although their findings are centered on different research interests, important insights can be derived. It is suggested that firms create internal complexity as a response to a complex environment. This relationship is illustrated by the authors by means of CSR. The external complexity of a firm is assumed to be increased by CSR issues. As a response to this increased external complexity, more complex internal structures are created by firms that aim to address the CSR issues (Schneider et al., 2017).

This higher level of CSR is adopted as a response to the more complex context that complex firms face. Accordingly, the first and main hypothesis of this paper is formulated as follows:

H1. Firm complexity positively influences CSR.

To gain a deeper understanding of the relationship between firm complexity and CSR, the concept of structural complexity is elaborated in detail. A complex firm is an open system consisting of several interdependent parts (Thompson, 1967) that interact with the environment (Daft, 2001). Firm complexity can be subdivided into different dimensions of differentiation. The three dimensions of vertical, horizontal, and spatial differentiation constitute structural complexity,
with the most complex structures resulting from high differentiation along all three dimensions (McKendall & Wagner, 1997). This is in line with extant studies that refer to complexity based on the construct of structural complexity (Anderson, 1999; Mileti et al., 1977). Following Blau (1970), Damanpour (1996) splits horizontal differentiation into functional and occupational differentiation. Subdividing the concept of structural complexity accordingly into vertical, functional, occupational, and spatial differentiation and assuming the lines of argumentation established above for structural complexity, firms with high levels of differentiation along the four dimensions of complexity should be more engaged in CSR. Thus, the following four hypotheses are formulated:

**H2.** Vertical differentiation positively influences CSR.

**H3.** Functional differentiation positively influences CSR.

**H4.** Occupational differentiation positively influences CSR.

**H5.** Spatial differentiation positively influences CSR.

### 3 SAMPLE AND METHODOLOGY

#### 3.1 Sample

In this study, we examine firms listed in the major world indices: S&P 500 (USA, 505 firms), EuroStoxx Total Market (Europe, 624 firms), Nikkei 225 (Japan, 225 firms), FTSE 100 (UK, 101 firms), and S&P/TSX 60 (Canada, 60 firms). The initial sample of 1515 firms was reduced by removing firms from the financial sector due to deviating regulations and a lack of comparability, leaving a total of 1223. Tables 1 and 2 present the sample distribution across countries and industry sectors. We chose to include more than one index so that firms from various countries of domicile and industry sectors are included to make the results applicable to multiple organizational settings. The sample is comparable to the one studied by Drempetic et al. (2019).

The research period of 2010 to 2019 was chosen to allow the longest possible period that avoids most of the effects of the global financial crisis. When retrieving the data from the Refinitiv (formerly Thomson Reuters) Datastream database in December 2020, the data for 2020 were not complete. Thus, the most recent available data is from 2019. Furthermore, the inclusion of any one particular company rests entirely upon it being on the constituent lists of the indices in Datastream at the time of retrieval. As the study deals with unbalanced panel data, the possible 12,230 firm-year observations (as apparent in Tables 1 and 2) were reduced due to missing data points. However, a minimum of 6696 firm-year observations are included in every regression. An overview of all the variables used as described in the following section is provided in Table 3.

<table>
<thead>
<tr>
<th>Country</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>210</td>
<td>1.72</td>
</tr>
<tr>
<td>Belgium</td>
<td>300</td>
<td>2.45</td>
</tr>
<tr>
<td>Bermuda</td>
<td>10</td>
<td>0.08</td>
</tr>
<tr>
<td>Canada</td>
<td>460</td>
<td>3.76</td>
</tr>
<tr>
<td>Cyprus</td>
<td>10</td>
<td>0.08</td>
</tr>
<tr>
<td>Finland</td>
<td>530</td>
<td>4.33</td>
</tr>
<tr>
<td>France</td>
<td>920</td>
<td>7.52</td>
</tr>
<tr>
<td>Germany</td>
<td>1110</td>
<td>9.08</td>
</tr>
<tr>
<td>Ireland</td>
<td>220</td>
<td>1.80</td>
</tr>
<tr>
<td>Isle of Man</td>
<td>10</td>
<td>0.08</td>
</tr>
<tr>
<td>Italy</td>
<td>670</td>
<td>5.48</td>
</tr>
<tr>
<td>Japan</td>
<td>1990</td>
<td>16.27</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>110</td>
<td>0.90</td>
</tr>
<tr>
<td>Mexico</td>
<td>10</td>
<td>0.08</td>
</tr>
<tr>
<td>Netherlands</td>
<td>370</td>
<td>3.03</td>
</tr>
<tr>
<td>Portugal</td>
<td>110</td>
<td>0.90</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>10</td>
<td>0.08</td>
</tr>
<tr>
<td>Spain</td>
<td>450</td>
<td>3.68</td>
</tr>
<tr>
<td>Switzerland</td>
<td>60</td>
<td>0.49</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>730</td>
<td>5.97</td>
</tr>
<tr>
<td>United States</td>
<td>3940</td>
<td>32.22</td>
</tr>
<tr>
<td>Total</td>
<td>12,230</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Note: This table shows the distribution of firm-year observations in total (N) and relative (Percent) numbers to countries of domicile.

<table>
<thead>
<tr>
<th>Industry</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>480</td>
<td>3.92</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>6120</td>
<td>50.04</td>
</tr>
<tr>
<td>Mining</td>
<td>450</td>
<td>3.68</td>
</tr>
<tr>
<td>Public administration</td>
<td>10</td>
<td>0.08</td>
</tr>
<tr>
<td>Retail trade</td>
<td>870</td>
<td>7.11</td>
</tr>
<tr>
<td>Services</td>
<td>1960</td>
<td>16.03</td>
</tr>
<tr>
<td>Transportation &amp; public utilities</td>
<td>2010</td>
<td>16.43</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>330</td>
<td>2.70</td>
</tr>
<tr>
<td>Total</td>
<td>12,230</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Note: This table shows the distribution of firm-year observations in total (N) and relative (Percent) numbers along industry sectors classified according to SIC Codes.

### 3.2 Variables

#### 3.2.1 Corporate social responsibility (CSR)

How to measure the implementation and reporting of CSR is a universal challenge for researchers. One widely accepted approach is the...
use of ESG scores to evaluate a firm’s CSR performance. Rating agencies providing ESG scores, which combine these three aspects, are key actors in the assessment of CSR (Avetisyan & Ferrary, 2013). An independent and reliable third-party rater is important because CSR reports prepared by firms themselves might be subject to bias (Schreck & Raithel, 2018). This study uses the established ESG scores provided by Refinitiv to evaluate CSR (Widyawati, 2020). Since the Refinitiv ESG proxies depend on reported and publicly available information, they reflect not only CSR performance/implementation but also CSR reporting. Refinitiv also provides a more comprehensive ESG Combined (ESGC) score which takes into account data on controversies regarding ESG issues (Refinitiv, 2021). All variables range between 0 and 100, with 100 being the best rating.

3.2.2 Complexity

Several approaches exist to measure the vertical, functional, occupational, and spatial dimensions of complexity (Blau, 1970; Damanpour, 1996).

Vertical differentiation describes the number of levels in an organizational hierarchy (McKendall & Wagner, 1997; Mileti et al., 1977) and the division of authority (DeWitt, 1993). As the definitive number of hierarchical levels cannot be collected in a quantitative empirical study researching such a large sample, this paper uses the number of employees in a firm as a proxy for vertical differentiation. The more employees a firm has, the more extensive and better coordination is required, possibly resulting in additional levels of hierarchy (Mintzberg, 1979). Thus, the number of employees in a firm reflects the differentiation along the vertical dimension. To set us apart from previous research employing size, we highlight that our argumentation would not work interchangeably with proxies of size, such as the amount of assets or total sales. To reduce the impact of large outliers distorting results, the variable is winsorized at the 1% and 99% level and logarithmized (Darnall et al., 2010).

Functional differentiation is associated with the number of different divisions, units, or sections (Blau, 1970) that divide a firm into structural components (Damanpour, 1996). Since the actual number of units or sections in a firm is not accessible in this type of research either, functional differentiation is measured by an appropriate proxy. The division of the entire firm is reflected by the division of the board of directors. Therefore, we examine the extent to which the board of directors is divided into structural components (i.e., committees). Board committees have specialized objectives and responsibilities (Dixon-Fowler et al., 2017). They foster the institutionalization of a particular topic and represent an element of board structure (Gennari & Salvioni, 2019). For the present study, the CSR committee, as a subcommittee of the board of directors which addresses risks and opportunities concerning corporate sustainability, is of particular importance (Burke et al., 2019). A company that has a CSR committee incorporated into its board of directors can be considered to be divided into structural components to a greater extent and consequently assumed to be more functionally differentiated. We employ a binary variable as a proxy for functional differentiation, which takes the value 1 if a firm has a specialized CSR committee and the value 0 if not.

Occupational differentiation represents the number of occupational positions (Blau, 1970) or the number of occupational specialties in a firm, the latter relating to the variety of specialists in a firm (Damanpour, 1996). Employee training fosters and increases the knowledge, abilities, and skills of the staff (Delgado Ferraz & Gallardo-Vázquez, 2016) and can therefore result in highly specialized
employees (Kotey & Folkter, 2007). Accordingly, occupational differentiation is measured in this study by a binary variable, which takes the value 1 if a company has a policy to support employee skills or career development training and the value 0 if not.

Spatial differentiation results from the number of geographical locations (Anderson, 1999) or the level of geographical dispersion (McKendell & Wagner, 1997). Spatial differentiation can be connected to international diversification describing an expansion across borders into new geographical locations (Hitt et al., 1994). This paper relates spatial differentiation to the degree of internationalization of a firm. Various measurement approaches for internationalization exist in the literature, with the foreign sales to total sales (FSTS) ratio being the most commonly used (Marshall et al., 2020). Sullivan (1994) agrees on the prevalence of the FSTS measure, but additionally suggests the usage of the foreign assets to total assets (FATA) ratio to measure internationalization. The two variables describe different attributes of internationalization: the former measures performance whereas the latter aims to measure the structure. Attig et al. (2016) also use this approach when using the FSTS ratio in their CSR-related study to measure sales to foreign markets, and the FATA ratio to assess a firm’s foreign stock holdings. Sullivan (1994) expresses concerns about the use of the FSTS ratio as a sole indicator of internationalization and proposes an index to measure the internationalization degree consisting of inter alia the FSTS and FATA ratios. This is consistent with further research that suggests employing the FSTS and FATA ratios as measurement proxies for internationalization (Nielsen & Nielsen, 2013; Qian et al., 2008). Similarly, the World Investment Report includes both variables in its Transnationality Index (UNCTAD, 2020). To measure spatial differentiation, we calculate the average of the FSTS and FATA ratios for every firm \( \frac{\text{FSTS} + \text{FATA}}{2} \). Ratios are winsorized at the 1% and 99% level. By calculating the average of the FSTS and FATA ratios, spatial differentiation reflects both performance as well as structural attributes.

All complexity proxies are included in the regression analysis with a time lag of 1 year (Drempetic et al., 2019). In addition to the four single differentiation proxies, we examine a joint complexity variable comprising all four dimensions of complexity, which was generated utilizing factor analysis using the principal factor method (Field, 2013). The scoring coefficients of the joint complexity variable are presented in Table 4. It is apparent that all four differentiation proxies positively contribute to the joint variable, with spatial differentiation having the least influence and functional differentiation the most. The validity of the variable was tested employing the Kaiser-Meyer-Olkin-Test for sampling adequacy. It suggests mediocre to middling, but acceptable results (Kaiser, 1974). Thus, it seems that the variables have enough in common to justify performing factor analysis. Cronbach’s \( \alpha \) (Cronbach, 1951), as an indicator for reliability, suggests results of 0.56 that slightly miss the acceptance threshold of 0.61 proposed by, for example, Delgado Ferraz and Gallardo-Vázquez (2016), but the joint complexity proxy is included in the analysis. As complexity is not only examined through the joint proxy but also the single differentiation proxies individually, the analysis is not limited to the outcome of the factor analysis, and the results of Cronbach’s \( \alpha \) suggesting limited quality suffice.

### 3.2.3 Control variables

We add several control variables to reduce the likelihood of omitted variable bias (Griffin & Mahon, 1997). Since the positive link between financial and CSR performance has been established (Margolis et al., 2009; van Beurden & Gössling, 2008), we include operating profit margin — calculated as operating income divided by net revenues—as an accounting-based performance proxy. We use earnings yield—calculated by dividing the earnings per share by the share price—as a market-based performance proxy (Busch & Lewandowski, 2018). Furthermore, we employ the return on assets—calculated as net income over total assets—as an operative performance proxy (Ioannou & Serafeim, 2012).

To account for risk (Lueg, Krastev & Lueg, 2019), we include leverage, which is calculated as total debt over total equity. Clarkson et al. (2008) report positive effects of leverage and environmental disclosure. All control variables are winsorized at the 1% and 99% level and logarithmized to reduce the influence of outliers.

### 3.3 Regression model

We performed fixed-effects regression to test the hypotheses. The following model was applied:

\[
\text{ESGC}_{it} = \beta_0 + \beta_1 \text{Complexity}_{i,t-1} + \sum \text{Controls}_{it} + \sum \text{EFE} + \sum \text{TFE} + \epsilon_{it}
\]

where \( \text{EFE} \) represents entity-fixed effects, \( \text{TFE} \) is the time-fixed effects, and \( \epsilon \) is the error term (please refer again to Table 3 for the definition of other variables). We applied a fixed-effects model with entity and time-fixed effects to reduce time-invariant omitted variables (Wooldridge, 2013). Hence, year-, country-, and industry-fixed effects are controlled for in the regression, and the omitted variable bias arising from unobserved heterogeneity is limited to time-variant confounders (Studenmund, 2017; Wintoki, Linck & Netter, 2012). Furthermore, the Breusch-Pagan-Lagrange-Multiplier-test recommends a

### Table 4: Scoring coefficients of complexity variable

<table>
<thead>
<tr>
<th>Scoring coefficients of Complexity</th>
<th>VerticalDiff</th>
<th>FunctionalDiff</th>
<th>OccupationalDiff</th>
<th>SpatialDiff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.252</td>
<td>0.334</td>
<td>0.314</td>
<td>0.155</td>
</tr>
</tbody>
</table>

Note: This table provides the scoring coefficients of the Complexity variable generated through factor analysis. The variables are: VerticalDiff = vertical differentiation proxy, FunctionalDiff = functional differentiation proxy, OccupationalDiff = occupational differentiation proxy, SpatialDiff = spatial differentiation proxy.
<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Min</th>
<th>Max</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
<th>(10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) ESGCS</td>
<td>9812</td>
<td>52.826</td>
<td>18.252</td>
<td>0.5</td>
<td>93.47</td>
<td>1.000*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Complexity</td>
<td>7883</td>
<td>0</td>
<td>0.717</td>
<td>-2.39</td>
<td>1239</td>
<td>0.486*</td>
<td>1.000*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) VerticalDiff</td>
<td>11,408</td>
<td>9.587</td>
<td>1.574</td>
<td>4.905</td>
<td>12.861</td>
<td>0.276*</td>
<td>0.708*</td>
<td>1.000*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) FunctionalDiff</td>
<td>9635</td>
<td>0.714</td>
<td>0.452</td>
<td>0</td>
<td>1</td>
<td>0.448*</td>
<td>0.716*</td>
<td>0.306*</td>
<td>1.000*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) OccupationalDiff</td>
<td>9634</td>
<td>0.855</td>
<td>0.353</td>
<td>0</td>
<td>1</td>
<td>0.436*</td>
<td>0.577*</td>
<td>0.241*</td>
<td>0.367*</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) SpatialDiff</td>
<td>9314</td>
<td>32.616</td>
<td>25.628</td>
<td>0</td>
<td>96.185</td>
<td>0.216*</td>
<td>0.488*</td>
<td>0.160*</td>
<td>0.150*</td>
<td>0.193*</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7) ROA</td>
<td>10,849</td>
<td>1.723</td>
<td>0.835</td>
<td>-4.605</td>
<td>3.341</td>
<td>-0.048*</td>
<td>-0.073*</td>
<td>-0.096*</td>
<td>-0.118*</td>
<td>-0.023</td>
<td>0.043*</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(8) OPM</td>
<td>11,238</td>
<td>2.318</td>
<td>0.885</td>
<td>-4.605</td>
<td>3.916</td>
<td>-0.038*</td>
<td>-0.211*</td>
<td>-0.313*</td>
<td>-0.095*</td>
<td>-0.082*</td>
<td>-0.074*</td>
<td>0.520*</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9) EPS/P</td>
<td>10,398</td>
<td>-3.016</td>
<td>0.674</td>
<td>-8.386</td>
<td>-1.624</td>
<td>0.074*</td>
<td>0.167*</td>
<td>0.161*</td>
<td>0.152*</td>
<td>0.108*</td>
<td>0.022</td>
<td>0.174*</td>
<td>-0.080*</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>(10) Leverage</td>
<td>11,184</td>
<td>4.006</td>
<td>1.463</td>
<td>-4.605</td>
<td>6.695</td>
<td>0.049*</td>
<td>0.053*</td>
<td>0.130*</td>
<td>0.070*</td>
<td>0.003*</td>
<td>-0.123*</td>
<td>-0.273*</td>
<td>-0.005</td>
<td>0.038*</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Note: This table provides summary statistics (number of firm-year observations, mean, standard deviation, minimum, maximum) for the used variables. In the following columns, Spearman's rank correlation coefficients of the variables presented in the descriptive statistics are shown. The variables are defined as follows: ESGCS = environmental, social and governance combined score, Complexity = joint complexity proxy, VerticalDiff = vertical differentiation proxy, FunctionalDiff = functional differentiation proxy, OccupationalDiff = occupational differentiation proxy, SpatialDiff = spatial differentiation proxy, ROA = return on assets, OPM = operating profit margin, EPS/P = earnings per share divided by share price, Leverage = total debt divided by total equity. The sample after the exclusion of financial institutions is presented. A time lag of 1 year is applied to the variables Complexity, VerticalDiff, FunctionalDiff, OccupationalDiff, and SpatialDiff. ROA, OPM, EPS/P, and Leverage are winsorized at the 1% and 99% level and logarithmized. *p < 0.01.
panel model and the Hausman test for fixed versus random-effects suggests a fixed-effects approach. This seems appropriate as the influence of complexity on the ESGC of a firm is likely to be influenced by time-constant effects such as country or industry.

The model uses robust standard errors employing the Huber-White-Sandwich estimator to correct for heteroscedasticity and serial correlation (Wooldridge, 2013). The maximum variance inflation factors (VIFs) are provided for every regression in the output tables. The results range from 1.84 to 1.97, indicating no multicollinearity problems and the normal distribution of residuals raises no concern. Even though the Shapiro–Wilk test does not confirm normality, the study deals with a large sample and the interquartile range test suggests normality as it finds no severe outliers (Field, 2013).

4 | RESULTS

4.1 | Descriptive statistics and correlation analysis

Table 5 presents the descriptive statistics and the correlation matrix of our study. The joint complexity proxy (Complexity) and its four

<table>
<thead>
<tr>
<th>Table 6</th>
<th>Regression analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ESGC Score</strong></td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Complexity</td>
<td>5.099***</td>
</tr>
<tr>
<td>VerticalDiff</td>
<td>2.707***</td>
</tr>
<tr>
<td>FunctionalDiff</td>
<td>4.610***</td>
</tr>
<tr>
<td>OccupationalDiff</td>
<td>5.954***</td>
</tr>
<tr>
<td>SpatialDiff</td>
<td>0.024</td>
</tr>
<tr>
<td>ROA</td>
<td>0.824*</td>
</tr>
<tr>
<td>OPM</td>
<td>0.155</td>
</tr>
<tr>
<td>EPS/P</td>
<td>−0.529</td>
</tr>
<tr>
<td>Leverage</td>
<td>0.365</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>43.057***</td>
</tr>
<tr>
<td>Observations (N)</td>
<td>6696</td>
</tr>
<tr>
<td>Number of firms</td>
<td>1001</td>
</tr>
<tr>
<td>Year, Country, Industry FE</td>
<td>Yes</td>
</tr>
<tr>
<td>Max. VIF</td>
<td>1.84</td>
</tr>
<tr>
<td>R²-adjusted</td>
<td>0.212</td>
</tr>
</tbody>
</table>

Note: This table presents the results of the regression analysis including the variables presented in the descriptive statistics. The variables are: ESGC = environmental, social and governance combined score, Complexity = joint complexity proxy, VerticalDiff = vertical differentiation proxy, FunctionalDiff = functional differentiation proxy, OccupationalDiff = occupational differentiation proxy, SpatialDiff = spatial differentiation proxy, ROA = return on assets, OPM = operating profit margin, EPS/P = earnings per share divided by share price, Leverage = total debt divided by total equity. Five different year-, country- and industry-fixed effects regressions researching the influence of five different independent variables (Complexity, VerticalDiff, FunctionalDiff, OccupationalDiff, and SpatialDiff) on the ESGC Score are performed. Mean VIF: mean-variance inflation factor derived from equivalent pooled-OLS estimation. Robust standard errors in parentheses.

*p < 0.1; **p < 0.05; ***p < 0.01.
dimensions (VerticalDiff, FunctionalDiff, OccupationalDiff, SpatialDiff), are positively correlated with the ESGC score at the 1% significance level. The correlation between the ESGC score and spatial differentiation is the weakest.

4.2 | Regression analysis

Table 6 displays the results of the five fixed effect regressions. \( R^2 \)-adjusted indicates acceptable explanatory power compared to related research (Schreck & Raithel, 2018).

Model 1 shows a positive relationship between the joint complexity proxy and the ESGC score (\( R^2 \)-adjusted = 0.212; \( p < 1% \)). This indicates that firms that are more complex appear to be more engaged in CSR, supporting hypothesis H1. Of the control variables, the positive impact of ROA (\( p < 10\% \)) may imply that a more profitable usage of assets is linked to better CSR.

To gain a more detailed insight into the relationship between complexity and CSR, we performed four further regressions. Starting with the relationship between vertical differentiation (VerticalDiff) and the ESGC score, Model 2 finds a positive and highly significant influence (\( R^2 \)-adjusted = 0.193; \( p < 1\% \)). This confirms H2. Furthermore, the control variable earnings yield (EPS/P) shows an influence that is negative and significant (\( p < 10\% \)). This could indicate a negative connection between accounting-based financial performance and CSR.

Models 3 and 4 also find significant positive influences of functional differentiation (FunctionalDiff; \( R^2 \)-adjusted = 0.196; \( p < 1\% \)) and occupational differentiation on ESGC (OccupationalDiff; \( R^2 \)-adjusted = 0.198; \( p < 1\% \)). This confirms hypotheses H3 and H4.

Only Model 5 does not show an effect of spatial differentiation (SpatialDiff) on ESGC. We will discuss this finding at length in Section 5.1. Thus, hypothesis H5 cannot be confirmed. The \( R^2 \)-adjusted of the regression is 0.195.

4.3 | Robustness checks

Two robustness checks were performed. First, the regression was re-estimated with the ESG score instead of the ESGC score. The ESG score is a more commonly used variable to measure CSR and is the same as the ESGC score except that it does not include the ESG controversy topics (Refinitiv, 2021). As Table 7 shows, the joint complexity proxy is positively linked to the ESG score (\( p < 1\% \)). This supports the results found for the ESGC score. Furthermore, the \( R^2 \)-adjusted of 0.310 is higher than the value of the prior regression (0.212), supporting our previous findings.

A second robustness test was performed, re-estimating the influence of the joint complexity proxy on the ESGC score using a random-effects model. A fixed-effects regression is limited to the variation within one entity over time, whereas a random-effects approach examines the variation across entities (Wooldridge, 2013). Year effects were still controlled for through the inclusion of a year dummy variable. Table 8 presents the respective results. The positive significant (\( p < 1\% \)) influence of the joint complexity proxy on the ESG score reported in the initial fixed effects regression was also found in the random-effects regression.

5 | DISCUSSION

5.1 | Contributions

It was the goal of this study to understand how different proxies of firm complexity relate to CSR from the perspective of contingency theory. Previous research by Drempt et al. (2019) finds a significant positive relation between different firm size proxies and ESG scores. Further literature contends that firm size suggests increased implementation of CSR practices (Darnall et al., 2010; Hörisch et al., 2015) and CSR reporting (Gallo & Christensen, 2011; Schreck & Raithel, 2018). Our study has added more nuances to this relationship by shifting the focus from firm size as a proxy for complexity to structural complexity. Thereby, it contributes to theory, methodology and practice.
TABLE 8  Robustness test with random-effects model

<table>
<thead>
<tr>
<th></th>
<th>ESGC Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity</td>
<td>9.445***</td>
</tr>
<tr>
<td>ROA</td>
<td>0.162</td>
</tr>
<tr>
<td>OPM</td>
<td>0.331</td>
</tr>
<tr>
<td>EPS/P</td>
<td>0.304</td>
</tr>
<tr>
<td>Leverage</td>
<td>0.279*</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>45.957***</td>
</tr>
</tbody>
</table>

Observations (N) 6696
Number of firms 1001
Year FE Yes

Note: This table gives the results of the robustness test of performing a random-effects regression instead of a fixed-effects regression. The variables are ESGC Score = environmental, social, and governance combined score. Complexity = joint complexity proxy, ROA = return on assets, OPM = operating profit margin, EPS/P = earnings per share divided by share price, Leverage = total debt divided by total equity. Year dummies are included for year-fixed effects. Robust standard errors in parentheses.

*p < 0.1; ***p < 0.01.

5.1.1 Contributions to theory

One contribution to theory in the area of CSR is a deeper theoretical understanding of its relationship to firm complexity. We have explained why the theoretical construct of firm complexity is not synonymous with the ubiquitously available proxies of firm size. We also unpacked the black box of firm complexity and elaborated on its various dimensions. Thus, future researchers will be better able to define which dimension of complexity they refer to and might be able to dissect different, possibly opposite, effects of complexity dimensions and CSR. As a last contribution to theory, we found that spatial differentiation—a complexity caused by a high degree of internationalization of a firm—is an exception to the rule. Literature on the relation between CSR and internationalization seems to be inconclusive (Brammer et al., 2009). Attig et al. (2016) find a positive relation but refer to mixed evidence provided by previous work. In line with the results of the present study, the findings of Simerly (1997) and Brammer et al. (2009) suggest no evidence of a significant link between the degree of internationalization per se and CSR. We suggest three main reasons why spatial differentiation is—an average—unrelated to the CSR of the firms in our sample: First, operating in several countries means adopting the local standards which impairs standardization in and unambiguous communication of CSR toward stakeholders. Second, these local particularities of CSR foster parallel organizational structures. These are expensive, so some firms might choose to limit CSR when faced with multiple national standards (Bouquet & Deutsch, 2008; Strike et al., 2006). Third, internationalization might be a sign of firms in developed countries attempting to circumvent their home countries’ CSR standards by offshoring activities to developing countries (Bouquet & Deutsch, 2008). The higher the degree of CSR avoidance, the less the complexity-CSR relationship might hold.

5.1.2 Methodological advancement

Our study offers two methodological advancements in the area of CSR. First, we employed the advanced ESGC score as an indicator of CSR, arguing that it is conceptually superior to the ESG score as it also considers ESG controversies (Refinitiv, 2021). Our robustness checks indicate that it is fit to use for future studies on this topic. Second, we have provided concise examples of how to operationalize firm complexity as an aggregate, as well as its dimensions, with publicly available data beyond the common, controversial proxies of firm size. Firm size can be an operationalization of many things, not just of firm complexity. Our new operationalization of structural complexity allows researchers to employ a more valid measurement of firm complexity.

5.1.3 Implications for practice

The findings of this study are of relevance for practice. While we confirm that complexity generally fosters CSR, we also find nuances that spatial differentiation is the exception to the rule. Managers faced mainly with spatial differentiation should therefore be mindful not to over-implement CSR to catch less differentiated industry peers. External stakeholders who observe pronounced CSR for firms facing primarily spatial differentiation should question if this CSR eschew was symbolic only.

5.2 Limitations and future research

The limitations of this study offer fruitful avenues for future research. First, the study is limited to the ESGC rating provided by the Refinitiv Datastream database. The firm selection restricted the study to listed firms from developed countries located in Europe, North America, and Japan with a large market capitalization. Reexamining the relationship with a sample from developing countries would specifically help to test our conjectures why spatial differentiation (especially offshoring for CSR avoidance) does not affect CSR. Second, the study is limited by the chosen variables, in this case, to measure firm complexity. This is especially relevant for the definition of the construct of complexity because there is no consensus of measurement in extant research. Moreover, the definition and understanding of the construct of complexity are subject to change over time (Schneider et al., 2017), so every theoretical development is temporarily limited. Third, the study uses the ESGC score as a proxy for CSR. Although this score is believed to cover a large part of the multidimensional construct of CSR, it faces the typical problems of third-party raters in that it is dependent on
publicly available information. Therefore, only CSR activities that are reported can be measured, excluding non-disclosing firms. Furthermore, concerns exist about the validity of CSR ratings due to a lack of agreement and limited consistency of judgment among different rating agencies and analysts (Chatterji et al., 2009; Chatterji et al., 2016; Hedeström et al., 2011). Last, the ability of any one single score to measure the complex construct of CSR is questionable (Capelle-Blancard & Petit, 2017). Future research should avoid this problem by creating more transparent ESG scores, for example, by analyzing annual and CSR reports using computer-aided text analysis (CATA).

5.3 | Conclusion

Since existing studies on the relationship between firm complexity and CSR are limited by employing size variables as proxies, this research defines complexity in terms of the structural complexity of a firm to satisfy the multidimensionality of CSR. It represents the first empirical study to examine the link between firm complexity and CSR in such a sophisticated manner. We contribute that more complex firms, differentiated along the vertical, functional, and occupational dimensions, are more engaged in CSR, whereas spatial differentiation is not associated with a higher level of CSR.

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REFERENCES


