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Demutualization, Corporatization, and Sustainability Initiatives: Evidence from the European Stock Exchange Industry

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Abstract

Purpose: The article analyzes the consequences of transformation in governance structures of stock exchanges on their CSR initiatives, in particular relations between their organizational forms and the number and nature of CSR initiatives as well as their influence on stock exchanges' performance.

Methodology: In our study covering 40 European stock exchanges, we identified 527 sustainability practices implemented between 1992 and 2019. We divided these practices into two categories: internal, applying to the stock exchange itself, and external, targeted at listed companies. Moreover, we proposed a synthetic indicator of stock exchange development to measure its economic performance.

Findings: We found that publicly traded stock exchanges undertake a greater number of CSR initiatives and have a higher proportion of internal practices, than stock exchanges organized as non-public entities. Our study also indicates that a large number of implemented CSR practices positively affects the economic performance of stock exchanges, and furthermore, that internal practices have a greater impact than external ones.

Research limitations: The surveyed European stock exchanges may differ from stock exchanges in other regions regarding their CSR policies.

Originality: Our study proved that the corporatization of stock exchanges affect their CSR practices. It also showed that some types of sustainability activities affect performance in a more significant way than others.

Keywords: stock exchange, corporate social responsibility (CSR), corporatization, demutualization, equity market performance.

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Introduction

During the last decades, stock exchanges have undergone a process of significant changes in their organizational forms, transforming from traditional mutual not-for-profit organizations (broker clubs) into for-profit corporations (Slimane, 2012). These transformations followed various paths. Some stock exchanges underwent demutualization processes, replacing the one-member one-vote governance structure with a one-share one-vote structure (Serifsoy, 2008) while maintaining the dominant position of traditional insiders. Other stock exchanges went one step further by becoming public companies which resulted in the corporatization of their structures (Oldford & Otchere, 2011), leading to an increase in the importance of outsiders. The main reason for these changes was the necessity to adjust governance regimes to new strategies and business models of stock exchanges in response to a more challenging business environment.

Corporatization of stock exchanges brings many advantages: improved access to capital, more efficient management structure that provides more freedom to stock exchanges' managers, better ability to implement innovation, more openness toward business diversification thanks to reduced influence of insiders, whose interests could be endangered by such innovation and diversification (Burke, 2002). As a result, stock exchanges being operated as public companies achieve better performance (Otchere, 2006; Oldford & Otchere, 2011). On the other hand, corporatization brings new challenges. One of them is the inevitable conflict of interests inside self-listed stock exchanges which still have regulatory power. Such stock exchanges are self-regulatory organizations (SRO) that set rules while becoming public companies subject to those rules (Fleckner, 2006; Christiansen & Koldertsova, 2009). Another challenge is the legitimation of exchanges operating as public for-profit companies, and their positive image and reputation protection. The organizational form of such exchanges makes it difficult for them to derive legitimacy from sources such as tradition or the aura of acting in the public interest, from which came the cognitive legitimacy of stock exchanges with the mutual not-for-profit status. Due to the more extensive network of their stakeholders, greater visibility, and media coverage, corporatized stock exchanges are simultaneously more vulnerable to image deterioration and reputation losses compared to demutualized but not self-listed stock exchanges. As a result, stock exchanges that operate as public companies face additional challenges while trying to gain acceptance for their new organizational form. Activities in corporate social responsibility (CSR) may prove to be an important instrument for gaining this approval.

In our study, we analyzed sustainability practices of corporatized stock exchanges as well as stock exchanges that operate under different organizational forms to determine

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whether there exist any differences between these two groups regarding the intensity and nature of CSR practices. Moreover, we analyzed the effect of CSR practices on stock exchange performance. Our study covered 40 European stock exchanges. In that group, we identified 527 CSR initiatives undertaken in 1992–2019. We assigned each of these initiatives into one of two categories, which we defined as practices applying to stock exchanges (henceforth: internal CSR practices) and practices directed at listed companies (henceforth: external CSR practices). This allowed us to study the relations between the organizational form of stock exchanges and the number and nature of implemented CSR practices. After we determined the relations among variables, we analyzed the impact of social engagement level on economic performance. To conduct the study, we proposed a new synthetic indicator of stock exchange development, which we utilized as a measure of economic performance. We believed that traditional metrics of performance utilized to assess the CSR–CFP (corporate financial performance) relationship, such as market value, return on assets (ROA), or return on equity (ROE) do not apply to stock exchanges that operate as not-for-profit companies. While assessing the level of stock exchange, development sets of criteria are usually utilized instead of single metrics (Sial et al., 2015). We utilized a set we transformed into a single aggregate normalized variable via appropriate statistical procedures. Our results confirmed that the legal status of a stock exchange is a significant factor affecting its CSR activities. Publicly traded stock exchanges exhibit a larger number of CSR initiatives than non-public stock exchanges, while a large share of their activities are internal CSR practices. Moreover, we found a positive relationship between a stock exchange's social commitment and its economic performance. Stock exchanges that implemented a larger number of CSR practices than others scored higher on the scale of our synthetic indicator of stock exchange's development. Furthermore, our research results indicated that the number of practices implemented is not the sole factor affecting the score: internal CSR practices have a more profound impact on our development indicator than external CSR practices.

Our study contributes to the subject literature in several ways. First, the study extends the understanding of consequences stemming from the transformation of stock exchanges' governance structures. Earlier research covers the influence of these changes on exchanges' operating performance (Otchere, 2006; Serifsoy, 2008; Oldford & Otchere, 2011), market quality (Krishnamurti et al., 2003; Abukari & Otchere, 2020), or listing fees (Geranio & Lazzari, 2014). Other studies analyze the moderating role that changes in corporate governance practices following the transformation of the stock market into a for-profit organization played in modifying the impact of demutualization and corporatization on performance (Slimane & Angulo, 2019). Our study proves that the corporatization of a stock exchange affects its CSR practices. Further-

more, our results indicate that CSR practices could be one of the factors affecting exchanges' performance. Positive influence of sustainability practices identified in our study agrees with meta-analyses results, which determine the numerical advantage of studies confirming the existence of such influence (Margolis & Walsh, 2003; Orlitzky et al., 2003; van Beurden & Gössling, 2008; Friede et al., 2015; Wang et al., 2016). However, stock exchanges were not the subject of such studies in the past. Thus, our study extends the scope of entities, in which one finds the presence of a relationship identified in earlier studies between governance structure and CSR practices. Moreover, our research provides better insight into the nature of the CSR–CFP relationship. Only very few earlier studies emphasized the nature of CSR activities for stock exchanges. Our research proves that some types of sustainability activities affect stock exchange performance more than other forms of sustainability practices. Identification of such diversity has important practical implications, as it allows more efficient allocation of resources reserved for CSR activities. Internal practices that allow stock exchanges to better answer stakeholder expectations and have a more profound effect on stock exchanges' public image contribute more to stock exchanges' success than external practices typically associated with educational and regulatory functions. Our findings support the belief that the performing of regulatory functions negatively affects stock exchange performance, and in that sense, conflicts with the profit orientation of stock exchanges operating as public companies.

Moreover, our research additionally develops the literature on internal antecedents of sustainability activities. Previous research in this area concentrated on the role of corporate governance (Arora & Dharwadkar, 2011; Jo & Harjoto, 2011), with particular emphasis on various corporate governance mechanisms (Jain & Jamali, 2016), shareholder structure (Lopatta et al., 2017), types of shareholders (e.g. family equity holdings) (Rees & Rodionova, 2015), executive compensation (Flammer et al., 2019), values and psychological characteristics of CEO (Chin et al., 2013; Petrenko et al., 2016), organizational culture (McCabe et al., 1996), organizational structure (Asmussen & Fosfuri, 2019), organizational type (Acar et al., 2001). In our study, we prove that organizational form is another important internal factor that affects social engagement as it influences both the extent of CSR activities and the type of these activities. Earlier research – in some respect similar to our study – was done by Acar et al. (2001), which concentrated on the analysis of the influence of organizational type. However, that research significantly differs from our approach with respect to methodology, as it utilized a special questionnaire to identify organizations' attitude. Our research is based on the identification of actual CSR initiatives undertaken by stock exchanges. Moreover, we managed to tie the extent and nature of CSR activities with economic performance. To do so we created the special synthetic indicator called summary development indicator

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or SDI. While creating this indicator we utilized a set of criteria, which were mostly relative in nature, which stood in contrast to previously utilized parameters. This allowed us to utilize our synthetic indicator to compare markets (stock exchanges) of different sizes and different levels of development (mature and emerging markets). We believe that the SDI is a universal tool that can be utilized by other researchers.

The rest of the article is structured as follows. The literature review will present the body of writing about demutualization and corporatization of stock exchanges as well as corporate social responsibility with its antecedents and influence on economic performance. Next, we will develop our research hypotheses based on the literature review. In the following section, we will present the research methodology and data, followed by research results and a discussion of implications. The final section will conclude the article.

Literature Review and Hypothesis Development

During the last few decades, the history of stock exchanges arrived at a crossroads. Through the ages, stock exchanges operated mostly as mutual not-for-profit organizations (Karmel, 2002). However, changes happening in the business environment prompted many to abandon this traditional organizational form. The changes sparked increased competition caused by new technologies, deregulation, and globalization (Fleckner, 2006). Stock exchanges lost their status as national monopolies and were exposed to competition with foreign stock exchanges (Aggarwal, 2002) and alternative trading systems (ATS). Mutual governance structures hindered the adjustment of stock exchanges to the new circumstances. The necessity of including the interests of many diverse members of an organization adversely affected stock exchanges' management efficiency necessary to successfully compete in the new business environment. Conflicts of interests obstructed key decision-making process (Aggarwal & Dahyia, 2006). The answer to these problems was demutualization, which meant the transformation of stock exchanges from not-for-profit member-owned organizations to profit-oriented privately held firms. In some cases, this step preceded corporatization, which led to an increased number of exchanges being run as publicly traded companies (PTC; Aggarwal, 2002). Going public enabled stock exchanges to reach new capital, develop financially, and implement modern technologies, thus opening new opportunities for participation in mergers and acquisitions, which in turn led to a consolidation among stock exchanges. Stockholm Stock Exchange was the first stock exchange to demutualize in 1993, and it was soon followed by other European exchanges: Helsinki Stock Exchange in 1995, Copenhagen Stock Exchange in 1996, Amsterdam Stock Exchange

and Borsa Italiana in 1997. The first exchange to go public and begin listing on its own stock exchange was Australian Stock Exchange in 1998. Due to the above changes, three main governance regimes are used by stock exchanges today: mutuals, demutualized but privately held organizations, and publicly listed companies. The first two of these organizational forms are considered privately owned organizations (POO) while the last one: a PTC.

The emergence of new organizational forms of stock exchanges required new sources for their legitimacy. Such a necessity led to changes in strategies for gaining and maintaining legitimacy. The survival of stock exchanges – as that of any other organization – depends on the degree of its acceptance by various groups of interests in its environment, which provides stock exchanges with its support and access to resources they control. Thus, external environment creates limitations for organizations, determining their structure and practices (Meyer & Rowan, 1977; Pfeffer & Slancik, 1978). Adaptation to such limitations should lead to a situation organization is perceived as desirable and behaving in accordance with prevailing and acceptable values and norms (Suchman, 1995). In the case of new organizations or forms of existing organizations, legitimacy can be gained via the mimetic imitation of structures, rules, and behaviors of other organizations. Isomorphism perceived as adaptation leading to similarity is considered to be an important legitimizing factor (Deephouse & Carter, 2005). Stock exchanges operating as mutual not-for-profit member-owned organizations draw upon a tradition of "broker clubs" dating back to the seventeenth century to establish their legitimacy (Poser, 2001). Due to that tradition, we may accept that the legitimacy of such organizational form of stock exchanges is taken for granted, which is the highest form of cognitive legitimacy (Aldrich & Fiol, 1994). Furthermore, not-for--profit organizations are surrounded by an aura of operating in the public interest to a greater extent than for-profit companies (Karmel, 2002). Stock exchanges operating as demutualized but privately held organizations and PTCs suffer from a "liability of newness" (Freeman et al., 1983; Suchman, 1995), so they must seek new sources of legitimacy. As for-profit companies, they may no longer benefit from the not-for-profit status. Stock exchanges that operate as POOs may gain legitimacy from their owners, previous members of the exchange, who "turned their seats into shares" (Karmel, 2002). However, stock exchanges which are PTCs lack such ability and, thus, must turn to other strategies for gaining and maintaining legitimacy. One avenue is to present itself as an organization representing a high level of social engagement, operating in accordance with a set of generally accepted norms and values. Therefore, legitimacy--seeking becomes the most important driver of corporate CSR practices (Schaltegger & Hörisch, 2017). In this context, the stock exchanges operating as PTCs mimetically imitate the behavior of other existing PTCs. Conformity to other PTCs would legitimize

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a market operator as an organization operating in the form that is taken for granted; although not necessarily with regard to organizations operating as stock exchanges.

Moreover, different organizational forms utilized by stock exchanges impinge the degree to which the image of the exchange is sensitive to changes that may negatively affect the approval of a stock exchange and its activities. This situation stems from the interrelation between organizational form and the scale and complexity of stakeholders' network, stock exchanges' visibility, and how much the society follows the stock exchanges' activities. The stock exchanges organized in the form that facilitates the creation of more extensive stakeholders' networks, greater organization visibility, and attracting public and media attention are more prone to acceptance loss in their environment compared to entities whose organizational forms limit interactions with external environment. More visible exchanges are more exposed to reputational risks due to the asymmetry in the perception of negative and positive elements in their message: the former are more receptive than the latter (Baumeister et al., 2001), and thus more strongly affect the perception of the organization. Creation and solidification of negative associations with an entity poses a significant risk of losing support in the environment. Therefore, for the stock exchanges whose form makes them more sensitive to the changes in perception, reputation protection and positive image creation become more important than for the stock exchanges whose organizational form makes their organization and reputation more resilient to external influences. Thus, entities more sensitive to the public image are more likely to undertake activities that are supposed to protect such an image (Lauterbach & Pajuste, 2017).

Stock exchanges that operate as public companies have much more extensive stakeholders' networks than stock exchanges operating as POO; the former are also more socially visible and attract more public interest than the latter. As a result, the former's reputation is more vulnerable to negative changes that may affect the level of an organization's acceptance in its surroundings. In turn, this generates greater demand for moral capital (Godfrey, 2005) and for safety nets (Fombrun et al., 2000), protecting the stock exchange from the outcome of events that may adversely affect its perception and evaluation. Moral capital and safety nets are both outcomes of organizations' social engagement. Thus, the stock exchanges that operate in the form of public companies are predestined to undertake initiatives in this area. Such initiatives might be perceived as a way of signaling the ethical nature of business activities (Zerbini, 2017) and higher standards in CSR. Signaling efficiency might be strengthened by increasing the number of signals sent (Connelly et al., 2011) or by an increase in the number of CSR practices implemented by the exchange.

H1: The fact that a stock exchange is operated by a publicly traded company positively affects the number of its CSR practices.

The level of social engagement by stock exchanges operated as publicly traded companies is compared by its stakeholders to the level of social engagement exhibited by other public companies. The latter's activity in this field sets the benchmark that helps stakeholders measure their expectations about stock exchange operators and to what extent do the latter meet these expectations. The outcome of such evaluations is reflected in the reputation of a company that operates the stock exchange. Reputation expresses the perceived ability of an organization to meet stakeholders' expectations (Waddock, 2000).

Many researchers have already signaled a connection between reputation and business social responsibility (e.g. Fombrun & Shanley, 1990; Mahon, 2002; Highhouse et al., 2009; Soppe et al., 2011; Aguilera-Caracuel & Guerrero-Villegas, 2018; Fernández-Gámez et al., 2020; Javed et al., 2020). However, the strength of CSR activities' influence on reputation may depend on the nature of organizations' social engagement. The CSR activities that are more attached to and coherent with organizations' core activities have a stronger effect on reputation than other CSR initiatives (Brammer & Pavelin, 2004; Siltaoja, 2006). It means that in the case of stock exchanges operating as public companies, the number of implemented CSR practices is as important as their nature. These stock exchanges' operators will attach more weight to internal CSR practices than to external CSR practices. As a result, the structure of CSR practices implemented by publicly traded stock exchanges will differ from that implemented by stock exchanges run as POOs.

Differences in the structure of practices can be further distinguished by the nature of stimuli driving stock exchanges to engage in sustainability activities. These stimuli are different for stock exchanges operating as POOs compared to the stock exchanges that function as PTCs. Traditional stock exchanges, organized as mutual institutions, used to play an important role in the regulation and self-regulation of capital markets, as they were considered self-regulatory organizations (SRO; Carson, 2003). Such a mode of operations determined by the history of stock exchanges will drive them toward preferring external CSR practices because such activities would be perceived as part of the function of promoting and maintaining higher standards addressed to market participants. The demutualization that leads to the transformation of stock exchanges from not-for-profit into for-profit organizations results in the reduction of stock exchange engagement in regulatory activities, stemming from their unwillingness to

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finance such regulatory functions – as these are not generating revenues (Movsesyan, 2007) – and reduced motivation to enforce regulations upon entities who are sources of exchange revenues (Akhtar, 2002). Moreover, once a stock exchange becomes a self-listed public company, a conflict of interests emerges between the creation and monitoring of rules and being subject to those rules. Thus, stock exchanges operating as PTCs withdraw from at least some regulatory functions directed toward external entities, concentrating instead on regulatory functions covering internal operations while transferring other regulatory functions to state regulatory institutions or independent SROs (Bradley, 2001; Steil, 2002; Carson, 2003). By doing so, stock exchanges limit their role as promoters of practices directed toward listed companies. At the same time, stock exchanges operating as PTCs are more strongly motivated than demutualized stock exchanges to emphasize their distinctiveness (as organizations) from their former members (brokerage houses etc.). The importance of such distinctiveness requires the creation of a stock exchange's own identity. Concentration on internal CSR practices may in that case help to accentuate one important element of such an identity, important from the viewpoint of a stock exchange's reputation creation.

> **H2:** The fact that a stock exchange is operated by a publicly traded company positively affects the share of internal CSR practices and negatively affects the share of external CSR practices.

An organization's engagement in CSR activities not only affects its reputation but also the stakeholders' attitude toward the organization. Previous research on the topic of economic entities' social engagement influence on the behavior of various groups of stakeholders shows generally positive effects, as social engagement increases stakeholders' readiness to support such entities by decisions beneficial to the organization. These stakeholder groups include not only clients (Sen & Bhattacharya, 2001) but also current (Peterson, 2004; Glavas & Kelley, 2014) and potential employees (Greening & Turban, 2000; Lin et al., 2012) as well as regulators and policymakers (Brown et al., 2006). Other studies indicate the improved perception of socially responsible enterprises among analysts (Ioannou & Serafeim, 2015). Assessment of companies' social engagement affects investors' decisions in debt markets (Gong et al., 2018) as well as equity markets (Lackmann et al., 2012; Adamska & Dabrowski, 2021). Investors react favorably to information on the improved level of a company's social responsibility (Consolandi et al., 2009; Ramchander et al., 2012), while reactions to information about a deterioration of social responsibility are generally negative (Doh et al., 2010, Kappou & Oikonomou, 2016). Companies that maintain higher CSR standards are more attractive to institutional investors (Wang & Chen, 2017). The so-called ethical investors are one group particularly sensitive to companies' social engagement. The significance of

that group in recent years grows both in term of the number of investors and value of assets under their management. In 2016–2018, the total value of assets managed in accordance with SRI principles has grown from $22.9 trillion to $30 trillion (Global Sustainable Investment Alliance, 2018). More than half of these assets were invested in publicly traded companies.

Maintaining higher standards in the field of CSR leads an organization to generate resources in the form of reputation (Surroca et al., 2010) and support by various groups of stakeholders, which results in the improvement of economic performance. Meta-analyses of relations between social responsibility and economic performance show the significant dominance of results that prove the positive influence of the former aspect on the latter one (Margolis & Walsh, 2003; Orlitzky et al., 2003; van Beurden & Gössling, 2008; Wang et al., 2016). In the case of organizations as specific as stock exchanges, that influence can be further magnified by the increased importance of ethical investing. Stock exchanges' CSR practices increase its attractiveness to that group of investors.

> **H3:** The more CSR practices implemented by a stock exchange the stronger its economic development.

Stock exchanges are economic organizations of a very specific nature. The two main groups of stock exchange services' clients are companies listed on the stock exchange and investors. Economic interests of those two groups are not always compatible. One of the areas of such incompatibility is the transparency of listed companies. It is often beneficial for the listed companies to limit their transparency, which allows them to manipulate their public image, extract profits from access to private information, limit competition's ability to forecast its future actions or plans, and reduce their reporting costs. From the investors' perspective, transparency and the reduction of information asymmetry are necessary conditions allowing them to undertake rational investment decisions, conduct proper valuations of companies, better forecast their future, and reduce monitoring costs. The incompatibility of interests may lead these two groups of stakeholders to treat differently various forms of CSR activities undertaken by the exchange. It may result in a positive reaction to a certain type of CSR practices by one group of stakeholders and a negative reaction to the same activity by the other group. Such a divergence has already been reported by studies on delisting, which signal that the higher standards imposed on listed companies by corporate governance codes – supposed to increase investor protections – are one of the factors increasing listed companies' willingness to go private (Block, 2004; Thomsen & Vinten, 2014; Martinez & Serve, 2017). As a result of such a divergence in primary stakeholders' reactions to stock exchanges' CSR initiatives, their implementation may have mixed effects on

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stock exchanges' economic performance and their development. This fact leads us to believe that the structure of CSR activities is as important as the sheer number of such initiatives.

H4: Stock exchanges' internal CSR practices have a stronger positive effect on stock exchanges' development than external CSR practices.

Methodology

Our study covered CSR initiatives conducted by European stock exchanges. The analysis included 40 stock exchanges (Appendix 1) in which we identified 527 CSR initiatives undertaken in 1992–2018; although the research covered the period of 1989–2018, the earliest CSR initiative was recorded in 1992. We split the identified CSR initiatives into two categories: internal CSR practices and external CSR practices (Appendix 2). Next, we determined the total number of CSR initiatives implemented by each exchange and the structure of these initiatives, namely the share of internal and external practices in the total number of CSR initiatives.

After we identified the number and structure of CSR practices for each of the 40 stock exchanges, we grouped these exchanges according to their organizational form. One group consisted of stock exchanges operating as publicly traded companies, while the other group included the remainder of stock exchanges, those operating as POOs.

To determine the relationship between the organizational form of a stock exchange and the number and structure of CSR initiatives, we applied simple regression (Sharpe et al., 2015) and correlation analysis by utilizing Pearson's linear correlation coefficient and Spearman's rank correlation coefficient alongside their statistical significance tests. We defined the following dependent variables:

- number of CSR practices (variable *GP_all*),
- share of stock exchange's internal CSR practices in the total number of CSR practices (variable *GP_exchange*),
- share of external CSR practices in the total number of CSR practices (variable *GP_companies*).

Organizational form of the stock exchange was defined as an independent variable (variable organizational form or OF). Our independent variable was a binary variable, which equaled 1 for PTC type of exchanges or 0 for the remaining exchanges. Our

model's parameters were estimated using the ordinary least square method (OLS; Stock & Watson, 2010), in which the parameters' estimators were chosen by the principle of least squares: minimizing the sum of the squares of the differences between the observed dependent variable in the given dataset and those predicted by the linear function:

$$\min_{\alpha \in R^K} \sum_{i=1}^{N} (Y_i - \mu(x_i, \alpha))^2 \quad (1),$$

in which $\hat{Y} = \mu(X)$ means the conditional expected value of independent variable Y with respect to dependent variables X

In the case of models, we estimated the conditional expected value of the number of CSR practices, the share of internal CSR practices in the total number of CSR practices, and the share of external CSR practices in the total number of CSR practices with respect to a binary variable representing the organizational form of the exchange (X). Moreover, we verified assumptions of our model regarding error term properties.

Three regression models were analyzed:

$$GP_i = \alpha_0 + \alpha_1 \cdot OF + \varepsilon \quad (2),$$

in which $i \in \{all, exchange, companies\}$.

Statistically significant estimated parameters $\widehat{\alpha_1}$ informed us about the effect of the organizational form of the stock exchange on the number and the structure of CSR practices; structure meaning the share of internal CSR practices and external CSR practices in the total number of identified CSR initiatives.

Another aim of our research was to identify any potential relationship between the number and structure of CSR practices implemented by a stock exchange and its economic performance. To analyze such a relationship, we required a new approach to measuring economic performance, as we determined that neither market indicators previously used in the studies of the CSR–CFP relationship (Brammer et al., 2006; Karagiorgos, 2010; Muller & Kraussl, 2011) nor measures based on book values (Wang et al., 2008; Choi & Wang, 2009; Garcia-Castro et al., 2010) would be adequate due to the diverse economic form of stock exchanges that include several not-for-profit institutions. Moreover, we found that other measures utilized in earlier studies – such as sales (Lev et al., 2010) or brand value (Wang, 2010) – were not applicable for the purpose of our study. Thus, we decided to utilize the level of an exchange's development as a measure of performance. While assessing the development of stock exchanges, sets of criteria are typically utilized instead of a single metric (Sial et al., 2015). We

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built such a set that primarily included relative criteria. This set was then transformed by utilizing appropriate statistical measures, into a single aggregate, normalized variable which can be interpreted as a synthetic indicator. Such an indicator can be applied regardless of the organizational form of the exchange.

While constructing our synthetic indicator, we applied tools of multivariate comparative analysis, namely methods of linear ordering. These methods are typically utilized to provide a single synthetic measure that describes objects characterized by multiple attributes (Hellwig, 1972; Hwang & Yoon, 1981). The approach we employed allowed us not only to assess objects of research but also to introduce their ranking.

While defining our synthetic indicator (summary development indicator or SDI), we assumed the following characteristics of exchange development as criteria for the exchange development's assessment:

- the ratio of a stock exchange's total capitalization to GDP of the country of exchange domicile,
- the number of publicly traded companies per capita (per 1 million citizens of a domicile country),
- the average market capitalization of a company listed on the stock exchange,
- turnover to market capitalization ratio.

After we determined our objects (European stock exchanges), the purpose of ranking (determination of exchange development level against the peer group), and the parameters that we used as assessment criteria, we built a basic observation matrix, which we used to calculate the SDI:

$$X = \begin{bmatrix} x_{11} & x_{12} & x_{13} & \cdots & x_{1m} \\ x_{21} & x_{22} & x_{23} & \cdots & x_{2m} \\ x_{31} & x_{32} & x_{33} & \cdots & x_{3m} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & x_{n3} & \cdots & x_{nm} \end{bmatrix} \quad (3),$$

in which x_{ij} value of j -th parameter in i-th object.

The actual matrix size was 40x4, in which each of the 40 rows consisted of the value of four parameters describing the development of a particular European stock exchange.

Some of the criteria of exchange development that constituted our diagnostic variables could replicate information, which could lead to the over- or underestimation of the SDI (our synthetic variable). Therefore, we performed a procedure that allowed us to identify satellite variables. We applied the capacity of information bearers' method based on correlation coefficient with a threshold level indicating strong correlation between attributes determined by critical value of Pearson's correlation coefficient (Moore et al., 2009). As a result, we determined that the variable "average capitalization of a listed company" replicates information and thus constitutes a satellite variable to the central variable: "the ratio of an exchange's total capitalization to the GDP of the domicile country of the stock exchange." We decided to omit the satellite variable in the final calculation of our synthetic indicator. To determine the value of the SDI, we applied two methods: the development pattern method as a primary calculation tool and the standardized sums method, which we utilize to verify the robustness of results from the first method. The development pattern method assumes that variables' values are normalized and can be either stimulants or dis-stimulants. The SDI calculation consisted of three steps (cf. Hellwig, 1972). In the first step, we defined abstract objects, so-called development patterns z_0, with the best value for each of the variables:

$$z_{0j} = \begin{cases} \max\limits_{i}\{z_{ij}\} for\ stimulant, \\ \min\limits_{i}\{z_{ij}\} for\ dis-stimulant \end{cases} \quad (4);$$

and anti-pattern z_{-0} with the worst values for each of the variables:

$$z_{-0j} = \begin{cases} \min\limits_{i}\{z_{ij}\} for\ stimulant, \\ \max\limits_{i}\{z_{ij}\} for\ dis-stimulant \end{cases} \quad (5).$$

Next, we analyzed the similarity of objects (stock exchanges) to the abstract best object by way of measuring the distance of each object (stock exchanges) from its development pattern. Distances were measured using Euclid's formula:

$$d_{i0} = \left[\sum_{j=1}^{m}\left(z_{ij} - z_{0j}\right)^2\right]^{\frac{1}{2}} \quad (6),$$

in which d_{i0} – distance of i-th object to development pattern.

The last step was to calculate the value of the development indicator for each of the objects using the following formula:

$$SDI_i = 1 - \frac{d_{i0}}{d_0} \quad (7),$$

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in which SDI_i means development indicator for i-th object, while d_0 – distance between pattern and anti-pattern.

The second method we utilized to determine the values of SDI were standardized sums method, which is an example of a "patternless" method. Under this method, the stimulation of variables was performed as a first step of the process, followed by the calculation of a synthetic variable performed for each object by determining the arithmetic mean of normalized variables' values:

$$s_i = \frac{1}{m}\sum_{j=1}^{m} z_{ij} i = 1, \ldots, n \quad (8),$$

in which Si is the value of synthetic variable in i-th object, while z_{ij} – normalized value of diagnostic variable.

Next, to determine the final value of synthetic variable for each of the objects, we performed the normalization procedure by applying the following formula:

$$SDI_i = \frac{s_i - \min\limits_i\{s_i\}}{\max\limits_i\{s_i\} - \min\limits_i\{s_i\}} \quad (9).$$

This last transformation resulted in the values of synthetic measure being normalized within the [0,1] range.

In our discussion of modeling, we chose the SDI estimated with development pattern method. Variants of models in which the SDI indicator was estimated by alternative method were used to test the robustness of analysis' results to the choice of estimation method.

After we calculated SDI indicators, we built several econometric models with the development level as dependent variable and CSR practices as independent variables in order to test the relationship between the presence of CSR practices and economic performance as measured by the development level. First, to test the effect of the number of CSR practices on exchange development level, we considered the following simple regression formula:

$$SDI = \alpha_0 + \alpha_1 \cdot GP_{all} + \varepsilon \quad (10).$$

The estimated significant parameter $\widehat{\alpha_1}$ informed us about the effect of the number of implemented CSR practices on the exchange development level. To test effect of the structure of CSR practices we apply multiple regression (Wooldridge, 2013):

$$SDI = \alpha_0 + \alpha_1 \cdot GP_{companies} + \alpha_2 \cdot GP_{exchange} + \varepsilon \quad (11).$$

The estimated significant parameter $\widehat{\alpha_1}$ informs us about the effect of external CSR practices on the stock exchange development, under the assumption of the share of internal CSR practices remaining constant. The significant parameter $\widehat{\alpha_2}$ informed us about the effect of exchange's internal CSR practices on the stock exchange development, under the assumption of the share of external CSR practices remaining constant.

Moreover, to assess the effect of the number and structure of CSR practices on the stock exchange development in relation to the current development level and to verify the robustness of our results, we built a quantile regression model (Koenker & Bassett 1978; Koenker, 2000). In the case of a quantile-based regression, we assumed that the quantile of the dependent variable became the dependent variable. In our research, we used first, second, and third quartile ($\tau = 0.25; 0.5; 0.75$) of the stock exchange development level measured by SDI. To come up with estimators α – which provide information about the effect of implementations of CSR practices depending on the current level of the stock exchange development – we minimized the following goal functions (with respect to $\alpha \in R^K$):

- for median:

$$\sum_{i=1}^{40}\left(SDI_i - Q_{0,5}(GP_{ji}, \alpha)\right)^2 \quad (12),$$

- for lower quartile:

$$\sum_{i=1}^{40} \rho_{0.25}\left(\left|SDI_i - Q_{0.25}(GP_{ji}, \alpha)\right|\right) \quad (13),$$

- for upper quartile:

$$\sum_{i=1}^{40} \rho_{0.75}\left(\left|SDI_i - Q_{0.75}(GP_{ji}, \alpha)\right|\right) \quad (14),$$

in which $Q_\tau(x)$ – quartile of τ level and $\rho_\tau(z) = \begin{cases} \tau z, z \geq 0 \\ (1-\tau)z, z < 0 \end{cases}$, while $\tau \in \{0.25, 0.5, 0.75\}$ and $j \in \{all, exchange, companies\}$.

Each time, a parameter estimation was performed over the full sample, but for each quartile, unique "alfa" parameters were estimated depending on whether the exchange was ranked as average (near the median of SDI), poorly developed (below the lower quartile of SDI), or highly developed (above the upper level of SDI).

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Results and Discussion

To verify H1 that stock exchanges operated by publicly traded companies show an increase in the number of CSR practices, we applied linear regression models with parameters estimated by OLS method. In the first step, we calculated the Pearson's correlation coefficients and Spearman's rank coefficients along with their significance test (t-test). The results of correlation analysis (Table 1) confirmed a relatively strong positive relationship between the variables, namely the stock exchange organizational form and the number of CSR practices.

Table 1. Values of correlation coefficients between OF and GP _ all

	Pearson's linear correlation coefficient	t-test	Spearman's rank correlation coefficient	t-test
GP_all	0,62	4,86***	0,61	4,78***

*** indicates statistical significance at the 1% level.

As both Pearson's and Spearman's coefficients have similar values, the use of linear regression was justified. The results of OLS model estimation are presented in Table 2.

Table 2. Simple regression model for OF and GP _ all

OLS model estimation		
Model factors	value	t-test
α_0	5,18	9,20***
α_1	3,61	4,86***
Model diagnostics		
R^2	0,38	
T-student test for expected value of dependent samples	Does not require verification	
White's test	LM = 0,20	
Shapiro-Wilk test	SW = 0,96	

*** indicates statistical significance at the 1% level.

Both model parameters were significant. Positive value of slope parameter indicated that for stock exchanges operated as publicly traded companies, we may expect a higher number of CSR practices: the number of CSR practices implemented on such exchanges

is greater by 3.6 on average. The R^2 value was relatively low (38%), but in the case of non-prognostic models such value should be considered adequate. The model was also tested for meeting the OLS method assumption, i.e. residuals properties. Our test values indicated the lack of correlation between error terms and independent variable, which have the expected value of 0 with constant variance and are normally distributed. Thus, all assumptions of the OLS method were met.

We applied a similar procedure to test H2 about stock exchanges operated by publicly traded companies having a positive effect on the share of internal CSR practices and a negative effect on the share of external CSR practices. Again, the correlation analysis results (Table 3) confirmed the relatively strong positive correlation between variables.

Table 3. Values of correlation coefficients between OF and GP _ exchange and GP _ companies

	Pearson's linear correlation coefficient	t-test	Spearman's rank correlation coefficient	t-test
GP_exchange	0,64	5,08***	0,64	5,08***
GP_companies	0,496	3,52***	0,499	3,55***

*** indicates statistical significance at the 1% level.

Along with the similarity of Pearson's and Spearman's coefficients value, such a relationship justified the application of linear regression in both cases. The OLS model estimation results are presented in Table 4.

Significance tests confirmed the parameters' significance for both simple regression models. Slope parameters were positive for both models. They indicated that – for stock exchanges operated by publicly traded companies – the share of CSR practices was greater for both internal CSR practices and external CSR practices. Noteworthy, internal CSR practices appeared to be more common in such exchanges. The share of internal CSR practices in the total number of CSR practices identified for PTCs-operated stock exchanges was larger by 1.5 percentage points on average than the share of such practices implemented by exchanges operating as POOs, while the share of external CSR practices was larger by only 1 p.p. We believe it signified the greater commitment of PTCs-operated stock exchanges to CSR activities, as these have a greater effect on exchanges' own reputation creation. Testing models for residuals properties allowed us to confirm that the OLS-model assumptions were satisfied: values of homoscedasticity and normality tests for error terms indicated that error terms were uncorrelated with independent variables, as they had constant variance and normal distribution.

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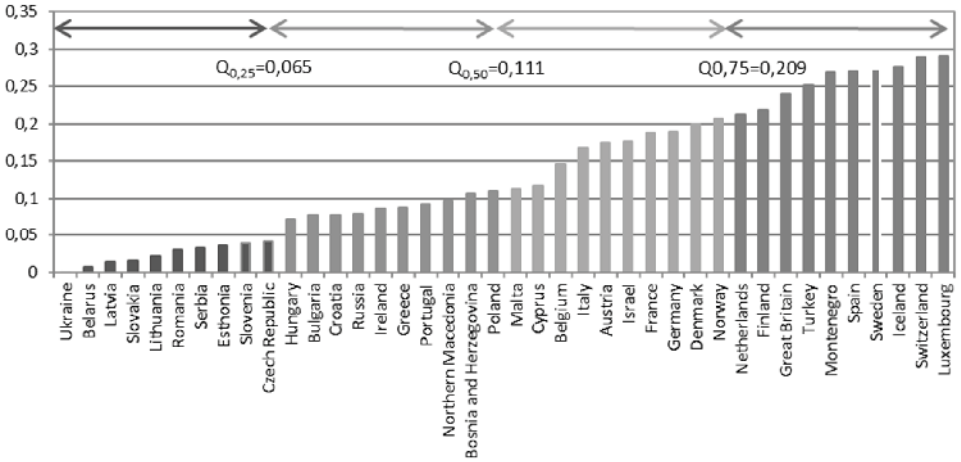
Table 4. Regression models for OF and GP _ exchange and GP _ companies

OLS model estimation				
	GP_exchange		GP_companies	
model factors	value	t-test	value	t-test
α_0	0,016	7,05***	0,019	8,91***
α_1	0,015	5,08***	0,010	3,52***
Model diagnostics				
R^2	0,404		0,246	
t-student test for expected value of dependent samples	Does not require verification		Does not require verification	
White's test	LM = 1,64		LM = 0,007	
Shapiro-Wilk test	SW = 0,96		SW = 0,954	

*** indicates statistical significance at the 1% level.

To test the relationship between CSR practices implemented by stock exchanges and their economic performance, we first applied the development pattern method to determine the value of SDI indicator for all the exchanges. Next, we ranked the exchanges by their development level and divided them into four groups representing various level of development (Figure 1).

Figure 1. Ranking of exchanges according to the level of development measured by the value of SDI indicator



In the following analysis – in which we attempt to assess the effect of CSR practices on a stock exchange's economic performance – the SDI indicator becomes a dependent variable with the number and structure of CSR practices as independent variables. To test the relationship between these variables, we calculated Pearson's correlation coefficients and Spearman's rank coefficients along with their significance test (t-test). Results of correlations testing (Table 5) confirmed the positive correlations between variables.

Table 5. Values of correlations' coefficients between SDI and GP _ all, GP _ exchange and GP _ companies

	Pearson's linear correlation coefficient	t-test	Spearman's rank correlation coefficient	t-test
GP_all	0,46	3,19***	0,48	3,38***
GP_exchange	0,48	3,35***	0,54	3,93***
GP_companies	0,36	2,40**	0,39	2,29**

** indicates statistical significance at the 5% level;
and *** indicates statistical significance at the 1% level.

The relationship between the number of CSR practices and the development level proved significant, with moderate strength, but the relationship between the structure of CSR practices and development appeared to be more complex. The relationship between internal CSR practices and the development level was significant and strong: the greater share of practices belonging to this category resulted in a higher level of stock exchange development. The relationship between external CSR practices also emerged as significant, but weaker than the previous relationship. The Pearson's and Spearman's coefficients had similar values in each case, which signified the linear character of the relationship mentioned above, thus the application of the linear regression model was justified.

To analyze the effect of the number of CSR practices on stock exchange development, we applied both linear regression and quantile regression. We applied the OLS method to estimate parameters of simple regression (Table 6).

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Table 6. OLS and quantile estimation of simple regression of SDI against GP _ all

Estimator	Parameters	t-test
OLS	0,018	10,81***
$Q_{0,25}$	0,011	9,50***
$Q_{0,50}$	0,018	10,60***
$Q_{0,75}$	0,024	12,33***

*** indicates statistical significance at the 1% level.

For the model in which parameters were estimated by the OLS method, we also performed residuals diagnostic tests (Table 7).

Table 7. Results of OLS assumptions diagnostics test for SDI against GP _ all

Test	Test statistic
t-Student test for expected value of dependent samples	t = -0,70
White's test	LM = 1,70
Shapiro-Wilk test	SW = 0,99

As error terms were normally distributed with expected value of 0 and constant variance, we concluded that assumptions of the OLS method were satisfied, and our model was correct.

In all our models, slope parameters for simple regressions were positive (Table 6), which indicated that the greater number of CSR practices positively affects stock exchange development. Estimations by the OLS and quantile methods resulted in similar values for quantile estimator $Q_{0.50}$, indicating that the implementation of CSR practices increases the value of the SDI indicator by 0.02 p.p. on average. At the same time, we found statistically significant differences between values of quantile regression coefficients, which implied a mixed effect of the number of CSR practices, with its strength dependent on the stock exchange's current development level. In the case of the CSR practices implementation on the most developed stock exchanges' influence is more than two times stronger than for the least developed exchanges. Results were resistant to changes in the SDI calculation method. Detailed analysis is provided in Appendix 3.

Stock exchange's development might be affected by the number of CSR practices, but also by their structure. We applied both multiple and quantile regressions to test the latter relationship (Table 8).

Table 8. OLS and quantile estimation of SDI multiple regression against GP _ exchange and GP _ companies

Estimator	Variable	Parameters	t-test
OLS	*GP _ exchange*	0,025	2,19**
	GP _ companies	0,005	0,41
$Q_{0,25}$	*GP _ exchange*	0,020	2,31**
	GP _ companies	0,004	0,44
$Q_{0,50}$	*GP _ exchange*	0,034	2,59***
	GP _ companies	0,006	0,43
$Q_{0,75}$	*GP _ exchange*	0,034	2,21**
	GP _ companies	0,010	0,68

** indicates statistical significance at the 5% level and *** indicates statistical significance at the 1% level.

The results of both multiple and quantile regressions indicated that out of the two categories of analyzed CSR practices, only one significantly affected stock exchanges' development – internal CSR practices – while external CSR practices proved to be statistically insignificant. At the same time, quantile regression revealed statistically significant differences in the strength of internal CSR practices' influence on stock exchanges at low and average levels of CSR development. For the former group, that influence was almost two times weaker than for the latter. Similar differences were not observed for stock exchanges on average and high levels of development. Our models' results – along with previous results of testing the effects of the number of CSR practices on the development level – were robust to changes in the SDI calculation method. Detailed analysis is provided in Appendix 4.

Our research confirmed the previously reported existence of a relationship between organizational form and social engagement (Acar et al., 2001) and between social engagement and economic performance (Luo & Bhattacharya, 2006; Lev et al., 2010; Ramanathan, 2018). While testing the influence of organizational form, we established that the European stock exchanges operated by publicly traded companies exhibited greater activity in CSR than the stock exchanges operating as POOs. Previous studies

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did not indicate that the structure of a publicly traded company would facilitate the inclusion of non-economic goals better than other organizational forms (Acar et al., 2001). We believe there might be three reasons for such discrepancies. Our study covered a more narrowly defined group of organizations, limited to market-oriented institutions only. Previous studies also included non-commercial organizations such as public institutions, which by their nature are more willing to engage in the implementation of social goals. Another factor could be the difference in research methodology. Our study was based on the identification of CSR activities actually implemented by organizations. Previous studies utilized pre-prepared questionnaires to identify the institutions' attitude but not the actually implemented activities. Meanwhile, market-oriented organizations may treat CSR activities as a tool for fulfilling economic goals (positive image creation, risk management) and not as a form of social engagement. Finally, the passage of time can be another factor explaining the differences. Our study is almost two decades younger than the most recent previous research, while for various reasons, PTC companies over that period of time became increasingly involved in business' social responsibility activities, which led to the increased popularity of sustainability activities among such organizations.

Our study results also indicated that organizational form affects implemented CSR initiatives. The stock exchanges operated by PTCs showed a greater commitment to implementing both internal CSR practices and external CSR practices. However, these stock exchanges exhibit greater activity regarding internal CSR practices. This pattern agrees with previous studies' results, indicating that CSR activities closely related to organizations' core activities better serve the goal of reputation building (Brammer & Pavelin, 2004; Siltaoja, 2006). Moreover, this means that the stock exchanges operated by PTCs attach more weight to internal CSR practices agrees with the study results indicating withdrawal of such organizations from performing regulatory functions regarding listed companies and passing such authorities to other external authorities (Steil, 2002; Carson, 2003).

Furthermore, our study confirmed the relationship between stock exchanges' social engagement and their economic performance. The greater the number of CSR practices implemented, the higher the values of the stock exchange development indicator, which indicates the positive influence of CSR activities on economic performance; a matter reported in previous studies (Luo & Bhattacharya, 2006; Lev et al., 2010; Ramanathan, 2018). However, we proved that only some types of CSR activities positively affect economic performance. We confirmed that such a positive influence occurs only in the case of internal CSR practices but not in external CSR practices. Thus, from the viewpoint of economic performance, the structure of social engagement

is equally important as the sheer number of undertaken initiatives: CSR activities that are closely and directly related to an organization and its core activities imprint the strongest on performance. Finally, our study suggested that the strength of CSR activities' effects depends on the current level of stock exchange development. The more developed stock exchanges benefited more from such activities than the less developed ones, which would indicate the existence of the Matthew effect regarding social engagement (Merton, 1968).

Conclusions

There have recently occurred many changes in the economic surroundings of modern stock exchanges, which resulted in increased competition in the stock exchange industry. This new reality has forced stock exchanges to change their strategies and business models, which in turn led to changes in stock exchanges' governance structures aimed at improving the management of these entities. As a result, there have begun to emerge new demutualized privately held stock exchanges and stock exchanges operating as PTCs, alongside traditional exchanges organized as mutual not-for-profit institutions, which resemble traditional "broker clubs," in which control over stock exchanges is held by a tight group of members, often representing conflicting interests. Our study found differences between stock exchanges operating as PTCs and POOs with respect to the level and nature of their social engagement. We proved that one of the consequences of corporatization is the increased activity of stock exchanges in CSR. Involvement in sustainability practices becomes an element of a legitimacy-seeking strategy and public image maintenance. This is confirmed not only by the larger number of implemented CSR practices by stock exchanges but also by the specific nature of these practices. The stock exchanges operated as PTCs concentrate more on internal CSR practices than on practices directed toward listed companies. This observation is consistent with theories that explain the reduction of regulatory functions of corporatized stock exchanges due to their conflicts with profit orientation. Our study indicated that such a profile of CSR activities – represented by PTC-operated stock exchanges – is more efficient. This conclusion should be of particular interest to managers of less developed stock exchanges, as in their case, the effect of an organization's social engagement is weaker. Therefore, the managers should be particularly interested to note that the resources available to conduct CSR policies are concentrated on activities that may generate the best outcome.

Our research has some limitations. Its scope is limited to the CSR activities of European stock exchanges. We admit that despite noticeable convergence, European stock

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exchanges may differ from stock exchanges in other regions in CSR policies. Thus, a comparison of CSR policies implemented by European, American, and Asian stock exchanges may constitute an interesting avenue for future research. Another possible field for future studies is the inclusion of a time factor to analyze possible changes in stock exchanges' approach to social engagement.

References

Abukari, K., & Otchere, I. (2020). Has stock exchange demutualization improved market quality? International evidence. *Review of Quantitative Finance and Accounting, 55*(3), 901–934. https://doi.org/10.1007/s11156-019-00863-y.

Acar, W., Aupperle, K.E., & Lowy, R.M. (2001). An empirical exploration of measures of social responsibility across the spectrum of organizational types. *The International Journal of Organizational Analysis, 9*(1), 26–57. https://doi.org/10.1108/eb028927.

Adamska, A., & Dąbrowski, T.J. (2021). Investor Reactions to Sustainability Index Reconstitutions: Analysis in Different Institutional Contexts. *Journal of Cleaner Production, 297*, 126715. https://doi.org/10.1016/j.jclepro.2021.126715.

Aggarwal, R., & Dahiya, S. (2006). Demutualization and Public Offerings of Financial Exchanges. *Journal of Applied Corporate Finance, 18*(3), 96–106. https://doi.org/10.1111/j.1745-6622.2006.00102.x.

Aggarwal, R. (2002). Demutualization and Corporate Governance of Stock Exchanges. *Journal of Applied Corporate Finance, 15*(1), 105–113. https://doi.org/10.1111/j.1745-6622.2002.tb00345.x.

Aguilera-Caracuel, J., & Guerrero-Villegas, J. (2018). How corporate social responsibility helps MNEs to improve their reputation. The moderating effects of geographical diversification and operating in developing regions. *Corporate Social Responsibility and Environmental Management, 25*(4), 355–372. https://doi.org/10.1002/csr.1465.

Akhtar, S. (2002). *Demutualization of Asian Stock Exchanges – Critical Issues and Challenges*. In S. Akhtar (Ed.), *Demutualization of Stock Exchanges: Problems, Solutions and Case Studies*. Asian Development Bank, Manila.

Aldrich, H.E., & Fiol, C.M. (1994). Fools Rush in The Institutional Context of Industry Creation. *Academy of Management Review, 19*(4), 645–670. https://doi.org/10.5465/amr.1994.9412190214.

Arora, P., & Dharwadkar, R. (2011). Corporate governance and corporate social responsibility (CSR): The moderating roles of attainment discrepancy and organization slack. *Corporate Governance: An International Review, 19*(2), 136–152. https://doi.org/10.1111/j.1467-8683.2010.00843.x.

Asmussen, C.G., & Fosfuri, A. (2019). Orchestrating Corporate Social Responsibility in the Multinational Enterprise. *Strategic Management Journal, 40*(6), 894–916. https://doi.org/10.1002/smj.3007.

Baumeister, R.F., Bratslavsky, E., Finkenauer, C., & Vohs, K.D. (2001). Bad Is Stronger Than Good. *Review of General Psychology, 5*(4), 323–370. https://doi.org/10.1037/1089-2680.5.4.323.

Block, S. (2004). The latest movement to going private: An empirical study. *Journal of Applied Finance, 14*(1), 36–44.

Bradley, C. (2001). Demutualization of financial exchanges: Business as usual. *Northwestern Journal of International Law and Business, 21*, 657–702.

Brammer, S., & Pavelin, S. (2004). Building a good reputation. *European Management Journal*, *22*(6), 704–713. https://doi.org/10.1016/j.emj.2004.09.033.

Brammer, S., Brooks, C., & Pavelin, S. (2006). Corporate Social Performance and Stock Returns: UK Evidence from Disaggregate Measures. *Financial Management*, *35*(3), 97–116. https://doi.org/10.1111/j.1755-053X.2006.tb00149.x.

Brown, W.O., Helland, E., & Smith, J. (2006). Corporate philanthropic practices. *Journal of Corporate Finance, 12*(5), 855–877. https://doi.org/10.1016/j.jcorpfin.2006.02.001.

Burke, K.S. (2002). Regulating Corporate Governance Through the Market: Comparing the Approaches of the Unit ed States, Canada and the United Kingdom. *Journal of Corporation Law*, *27*, 341–380.

Carson, J.W. (2003). Conflicts of Interest in Self-Regulation: Can Demutualized Exchanges Successfully Manage Them. *World Bank Policy Research Working Paper 3183*. https://doi.org/10.1596/1813-9450-3183.

Chin, M.K., Hambrick, D.C., & Treviño, L.K. (2013). Political Ideologies of CEOs: The Influence of Executives' Values on Corporate Social Responsibility. *Administrative Science Quarterly, 58*(2), 197–232. https://doi.org/10.1177/0001839213486984.

Choi, J., & Wang, H. (2009). Stakeholder relations and the persistence of corporate financial performance. *Strategic Management Journal*, *30*(8), 895–907. https://doi.org/10.1002/smj.759.

Christiansen, H., & Koldertsova, A. (2009). The Role of Stock Exchanges in Corporate Governance. *OECD Journal: Financial Market Trends*, *1*, 191–220. https://doi.org/10.1787/fmt-v2009-art10-en.

Connelly, B.L., Certo, S., Ireland, R.D., & Reutzel, C.R. (2011). Signaling theory: A review and assessment. *Journal of Management*, *37*(1), 39–67. https://doi.org/10.1177/0149206310388419.

Consolandi, C., Jaiswal-Dale, A., Poggiani, E., & Vercelli, A. (2009). Global Standards and Ethical Stock Indexes: The Case of the Dow Jones Sustainability Stoxx Index. *Journal of Business Ethics*, *87*(1), 185–197. https://doi.org/10.1007/s10551-008-9793-1.

Deephouse, D.L., & Carter, S.M. (2005). An examination of differences between organizational legitimacy and organizational reputation. *Journal of Management Studies, 42*(2), 329–360. https://doi.org/10.1111/j.1467-6486.2005.00499.x.

Doh, J.P., Howton, S.D., Howton, S.W., & Siegel, D. (2010), Does the Market Respond to an Endorsement of Social Responsibility? The Role of Institutions, Information, and Legitimacy. *Journal of Management*, *36*(6), 1461–1485. https://doi.org/10.1177/0149206309337896.

Fernández-Gámez, M.Á., Gutiérrez-Ruiz, A.M., Becerra-Vicario, R., & Ruiz-Palomo, D. (2020). The impact of creating shared value on hotels online reputation. *Corporate Social Responsibility and Environmental Management*, *27*(5), 2201–2211. https://doi.org/10.1002/csr.1958.

Flammer, C., Hong, B., & Minor, D. (2019). Corporate governance and the rise of integrating corporate social responsibility criteria in executive compensation: Effectiveness and implications for firm outcomes. *Strategic Management Journal, 40*(4), 1097–1122. https://doi.org/10.1002/smj.3018.

Fleckner, A.M. (2006). Stock Exchanges at the Crossroads. *Fordham Law Review*, *74*(5), 2541–2620.

Fombrun, C.J., & Shanley, M. (1990). What's in a name? Reputation building and corporate strategy. *Academy of Management Journal*, *33*(2), 233–258. https://doi.org/10.5465/256324.

Fombrun, C., Gardberg, N., & Barnett, M. (2000). Opportunity platforms and safety nets: Corporate citizenship and reputational risk. *Business and Society Review*, *105*(1), 85–106. https://doi.org/10.1111/0045-3609.00066.

Freeman, J., Carroll, G.R., & Hannan, M.T. (1983). The Liability of Newness: Age Dependence in Organizational Death Rates. *American Sociological Review*, *48*(5), 692–710. https://doi.org/10.2307/2094928.

 DOI: 10.7206/cemj.2658-0845.80

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, *5*(4), 210–233. https://doi.org/10.1080/20430795.2015.1118917.

Garcia-Castro, R., Arino, M.A., & Canela, M.A. (2010), Does social performance really lead to financial performance? Accounting for endogeneity. *Journal of Business Ethics*, *92*(1), 107–126. https://doi.org/10.1007/s10551-009-0143-8.

Geranio, M., & Lazzari, V. (2014), Exchange competition in listing services: evidence for Italian companies, *Economic Notes*, *43*(3), 283–307. https://doi.org/10.1111/ecno.12024.

Glavas, A., & Kelley, K. (2014). The effects of perceived corporate social responsibility on employee attitudes. *Business Ethics Quarterly*, *24*(2), 165–202. https://doi.org/10.5840/beq20143206.

Global Sustainable Investment Alliance (2018). *The Global Sustainable Investment Review 2018*. http://www.gsi-alliance.org/wp-content/uploads/2019/03/GSIR_Review2018.3.28.pdf.

Godfrey, P.C. (2005). The Relationship between Corporate Philanthropy and Shareholder Wealth: A Risk Management Perspective. *The Academy of Management Review*, *30*(4), 777–798. https://doi.org/10.5465/amr.2005.18378878.

Gong, G., Xu, S., & Gong, X. (2018). On the Value of Corporate Social Responsibility Disclosure: An Empirical Investigation of Corporate Bond Issues in China. *Journal of Business Ethics*, *150*(1), 227–258. https://doi.org/10.1007/s10551-016-3193-8.

Greening, D.W., & Turban, D.B. (2000). Corporate Social Performance as a Competitive Advantage in Attracting a Quality Workforce. *Business & Society*, *39*(3), 254–280. https://doi.org/10.1177/000765030003900302.

Hellwig, Z. (1972). Procedure of Evaluating High-Level Manpower Data and Typology of Countries by Means of the Taxonomic Method. In Z. Gostkowski (Ed.), *Towards a system of Human Resources Indicators for Less Developed Countries* (pp. 115–134). Papers Prepared for UNESCO Research Project. Ossolineum – The Polish Academy of Sciences.

Highhouse, S., Brooks, M.E., & Gregarus, G. (2009). An Organizational Impression Management Perspective on the Formation of Corporate Reputations. *Journal of Management*, *35*(6), 1481–1493. https://doi.org/10.1177/0149206309348788.

Hwang, C.-L., & Yoon, K. (1981). *Multiple Attribute Decision Making: Methods and Applications*. Springer-Verlag.

Ioannou, I., & Serafeim, G. (2015). The impact of corporate social responsibility on investment recommendations: Analysts' perceptions and shifting institutional logics. *Strategic Management Journal*, *36*(7), 1053–1081. https://doi.org/10.1002/smj.2268.

Jain, T., & Jamali, D. (2016). Looking inside the black box: The effect of corporate governance on corporate social responsibility. *Corporate Governance: An International Review*, *24*(3), 253–273. https://doi.org/10.1111/corg.12154.

Javed, M., Rashid, M.A., Hussain, G., & Ali, H.Y. (2020). The effects of corporate social responsibility on corporate reputation and firm financial performance: Moderating role of responsible leadership. *Corporate Social Responsibility and Environmental Management*, *27*(3), 1395–1409. https://doi.org/10.1002/csr.1892.

Jo, H., & Harjoto, M.A. (2011). Corporate Governance and Firm Value: The Impact of Corporate Social Responsibility. *Journal of Business Ethics*, *103*(3), 351–383. https://doi.org/10.1007/s10551-011-0869-y.

Kappou, K., & Oikonomou, I. (2016). Is There a Gold Social Seal? The Financial Effects of Additions to and Deletions from Social Stock Indices, *Journal of Business Ethics, 133*(3), 533–552. https://doi.org/10.1007/s10551-014-2409-z.

Karagiorgos, T. (2010). Corporate social responsibility and financial performance: An empirical analysis on Greek companies. *European Research Studies Journal*, *13*(4), 85–108. https://doi.org/10.35808/ersj/301.

Karmel, R.S. (2002). Turning Seats into Shares: Causes and Implications of Demutualization of Stock and Futures Exchanges. *Hastings Law Journal*, *53*(2), 367–430. https://doi.org/10.2139/ssrn.256867.

Koenker, R., & Bassett, G. (1978). Regression Quantiles. *Econometrica*, *46*(1), 33–50. https://doi.org/10.2307/1913643.

Koenker, R. (2000). Galton, Edgeworth, Frisch, and prospects for quantile regression in econometrics. *Journal of Econometrics*, *95*(2), 347–374. https://doi.org/10.1016/S0304-4076(99)00043-3.

Krishnamurti, C., Sequeira, J.M., & Fu, F. (2003). Stock Exchange Governance and Market Quality. *Journal of Banking and Finance*, *27*(9), 1859–1878. https://doi.org/10.1016/S0378-4266(03)00105-5.

Lackmann, J., Ernstberger, J., & Stich, M. (2012). Market Reactions to Increased Reliability of Sustainability Information. *Journal of Business Ethics*, *107*(2), 111–128. https://doi.org/10.1007/s10551-011-1026-3.

Lauterbach, B., & Pajuste, A. (2017). The media and firm reputation roles in corporate governance improvements: Lessons from European dual class share unifications. *Corporate Governance: An International Review*, *25*(1), 4–19. https://doi.org/10.1111/corg.12153.

Lev, B., Petrovits, C., & Radhakrishnan, S. (2010). Is doing good good for you? How corporate charitable contributions enhance revenue growth. *Strategic Management Journal*, *31*(2), 182–200. https://doi.org/10.1002/smj.810.

Lin, C.-P., Tsai, Y.-H, Joe, S.-W., & Chiu, C.-K. (2012). Modeling the Relationship Among Perceived Corporate Citizenship, Firms' Attractiveness, and Career Success Expectation. *Journal of Business Ethics*, *105*(1), 83–93. https://doi.org/10.1007/s10551-011-0949-z.

Lopatta, K., Jaeschke, R., Canitz, F., & Kaspereit, T. (2017). International evidence on the relationship between insider and bank ownership and CSR performance. *Corporate Governance: An International Review*, *25*(1), 41–57. https://doi.org/10.1111/corg.12174.

Luo, X., & Bhattacharya, C.B. (2006). Corporate Social Responsibility, Customer Satisfaction, and Market Value. *Journal of Marketing*, *70*(4), 1–18. https://doi.org/10.1509/jmkg.70.4.001.

Mahon, J.F. (2002). Corporate Reputation: A Research Agenda Using Strategy and Stakeholder Literature, *Business and Society*, *41*(4), 415–445. https://doi.org/10.1177/0007650302238776.

Margolis, J., & Walsh, J. (2003). Misery loves companies: Rethinking social initiatives by business. *Administrative Science Quarterly*, *48*(2), 268–305. https://doi.org/10.2307/3556659.

Martinez, I., & Serve, S. (2017). Reasons for delisting and consequences: A literature review and research agenda. *Journal of Economic Surveys*, *31*(3), 733–770. https://doi.org/10.1111/joes.12170.

McCabe, D.L., Trevino, L.K., & Butterfield, K.D. (1996). The Influence of Collegiate and Corporate Codes of Conduct on Ethics-Related Behavior in the Workplace. *Business Ethics Quarterly*, *6*(4), 461–476. https://doi.org/10.2307/3857499.

Merton, R.K. (1968). The Matthew Effect in Science. *Science, 159*(3810), 56–63. https://doi.org/10.1126/science.159.3810.56.

Meyer, J.W., & Rowan, B. (1977). Institutional organizations: formal structure as myth and ceremony. *American Journal of Sociology*, *83*(2), 340–363. https://doi.org/10.1086/226550.

Moore, D.S., McCabe, G.P., & Craig, B.A. (2009). *Introduction to the Practice Statistics.* W.H. Freeman and Company.

Movsesyan, V. (2007). Demutualisation Of, and Self-Regulation By, Stock Exchanges. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1882432.

 DOI: 10.7206/cemj.2658-0845.80

Muller, A., & Kraussl, R. (2011), Doing good deeds in times of need: A strategic perspective on corporate disaster donations. *Strategic Management Journal*, *32*(9), 911–929. https://doi.org/10.1002/smj.917.

Oldford, E., & Otchere, I. (2011). Can commercialization improve the performance of stock exchanges even without corporatization? *Financial Review*, *46*(1), 67–87. https://doi.org/10.1111/j.1540-6288.2010.00290.x.

Orlitzky, M., Schmidt, F., & Rynes, S. (2003). Corporate social and financial performance: A meta-analysis. *Organization Studies*, *24*(3), 403–441. https://doi.org/10.1177/0170840603024003910.

Otchere, I. (2006). Stock exchange self-listing and value effects. *Journal of Corporate Finance*, *12*(5), 926–953. https://doi.org/10.1016/j.jcorpfin.2006.02.003.

Peterson, D.K. (2004). The Relationship between Perceptions of Corporate Citizenship and Organizational Commitment. *Business and Society*, *43*(3), 296–319. https://doi.org/10.1177/0007650304268065.

Petrenko, O.V., Aime, F., Ridge, J., & Hill, A. (2016). Corporate social responsibility or CEO narcissism? CSR motivations and organizational performance. *Strategic Management Journal*, *37*(2), 262–279. https://doi.org/10.1002/smj.2348.

Pfeffer, J., & Salancik, G. (1978). *The External Control of Organizations: A Resource Dependence Perspective*. Harper & Row.

Poser, N.S. (2001). The Stock Exchanges of the United States and Europe: Automation, Globalization, and Consolidation. *University of Pennsylvania Journal of International Economic Law*, *22*(3), 497–540.

Ramanathan, R. (2018). Understanding Complexity: The Curvilinear Relationship Between Environmental Performance and Firm Performance. *Journal of Business Ethics, 149*(2), 383–393. https://doi.org/10.1007/s10551-016-3088-8.

Ramchander, S., Schwebach, R.G., & Staking, K. (2012). The informational relevance of corporate social responsibility: evidence from DS400 index reconstitutions. *Strategic Management Journal*, *33*(3), 303–314. https://doi.org/10.1002/smj.952.

Rees, W., & Rodionova, T. (2015). The influence of family ownership on corporate social responsibility: An international analysis of publicly listed companies. *Corporate Governance: An International Review*, *23*(3), 184–202. https://doi.org/10.1111/corg.12086.

Schaltegger, S., & Hörisch, J. (2017). In search of the dominant rationale in sustainability management: Legitimacy or profit-seeking?, *Journal of Business Ethics*, *145*(2), 259–276. https://doi.org/10.1007/s10551-015-2854-3.

Sen, S., & Bhattacharya, C.B. (2001). Does Doing Good Always Lead to Doing Better? Consumer Reactions to Corporate Social Responsibility. *Journal of Marketing Research, 38*(2), 225–243. https://doi.org/10.1509/jmkr.38.2.225.18838.

Serifsoy, B. (2008). Demutualization, outsider ownership, and stock exchange performance: Empirical evidence. *Economics of Governance*, *9*(4), 305–339. https://doi.org/10.1007/s10101-007-0037-0.

Sharpe, N.R., De Veaux, R., & Velleman, P. (2015). *Business Statistics*. Pearson.

Sial, A.W., Talib, N., Ashkanani, F.A., & Alam, M.A. (2015). Demutualization of stock exchanges: A corporate blessing in disguise for stock market growth. *Strategic Change*, *24*, 389–400. https://doi.org/10.1002/jsc.2017.

Siltaoja, M.E. (2006). Value Priorities as Combining Core Factors between CSR and Reputation – A Qualitative Study. *Journal of Business Ethics, 68*(1), 91–111. https://doi.org/10.1007/s10551-006-9042-4.

Slimane, F.B., & Angulo, L.P. (2019). Strategic change and corporate governance: Evidence from the stock exchange industry. *Journal of Business Research*, *103*, 206–218. https://doi.org/10.1016/j.jbusres.2018.10.045.

Slimane, F.B. (2012). The Structural Evolution of Stock Exchanges. *Recherches en Sciences de Gestion*, *6*(93), 47–71. https://doi.org/10.3917/resg.093.0045.

Soppe, A.B.M., Schauten, M.B.J., Soppe, J., & Kaymak, U. (2011). Corporate Social Responsibility Reputation (CSRR): Do Companies Comply to their Raised CSR Expectations? *Corporate Reputation Review*, *14*(4), 300–323. https://doi.org/10.1057/crr.2011.21.

Steil, B. (2002). Changes in the Ownership and Governance of Securities Exchanges: Causes and Consequences. *Brookings-Wharton Papers on Financial Services*, *02–15*, 61–82. https://doi.org/10.1353/pfs.2002.0021.

Stock, J.H., & Watson, M.W. (2010). *Introductory Econometrics*. Prentice Hall.

Suchman, M.C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review*, *20*(3), 571–610. https://doi.org/10.2307/258788.

Surroca, J., Tribó, J., & Waddock, S. (2010). Corporate Responsibility and Financial Performance: the role of Intangible Resources, *Strategic Management Journal*, *31*(5), 463–490. https://doi.org/10.1002/smj.820.

Thomsen, S., & Vinten, F. (2014), Delistings and the costs of governance: A study of European stock exchanges 1996–2004. *Journal of Management & Governance*, *18*(3), 793–833. https://doi.org/10.1007/s10997-013-9256-7.

van Beurden, P., & Gössling, T. (2008). The Worth of Values – A Literature Review on the Relation Between Corporate Social and Financial Performance. *Journal of Business Ethics*, *82*(2), 407–424. https://doi.org/10.1007/s10551-008-9894-x.

Waddock, S. (2000). The Multiple Bottom Lines of Corporate Citizenship: Social Investing, Reputation and Responsibility Audits. *Business and Society Review*, *105*(3), 323–345. https://doi.org/10.1111/0045-3609.00085.

Wang, H.M.D. (2010). Corporate social performance and financial-based brand equity. *Journal of Product & Brand Management*, *19*(5), 335–345. https://doi.org/10.1108/10610421011068577.

Wang, H., Choi, J., & Li, J. (2008). Too little or too much? Untangling the relationship between corporate philanthropy and firm financial performance. *Organization Science*, *19*(1), 143–159. https://doi.org/10.1287/orsc.1070.0271.

Wang, M., & Chen, Y. (2017). Does voluntary corporate social performance attract institutional investment? Evidence from China. *Corporate Governance: An International Review*, *25*(5), 338–357. https://doi.org/10.1111/corg.12205.

Wang, Q., Dou, J., & Jia, S. (2016). A Meta-Analytic Review of Corporate Social Responsibility and Corporate Financial Performance: The Moderating Effect of Contextual Factors. *Business and Society*, *55*(8), 1083–1121. https://doi.org/10.1177/0007650315584317.

Wooldridge, J.M. (2013). *Introductory Econometrics. A Modern Approach*, South-Western Cengage Learning.

Zerbini, F. (2017). CSR Initiatives as Market Signals: A Review and Research Agenda. *Journal of Business Ethics*, *146*(1), 1–23. https://doi.org/10.1007/s10551-015-2922-8.

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Appendix 1

Name of the exchange	Country (exchange domicile)	Exchange website address
Athens Stock Exchange	Greece	www.athexgroup.gr
Belarusian Currency and Stock Exchange	Belarus	www.bcse.by
Belgrade Stock Exchange	Serbia	www.belex.rs
Bolsa y Mercados Espanoles	Spain	www.bolsasymercados.es
Borsa Istanbul	Turkey	www.borsaistanbul.com
Borsa Italiana	Italy	www.borsaitaliana.it
Bratislava Stock Exchange	Slovakia	www.bsse.sk
Bucharest Stock Exchange	Romania	www.bvb.ro
Budapest Stock Exchange	Hungary	www.bse.hu
Bulgarian Stock Exchange	Bulgaria	www.bse-sofia.bg
CEESEG Prague Stock Exchange	Czech Republic	www.pse.cz
Cyprus Stock Exchange	Cyprus	www.cse.com.cy
Deutsche Börse AG	Germany	www.deutsche-boerse.com
Euronext	Belgium	www.euronext.com/en/markets/brussels
Euronext	France	www.euronext.com/en/markets/paris
Euronext	Netherlands	www.euronext.com/en/markets/amsterdam
Euronext	Portugal	www.euronext.com/en/markets/lisbon
Irish Stock Exchange	Ireland	www.ise.ie
Ljubljana Stock Exchange	Slovenia	www.ljse.si
London Stock Exchange	Great Britain	www.londonstockexchange.com
Luxembourg Stock Exchange	Luxsembourg	www.bourse.lu
Macedonian Stock Exchange	Northern Macedonia	www.mse.mk
Malta Stock Exchange	Malta	www.borzamalta.com.mt
Montenegro Stock Exchange	Montenegro	www.mnse.me
Moscow Exchange	Russia	www.moex.com

NASDAQ Nordic	Denmark	www.nasdaqomxnordic.com/news/marketnotices/copenhagen
NASDAQ Nordic	Finland	www.nasdaqomxnordic.com/news/marketnotices/helsinki
NASDAQ Nordic	Iceland	http://www.nasdaqomxnordic.com/news/marketnotices/iceland
NASDAQ Nordic	Sweden	http://www.nasdaqomxnordic.com/news/marketnotices/stockholm
Nasdaq Riga	Latvia	nasdaqbaltic.com/about-us/nasdaq-riga/
Nasdaq Tallinn	Estonia	nasdaqbaltic.com/about-us/nasdaq-tallinn/
Nasdaq Vilnius	Lithuania	asdaqbaltic.com/about-us/nasdaq-vilnius/
Oslo Stock Exchange	Norway	www.oslobors.no
Sarajevo Stock Exchange	Bosnia and Herzegovina	www.sase.ba
SIX Swiss Exchanges	Switzerland	www.six-group.com
Tel-Aviv Stock Exchange	Israel	www.tase.co.il
Ukrainian Exchange	Ukraine	www.ux.ua
Warsaw Stock Exchange	Poland	www.gpw.pl
Wiener Börse	Austria	www.wienerborse.at
Zagreb Stock Exchange	Croatia	www.zse.hr

Appendix 2

Exchange internal CSR practices	Exchange external CSR practices
Market segmentation (small and medium size companies market segments, etc.) Ethical products (i.e., green bonds) CSR reporting by exchanges ESG/CSR indices Exchange membership in international CSR organizations	Best practices codes CSR reporting as listing requirements Support for CSR reporting by listed companies Conferences/events promoting CSR Promotion of ESG/CSR measures Preparation and publication of reports CSR trainings

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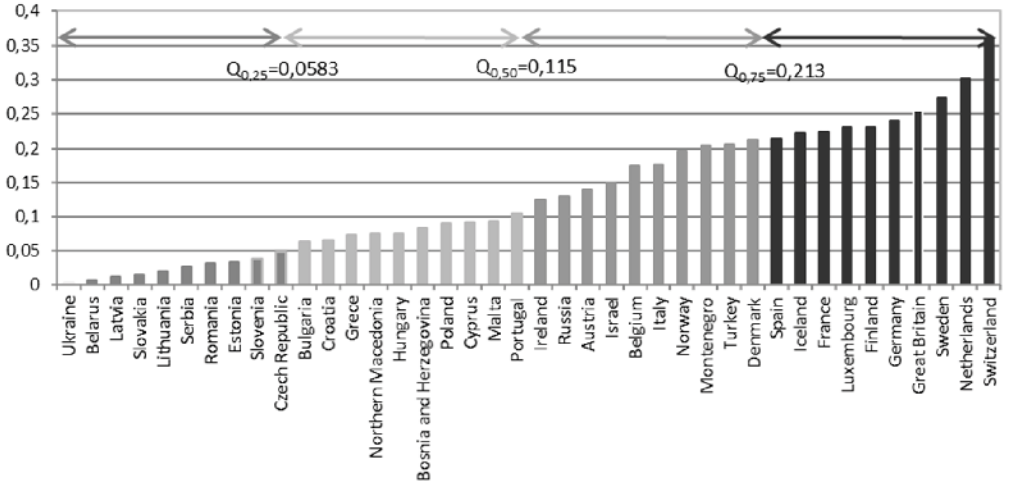
Appendix 3

Figure A3.1. Ranking of exchanges according to the level of development measured by alternative value of SDI[a]



[a] SDI determined by standardized sums method.

Table A3.1. Value of correlation coefficients between alternative SDI and GP _ all

	Pearson's linear correlation coefficient	t-test	Spearman's rank correlation coefficient	t-test
GP_all	0,51	3,67***	0,55	4,03***

*** indicates statistical significance at the 1% level.

Table A3.2. OLS and quantile estimation of simple regression of alternative SDI against GP _ all

Estimator	Parameter	t-test
OLS	0,018	11,04***
$Q_{0,25}$	0,010	4,77*
$Q_{0,50}$	0,019	14,54***
$Q_{0,75}$	0,023	14,71***

* indicates statistical significance at the 10% level; and *** indicates statistical significance at the 1% level.

Table A3.3. Results of OLS assumptions diagnostics test for alternative SDI against GP _ all

Test	Test statistic
t-Student test for expected value of dependent samples	t = 0,15
White's test	LM = 0,07
Shapiro-Wilk test	SW = 0,97

Appendix 4

Table A4.1. Values of correlation coefficients between alternative SDI and GP _ exchange and GP _ companies

	Pearson's linear correlation coefficient	t-test	Spearman's rank correlation coefficient	t-test
GP_exchange	0,57	4,24***	0,66	5,45***
GP_companies	0,37	2,44**	0,36	2,41**

** indicates statistical significance at the 5% level and *** indicates statistical significance at the 1% level.

Table A4.2. OLS and quantile estimation of alternative SDI multiple regression against GP _ exchange and GP _ companies

Estimator	Variable	Parameters	t-test
OLS	*GP _ exchange*	0,034	3,19***
	GP _ companies	-0,001	-0,10
$Q_{0,25}$	*GP _ exchange*	0,027	4,69***
	GP _ companies	-0,004	-0,76
$Q_{0,50}$	*GP _ exchange*	0,038	6,21***
	GP _ companies	0,008	1,35
$Q_{0,75}$	*GP _ exchange*	0,041	6,20***
	GP _ companies	0,008	1,17

*** indicates statistical significance at the 1% level.

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