How Institutions Moderate the Effect of Gender Diversity on Firm Performance

Felix Hoch/Lilo Seyberth

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Abstract

Research investigating the relationship between firm performance and gender diversity has so far reported conflicting evidence: Some studies find firm performance to benefit from gender diversity, others find negative results or no effect at all. Taking this inconclusive evidence as a sign for moderators influencing the effect of gender diversity on firm performance, we investigate the moderating influence of institutions on this relationship. Using data on 7,661 firms in 71 countries, we employ a multilevel linear regression with fixed effects to examine the moderating effect of formal as well as informal institutional characteristics. We find that institutions indeed moderate the relationship between gender diversity and firm performance. In particular, informal institutions seem to moderate the effect of diversity on market valuation (Tobin's Q), while formal institutions moderate the effect of gender diversity on firm financial performance (ROA). These results have important theoretical implications for the academic debate on gender diversity and firm performance as well as practical implications for both businesses and lawmakers.

JEL Codes: J16, J71, L25, M12, M14

Wie Institutionen den Effekt von Geschlechterdiversität auf den Unternehmenserfolg moderieren

Zusammenfassung

Die bisherige Forschung zum Zusammenhang zwischen Geschlechterdiversität und Unternehmenserfolg brachte widersprüchlichen Ergebnissen hervor: Einige Studien unterstützen die Sichtweise, dass Geschlechterdiversität den Erfolg steigert, andere finden einen negativen oder gar keinen Zusammenhang. Diese widersprüchlichen empirischen Ergebnisse deuten darauf hin, dass der Einfluss der Geschlechterdiversität auf den Unternehmenserfolg von äußeren Umständen abhängt, weshalb wir den moderierenden Einfluss von Institutionen untersuchen. Wir untersuchen diesen Moderationseffekt mittels einer hierarchischen linearen Regression mit fixen Effekten basierend auf einem Datensatz von 7.661 Unternehmen aus 71 Ländern. Dabei finden wir tatsächlich Moderation durch Institutionen, wobei informelle Institutionen den Einfluss auf den Marktwert (Tobin's Q) moderieren, während formelle Institutionen den Einfluss auf finanzielle Kennzahlen bezüglich der Profitabilität (ROA) moderieren. Unsere Ergebnisse haben sowohl wichtige theoretische Implikationen für die wissenschaftliche Debatte über Geschlechterdiversität und Unternehmensleistung als auch praktische Implikationen für Unternehmen und Gesetzgeber.

How Institutions Moderate the Effect of Gender Diversity on Firm Performance

1. Introduction

Increasingly relevant developments such as the economic and political empowerment of women (Doepke & Tertilt, 2009), growing female labour market participation (Fernandez, Fogli & Olivetti, 2004), and efforts to increase female board presence by both companies (Leslie, Manchester & Dahm, 2017) and law-makers (Leibbrandt, Wang & Foo, 2018) beg the question of whether and how gender diversity affects firm performance. Accordingly, scholars have been investigating and debating this highly relevant and controversial question for decades (Joshi, Neely, Emrich, Griffiths & George, 2015; Nkomo, Bell, Roberts, Joshi & Thatcher, 2019), resulting in a vast and rapidly growing body of research on the relationship between gender diversity and firm performance (Baker, Pandey, Kumar & Haldar, 2020). However, extensive research on the relationship between gender diversity and firm performance has not found conclusive evidence on the size, sign, and significance of the correlation (Jeong & Harrison, 2017; Post & Byron, 2015). Several studies find a significant positive correlation (Dezsö & Ross, 2012; Li & Chen, 2018), others a negative one (e.g. Adams & Ferreira, 2009; Ahern & Dittmar, 2012) and some an ambiguous one (Abdullah, Ismail & Nachum, 2016; Herdhayinta, Lau & Shen, 2021) or none at all (Alvarado, Briones & De Fuentes Ruiz, 2011; Miller & Del Carmen Triana, 2009). This inconclusive empirical evidence points to the existence of potential moderators in the form of contextual dependencies (Post & Byron, 2015; Zhang, 2020). At the same time, literature on gender diversity already acknowledges the important role of institutions as a determinant of female board presence (Grosvold & Brammer, 2011; Terjesen & Singh, 2008) while institutional influences constitute well-established moderators of the relationship between other board characteristics and firm performance (Peng, 2004).

Despite their great explanatory potential, empirical investigations into institutional moderators in the context of gender diversity are scarce. Naghavi et al. (2020) investigate the moderating influence of broad cultural values on the relationship between board gender diversity and firm performance, while Nguyen et al. (2021) provide evidence that this relationship is positively moderated by national governance quality. Similarly, Post and Byron (2015) find shareholder protection to be a positive moderating influence and theorise that social gender differences are another potential moderator. However, a possible moderating effect of specifi-

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cally gender-related institutions on the relationship between gender diversity and firm performance remains surprisingly understudied. In the only example we are aware of, Zhang (2020) finds moderating effects of gender-related institutions on the relationship between workforce gender diversity and firm performance and calls for further research on potential similar effects regarding board gender diversity.

We answer these and further calls in the literature (Grosvold & Brammer, 2011; Baker et al., 2020) by investigating the potential influence of formal as well as informal gender-related institutions on the relationship between board gender diversity and firm performance. In general, we propose that discriminating gender-related institutions negatively moderate the relationship, whereat formal and informal institutions target different effects of gender diversity. We expect that formal gender-related institutions affect the influence of gender diversity on profitability by restricting the managerial resources of female managers. Informal gender-related institutions we expect to affect the influence of gender diversity on market valuation by altering its value as a signal for compliance with social norms. To test these claims empirically, we draw on a panel dataset of 7,661 firms between the years 2008 and 2017 in 71 countries and combine it with country-level institutional variables. We employ the *Gender Inequality Index* (United Nations Development Programme, 2020a) as a measure for institutionalised gender-related discrimination in general, the *Workplace* dimension of the *Women Business and the Law* (World Bank, 2021) database as a measure for formal institutions, and the *Gender Social Norms Index* (United Nations Development Programme, 2020b) as a measure for informal institutions.

Our results indicate that gender-related institutions indeed moderate the influence of gender diversity on firm performance to such an extent that the relationship only remains positive in an institutional environment promoting gender equality. Furthermore, our findings suggest that the effect of gender diversity on profitability depends on formal gender-related institutions while the effect on market valuation depends on informal gender-related institutions.

Accordingly, our main contribution is straightforward. We answer the call in the literature (Grosvold & Brammer, 2011; Post & Byron, 2015; Zhang, 2020) and provide evidence that the relationship between board gender diversity and firm performance is moderated by gender-related institutions. In fact, this moderating influence is so substantial that the influence of gender diversity can be either positive or negative depending on the institutional context. This finding has serious implications for the academic debate about the effects of gender diversity. On the one hand, the presence of meaningful institutional moderators helps to reconcile the

hitherto mixed empirical evidence. On the other hand, the observed significant negative effects under discriminatory gender-related institutions question the idea of universal positive effects especially beyond the context of liberal Western societies. Furthermore, we hope to add further insights into the mechanisms of how gender diversity affects firm performance by pointing out that different institutions moderate different channels through which gender diversity and firm performance might be related. In particular, we propose that formal institutions moderate the effect on profitability by affecting the female directors' resources, while informal institutions moderate the effect on market valuation by altering the value of female directors as a signal for compliance with social norms.

The remainder of the paper is structured as follows. Section 2 explains the theoretical mechanisms behind how and why board gender diversity might influence firm performance. Section 3 views these mechanisms through an institutional perspective and develops hypotheses on the moderating effect of gender-related institutions. Section 4 describes our analytical strategy and Section 5 introduces our database. Section 6 presents the results before Section 7 offers additional robustness tests. Section 8 concludes by discussing implications, limitations, and potential avenues for future research.

2. Board Gender Diversity and Firm Performance

Several studies show that the composition of the board of directors can affect various dimensions of firm performance such as financial performance, risk-taking, market value, sustainability, and social responsibility (Bear, Rahman & Post, 2010; Certo, 2003; Hillman & Dalziel, 2003; Jeong & Harrison, 2017; Post & Byron, 2015; Triana, Miller & Trzebiatowski, 2014). These effects can occur in different ways and for several reasons. Among the most important are an increased pool of human capital (Brahma, Nwafor & Boateng, 2020), the unique skills and resources female managers bring in (Ali, Kulik & Metz, 2011; Hillman, Shropshire & Cannella, 2007), and signalling of qualities such as compliance to social norms or catering to gender diversity within customers and stakeholders (Miller & Del Carmen Triana, 2009; Zhang, 2020).

2.1. Board Composition and Resources

One prominent theory explaining the effect of the board of directors on firm performance is the resource dependency theory (Bear et al., 2010; Hillman & Dalziel, 2003; Hillman, Withers & Collins, 2009; Pfeffer, 1972). Resource dependence theory sees the board as the

mitigating instrument (Pfeffer, 1972) and principal link (Hillman et al., 2007) in the interdependent relationship between an organisation and its environment. By providing resources (e.g. knowledge and skills, networks, legitimacy, advice) facilitated through board capital (Hillman & Dalziel, 2003), the board of directors manages influence of and dependence on external organisations, which might impact organisational behaviour and thus firm performance (Bear et al., 2010; Hillman & Dalziel, 2003; Hillman et al., 2009). Empirical evidence supports this theory, emphasising the significance of board characteristics for firm performance (Ahmadi, Nakaa & Bouri, 2018; Hillman et al., 2007).

Factors affecting board capital are, amongst others, board size and board composition (Pfeffer, 1972). Larger boards might facilitate more relations to important external resources and consequently positively impact firm performance (Dalton, Daily, Johnson & Ellstrand, 1999). However, this will only work if links formed enable access to further resources and not the ones already linked with the firm. Hence, board composition is not to be neglected. On a very homogenous board, members are more likely to share similar skills, opinions, or networks, whereas diversifying the board may improve board performance (Adams, de Haan, Terjesen & van Ees, 2015; Westphal & Milton, 2000).

One observable measure of diverse board composition is board gender diversity. Female directors can bring unique resources into a company, such as different perspectives and different behavioural tendencies. Thus, they can improve management through e.g. a different attitude towards risk-taking (Jeong & Harrison, 2017). Several studies finding gender diversity improving firm financial performance (Ahmadi et al., 2018; Isidro & Sobral, 2015; Kılıç & Kuzey, 2016) support this theory.

Following the resource dependency approach also means, however, that a board member can only effectively influence firm performance positively if they can access external resources. Members of the board are constrained by their environment, which can restrict their influence over necessary resources (Hillman et al., 2009).

2.2. Board Composition as a Signal

Board members can influence firm performance not only through what they actually contribute to the firm, but also through what they are perceived to provide for the firm. Given asymmetric information due to externally unobservable firm characteristics, board composition can be used as a signal of a firm's quality, status and/or intent (Miller & Del Carmen Triana, 2009). This is explained through signalling theory (Connelly, Certo, Ireland & Reutzel, 2011;

Stiglitz, 2000). Trying to overcome the problem of information asymmetry, market participants use signals to convey important unobservable information (Connelly et al., 2011; Spence, 1973). Seminal work by Spence (1973) focuses on applicant signalling in the labour market to improve the selection ability of the potential employer. This is also applicable to other market environments, particularly when looking at the information asymmetry between (future) stakeholders and a company. Certo (2003) as well as Filatotchev and Bishop (2002) find potential investors' decision on whether or not to invest in a company to be influenced by board characteristics such as board prestige. Similarly, Deutsch and Ross (2003) find evidence that young companies might improve their survival chance by hiring reputable directors. Board member characteristics can signal firm quality independent of the members' actions (see Zhang & Wiersema, 2009). The stock market response depends on the perceived credibility of the firm's CEO (Zhang & Wiersema, 2009). Involuntary signalling can also happen. For example share prices fall when firms issue new shares, share prices rise when they buy back shares (Stiglitz, 2000, p. 1461), which can lead to firms refraining from issuing new shares so as to not convey an inadvertent and unfavourable signal (Stiglitz, 2000, p. 1445). To counteract this, board composition can be consciously used as a signal. In cases of information asymmetry, decision makers use signals, voluntarily or involuntarily sent out by the other party concerned, to facilitate their decision-making process (Spence, 1973).

Appointments of female CEOs receive significantly more attention than male CEO appointments (Gaughan & Smith, 2016). Research shows that board gender diversity is used as a signal (Miller & Del Carmen Triana, 2009; Solal & Snellman, 2019). A diverse board is perceived to signal commitment to social values as well as compliance with social norms and increases a firm's public status and reputation (Miller & Del Carmen Triana, 2009). However, investors can also respond unfavourably to this signal if they see this pursue of diversity as endangering the firm's commitment to shareholder value (Dobbin & Jung, 2011; Solal & Snellman, 2019). Important in all these instances is a clean signalling environment, without any prevailing negative signals, so as to not confuse the receiver of the signal (Taj, 2016).

2.3. Board Gender Diversity and Institutions

As indicated above, firm performance can be affected by board composition, for which gender diversity is an observable measure. Gender diversity on boards can be situated by various factors. While several organisational predictors like industry type and company size play an important role (Hillman et al., 2007), the company's environment is a further determining factor. Grosvold and Brammer (2011) find board gender diversity to be shaped by national

institutional systems, particularly by cultural and legal systems. Women's historical political representation, level of gender pay gap, and already existing gender diversity in senior management (Terjesen & Singh, 2008) as well as national culture (Lewellyn & Muller-Kahle, 2020) play a further role in the existence and number of female board members.

Several governments have also taken it upon themselves to raise female board representation by introducing (mandatory) quotas (Terjesen, Aguilera & Lorenz, 2015). While this measure indeed raises the share of female board members (Soare, Detilleux, & Deschacht, 2021), natural experiments have shown this might financially not be very beneficial for the companies concerned (Ahern & Dittmar, 2012; Soare et al., 2021).

3. An Institutional Perspective on Gender Diversity

According to the seminal work of North (1991), institutions are artificial constraints that constitute "the rules of the game" (North, 1991, p. 98) by structuring the interactions between members of a society. In this context, the institutional perspective on management states that firms, as well as individual managers, are embedded in an institutional environment that shapes their actions and affects the outcomes of these actions (Scott, 1995, 2008). More specifically, formal regulations or informal norms prevent some activities and legitimize others, but they also alter the costs and gains of economic activities by influencing transaction costs and resources (Williamson, 1981). Accordingly, institutions influence firm behaviour as well as firm performance directly (Banalieva, Cuervo-Cazurra & Sarathy, 2018) and simultaneously moderate the effect of other factors such as strategies, ownership, or governance on firm performance (Lohwasser, Hoch, & Kellermanns 2021; Wan & Hoskisson, 2003). We argue that an institutional perspective on the relationship between gender diversity and firm performance provides similar valuable insights since the potential advantages of gender diversity depend on characteristics of the institutional environment.

As elaborated in the previous section, there are multiple reasons how and why gender diversity might influence firm performance. We propose that all of these depend on the institutional environment, in particular on the existence and extent of institutionalised disadvantages for women facilitated by discriminatory institutions.

Firstly, the institutional environment affects the human capital of women by restricting or enabling their access to formal education (Ahmed & McGillivray, 2015). Thus, an institutional environment that creates equal educational opportunities for men and women increases the

advantage of gender diversity due to higher potential gains in human capital compared to discriminatory firms (Siegel, Pyun & Cheon, 2019). Secondly, the value and availability of specific resources of female managers also depend on the institutional environment. This becomes especially clear in the face of institutionalised restrictions that explicitly target women. When female managers do not possess the same rights as their male counterparts, their productivity could be severely damaged. Thirdly, the value of gender diversity as a signal depends on the value of the signalled qualities, which, in turn, depends on the institutional environment. The value of a signal not only depends on the signal itself but also on the interpretation by the receiver as well as the signalling environment so that a firm might even unintentionally send out negative signals (Taj, 2016). Applied to our setting, gender diversity can only function as a positive signal for compliance with social norms if the institutional environment actually embraces diversity as a norm (Zhang, 2020). Hence, we conclude that the value of gender diversity depends on the institutional environment, which leads us to our first hypothesis:

Hypothesis 1: *An institutional environment characterised by institutions promoting gender equality positively moderates the relationship between a firm's board gender diversity and its performance regarding profitability as well as market valuation.*

Building upon these general considerations about the institutional environment as a whole, we now consider distinct aspects of the institutional environment by distinguishing between formal and informal institutions (Holmes, Miller, Hitt & Salmador, 2013; North, 1991). Formal institutions are rules explicitly codified in laws and regulations that are authoritatively enforced by the government (Scott, 1995). Informal institutions are shared values and standards of a society, constituting noncodified rules embedded in culture (Peng, Wang & Jiang, 2008). Unquestionably, formal and informal institutions are interdependent as they can reinforce, substitute or alter each other. For instance, laws are oftentimes rooted in cultural values and sometimes only codify an already established practice (North, 1990; Platteau, 1994). The other way around, laws and regulations can foster the development of informal institutions by establishing rules that subsequently become social norms or by enforcing already existing norms (Knight, 1998; North, 1991; Ostrom, 2015). Nevertheless, formal and informal institutions clearly constitute distinct dimensions of the institutional environment and crucial differences in mechanisms and effects require a dedicated analysis of both of them (e.g. Casson, Della Giusta & Kambhampati, 2010). Accordingly, we propose that formal and informal institutions affect the relationship between gender diversity and firm performance differently.

Namely, we expect formal institutions to primarily affect profitability through a direct restriction of female managers' resources, while we expect informal institutions to primarily affect market valuation by altering the value of gender diversity as a signal.

3.1. Formal Institutions and Gender Diversity

Formal institutions have a direct impact on the behaviour of firms and managers as they directly prohibit specific activities or alter their outcomes (Scott, 1995, 2008). Accordingly, extensive research on the interplay between resources and formal institutions provides evidence that formal institutions affect the value of managerial resources (Peng, Sun, Pinkham & Chen, 2009). Hence, we expect formal gender-related institutions to alter the value of resources of female managers. The intuitive logic behind this reasoning is simple. If laws and regulations specifically target women so that female managers are more restricted than their male counterparts, female managers experience difficulties in utilising their resources, which decreases their productivity. It is worth noting that this effect is twofold. First, formal institutions might prevent female managers from bringing in their unique resources that constitute an advantage of gender diversity. In doing so, discriminatory regulations might discourage female managers to contribute their unique views and experiences while also reducing the effect of female leadership on the workforce (Zhang, 2020). The other way around, through higher authorities formally institutionalised leadership can help overcome the negative effects of gender stereotypes (Lucas, 2003). Second, discriminatory institutions might even prevent female managers from utilising general resources that every manager could possess regardless of their gender. For instance, it would be no surprise if laws restricting the right of women to employ the same jobs as men hamper the productivity of female managers, while formal laws against sexual harassment and discrimination based on gender might enhance it.

Hypothesis 2: *Formal institutions promoting gender equality positively moderate the relationship between a firm's board gender diversity and its profitability.*

A possible moderating effect of formal institutions on the relationship between gender diversity and market valuation is less clear, although a similar line of argumentation might be applicable. For instance, previous research provides evidence that formal institutions promoting gender equality such as gender quotas can cause backlashes (Leibbrandt et al., 2018). In fact, evidence from natural experiments indicates a negative effect of increased gender diversity on firm performance as a result of quotas (Ahern & Dittmar, 2012; Soare et al., 2021). This example highlights the more general observation that formal institutions might not be effective

in providing legitimacy but, to the contrary, can delegitimise the enforced outcomes and even cause adverse social reactions (Bond & Pyle, 1998; Cole & Salimath, 2013). Likewise, formal institutions promoting gender equality might impede or at least not enhance an otherwise positive effect of gender diversity on market valuation.

3.2. Informal Institutions and Gender Diversity

Informal institutions work less directly and explicitly than formal institutions (Casson et al., 2010). Instead of strictly prohibiting or allowing certain activities, informal institutions rather legitimise or delegitimise them (Webb, Tihanyi, Ireland & Sirmon, 2009). Thus, we argue that gender-related informal institutions primarily target the signalling connected to gender diversity by altering the value of the signal. As mentioned above, gender diversity can work as a signal for compliance with social norms (Miller & Del Carmen Triana, 2009), but the value of such a signal depends on the social norms embodied by informal institutions (Zhang, 2020). In short, gender diversity cannot serve as a signal for compliance with social norms if the social norms of a society do not promote gender equality. Furthermore, if social norms delegitimise or even condemn female leadership (Baker & Palmieri, 2021; Rudman, Moss-Racusin, Phelan & Nauts, 2012), gender diversity might even send a negative signal that the firm does not comply with these social norms. The argument also holds for gender diversity as a signal for managerial quality (Quintana-García & Benavides-Velasco, 2016). If the social values in a society connect desirable leader characteristics with traditionally male attributes, thus seeing women as worse leaders (Eagly & Karau, 2002), gender diversity might actually send a negative signal regarding managerial quality (Solal & Snellman, 2019).

Hypothesis 3: *Informal institutions promoting gender equality positively moderate the relationship between a firm's board gender diversity and its market valuation.*

A possible moderating effect of informal institutions promoting gender equality on the relationship between gender diversity and profitability is less convincing due to simultaneous effects on the selection process of female managers. While it is uncontroversial that informal institutions promoting gender equality help women to reach positions in management (Grosvold & Brammer, 2011; Lewellyn & Muller-Kahle, 2020), we are interested in the effect of women that already occupy such positions. This causes a classic problem for investigations of the effects of gender diversity because women that reach such positions might systematically differ from other women (Adams 2012; Yang 2019). Applied to our context, discriminatory institutions promote a selection process where only the most productive women can

overcome the institutionalised disadvantages and become managers in the first place. Informal institutions promoting gender equality weaken this selection process and thus might decrease the positive effect of gender diversity on firm profitability. This potential countervailing effect does not apply to the effect of gender diversity on market valuation since the other market participants cannot assess the actual productivity of a manager but might only utilize the observable gender as a signal. Hence, we only hypothesise a moderating influence of informal institutions on the effect of gender diversity on market valuation while our theoretical expectations regarding its effect on profitability remain inconclusive.

4. Analytic Strategy

To test our hypotheses of moderating institutional effects on the relationship between gender diversity and firm performance, we employ a multilevel linear regression with fixed effects including interaction terms between institutional variables and gender diversity. We chose the fixed effects model over the more efficient random effects approach in our main analysis because it provides more conservative hypothesis testing and mitigates endogeneity due to omitted variable bias. More specifically, country-year and industry-year effects control for all factors on the industry and year level while the firm-fixed effects control for time-invariant firm-level factors. This is especially relevant in our case as data on crucial confounding factors on these levels such as firm culture or various macro-economic, regulatory and cultural characteristics of different countries is not available. The fixed-effects approach solves this problem, resulting in the following regression equation:

$$Perf_{it} = \beta_0 + \beta_1 Div_{it-1} + \beta_2 Div_{it-1} \times Inst_{ct} + \beta_3 Contr_{it} + \beta_4 \gamma_i + \beta_5 \delta_{ct} + \beta_6 \theta_{st} + \varepsilon_{icst}$$

Perf represents the performance of firm *i* in year *t, Div* represents gender diversity, and *Inst* represents the institutions in country *c*. *Contr* represents the firm-level control variables, γ are the firm fixed effects, δ are the country-year fixed effects, θ are the industry-year fixed effects of sector *s*, and ε is the error term. Note, that we do not have to include the main effect of *Inst* as it is already included in the country-year fixed effects.

5. Database

In this section, we describe our variables and measurements and provide descriptive statistics. In addition, Appendix A provides detailed information on the definitions, calculations, and sources of all variables.

5.1. Firm-level Main Variables

As a straightforward measure for our main independent variable, gender diversity, we use the *Female Share* obtained from BoardEx. The BoardEx database is provided by Wharton Research Data Services and constitutes a well-established source for data on board compositions (Adams, 2016; Cai, Kim, Li & Pan, 2019). In addition to *Female Share,* we present additional analyses with the *Blau Index* and a dummy variable capturing *Female Presence* on the board as robustness tests. As indicated in our regression equation, we lag *Female Share* by one year since the effects of board characteristics do not take place immediately but take some time to come into effect.

For firm performance as our dependent variable, we follow the convention in the literature and utilize different measures of firm performance reflecting both market valuation and profitability (Nguyen et al., 2021; Post & Byron, 2015; Zhang, 2020). As a market-based performance measure, we employ the natural logarithm of *Tobin's Q*. As measures for profitability, we utilize the accounting measure *Return on Assets (ROA)*. As such, *ROA* only reflects the short-term performance indicated by the accounting data, while *Tobin's Q* represents the valuation of a firm including risk assessments and expectations on future earnings (Lewellen & Badrinath, 1997). We obtain both performance variables from Osiris, which is a database compiled by the Moody's Analytics company Bureau van Dijk and regularly utilized in business research (Banalieva et al., 2018; Berrone, Surroca & Tribó, 2007).

5.2. Institutional Variables

The Gender Inequality Index (GII) provided by the United Nations Development Programme serves as a first measure for the gender-related institutional environment as a whole. The GII encompasses both formal and informal institutions, since it "reflects gender-based disadvantage [and] shows the loss in potential human development due to inequality between female and male achievements" (United Nations Development Programme, 2020a, p. 8). Thus, the GII does not quantify characteristics of specific formal or informal institutions but rather captures general gender-related disadvantages as the result of a given institutional environment (Gutiérrez-Martinez, Saifuddin & Haq, 2021). Accordingly, research in business and economics utilizes the GII as a measure for gender inequality due to institutionalized disadvantages of women (Awaworyi Churchill, Nuhu & Lopez, 2019; Bosch, Heras, Russo, Rofcanin & Grau i Grau, 2018).

As a measure for informal gender-related institutions, we employ the Gender Social Norms Index (GSNI) also provided by the United Nations Development Programme (United Nations Development Programme, 2020b). The GSNI captures social beliefs regarding gender equality measured by the percentage of people with biases against women based on data from the World Values Survey. At that, the first variant, GSIN1, measures the percentage of people with at least one bias, while the second variant, GSNI2, measures the percentage of people with at least two biases. Since such biases reflect cultural values but no formal regulations, the GSNI serves as a proxy for the informal dimension of gender-related institutions. In contrast to the other two indices, the GSNI is not available on a yearly basis as one wave of the World Values Survey spans over five years. Consequently, only one value is available for many countries so that we treat the GSNI as a time-invariant variable. Although this limitation in data availability only allows a cross-sectional analysis for the moderating effect of the GSNI, the treatment of informal institutions as time-invariant variables is a common and reasonable assumption (Berrone et al., 2020; Davies, Ionascu & Kristjánsdóttir, 2008) as cultural values only change slowly (Roland, 2008; Waylen, 2014).

Finally, we use data from Women, Business and the Law (WBL) provided by the World Bank to capture formal gender-related institutions. WBL focusses exclusively on formal regulatory institutions as it "measures laws and regulations affecting women's economic inclusion" (World Bank, 2021). In doing so, WBL provides an aggregate index composed of eight indicators. We focus on the indicator *Workplace* while neglecting other indicators such as *Parenthood* or *Marriage,* since we are interested in regulatory institutions that distinctively target the resources and capabilities of female managers. *Workplace* captures "laws affecting women's decision to enter the labor market" (World Bank, 2021).

5.3. Control Variables

While the fixed-effects control for all variables on the country and industry level as well as for time-invariant firm-level variables, we have to include additional time-varying firm-level variables. First, we control for board characteristics by including *Board Size* and *Board Nationality* both obtained from BoardEx. *Board Size* represents the number of board members and *Board Nationality* captures the percentage of directors with a foreign nationality. Further, we include *Sales, log(Employees),* and *Turnover per Employee* obtained from Osiris. *Sales* and *Employees* account for firm size while *Turnover per Employee* controls for productivity.

5.4. Descriptive Statistics

Table 1 provides the descriptive statistics for all variables. Our final sample comprises 48,911 observations nested in 7,661 firms and 71 countries over the years 2008 to 2017. However, the number of observations applicable for the regression analysis is limited by the use of lagged values and the availability of institutional data. Table 2 provides descriptive statistics for our main variables of interest for each country.

Variable	Obs	Mean	SD	Min	Max
Female Share	48,911	0.12	0.12	0	0.8
log(Tobin's Q)	48,911	1.254	2.651	0.001	379.821
ROA	48,911	4.176	13.316	-99.7	99.01
Board Size	48,911	8.552	2.946	1	32
Board Nationality	48,911	0.139	0.215	0	0.9
Sales	48,911	3850762	0.00	0	0.00
log(Employees)	48,911	12011.07	45012.09	1	2300000
Turnover / Employee	48,911	917.136	10181.44	1.962	1219639
WBL Workplace	48,908	95.016	14.11258	0	100
GII	39,258	0.207	0.112	0.041	0.776
GSNI1	44,948	60.102	13.432	30.01	99.73
GSNI2	44,948	23.935	16.201	10.75	95.67

Table 1: Descriptive Statistics

Figure 1 illustrates the worldwide availability and distribution of our institutional variables by displaying the latest available value for each country. These descriptive statistics support the notion that formal and informal gender-related institutions are not independent but also not equivalent. For instance, Workplace shows very high values throughout the entire European Union, whereas GSNI1 and GSNI2 differ substantially within the same region.

Country	Obs	Female Share			Workplace			GII			GSNI1			GSNI2		
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
ARE	12	0	0.13	0.2	0	0	0	0.16	0.24	0.21	-	-	-	-	-	-
ATG	4	0	0.2	0.05	50	50	50	-	-	-	-	-	-	-	-	-
AUS	239	0	0.5	0.078	100	100	100	46.24	46.24	46.24	23	23	23	18.06	18.06	18.06
AUT	314	0	0.429	0.082	100	100	100	0.079	0.111	0.094	-	-	-	-	-	-
BEL	434	0	0.429	0.082	100	100	100	0.52	0.91	0.069	-	-	-	-	-	-
BGD	2	0	0.2	0.1	50	50	50	0.542	0.555	0.549	-	-	-	-	-	-
BHS	15	0	0.429	0.165	100	100	100	0.367	0.38	0.376	-	-	-	-	-	-
BRA	162	0	0.4	0.078	100	100	100	0.428	0.456	0.447	89.5	89.5	89.5	52.39	52.39	52.39
CAN	442	0	0.5	0.159	100	100	100	0.095	0.132	0.109	51.53	51.53	51.53	26.94	26.94	26.94
CHE	806	0	0.4	0.091	100	100	100	0.041	0.062	0.049	56.03	56.03	56.03	26.94	26.94	26.94
CHL	50	0	0.333	0.054	75	75	75	0.288	0.342	0.307	74.4	74.4	74.4	42.2	42.2	42.2
CHN	720	0	0.5	0.092	50	100	82.43	0.168	0.194	0.178	88.27	88.27	88.27	64.42	64.42	64.42
CIV	2	0.167	0.167	0.167	100	100	100	0.66	0.664	0.662	-	-	-	-	-	-
COL	15	0	0.286	0.153	75	100	95	0.431	0.463	0.447	91.4	91.4	91.4	33.73	33.73	33.73
CYP	44	0	0.4	0.175	100	100	100	0.089	0.139	0.109	81.05	81.05	81.05	49.44	49.44	49.44
CZE	22	0	0.158	0.054	75	100	97.727	0.132	0.139	0.135	-	-	-	-	-	-
DEU	1,833	0	0.5	0.103	100	100	100	0.076	0.097	0.084	62.6	62.6	62.6	33.07	33.07	33.07
DNK	298	0	0.429	0.149	100	100	100	0.41	0.56	0.046	-	-	-	-	-	-
EGY	11	0	0.143	0.036	25	75	34.09	0.452	0.574	0.493	-	-	-	-	-	-
ESP	141	0	0.4	0.124	100	100	100	0.078	0.115	0.094	50.5	50.5	50.5	25.16	25.16	25.16
FIN	411	0	0.6	0.264	100	100	100	0.057	0.077	0.065	51.16	51.16	51.16	22.67	22.67	22.67
FRA	1,780	0	0.8	0.217	100	100	100	0.061	0.107	0.086	56	56	56	26.81	26.81	26.81
GAB	9	0	0.1	0.056	25	25	25	0.53	0.553	0.543	-	-	-	-	-	-
GBR	7,976	0	0.6	0.089	75	100	91.916	0.131	0.183	0.16	54.6	54.6	54.6	25.5	25.5	25.5
GRC	194	0	0.364	0.079	100	100	100	0.124	0.157	0.135	-	-	-	-	-	-
HKG	523	0	0.364	0.079	100	100	100	0.124	0.157	0.135	-	-	-	-	-	-
HRV	15	0	0.4	0.134	100	100	100	0.127	0.16	0.141	-	-	-	-	-	-
HTI	10	0.67	0.267	0.128	50	50	50	0.632	0.776	0.655	98.91	98.91	98.91	92.82	92.82	92.82
HUN	25	0	0.286	0.08	100	100	100	0.235	0.247	0.238	65.89	65.89	65.89	40.36	40.36	40.36
IDN	262	0	0.455	0.096	50	50	50	0.478	0.508	0.493	97.44	97.44	97.44	80.36	80.36	80.36
IND	1,665	0	0.375	0.102	50	100	83.994	0.525	0.59	0.553	98.28	98.28	98.28	83.25	83.25	83.25
IRL	281	0	0.375	0.088	100	100	100	0.105	0.17	0.137	-	-	-	-	-	-
ISL	22	0	0.6	0.176	100	100	100	0.106	0.149	0.127	-	-	-	-	-	-
ISR	461	0	0.6	0.296	100	100	100	0.066	0.099	0.084	-	-	-	-	-	-
ITA	733	0	0.6	0.176	100	100	100	0.081	0.124	0.095	-	-	-	-	-	-
JOR	2	0.154	0.154	0.154	0	0	0	0.544	0.46	0.458	99.33	99.33	99.33	95.67	95.67	95.67
JPN	1,100	0	0.375	0.029	50	50	50	0.103	0.13	0.118	68.81	68.81	68.81	41.67	41.67	41.67
KEN	17	0.2	0.417	0.312	100	100	100	0.524	0.594	0.555	-	-	-	-	-	-
KOR	3	0	0.25	0.083	100	100	100	0.076	0.078	0.077	87.07	87.07	87.07	62.91	62.91	62.91
LBR	7	0	0.167	0.111	25	100	35.714	0.656	0.665	0.659	-	-	-	-	-	-
LKA	6	0	0.25	0.122	75	75	75	0.398	0.398	0.398	-	-	-	-	-	-
LUX	186	0	0.4	0.059	100	100	100	0.068	0.126	0.086	-	-	-	-	-	-
MAR	9	0	0.077	0.048	100	100	100	0.471	0.533	0.498	96.25	96.25	96.25	80.58	80.58	80.58
MEX	109	0	0.385	0.062	75	100	89.22	0.336	0.403	0.354	87.7	87.7	87.7	51	51	51
MHL	68	0	0.222	0.048	25	25	25	-	-	-	-	-	-	-	-	-
MLT	11	0	0.25	0.142	100	100	100	0.192	0.259	0.205	-	-	-	-	-	-
MUS	7	0	0	0	100	100	100	0.37	0.403	0.386	-	-	-	-	-	-
MYS	232	0	0.455	0.138	25	50	45.689	0.263	0.277	0.267	98.54	98.54	98.54	88.38	88.38	88.38
NGA	95	0	0.4	0.152	25	75	65.526	-	-	-	99.73	99.73	99.73	94.99	94.99	94.99
NLD	599	0	0.429	0.105	100	100	100	0.045	0.054	0.049	39.75	39.75	39.75	15.88	15.88	15.88
NOR	550	0	0.667	0.395	100	100	100	0.048	0.075	0.061	41.27	41.27	41.27	16	16	16
NZL	56	0	0.5	0.227	100	100	100	0.133	0.165	0.147	46.14	46.14	46.14	21.28	21.28	21.28
PAN	18	0	0.3	0.083	75	100	83.333	0.442	0.502	0.464	-	-	-	-	-	-
PHL	154	0	0.333	0.065	100	100	100	0.431	0.457	0.44	98.87	98.87	98.87	86.8	86.8	86.8
PNG	10	0.091	0.125	0.107	50	50	50	0.573	0.728	0.616	-	-	-	-	-	-
POL	115	0	0.444	0.111	25	100	88.043	0.131	0.17	0.147	79.75	79.75	79.75	47.31	47.31	47.31
PRT	160	0	0.429	0.103	100	100	100	0.09	0.135	0.114	-	-	-	-	-	-
ROU	3	0.286	0.429	0.363	-	-	-	0.279	0.317	0.304	85.5	85.5	85.5	60.84	60.84	60.84
RUS	76	0	0.333	0.063	50	50	50	0.236	0.305	0.275	86.83	86.83	86.83	68.56	68.56	68.56
SAU	15	0	0.111	0.007	25	25	25	0.262	0.634	0.322	-	-	-	-	-	-
SGP	254	0	0.333	0.086	25	75	43.898	0.066	0.094	0.073	92.34	92.34	92.34	73.2	73.2	73.2
SVN	6	0.214	0.429	0.361	100	100	100	0.055	0.072	0.064	59.21	59.21	59.21	28.25	28.25	28.25
SWE	1,040	0	0.667	0.269	100	100	100	0.044	0.05	0.046	30.01	30.01	30.01	10.75	10.75	10.75
THA	2	0.083	0.083	0.083	100	100	100	0.361	0.423	0.392	95.47	95.47	95.47	74.5	74.5	74.5
TTO	3	0.077	0.154	0.128	50	50	50	0.333	0.358	0.342	85.99	85.99	85.99	51.25	51.25	51.25
TUR	78	0	0.556	0.101	100	100	100	0.325	0.387	0.351	96.52	96.52	96.52	85.7	85.7	85.7
TWN	95	0	0.308	0.077	100	100	100	-	-	-	-	-	-	-	-	-
UGA	2	0.1	0.182	0.141	100	100	100	0.543	0.544	0.544	-	-	-	-	-	-
USA	23,005	0	0.8	0.112	100	100	100	0.229	0.259	0.244	57.31	57.31	57.31	30.07	30.07	30.07
VNM	11	0	0.167	0.102	50	100	90.909	0.302	0.319	0.313	92.89	92.89	92.89	69.17	69.17	69.17
ZAF	885	0	0.625	0.199	50	100	74.887	0.414	0.439	0.424	96.32	96.32	96.32	80.9	80.9	80.9
ZMB	9	0	0.286	0.131	50	100	61.111	0.542	0.599	0.569	-	-	-	-	-	-
TOTAL	48,911	0	0.8	0.119	0	100	95.016	0.041	0.776	0.207	30.01	99.73	60.102	10.75	95.67	33.595

Table 2: Descriptive Statistics by Country
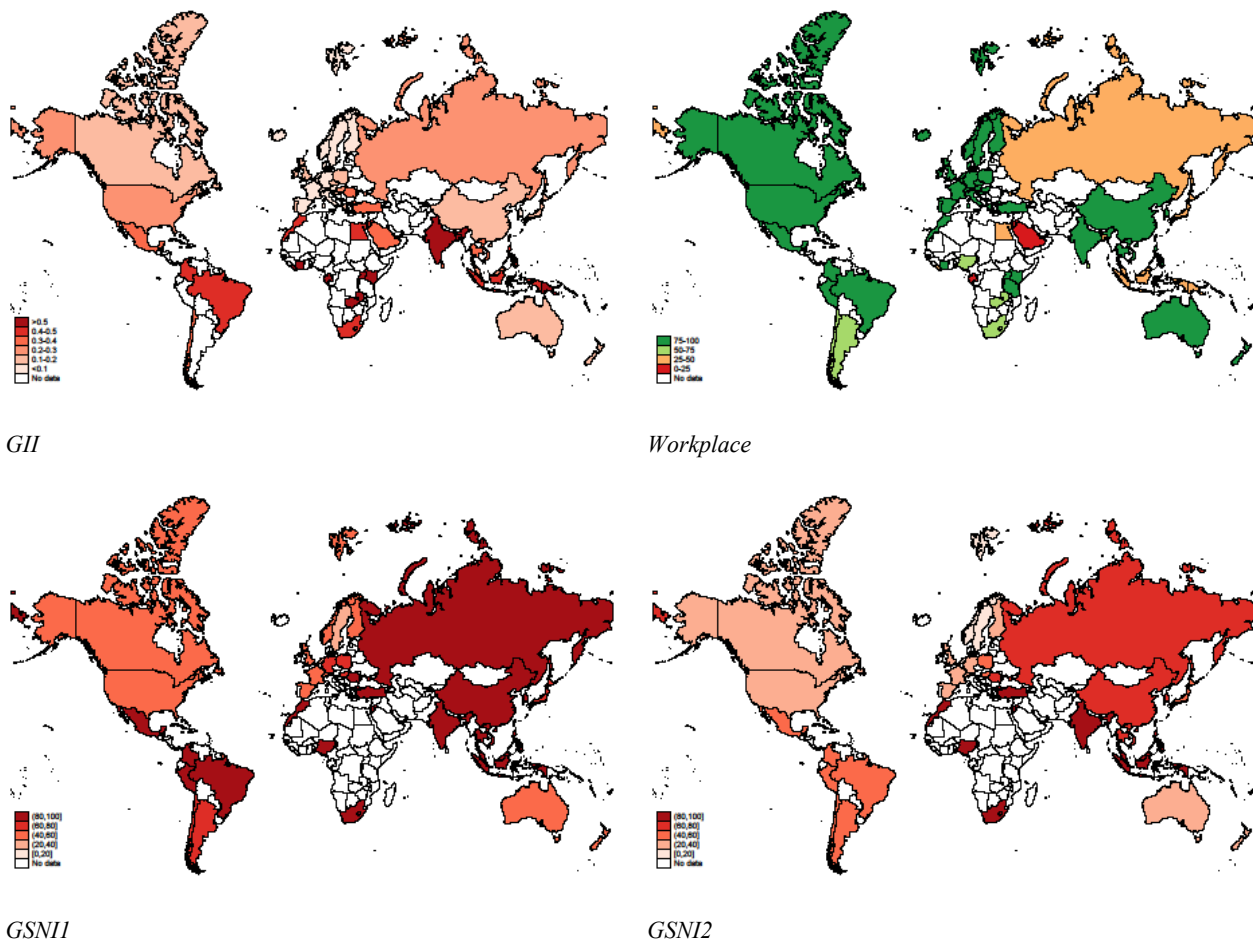
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GII

Workplace

GSNI1

GSNI2

Figure 1: Worldwide Availability and Mean Values of Institutional Variables

Table 3 provides pairwise correlations for all variables. Without control variables and possible moderating effects, we find a positive and significant correlation between both measures for gender diversity and all performance measures. Again, the significant correlations between the different institutional variables support the idea of interdependent formal and informal institutions, while the moderate correlation coefficients indicate that they still constitute distinct measures.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Female Share	1.000						
(2) Tobin's Q	0.027***	1.000					
(3) ROA	0.087***	0.135***	1.000				
(4) Workplace	0.134***	0.020***	-0.056***	1.000			
(5) GII	-0.132***	0.064***	0.071***	-0.183***	1.000		
(6) GSNI1	-0.109***	0.021***	0.096***	-0.479***	0.701***	1.000	
(7) GSNI2	-0.068***	0.029***	0.107***	-0.485***	0.721***	0.980***	1.000

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Pairwise Correlations

6. Results

As we apply two different measures of firm performance as our dependent variable to capture performance both in terms of profitability and market valuation, we provide regression results for both of these dependent variables. Table 4 shows the results for *ROA* and Table 5 shows the results for *Tobin's Q.* For each dependent variable, we run five different regression models. Model (1) is a baseline model for the relationship between gender diversity and firm performance without any institutional moderators. The other five models each feature an interaction between gender diversity and one of our institutional variables as a moderator. Model (2) refers only to Hypothesis 1 and features *GII* as our broad measure for gender-related institutions as a whole. Model (3) also refers to Hypothesis 1 and in particular to Hypothesis 2, featuring *Workplace* as the measure of formal institutions promoting gender equality. Models (4) and (5) refer to Hypotheses 1 and 3, featuring *GSNI1* and *GSNI2* as our measures of informal institutions promoting gender equality.

Dep. Var.: ROA	(1)	(2)	(3)	(4)	(5)
Female Share $_{t-1}$	1.07	3.44	-10.11**	0.45	0.98
	(0.92)	(2.43)	(4.06)	(6.99)	(3.36)
Female Share $_{t-1}$ x GII		-14.14			
		(9.902)			
Female Share $_{t-1}$ x Workplace			0.11***		
			(0.04)		
Female Share $_{t-1}$ x GSNI1				0.01	
				(0.11)	
Female Share $_{t-1}$ x GSNI2					-0.00
					(0.09)
Log(Employees)	-0.42	-0.46	-0.42	-0.12	-0.12
	(0.37)	(0.30)	(0.37)	(0.37)	(0.37)
Board Size	-0.06	-0.01	-0.06	-0.07	-0.07
	(0.08)	(0.07)	(0.08)	(0.09)	(0.09)
Board Nationality	-0.68	-0.45	-0.68	-0.03	-0.03
	(0.598)	(0.65)	(0.596)	(0.54)	(0.54)
Sales	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Turnover / Employee	0.00	0.00	0.00	0.00*	0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Independence Indicator	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES
Observations	38,559	33,997	38,557	35,428	35,428
Firms	7,661	7,197	7,660	7,052	7,052
Adjusted R-squared	0.59	0.61	0.59	0.59	0.59

*p<0.1, **p<0.05, ***p<0.01
Robust standard errors in parentheses are three-way clustered by firm, industry, and country.

Table 4: Regression Results for ROA

Dep. Var.: log(Tobin's Q)	(1)	(2)	(3)	(4)	(5)
Female Share $_{t-1}$	-0.01	0.12*	0.00	0.52**	0.22**
	(0.04)	(0.07)	(0.56)	(0.22)	(0.09)
Female Share $_{t-1}$ x GII		-0.83**			
		(0.36)			
Female Share $_{t-1}$ x Workplace			-0.00		
			0.01		
Female Share $_{t-1}$ x GSNI1				-0.01**	
				(0.00)	
Female Share $_{t-1}$ x GSNI2					-0.01***
					(0.00)
Log(Employees)	-0.11***	-0.11***	-0.11***	-0.12***	-0.12***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Board Size	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Board Nationality	-0.04	-0.04	-0.04	-0.00	-0.00
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Sales	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Turnover / Employee	-0.00***	-0.00	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
ROA	0.02***	0.01***	0.02***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Independence Indicator	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES
Observations	38,559	33,997	38,557	35,428	35,428
Firms	7,661	7,197	7,660	7,052	7,052
Adjusted R-squared	0.86	0.61	0.59	0.86	0.86

*p<0.1, **p<0.05, ***p<0.01

Robust standard errors in parentheses are three-way clustered by firm, industry, and country.

Table 5: Regression Results for Tobin's Q

First, we find no evidence for a global effect of *Female Share$_{t-1}$* on firm performance as the coefficient for *Female Share$_{t-1}$* in Model (1) without further consideration of institutional moderators is insignificant for both dependent variables. However, in the models with institutional variables, we find multiple significant moderators that change the overall effect size of *Female Share$_{t-1}$*. In Model (2), the interaction term between *Female Share$_{t-1}$* and *GII* is negative and significant for *Tobin's Q* and also negative but insignificant for *ROA*. This result provides first evidence in favour of Hypothesis 1 as a positive effect of gender diversity on market valuation is stronger in institutional environments promoting gender equality. Notably, the effect sizes suggest that the overall effect of gender diversity can be significantly positive or negative depending on the institutional environment. For instance, the positive and significant main effect of *Female Share$_{t-1}$* in Model (2) of Table 3 indicates a positive relationship between *Female Share$_{t-1}$* and *Tobin's Q* when *GII* is zero. Figure 2 illustrates this dependence showing the marginal effects of *Female Share$_{t-1}$* on *Tobin's Q* depending on the level of *GII*.
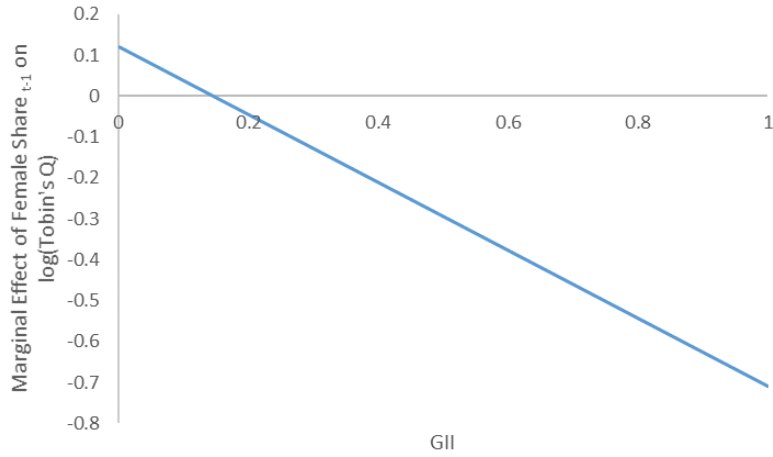
Figure 2: Marginal Effects of Female Share on Tobin's Q Conditional on GII

Model (3) in Table 4 shows a positive and significant interaction between *Female Share$_{t-1}$* and *Workplace* for *ROA* as the dependent variable. This result supports Hypothesis 2 providing evidence for a positive moderating effect of formal institutions promoting gender equality on profitability. Again, the estimated effect sizes suggest that this moderation not only slightly alters the main effect but also changes the sign of the overall effect. As illustrated by the marginal effects in Figure 3, *Female Share$_{t-1}$* might have a positive or negative effect on *ROA* depending on the value of *Workplace*. Although the marginal effects for very low levels of *Workplace* should be treated with caution due to few data in this area, the general trend highlights the relevance of the moderating effect as crucial for the extend and also for the direction of the overall effect. As expected, these results do not translate to a moderating effect of formal institutions on the relationship between *Female Share$_{t-1}$* and market valuation measured by *Tobin's Q*. For *Tobin's Q* we do not find any evidence of a moderating effect of formal institutions, as the interaction term featuring *Workplace* remains insignificant.
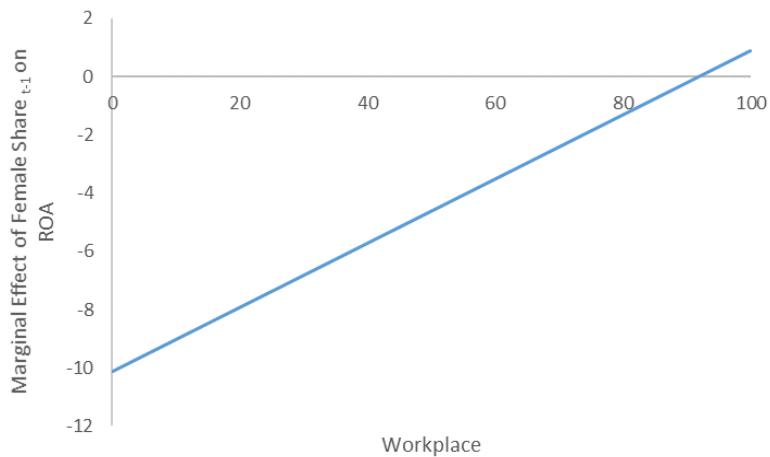

Figure 3: Marginal Effects of Female Share on ROA Conditional on Workplace

Finally, Models (4) and (5) in Table 5 show negative and significant interactions between *Female Share* and the two measures for the informal institutional environment, *GSNI1* and *GSNI2*. Thus, our results provide evidence for Hypothesis 3 as the effect of gender diversity on market valuation depends on informal institutions. More specifically, the positive and significant main effect, representing the effect size at a value of zero for *GSNI1* and *GSNI2* respectively, decreases with social norms that are more biased against women. Again, this moderating influence is so substantial that the overall relationship between gender diversity and market valuation even becomes significantly negative for high values of *GSNI1* and *GSNI2*. Figure 4 illustrates this interaction by depicting the marginal effects of *Female Share$_{t-1}$* depending on *GSNI1*. Again, the figure illustrates the broad trend of the interaction, whereat the marginal effects at very low values of *GSNI1* do not provide meaningful insights. In contrast to the significant results regarding market valuation, the interactions between *Female Share$_{t-1}$* and *GSNI1* and *GSNI2* respectively remain insignificant in Table 4. Hence, we do not find any evidence that informal institutions moderate the relationship between gender diversity and profitability.
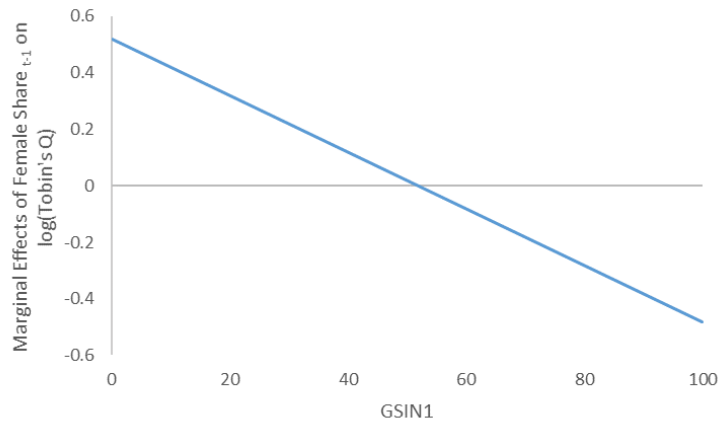

Figure 4: Marginal Effects of Female Share on Tobin's Q Conditional on GSNI1

Overall, our results provide evidence for all three of the proposed Hypotheses. Namely, we find several relevant institutional moderators (H1), whereat the moderating influence seems to be more relevant for the effect of gender diversity on market valuation than on profitability. Nevertheless, *Workplace,* which captures the formal institutional environment, significantly moderates the relationship between gender diversity and profitability but not between gender diversity and market valuation (H2). The other way around, our institutional moderators capturing the informal institutional environment, *GSNI1* and *GSNI2,* only significantly moderate the relationship between gender diversity and market valuation (H3).

7. Robustness Tests

We provide a series of robustness tests including alternative measures, variations in the time structure, multiple subsample analyses, additional control variables, and an alternative model specification. We present the results for all the robustness tests in Appendix B. For convenience, we display only the models reflecting our main findings and only the coefficients for the main variables of interest.

7.1. Alternative Measures

As an alternative to our main explanatory variable, *Female Share*, we follow previous studies (e.g. Zhang 2020; Campbell 2008) and also calculate the *Blau Index* (Blau, 1977) as an alternative measure for gender diversity:

$$Blau\ Index = 1 - Female\ Share^2 - (1 - Female\ Share^2)$$

The *Blau Index* captures the theoretical idea behind diversity more precisely as it defines boards with equal representation as the most diverse ones. Nevertheless, *Female Share* still constitutes a sensible measure in our case, since we investigate the moderating effect of institutions that specifically affect female managers. However, the practical difference between the two measures might be neglectable as boards with a female share larger than 50% are still the exception (Belaounia, Tao & Zhao, 2020), which is also true for our sample.

As a second alternative measure, we employ the dummy variable *Female Presence* indicating the presence of at least one female director. The presence of at least one female director might be more decisive than the actual number of female directors to establish a female role model sending a signal to other women within the organization (Daily & Dalton, 2003). This is especially relevant in the context of institutional pressure as even one female director can serve as a token signalling compliance with social norms whereas the addition of further female directors may show diminishing returns regarding legitimacy (Guldiken, Mallon, Fainshmidt, Judge & Clark, 2019; Perrault, 2015). Regarding *Tobin's Q*, our results do not change qualitatively both with the *Blau Index* and *Female Presence*. For *ROA,* the moderating effect of GII becomes significant for both alternative measures, but the interaction between *Female Presence* and *Workplace* becomes insignificant (see Table B1 and Table B2).

Furthermore, we employ *Profit Margin* instead of *ROA* as an alternative measure for profitability and explore the moderating effect of three sub-indices of the *GSNI* as more fine-grained measures for different dimensions of biases based in gender. The political dimension *GSNIpol*

assesses prejudice against women as political leaders and whether equal rights between men and women are seen as essential. The economic dimension *GSNIecon* captures the beliefs that men make better business executives than women and that a man should have more right to a job than a woman. Finally, the educational dimension *GSNIeduc* captures the belief that university is more important for men than for women (United Nations Development Programme, 2020b). The results for *Profit Margin* are similar to *ROA*, whereas the moderating effect of *GII* is significant. Likewise, all three sub-indices of *GSNI* support our main findings showing a negative and highly significant moderating effect (see Table B3).

7.2. Variations in the Time Structure

Although lagging the explanatory variable by one year emerged as the standard procedure for panel models of board characteristics and firm performance (e.g. He, 2008), changes on the board of directors might very well take more than one year to affect firm performance (Gupta, Lam, Sami & Zhou, 2021). Hence, we rerun our models with gender diversity lagged by two years. This does not qualitatively change our results (see Table B4).

7.3. Subsample Analysis

Since our sample is biased towards the United States as the country with the most observations by far, we conduct a subsample analysis without the United States (see Table B5). Furthermore, we conduct an outlier analysis (see Table B6) where we exclude observations with unusually high values of female share via the interquartile range criterion (Aggarwal, 2017). In doing so, we ensure that our results are not driven by unusual observations or nonlinear relationships at high levels of female shares such as threshold effects. Our results remain robust in both of these subsample analyses.

7.4. Additional Interactions as Control Variables

Although our fixed effects approach already controls for all possible confounders on the country and industry levels, we additionally include interactions with gender diversity to further reduce the potential for omitted variable bias. First, we interact *Female Share* with *Industry* as the effects of gender diversity substantially differ between industries. Second, we include an interaction between *Female Share* and *GDP per Capita* to control for a possible moderating influence of economic development on the effect of gender diversity. Third, we also include an interaction term between *Female Share* and the ratio of female and male years of schooling, *Schooling Ratio,* to control for differences in human capital as a possible con-

founder. We obtain *GDP per* Capita from the World Bank and *Schooling Ratio* from the United Nations Development Programme. *Schooling Ratio* shows no significant moderating influence, while the expected positive effect of *GDP per Capita* is only significant in Model (5). Most importantly, however, the results regarding the institutional interaction still support the findings of our main analysis after including these additional controls (see Table B7).

7.5. Cross-lagged Dynamic Panel Model

As suggested by Zhang (2020) and Ngyuen (2021), we also include the lagged firm performance as an additional independent variable, resulting in a fixed-effects dynamic panel model (Hsiao, Hashem Pesaran & Kamil Tahmiscioglu, 2002). This cross-lagged panel model with fixed effects also accounts for endogeneity due to reverse causality but is less susceptible to mis-specified temporal lags than first-difference approaches (Leszczensky & Wolbring, 2019). Our results remain robust in this alternative model specification (see Table B8).

7.6. Robustness in General

To sum up, our results are robust against alternative measures of gender diversity and firm performance, variations in the time structure, changes in the sample structure, additional control variables, and alternative model specifications, namely a cross-lagged dynamic panel model with fixed effects. Furthermore, the dynamic panel model also mitigates potential problems due to reverse causality in the focal relationship. That said, endogeneity due to reverse causality does not pose a serious problem to our main research question since, at least in our context, institutional moderators can be treated as exogenous variables.[1] In these settings, omitted variable bias, especially on the country level, typically is the more important source of endogeneity (Allison, 2009). However, the employed fixed-effects approach provides a natural robustness against omitted variable bias (Antonakis, Bastardoz & Rönkkö, 2021) while the additional controls for further interaction effects specifically target possible remaining confounders. Thus, although we clearly cannot and do not claim causality, our robustness tests provide at least some justification to believe that neither our choices regarding sample

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[1] We are well aware of the fact that institutions are by no means to be treated as exogenous variables in general (Efendic, Pugh & Adnett, 2011) as macroeconomic performance and other factors clearly shape and change institutions (Seo & Creed, 2002). However, in our case we are interested in the moderating effect of institutions on a relationship on the firm level. Here, it is hard to imagine how not only a single firm but the relationship between gender diversity and performance within this firm could substantially alter the institutional environment. Accordingly, empirical analyses of institutional effects on gender diversity traditionally treat institutional change as an exogenous shock (e.g. Yang, Riepe, Moser, Pull & Terjesen, 2019).

and methods, nor problems of endogeneity due to omitted variables or reversed causality constitute the driving force behind our results.

8. Discussion and Conclusion

8.1. Implications

Our findings have important theoretical and practical implications. First, the moderating effect of institutions helps to reconcile the conflicting empirical evidence regarding the relationship between gender diversity and firm performance. This finding shifts the relevant question from whether to when gender diversity enhances firm performance since both sign and strength of the correlation depend on institutional context. In general, our findings highlight that context matters for effects of gender diversity. Thus, researchers should mind the institutional context in both their research design and the interpretation of their results. In particular, we should acknowledge that valid findings in liberal Western societies cannot be generalised to the rest of the world (Zhang, 2020). Likewise, shareholders and executives should be aware of these institutional influences when evaluating board performance. Without considering the harmful influence of discriminating institutions, companies might hold wrong expectations about the effects of their personnel decisions (Adams, 2016). In the worst case, absent positive results of gender diversity due to institutional constraints might be falsely attributed to bad individual performance of female managers. These insights might also help to explain the surprisingly slow increase in female board representation. While biased decision-making (Carrasco, Francoeur, Labelle, Laffarga & Ruiz-Barbadillo, 2015) and systematic disadvantages due to *glass ceilings* (Lewellyn & Muller-Kahle, 2020) and *old boys networks* (Perrault, 2015) offer valuable explanations, the remarkably small and only very slowly increasing female share in board of directors is still hard to reconcile with a notion of purely and universally positive effects of board gender diversity. However, if these effects can also become negative depending on the institutional environment, explaining the reluctance to appoint female directors becomes straightforward for many parts of the world. Accordingly, our findings also offer implications for lawmakers as a first step in improving female board representation should be getting rid of discriminating gender-related institutions, which, simultaneously, opens up potential for improvements in firm performance.

On a second level, our findings also have important implications for our understanding of the mechanisms behind the relationship between board gender diversity and firm performance. As formal and informal institutions affect the influence of gender diversity on profitability and

market valuation differently, our results indicate that these two effects indeed rely on different causal mechanisms. More specifically, different institutional interactions suggest that gender diversity affects market valuation primarily as a signal for compliance with social norms and profitability due to unique managerial resources that female directors bring into the board.

8.2. Limitations and Future Research

As the first empirical investigation of gender-related institutional moderators on the relationship between board gender diversity and firm performance, this study suffers from some limitations and opens up a variety of avenues for future research.

First, just like virtually every empirical analysis of real-world data, we are restricted to the available data. In our case, the most important data limitation is the lack of high-quality data in developing countries and a resulting bias towards Western industrial countries, especially the United States. Although our sample still comprises several thousand observations in non-Western countries and our results are robust against excluding the United States, future research would clearly profit from a better coverage of different institutional contexts. Furthermore, our sample is limited to large, publicly listed firms. While these firms constitute a meaningful and important sample, the question whether our results also hold for small, private firms remains open for further research.

Second, we focus on broad institutional moderators and performance measures. Our institutional variables only capture broad institutionalised restrictions on female directors. More fine-grained measures of these restrictions such as specific laws might provide further insights into the exact interactions between board dynamics due to gender diversity and the surrounding institutional environment. Furthermore, gender-related institutions not only exist on country-level. Lower-level institutions like regional environments (van der Vegt, Van de Vliert & Huang, 2005) or social norms within different industries (Ali et al., 2011; Joshi & Roh, 2009) also offer potentially meaningful insights. Likewise, the investigation of gender-related institutional moderators on the effects of gender diversity is by no means limited to firm performance as dependent variable. Other outcomes influenced by gender diversity such as innovativeness (Foss, Lee, Murtinu & Scalera, 2021) or corporate social responsibility (Bear et al., 2010) might very well be subject to similar institutional influences.

We hope that our findings highlight the interdependence between gender diversity and the institutional environment and inspire future investigations to explore these complex interactions further.

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Appendix A: Codebook

Variable	Definition	Source
WBL	"*Women, Business and the Law* measures laws and regulations affecting women's economic inclusion in 190 economies. […] The indicators not only represent women's interactions with the law as they begin, progress through, and end their careers, but also are an easily replicable measure of the legal environment that women face as entrepreneurs and employees." (World Bank, 2021, p. 67)	World Bank https://wbl.worldbank.org/en/wbl
Workplace	"The Workplace indicator analyzes laws affecting women's decision to enter the labor market, including women's legal capacity and ability to work, as well as protections in the workplace against discrimination and sexual harassment." (World Bank, 2021, p. 74)	
GII	"The Gender Inequality Index (GII) reflects gender-based disadvantage in three dimensions – reproductive health, empowerment and the labour market […] It shows the loss in potential human development due to inequality between female and male achievements in these dimensions." (United Nations Development Programme, 2020a, p. 8)	United Nations http://hdr.undp.org/en/content/gender-inequality-index-gii
GSNI	"The gender social norms index […] comprises four dimensions – political, educational, economic and physical integrity – and is constructed based on responses to seven questions from the World Values Survey. […] The gender social norms index captures how social beliefs can obstruct gender equality along multiple dimensions" (United Nations Development Programme, 2020b, p. 6f.)	United Nations http://hdr.undp.org/en/gsni
GSNI1	"measures the percentage of people with bias(es), independent of the number of biases" (United Nations Development Programme, 2020b, p. 7)	
GSNI2	"measures the percentage of people with at least two biases" (United Nations Development Programme, 2020b, p. 7)	
Female Share	The proportion of female directors, calculated as 1 minus "the proportion of male directors at the Annual Report Date" (WRDS, 2016, p. 7)	BoardEx Wharton Research Data Services https://www.boardex.com/
Board Size	"Number of Executive Directors, Supervisory Directors or All of the Directors at the Annual Report Date" (WRDS, 2016 p. 7)	
Nationality Mix	"Proportion of Directors from different countries at the Annual Report Date" (WRDS, 2016, p. 7)	
Tobin's Q	Market capitalisation divided by total assets	Osiris Bureau van Dijk https://www.bvdinfo.com/en-gb/our-products/data/international/osiris
ROA	Net income divided by average total assets for the year	
Profit Margin	(Profit before tax / operating revenue)*100	
Employees	Total number of employees for the company at year end	
Turnover	Total operating revenues (net sales + other operating revenues + stock variations)	
Turnover / Employee	Turnover divided by number of employees	
Industry	Industry of the firm as categorized by the United States Standard Industry Classification (USSIC)	

Appendix B: Robustness Checks

	ROA		log(Tobin's Q)		
	(1)	(2)	(3)	(4)	(5)
Blau Index $_{t-1}$	2.83*	-8.18**	0.13**	0.46***	0.19***
	(1.62)	(3.76)	(0.06)	(0.12)	(0.06)
Blau Index $_{t-1}$ x GII	-14.84**		-0.81***		
	(5.76)		(0.27)		
Blau Index $_{t-1}$ x Workplace		0.09**			
		(0.02)			
Blau Index $_{t-1}$ x GSNI1				-0.01***	
				(0.00)	
Blau Index $_{t-1}$ x GSNI2					-0.01***
					(0.00)
Controls	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES
Observations	33,997	38,557	33,997	35,428	35,428
Firms	7,197	7,660	7,197	7,052	7,052
Adjusted R-squared	0.61	0.59	0.87	0.86	0.86

*p<0.1, **p<0.05, ***p<0.01
Robust standard errors in parentheses are three-way clustered by firm, industry, and country.
Control variables for all models are log(Employees), Board Size, Board Nationality, Sales, Turnover per Employee, and Independence. Models 3 to 5 additionally include ROA as a control variable.

Table B1: Blau Index Instead of Female Share

	Profit Margin		log(Tobin's Q)		
	(1)	(2)	(3)	(4)	(5)
Female Share $_{t-1}$	6.57**	-17.96**	0.26**	0.12	0.09
	(2.92)	(8.98)	(0.10)	(0.09)	(0.06)
Female Share $_{t-1}$ x GII	-32.97**				
	(13.42)				
Female Share $_{t-1}$ x Workplace		0.19**			
		(0.09)			
Female Share $_{t-1}$ x GSNIpol			-0.01***		
			(0.00)		
Female Share $_{t-1}$ x GSNIecon				-0.01**	
				(0.00)	
Female Share $_{t-1}$ x GSNIeduc					-0.013**
					(0.005)
Controls	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES
Observations	33,997	38,557	35,428	35,428	35,428
Firms	7,197	7,660	7,052	7,052	7,052
Adjusted R-squared	0.62	0.61	0.86	0.86	0.86

*p<0.1, **p<0.05, ***p<0.01
Robust standard errors in parentheses are three-way clustered by firm, industry, and country.
Control variables for all models are log(Employees), Board Size, Board Nationality, Sales, Turnover per Employee, and Independence. Models 3 to 5 additionally include ROA as a control variable.

Table B2: Alternative Variables

	ROA		log(Tobin's Q)		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Female Presence $_{t-1}$	0.43	-2.02	0.05***	0.08**	0.04**
	(1.62)	(1.28)	(0.02)	(0.04)	(0.01)
Female Presence $_{t-1}$ x GII	-4.31***		-0.3***		
	(1.44)		(0.08)		
Female Presence $_{t-1}$ x Workplace		0.02			
		(0.01)			
Female Presence $_{t-1}$ x GSNI1				-0.002**	
				(0.001)	
Female Presence $_{t-1}$ x GSNI2					-0.001***
					(0.000)
Controls	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES
Observations	33,997	38,557	33,997	35,428	35,428
Firms	7,197	7,660	7,197	7,052	7,052
Adjusted R-squared	0.61	0.59	0.87	0.86	0.86

*p<0.1, **p<0.05, ***p<0.01
Robust standard errors in parentheses are three-way clustered by firm, industry, and country.
Control variables for all models are log(Employees), Board Size, Board Nationality, Sales, Turnover per Employee, and Independence. Models 3 to 5 additionally include ROA as a control variable.

Table B3: Female Presence Instead of Female Share

	ROA		log(Tobin's Q)		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Female Share $_{t-2}$	0.76	-10.54*	0.28***	0.65***	0.31***
	(2.84)	(5.35)	(0.08)	(0.01)	(0.05)
Female Share $_{t-2}$ x GII	-6.07		-1.05**		
	(11.64)		(0.40)		
Female Share $_{t-2}$ x Workplace		0.10*			
		(0.05)			
Female Share $_{t-2}$ x GSNI1				-0.01***	
				(0.00)	
Female Share $_{t-2}$ x GSNI2					-0.01***
					(0.00)
Controls	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES
Observations	30,847	31,319	30,847	28,772	28,772
Firms	6,561	6,682	6,561	6,153	6,153
Adjusted R-squared	0.61	0.61	0.87	0.87	0.87

*p<0.1, **p<0.05, ***p<0.01
Robust standard errors in parentheses are three-way clustered by firm, industry, and country.
Control variables for all models are log(Employees), Board Size, Board Nationality, Sales, Turnover per Employee, and Independence. Models 3 to 5 additionally include ROA as a control variable.

Table B4: Two-year Time Lag in Female Share

	ROA		log(Tobin's Q)		
	(1)	(2)	(3)	(4)	(5)
Female Share $_{t-1}$	2.13 (2.18)	-12.295* (6.248)	0.15** (0.06)	0.596*** (0.22)	0.28*** (0.08)
Female Share $_{t-1}$ x GII	-14.28 (10.82)		-0.93** (0.46)		
Female Share $_{t-1}$ x Workplace		0.13* (0.07)			
Female Share $_{t-1}$ x GSNI1				-0.01*** (0.00)	
Female Share $_{t-1}$ x GSNI2					-0.01*** (0.00)
Controls	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES
Observations	17,634	19,959	17,634	16,830	16,830
Firms	4,009	4,276	4,009	3,668	3,668
Adjusted R-squared	0.55	0.55	0.88	0.87	0.87

*p<0.1, **p<0.05, ***p<0.01
Robust standard errors in parentheses are three-way clustered by firm, industry, and country.
Control variables for all models are log(Employees), Board Size, Board Nationality, Sales, Turnover per Employee, and Independence. Models 3 to 5 additionally include ROA as a control variable.

Table B5: Subsample Without USA

	ROA		log(Tobin's Q)		
	(1)	(2)	(3)	(4)	(5)
Female Share $_{t-1}$	3.57 (2.55)	-11.61 (7.02)	0.15* (0.08)	0.61*** (0.19)	0.25*** (0.08)
Female Share $_{t-1}$ x GII	-15.56 (10.13)		-0.92** (0.42)		
Female Share $_{t-1}$ x Workplace		0.13* (0.07)			
Female Share $_{t-1}$ x GSNI1				-0.01*** (0.00)	
Female Share $_{t-1}$ x GSNI2					-0.01*** (0.00)
Controls	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES
Observations	33,539	38,069	33,539	34,961	34,961
Firms	7,160	7,624	7,160	7,017	7,017
Adjusted R-squared	0.61	0.59	0.87	0.86	0.86

*p<0.1, **p<0.05, ***p<0.01
Robust standard errors in parentheses are three-way clustered by firm, industry, and country.
Control variables for all models are log(Employees), Board Size, Board Nationality, Sales, Turnover per Employee, and Independence. Models 3 to 5 additionally include ROA as a control variable.

Table B6: Subsample Without Outliers in Female Share

	ROA		log(Tobin's Q)		
	(1)	(2)	(3)	(4)	(5)
Female Share $_{t-1}$	-27.19 (17.18)	-43.83** (22.06)	-0.76 (1.04)	-1.36 (1.21)	-1.41 (1.098)
Female Share $_{t-1}$ x GII	-8.84 (9.56)		-0.85* (0.44)		
Female Share $_{t-1}$ x Workplace		0.15* (0.09)			
Female Share $_{t-1}$ x GSNI1				0.01*** (0.00)	
Female Share $_{t-1}$ x GSNI2					0.01*** (0.00)
Female Share $_{t-1}$ x log(GDP per Capita)	-0.68 (3.51)	-1.07 (3.79)	0.02 (0.19)	0.298 (0.15)	0.36** (0.16)
Female Share $_{t-1}$ x Schooling Ratio	25.199 (26.53)	26.51 (28.40)	1.24 (1.36)	-0.197 (1.23)	-0.25 (1.19)
Female Share $_{t-1}$ x Industry	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES
Observations	33,976	34,101	31,724	31,724	31,724
Firms	7,193	7,225	6,741	6,741	6,741
Adjusted R-squared	0.61	0.61	0.87	0.87	0.87

*p<0.1, **p<0.05, ***p<0.01
Robust standard errors in parentheses are three-way clustered by firm, industry, and country.
Control variables for all models are log(Employees), Board Size, Board Nationality, Sales, Turnover per Employee, and Independence. Models 3 to 5 additionally include ROA as a control variable.

Table B7: Additional Controls

	ROA		log(Tobin's Q)		
	(1)	(2)	(3)	(4)	(5)
Female Share $_{t-1}$	3.63 (2.28)	-9.29*** (3.13)	0.13* (0.07)	0.51** (0.22)	0.21** (0.09)
Female Share $_{t-1}$ x GII	-15.45 (9.51)		-0.83** (0.35)		
Female Share $_{t-1}$ x Workplace		0.11*** (0.03)			
Female Share $_{t-1}$ x GSNI1				-0.01** (0.00)	
Female Share $_{t-1}$ x GSNI2					-0.01*** (0.00)
ROA $_{t-1}$	0.15*** (0.01)	0.15*** (0.03)			
log(Tobin's Q) $_{t-1}$			0.04 (0.03)	0.04 (0.03)	0.04 (0.03)
Controls	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES
Observations	33,997	38,557	33,997	35,428	35,428
Firms	7,197	7,660	7,197	7,052	7,052
Adjusted R-squared	0.62	0.60	0.88	0.86	0.86

*p<0.1, **p<0.05, ***p<0.01
Robust standard errors in parentheses are three-way clustered by firm, industry, and country.
Control variables for all models are log(Employees), Board Size, Board Nationality, Sales, Turnover per Employee, and Independence. Models 3 to 5 additionally include ROA as a control variable.

Table B8: Cross-Lagged Dynamic Panel Model

Diskussionspapiere des Instituts für Organisationsökonomik

Seit Institutsgründung im Oktober 2010 erscheint monatlich ein Diskussionspapier. Im Folgenden werden die letzten zwölf aufgeführt. Eine vollständige Liste mit Downloadmöglichkeit findet sich unter http://www.wiwi.uni-muenster.de/io/de/forschen/diskussionspapiere.

DP-IO 11/2021 How Institutions Moderate the Effect of Gender Diversity on Firm Performance
Felix Hoch/Lilo Seyberth
November 2021

DP-IO 10/2021 11. Jahresbericht des Instituts für Organisationsökonomik
Alexander Dilger/Lars Vischer
Oktober 2021

DP-IO 9/2021 Einkommenssteigerung durchs Studium als wichtiges Maß
Alexander Dilger
September 2021

DP-IO 8/2021 Losen statt Stimmverluste unter Prozent-Hürden und bei Sitzanteilen
Alexander Dilger
August 2021

DP-IO 7/2021 Einfache Vermeidung von Stimmverlusten durch Prozent-Hürden
Alexander Dilger
Juli 2021

DP-IO 6/2021 Die Up-or-out-Regel
Alexander Dilger
Juni 2021

DP-IO 5/2021 Entwicklungen der Vorstandsabfindungen von 2010 bis 2019
Ute Schottmüller-Einwag/Alexander Dilger
Mai 2021

DP-IO 4/2021 Kapitalwert bei Null- und Negativzinsen
Alexander Dilger
April 2021

DP-IO 3/2021 Erfahrungen eines Hochschullehrers aus einem Jahr Corona-Pandemie
Alexander Dilger
März 2021

DP-IO 2/2021 Anreize für Hochschullehrer vor und nach der Dienstrechtsreform
Alexander Dilger
Februar 2021

DP-IO 1/2021 Cheating Alone and in Teams
Alexander Dilger
Januar 2021

DP-IO 12/2020 Liberale Corona-Politik
Alexander Dilger
Dezember 2020