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Female board appointments and stock market reactions: evidence from the German stock market

Abstract

Gender diversity at board level is probably one of the most controversially discussed topics among policy-makers, in business and, in society today. This study examines female board appointments between 2007 and 2012. Subsequently, an event study is performed covering 30 announcements of female board appointments during this period. The findings demonstrate significant positive stock market reactions to the announcement of women entering a corporate board, suggesting that investors on average believe that female directors add value. Thus, female board appointments appear to be a significant instrument in enhancing shareholder value. Also, this study has found that the dissemination of information about female board appointments prior to the official appointment tends to significantly positively influence stock returns.

Keywords: corporate governance, gender diversity, women, board of directors, market reaction.

JEL Classification: M41.

Introduction

Attention paid to the promotion of gender diversity has increased dramatically in Europe during the last few years. It is noteworthy that the European Commission considers passing a law according to which women will represent 40% of non-executive board members of listed companies by 2020¹. This rule would apply to all firms in the 27 member states that are listed on the stock market and have more than 250 employees or annual revenue of €50 million or more². This law proposal is expected to be approved by a majority vote in the European Parliament while, in the European Council, several member states have already stated their opposition, including Germany (Holst and Schimeta, 2013). In particular, the German Parliament voted to not pass a law on binding quotas, and so what remains is a voluntary commitment to bring more women onto the supervisory boards. Several countries warn against overregulation and argue that such a decision should stay at national level.

The board system in Germany is a two-tier system with the supervisory board appointing and supervising the management board. Under a one-tier system, the company is governed by a unified board performing both management and supervisory functions, thus there is no separate supervisory board (Plessis et al., 2012). Gender equality in Germany has recently come under great scrutiny. Women are still underrepresented at board level. At the end of 2012, women constituted 7.8% of the management boards (or executive boards) and 19.4% of the supervisory

boards (or non-executive boards) of the largest traded companies on the Frankfurt Stock Exchange, the DAX 30. The majority (63.5%) of these female supervisory board seats were held by employee representatives, meaning that they were appointed to the board because of German codetermination rights. Here, it should be noted that the German system of codetermination allows for employee participation at supervisory board level to give employees rights to participate in the decision making process of companies (Plessis et al., 2012). Despite an increase of women at board level compared to the previous year, female representation remained still relatively low at the end of 2012 (Holst and Schimeta, 2013).

It is not surprising that, in several countries, policy-makers explicitly stress the importance of gender diversity in boardrooms. Most legislative initiatives are based on the view that greater gender diversity would improve performance and hence create shareholder value. The topic of a possible gender quota in supervisory boards has divided opinion in Germany. The debate revolves around whether to legally force listed and codetermined companies to meet quotas of women on supervisory boards, or whether firms should undertake a transformation to a more effective gender-diversity ecosystem under their own initiative. Supervisory boards cannot intervene in a company's business, but they do appoint members to the management board. Therefore, it can be assumed that the more women who join a supervisory board, the greater the chances that they will also assign more women to the company's management levels. The issue remains delicate. From an ethical point of view encouraging female representation is indisputable. However, from an economic point of view the performance outcomes of increased female representation at the board level are still not clear.

Academic research has often investigated Anglo-Saxon countries with legal systems based on common

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¹ Closing the gender gap: European Commission calls for quotas, Spiegel, November 14, 2012: <http://www.spiegel.de/international/europe/European-commission-moves-towards-approving-board-gender-quotas-a-867181.html>.

² Battle with Brussels: Germany to Lobby against EU gender quota, Spiegel, March 06, 2013. <http://www.spiegel.de/international/europe/germany-to-lobby-against-eu-gender-quota-a-887174.html>.

law. The main alternative to common law is civil law, the legal system used in Germany. German empirical evidence on this high profile issue remains scarce. The aim of the thesis is to investigate whether shareholders reward gender diversity on corporate boards in Germany. The central question of this study is “whether shareholders reward gender diversity on corporate boards”. Using an event study analysis, we can analyze market reactions to a firm-specific event. This study assesses the impact of announcements of female board appointments on firms’ stock performance. The impact is evaluated for both executive board and non-executive board appointments. The sample, used in this study, consists of both female appointments to the management board and female appointments to the supervisory board. Henceforth, for reasons of simplicity, the word corporate board is used.

This study makes a number of contributions to the existing academic literature. First, it adds to the limited empirical evidence on the impact of women on corporate boards in Germany. Further, it provides evidence as to whether stock markets encourage or punish gender diversity at the time of board appointments. Finally, it gives an approach to determine whether there is an economic rationale for campaigns to promote women as board members in Germany.

For the sample used in the study, a positive stock market response was found. More precisely, a positive reaction to the announcement of a woman entering a corporate board was found using both a parametric test and a non-parametric test. Consequently, it can be inferred that female board members are positively related to the value of a firm. Also, this study has found that the dissemination of information about female board appointments prior to the official appointment tends to significantly positively influence stock returns.

The remaining sections of the study are as follows. Section 1 presents the background considerations of the study. Section 2 shows the research hypotheses. Section 3 shows the dataset and the methodology implemented. Section 4 discusses the empirical findings, and the final section presents the conclusions of the study.

1. Literature review

The drive to promote female representation is based on the view that the presence of women on boards may affect the governance of companies in a significant manner. There is a growing understanding across Europe that gender equality is vital for Europe’s economic well-being in several ways. In Norway, for instance, all listed companies must abide to a 40% gender quota for seats on supervisory boards or face

dissolution¹. According to Holst and Schimeta (2013) it remains the only country in Europe to have almost achieved a balanced representation of women and men on supervisory boards (45% at the end of 2012). Meanwhile, countries such as France, Spain, the Netherlands, Belgium and Italy have all passed gender quotas as well. France implemented a gender quota law for supervisory boards in January 2011, which becomes legally binding in 2017. Gender diversity at board level remains a fundamental theme of corporate governance reform efforts in Europe.

With the growing attention paid towards establishing equality between women and men at European board level, be it mandatory or voluntarily, it would be interesting to see how far these political initiatives match up to reality. According to Heidrick and Struggles (2007), the average number of women at board level in the European Union increased in recent years, from 5% in 2001 to 8.4% in 2007. This is still a low level of representation compared to the U.S. and encapsulates a wide degree of variation across the member states. At the end of 2012, Finland had the highest proportion of female directors (28%) in the largest quoted companies, while Malta had the lowest proportion (3%) in the largest quoted companies as shown in Fig. 1.

German boards were made up of 17% of female directors, which ranked Germany 7th in the European Union. The United Kingdom was placed directly above Germany and Denmark a position below. When it comes to comparison at the European level, however, only the supervisory board is taken into account for German firms. Therefore, the relatively high position of Germany can be attributed to the high percentage of women appointed to supervisory boards as employees’ representatives. When controlling for this proportion, Germany drops to the same level as Portugal or Italy (Holst and Schimeta, 2012). Scandinavian countries, such as Finland and Sweden, are at the top of the rankings, with Norway almost achieving gender equality on its supervisory boards.

The effort to promote female supervisory board representation features in what is known as the German Corporate Governance Code (2013). “The Supervisory Board shall specify concrete objectives regarding its composition, which ... take into account the international activities of the enterprise ... and diversity. These concrete objectives shall, in particular, stipulate an appropriate degree of female representation”². However, without mandatory

¹ Norway is not part of the European Union, however the country is worthy of mentioning when it comes to comparison with other countries at the European level.

² German Corporate Governance Code, Section 5, para 5.4.1, pp. 9-10: http://www.corporate-governance-code.de/eng/download/kodex_2013/D_CorGov_final_May_2013.pdf.

quotas, companies may not take action to include more women. Such mandatory quotas would ensure that work conditions change in the workplace, for example, the better balance of work and family

through more flexible work schedules or increased training efforts. There is a noteworthy relationship between female non-executive board representation and legally binding gender quotas.

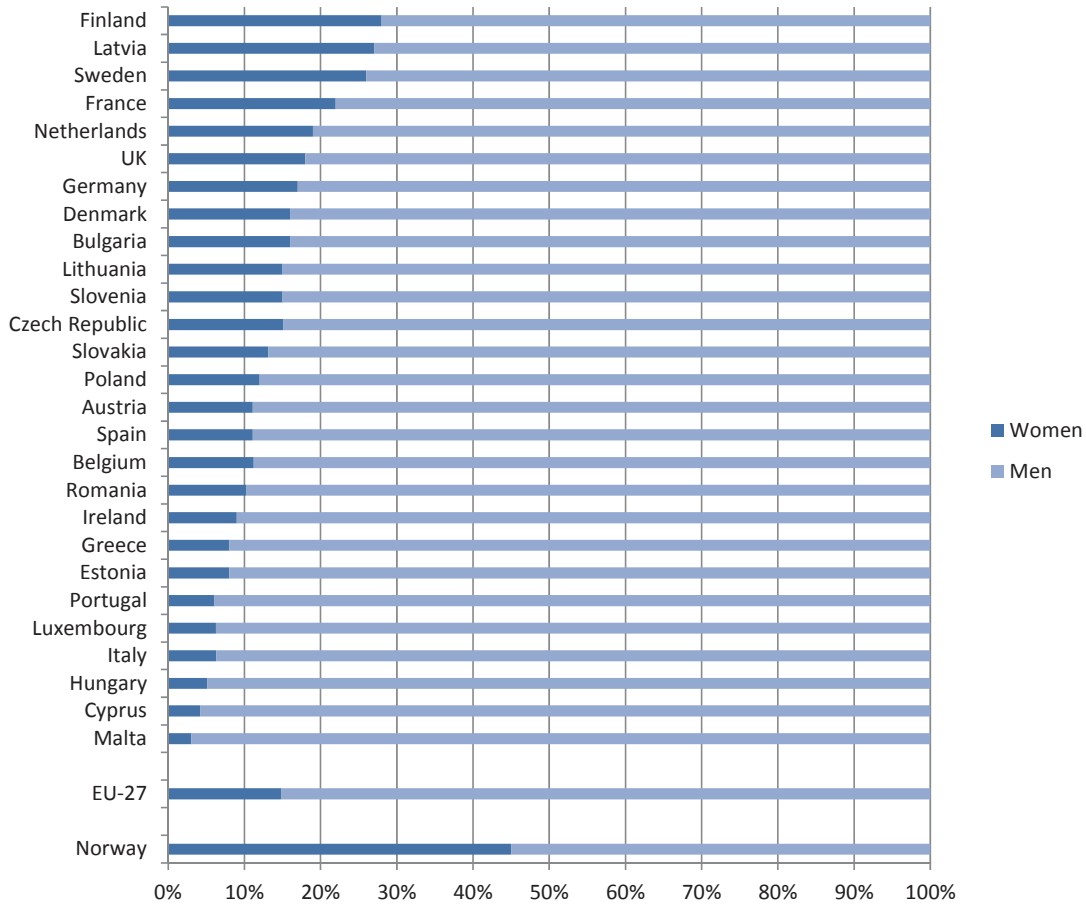


Fig. 1. Women and men in the board of directors

The gender composition of the board can influence the quality of the monitoring role and hence the financial performance of a company. The U.S. based study by Adams and Ferreira (2009) has showed that boards with more female directors are characterized by the potential for greater contribution of directors in decision-making, by tougher monitoring of the CEO, and by more alignment with the interests of shareholders through equity-based compensation. Improved board effectiveness could have both positive and negative effects on corporate performance. On the one hand, because boards are essential to overcoming agency problems between managers and shareholders, stronger governance should increase shareholder value. On the other hand, excessive board monitoring can decrease shareholder value through greater disagreement or conflict between board members.

Adams and Ferreira (2009) found that female directors have a significant and value-relevant impact on board structures since they generally exercise tougher monitoring. Srinidhi et al. (2011) provided evidence of improved earnings quality in

U.S. corporations as a tangible consequence of higher level of monitoring. They indicated that greater female participation on the board level leads to higher earnings quality due to increased oversight and independence. The theoretical developments by Joecks et al. (2012) are also noteworthy. They found empirical evidence in Germany that gender diversity initially negatively impacts firm performance. Only after a level of about 30% of female representation on the board level is reached, can higher firm performance be observed, compared to a board made up of only men. This result would confirm Torchia et al. (2011), who established that there must be a threshold of at least three women on the board in order to enhance the level of firm innovation. Given these results, this raises the question of whether there is a “magic number” of women needed in boardrooms. However, most boards have only one woman director or a small minority of women directors, which would not improve firm performance under this theory.

Carter et al. (2003) have found a significantly positive relationship between gender and ethnic

diversity of the board and firm value for Fortune 1000¹ firms, as measured by Tobin's Q. They also found that gender and ethnic diversity rises with firm size and board size, but falls as the number of inside directors compared to outside directors rises. Outside directors are advantageous to the company because they have very little conflict of interest and may see the big picture differently than insiders. Campbell and Vera (2008) also found that, in the case of Spanish companies, the importance is the balance between women and men rather than simply the presence of women. Furthermore, they found that Spanish investors do not penalize an increase in female participation on boards. In another study in 2010, they showed that the stock market reacts positively in the short term to the announcement of female board appointments, suggesting that investors, on average, believe that female directors add value in Spain. It also has been clearly identified that female board representation is positively related to firm value over a sustained period for Spanish companies.

2. Research hypotheses

It is hypothesized that the stock market in Germany reacts favorably to the announcements of female board appointments. In this respect, average abnormal returns, AAR_t , and cumulative average abnormal returns, $CAAR_{(T_1, T_2)}$, are examined. The hypotheses that are tested in the attempt to identify the stock market response to female board appointments are structured more formally as follows.

Hypothesis 1:

$$H_0: AAR_t \leq 0 \text{ versus } H_a: AAR_t > 0.$$

Hypothesis 2:

$$H_0: CAAR_{(T_1, T_2)} \leq 0 \text{ versus } H_a: CAAR_{(T_1, T_2)} > 0.$$

This study makes a number of contributions to the current literature. To begin with, while a great deal of work has focused on empirical results based on U.S. data, European countries have received little attention in the academic literature. Even less has been written for Germany itself. This study adds to a growing number of European studies by investigating whether there are any measurable effects on firm value for German companies. First of all, it adds to the scarce empirical evidence of the impact of women on corporate boards in Germany. Furthermore, it provides evidence as to whether stock markets encourage or punish gender diversity at the time of female board appointments. Finally, it presents an approach to determine whether there is an economic

rationale for campaigns to promote women as board members in Germany.

This study is limited in the following respect. The objective of this study is to investigate the female appointments. It would be useful to compare the impact with male appointments. This comparison, however, should be carried out with significant caution in order to isolate the very effects of different gender appointments. The conditions of male and female appointments would not be expected to be the same; therefore, such a comparative analysis may be biased, but still may be executed with caution.

3. Data

Companies with female board representation from DAX, MDAX² and SDAX³ were identified as the starting point for constructing the sample. This information was obtained from the German Institute for Economic Research (DIW Berlin). As already mentioned, here board representation means either the management board or the supervisory board. Financial institutions, such as banks and insurance companies, were excluded as their accounting measures may not have the same meanings compared to industrial firms. The companies identified are from a number of industries based on the classification of the Frankfurt Stock Exchange. To determine the event date (or day 0), Factiva⁴ was used to identify the date when the first public announcement or notice of a female board appointment appeared. Companies with female board representation, but no press release either on Factiva or the company's webpage, were omitted.

To select the announcements for the sample, we applied the following criteria. First, if the publication date of the press release fell on a Saturday, then the announcement was excluded from the sample to ensure accurate results. The Stock Exchanges are closed on Sunday and so we did not want to allow news that might be published during the weekend to distort or influence the market response. Also, for comparability and homogeneity purposes, we wanted to treat all our observations equally and have them in working days when the market is open, i.e. we wanted to avoid having observations when the market is open and at the same time observations when the market is closed.

² The MDAX comprises 50 mid-cap companies. In terms of market capitalization and trading volume, these 50 companies are directly ranked below the DAX 30 companies.

³ The SDAX comprises 50 small-cap companies. In terms of market capitalization and trading volume, these 50 companies are directly ranked below the MDAX companies.

⁴ Factiva is a business information and research tool used to identify latest company news, events and announcements. Factiva provides access to sources, such as newspapers, journals, magazines, television and radio transcripts, etc., in 28 languages from nearly 200 countries.

¹ The Fortune 1000 is a list created by Fortune magazine which details the thousand largest companies in the United States. The list is based on revenue rather than on market capitalization or enterprise value.

Further, other firm specific events occurring at the same event date (such as dividend increase or decrease, capital issues, restructurings and takeovers) that would contaminate the sample were identified. Other criteria for selecting the announcements and, hence, for including them in the sample were that there must have been at least 110 stock prices and market prices before, and at least 10 stock prices and market prices after, the event date per company. After removing the announcements that did not meet the above-mentioned criteria, 30 announcements of female board appointments remained. More precisely, the sample consists of a total of 30 announcements that occurred from October 2007 to October 2012, affecting 26 different firms.

To categorize the announcements in the sample, two tables were constructed. Table 1 illustrates the distribution of announcements per year, while Table 2 shows the distribution of announcements by sector. It can be seen that firms appointing women to the board increased over time. This might be a consequence of increasing public attention paid to promoting women to top management levels; this being more evident especially for DAX 30. Further, it can be observed that the majority of the firms appointing women belong to the “Consumer goods” sector and “Industrials” sector. This might be logical given that these two sectors contain a greater number of firms.

Table 1. Final sample of female appointments

Year	Number	(%)
2007	2	6.7%
2008	2	6.7%
2009	3	10.0%
2010	4	13.3%
2011	9	30.0%
2012	10	33.3%
Total	30	100.0%

Table 2. Announcements of female board appointments (following the classification of Frankfurt Stock Exchange)

Sector	Number of announcements	Number of firms
Basic materials	2	2
Consumer goods	8	7
Consumer services	5	4
Industrials	8	8
Information technology	1	1
Pharmaceuticals & healthcare	2	2
Telecommunication	3	1
Utilities	1	1
Total	30	26

After the sample size was identified, announcements were matched with their stock prices and market prices in order to subsequently calculate abnormal returns on security prices. Both prices were obtained

from DataStream. Since the sample for the analysis comprises listed firms from the DAX, MDAX and SDAX, three market indices were used respectively.

4. Methodology

The event study analysis seeks to answer the question whether shareholders reward gender diversity on corporate boards. In order to measure the impact of an announcement on firms' stock returns, abnormal returns are computed. To compute abnormal returns, the Ordinary Least Square (OLS) *market model* is employed (see Strong, 1992). To this end, a 100 day estimation window (-120; -20) and a 21 day event window (-10; 10) are used. 0 represents the event date. In the regression, stock returns is the dependent variable and market returns is the independent variable. Stock returns of security i on day t are obtained as follows.

$$R_{i,t} = \alpha_i + \beta_i \times R_{m,t} + u_{i,t},$$

where $R_{i,t}$ is the return on security i in period t ; α_i is the intercept for security i ; β_i is the systematic risk of security i in relation to the market index; $R_{m,t}$ is the return of the stock market in period t ; $u_{i,t}$ is the prediction error, i.e. residuals of security i in t .

The abnormal returns, $AR_{i,t}$, of security i on day t are calculated as the actual returns, $R_{i,t}$, minus expected returns.

$$AR_{i,t} = R_{i,t} - (\alpha'_i + \beta'_i \times R_{m,t}),$$

where the coefficients α'_i and β'_i are ordinary least squares estimates of α_i and β_i .

The average abnormal return during day t , ARR_t , is the sample mean as presented below.

$$AAR_t = (1/N) \times x \times \Sigma AR_{i,t},$$

where N is the number of firms in the sample.

Over an interval of two or more trading days beginning with day T_1 , and ending with T_2 , the cumulative average abnormal return, $CAAR_{(T_1, T_2)}$, is the following:

$$CAAR_{(T_1, T_2)} = \Sigma AAR_t.$$

After calculating AAR_t and $CAAR_{(T_1, T_2)}$, the study has to verify the extent to which the abnormal returns reflect a significant reaction. Here, we use the Patell test and the Corrado rank test to analyze the abnormal returns' statistical significance.

The Patell test is a parametric test (Patell, 1976). It is based on the market model and relies on the assumption of normality and on cross-sectional independence. By dividing each firm's abnormal return by its standard deviation (obtained over the estimation window), standardized abnormal returns, AR'_t , can be calculated as follows.

$$AR'_{i,t} = AR_{i,t} / S(AR_i),$$

where $S(AR_i) = \text{sq. root of } [1 + 1/T + (R_{m,j} - \text{mean of } R_m)^2 / \sum_t (R_{m,t} - \text{mean of } R_m)^2]$; T is the number of days in the estimation window; $R_{m,j}$ is the return of the market portfolio m in j (estimation window); $R_{m,t}$ is the return of the market portfolio m in t (event window); R_m is the average return of the market portfolio in the estimation period.

The test statistic for the average standardized abnormal return, AAR'_t , on day t is presented below.

$$t = AAR'_t / S(AAR'_t) = (1/N \times \sum AR'_{i,t}) / S(AAR'_t),$$

where $S(AAR'_t) = 1/\text{sq. root of } N$.

The Corrado rank test is a non-parametric test and is robust to any event-induced increase in variance as well as towards smaller sample sizes (Corrado, 1989). Further, it does not rely on the assumption of normality of abnormal returns.

To implement this test, a firm's abnormal returns must be transformed in terms of ranks (k_i) over both the estimation window and the event window ($t_1 + t_2$). In this way, $k_{i,t} = \text{rank}(AR_{i,t})$. If $AR_{i,t} > AR_{i,j}$, then $k_{i,t} > k_{i,j}$. The average rank of security i is mean of $k_i = (t_1 + t_2 + 1) / 2$.

The rank test statistic is calculated using the following formula.

$$z = [1/N \sum (k_{i,t} - \text{mean of } k_i)] / s'_k,$$

where s'_k is the estimated standard deviation of the portfolio mean abnormal return rank over the estimation window and the event window as presented below.

$$s'_k = \text{sq. root of } (1 / t_1 + t_2) \times \sum [1/N \times \sum (k_{i,t} - \text{mean of } k_i)].$$

5. Empirical findings

The empirical findings are reported in Table 3 and Table 4. Table 3 shows the average abnormal returns and the cumulative average abnormal returns with their respective test statistics for each day in the event window. Table 4 presents the cumulative average abnormal returns for different event windows around the event date.

Table 3. Average abnormal returns (AARs) and cumulative average abnormal returns (CAARs) in the event window

Day	AAR (%)	CAAR (%)	Patell test	Corrado test
-10	0.85	0.85	2.08**	0.79
-9	-0.22	0.62	-1.36*	-1.48*
-8	0.01	0.64	0.30	0.13
-7	-0.16	0.48	-0.42	-0.33
-6	-0.63	-0.15	-1.58*	-1.82**
-5	0.22	0.07	0.27	0.76

-4	-0.20	-0.13	-1.05	-0.97
-3	-0.13	-0.27	-0.48	-0.11
-2	-0.32	-0.58	-0.52	0.18
-1	0.09	-0.49	0.31	0.17
0	0.20	-0.29	0.98	0.46
1	0.11	-0.18	0.00	0.30
2	-0.15	-0.33	-0.25	-0.49
3	0.65	0.32	1.72**	2.01**
4	0.30	0.62	1.44*	1.37*
5	0.07	0.69	0.49	0.66
6	-0.03	0.67	0.07	-0.25
7	0.44	1.10	0.19	0.59
8	0.29	1.40	1.08	0.67
9	0.11	1.50	0.32	0.54
10	-0.08	1.43	0.12	-0.13

Notes: ***, ** and * indicate statistical significance at the 1%, 5% and 10% level (one-tailed) respectively.

Table 4. Cumulative average abnormal returns (CAARs) for different periods

	CAAR (%)	Patell test	Corrado test
(0; +1)	0.31	0.70	0.54
(-1; 0)	0.29	0.91	0.44
(-1; 1)	0.41	0.75	0.53
(-2; +2)	-0.06	0.23	0.28
(-3; +3)	0.45	0.66	0.95
(0; 10)	1.92	1.86**	1.73**

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% level (one-tailed) respectively.

Table 4 shows positive average abnormal returns on days $t = -1$, $t = 0$ and $t = +1$. One explanation could be that the information of a planned female board appointment becomes known to the market prior to the announcement date; hence, there is an information leakage. However, no statistically significant positive abnormal returns could be found for these three dates under the Patell test or the Corrado rank test. For days $t = +3$ and $t = +4$, a quiet large positive abnormal return is reported compared to the other dates in the event window. Day $t = +3$ displays a positive reaction of 0.65%, which is significant at the 5% level according to both methods. The day after, a positive reaction of 0.30% is observed, which is significant at the 10% level according to both methods. We find a significant stock market reaction three to four days after the day of announcement in the press.

Event studies typically assess security price reactions by measuring the timing of security price reactions relative to the date of the event. In a relatively efficient market, it is expected that the effect of the event on security prices will occur very quickly after the event. Given the results obtained in this study, it could be argued that there was a stock market under-reaction to the information announcement. In this case, investors learn about

the event relatively slowly, suggesting that security prices do not reflect all available information. So, under the assumption of a delayed effect of the event on security prices, it can reasonably be inferred that on average the announcement of female appointments to German boards is positively viewed by investors. Consequently, it can be inferred that female board members are positively related to the value of a firm, at least, in the short run (see also Campbell and Vera, 2010). Under the assumption of a delayed effect of the event on security prices, the null hypothesis 1 can be rejected for days $t = +3$ and $t = +4$.

To determine the overall capital market reaction surrounding the event date, cumulative average abnormal returns over various event windows were calculated as shown in Table 5. The cumulative average abnormal returns capture the total firm-specific stock movements to the announcement of female board appointments. The event window from $t = 0$ to $t = +10$ displays a cumulated average abnormal return of 1.92%, which is significant at the 5% level according to both methods. Thus, we can confirm a positive cumulative market reaction after the announcement of a female board appointment in the press. As a consequence, the null hypothesis 2 can be rejected for the event window from $t = 0$ to $t = +10$. For any other testing period, the null hypothesis cannot be rejected.

Conclusions

Gender diversity and company management is a key topic for governments and companies in Europe and around the world. Awareness of the benefits of gender diversity is increasing among company leaders. However, the consequences of changing the gender diversity of a company's board still require further research. This study examines whether shareholders reward gender diversity on corporate boards. An event study is used to measure the reaction of the German stock market to female board appointments.

The findings show that the market response to the announcement of female board appointments, either executive or non-executive, is significantly positive. Hence, it can be argued that the contributions made by female directors are hailed by the stock market.

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This suggests that investors generally recognize that female board members add value, implying that female board appointments constitute a significant means in enhancing shareholder value. Also, this study has found that the dissemination of information about female board appointments prior to the official appointment tends to significantly positively influence stock returns.

The results imply that increased gender diversity can be achieved without distorting shareholder value. When the presence of women in boardrooms is positively related to shareholder value, the question that arises is whether policy makers should force companies to implement gender quotas on their supervisory boards. Given the slow speed by which the number of women on supervisory boards is growing, there should be stronger calls for more efficient methods to reach a gender balance. On the one hand, the presence of women on company boards may enhance shareholder value if women bring new ideas and different perspectives at the decision making level. On the other hand, a quota system would potentially harm a company if women were appointed to a board to just satisfy such a system, neglecting the otherwise required expertise, qualifications and skills. However, voluntary decisions, such as the voluntary appointment of more women to supervisory boards based on certain quality standards, would be expected to be appreciated by investors and to positively affect stock valuation.

To fully understand the economic consequences of gender diversity, research needs to concentrate more on the role that women play in companies. An important topic to further investigate would be the source of value arising from greater gender diversity at board level, as gender-diverse boards would be expected to exercise tougher monitoring on managerial behavior and decision-making. Future research should also examine the contributions that women make at executive board level in positions, such as CEO or CFO, and the relative company financial effects and stock market reaction. The examination of stock market response to female appointments in the financial sector is also very important to study. This could very well be an objective for future research.

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