



Sinha, T. (2023). The Role of Female Leadership in Times of Financial Crisis – an Analysis During the COVID-19 Pandemic. *Copernican Journal of Finance & Accounting*, 12(2), 79–98. <http://dx.doi.org/10.12775/CJFA.2023.012>

TANJA SINHA*

Technische Hochschule Ingolstadt

THE ROLE OF FEMALE LEADERSHIP IN TIMES OF FINANCIAL CRISIS – AN ANALYSIS DURING THE COVID-19 PANDEMIC

Keywords: gender diversity, female leadership, firm performance, financial crisis.

J E L Classification: J16, G01, G11.

Abstract: In 2020 the new COVID-19-virus brought an external shock to the stock markets. In this situation effective leadership was essential to bring companies through the crisis.

Political observation showed that countries led by women managed the pandemic situation more effectively than those led by men. Therefore, the research objective of this article is to examine whether female leaders were also more successful to guide companies through the pandemic. Success in this study is defined as financial performance based on stock prices.

To find out whether female managers showed a better financial performance during this crisis, this study examined all companies listed on the German Stock Exchange, which have at least 50% women in the board. To compare this female managed companies to firms managed mainly by male managers, a market value weighted index for the female managed companies was conducted and compared to the German Stock Index DAX by looking at several financial key figures.

The analysis of these key figures shows that female managed companies outperformed male managed companies in terms of return as well as risk in the year of the COVID-pandemic but were not able to keep their overperformance in the subsequent

Date of submission: April 17, 2023; date of acceptance: September 22, 2023.

* Contact information: tanja.sinha@thi.de, Technische Hochschule Ingolstadt, Business School, Esplanade 10, D-85049 Ingolstadt, Germany, phone: +4984193482555, ORCID ID: <https://orcid.org/0009-0001-4966-1980>.

years. This may be an indicator that women are superior in leading a company through a crisis but suffer in terms of performance when times have calmed down.

■■■ INTRODUCTION

In today's time there are major discussions whether female representation, especially in business life, should be enforced by quota regulations. On the one hand there is the fear that with such quota enforcements management positions will not be filled based on qualification and competence. On the other hand, there are many arguments why such quotas are needed to empower female leadership in today's business life. Despite the numbers have improved significantly in the last years, in 2021 in the European Union still only 34% of all leadership roles were held by women (Grant Thornton International Business Report, 2021).

During the COVID-Crisis it could be seen that countries with female leaders had lower fatality rates and were able to better manage this crisis (Garikipati & Kambhampati, 2021). Also, US-states with female governors had fewer deaths due to COVID than those with male governors (Sergent & Stajkovic, 2020). In a leader assessment of more than 60,000 leaders in the first phase of the COVID-pandemic Zenger and Folkman (2020) found out that also in companies the leadership effectiveness of women was higher rated than that of men.

This study will not stick to the emotional aspect of this discussion, but rather wants to give proof whether female leadership is beneficial in times of crisis in terms of return, risk, and performance figures. Contrary to most other studies conducted in this field, this study is not looking at gender diversity in companies in general but will examine companies with a share of at least 50% women in the board of the firm and therefore explore whether women are the better leaders in times of crisis.

LITERATURE REVIEW

Previous studies on the effect of gender diverse leadership find mixed effects on the firms' performances. Several studies investigated the impact of gender diversity (defined in different ways) for diverse time periods and in different regions.

Some research was conducted regarding the return or performance of companies, other focused on the risk perspective. As there are very different outcomes, in the following tables the studies are clustered depending on finding positive, neutral, or negative effects of gender diversity.

In the following table 1 former research showing a positive relationship of female influence on the key figures of companies are summarized.

Table 1. Literature Review: Studies with positive effects of gender diversity

Authors and Year of Study	Time Period	Region	Impact	Effect Determined
Sudeck & Iatridis (2014)	2007–2012	Germany	Event study for announcements regarding the appointment of female board members	Positive effect on stock prices
Qian (2016)	2011–2014	Asia and the Pacific	Incorporation of gender diversity in a company	Increase in financial performance, but with big cross-country difference
Rossi, Galasso, & Capasso (2017)	2016	Italy	Women in key roles	Positive influence on performance of the companies
Trinh, Pham, Pham & Nguyen (2018)	2006–2016	UK	Female directors on the board of a company	Positive effect on the market value of the companies
Valls Martinez & Cruz Rambaud (2019)	2003–2017	Spain	Number of women on board	Positive influence on financial performance of the firms
Fernando, Jain & Tripathy (2020)	1992–2015, with special view at the financial crisis 2007-2009	US	Women in top management teams	Positive effect on performance, which is even stronger in times of crisis
Magnanelli, Nasta & Raoli (2020)	2011–2016	Italy	Women on the corporate board	Positive effect on performance of the firms
Yang, Riepe, Pull & Terjesen (2019)	2002–2008	Norway	Number of women on the board	Decrease in risk of the firms
Papangkorn, Chatjuthamard, Jiraporn & Chueykamhang (2019)	Before and during the great recession 2008	US	Number of female directors	Positive effect during the crisis on accounting performance
Mohsni, Otchere & Shahriar (2021)	2005–2016	27 developing Countries	Board gender diversity	Positive effect on the performance of the firms

Table 1. Literature...

Authors and Year of Study	Time Period	Region	Impact	Effect Determined
Valls Martínez & Soriano Román (2022)	2015–2019	US	Number of women on the board	Positive effect on the risk (in terms of stock beta)
Achour (2022)	2011–2018	France	Number of women on the board	Decrease in risk (in terms of volatility of stock returns)

Source: own illustration based on the studies cited in the first column.

However, not all former studies find a positive relationship between female influence and the key figures of companies. Therefore, in the following table 2 the former research is summarized which could neither show a significant positive nor a significant negative impact on the companies.

Table 2. Literature Review: Studies with no effects of gender diversity

Authors and Year of Study	Time Period	Region	Impact	Effect Determined
Galluci, D'Amato & Santulli (2019)	2008–2012	Italy	Women on the board	No significant effect on performance of the firms
Suhermana, Ramadhania, Nazir, Zakariad & Witiastutie (2021)	2013–2017	Indonesia	Gender diversity	No effect on firm performance, but female CEOs have significant effect on the return on assets
Yu and Madison (2021)	2012–2020	Meta-analysis	Gender diversity in the board	Mixed results on the financial performance of the companies
Loy & Rupertus (2022)	2008–2014	13 different countries	Number of female board members	No effect on long-term stock performance of firms
Sila, Gonzalez & Hagedorff (2016)	1996–2010	US	Gender diversity on the boards	No significant effect on equity risk
Bruna, Dang, Scotto & Ammari (2019)	2006–2010	France	Female members on the board	No significant effect on the risk-taking activities of the firms
Valls Martínez & Soriano Román (2022)	2015–2019	Europe	Number of women on the board	No effect on risk (in terms of stock beta)

Source: own illustration based on the studies cited in the first column.

The reasons for not finding any significant effect may be diverse. For example, Suherman et al. (2021) state that most of the Indonesian public companies investigated in their analysis are controlled by families and therefore probably the female directors are not chosen because of their knowledge and expertise but rather based on their family relationship with shareholders.

Finally, there are also studies which figured out a negative relationship of women and the key figures of the companies. These are summarized in the following table 3.

Table 3. Literature Review: Studies with negative effects of gender diversity

Authors and Year of Study	Time Period	Region	Impact	Effect Determined
Adams & Ferreira (2009)	1996–2003	US	Board gender diversity	Negative effect on firm performance
Yang, Riepe, Pull & Terjesen (2019)	2002–2008	Norway	Number of women on the board	Adverse effect on financial performance
Papangkorn, Chatjuthamard, Jiraporn & Chueykamhang (2019)	Before and during the great recession 2008	US	Number of female directors	Negative effect on performance in normal times
Mohsni, Otchere & Shahriar (2021)	2005–2016	27 developing Countries	Board gender diversity	Negative effect on the risk

Source: own illustration based on the studies cited in the first column.

The number of studies showing a positive relationship is far higher than those showing a negative relationship. This may be because of a publication bias (studies with negative or no significant effects are published less frequently than studies retrieving positive effects) or in fact gender diversification improves a company's results. None of these studies has found only a negative relationship but showed some positive effects as well (therefore most of these studies are also listed in table 1). Adams & Ferreira (2009) observed fewer attendance-problems in gender diverse boards but showed a negative effect on the performance of the firm. Papangkorn et al. (2019) found a difference between normal times and times of crisis as well as a difference between the effect on the accounting performance and the reflection on the stock markets.

Also, a difference between the effect on risk and the effect on performance could be seen (Mohsni et al., 2021).

Although there are already several studies that have conducted research on the role of female leadership, there is still need for more research to be done in this area. First, only Sudeck & Iatridis (2014) examined the German stock market. Second, only two studies (Fernando et al., 2020; Papangkorn et al., 2019) had an eye on a crisis (the great recession respectively the financial crisis). Third, there is no study analysing companies with a mainly female board or leadership team.

Thus, to close this research gap, the research question in this study will be whether female leadership (in form of at least 50% women on the board of a firm) has a positive effect on the key performance indicators of companies in times of the COVID-19-crisis.

THE RESEARCH METHODOLOGY AND THE COURSE OF THE RESEARCH PROCESS

Most of the former studies on gender diversity or female leadership focus on accounting figures to measure the performance of a firm (Rossi et al., 2017; Yang et al., 2019; Galluci et al., 2019; amongst others). Even when market performance is to be measured, mainly figures as Tobins'Q or Book-to-Market-Value (which are also – at least partly - based on accounting figures) are used. Against this in this study performance will be understood as financial performance based on stock price development. Other studies (Sudeck & Iatridis, 2014) focus on the event of announcing a new female member to the board and therefore examine the short-term effect of gender diversity on boards, but do not examine the effects on the stock price on the longer run.

Additionally, previous studies took as measure for gender diversity that there is at least one woman in the board or a certain percentage of female representatives in the management. As the presence of one woman in the management team cannot be evaluated as female leadership, in this study a different approach should be used to evaluate effects of female leadership. Therefore, companies with at least 50% women on the board are looked at to evaluate the effects of female leadership for firms listed on the German Stock Exchange. It is important to note that Germany has a two-tier board system and therefore the board is separated into a management and a supervisory board, whereas internationally the one-tier board system is common (Hopt, 2022).

To select the female managed companies, the Refinitiv Eikon Database was used. Applying its screening tool, all companies with their respective headquarter in Germany and being listed for trading on the German Stock Exchange were filtered regarding having at least 50% females on the board. This filter figured out 10 companies, which were classified as “female managed”. For all the companies resulting from this search, it was doublechecked via company information given on the internet whether on 31 of December 2022 the situation still was that the members of the board (due to the two-tier board system meaning executive board and / or supervisory board) were at least 50% female. This additional research rejected the criterion to be mainly female managed for one of the companies and resulted in 9 companies with a share of at least 50% women in the executive and / or advisory board. Two of these companies (Gigaset AG and Evotec SE) have at least 50% women in the supervisory board but only men in the executive board. Therefore, both companies were excluded from this study, as they cannot be classified as female managed without having at least one woman in the executive board. Additionally, the Hoftex Group AG was excluded from this study because of very rare trading activities during the last six years, so it would not have been possible to calculate reliable key figures for the financial performance on the stock market.

Therefore, remaining for this study were 6 companies, which are described in more detail in the following table 4.

Table 4. Female managed companies considered in this study

Name of Company	Business Field	Location of Headquarter
CEWE Stiftung & Co. KGaA	Photo processing services	Oldenburg
Covestro AG	Manufacturing of polymer materials	Leverkusen
Fuchs Petrolub SE	Development, production and supply of lubricants and related products for industry	Mannheim
HORNBACH Holding AG & Co KGaA	Holding company of the Hornbach Group, whose subsidiaries are engaged in the building trade, building component manufacture and construction industries.	Bornheim
MorphoSys AG	Global commercial-stage biopharmaceutical company	Planegg
Zalando SE	Online shoes and fashion retailer	Berlin

Source: own study based the Refinitiv Eikon Database as well as public available company information (References: See Online Sources).

The financial performance of these female managed companies will be compared to the DAX, which will be used as a proxy for mainly male managed companies. To allow a direct comparison of key figures for female managed companies and the DAX, based on the 6 female managed companies an index will be created. This index for female managed companies will be named FCX. For comparability reasons with the DAX this index FCX will also be calculated as Laspeyres Index using the following formula and basing the weights of the individual companies on the market value of the free float:

$$FCX_t = \frac{\sum_{j=1}^6 p_t^j \cdot c_0^j}{\sum_{j=1}^6 p_0^j \cdot c_0^j} \quad (1)$$

FCX_t is the index for German female managed companies at day t , c_0^j is the market capitalisation based on the free float for company j at day 0 and p_0^j is the stock price of company j at day 0 .

Market data and daily stock returns are retrieved from the Refinitiv Datastream database. All data is chosen to include capital measures such as dividends and therefore show the total return of the stocks as well as of the DAX.

To examine the financial performance of the companies in terms of the FCX and to compare them with the results from the German DAX the following key figures will be calculated and analysed: Return as well as risk (in terms of volatility, Beta, Maximum One-Day-Loss and Value at Risk) and also the Sharpe-Ratio as combination of return and risk and therefore showing the performance of an investment.

Accounting measures, such as return-on-equity or Tobin's Q, which are often used to measure a firm's performance, will not be considered as they are based on accounting numbers at a single point in time and therefore are not suitable to analyse the development over a certain period or the performance on the stock market.

All financial key figures will be examined over 6 years from 2017 to 2022, which is a three-year period before the Covid-pandemic and a three-year period after the start in the beginning of 2020. This enables to show the effects of the crises in comparison to the rather "normal" times before and after and therefore how the crisis was managed from the shareholders' point of view. As the stock markets recovered quite fast from the COVID-crash in 2020, the year 2020 will be considered as the year of the crisis, whereas the years 2021 and

2022 will be taken as “normal” years. This perspective only applies to the perspective looking at the stock price development, as it is well known that the COVID-pandemic was not over at the end of 2020.

Obviously the first aspect shareholders evaluate is the return of their company. Return in terms of a stock-listed firm is the increase in the share price (as adjusted share prices are used, changes in share price also include all effects from capital measures such as e.g., dividends or stock splits). Due to their time additivity, returns will be calculated as continuous returns using.

$$r_{t,i} = \ln\left(\frac{p_{t,i}}{p_{t-1,i}}\right) \tag{2}$$

Where: $r_{t,i}$ is the continuous return for asset i at time t , $p_{t,i}$ is the stock price for asset i at time t and $p_{t-1,i}$ is the stock price for asset i at time $t-1$.

As return cannot be evaluated without taking the risk perspective into account, also several risk measures will be calculated and compared. First, as this is the most common risk indicator when talking about stock prices, the volatility in terms of standard deviation will be calculated, using:

$$\sigma_i = \sqrt{\frac{1}{T-1} \cdot \sum_{t=1}^T (r_{t,i} - \mu_i)^2} \tag{3}$$

Where: σ_i is the volatility (=standard deviation) of asset i , T reflects the number of observations, $r_{t,i}$ is the return for asset i at time t and μ_i is the mean value of returns for asset i . As the volatility calculation is based on daily stock returns, this also results in the daily volatility. To be able to analyse all financial figures per year, volatility must be annualised using:

$$\sigma_{i.p.a.} = \sigma_i \cdot \sqrt{N_{p.a.}} \tag{4}$$

with $\sigma_{i.p.a.}$ being the volatility of asset i per year, σ_i is the daily volatility of asset i and $N_{p.a.}$ is the number of trading days in the respective year.

Afterwards, risk will be separated into its systematic and its idiosyncratic part. As idiosyncratic risk can be eliminated by diversification it should not be a big issue for an investor. Systematic risk on the other hand, must be compensated

by a higher return to investors and therefore affects the cost of capital for the company. Systematic risk can be measured by beta, which gives the correlation between the return of an individual stock and the market return. Beta can be measured as:

$$\beta_i = \frac{\text{cov}(r_i, r_M)}{\text{var}(r_M)} \quad (5)$$

Where: β_i is the beta factor of asset i , $\text{cov}(r_i, r_M)$ is the covariance between the daily returns of asset i and the market M and $\text{var}(r_M)$ is the variance of the daily returns of the market M .

For calculating the market return, the market is usually represented by a stock market index. The proxy for the market in this study will be the CDAX as it represents all stocks listed in the General Standard and the Prime Standard of the Frankfurt Stock Exchange. As only German stocks are listed in the CDAX it gives a good basis for comparison with the DAX as well as the FCX.

Additionally, the Maximum One-Day-Loss will be calculated for both indices to evaluate the risk by using:

$$ML_i = \min (r_{t,i}) \quad (6)$$

Where: ML_i is the Maximum Loss of asset i and r_t is the daily return of asset i on day t . Therefore, the biggest loss on a single trading day will be given.

To conclude the risk assessment, Value at Risk measures the maximum amount of loss (in monetary units) not be exceeded at a defined confidence level within a certain time period. In this study the Value at Risk will be calculated using the parametric approach (variance-covariance-method) without considering the expected return, which is a conservative approximation for the risk of an asset.

$$VaR_i = V_i \cdot L(\alpha) \cdot \sigma_i \quad (7)$$

Where: VaR_i is the Value at Risk of asset i , V_i represents the market value of asset i , σ_i is the standard deviation of asset i and $L(\alpha)$ is the fractile of the standard normal distribution, set by the confidence level $(1 - \alpha)$.

Finally, to evaluate the performance of a certain asset it is necessary to put its return in relation to its risk. To understand an investment's return compared to its risk the Sharpe-Ratio is well-suited (Sharpe, 1966). The Sharpe-Ratio can be calculated as follows:

$$SR_i = \frac{\mu_i - r_f}{\sigma_i} \quad (8)$$

with SR_i being the Sharpe-Ratio of asset i , μ_i is the mean value of returns for asset i , r_f is the risk-free interest rate and σ_i is the volatility (=standard deviation) of asset i .

As an approximation for the risk-free interest rate usually the Euribor is used. As the time frame for this study coincides with the low or even negative risk phase (with the interest level starting to turn in the second half of the year 2022) the risk-free interest rate in this analysis will be approximated by zero.

ASSUMPTIONS

In this study normal distribution was assumed for the firms' returns as well as for the DAX returns. This assumption is based on comparisons of histograms of daily returns, which showed a picture being close to a normal distribution.

The proxy for the market used in this study was the CDAX. This is because the CDAX represents all German shares across Prime Standard and General Standard. As these are the most important market segments of the Frankfurt Stock Exchange it should be an appropriate approximation for the German stocks traded.

For the risk-free interest rate, it was assumed that this was 0.00%. Due to the low-risk phase – and partially having negative interest rates in the examined time frame – this assumption seems reasonable. Nevertheless, as all financial figures are compared for two indices for the same time periods, a change in the risk-free interest rate would only result in a change of the absolute numbers, but not in any changes in the relations and therefore in the interpretations.

THE OUTCOME OF THE RESEARCH PROCESS

In the following section the results for the financial figures will be described and discussed. All key figures were calculated for the FCX (German index for the female managed companies) as well as for the DAX (German Stock index) as a proxy for male managed companies for the years 2017 to 2022. Therefore, the effect of the COVID 19-crisis in year 2020 can be analysed.

First, the returns for each year are shown in table 5.

Table 5. Return per year

Year	FCX	DAX
2017	25.64%	11.79%
2018	-48.16%	-20.16%
2019	29.06%	22.69%
2020	23.15%	3.48%
2021	-13.24%	14.66%
2022	-52.75%	-13.18%

Source: own study based on data from Refinitiv.

In the years before the crisis the female managed companies summarised in the FCX were able to achieve a higher return in good years and suffered a higher loss in the bad year 2018 compared to the DAX. In the year 2020, the year of the COVID-19 crisis, the FCX achieved a return of 23.15% compared to 3.48% generated by the DAX, which is more than 660% of the DAX-return. From 2019 to 2020 the return of the FCX dropped by almost 6%, whereas the return of the DAX declined by more than 19%. Despite the FCX achieved such a positive return in the year 2020, in both years after the crisis the companies in this index occurred losses and showed far worse returns than the DAX.

As return cannot be evaluated on its own, in the following sections also the risk should be evaluated. To start this assessment, in table 6 the volatility per year (based on daily returns) is shown for the years 2017 to 2022.

Table 6. Volatility per year

Year	FCX	DAX
2017	17.77%	10.59%
2018	23.93%	15.52%
2019	22.80%	13.97%
2020	33.43%	33.34%
2021	19.22%	14.47%
2022	35.83%	23.47%

Source: own study based on data from Refinitiv.

The volatility figures show that in all years the FCX has a higher volatility than the DAX. But in the year of the crisis, 2020, both numbers are almost matching. Also, the increase in volatility from 2019 to 2020 is only 10.6% for the FCX compared to 19.4% for the DAX. So, the DAX much more increased its risk in terms of volatility through the crisis. In the years following the crisis, the DAX again showed a lower volatility and therefore a lower risk compared to the FCX.

As volatility gives information on the risk in terms of fluctuation around the expected value, it is sensible to additionally consider Beta as a risk measure for the systematic risk of an investment compared to the market.

Table 7. Beta

Year	FCX	DAX
2017	0.994	1.045
2018	1.173	1.017
2019	1.235	1.013
2020	0.807	1.054
2021	0.844	1.035
2022	1.202	0.986

Source: own study based on data from Refinitiv.

The Betas given in table 7 are based on the CDAX as proxy for the market and therefore show the risk of both indices in relationship to the CDAX. The Betas in some years confirm the results received from analysing the volatility, whereas in others they show a different picture. In 2017 the Beta stated a lower risk for the FCX than for the DAX, with the FCX having even a lower risk than the market. For the years 2018 and 2019 the higher volatility risk of FCX compared to DAX is also stated in the Beta and so in relation to the market. In the year 2020, when the COVID-crisis started, FCX's Beta again was below 1, showing a lower risk than the market, whereas the Beta for the DAX stayed above 1. Deviating from the volatility figures in 2021 Beta for FCX remained lower than the market, but slightly increased, whereas the Beta for the DAX decreased (but was still higher than the market). For year 2022 the results from the volatility figures are confirmed as risk for FCX heavily increases.

To evaluate the extent of loss on a single trading day the Maximum One-Day-Loss is considered in the following table 8.

Table 8. Maximum One-Day-Loss

Year	FCX	DAX
2017	-3.81%	-1.84%
2018	-7.35%	-3.54%
2019	-4.12%	-3.16%
2020	-8.58%	-13.05%
2021	-3.49%	-4.24%
2022	-8.04%	-4.51%

Source: own study based on data from Refinitiv.

In the years 2017 to 2019 the Maximum One-day-loss is higher for the FCX than for the DAX in all three years and therefore also in the (from a return perspective) good years 2017 and 2019. But for the year 2020 the effect is the same as seen before: FCX is better able to manage the crisis than DAX as the Maximum One-day-loss in this year for the FCX is only about 65% of the amount of the DAX. Remarkably to note is that also in the year 2021, the year following the

COVID-crisis, the Maximum One-Day-Loss for the FCX is -3.49% and thus below the one for the DAX, which is -4.24%. However, it must be noted that return shows an average result for the whole year, whereas the Maximum One-Day-Loss marks the development on one single day.

Table 9. Value at Risk

Year	FCX	DAX
2017	-4,117.63 EUR	-2,454.74 EUR
2018	-5,554.75 EUR	-3,604.13 EUR
2019	-5,292.52 EUR	-3,244.19 EUR
2020	-7,713.91 EUR	-7,694.73 EUR
2021	-4,425.94 EUR	-3,333.95 EUR
2022	-8,219.66 EUR	-5,384.54 EUR

Source: own study based on data from Refinitiv.

To complete the risk investigation the Value at Risk is calculated for both indices and presented in table 9. This calculation was based on an assumed investment of 100,000 EUR, a holding period of 5 days and a confidence level of 5%. Remarkably, for all years examined in this study the Value at Risk for the FCX is higher than for the DAX, which is consistent to the volatility figures, which are higher for the FCX than for the DAX in all years, too. But the increase in Value at risk in the year 2020 compared to the year 2019 for the FCX is only 146% compared to 237% for the DAX. This again shows the higher resilience of the FCX in this crisis. In the years after 2020 the Value at Risk confirms the results from the volatility analysis and shows a higher risk for the FCX in relation to the DAX. The synchronous results for volatility and Value at Risk are a compelling consequence from the calculation of the Value at Risk figures using the variance-covariance-approach.

To combine the return and the risk the performance in terms of the Sharpe Ratio, this key figure will be investigated to conclude this analysis.

Table 10. Sharpe Ratio

Year	FCX	DAX
2017	144.25%	111.28%
2018	-201.30%	-129.87%
2019	127.47%	162.40%
2020	69.25%	10.45%
2021	-68.92%	101.28%
2022	-147.24%	-56.15%

Source: own study based on data from Refinitiv.

As shown in table 10, the performance of both indices measured by the Sharpe Ratio shows a similar picture as the return figures. In the years before the COVID-crisis the FCX indicates higher fluctuations: Higher Sharpe Ratios in successful years, a lower one in the bad year 2018. As well as the return in the year 2020 the Sharpe Ratio for the FCX exceeded the DAX by about 660%, which is the same range as the return. This is because of the low interest rate phase the riskless interest rate was assumed to be 0% p.a. and the volatility of FCX and DAX almost matched. Consequently, the relation must be the same as for the returns. In the years following the crisis the FCX was not able to keep the good performance of 2020 and achieved worse, and even negative, results than the DAX.

FINAL CONCLUSIONS AND DISCUSSION

To answer the question of research, this study investigated the performance of firms with mainly female members on the board before and during the time of the COVID-19 crisis. Therefore, the FCX-index was conducted from the companies with at least 50% women on the board, having their respective head-quarter in Germany and being traded on the Frankfurt Stock Exchange. Subsequently, key figures regarding return, risk and performance were calculated and compared to the results for the DAX as a proxy for mainly male managed companies.

The results show that from a return perspective in the years before the crisis the FCX achieved – compared to the DAX - higher returns in the good years 2017 and 2019 and a worse return in the bad year 2018. In the year of the crisis the FCX had a much higher return, whereas in the years afterwards the results were much worse.

From a risk perspective the figures show that the FCX shows a higher risk in normal times, whereas in the year of the pandemic 2020, the risk is comparably lower than measured by the DAX. Only the Betas show (except in 2022) lower values for the FCX than for the DAX, with the Betas of the FCX even showing a lower risk than the market (for which in this study the CDAX was used as a proxy).

The Sharpe Ratio as performance measure confirms the results of the return and risk analysis and shows the FCX to be superior to the DAX in the year of the crisis as well as lower values in most other years.

The results in the normal years contrast with the statements that women are considered to be more risk-averse than men respectively that men have a higher risk-taking behavior (Byrnes, Miller & Schafer 1999). But as this is derived of an analysis of the population in total, it could be an explanation that women must adapt to male behaviors to get promoted to leading positions in a firm. This was also figured out by Adams & Funk (2012) in examining the risk-aversion of directors.

The results of this study are in line with the findings of Papangkorn et al. (2019), as they also found a negative relationship between female directors and performance, but during the crisis the female directors had a positive effect on the performance. Additionally, Fernando et al. (2020) found this positive effect of female leaders on the performance during the financial crisis.

For sure there is still much more research to be done on this topic. A weakness of this study is the very small number of firms that was analysed, so it would be sensible to conduct a study based on international data to include more female managed companies. Then it must be pointed out that the DAX is an index consisting of 40 companies (which have a higher market capitalization than the companies in the FCX), so it is possible to have some bias through the higher diversification. And it must be mentioned that one of the female managed firms (Covestro) is also included in the DAX. Despite it has the lowest market capitalization within the DAX, Covestro is therefore included in both indices.

Besides including a higher number of female managed companies, it would be worth to look at the statistical correlation between performance and mainly female boards using some regression analysis.

■■■ REFERENCES

- Achour, Z. (2022). Board gender diversity and firm risk. *Corporate Governance, Recent Advances and Perspectives*. 1-16. <https://doi.org/10.5772/intechopen.100189>.
- Adams, R.B., Funk, P. (2012). Beyond the glass ceiling: does gender matter? *Management Science*, 58(2). 219-235. <https://www.jstor.org/stable/41406385>.
- Adams, R., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of Financial Economics*, 94(2). 291-309. <https://doi.org/10.1016/j.jfineco.2008.10.007>.
- Bruna, M.G., Dang, R., Scotto, M.-J., & Ammari, A. (2019). Does board gender diversity affect firm risk-taking? Evidence from the French stock market. *Journal of Management & Governance*, 23(4). 915-938. <https://doi.org/10.1007/s10997-019-09473-1>.
- Byrnes, J.P., Miller, D.C., & Schafer, W.D. (1999). Gender differences in risk taking: A meta-analysis. *Psychological Bulletin*, 125(3), 367-383. <https://doi.org/10.1037/0033-2909.125.3.367>.
- Fernando, G.D., Jain, S.S., & Tripathy, A. (2020). This cloud has a silver lining: Gender diversity, managerial ability, and firm performance. *Journal of Business Research*, 117, 484-496. <https://doi.org/10.1016/j.jbusres.2020.05.042>.
- Gallucci, C., D'Amato, D., & Santulli, R. (2019). Women on the Board of Directors and Firm Performance: The Moderating Role of Female Ownership. Empirical Evidence from the Italian Wine Industry. *Journal of Financial Management, Markets and Institutions*, 2, 225-244. <https://doi.org/10.12831/82214>.
- Garikipati, S., & Kambhampati, U. (2021). Leading the Fight Against the Pandemic: Does Gender Really Matter? *Feminist Economics*, 27, 401-418. <https://doi.org/10.1080/13545701.2021.1874614>.
- Grant Thornton International Business Report (2021). Women in Business 2021 – A window of opportunity.
- Hopt, K.J. (2022). The German Supervisory Board. *Revista da Faculdade de Direito da Universidade de Porto (RFDUP)*, 2020-2021, 539-562. <https://ssrn.com/abstract=4234039>.
- Loy, T.R., & Rupertus, H. (2022). How Does the Stock Market Value Female Directors? International Evidence. *Business & Society*, 61(1), 117-154. <https://doi.org/10.1177/0007650320949839>.
- Magnanelli, B.S., Nasta, L., & Raoli, E. (2020). Do Female Directors on Corporate Boards Make a Difference in Family Owned Businesses? *Journal of International Accounting Research*, 19(1), 85-102. <https://dx.doi.org/10.2308/jiar-17-561>.
- Mohsni, S., Otchere, I., & Shahriar, S. (2021). Board gender diversity, firm performance and risk-taking in developing countries: The moderating effect of culture. *Journal*

- of *International Financial Markets, Institutions and Money*, 73, 101360. <https://doi.org/10.1016/j.intfin.2021.101360>.
- Papangkorn, S., Chatjuthamard, P., Jiraporn, P., & Chueykamhang, S. (2019). Female Directors and Firm Performance: Evidence from the Great Recession. *International Review of Finance*, 21(2), 598-610. <https://doi.org/10.1111/irfi.12275>.
- Qian, M. (2016). Women's Leadership and Corporate Performance. *Asian Development Bank Economics Working Paper Series No. 472*. <http://dx.doi.org/10.2139/ssrn.2737833>.
- Rossi, M., Glasso, S., & Capasso, A. (2017). Women Do it Better: An Investigation on the Association Between Gender Diversity in Board of Directors and the Financial Performance. *International Journal of Economics and Financial Issues*, 7(6), 41-50.
- Sergent, K., & Stajkovic, A.D. (2020). Women's Leadership Is Associated with Fewer Deaths During the COVID-19 Crisis: Quantitative and Qualitative Analyses of United States Governors. *Journal of Applied Psychology*, 105(8), 771-783. <https://doi.org/10.1037/apl0000577>.
- Sharpe, W.F. (1966). Mutual Fund Performance. *The Journal of Business*, 39 (1, Part 2: Supplement on Security Prices), 119-138. <http://www.jstor.org/stable/2351741>.
- Sila, V., Gonzales, A. & Hagendorff, J. (2016). Women on board: Does boardroom gender diversity affect firm risk? *Journal of Corporate Finance*, 36, 26-53. <https://doi.org/10.1016/j.jcorpfin.2015.10.003>.
- Sudeck, K., & Iatridis, G. (2014). Female board appointments and stock market reactions: Evidence from the German stock market. *Investment Management and Financial Innovations*, 11(3), 73-80.
- Suhermana, M.R., Ramadhania, G., Nazir, A., Zakariad, A., & Witiastutie, R.S. (2021). The Effect of Gender Diversity and the Business Expertise of Female Directors on Firm Performance: Evidence from the Indonesia Stock Exchange. *International Journal of Business*, 26(3), 38-52.
- Trinh, V.Q., Pham, H.T., Pham, T.N., & Nguyen, G.T. (2018). Female Leadership and Value Creation: Evidence from London Stock Exchange. *Corporate Ownership & Control*, 15(2-1), 248-257. <https://doi.org/10.22495/cocv15i2c1p10>.
- Valls Martinez, M.C., & Cruz Rambaud, S. (2019). Women on corporate boards and firm's financial performance. *Women's Studies International Forum*, 76, 102251-102211. <https://doi.org/10.1016/j.wsif.2019.102251>.
- Valls Martinez, M.C., & Soriano Román, R. (2022). Women in monitoring positions and market risk. Are the stocks of companies with gender diverse boards less volatile? *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.1049175>.
- Yang, P., Riepe J., Moser, K., Pull, K., & Terjesen, S. (2019). Women directors, firm performance, and firm risk: A causal perspective. *The Leadership Quarterly*, 30(5), 101297. <https://doi.org/10.1016/j.leaqua.2019.05.004>.
- Yu, J., & Madison, G. (2021). Gender quotas and company financial performance: A systematic review. *Economic Affairs*, 41(3), 377-390. <https://doi.org/10.1111/ecaf.12487>.

Zenger, J., & Folkman, J. (2020). Research: Women are Better Leaders During a Crisis. Harvard Business Review. <https://hbr.org/2020/12/research-women-are-better-leaders-during-a-crisis> (accessed: 03.03.2023).

(www1) <https://company.cewe.de/de/ueber-uns/> (accessed: 10.03.2023).

(www2) <https://www.covestro.com/de/company/> (accessed: 10.03.2023).

(www3) <https://www.fuchs.com/gruppe/unternehmen/> (accessed: 10.03.2023).

(www4) <https://www.hornbach-holding.de/unternehmen/> (accessed: 10.03.2023).

(www5) <https://www.morphosys.com/de/home> (accessed: 10.03.2023).

(www6) <https://www.refinitiv.com/en> (accessed: 10.03.2023).

(www7) <https://corporate.zalando.com/de> (accessed: 10.03.2023).