# The Effect of Board Characteristics on Capital Structure—Evidence from UK, France, Germany, and China

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**Abstract.** This study uses a new data set to assess the effect of board characteristics on capital structure. The panel data is used to analyze the board characteristics and capital structure choices of firms in the listed companies from UK, Germany, France, and China during 2009-2021. And this paper empirically provide evidence that there are some significant relationships between the board characteristics and capital structure by estimating the fixed effects model. Although the overall evidence supports the influence of corporate board's composition on corporate financing decisions in both shareholder-oriented and stakeholder-oriented environments, these findings suggest that the impact of board characteristics on capital structure choices varies according to the different institutional features.

**Keywords:** board characteristics, capital structure, corporate governance

## 1 Introduction

Capital structure has a significant impact on investment, which suggests that too much debt leads to underinvestment. [1] So the effect of the board on capital structure can have a real effect on economic growth and national prosperity. As a critical part of the internal governance mechanism, the effectiveness and preference of the board of directors are closely related to agency problems and agency costs. [2] point out that the board is a part of the equilibrium solution of the contract problem between decentralized shareholders and managers. John and Senbet show that the effectiveness of the board is determined by size, composition, and independence of the board. [3] The idea that board composition mitigates agency conflict indicates that there is a link between the capital structure and the board, providing a theoretical cornerstone to understand how the board affects the capital structure. [4]

© The Author(s) 2023
V. Escudero et al. (Eds.): BADS 2022, AHCS 11, pp. 1081–1098, 2023.
https://doi.org/10.2991/978-94-6463-102-9_113

The sample in this paper consists of not only European firms, but also Asian firms, including both unitary board systems (one-tier) and two-tier board systems. For instance, Ezeani et al. show Germany and UK have a two-tier board system that enhances scrutiny and monitoring system. [5,6] In contrast, French and Chinese firms can adopt either of the two systems. The empirical analysis from Berger, Ofek and Yermack indicates that the ratio of outside directors to all directors is positively correlated with leverage. [7] Furthermore, Byrd and Hickman show that companies with a higher proportion of outside directors increase the effectiveness of supervision and affect the company's financial structure, leading them to take on more debt. [8]

There are some additional board characteristics that need to be considered. First, according to the agency theory and organizational behavior, a large number of directors are not conducive to the efficiency of corporate governance. Evans and Dion note that the larger the board, the less possibility that directors are motivated to participate in board meetings. [9] In addition to, Lipton and Lorsch point that an increase of board numbers can enhance board monitoring capabilities and create corresponding costs which will outweigh the benefits. [10] Second, on the other hand, the non-quantifiable characteristics of the board, such as the gender characteristics of the board, may also affect the capital structure. Stinerocka et al. suggest that women are more likely to be risk-averse than men when they try to make a financial decision. Further evidence is from the study made by Singh and Vinicombe who find that female directors reduce the independence of directors swayed by their own personal will. It seems that female directors help to improve corporate governance. [11,12]

This study makes two essential contributions to the recent capital structure literature. Firstly, it fills a gap which has existed in the work of Ernest et al through adding some evidence from China. [5,6] The results of this paper find there are some similarities among these four countries, whilst certain persistent differences across countries show that specific institutional elements are at work. Second, this paper further compares the evidence from shareholder environments with that from stakeholder environments.

The remains of this paper are structured as the following sections: Section 2 discusses the institutional background and views from the related literature. Section 3 depicts details of the data and method in this study. Section 4 presents the analysis of these samples and robustness test while comparing the evidence from another paper. Section 5 concludes and discusses the limitations.

## 2 Background of the board

### 2.1 How Board Characteristics affect Companies' Capital Structures in the in the UK, Germany, France, and China

Board characteristics, mainly independence, board ownership, gender diversity, and board size, have an enormous effect on the overall financial performance. According to Alqatan, Chbib and Hussainey, board characteristics play an integral role in informing the overall corporate governance of a company. [13] Over the last few years, companies in the UK, Germany, France, and China have witnessed major corporate scandals that significantly affected financial performance and capital structure.

It is, however, worth noting that the board characteristics of a specific company differ significantly between countries due to the differences in the corporate culture, financial markets, market structure, and the applied theoretical framework. [5,6] While the UK, Germany, and France operate in holly capitalistic markets that allow for private ownership and governance, China is largely a socialist market economy. Thus, the Chinese government maintains dominance and autonomy over corporate governance, unlike western companies.

Furthermore, Chinese, German, and French companies incorporate a stakeholder's corporate governance that does not depend on shareholders for financing. [13] On the other hand, in a shareholder-centric model, the board's main goal is to protect the interests of the shareholders.

### 2.2 Board Composition (The Number of Independent Directors)

A board's independence is a keyboard characteristic that significantly influences a company's capital structure. Applying the agency theory, board independence implies the extent to which the board can discharge decision-making processes autonomously without managerial control.[13] According to Ezeani et al, independent directors are more effective in protecting the shareholders' interests and minimizing information asymmetry and conflict of interest in a company. This plays an important role in promoting leverage in the UK but has negative implications for German, China, and French companies whose corporate governance model is mainly stakeholders-based. [5,6]

According to the agency theory, independent directors are compelled to safeguard their reputation, and thus, they are more effective in managing managers than insiders]. Vijayakumaran and Vijayakumaran assert that external directors usually have a better understanding of the dynamics of the external business environment. [13,14]

H1. A positive correction exists between the number of external directors and a company's leverage level.

### 2.3 Gender Diversity (The Number of Women in a Board)

According to Saad and Belkacem, the number of women on a board has a big impact on how the capital structure of the company is determined. Saad and Belkacem assert that women score higher in diligence, responsibility, and independence than men.[15] As such, women directors typically tend to apply strict oversight over the management, ensuring the company's objectives are attained promptly.

In all companies, whether in Germany, France, the UK, or China, gender diversity on boards helps expand the worldview and improve creativity. However, studies show that women score higher in risk aversion than men; hence, they are less likely to spend high amounts of debt on high-risk financial activities.[14] Thus, women directors usually incorporate low-risk strategies that can affect leverage negatively.

H2: Their exists a negative correlation between board gender diversity and leverage for companies in China, France, Germany, and the UK

### 2.4 Size of Board

Another important element that significantly impacts a company's capital structure is the size of the board. Studies show that companies with many directors are more likely to experience high leverage than those with the smaller board sizes. According to Amin et al, companies with fewer directors can make decisions swiftly while minimizing agency costs and issues. [16] In addition, studies suggest that a larger board is effective in resource allocation, stringent oversight, and adopting a high debt strategy. This improves the company's value significantly since managers can increase debt and focus on enhancing the overall shareholders' value. [5,6]

The number of board members is also influenced by whether a company has a unitary (one-tier) or two-tier board system (dual boards). Executive and non-executive directors both make up the unitary board of directors. Since both the executive and non-executive directors serve on the same board, there is no real distinction between their roles. Process of making decisions by a unitary board is quicker, and all decisions require continual participation from both of these directors. On the other hand, a two-tier board of directors is made up of a management board and a supervisory board. Directly chosen by the shareholders, the supervisory board oversees the management board. As a result, the supervisory board must first accept decisions made by the management board before they can be put into action, which takes much time. The delay could eventually be lengthier if the management and the supervisory board are unable to reach consensus on a timetable. Because the two boards meet separately in a two-tier arrangement, the supervisory board is unable to aggressively hold the management board accountable. They only get the information that the management board gives them, instead. Their separation opens up the possibility of involving more stakeholders, particularly employees. Vijayakumaran and Vijayakumaran assert that the application of both boards in China makes the firms to be more shareholder-oriented and thus helps them in making effective managerial decisions. Besides, since the ownership structure of Chinese firms differs, and different ownership groups (the state, legal-person, and domestic individuals) have different capabilities and incentives, they can positively influence the capital structure choices of Chinese firms. This can also be reflected in France and UK. [14]

H3: There exists a positive correlation between a company's board size and leverage levels.

## 3 Study methods

### 3.1 Data and approach

The sample of Western economies is taken from three countries, France, the United Kingdom and Germany, and on the Chinese side, the Eastern economies of China are selected as a representative sample. These four countries have different financial traditions, which can be divided into market-based economies and bank-based economies. [5,6] Of three western economies, CG in the UK is shareholder-oriented, and CG in France and Germany is stakeholder oriented. At the same time, CG is stakeholder

oriented in China. [17,18]. This paper takes all listed companies in these four countries from 2009 to 2021 as the research object. After excluding the Chinese S, ST and ST* categories listed companies and companies with more residuals in some years in each country, a sample of 1166 listed companies is obtained as the initial sample, including 620 in China, 407 in the United Kingdom, 63 in France and 76 in Germany. All data is obtained from the wind database and supplemented manually with the Bloomberg database. In order to ensure the objectivity and truthfulness of the results, samples with obvious abnormalities in key data and more serious missing cases are excluded from this paper. Also, all continuous variables are Winsorised at 1 percent to reduce the impact of extreme values.

### 3.2 Measuring of dependent and independent variables

Book value is the net value of an account's book balance (often an asset account), less applicable allowances. The price on the trading market is the market value. The ratio of equity capital to all assets on the balance sheet is known as the leverage ratio. It serves as a gauge for a company's liability risk and an outside reflection of its capacity to make payments. Equity is the owner's equity, which is the remaining equity that remains after obligations are subtracted from an enterprise's assets. A company's owner equity is sometimes referred to as its shareholders' equity. The sum is equal to the total assets minus total liabilities. Leverage can be calculated based on the item's book value and market value. According to Kieschnick and Moussawi, book equity is a plug number in accounting. When reviewing a company's capital structure decisions, book equity alone is not sufficient. The following is a measure of the dependent variable designed for this paper. [19]

$$MKlev_{it} = \frac{D_{it}}{D_{it}+S_{it}P_{it}} \tag{1}$$

Where $P_{it}$ is the price per share of each company(I) at time t. $S_{it}$ represents the amount of a company's common shares that are outstanding at time t (I). And $D_{it}$ represents the financial obligations of the corporation (I) at time T, liabilities that span the long and short term. A financial liability arises when a company has a liability problem in one of three situations: The first situation is when the company has a contractual obligation to deliver cash or other financial assets to another party. The second situation is when the company has a contractual obligation to exchange a financial asset or financial liability with another party under potentially unfavorable conditions. The third situation arises when the company will settle in the future with the company's own equity instruments or available non-derivative contracts, under which the company will deliver varying amounts of its own equity instruments.

Here are leverage measurements from our book.

$$BKlev_{it} = \frac{LTD+STD}{TA} \tag{2}$$

Where BKLEV is book leverage, TA is total assets, and TD represents debt: LTD and STD represent debt with long and short terms, respectively.

These features are BI, BZ, and BGD. BI is the percentage of non-executive directors on the board; BZ is the number of directors on the board; BGD is a measure of the proportion of women on boards.

### 3.3 Control variables

In this study, the control variable chosen is firm characteristics, which are related to the effect of firm-level factors on the capital structure of the firm. The characteristics of the enterprise usually include the historical background of the establishment of the enterprise, the legal status and ownership of the organizational law, and the material on the analysis of the activities of the company in all areas necessary for the operation of the organization. In addition, the company features analysis of financial and economic activities. According to research, it can be found that the capital structure and adjustment behavior of enterprises are related to the characteristics of enterprises.[20] Because the change of enterprise characteristics will bring the difference of adjustment cost. A large number of research results show that there is a correlation between enterprise profitability, asset size and growth opportunities. In their study, tax effects were controlled by Oztekin and Flannery.[21] In this study, the effect of macroeconomic factors will also be limited.

To remove individual heterogeneity of each firm, we finally choose the fixed effect model. The basic model we built is as follows.

$$Leverage_{it} = \beta_0 + \beta_{it}x_{it} + \mu controls_{it} + \alpha_i + \varepsilon_{it} \quad (3)$$

Where $Leverage_{it}$ denotes the leverage for individual companies in country j during the year t, $\varepsilon_{it}$ is the error term. The standard in this study is to allow the leverage to change over time. Therefore, the unobserved individual heterogeneity of each firm $\alpha_i$does not change over time.

Meanwhile, $\beta_{it}$ and $\mu$ represent the coefficients explaining variables and control variables, respectively. $x_{it}$ represent a set of explanatory variables and $controls_{it}$ is the control variables.

## 4 Methods of regression

### 4.1 Descriptive statistics

Table 1 consists of the dependent variable, leverage ratio, independent variables, BGD, BZ, Inddirr and control variables in the model. The table 1 illustrates that the average book leverage of UK companies is 1.811, which is much higher than that of the other three countries. The average book leverage of German companies is 0.71 and it is a little higher than that of France,0.60. It is interesting to note that the average book leverage in stakeholder-oriented China is minimal, 0.34. In general, both Germany and China have smaller average book leverage than the UK, which means that the unique stakeholder-oriented nature mentioned by Tran is not met. [22] On the other hand, Germany has a higher average market leverage ratio than France, while French companies have a higher average market leverage ratio than China. And the UK has the smallest

average market leverage of the four countries. The UK's lowest market leverage ratio compared to the other three countries suggests that UK firms prefer financing rather than debt. Ezeani similarly refers to the lower book and market leverage of UK firms, suggesting that within the Anglo-Saxon environment, managers preferred equity financing to debt. [5,6] This preference is linked to the UK's developed capital markets and lack of close relationships with lenders. Indeed, China's average market leverage is similar to that of the UK. This may be due to China's particular regulatory issues, particularly financial, legal and institutional; and the unique economic environment which also causes Chinese companies to prefer financing to debt. The pecking order theory introduced by Myers and Majluf argues that firms have no significant preference for leverage ratios. [23,24] However, evidence from China and the UK suggests that the corporate governance environment may change firms' financing preferences. Compared to the UK and Germany, France's inddirr is the largest, indicating a higher level of stakeholder-oriented French director independence. In 2001, the China Securities Regulatory Commission (CSRC) adopted a policy that the proportion of independent directors on the board should be at least one-third. But the data in Table 1 suggest that the level of board independence in China is low. Then China has the highest average board size,9.27, followed by Germany,6.55. This may be the result of increased stakeholder and employee representation in German and Chinese companies. Shao also mentioned that, in 2005, the CSRC imposed a requirement that at least one-third of the members of the Supervisory Board be composed of elected labour representatives. Due to information asymmetry, only Chinese BGDs were found. This is difficult to compare with other countries' BGD in this model. [25]

**Table 1.** Descriptive statistics: Board, firm-level, macroeconomics and institutional variables

| | UK | | | | China | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | Mean | Min | Max | SD | Mean | Min | Max | SD |
| MKLev | 0.2447 | 0 | 1 | 0.241 | 0.67388 | 0.01155 | 0.99828 | 0.263 |
| BKLev | 1.811 | 0 | 3255 | 52.6 | 0.71056 | 0.07038 | 41.09372 | 1.463 |
| BGD | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| BZ | 4.231 | 1 | 20 | 3.521 | 6.547 | 1 | 20 | 3.669 |
| Inddirr | 2.42 | 1 | 16 | 2.106 | 3.249 | 1 | 12 | 2.627 |
| Astang | 0.451 | 0.1114 | 0.999 | 0.251 | 0.29658 | 0 | 0.91404 | 0.246 |
| PROF | 0.2884 | -25 | 4.44 | 0.636 | 0.03409 | -25.93812 | 0.69068 | 0.95 |
| LIQ | 2.0504 | 0.1147 | 261.3281 | 1.43 | 1.42874 | 0.02308 | 12.30598 | 1.136 |
| INF | 1.977 | 0.368 | 3.856 | 0.875 | 1.315 | 0.3 | 3.1 | 0.743 |
| GDP | 0.9849 | -9.3962 | 7.5 | 3.688 | 1.003 | -5.7 | 4.2 | 2.66 |
| TX | 0.194 | -87.33 | 55.5 | 2.524 | 0.2162 | -7.5033 | 32.5455 | 1.24 |
| | France | | | | China | | | |
| Variable | Mean | Min | Max | SD | Mean | Min | Max | SD |
| MKLev | 0.4324 | 0.01901 | 1 | 0.274 | 0.3202391 | 0.0002054 | 0.9353854 | 0.21 |
| BKLev | 0.59658 | 0.06177 | 1.42587 | 0.183 | 0.3360500 | 0.0001622 | 1.6901521 | 0.163 |
| BGD | N/A | N/A | N/A | N/A | 1.083 | 0 | 6 | 1.059 |
| BZ | 4.857 | 1 | 20 | 4.34 | 9.274 | 0 | 18 | 1.99 |
| Inddirr | 3.447 | 1 | 16 | 3.128 | 0.3753 | 0.1667 | 1 | 0.061 |
| Astang | 0.1795687 | 0.0009959 | 0.680813 | 0.152 | 0.2700879 | 0.0001656 | 0.9541789 | 0.202 |
| PROF | 0.03061 | -1.1023 | 0.71472 | 0.158 | 0.03317 | -1.99099 | 0.7443 | 0.067 |
| LIQ | 1.8501 | 0.3511 | 21.8973 | 2.085 | 1.29144 | 0.02967 | 10.5729 | 0.75 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| INF | 0.98485 | 0.03751 | 2.1116 | 0.716 | 0.02331 | -0.007 | 0.54 | 0.014 |
| GDP | 0.7107 | -7.8 | 6.8 | 2.535 | 7.325 | 2.3 | 10.4 | 1.933 |
| TX | 0.2208 | -11.5294 | 6.8 | 0.723 | 0.3678 | -0.9955 | 1.7812 | 0.298 |

Note: Table 1 illustrates that the average book leverage of UK companies is 1.811, which is much higher than that of the other three countries. The average book leverage of German companies is 0.71 and it is a little higher than that of France,0.60. It is interesting to note that the average book leverage in stakeholder-oriented China is minimal, 0.34.

Abbreviations: MKLev, market value of leverage; BKLev, book value of leverage; BGD, board gender diversity; BZ, broad size; Astang, asset tangibility; PROF, profitability; Liq, liquidity; Inf, inflation; GDP, gross domestic product; TX, tax; Inddirr, the Ratio of Independent Directors.)

The correlation matrix was used to test for multicollinearity between the study variables. By comparing the data for the four countries, the UK has the highest correlation between BZ and Inddirr at 0.759, which is shown in table 2. Gujarati and Porter suggest that the threshold for severe multicollinearity is 80%. This means that there is no multicollinearity in this model. [26]

**Table 2.** Pairwise correlations of UK

| Variables | bz | inde | astang | prof | liq | tx | gdp | inf |
|---|---|---|---|---|---|---|---|---|
| bz | 1.000 | | | | | | | |
| | | | | | | | | |
| inde | 0.759* | 1.000 | | | | | | |
| | (0.000) | | | | | | | |
| astang | 0.007 | 0.032 | 1.000 | | | | | |
| | (0.648) | (0.046) | | | | | | |
| prof | 0.069* | 0.057* | 0.028 | 1.000 | | | | |
| | (0.000) | (0.000) | (0.082) | | | | | |
| liq | -0.062* | -0.040 | -0.058* | -0.052* | 1.000 | | | |
| | (0.000) | (0.012) | (0.000) | (0.001) | | | | |
| tx | 0.029 | 0.025 | -0.001 | 0.025 | 0.025 | 1.000 | | |
| | (0.069) | (0.118) | (0.956) | (0.126) | (0.125) | | | |
| gdp | -0.003 | 0.012 | 0.004 | 0.040 | 0.007 | 0.037 | 1.000 | |
| | (0.829) | (0.457) | (0.814) | (0.011) | (0.682) | (0.023) | | |
| inf | -0.082* | -0.056* | -0.026 | 0.002 | 0.014 | 0.019 | 0.254* | 1.000 |
| | (0.000) | (0.000) | (0.115) | (0.878) | (0.394) | (0.252) | (0.000) | |
| *** $p<0.01$, ** $p<0.05$, * $p<0.1$ | | | | | | | | |

Note: Table 2 shows that the correlation matrix was used to test for multicollinearity between the study variables. By comparing the data for the four countries, the UK has the highest correlation between BZ and Inddirr at 0.759.

**Table 3.** Pairwise correlations of Germany

| Variables | bz | inde | astang | prof | liq | tx | gdp | inf |
|---|---|---|---|---|---|---|---|---|
| bz | 1.000 | | | | | | | |
| | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| inde | 0.667* | 1.000 | | | | | | |
| | (0.000) | | | | | | | |
| astang | -0.066 | -0.016 | 1.000 | | | | | |
| | (0.059) | (0.644) | | | | | | |
| prof | 0.089* | 0.046 | 0.039 | 1.000 | | | | |
| | (0.010) | (0.177) | (0.267) | | | | | |
| liq | 0.068 | 0.074 | -0.094* | 0.089* | 1.000 | | | |
| | (0.047) | (0.030) | (0.007) | (0.009) | | | | |
| tx | 0.005 | -0.008 | -0.040 | 0.003 | -0.008 | 1.000 | | |
| | (0.895) | (0.811) | (0.252) | (0.933) | (0.809) | | | |
| gdp | 0.002 | 0.013 | -0.004 | -0.020 | -0.018 | -0.070 | 1.000 | |
| | (0.945) | (0.695) | (0.909) | (0.561) | (0.592) | (0.045) | | |
| inf | 0.017 | -0.007 | -0.049 | 0.000 | 0.013 | -0.011 | 0.478* | 1.000 |
| | (0.622) | (0.848) | (0.161) | (1.000) | (0.711) | (0.752) | (0.000) | |
| **** p<0.01, ** p<0.05, * p<0.1* | | | | | | | | |

Note: Table 3 shows that the correlation matrix was used to test for multicollinearity between the study variables. By comparing the data for the four countries, the Germany has the highest correlation between BZ and Inddirr at 0.667.

**Table 4.** Pairwise correlations of France

| Variables | bz | inde | astang | prof | liq | tx | gdp | inf |
|---|---|---|---|---|---|---|---|---|
| bz | 1.000 | | | | | | | |
| | | | | | | | | |
| inde | 0.898* | 1.000 | | | | | | |
| | (0.000) | | | | | | | |
| astang | -0.083 | -0.028 | 1.000 | | | | | |
| | (0.036) | (0.480) | | | | | | |
| prof | -0.002 | 0.025 | 0.160* | 1.000 | | | | |
| | (0.967) | (0.522) | (0.000) | | | | | |
| liq | 0.098 | 0.053 | -0.206* | -0.382* | 1.000 | | | |
| | (0.013) | (0.177) | (0.000) | (0.000) | | | | |
| tx | 0.027 | 0.023 | -0.060 | 0.095 | -0.032 | 1.000 | | |
| | (0.497) | (0.560) | (0.135) | (0.018) | (0.420) | | | |
| gdp | 0.019 | 0.023 | -0.028 | 0.010 | 0.017 | -0.017 | 1.000 | |
| | (0.633) | (0.561) | (0.480) | (0.805) | (0.662) | (0.677) | | |
| inf | -0.005 | -0.009 | -0.010 | 0.056 | -0.016 | 0.007 | 0.398* | 1.000 |
| | (0.890) | (0.819) | (0.805) | (0.162) | (0.690) | (0.858) | (0.000) | |
| **** p<0.01, ** p<0.05, * p<0.1* | | | | | | | | |

Note: Table 4 shows that the correlation matrix was used to test for multicollinearity between the study variables. By comparing the data for the four countries, the France has the highest correlation between BZ and Inddirr at 0.898.

**Table 5.** Pairwise correlations of China

| Varia-bles | bgd | bz | inde | astang | prof | liq | tx | gdp | inf |
|---|---|---|---|---|---|---|---|---|---|
| bgd | 1.000 | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| bz | 0.121* | 1.000 | | | | | | | |
| | (0.000) | | | | | | | | |
| inde | -0.107* | -0.347* | 1.000 | | | | | | |
| | (0.000) | (0.000) | | | | | | | |
| astang | -0.030* | 0.166* | -0.059* | 1.000 | | | | | |
| | (0.007) | (0.000) | (0.000) | | | | | | |
| prof | 0.012 | 0.027 | -0.007 | -0.044* | 1.000 | | | | |
| | (0.280) | (0.015) | (0.521) | (0.000) | | | | | |
| liq | 0.038* | -0.114* | 0.006 | -0.450* | 0.204* | 1.000 | | | |
| | (0.001) | (0.000) | (0.598) | (0.000) | (0.000) | | | | |
| tx | -0.002 | -0.032* | -0.005 | -0.059* | 0.029 | 0.019 | 1.000 | | |
| | (0.841) | (0.005) | (0.678) | (0.000) | (0.010) | (0.099) | | | |
| gdp | -0.080* | 0.077* | -0.048* | 0.036* | 0.069* | -0.007 | -0.083* | 1.000 | |
| | (0.000) | (0.000) | (0.000) | (0.002) | (0.000) | (0.528) | (0.000) | | |
| inf | -0.007 | 0.015 | 0.004 | -0.007 | 0.017 | -0.018 | 0.002 | -0.037* | 1.000 |
| | (0.526) | (0.186) | (0.737) | (0.519) | (0.137) | (0.105) | (0.838) | (0.001) | |
| *** *p<0.01*, ** *p<0.05*, * *p<0.1* | | | | | | | | | |

Note: Table 5 represent that the correlation matrix was used to test for multicollinearity between the study variables. By comparing the data for the four countries, the China has the highest correlation between BZ and Inddirr at 0.121.

Abbreviations: MKLev, market value of leverage; BKLev, book value of leverage; BGD, board gender diversity; BZ, broad size; Astang, asset tangibility; PROF, profitability; Liq, liquidity; Inf, inflation; GDP, gross domestic product; TX, tax; Inddirr, the Ratio Of Independent Directors.

Wintoki et al suggest that there are endogeneity problems in related studies, which stem from unobservable heterogeneity. [27] This suggests that the traditional ordinary least squares method ignores the problem of heterogeneity. Durbin-Wu-Hausman was used to test the endogeneity of the model. the results of the Hausman test showed that the original hypothesis was violated as p-value for most countries was less than 0.01. Thus, the fixed effect model is used in this model. Indeed, the French data was tested and p was found to be greater than 0.01. This suggests that the relationship between the predictor variables may be endogenous in France. Then results should be interpreted as establishing a correlation rather than determining causality. Although, the fixed effects estimator sweeps out the individual effects (αi), these are actually estimated. The plm package is used in Rstudio, it provides statistical tests to examine whether these individual effects are jointly significant. This means that the following null hypothesis is tested, $H_0: \alpha_i = 0$. In this situation, p-value is extremely small, then the null hypothesis was rejected. Therefore, it is allowed to use the FE estimator to estimate the model.

### 4.2 Regression analysis

Tables 6 and 7 present the results of the study based on a sample of companies from the UK, Germany, France and China. Table 6 shows that China has a negative BGD coefficient. So, A rise in the proportion of women on boards can lead to a decrease in market leverage. This means that gender diversity on the board leads to companies borrowing less in China. Barber and Odean researched that the large number of women are risk-adversed and they are prefer low risk strategies. Barber and Odean's view is consistent with our research findings. Dalton et al suggest that large board size may have a positive impact on firm performance. [28,29] In China the effect of board size on leverage is positive but the coefficient is approximately zero. This result may be based on the fact that the development of corporate governance in China is still immature.[23] Indeed, the board structure in China appears to be largely the result of regulation rather than based on the specific characteristics of the company. This means that board size has little or no impact on corporate leverage of listed Chinese companies. The coefficient on board size is negative for both France and Germany, a result which implies that the larger the board size, the lower the market leverage in a stakeholder-oriented corporate governance environment. Board size in the UK is also negatively correlated with market leverage in this study. This is inconsistent with the expected results based on studies of debt in a shareholder-oriented environment. Morellec et al believed that the UK is in an Anglo-Saxon corporate governance environment and therefore leverage should increase with board size. [30] In this study, only about three hundred UK listed companies were sampled. This finding bias may therefore be due to the inadequate sample size. According to the results obtained from fixed effects, board independence in China has a positive impact on leverage. But Liu et al mentioned that China's independent director system is ineffective in regulatory terms and only meets regulatory requirements. [31,32] This means listed companies retain only a minimum number of independent directors. This conclusion is supported by the data in Table 1, where the largest number of independent directors in Chinese listed companies is extremely low. Therefore, the results of the effect of independent directors on leverage in China are meaningless. Generally, board independence is inversely related to leverage in Germany but positively related to leverage in the UK. Indeed, the UK is in an Anglo-Saxon corporate governance environment, which enhances the independence of the board and allows members to increase leverage for the benefit of shareholders.

**Table 6.** Regression result (Germany and China)

| Variables | Germany | China |
|---|---|---|
| BGD | NA | -2.9529e-03<br>(0.092663 |
| BZ | -0.0014097<br>(0.5775596) | 2.3032e-03<br>(0.093100) |
| Inde | -0.0033578<br>(0.4292612) | 2.5838e-02<br>(0.450262) |

| | | |
|---|---|---|
| Astang | -0.0733208<br>(0.3228214) | -3.9131e-02<br>(0.15400*) |
| PROF | -0.2964896<br>(6.348e − 06***) | -4.9459e-01<br>(2.2e − 16***) |
| LIQ | -0.0040577<br>(0.6058427) | -5.6731e-02<br>(2.2e − 16***) |
| INF | 0.0140239<br>(0.0126534*) | 1.8100e+00<br>(2.2e − 16***) |
| GDP | -0.0056987<br>(0.0002693***) | 1.7332e-07<br>(2.2e − 16***) |
| TX | -0.0087005<br>(0.0015274**) | -1.3029e-02<br>(0.003785***) |
| AR | -0.042299 | 0.20603 |

Note: Table 6 presents the regression analysis of the fixed effects model, which is used in our estimation. ***, ** and * indicate 1%, 5% and 10% statistical significance, respectively.

**Table 7.** Regression result (UK and France)

| Variables | UK | France |
|---|---|---|
| BGD | NA | NA |
| BZ | -0.00164219<br>(0.5495658) | -0.0148323<br>(0.003052**) |
| Inde | 0.00324634<br>(0.4487577) | 0.0226496<br>(20.004042**) |
| Astang | -0.00209585<br>(0.9068400) | 0.1453782<br>(0.228979) |
| PROF | -0.02825102<br>(0.0014011**) | -0.2288521<br>(20.000168***) |
| LIQ | -0.01502583<br>(2.384e − 08***) | -0.0234982<br>(3.145e − 07***) |
| INF | -0.00167326<br>(0.6312790) | 0.0178847<br>(0.007075***) |
| GDP | -0.00257547<br>(0.0008074***) | -0.0032764<br>(0.073028) |
| TX | 0.00047788<br>(0.6574906) | -0.0018682<br>(0.76794) |
| AR | -0.098652 | -0.0092986 |

Note: Table 7 present the regression analysis of the fixed effects model, which is used in our model.

Abbreviations: MKLev, market value of leverage; BKLev, book value of leverage; BGD, board gender diversity; BZ, broad size; Astang, asset tangibility; PROF, profitability; Liq, liquidity; Inf, inflation; GDP, gross domestic product; TX, tax; Inddirr, the Ratio of Independent Directors.

### 4.3 Compared with another model

To analyze the impact of female directors on capital structure in the other three countries, the GMM model mentioned by Ezeani et al is cited. [5,6] Estimation of the system GMM is based on the mean and first difference. Both GMM models and fixed effects models solve for the unobserved heterogeneity. The empirical model was constructed as follows:

$$Lev_{ij,t}\text{-}Lev_{ij,t-1} = \lambda_j\left(Lev^*_{ij,t} - Lev_{ij,t-1}\right) + \delta_{ij,t} \tag{4}$$

$Lev^*_{ij,t}$ denotes country j and the optimal leverage ratio for individual firms in year t, Optimal leverage over time, $\lambda_j$ indicating SOA. If there is no adjustment, where $\lambda_j = 0$. Then $\delta_{ij,t}$ is the error term.

$$Lev^*_{ij,t}=\beta_j X_{ij,t-1} + F_{ij} \tag{5}$$

The vector of macroeconomic factors is denoted by $X_{ij,t-1}$, and $F_{ij}$ is estimated coefficient.

Combine equation (4) and equation (5), the final model will be obtained as following:

$$Lev_{ij,t}=\left(\lambda_j\beta_j\right)X_{ij,t-1} + \left(1-\lambda_j\right)Lev_{ij,t} + \lambda_j F_{ij} + \delta_{ij,t} \tag{6}$$

**Table 8.** Estimation of the system GMM

| | BGD | BI | BZ | BM | PROF | Astang | FSZ | MVB | Liq | NDTS | TX |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Panel A (UK) | | | | | | | | | | | |
| BGD | 1.0000 | | | | | | | | | | |
| BI | 0.3000 | 1.0000 | | | | | | | | | |
| BZ | 0.2175 | 0.1395 | 1.0000 | | | | | | | | |
| BM | 0.1241 | 0.1387 | 0.0895 | 1.0000 | | | | | | | |
| PROF | 0.1747 | 0.1027 | 0.0033 | -0.0491 | 1.0000 | | | | | | |
| Astang | -0.0476 | -0.0956 | 0.0374 | -0.0318 | -0.0053 | 1.0000 | | | | | |
| FSZ | 0.0242 | 0.1590 | 0.1297 | -0.0230 | -0.0888 | 0.0738 | 1.0000 | | | | |
| MVB | -0.0132 | 0.0229 | 0.0024 | -0.0414 | 0.0376 | -0.0219 | -0.0270 | 1.0000 | | | |
| Liq | -0.0435 | 0.0264 | 0.0148 | -0.0114 | -0.0476 | -0.0521 | 0.0465 | 0.0044 | 1.0000 | | |
| NDTS | -0.0404 | -0.0804 | 0.0356 | -0.1152 | 0.1572 | 0.4055 | -0.1236 | 0.0070 | -0.0382 | 1.0000 | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TX | 0.0324 | 0.0367 | -0.0169 | -0.0543 | 0.0368 | 0.0135 | -0.0225 | 0.0009 | -0.0162 | -0.0057 | 1.0000 |
| Panel B (Germany) | | | | | | | | | | | |
| BGD | 1.0000 | | | | | | | | | | |
| BI | 0.3640 | 1.0000 | | | | | | | | | |
| BZ | 0.2674 | 0.6357 | 1.0000 | | | | | | | | |
| BM | 0.0639 | 0.0559 | 0.1142 | 1.0000 | | | | | | | |
| PROF | 0.2370 | 0.2265 | 0.2493 | 0.0734 | 1.0000 | | | | | | |
| Astang | -0.0314 | -0.1231 | -0.1589 | 0.0423 | -0.1200 | 1.0000 | | | | | |
| FSZ | -0.0630 | 0.0725 | 0.0831 | 0.1039 | -0.0327 | -0.0524 | 1.0000 | | | | |
| MVB | -0.0543 | -0.1721 | -0.1810 | -0.0991 | -0.0900 | -0.0230 | -0.0686 | 1.0000 | | | |
| Liq | -0.0205 | 0.1464 | 0.1168 | -0.0798 | 0.1136 | 0.0850 | 0.0589 | -0.1421 | 1.0000 | | |
| NDTS | -0.2245 | -0.1782 | -0.4135 | -0.0402 | -0.2919 | 0.2063 | 0.0491 | 0.1136 | -0.0571 | 1.0000 | |
| TX | 0.0281 | 0.0081 | 0.0108 | 0.0161 | 0.0087 | 0.0299 | 0.0895 | -0.0292 | 0.0285 | -0.0887 | 1.0000 |

Note: Table 8 was drawn by Ezeani et al. In 2022, illustrating the correlation matrix. [5]

**Table 9.** Regression result

| Variable | All samples | UK | Germany | France |
|---|---|---|---|---|
| BGD | -4.11 (0.001***) | -1.82 (0.068*) | -5.9 (0.001***) | -6.95 (0.001***) |
| BI | -0.76 (-0.448) | 1.83 (0.069*) | -4.93 (0.001***) | -4.86 (0.001***) |
| BZ | -1.98 (0.047**) | 0.0010 (0.099*) | -3.69 (0.001***) | -2.15 (0.032**) |
| BM | -2.81 (0.005***) | -3.07 (0.002***) | -3.14 (0.001***) | -7.92 (0.001***) |
| PROF | -5.23 (0.001***) | -13.25 (0.001***) | 0.07 (0.945) | -1.94 (0.052*) |
| Astang | -2.14 (0.032**) | -2.59 (0.009***) | 6.02 (0.001***) | 0.34 (0.731) |
| FSZ | -2,47 (0.014***) | 2.97 (0.003***) | -3.94 (0.001***) | -10.7 (0.001***) |
| MVB | -1.42 (0.155) | -1.87 (0.062*) | -0.27 (0.785) | 2.18 (0.030**) |
| Liq | 0.74 (0.461) | 1.89 (0.062*) | -0.02 (0.983) | 2.52 (0.12**) |
| NDTS | -1.15 (0.248) | 0.81 (0.420) | -1.35 (0.178) | -0.02 (0.987) |
| TX | -1.83 (0.067*) | 0.6 (0.548) | -3.91 (0.0001***) | -1.42 (0.155) |
| Inf | -2.61 (0.009***) | - - | - - | - - |
| GDP | -0.02 (0.98) | - - | - - | - - |
| _cons | 4.11 (0.001***) | -1.45 (0.0001***) | 7.57 (0.0001***) | 15.13 (0.0001***) |
| SOA (%) | 48% | 33% | 43% | 39% |

| | | | | |
|---|---|---|---|---|
| AR1 | 0.013 | 0.022 | 0.072 | 0.052 |
| AR2 | 0.131 | 0.632 | 0.342 | 0.153 |

Note: Table 9 presents the regression analysis of generalized method of moments (GMM) [5].

An absolute value correlation equal to or greater than point eight may mean that there is a multicollinearity problem. The largest absolute value correlation can be found in table 8 at 0.7938, which is small than 0.8. This evidence suggests that GMM models, as well as fixed effects models, do not suffer from multicollinearity. Table 9 gives the regression results for the UK Germany and France in the GMM model. It points out that increased gender diversity on boards of directors in both stakeholder-oriented Germany, France and shareholder-oriented UK has reduced the use of debt by companies. This is consistent with the impact of board diversity on capital structure in China studied. Further confirming Barber and Odean's view that women are more likely to adopt a low-risk strategy and thus reduce their company's leverage.

## 5 Conclusion

In conclusion, the characteristics of the board have a significant influence on the capital structure after controlling the generally accepted factors influencing capital structure, such as the liquidity, profitability, asset tangibility, etc. One important implication of this study is that gender diversity on the board is negative with the leverage in China, which is similar to the evidence from the other three countries. Turning to board size, this study shows that it seems to have little or no impact on corporate leverage of listed Chinese companies, while it significantly negative for UK, Germany and France. The result also suggests that the effect of independent directors on leverage is positively related to leverage in UK and France. This finding above highlights the importance of the independence of the board that allows members to increase leverage for the benefit of shareholders. Nevertheless, board independence is in inverse proportion to leverage in Germany, representing a stakeholder-oriented environment. Second, the ratio of independent directors in Chinese private listed companies is not related to the capital structure. This result implies that the independent directors of privately listed companies in China are not yet functioning as they should, and that privately listed companies need to further improve the system of independent directors to effectively enhance the independence and professionalism of their boards of directors.

This study not only focuses on firms in developed countries, but also investigates the data from a developing country where the market is quite different from the European countries. Unlike the current study, this paper compares the results attained from both developed and developing countries. Another significant advantage is that it further addresses the distinction between shareholder environments and stakeholder environments, indicating the board independence reflects the distinctions of two environments. While this study finds the impact of board characteristics on capital structure, it remains to be seen whether this result will be unchanged if a larger sample from these four countries. This limitation can be eliminated by including more countries with different environments. Another limitation is that this fixed effects model may ignore the endogeneity of these variables, which leads to the bias of findings. Furthermore, the

current study focused on the number of female directors on the board. However, it may by interesting that further research can address how the personalities of directors affect the capital structure.

In summary, there is still much that needs to be optimized, both in terms of empirical research as more countries are included, and in the theoretical model that provides a further clearer link between characteristics of the board and capital structure choice.

## Acknowledgement

Fujun Li, Yichi Gong and Yushan Tang contributed equally to this work and should be considered co-first authors.

## References

1. Myers S C., "Determinants of Corporate Borrowing", Journal of Financial Economics, PP147-175,1977.
2. Hermalin, B.E. and Weisbach, M.S. (2001) Boards of Directors as an Endogenously Determined Institution: A Survey of the Economic Literature. National Bureau of Economic Research.
3. John, K. and Senbet, L. (1988) Limited Liability, Corporate Leverage, and Public Policy. New York University and University of Wisconsin-Madison, Mimeo.
4. John, K. and Senbet, L. (1988) Limited Liability, Corporate Leverage, and Public Policy. New York University and University of Wisconsin-Madison, Mimeo.
5. Ezeani, E., Kwabi, F., Salem, R., Usman, M., Alqatamin, R.M.H. and Kostov, P., 2022. Corporate board and dynamics of capital structure: Evidence from UK, France and Germany. International Journal of Finance and Economics.
6. Ezeani, E., Salem, R., Kwabi, F., Boutaine, K. and Komal, B., 2022. Board monitoring and capital structure dynamics: evidence from bank-based economies. Review of Quantitative Finance and Accounting, 58(2), pp.473-498.
7. Berger, G. Philip, Eli Ofek and David L. Yermack, 1997, Managerial entrenchment and capital structure decisions, Journal of Finance 52, 1411-1438.
8. Byrd, J.w.and K.A.Hickman. (1992). Do Outside Directors Monitor Managers? [J]. Journal of Financial Economics, (vo132): 195~221
9. Evans C.R. and K.L. Dion. (1991). “Group Cohesion and performance: A Meta-Analysis.” Small Group Research, 22(7): 175-186.
10. Lipton, M., and J.W. Lorsch, 1992, “A Modest Proposal for Improved Corporate Governance”, Business Lawyer 48: 59-77.
11. Stinerocka R N, Sternb B B, Solomon M R., (1991) Gender Differences in the Use of Surrogate Consumers for Financial Decision-Making [J]. Journal of Professional Services Marketing, 7 (2):167-182.
12. Singh, V. & Vinicombe, S. (2004). Why so few women directors in top UK boards? Evidence and theoretical explanations. Corporate Governance: An International Review, 12: 479~488.
13. Alqatan, D., Chbib, I. and Hussainey, K., 2019. How does board structure impact on firm performance in the UK? Corporate Board: Role, Duties and Composition, 15(2).

14. Vijayakumaran, S. and Vijayakumaran, R., (2019). Corporate governance and capital structure decisions: Evidence from Chinese listed companies. Vijayakumaran, R., and Vijayakumaran, S. (2019). Corporate governance and capital structure decisions: Evidence from Chinese listed companies. Journal of Asian Finance, Economics and Business, 6(3), pp.67-79.
15. Saad, S.B. and Belkacem, L., 2021. Does board gender diversity affect capital structure decisions? Corporate Governance: The International Journal of Business in Society.
16. Amin, A., ur Rehman, R., Ali, R. and Mohd Said, R., 2022. Corporate Governance and Capital Structure: Moderating Effect of Gender Diversity. SAGE Open, 12(1), p.21582440221082110.
17. Antoniou, A., Guney, Y., & Paudyal, K. (2008). The determinants of capital structure: Capital market-oriented versus bank-oriented institutions. Journal of Financial and Quantitative Analysis, 43, 59–92.
18. Jiang, F.X., & Kenneth, A.K. (2020). Corporate Governance in China: A Survey. (Volume. 24, Issue. 4, Pages.733–772). Review of Finance.
19. Kieschnick, R., & Moussawi, R. (2018). Firm age, corporate governance, and capital structure choices. Journal of Corporate Finance, 48, 597–614.
20. Byoun, S. (2008). How and when do firms adjust their capital structures toward targets? The Journal of Finance, 63(6), 3069–3096.
21. Öztekin, Ö., & Flannery, M. J. (2012). Institutional determinants of capital structure adjustment speeds. Journal of Financial Economics, 103(1), 88–112.
22. Tran, D. H. (2014). Multiple corporate governance attributes and the cost of capital–evidence from Germany. The British Accounting Review, 46(2), 179–197.
23. Jiang, F., and Kim, K.A. (2015), "Corporate governance in China: a modern perspective", Journal of Corporate Finance, Vol. 32, pp. 190-216.
24. Dang, V. A., Kim, M., & Shin, Y. (2014). Asymmetric adjustment toward optimal capital structure: Evidence from a crisis. International Review of Financial Analysis, 33, 226–242.
25. Shao, L. (2019). Dynamic study of corporate governance structure and firm performance in China: Evidence from 2001-2015. Chinese management studies, 13(2), pp.299–317.
26. Gujarati, D. N., & Porter, D. C. (1999). Essentials of econometrics (Vol. 2). Irwin/McGraw-Hill Singapore.
27. Wintoki, M.B., Linck, J.S. and Netter, J.M. (2012), "Endogeneity and the dynamics of internal corporate governance", Journal of Financial Economics, Vol. 105 No. 3, pp. 581-606.
28. Barber, B. M., & Odean, T. (2001). Boys will be boys: Gender, over-confidence, and common stock investment. The Quarterly Journal of Economics, 116(1), 261–292.
29. Dalton, D.R., Daily, C.M., Johnson, J.L. and Ellstrand, A.E. (1999), "Number of directors and financial performance: a Meta-analysis", Academy of Management Journal, Vol. 42 No. 6, pp. 674-686.
30. Morellec, E., Nikolov, B., & Schürhoff, N. (2012). Corporate governance and capital structure dynamics. The Journal of Finance, 67(3), 803–848.
31. Liu, Y., Miletkov, M.K., Wei, Z. and Yang, T. (2015), "Board independence and firm performance in China", Journal of Corporate Finance, Vol. 30 (C), pp. 223-244.
32. Miloud, T. (2022). Corporate governance and the capital structure behavior: empirical evidence from France. Managerial finance, 48(6), pp.853–878.

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