ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Master's Thesis: MSc. Accounting Auditing and Control

Gender diversity on corporate boards: implications for firm profitability, liquidity and efficiency.

Student Name	Hansi Hettiarachchi
Student Number	469667
1st Supervisor	Prof. Ying Gan
2nd Supervisor	Prof. Jeroen Suijs
Date of submission (2st draft)	8th August 2021

Abstract

The causes and consequences of gender diversity in corporate boardrooms have been widely studied, but with little academic consensus with regard to the results. This study draws insights from leading psychological theories on the male and female behaviour within the boardroom. Furthermore, using a sample of S&P 500 firms, this paper tests the relation between board gender diversity and firm performance. Ordinary least squares regression is used to measure the effect of the board gender ratio on return on assets, current ratio and asset turnover respectively. My results suggest a positive relation between board gender diversity and firm liquidity, but do not show a relation between board gender diversity and profitability and efficiency.

Table of Contents

Introduction

In many parts of the world, gender equality is becoming a social phenomenon of increasing significance. This translates into the corporate sphere in many ways - a particularly observable one is the representation of women in leadership positions. Many firms, particularly in the United States, are being subject to increasing public pressure to promote gender diversity in the boardroom (Adams & Ferreira, 2009). Although there are no gender quotas mandating the presence of female directors in the US, SEC disclosure rules and various firm stakeholders tend to nudge firms towards appointing a larger proportion of female directors. While boardroom gender diversity can be expected to increase, current literature provides only limited and inconsistent evidence as to what economic implications this may have for firms (Gonzalez & Hagendorff, 2014).

Prior studies make a theoretical 'business case' for more female directors on corporate boards. A key argument is that if a segment of society is systematically excluded from boardrooms for factors other than their level of competence, resulting board compositions are sub-optimal (Burke, 1999; Cassell, 2000; Carver, 2002). Furthermore, it is argued that women contribute a unique skill set that is much needed within a well-functioning board (Boutchkova et al., 2021). However, although a gender-diverse board could be expected to improve board decision making and hence firm performance (Kumar & Zattoni, 2016), the empirical evidence has remained inconclusive (Ferreira, 2015; Larcker, Richardson, & Tuna, 2007). Most research in the area of gender diversity on boards of directors focuses on firm profitability and, so far, there is no consensus in the literature on the relationship between board female representation and firm performance. Some studies find that board diversity leads to better performance, others find no such relationship (e.g., Carter et al., 2003, Gregory-Smith et al., 2014). Using a fairly recent sample from 2018, this paper contributes to the debate by considering the research question:

Does diversity on the management board have an effect on firm performance?

The contribution of this paper is twofold: unlike most prior work that focus solely on firm profitability, this paper considers three metrics of firm performance: profitability, liquidity and efficiency. Furthermore, this paper draws from various multidisciplinary studies to establish a firm theoretical framework as to how male and female behaviour differs, and how this can in turn translate into different financial outcomes for the firm. The results of this study could yield useful

insights to various firm stakeholders as to what the financial consequences of increased boardroom gender diversity would be. This in turn could also inform and influence policy-making with respect to diversity legislation.

This paper is structured as follows: first, the literature review unpacks insights from three leading psychological theories as to how male and female behaviour can differ - these are then applied to the context of this study, the boardroom. Next, the role of the board of directors and corporate governance implications of female board representation are discussed. Hypotheses are formulated to check for a positive relation between increased board gender diversity and performance in terms of profitability, liquidity and efficiency. Using a sample of 423 S&P 500 firms, ordinary least squares (OLS) regressions are used to test the relation between the proportion of women on board and the return on assets, current ratio and asset turnover as proxies for profitability, liquidity and efficiency respectively. The corresponding results suggest that there is a positive relation between board gender diversity and firm liquidity, but fails to find a relation between board gender diversity and profitability or efficiency.

Theoretical Background

This chapter first establishes the differences in behaviour between men and women, in order to establish a foundation as to why a mixed-gender boardroom could be different from an all-male one. This is done by considering three leading psychological theories on gender differences followed by gender-based variations in preferences. Subsequently, the importance of the board of directors and the implications for corporate governance of female representation is also described.

Gender-based differences in behaviour: evidence and explanations from psychology and behavioural economics

Cognitive social learning theory

Cognitive social learning theory, as formulated by Bussey & Bandura (1999) posits that human behaviour is shaped by reinforcements and punishments. Furthermore, people imitate or model others in their environment, particularly if these others are powerful or admirable. This suggests that the underrepresentation of females in positions of power - such as in corporate board positions - is likely to create a cycle where young girls and women are not encouraged to take up these roles as they are not exposed to sufficient role models to emulate. Recent extensions of the theory incorporate cognitive factors such as attention, self-regulation, and self-efficacy. Of these, Hyde (2013) suggests that self-efficacy, or a person's belief in their ability to fulfil a challenging task, can be particularly important in explaining gender differences. For instance, a study by Else-Quest et al. (2010) reveals that although girls' math performance is equal to that of boys, generally a wider gender gap in math self-efficacy exists. It is theorized that in the general population, women tend to have lower self-efficacy than men. Self-efficacy plays a powerful role in shaping people's decisions about whether to take on a challenging task, such as majoring in mathematics (Hyde, 2013). In the context of this study, it could partially explain why fewer women take up powerful positions in the corporate world, leading to a smaller candidate pool for female directors. Further research is needed as to whether lower self-efficacy is also present in female as compared to male board directors to investigate whether this trait could influence decision making and in turn, financial results.

Sociocultural theory

The essential argument of sociocultural theory is that a society's division of labour by gender drives all other psychological gender differences. Therefore, psychological gender differences are a result of individual accommodations of the restrictions placed on their gender by their society. This theory acknowledges that historically, the division of labour by gender was influenced by biological differences in men and women such as variations in size and strength, and the female capacity to bear children. Contemporary gender differences are psychological, and find their origin in this prehistoric division of labour. In a modern context, researchers have tested the hypothesis that psychological gender differences should be smaller in nations with higher gender equality. Domain-specific indicators of gender inequality, such as the women's share of research positions in nations were successful in predicting cross-national differences in smaller gender gaps in both math performance as well math self-efficacy. This theory could be used as a starting point for explaining geographical differences in female board representation, where countries with higher measures of gender inequality also have fewer women occupying corporate board positions.

Expectancy-value theory

Eccles's expectancy-value theory (Eccles et al. 1994, Meece et al. 1982), builds on multiple phenomena discussed above. It proposes that two categories of factors contribute to a person's decision to take on a challenging task, such as enrolling in advanced calculus in high school: expectancies (expectations of success at the task) and task values (e.g., interest in the task, usefulness of the task for current or future goals). These expectancies and values are in turn influenced by many factors. For instance, an adolescent's expectancy of success in a calculus course may be influenced by her own perception of math ability, past achievement experiences (scores on standardized tests, grades in past math courses), socializers' beliefs and behaviours (parents' belief that a highly technical career would be a good fit for their daughter), and the broader socio-cultural milieu (the gender distribution that she observes in her intended occupation) (Hyde, 2013). This theory further corroborates the idea that social phenomena beyond the individual influence individual career outcomes. In terms of this paper, this implies that discrepancies in male and female socialization are linked to variances in the degree of female board representation over time and across different cultures.

Gender-based differences in preferences

Personal preferences, to a large extent, shape decision making. Differences in the preferences of male and female board directors could therefore lead to different sets of decisions and different financial outcomes for a company given the same circumstances. A vast body of literature attempts to reconcile gender-based differences in preferences. Crozon and Gneezy (2009) provide a comprehensive review of economic experiments that attempt to isolate these preferences from the decisions made by individuals. They focus on three widely studied aspects: risk preferences, social preferences and competitive preferences.

Firstly, in terms of risk preferences, their results indicate that women are in general more risk-averse than men. A major factor for this is stated to be different emotional reactions to similar situations: previous research demonstrates that women are more likely to express fear and men are more likely to express anger in identical scenarios (Grossman and Wood 1993); in turn, it is evidenced that individuals evaluate gambles as riskier when they are afraid rather than when they are angry (Lerner et al., 2003). A second reason for this difference is that men tend to be more overconfident in their ability to succeed than women (Lichtenstein et al., 1982; Deaux and Farris, 1977; Lundeberg et al., 1994).

However, it is important to note that this discrepancy between male and female risk preference disappears in samples of managers or entrepreneurs: both men and women in these roles display similar attitudes towards risk. This is attributed to the self-selection of more risk-seeking women into these positions (Crozon and Gneezy, 2009). For female directorships, while this could mean that there are no significant differences in risk preferences, it could also mean that the candidate pool for female directors is smaller as the general female population is more risk-averse.

With regards to social preferences - or preferences in decision making when involving another party - the authors find mixed evidence for gender discrepancies. In some experiments, women are more altruistic, cooperative, inequality averse and reciprocal than men, and in others, they are less so. The authors attribute the cause of these conflicting results to the idea that women are more sensitive to cues in the experimental context than

are men. As suggested by Gilligan (1982), men's decisions are less context-specific than women's. Participants of both genders are likely maximizing an underlying utility function, but the function that men use is less sensitive to the conditions of the experiment, information about the other party, and the other party's actions than the function that women use. Varying social preferences of female directors could indicate that boards with a strong female presence make different decisions in different contexts compared to all-male boards, which could in turn influence financial performance. It is, however, uncertain if this possible change in financial performance would be positive or negative.

Finally, as for competitive preferences, extant literature suggests that women's preferences for competitive situations in Western societies are lower than men's, both in purely competitive and bargaining settings. Evidence and explanations are provided both from a 'nurture' or socialization angle by comparing samples from matriarchal and patriarchal societies (women from matriarchal societies are shown to be more competitive) and a 'nature' or biological perspective: the levels of testosterone and other hormones such as cortisol affecting competitiveness are known to be different among genders. A significant body of literature exists linking the role of testosterone to competitiveness (Bateup et al., 2002). Varying competitive preferences between men and women directors could also have varying implications for business outcomes, in terms of, for instance, securing bids and maintaining good relationships with business partners - the direction of this relationship has not been adequately confirmed by current literature.

The importance of the board of directors and the impact of board female representation.

Role of the board of directors within a firm

A firm's board of directors is often considered its first line of defence in corporate governance. Its importance is reflected in the vast body of corporate governance literature and the level of regulatory scrutiny they attract (Ferreira & Kirschmaier, 2013). In public corporations, the board of directors represent the highest point of the decision-making process; all major operational or strategic decisions and overarching firm policies must be reviewed by the board. Furthermore, it has access to timely, privileged information

pertaining to the firm as well as holding a fiduciary obligation towards the shareholders it represents (Kassinis & Vaeas, 2002).

The role of the board of directors extends to advising and monitoring the management and as such is typically composed of individuals who are well experienced and skilled in performing such duties. The board usually includes inside directors and outside directors: the former refers to current and former members of the top management team, and the latter serves the role of professional referees who oversee and monitor top management (Fama, 1980). It should also be acknowledged that the extent to which the board can carry out its function effectively also depends on the quality of the information provided by the management (Adams & Ferreira, 2007).

Female representation in the board of directors: implications for corporate governance.

Prior literature suggests that boards with three or more women are significantly different from fully male boards. A significantly higher number of boards with women explicitly identifies criteria for measuring corporate strategy (three quarters compared to less than half) and explicitly monitors the implementation of the strategy (94 per cent compared to only two thirds) compared to their all-male counterparts (Brown et al., 2002). More female board representation is also associated with better conflict of interest guidelines and ensuring a code of conduct for a firm. Such boards are also more likely to have a greater degree of board accountability with formal limits to authority and director orientation programs.

Moreover, the presence of female directors is said to increase the likelihood of forced CEO departures after poor stock price performance (Adams and Ferreira, 2009) and is associated with greater quality and accuracy of financial accounting information (Clatworthy & Peel, 2013; Gul et al., 2011). Furthermore, female directors improve firm transparency by increasing public disclosure of corporate information (Gul et al., 2011). Boards with two or more female directors emphasize the importance of search consultants than other boards, likely undermining the influence of the ‘old boys network’ and increasing transparency in selection for executive positions (Terjeson et al., 2009).

The presence of three or more females on corporate boards is also associated with improved communication between the board and its various stakeholders (Terjeson et al., 2009). Nevertheless, other research also suggests that boards that are too dissimilar might lack sufficient cohesion and unity: diverse boards may have an increased likelihood of team conflicts and thus impede the speed and quality of decision making (Pelled, Eisenhardt, & Xin, 1999). Board diversity may also foster social categorization within boards that is disruptive to board effectiveness. In addition, diversity might result in tokenism, whereby directors are hired not entirely based on their own merit, but rather for token diversity purposes (Larcker and Tayan, 2011, Torchia et al., 2011).

On the other hand, further research also argues that women are generally more ethical and are better at promoting deliberation and communication - traits that suggest that women are better suited to monitoring roles than men (Albaum & Peterson, 2006; Larkin, 2000). Recent research also provides evidence that female directors are indeed tougher monitors of the CEO. Female directors are less likely to miss board meetings and are more likely to hold positions on monitoring committees. However, Adams and Ferreira (2009) posit that although a gender diverse board is associated with more stringent board monitoring, it might not translate into better firm performance. Gender diversity is only observed to enhance the value of those firms with weaker shareholder rights - additional board monitoring is beneficial in this case, while it is harmful to companies with stronger shareholder rights.

Hypothesis development

The business case for women on boards

Prior studies make a theoretical 'business case' for more female directors on corporate boards. A key argument is that if a segment of society is systematically excluded from boardrooms for factors other than their level of competence, resulting board compositions are sub-optimal (Burke, 1999; Cassell, 2000; Carver, 2002). Furthermore, it is argued that women contribute a unique skillset that is much needed within a well-functioning board (Boutchkova et al., 2021)

The potential benefits from female board representation can be seen as two-fold: boardroom specific and company wide (Huse, 2005; Nielsen and Huse, 2010; Singh, Vinnicombe and Terjesen, 2007). Diversity could contribute to more effective boardroom behaviour, better decision making and a more holistic understanding of the workforce and marketplace. Corporate performance, on the other hand, is ultimately influenced by diversity through an enhanced firm reputation, increased legitimacy, attracting further investments by ethically minded investors and inspiring female employees at lower levels.

However, increasing board diversity comes with additional costs: diverse top management teams are challenging to coordinate and conflicts may occur more frequently. It is unclear if these costs outweigh potential benefits (Smith et. al, 2006). In fact, Adams and Ferreira (2008) unearth a negative relation between gender diversity and firm performance which is attributed to over-monitoring in firms that already have strong corporate governance in place. Darmadi (2011) also observes that the presence of women on corporate boards negatively impacts firm performance in a sample of Indonesian firms; he speculates that this is might be due to the appointment of women to corporate boards based on familial ties rather than occupational expertise. Wang and Clift (2009) and Carter et al. (2010) fail to find significant relations between gender diversity and firm performance for Australian and US samples respectively; they attribute this to the contingency effect of board diversity on board performance.

Overall, although a gender-diverse board could be expected to improve board decision making and hence firm performance (Kumar & Zattoni, 2016), the empirical evidence attempting to measure this link has remained inconclusive (Ferreira, 2015; Larcker, Richardson, & Tuna, 2007). Most research in the area of gender diversity on boards of directors focuses on firm profitability and, so far, there is little to no consensus in the literature on the relationship between board female representation and firm performance. While some studies find that board diversity leads to better performance, others fail to find such an association (e.g., Carter et al., 2003, Gregory-Smith et al., 2014).

Other metrics of firm performance

Considering that a significant body of literature focuses on linking board gender diversity with profitability, this paper attempts to investigate the impact of board gender diversity on other metrics of firm performance, namely liquidity and efficiency. The link with profitability will also be investigated with more recent data. As theoretical arguments generally tend to point towards female board representation improving firm financial performance, the hypotheses of this paper are formulated as follows:

H1: There is a positive relation between the proportion of female board directors and firm profitability.

H2: There is a positive relation between the proportion of female board directors and firm liquidity.

H3: There is a positive relation between the proportion of female board directors and firm efficiency.

Data and Methodology

This section discusses the dataset used for the purpose of this study. First, the data sources and sample utilized are described, followed by an explanation of the variables and their operationalization. A table of descriptive statistics for key firm-level variables is provided and the methodology employed is discussed.

Data source, sample and variable description

The data used in this study is extracted from multiple databases available via the Wharton Research Data Services (WRDS) interface. Data concerning the number of male and female board members is obtained from the Execucomp database, and this is used to manually compute the variables gender ratio and board size. All financial ratios used are obtained from the WRDS financial ratios suite. The variable Total Assets is obtained via Compustat Global North America.

The sample used comprises of firms included in the Standard and Poor's 500 (S&P 500), which is a stock market index consisting of 500 large, listed companies in the United States. For the purpose of this study, this setting is useful due to the existence of a sufficient number of gender diverse boards. Due to data constraints, the sample is limited to observations from 2018. Omitting observations with missing values yields a total sample size of 423 firms.

In order to test the aforementioned hypotheses, gender ratio is the key variable of interest - it is hand calculated as the number of female directors divided by the number of male directors. The proportion of women on the board is a frequently used measure in extant literature (Isidro and Sobral, 2015). The profitability, liquidity and efficiency of a firm is captured by its return on assets (ROA), current ratio (CR), and asset turnover (AT) respectively; these are included as independent variables in separate regression models and are further discussed below in the methodology section.

To control for the effects of other firm characteristics, a selection of other financial ratios are included as control variables. A full list of these variables is provided in the appendix. The

variable total assets is used to control for firm size and board size is used to account for differences in the size of the board of directors. Industry effects are used to isolate discrepancies across sectors - industry classification is based on 2-digit Standard Industry Classification codes.

Table 1 summarizes the key descriptive statistics for this dataset. There appears to be no major skewness in the data as the mean and median values for each variable do not differ significantly. On average, firms in the sample have a board gender ratio 0.17, which is equivalent to an average presence of female directors of 17%. Figure 1 plots the logarithm of total assets against the board gender ratio and represents the board size through the colour of the scatter points. The board gender ratio appears to be quite evenly distributed across firms of all sizes; there is no visible association that larger firms tend to have greater board gender diversity or vice versa. The same is true for the board size: firm size does not appear to make much of a difference for the number of directors on the board. These observations are confirmed by a pairwise correlation check conducted in the results section (Table 5), which demonstrate no major correlation among any of the variables utilized.

Table 1. Summary of key firm level variables

Number of observations = 423	Mean	Median	Standard Deviation	Minimum	Maximum
Gender Ratio	0.17	0.17	0.22	0.00	1.50
Log (Total Assets)	9.96	9.86	1.44	5.83	14.78
Board Size	5.49	5.00	0.84	3.00	10.00
Return on Assets	0.15	0.14	0.09	-0.11	0.72
Current Ratio	1.46	1.21	1.27	0.00	8.03

Asset Turnover	0.78	0.61	0.68	0.04	4.60

This table outlines key descriptive statistics for the observations included in the sample. All figures except Total Assets are correct to 2 decimal places. Total Assets are quoted in thousands, US dollars.

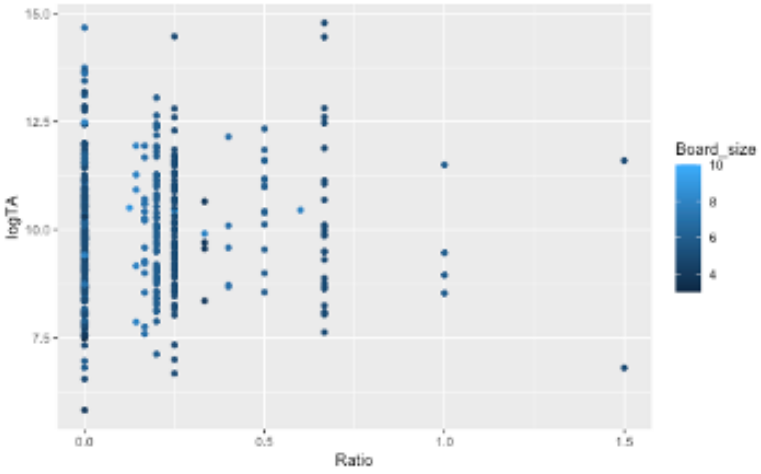

Figure 1: Relation between the logarithm of total assets (logTA), board gender ratio (Ratio) and the number of directors on the board (Board_size)

Methodology

In order to investigate whether the gender ratio of a board of directors has any effect on the profitability, liquidity and efficiency of a firm, ordinary least squares (OLS) regressions are performed. Gender ratio remains the variable of interest in all models: if a relationship exists, the coefficient of this variable is expected to be positive and significant.

The first hypothesis to be tested focuses on firm profitability and is reformulated below:

H1: There is a positive relation between the proportion of female board directors and firm profitability.

Firm profitability is operationalised as the Return on Assets (ROA), which is defined as Net Income before extraordinary items over Total Assets. This measure yields a metric for profitability that accounts for firm size. The model constructed to test this hypothesis includes various firm level ratios as control variables to account for differences in firm characteristics such as liquidity (current ratio), efficiency (asset turnover) and solvency (total debt/ EBITDA). Industry effects are also included.

Additionally, research and development (R&D) funding has been shown to increase the likelihood of innovation (Heimonen, 2012). The inclusion of the research and development over sales variable, therefore, controls for an element of innovation scaled by firm size (as measured by sales), and accounts for the fact that groups of companies with certain characteristics - such as firm age and industry - tend to spend more on R&D. It should be noted that R&D is not a perfect proxy for innovation, primarily as R&D spending might be inefficient; also, innovation is an abstract concept that has multiple drivers in a corporate context making it difficult to operationalise empirically. This model is formulated as follows:

Model 1: ROA = Gender Ratio + Board Size + Current Ratio + Asset Turnover + Total Debt/ EBITDA + Research and Development/Sales + log(Total Assets)

The second hypothesis, as formulated below, considers the effect of board gender diversity on firm liquidity:

H2: There is a positive relation between the proportion of female board directors and firm liquidity.

Here, firm liquidity is operationalized with the current ratio, which is obtained by dividing a firm's current assets by its current liabilities. This reflects a company's ability to generate enough cash to pay off all its liabilities as they are due, making it an appropriate measure of liquidity. The model to test this hypothesis is formulated in a similar vein to Model 1, but with the current ratio as the independent variable.

Model 2: Current Ratio = Gender Ratio + Board Size + ROA + Asset Turnover + Total Debt/ EBITDA + Research and Development/Sales + log(Total Assets)

Finally, the third hypothesis captures the link between board gender diversity and firm efficiency.

H3: There is a positive relation between the proportion of female board directors and firm efficiency.

In this case, efficiency is represented by the Asset Turnover of a firm. This is calculated as the ratio of Total Sales to Average Assets. Average assets are equivalent to the sum of the total assets at the beginning of the period and the total assets at the end of the period, divided by two. The regression model to test this relation is similar to the previous models, and is formulated as follows:

Model 3: Asset Turnover = Gender Ratio + Board Size + ROA + Current Ratio + Total Debt/ EBITDA + Research and Development/Sales + log(Total Assets)

Results

Key findings

In order to empirically verify whether the board gender ratio has an impact on firm performance, the formulated hypotheses are tested. The following section discusses the results obtained from the statistical tests carried out to this effect. The resulting regression coefficients are summarised in the tables below. All analyses are conducted in the programming environment R Studio, and a significance threshold of 5% is used to determine whether to reject the null hypotheses or conclude that there is insufficient evidence to do so.

Table 2 summarises the results pertaining to the effects of board gender diversity on firm profitability as represented by hypothesis 1: *There is a positive relation between the proportion of female board directors and firm profitability.* The expected coefficient for the gender ratio variable, in this case, is positive; however, the results demonstrate that the positive coefficient of 0.0115 is not statistically significant. In line with most prior research, it is not possible to confirm in this case that there is a positive relation between the proportion of female board directors and firm profitability. The null hypothesis is therefore not rejected.

Table 2. Linear regression estimates of Gender Ratio on Return on Assets

Variables	Coefficients (Model 1)
Constant term	0.1142 (0.0784)
Gender Ratio	0.0115 (0.0156)
Board Size	0.0066 (0.0041)

Asset Turnover	0.0637***
	(0.0092)
Current Ratio	0.0103**
	(0.0035)
Total Debt/EBITDA	-0.0067***
	(0.0019)
Research and development/Sales	-0.1737**
	(0.0012)
log(Total Assets)	-0.0092**
	(0.0033)
Observations	423
Adjusted R^2	0.507

*Notes: This table reports coefficients from the OLS regression run on the dependent variable ROA (return on assets) conducted on the full sample. The variable Gender Ratio - or the proportion of female to male directors - is the variable of interest, while the other listed variables are used as control variables. Standard errors are given in parentheses, and significance stars are used to indicate p-values * p-value < 0.1 , ** p-value < 0.05, *** p-value < 0.01. All variables are described in appendix 1.*

The results pertaining to the second hypothesis: *There is a positive relation between the proportion of female board directors and firm liquidity* are summarised in Table 3. The coefficient of gender ratio is again expected to be positive. In this case, the coefficient obtained is also positive and significant (0.6215). This implies that a 1% increase in the board gender ratio would lead to a 0.6215% increase in firm liquidity. The null hypothesis is rejected in favour of the aforementioned alternative hypothesis: there is enough evidence

on the basis of this statistical test to conclude that a more diverse board leads to increased firm liquidity.

Table 3. Linear regression estimates of Gender Ratio on Current Ratio

Variables	Coefficients (Model 1)
Constant term	2.8792* (1.1395)
Gender Ratio	0.6215 ** (0.2263)
Board Size	0.0042 (0.0602)
Return on Assets	2.2180** (0.7606)
Asset Turnover	-0.1880 (0.1436)
Total Debt/EBITDA	-0.0493 0.0287
Research and development/Sales	4.3893*** (0.7552)
log(Total Assets)	-0.1242* (0.0494)

Observations	423
Adjusted R^2	0.4206

*Notes: This table reports coefficients from the OLS regression run on the dependent variable Current Ratio conducted on the full sample. The variable Gender Ratio is the variable of interest, while the other listed variables are used as control variables. Standard errors are given in parentheses, and significance stars are used to indicate p-values * p-value < 0.1 , ** p-value < 0.05, *** p-value < 0.01. All variables are described in appendix 1.*

Table 4 presents the results relating to the third hypothesis: There *is a positive relation between the proportion of female board directors and firm efficiency.* Similarly to the first hypothesis, the expected sign of the coefficient of Gender ratio is positive, however, the actual coefficient is not significant. Therefore, there is insufficient evidence to conclude that a higher proportion of female directors could lead to improved firm efficiency: the null hypothesis is not rejected.

Table 4. Linear regression estimates of Gender Ratio on Asset Turnover

Variables	Coefficients (Model 1)
Constant term	1.2783** (0.4151)
Gender Ratio	0.0915 (0.0835)
Board Size	-0.0119 (0.0220)
Return on Assets	1.8240*** (0.2646)

Current Ratio	-0.0252 (0.0192)
Total Debt/EBITDA	-0.0084 0.0106
Research and development/Sales	-0.3604 (0.2883)
log(Total Assets)	-0.0844 (0.0177)
Observations	423
Adjusted R^2	0.7317

*Notes: This table reports coefficients from the OLS regression run on the dependent variable Asset Turnover conducted on the full sample. The variable Gender Ratio is the variable of interest, while the other listed variables are used as control variables. Standard errors are given in parentheses, and significance stars are used to indicate p-values * p-value < 0.1 , ** p-value < 0.05, *** p-value < 0.01. All variables are described in appendix 1.*

Overall, the results of the first and third models are in line with prior literature that fails to identify a link between the board gender ratio and firm financial performance. This could be attributed to the possibility that at the boardroom level, the behaviour and decision making of male and female directors are not significantly different, leading to similiar financial outcomes. However, it could also mean that these models are not capable of accurately capturing the effect of the gender ratio on firm profitability, as there are many drivers of firm profitability that are difficult to capture in an empirical model. At a sociological level, there is also the possibility that since female board representation is quite low (average of 17%), the effects of their presence are not fully felt in the boardroom, due to factors such as discrimination and tokenism. These possibilities are discussed in further detail in the discussion and conclusion section.

The second regression model on the other hand, indicates that there is a positive relation between the proportion of women on the board and firm liquidity. As a higher firm liquidity is generally associated with lower firm risk (Imbierowicz & Rauch, 2014), this result could potentially be linked to women's higher aversion to risk, as established in the theoretical framework. This contradicts the claim of Crozon and Gneezy (2009) that there are no significant differences in risk-preferences between men and women in leadership positions, due to more risk-seeking women self-selecting into these roles. However, this result should be interpreted with some caution due to certain econometric and sociological limitations of this study, as discussed in the final section.

Robustness checks

Multicollinearity check

To check for collinearity between the independent variables, a pairwise correlation test is conducted on all variables used in the sample: the results are presented in Table 5 below. The variance inflation factors (VIFs) for each predictor are also calculated as depicted in Table 6. In an OLS regression, it is assumed that the independent variables are uncorrelated with each other. Multicollinearity results if this assumption doesn't hold, which reduces the precision of the coefficients estimated.

Table 5: Pairwise correlations of variables

Variable	*Gender Ratio*	*Board Size*	*ROA*	*Total Debt/ EBITDA*	*Current Ratio*	*Asset Turnover*	*Research & Development /Sales*	*log(Total Assets)*
Gender Ratio	1.000	0.018	0.018	-0.026	0.078	0.011	0.028	0.056
Board Size		1.000	0.047	0.052	-0.034	0.043	0.002	0.124
ROA			1.000	-0.417***	0.349***	0.462***	0.056	-0.481***
Total Debt/ EBITDA				1.000	-0.387***	-0.294***	-0.293***	0.443***
Current Ratio					1.000	0.0121	0.455***	-0.433***
Asset Turnover						1.000	-0.107	-0.325***
Research & Development/ Sales							1.000	-0.216***
log(Total Assets)								1.000

Notes: This table presents the pairwise correlation coefficients of all variables used. Significance stars are used to indicate p-values
** p-value < 0.1 , ** p-value < 0.05, *** p-value < 0.01*

The variable of interest gender ratio displays no major correlation with any other variable, which is desirable for the purpose of this study: these coefficients can be reliably interpreted based on this result alone. Some control variables display a moderate degree of correlation, for instance, return on assets is negatively correlated (-0.481) with log(total assets) implying that larger firms in this sample have a lower return on assets. This is not too concerning for interpreting the results, as the absolute correlation is not too high. Furthermore, although there is little academic consensus as to what constitutes an acceptable threshold for generalized variance inflation factors (GVIFs), these remain low for all predictors across all three regressions, well below

frequently used thresholds of 3,5 or 10 (O'Brien, 2007). This further confirms that multicollinearity doesn't pose too much of a problem for this analysis.

Table 6: Generalized variance inflation factors of variables used

Variable	*df*	*Model 1*	*Model 2*	*Model 3*
Gender Ratio	1	1.094	1.084	1.093
Board Size	1	1.073	1.077	1.077
Return on Assets	1	-	1.521	1.447
Current Ratio	1	1.403	-	1.417
Asset Turnover	1	1.962	2.082	-
Total Debt/EBITDA	1	1.350	1.366	1.371
Research and development/ Sales	1	1.371	1.330	1.388
log(Total Assets)	1	1.521	1.524	1.491

Notes: This table presents the variance inflation factors (VIFs) for all predictors in the three models constructed. VIFs measure the degree of multicollinearity in a set of multiple regression variables. A high VIF indicates that the respective independent variable is highly collinear with the other variables in the model.

Heteroskedasticity check

OLS regression assumes that residuals are drawn from a population with constant variance (homoscedasticity). Heteroskedasticity arises when this assumption is not met: it is problematic for the precision of coefficients and their respective p-values. To check if heteroskedasticity exists in all estimated regression models, Breusch-Pagan tests are conducted with all

independent variables used. The null hypothesis for this test is that the error variances are all equal, or that no heteroskedasticity exists. For all three regressions, this results in a test statistic with 61 degrees of freedom as depicted in Table 5. All p-values are less than the 5% threshold of statistical significance, therefore the null-hypothesis is rejected. Heteroskedasticity exists in all three models and could affect the reliability of the estimated coefficients.

Table 5: Breusch-Pagan test for heteroskedasticity

df(61)	*Model 1*	*Model 2*	*Model 3*
Test statistic	113.44	98.42	120.59
P-Value	0.036	0.002	0.0211

Discussion and conclusion

Recent years have brought about growing social pressures for gender diversity across the corporate sphere. With respect to diversity on corporate boards, firms in certain countries now have to adhere to legislation such as quotas, and yet other firms face scrutiny from shareholders and public pressure groups. However, empirical results as to what such changes may entail for firm financial performance remain inconclusive. This study contributes to the ongoing debate by investigating the effects of gender diversity across three metrics of firm financial performance: profitability, liquidity and efficiency. Through OLS regression analyses with controls for various firm characteristics of a sample of 423 S&P 500 firms, this research unearths a positive relation between board gender diversity and firm liquidity and fails to find a relation between board gender diversity and both profitability and efficiency. The remainder of this section discusses some key caveats of this work and provides suggestions for future research.

Generally speaking, establishing a causal relationship between board gender diversity and firm performance is difficult. Board characteristics, and to a large extent firm characteristics, are not exogenous random variables; rather, they are endogenously adopted by firms to suit their operating and contracting circumstances (Adams and Ferreira, 2007). In particular, endogeneity arising from omitted variables and reverse causality can bias estimates of how gender diversity affects firm performance. Firstly, omitted unobservable firm characteristics such as corporate culture may simultaneously affect both board gender diversity and firm performance. Indeed, it is hard to expect that empirical models can capture all possible determinants of firm performance: there will be observable and unobservable, fixed and time varying characteristics that influence both the independent and dependent variables. Secondly, reverse causality could potentially mean that firm performance drives director appointments and in turn, the board gender ratio. It could also mean that females self-select into high performance, low risk firms, possibly as a result of their higher risk aversion (Farrell and Hersch, 2005). All these factors can render empirical attempts to draw causal relationships misleading.

Furthermore, a major limitation specific to this study is the use of cross-sectional data as opposed to panel data. The original intention was to include firm observations from both 2018 and 2019, however, observations from 2019 were dropped during the data cleaning process

due to a large number of missing values in the various datasets used and time constraints. This has multiple negative consequences for the validity of these findings. Firstly, while a sample size of 423 can be considered sufficient to draw statistical inferences, the total number of firm year-observations is lower than it could have been. The problem of heteroscedasticity discussed in the results section could have been mitigated with a larger sample: typically, if the data set is large, then error variances tend to be more or less constant. A larger sample could have improved both the internal and external validity of this research, by making it more econometrically sound and externally generalizable.

Secondly, considering the nature of this study, panel data would have also been useful for capturing dynamic effects. For instance, profitability, liquidity and efficiency can all be affected by prior-year results - lagged variables could have better accounted for this. Moreover, technically speaking, panel data would have allowed for more accurate inference of model parameters: more degrees of freedom and sample variability improves the efficiency of econometric estimates (Hsiao, 2006). The use of such data would have also allowed for the use of a more sophisticated model better suited to the dataset, such as a fixed-effect panel regression model. It may have also been useful to control for some of the effects of missing or unobserved variables, as some of these attributes remain constant over time.

Furthermore, tokenism is a phenomenon that could undermine the validity of this study; this occurs when firms appoint female directors independent of their qualifications and skills simply to satisfy investor demand or alleviate social pressure. Recent research partially accounts for this by applying critical mass theory in an organizational context. This theory posits that the impact of a minority group is only felt when the group size is above a certain threshold; some research suggests that a group of at least three (women directors) are required to exert any significant influence on group activity (board proceedings) (Tanford and Penrod, 1984; Bond, 2005; Nemeth, 1986). If this is true, it could imply that the relation between the board gender ratio and firm performance is not exactly linear, and thus a standard OLS model would not be suitable to model the relationship between these concepts. However, research on critical mass theory in a corporate board context is not yet comprehensive, and has not yet been convincingly applied to firm liquidity and efficiency. Future research could therefore further investigate if this theory is applicable to research in the current domain and factor it in when considering methodologies to capture the relation between gender diversity and firm performance.

Moreover, akin to most papers on the field of board gender diversity, this research focuses on a sample of firms from the United States due to data availability and time constraints. Future research could expand on the geographic perimeter of this study: for instance, it would be interesting to investigate the effects of diversity on firm performance in developing economies, as they typically tend to have less institutional infrastructure to facilitate gender equality, and larger cultural/ socioeconomic barriers to achieving it (Klasen, 2018). A broader sample, perhaps spanning multiple countries, would also help to improve the generalizability of the findings to a larger population. As a final note, this paper uses the terms female board representation and board gender diversity interchangeably. While non-binary gender identities are becoming more common in society, these are not yet reflected at the corporate board level and in the datasets used. As further data becomes available, future research could also consider a broader definition of board gender diversity beyond female board representation.

Bibliography

Abbott, L. J., Parker, S., & Presley, T. J. (2012). Female board presence and the likelihood of financial restatement. *Accounting Horizons*, *26*(4), 607-629.

Adams, R. B., & 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

Ararat, M., Aksu, M., & Tansel Cetin, A. (2015). How Board Diversity Affects Firm Performance in Emerging Markets: Evidence on Channels in Controlled Firms. *Corporate Governance: An International Review*, *23*(2), 83–103. https://doi.org/10.1111/corg.12103

Belcredi, M., & Ferrarini, G. (Eds.). (2013). *Boards and shareholders in European listed companies: facts, context and post-crisis reforms*. Cambridge University Press.

Boutchkova, M, Gonzalez, A, Main, B & Sila, B 2021, Gender diversity and the spillover effects of women on boards, *Corporate Governance*, *29(1),* 2-21.

Campbell, K., & Mínguez-Vera, A. (2008). Gender diversity in the boardroom and firm financial performance. *Journal of Business Ethics*, *83*(3), 435–451. https://doi.org/10.1007/s10551-007-9630-y

Carter, D. A., D'Souza, F., Simkins, B. J., & Simpson, W. G. (2010). The gender and ethnic diversity of US boards and board committees and firm financial performance. *Corporate Governance: An International Review*, *18*(5), 396–414. https://doi.org/10.1111/j.1467-8683.2010.00809.x

Conyon, M. J., & He, L. (2017). Firm performance and boardroom gender diversity: A quantile regression approach. *Journal of Business Research*, *79*, 198-211.

Chen, J., Leung, W. S., & Evans, K. P. (2018). Female board representation, corporate innovation and firm performance. *Journal of Empirical Finance*, *48*, 236-254.

Croson, R., & Gneezy, U. (2009). Gender differences in preferences. *Journal of Economic literature*, *47*(2), 448-74.

Dalton, D. R., Daily, C. M., Ellstrand, A. E., & Johnson, J. L. (1998). Meta-analytic reviews of board composition, leadership structure, and financial performance. *Strategic management journal*, *19*(3), 269-290.

Erhardt, N. L., Werbel, J. D., & Shrader, C. B. (2003). Board of director diversity and firm financial performance. *Corporate governance: An international review*, *11*(2), 102-111.

Ferreira, D. (2015). Board diversity: Should we trust research to inform policy?. *Corporate Governance: An International Review*, *23*(2), 108-111.

Finegold, D., Benson, G. S., & Hecht, D. (2007). Corporate boards and company performance: Review of research in light of recent reforms. *Corporate Governance: an international review*, *15*(5), 865-878.

Grosvold, J., & Brammer, S. (2011). National institutional systems as antecedents of female board representation: An empirical study. *Corporate Governance: An International Review*, *19*(2), 116-135.

Hsiao, C. (2014). Analysis of panel data (No. 54). *Cambridge university press.*

Hyde, J. S. (2014). Gender similarities and differences. *Annual review of psychology*, *65*, 373-398.

Isidro, H., & Sobral, M. (2015). The effects of women on corporate boards on firm value, financial performance, and ethical and social compliance. *Journal of Business Ethics*, *132*(1), 1-19.

Imbierowicz, B., & Rauch, C. (2014). The relationship between liquidity risk and credit risk in banks. *Journal of Banking & Finance, 40,* 242-256.

Kassinis, G., & Vafeas, N. (2002). Corporate boards and outside stakeholders as determinants of environmental litigation. *Strategic management journal*, *23*(5), 399-415.

Low, D. C. M., Roberts, H., & Whiting, R. H. (2015). Board gender diversity and firm performance: Empirical evidence from Hong Kong, South Korea, Malaysia and Singapore. *Pacific Basin Finance Journal*, *35*, 381–401. https://doi.org/10.1016/j.pacfin.2015.02.008

Marinova, J., Plantenga, J., & Remery, C. (2016). Gender diversity and firm performance: evidence from Dutch and Danish boardrooms. *International Journal of Human Resource Management*, *27*(15), 1777–1790. https://doi.org/10.1080/09585192.2015.1079229

Mooney, C. F. (1983). Public Morality and Law. *Journal of Law and Religion*, *1*(1), 45. https://doi.org/10.2307/1051072

Nielsen, S., & Huse, M. (2010). The contribution of women on boards of directors: Going beyond the surface. *Corporate governance: An international review*, *18*(2), 136-148.

O'brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & quantity, 41(5)*, 673-690.

O'Neill (2001) Building Better Global Economic BRICs, *Global Economics,* 66.

Rose, C. (2007). Does female board representation influence firm performance? The Danish evidence. *Corporate Governance: An International Review*, *15*(2), 404-413.

Ryan, M. K., & Haslam, S. A. (2005). The glass cliff: Evidence that women are over-represented in precarious leadership positions. *British Journal of management*, *16*(2), 81-90.

Saeed, A., Belghitar, Y., & Yousaf, A. (2016). Firm-level determinants of gender diversity in the boardrooms: Evidence from some emerging markets. *International Business Review*, *25*(5), 1076–1088. https://doi.org/10.1016/j.ibusrev.2016.01.002

Sila, V., Gonzalez, A., & Hagendorff, J. (2014). Women on board: Does boardroom gender diversity really affect firm risk. In *Young Finance Scholars' Conference*.

Smith, N., Smith, V., & Verner, M. (2006). Do women in top management affect firm performance? A panel study of 2,500 Danish firms. *International Journal of Productivity and Performance Management, 55*, 569–593.

Terjesen, S., Sealy, R., & Singh, V. (2009). Women directors on corporate boards: A review and research agenda. *Corporate governance: an international review*, *17*(3), 320-337.

Terjesen, S., & Singh, V. (2008). Female presence on corporate boards: A multi-country study of environmental context. *Journal of business ethics*, *83*(1), 55-63.

Torchia, M., Calabrò, A., & Huse, M. (2011). Women directors on corporate boards: From tokenism to critical mass. *Journal of business ethics*, *102*(2), 299-317.

Wang, Y., & Clift, B. (2009). Is there a "business case" for board diversity?. *Pacific Accounting Review*.

Ye, K., Zhang, R., & Rezaee, Z. (2010). Does top executive gender diversity affect earnings quality? A large sample analysis of Chinese listed firms. Advances in Accounting, 26(1), 47–54. https://doi.org/10.1016/j.adiac.2010.02.008

Appendix

Appendix 1: Variable descriptions

Gender Ratio	Proportion of female to male directors on the board, calculated as the number of female directors over the number of male directors
Board Size	Total number of directors on the board
Return on Assets	Net Income before extraordinary items over Total Assets
Current Ratio	Total current assets over total current liabilities
Asset Turnover	Ratio of Total Sales to Average Assets. Average assets are equivalent to the sum of the total assets at the beginning of the period and the total assets at the end of the period, divided by two.
Total Debt/EBITDA	Total debt divided by earnings before interest, taxes, depreciation and amortization
Research and development/Sales	Total annual research and development expenditures over sales
log(Total Assets)	Logarithm of total assets