Board composition and the gender pay gap: Evidence from the United Kingdom

Author: David Dokter
University of Twente
P.O. Box 217, 7500AE Enschede
The Netherlands

ABSTRACT,
This thesis investigates the relationship between the proportion of women on corporate boards and the median gender pay gap within large companies in the United Kingdom. Despite legislative measures like the Equal Pay Act 1970 and the Equality Act 2010, the gender pay gap remains a persistent problem in the UK. This study examines whether increasing female representation on corporate boards can mitigate this disparity. Using data from the UK Government's Gender Pay Gap Reporting Service and the Orbis database, this thesis analyzes 1,194 companies. The methodology includes a robust regression analysis to explore the correlation between the percentage of female directors on the board and the median hourly gender pay gap. Results indicate a significant negative relationship; higher female board representation correlates with a smaller median gender pay gap.

Graduation Committee members:
First supervisor: Dr. Maximilian Goethner
Second supervisor: Dr. Igors Skute

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Gender pay gap, boardroom composition, gender diversity, United Kingdom.

1. INTRODUCTION

1.1 Situation and complication

In recent years, the difference in compensation for men and women gained increasing attention from governments, media and businesses. This phenomenon, commonly referred to as the gender pay gap, captures the systemic difference in average earnings between men and women in the workforce. It indicates that on average women earn less than men. The gender pay gap is a multifaceted problem that is influenced by different factors such as sectoral segregation, the glass ceiling, pay discrimination and overrepresentation of women in unpaid work (European Commission, 2022). Sectorial segregation is the overrepresentation of women in specific sectors or industries, such as healthcare and education and those are relatively low paying (Boll et al., 2017). The glass ceiling are the invisible barriers that prevent women from climbing up the career ladder, despite their qualifications or achievements. The barriers are named "glass ceiling" because it is not officially acknowledged and they are difficult to identify (Bertrand, 2017). Another factor that influences the gender pay gap is pay discrimination, this term refers to paying women less for the same or similar work based on their gender (European Commission, 2022).

The Equal Pay Act of 1970 was the legislative act that addressed the problem of pay discrimination in the United Kingdom. It required that men and women receive equal pay for the same or similar work (UK Government, 1970). The legislation that currently is governing the gender pay gap in the United Kingdom is the Equality Act 2010. This replaced previous anti-discrimination laws, including the Equal Pay Act of 1970. Under the Equality Act it is illegal for companies to pay people unequally because of their gender. Men and women should be receiving equal pay unless there is a justifiable reason not to. This includes all aspects of pay and benefits such as: salary, bonus payments, overtime rates and access to pension schemes (UK Government, 2010). If an individual thinks they are not receiving equal pay compared to a person of the opposite sex for the same or similar work, they can make a claim to an Employment Tribunal. The claim must be made within six months of the end of the service (Local Government Association, 2023). In 2015 the United Kingdom took a pioneering initiative to implement legislation regarding gender equality in the workplace. The law required all corporations with more than 250 employees to publish financial data about their gender pay gap on an annual basis (Feikert-Ahalt, 2015). Under the regulations, the corporations are mandated to disclose their mean and median gender pay gap, the proportion of men and women that are receiving bonuses and the gender distribution across pay quartiles within their organization (UK Government, 2024). Despite the legislation in the United Kingdom the disparity of earnings between male and female remains a persistent problem. As of April 2023, the median gross hourly earnings gender pay gap of full-time employees stands at 7.7% and the median gross hourly earning gender pay gap for all employees is 14.3% in the United Kingdom (White, 2023). This means that all working women tend to earn 14.3% less per hour than men.

The complication here is that despite the legislative acts of the government at reducing the gender pay gap, such as the Equality Act 2010 and the regulations introduced in 2015, it remains a notable concern in the United Kingdom. This indicates that law and regulations alone may not be enough to address the problem. That leads us to explore other factors that might influence the gender pay gap. One such factor is the gender composition of corporate boards, that term refers to the division of men and women on the boards of directors of companies. In 2021 the percentage of board seats held by women globally was 19.7%. That is an increase of 2.8% since 2019. At that rate the global gender parity will not be reached in the next 20 years (Deloitte Global Boardroom Program, 2021).

Lord Davies of Abersoch, former Labour government minister of the United Kingdom, made a report in 2011 named "Women on Boards". The report highlighted the underrepresentation of women on corporate boards in the United Kingdom and offered recommendations to increase gender diversity. The report stated that in 2010 the percentage of women on FTSE 100 boards was 12.5%. FTSE 100 is a market index on the London Stock Exchange that represents the 100 largest companies that are listed on the exchange. To address this issue the report recommended that FTSE 100 companies should aim for a minimum of 25% women on their boards by 2015 (Lord Davies of Abersoch, CBE, 2011). Following up on the report of Davies, The Hampton-Alexander Review was introduced in 2016. This review was also aimed to improve the number of women on FTSE 350 boards. FTSE 350 is a market index on the London Stock Exchange that is composed of two sub-indices: FTSE 100 and FTSE 250. A new recommendation was made for FTSE 350 companies to aim for a minimum of 33% women on their corporate boards. The review also recommended to increase the number of women in key roles (Hampton et al., 2016). Both the targets of the Lord Davies Report and the Hampton-Alexander Review for increasing the percentage of women on corporate boards in the UK were met (Davies et al., 2015; Hampton-Alexander Review, 2021). Following the reports of Hampton-Alexander and Davies the FTSE Women Leaders Review in 2022 continued the work to achieve gender balance in boards of UK companies. This review set a target for FTSE 350 boards to reach 40% women by the end of 2025 (FTSE Women Leaders Review, 2022). While these efforts have increased the presence of women on corporate boards the gender pay gap still is a persisting problem in the UK. This thesis will investigate the potential relationship of women on boards and the gender pay gap within the United Kingdom.

1.2 Research objective and question

The main objective of this paper is to investigate the relationship between the percentage of female board members and the gender pay gap withing large companies in the United Kingdom. Companies are classified as large if they have 250 or more employees (OECD, 2024). The research aims to assess the current state of the gender pay gap within those firms and determine the impact of board composition.

The research question for this thesis is: *"What is the relationship between the proportion of women on boards and the gender pay gap within large UK companies?"*

1.3 Academic and practical relevance

The gender wage gap still exists despite media attention and legislative efforts to close it, which emphasizes the need for more research. The investigation of the gap is essential to promote fairness and equity in pay across genders. By expanding the literature on the factors contributing to the gender pay gap, researchers and legislators can better identify and address the mechanisms that effect the pay differences between men and women.

The academic relevance of this thesis contributes to the existing academic literature on the gender pay gap by examining the impact of gender composition on corporate boards. While gender pay has been extensively researched for the last years, the influence of board gender composition remains relatively underexplored. Previous research that investigated board composition and the effect on the overall gender pay gap focused

on the presence of foreign directors and not specifically on gender composition of the board (Ahamed et al., 2019).

Additionally, a study on executive gender pay gaps in S&P1500 firms from 1996 to 2010 in the US found that female executives earn significantly less than their male colleagues. It also highlighted that firms with more gender-diverse boards had smaller gender pay gaps among executives, with a 5% smaller gap in firms with an average female board representation of 9% compared to those with no female board members (Carter et al., 2017). This highlights the positive impact of gender diversity on corporate boards in lowering pay gaps at the executive level. Moreover, research on UK firms listed on the London Stock Exchange from 1999 to 2015 examined the gender pay gap among non-executive directors (NEDs) and revealed that a significant female presence on boards (at least 33%) is necessary to reduce the pay gap among NEDs (Tarkovska et al., 2023). While these studies focus on top corporate positions, my research will extend the analysis to include the average gender pay gap within large UK companies, including different organizational levels.

The practical relevance of the findings of this research can offer valuable insights for legislators and business owners. If the gender composition of the board is correlated with mitigating the gender pay gap. It could help the development of strategies for promoting gender equality in the boardroom and create more equitable workplaces in the United Kingdom. Additionally, it could also guide companies to adapt more equitable practices to potentially lead to a better corporate reputation and that could lead to a better corporate performance.

2. LITERATURE REVIEW

2.1 The gender pay gap

The definition of the gender pay gap is the difference in average gross hourly earnings between women and men (European Parliament, 2020). If the gender pay gap is 10%, it means women earn 10% less on average than men do. The gender pay gap can also be defined as the difference between median earnings of men and women relative to median earnings of men (OECD, 2022). This is considered to be a more accurate reflection of the pay gap because the median is less affected by outliers; extremely high or extremely low earnings can affect averages a lot.

In the human capital theory, it was argued that the difference in pay between men and women was largely explained by the differences in "human capital". That term refers to the differences in education, work experience and skills. The theory suggested that the lower levels of women's human capital led to decreased productivity which resulted in lower pay (Manning & Swaffield, 2008).

Sectorial segregation is the overrepresentation of women in specific sectors or industries (Boll et al., 2017). Fields that are predominantly dominated by women are labeled as feminized. Some studies suggest that as the percentage of women in a field increases the average pay for that job tends to decrease (Blau & Kahn, 2001; Publications Office of the European Union, 2009). This affects both genders, but because women overrepresent these professions they are more negatively affected. The exact reasons why feminized jobs are paid less remain unsure. It could be that the average pay for women is lower so if they segregate to a job and overrepresent it the average pay goes down.

The theory of undervaluation suggests that the difference in pay between men and women may be caused by a societal bias where work that is typically performed by women is considered less valuable (Perales, 2013). The determination of pay is influenced by societal norms and decisions made by managers and governments. Traditional work behaviour seen as manly, such as working extended hours, having a continuous presence in the workforce and an aggressive negotiating style drive pay decisions. Women who do not fit to these norms can find themselves at a disadvantage.

The gender pay gap is a complex problem that cannot be attributed to a single cause. The persistence of this gap highlights the need for more research.

2.2 Composition of corporate boards

The agency theory suggests that a supervisory body, the corporate board, must exist on behalf of the shareholders (Bathala & Rao, 1995). A corporate board has directors that act in the interest of the company's investors. Their task is to monitor and control managers. The composition of corporate boards typically refers to the demographic division of members on the board. When demographics are discussed, they typically consider characteristics such as gender, age and ethnicity. Generally, when talking about the board composition, it revolves around the proportion of women to men.

The relationship between gender diversity of corporate boards and financial performance has been subject of extensive research for over the past two decades. The research conducted by Hazaea et al. (2023) offers an analysis of the literature published from 2002 to 2022 about this relationship. A key finding of this paper is the inconsistency in results across the 152 studies they analyzed. While some studies indicate a positive correlation (Alvarado et al., 2015), other report no significant effect (Pletzer et al., 2015). This difference in findings shows the complexity of the relationship.

Bear et al. (2010) investigated the impact of gender diversity of boards on Corporate Social Responsibility. They found that board diversity and gender composition have a significant impact on CSR and firm reputation. This suggests that having a diverse board, including gender diversity, can enhance a company's commitment to social and environmental issues and that may positively influence their reputation.

The Deloitte Global report, "Women in the boardroom: A Global Perspective", provides an analysis of the female representation in corporate boardrooms across the world. They analyzed data from 10,493 companies in 51 different countries, examining more than 176,000 directors' positions to understand the state and progress of achieving gender diversity at corporate boards. The report states that in 2021 only 19.7% of board members globally were women (Deloitte Global Boardroom Program, 2021). This underrepresentation of women in leadership roles shows the enduring presence of the glass ceiling. That term refers to the invisible barriers that prevent women's promotions to higher professional positions (Bertrand, 2017).

The composition of corporate boards, in particular the gender aspect, remains an area of academic and practical interest. While steps have been made to increase female representation, the full benefits of gender diversity on boards are still being realized and investigated. This presents an opportunity for additional research that examines possible benefits of gender diversity on corporate boards.

2.3 The effect of composition of boards on the gender pay gap

A study by Ahmed et al. (2019) analyzed firm-level gender pay gap data in combination with corporate board characteristics. The researchers found that the presence of foreign directors on

corporate boards in Britain is associated with lowering the gender pay gap. That effect is more noticeable in profitable firms and firms with fewer than 5000 employees. While this study focuses on the nationality diversity of board members. It opens the door to consider how other aspects of board composition, such as gender diversity, may impact the gender pay gap.

Another study investigated executive gender pay gaps within S&P1500 firms from 1996 to 2010 in the US, focusing on the differences in pay between male and female executives and the impact of board gender diversity. They found that female executives receive significantly lower total compensation than their male colleagues. The research suggests that firms with more gender-diverse boards exhibit smaller gender pay gaps among executives. In firms where the board composition includes women at the sample's average level, which is 9% female representation on the board, the gender pay gap in total compensation for female executives is smaller. Then the pay gap is about 5% less than the 21% gap in companies that do not have any female board members (Carter et al., 2017). This finding shows the positive impact that gender diversity on corporate boards can have on reducing the gender pay gap at the executive level. While this study provides an analysis of the gender pay gap among top positions, executives, my research will focus to investigate the average gender pay gap within large UK companies.

Tarkovska et al. (2023) researched the gender pay gap at the board level, particularly among non-executive directors (NEDs) within UK firms listed on the London Stock Exchange from 1999 to 2015. The research reveals that having a significant number of women, specifically at least 33% representation on boards, is needed for reducing the gender pay gap among non-executive directors. This study also highlights the enhanced role of women on key committees, such as compensation and nomination committees, in further narrowing this pay gap. While this study also analyses the gender pay gap of top positions, non-executive directors, my research will also include the gender pay gap among lower levels.

2.4 Hypothesis

Based on the literature reviewed and the research objective to investigate the relationship between the percentage of female board members and the gender pay gap within large UK companies, the following hypothesis has been formulated: *"In large UK companies, a higher proportion of women on corporate boards is correlated with a smaller gender pay gap among the workforce."*

This hypothesis suggests a negative relationship between the proportion of women on corporate boards (the independent variable) and the gender pay gap within the company (the dependent variable).

3. METHODOLOGY

3.1 Research design

This thesis uses a quantitative research design to examine the relationship between the gender composition of corporate boards and the gender pay gap within large UK companies. This design is chosen for its effectiveness in analyzing data to identify patterns and correlations between the variables. The research will involve statistical analysis of data to test the proposed hypothesis, existing literature also used this research design and investigated board composition and the gender pay gap, demonstrating the robustness and relevance of this approach in exploring these variables (Carter et al., 2017; Ahmed et al., 2019). The UK economy is particularly relevant for this analysis due to its characteristics and the presence of globally relevant firms. The UK has a wide range of multinational corporations and influential businesses that could set trends in corporate governance and economic policies worldwide (Portes et al., 2024). The UK's corporate sector is known for its transparency

Table 1 Description of variables.

Variable	Definition
DiffMedianHourlyPercent	Difference in median hourly pay between male and female employees, expressed as a percentage of men's earnings
ShareFemaleDirectors	Proportion of female directors on the board of the company, expressed in percentage
CSize250_499	Company size between 250 and 499 employees (1 if yes, 0 if no)
CSize500_999	Company size between 500 and 999 employees (1 if yes, 0 if no)
CSize1000_4999	Company size between 1,000 and 4,999 employees (1 if yes, 0 if no)
CSize5000_19999	Company size between 5,000 and 19,999 employees (1 if yes, 0 if no)
CSize20000_inf	Company size with 20,000 or more employees (1 if yes, 0 if no)
Edu_Health_Industry	Control variable for companies in the education or health industry (1 if yes, 0 if no)
Manufacture_Industry	Control variable for companies in the manufacturing industry (1 if yes, 0 if no)
Retail_Transport_Industry	Control variable for companies in the retail or transport industry (1 if yes, 0 if no)
Service_Industry	Control variable for companies in the service industry (1 if yes, 0 if no)
HasPatents	Control variable for companies that have patents (1 if yes, 0 if no)
GovInstitution	Control variable for government institutions (1 if yes, 0 if no)

Notes: This table presents the definitions of the variables used in this thesis.

and regulatory frameworks, which enable the collection of reliable data on gender pay gaps and board compositions. Additionally, the UK's legislative environment, including the Equality Act 2010 and mandatory gender pay gap reporting for large companies. This provides an environment for analyzing how these regulations impact company behavior and outcomes (UK Government, 2010; Feikert-Ahalt, 2015).

3.2 Data collection and sampling

As discussed in section 1.1, every company in the United Kingdom with 250 or more employees is legally required to publish financial data annually about their gender pay gap since 2015 (Feikert-Ahalt, 2015). The UK Government's Gender Pay Gap Reporting Service is going to be our primary source of data. This platform provides the financial data of the gender pay gap of companies with 250 or more employees. It offers detailed breakdowns of the pay gap between men and women, including mean and median gender pay gap figures. For information on the composition of corporate boards the Orbis database will be used (Orbis, 2024). Orbis provides a lot of information on public and private companies worldwide. The data they provide includes specific details on the gender composition of boards. This database will serve as a primary source for identifying the percentage of women holding board positions.

For the analysis of board composition and the gender pay gap, datasets from the UK Government's Gender Pay Gap Reporting Service and Orbis are merged. The first dataset had 13,422 companies, which are all UK companies with 250 or more employees because they are legally required to report their gender pay gap data. From this dataset, a subsample has been made that only includes companies for which both board composition and gender pay gap data were available. This sample consists of 1,194 companies, representing around 8.9% of the total dataset. This is the main dataset that is going to be used for the analysis of this thesis.

3.3 Measurement

The main variables measured in this study are the proportion of women on corporate boards and the gender pay gap. The independent variable is the proportion of women on corporate boards. It is measured as the percentage of female directors from the total board members. This number provides a comparable metric for different companies. The percentage is calculated by dividing the number of females on a board by the total number of members on that board. The dependent variable is the gender pay gap, which is measured with the median, representing the percentage difference in median hourly earnings between male and female employees within a company. The difference in median salary is calculated by subtracting the median hourly rate of females from the median hourly rate of males. The percentage difference in median hourly earnings is calculated by dividing the difference in median hourly earnings between men and women by the median hourly earnings of men. The median gender pay gap is expressed as a percentage of men's earnings.

In addition to the main variables a few control variables will be included in the analysis. These control variables will help isolate the effect of the main independent variable (share female directors) on the dependent variable (median hourly gender pay gap) by controlling for other influential factors. The control variables include company size, industry sectors, having patents and being a government institution. Controlling for company size is important for this analysis, because larger companies often pay higher wages and that could affect the gender pay gap (Llorens, 2023). Also, the biggest industry sectors of the main dataset used in the analysis are controlled for. Different industries have different pay structures and gender compositions which can impact the gender pay gap. The presence of patents is also included as a control variable because companies with patents tend to be more innovative and that could lead to higher salaries (Phelps, 2016). The names and definitions of the variables used in this analysis can be found in Table 1.

3.4 Data analysis

The collected data from the Orbis database and the UK Government's Gender Pay Gap Reporting Service will be analyzed using statistical software such as Stata or RStudio. The main objective of this analysis is to investigate the relationship between the proportion of women on corporate boards and the gender pay gap within large UK companies. The analysis of this thesis will consist of exploratory data analysis (EDA) and a regression analysis. The EDA way of analyzing includes visualization, summary statistics and the identification of patterns and relationships. First, through visualization, charts like histograms, line charts and bar charts will be used. This gives a clear picture of what our data looks like. Next, summary statistics will be shown to help understand the data better, measures such as mean, median, mode and standard deviation.

Also, a Robust Regression will be used to investigate the relationship between the share of women on corporate boards and the gender pay gap within large UK companies. The Robust Regression is a type of regression analysis used to estimate the relationships between a dependent variable and independent variables. Robust Regression is designed to be less sensitive to outliers than other regression models, such as Ordinary Least Squares (OLS) regression. This model will be performed using statistical software such as Stata or RStudio. In a Robust Regression the aim is to find a regression line that is less sensitive to outliers. This provides a more reliable estimate of the relationship between the independent variables and the dependent variable. To achieve this the differences between the actual data points and the predicted data points from the regression model are calculated. These differences are known as residuals. The model minimizes a weighted sum of residuals, and the weights are determined by a function that reduces the influence of outliers. This function selects lower weights for the observations with larger residuals. That is why the Robust Regression method makes sure that the estimated coefficients are not heavily influenced by outliers. This method is useful when dealing with real-world data where outliers are common, such as the data from the UK Government's Gender Pay Gap Reporting Service.

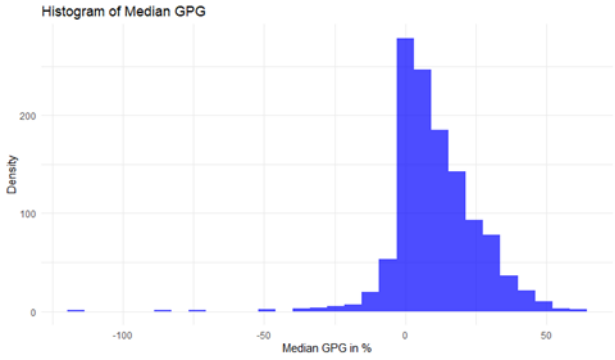

Figure 1. Distribution median hourly gender pay gap.

Figure 1 presents the distribution of the median hourly gender pay gap (GPG) of the main dataset that is used for this thesis (1,194 companies). The x-axis represents the bins median GPG in percentages and the y-axis represent the density of those bins. Figure 1 shows that there are indeed outliers in the dataset, with some data points lying far away from the main group of

datapoints. Because of these outliers a Robust Regression model will be used in this thesis.

The main robust regression model used in this analysis:

$$DiffMedianHourlyPercent_i = \beta_0 + \beta_1(ShareFemaleDirectors_i) + \beta_2(CSize500\_999_i) + \beta_3(CSize1000\_4999_i) + \beta_4(CSize5000\_19999_i) + \beta_5(CSize20000\_inf_i) + \beta_6(Edu\_Health\_Industry_i) + \beta_7(Manufacture\_Industry_i) + \beta_8(Retail\_Transport\_Industry_i) + \beta_9(Service\_Industry_i) + \beta_{10}(HasPatents_i) + \beta_{11}(GovInstitution_i) + \epsilon_i$$

The definitions of the variables can be found in Table 1. The error term is ϵ and i represents the different companies. The β_0 is the intercept of the model and β_1 is the coefficient for the proportion of women on boards. The betas β_2, β_3, …, β_{12} are the coefficients for the control variables.

4. FINDINGS

4.1 Plots analysis

4.1.1 Gender pay gap over time

Figure 2 presents the average median gender pay gap in the United Kingdom from 2017 to 2023. The data supporting the graph is based on the datasets from the UK Government's Gender Pay Gap Reporting Service (Gender Pay Gap Service, n.d.). This data has to be reported annually by every company in the UK with over 250 employees (Feikert-Ahalt, 2015). The datasets provide an overview of the gender pay gap disparity within large UK companies. The datapoints for each year in Figure 2 is based on the snapshot date of 5 April for private employers and 31 March for public authority employers of the respective year (When to Report, 2024). By using data from the same date each year, it is consistent and comparable. On the y-axis of Figure 2 you find the percentage of the median gender pay gap and on the x-axis you find the years. The graph is made using the statistical software R-Studio.

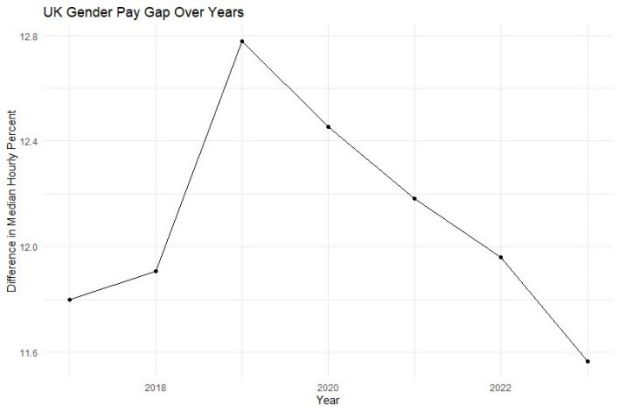

Figure 2. Percentage median gender pay gap large UK companies from 2017 to 2023.

The median hourly gender pay gap has decreased from just below 12.8% in 2019 to just below 11.6% in 2023. This section will discuss the trend of the observed datapoints. Figure 1 shows the trend in the median gender pay gap. The graph shows an upward move between 2017 and 2019 and is followed by a consistent downward trend. In 2017 the median gender pay gap was 11.8%. In 2018 there was a small increase, bringing the gap to just above 11.9%. However, 2019 saw a big increase to just below 12.8%. The gender pay gap reporting of 2019 was temporarily suspended due to COVID-19. As a result, the number of companies reporting their gender pay gap data for this reporting year was significantly reduced (House of Commons Library, 2024). This lower reporting rate led to a smaller dataset and that might have skewed the median gender pay gap figures. In 2020 the median gender pay gap dropped to a little above 12.4%. This is the beginning of the downward trend. From 2021 to 2023, the median gender pay gap declined more and more. By 2021 the gap reduced to around 12.2%. In 2022, the downward trend continued, with the gap just below 12%. By 2023, the median gender pay gap had further fallen to below 11.6%, that is the biggest annual reduction observed in this graph.

In summary, Figure 2 shows a clear trend in the median hourly gender pay gap. After the increase from 2017 to 2019 to just below 12.8%, a consistent downward trend from 2020 onwards is shown. The median gender pay gap hits it lowest point to just below 11.6% in 2023. This downward trend suggests that initiatives from legislators aimed at reducing the gender pay gap are having a positive impact.

4.1.2 Women on boards over time

Figure 3 presents the average percentage of women on boards of the FTSE 100 and FTSE 250 companies from 2017 to 2023. The FTSE 100 and FTSE 250 are market indices on the London Stock Exchange. The FTSE 100 index consists of the 100 largest companies that are listed on the London Stock Exchange based on market capitalization. The FTSE 250 index includes the next 250 largest companies after those that are in the FTSE 100. These 250 companies are more focused on the UK market in general, compared to the FTSE 100 firms (Hirst, 2024). Due to the smaller size and greater focus on the UK market, companies in the FTSE 250 can be more sensitive to national policy changes. On the y-axis of Figure 3 you find the percentage of women on boards and on the x-axis you find the names of the indices. The years 2017 to 2023 are represented by colours from light to dark purple. This graph is sourced from the FTSE Women Leaders Review (2024).

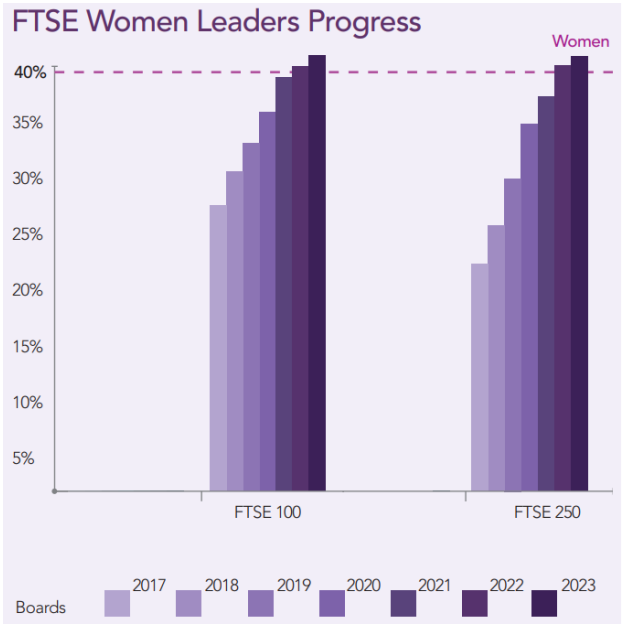

Figure 3. Percentage women on boards FTSE 100 and FTSE 250 from 2017 to 2023 (FTSE Women Leaders Review, 2024).

The graph in Figure 3 shows a consistent upward trend for the percentage of women on boards in FTSE 100 companies from 2017 to 2023. In 2017, the representation of women on corporate boards was low, with the percentage being just above 25%. It increased each year, and by 2020, the percentage was higher than 35%. In 2023, the representation of women on corporate boards

reached its highest point, exceeding 40%. This consistent upward trend shows the commitment of the largest UK companies to improve gender diversity on their corporate boards. Similar to the FTSE 100, the FTSE 250 also has an upward trend in the percentage of women on boards from 2017 to 2023. This upward trend is even steeper, starting at just above 20% and ending in 2023 over 40%. This suggests that also mid-sized companies are making progress to a more gender diverse board composition.

Overall, Figure 3 shows an obvious and consistent upward trend in the percentage of women on boards for the FTSE 100 and FTSE 250 companies from 2017 to 2023. This consistent trend suggests that the initiatives aimed at increasing women on boards are having a positive impact.

4.1.3 Female share of directors

Figure 4 presents the relationship between the median hourly gender pay gap and the share of female directors. The data used to make this graph came from a merged dataset that included Orbis data on board composition and the UK Government's Gender Pay Gap Reporting Service data. By merging those datasets, the relationship between board composition and the gender pay gap can be investigated. On the y-axis you find the median hourly gender pay gap in percentages and on the x-axis you find the ranges of the percentage female directors on boards. The datapoints are binned into 6 intervals on the x-axis to make the graph simpler and more readable. Each bin represents a range of values for the share of female directors in that bin. This process of binning the data makes it easier to observe patterns and trends. The number of observations (N) is shown above each bar.

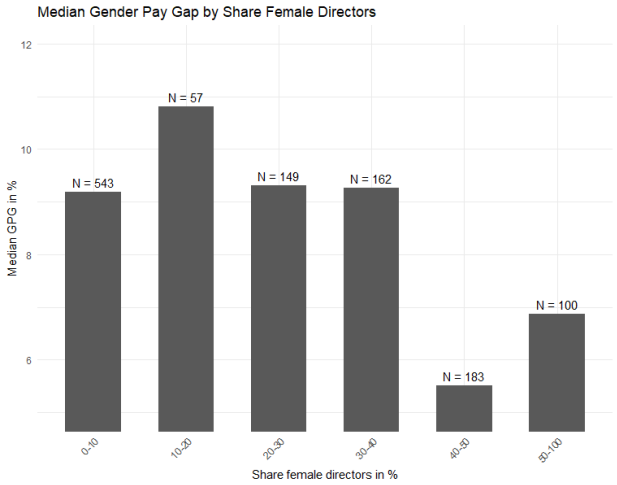

Figure 4. Impact of the percentage female board members on median hourly gender pay gap.

The chart in Figure 4 shows several trends. For the 0-10% bin the median gender pay gap is just above 9% with 543 observations. As the share of female directors increases to the 10-20% bin there is a slight increase in the median gender pay gap to approximately 11%, but this bin has the lowest count of observations at 57. This is followed by a downward move to just above 9% as the bin of female directors increases to 20-30%. At the 30-40% bin the median gender pay gap remains stable at around 9%. After that bin there is a big decline in the median gender pay gap to around 5.5% for the 40-50% bin. The 50-100% bin is the last bin and the median gender pay gap rises to around 7%.

In summary, Figure 4 shows a complex relationship between the median gender pay gap and the share of female directors on the board. The observations of Figure 4 suggest that there is no clear linear relationship between the share of female directors and the gender pay gap. The bar chart shows that the bins from 0-10% till 30-40% have approximately the same median gender pay gap. However, the data indicates that having a more balanced representation (40-50% bin) on the board is associated with the lowest median gender pay gap. This could suggest that companies with an equal gender representation on their boards might have lower gender pay gaps. Moreover, the bin of 50-100% has also a notably lower median gender pay gap than the first four bins. This suggests that a higher proportion of female board members might be correlated with a lower median gender pay gap.

4.1.4 Presence of female directors on board

Figure 5 presents a bar chart that shows a comparison of the median gender pay gap between companies with and without female directors on their boards. The dataset used to create this chart is the same dataset that is used for Figure 4. In the chart you find on the y-axis the percentage median gender pay gap. The x-axis has two values, with "0" representing companies with no female directors on their boards and "1" representing companies with female directors. The blue bar represents the companies without women on their boards. The bar chart shows that the median gender pay gap for these companies is just above 9%. The red bar represents companies with female directors on their boards. For these companies, the median gender pay gap is lower, just above 7.5%, than the gap for companies that do not have female directors on their boards.

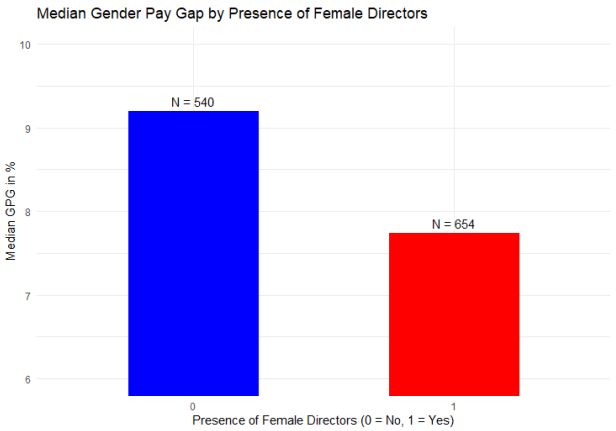

Figure 5. Median gender pay gap with and without the presence of female directors.

In summary, Figure 5 highlights a notable difference in the median gender pay gap between companies with and without women on their boards. The bar chart shows that companies with female directors tend to have a smaller gender pay gap compared to those without female directors. This suggests that the presence of female directors may help to reduce the gender pay gap.

4.1.5 Gender Diversity Index

Figure 6 presents a bar chart that shows the relationship between the median gender pay gap and the Gender Diversity Index (GDI) that is binned into 6 intervals. The dataset used for this graph is the same dataset that was used for Figure 4 and Figure 5. On the y-axis of Figure 6 you find the percentage median gender pay gap and the x-axis shows the GDI bins. This helps in simplifying the data and making it more readable. The Gender Diversity Index is a measure that shows the balance of gender on the board. The GDI is calculated as follows: GDI = (Number of female directors

x Number of male directors) / (Total numbers of directors)². A higher value for the index indicates a more gender diverse board. If the GDI is 0 there is only 1 gender on the board. Two relevant studies have used the Gender Diversity Index (GDI) in their analyses. The first study by European Women on Boards (2021) uses the GDI to evaluate gender diversity in corporate leadership across the EU, providing insights into gender balance at various organizational levels. The second study by Humbert et al. (2021) uses the GDI to examine gender diversity within research teams, assessing its impact on team performance and innovation.

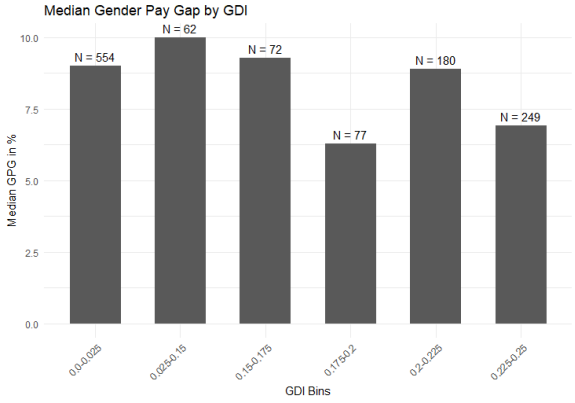

Figure 6. Relationship between the Gender Diversity Index (GDI) and the median gender pay gap.

The bar chart in Figure 6 shows that in the lowest GDI bin, 0-0.025 on the x-axis, the median gender pay gap is just above 8.75%. As the GDI bin increases to 0.025-0.15, the median gender pay gap increases slightly to around 10%. After that the gender pay gap decreases to approximately 9% at a GDI bin of 0.15-0.175. Following this a drop in the median gender pay gap is observed to about 6.25% at a GDI bin of 0.175-0.2 and after this drop the gender pay gap increases to around 8.75% at a GDI bin of 0.2-0.225. After this point the gender pay drops again to approximately 7% in the highest GDI bin of 0.225-0.25.

Overall, Figure 6 reveals a complicated relationship between the Gender Diversity Index and the median hourly gender pay gap. At the lower GDI values the median gender pay gap tend to be a little bit higher than at the higher GDI values. This could suggest that a more gender diverse board may be associated with lowering the gender pay gap.

4.2 Summary statistics

The dataset used to create all the tables of this thesis is the main dataset we used for the analysis. The definitions of all the variables can be found in Table 1. Table 2 presents the summary statistics of the main variables used in the analysis. The table provides statistics about the independent (ShareFemaleDirectors) and dependent (DiffMedianHourlyPercent) variable including the mean, standard deviation (SD), minimum, first quartile (Q1), median, third quartile (Q3), maximum and the number of observations (N).

The mean of the dependent variable (DiffMedianHourlyPercent) is 10.61%, this means that on average women earn 10.61% less per hour than men in this dataset. The standard deviation of 14.62% shows the variability in the median hourly gender pay gap across the different companies. This relatively high standard deviation suggests that the actual average pay gaps between the companies can vary widely. The lowest value found in the dataset for the dependent variable is -116.26%, this is one of the extreme outliers. Such observations justify the use of Robust Regression for this analysis. The median value for the dependent variable is 8.56%, this means that half of the companies of the dataset have a median hourly gender pay of 8.56% or less. The highest observed value in the dataset is 61.70%. Table 2 also presents summary statistics of the independent variable (ShareFemaleDirectors). The mean value is 21.26%, this means that on average 21.26% of the board members are females. This suggests that women are underrepresented in the corporate boards of the companies in the dataset. This value is almost the same as the 19.7% female representation on boards globally that is found by research of Deloitte Global Boardroom Program (2021). However, it is not in line with the percentage women on boards of FTSE 100 and FTSE 250 in 2023. This report found that the average percentage of women on boards in those 350 biggest companies listed on the London Stock Exchange was more than 40% (FTSE Women Leaders Review, 2024). This difference could be explained by the company sizes in my

Table 2 Summary statistics of the main variables.

Main variables	Mean	SD	Min	Q1	Median	Q3	Max	N
DiffMedianHourlyPercent	10.61	14.62	-116.26	1.50	8.56	18.18	61.70	1194
ShareFemaleDirectors	21.26	23.44	0.00	0.00	16.67	37.22	100.00	1194

Notes: This table presents summary statistics of the dependent variable (DiffMedianHourlyPercent) and the main independent variable (ShareFemaleDirectors).

Table 3. Summary statistics control variables company sizes.

	CSize250_499	CSize500_999	CSize1000_4999	CSize5000_19999	CSize20000_inf
1 = yes	505	345	295	40	9
N	1194	1194	1194	1194	1194

Notes: This table presents the summary statistics of the control variables of company sizes.

Table 4. Summary statistics other control variables.

	Edu_Health _Industry	Manufacture _Industry	Retail_Transport _Industry	Service _Industry	HasPatents	GovInstitution
1 = yes	170	241	267	262	379	71
N	1194	1194	1194	1194	1194	1194

Notes: This table presents the summary statistics of the control variables about the main industries and specific characteristics.

dataset. In Table 3 you can find that almost half (505 out of 1194) of the companies observed in the dataset have between 250 and 499 employees. The FTSE 350 are the 350 largest companies that are listed on the London Stock Exchange (Hirst, J. B. ,2024). Those are among the largest and most visible companies in the United Kingdom and more visible companies have more public pressure to implement diversity initiatives. Additionally, Figure 5 shows that almost half of the observations (540 out of 1194) have no female on their boards. This means that for 540 companies the average percentage of women on boards is 0%, and that brings down the average of the dataset. The median value of the independent variable (ShareFemaleDirectors) in the dataset is 16.67%, indicating that half of the observed companies have women filling board seats up to 16.67%. The maximum observed value is 100% which means that the entire board is represented by females.

Tables 3 and 4 show the summary statistics for the control variables used in the analysis. These control variables are included to isolate the effect of the main independent variable on the dependent variable. Table 3 shows that most companies in the dataset have a company size between 250 and 499 employees (42.3%). It also shows that there are not many companies in the dataset that have between 5,000 and 19,999 employees (40 observations) and more than 20,000 employees (9 observations). In Table 4 summary statistics of the four biggest industries of the dataset and specific characteristics can be found. Most of the companies in the dataset operate in the service industry (21.9%). It also shows that 379 companies have patents (31.7%). Having patents as a company indicates a level of innovation (Phelps, 2016). Only a small number of companies are government institutions (71 observations), which are organizations owned by the government to provide services to the public.

4.3 Regression analysis

Table 5 shows the results of two robust regression models. At the top of the table you find the dependent variable (DiffMedianHourlyPercent). On the left side of the table the independent (ShareFemaleDirectors) variable and control variables are found. Also, the intercept (Constant) of the model can be found on the left side of the table. The first column (1) presents the results of a model without the main independent variable and the second column (2) show the results of the main model with the independent variable. To correctly assess the impact of the proportion female directors of corporate boards on the median hourly gender pay gap a model without the main independent variable (1) is also run. By comparing the two regression results the impact of the main independent variable on the dependent variable can be determined more accurately. The control variables in both regression models include different company sizes, industry sectors and specific characteristics. The omitted control variable for company size is CSize250_499. By omitting this variable, the model uses this as the reference group. This was chosen as it represents the largest observed company size in the dataset (505 of 1194), providing a stable baseline for comparison. The effects of other control variables about company sizes are measured relative to the omitted variable. Similarly for the control variables about industry sectors, a few were omitted (Real Estate Industry, Financial Industry, Information and Communication Industry, Construction Industry and Others). These variables were omitted to keep the models manageable and avoid overfitting. The included industry sectors in the models represent the four largest industries in the dataset. Those four industry variables represent a combined total of 940 out of 1194 observations.

The first column (1) in Table 5 shows the results of the regression model without the main independent variable. The comparison between this model and the main model allows a clearer assessment of the unique impact of ShareFemaleDirectors on DiffMedianHourlyPercent. The coefficients and significance levels of the control variables remain almost the same when ShareFemaleDirectors is introduced. The big difference is that in the main model (2), ShareFemaleDirectors has a negative coefficient (-0.04), which is statistically significant at the 1% level. The consistency in the coefficients of the control variables between the two models suggests that the impact of ShareFemaleDirectors is independent of the effects of the control variables. This implies that ShareFemaleDirectors adds unique

Table 5. Robust regression results

	DiffMedianHourlyPercent	
	(1)	(2)
ShareFemaleDirectors		-0.040**
		(0.015)
CSize500_999	-1.156	-1.250
	(0.881)	(0.879)
CSize1000_4999	-0.903	-0.928
	(0.859)	(0.857)
CSize5000_19999	-4.672***	-4.527**
	(1.352)	(1.376)
CSize20000_inf	-4.345*	-4.113
	(2.162)	(2.142)
Edu_Health_Industry	-11.472***	-10.953***
	(1.344)	(1.360)
Manufacture_Industry	-5.567***	-5.950***
	(1.191)	(1.210)
Retail_Transport_Industry	-8.626***	-8.793***
	(1.170)	(1.171)
Service_Industry	-4.437***	-4.429***
	(1.281)	(1.275)
HasPatents	1.776*	1.786*
	(0.833)	(0.833)
GovInstitution	8.152**	8.815**
	(2.972)	(2.960)
Constant	15.538***	16.461***
	(1.174)	(1.238)
Observations	1,194	1,194
R^2	0.107	0.113
Adjusted R^2	0.100	0.105
Residual Std. Error	10.177 (df = 1183)	10.182 (df = 1182)

Notes: This table presents the robust regression results of the main model with the independent variable (2) and without the independent variable (1). *p**p***p<0.05

explanatory power to the model without confounding the relationship between the control variables and the dependent variable. The consistency of the effects of the control variables across both models increases the credibility of the findings. It suggests that the relationships captured by the control variables are stable and reliable.

The second column (2) in Table 5 shows that there is a negative relationship between the proportion of female on boards and the median hourly gender pay gap. The coefficient for ShareFemaleDirectors is -0.04 which is statistically significant at the 1% level. A significance level of 1% means that there is 99% confidence that the observed relationship is real and not due to random chance. The coefficient for ShareFemaleDirectors (-0.04) indicates that for every 10% increase in women on corporate boards, the median hourly gender pay gap (DiffMedianHourlyPercent) decreases by -0.4%. This suggests that increasing female representation on boards of companies is associated with a decrease in the gender pay gap. Column 2 also shows the results of the regression for the control variables. Regarding company size, like said earlier the omitted variable (CSize250_499) serves as the reference group. The coefficients for CSize500_999, CSize1000_4999 and CSize20000_inf are not statistically significant. However, CSize5000_19999 has a coefficient of -4.527 which is statistically significant at the 1% level. These results suggest that companies with 5000 to 19,999 tend to have a lower median hourly gender pay gap compared to the reference group. Regarding the four control variables about industry sectors that are included in the model are also measured to the omitted variables of that control group (Real Estate Industry, Financial Industry, Information and Communication Industry, Construction Industry and Others). The coefficients for Edu_Health_Industry, Manufacture_Industry, Retail_Transport_Industry and Service_Industry are -10.953, -5.950, -8.793 and -4.429 respectively. Those 4 coefficients are all statistically significant at the 0.1% level. These findings highlight that the industries included in the model have a big impact on reducing the median gender pay gap compared to the omitted industry sectors. Regarding the control variables of specific organizational characteristics, HasPatents has a coefficient of 1.786, which is significant at the 5% level and GovInstitution has a coefficient of 16.461, which is significant at the 1% level. These findings suggest that organizations with patents and government institutions tend to have a higher median gender pay gap. The robust residual standard error is 10.18, that is the average distance that the observed values fall from the regression line. The multiple R-squared value is 0.113 and the adjusted R-squared value is 0.105, suggesting that approximately 10.5% of the variance in DiffMedianHourlyPercent is explained by the model.

In summary, the analysis of the two robust regression models highlights a key finding. The main model (2) shows that an increase in the proportion of female directors on corporate boards is significantly associated with a decrease in the median hourly gender pay gap. This result provides empirical support for the hypothesis that in large UK companies, a higher proportion of women on corporate boards is correlated with a smaller gender pay gap among the workforce. The significant correlation observed in the analysis suggests that gender diversity at the board level can play a crucial role in lowering pay gaps within organizations.

5. DISCUSSION

This thesis investigated the relationship between the proportion of women on corporate boards and the gender pay gap within large companies in the United Kingdom. The findings reveal patterns and trends to better understand how presence of women on boards impacts the gender pay gap.

5.1 Conclusion

The research question of this thesis was: *"What is the relationship between the proportion of women on boards and the gender pay gap within large UK companies?"* This study answered the question by doing a plots and regression analysis. The regression analysis showed a significant negative relationship between the proportion of female directors and the median gender pay gap. The results suggested that companies with a higher proportion of females on corporate boards tend to have smaller pay gaps. This aligns with the existing literature, which suggests that increased female representation on boards can lead to smaller gender pay gaps among top positions (Carter et al., 2017). The plots analysis further confirms these findings. For instance, the bar chart in Figure 4 shows that companies with a higher percentage of female directors (40-50%) have the lowest median gender pay gaps. This indicates that a critical mass of female representation on boards is necessary to lower the gender pay gap. This aligns with existing literature which suggested that having a significant number of women, specifically at least 33% representation on boards, is needed for reducing the gender pay gap among non-executive directors (Tarkovska et al., 2023). Furthermore, Figure 5 shows that companies with no female directors on their boards have a notably higher median gender pay gap compared to those companies with female directors. The hypothesis that *"In large UK companies, a higher proportion of women on corporate boards is correlated with a smaller gender pay gap among the workforce"* was supported by the findings. This research finds evidence of a significant negative effect of the proportion females on boards on the median gender pay gap.

5.2 Implications

5.2.1 Practical implications

The findings of this thesis have a few practical implications. For policymakers, the results suggest that legislative efforts to increase the proportion of women on corporate boards can be an effective strategy to reduce the gender pay gap. This could be achieved by setting quotas or targets for female representation on boards. By doing that governments could drive systematic change that promotes equal gender pay and gender equality in the boardroom. Business owners can also benefit from the results of this thesis. By recognizing the importance of having more women on corporate boards they can implement policies that promote gender equality in the boardroom. This can lead to more equal wages for men and women. Enhancing corporate reputation is another implication. Companies that show commitment to gender diversity and equal pay can build a positive brand image. This could attract customers, investors and other stakeholders that value ethical business practices.

5.2.2 Theoretical implications

The findings of this thesis contribute to the existing literature of the impact of female representation on corporate boards on organizational outcomes (Hazaea et al., 2023; Pletzer et al., 2015; Alvarado et al., 2015). This study also contributes to the existing literature about the gender pay gap (Manning & Swaffield, 2008; Perales, 2013). By analysing the relationship between the proportion of women on boards and the gender pay gap, the findings support and extend theories that highlight the benefits of gender diversity. Figure 4 shows that companies with a percentage of female directors between 40 and 50 have the lowest median gender pay gap. This aligns with existing literature which suggested that at least a 33% women representation on boards is needed for reducing the gender pay gap (Tarkovska et al., 2023). The evidence from this thesis, showing that a higher proportion

of women on boards correlates with a smaller gender pay gap, suggests that achieving critical mass can lead to more equitable outcomes. Furthermore, the results show that increasing the percentage of females on corporate boards decrease the median gender pay gap, this aligns with the existing literature of Carter et al. (2017). That study suggested that increased female representation on boards can lead to smaller gender pay gaps among top positions.

5.3 Limitations and future research

Despite its contributions, this thesis has its limitations. The analysis is based on data from the UK Government's Gender Pay Gap Reporting Service. This data only includes gender pay gap data of UK companies with 250 employees or more. Small and medium-sized companies with fewer than 250 employees were excluded from the analysis due to the data limitations, which may limit the generalizability of the findings to smaller companies. Moreover, the thesis is limited to the United Kingdom. Different countries have different regulatory environments and cultural norms that can influence the gender pay gap and the impact of board diversity. Therefore, the findings of this thesis may not be applicable to companies in other countries outside the United Kingdom without considering these local factors. Additionally, the study relies on reported data, which could be subject to reporting biases. Furthermore, the main dataset used in this thesis was created by merging the UK Gender Pay Gap Reporting Service data with the Orbis data, which contained information about the genders of the board members. This process reduced the sample size from 13,422 companies to 1,194 companies, potentially limiting the representativeness of the findings.

Future research should address these limitations to provide a better understanding of the relationship between board gender diversity and the gender pay gap. Additionally, future studies could investigate effects of board gender diversity on the gender pay gap over a longer period. This approach could help identify trends and causal relationships more accurately, providing insights into how changes in board composition influence gender pay gaps over time.

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