

# Exploring the Impact of Nationality Diversity in Corporate Boards on the Gender Pay Gap

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## ABSTRACT,

*Since the 1900s there has been an increase in female working which has resulted in the gender pay gap. Defined as the gap between male versus female income, where it is commonly found that males are paid more than females. One of the key aspects in a company that influences decisions is the corporate board of a firm, where diversities present there can impact decisions. The specific diversity focused on is nationality diversity, looking at how many additional nationalities are present in the board. There are multiple theories used to explain both the gender pay gap and nationality diversity. Specifically for the pay gap there are the human capital model theory, labor market discrimination theory, and location and cultural background. For nationality diversity there is the agency theory and the impact of international perspective. The analysis focused on what impact the increase in nationality diversity has on the gender pay gap. Quantitative research was performed, within which one variable, two variable t-test were performed, followed by linear regression with added constants, resulting in quadratic analysis. The quadratic analysis shows a slight inverse U-curve, where the turning point was found within ShareNonUKMembers. From the outputs can be found that there is a slight relationship present between the impact nationality diversity has on the gender pay gap. Therefore the recommendation for future research would be to look at a broader research to include multiple nationalities. There is also the recommendation to include a part of nationality diversity, as it does show to have added benefits, or have a mainly diverse board. Having a majority creates more unity, with the added perspective from the diversifiers.*

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## Keywords

Board room, Gender pay gap, Nationality diversity, ShareNonUKMembers (share of Non UK board members present), Linear Regression, Quadratic relation

# 1. INTRODUCTION

“The Guardian view on the gender pay gap: transparency on its own isn’t enough” (The Guardian | Editorial, 2023)

Within this thesis the topics to be discussed are the female gender pay gap and a diversity within the board room, and what effect this diversity has on the pay gap. Firstly it is important to discuss the different components present within the research question being the gender pay gap, then looking at it specifically in the UK. The UK is due to the data being able to be collected from the UK, which will be specified later on. Then there is diversity within the board room specifically looking at nationality diversity. In a boardroom it is important to look at the diversity as any type of diversity could significantly impact aspects within a company.

The first relevant topic to be focused on is the female gender pay gap. The female gender pay gap was established as soon as women started working, and has been present ever since. One of the first clear moments it was brought to attention was during world war one, where females were expected to perform the same jobs as men, but for a lower wage. The first moment the issue of the gender pay gap was more widely known was during the 1960s, as it then became more clear with more females in the workforce. Through this awareness there was an equal pay act passed in 1970, but wasn’t enforced until 1976 (Gender Pay Gap and the Struggle for Equal Pay | Striking Women, n.d.).

The female gender pay gap can be defined as the “difference in average gross hourly earnings between women and men” (Understanding the Gender Pay Gap: Definition and Causes | Topics, 2023). It is based on the salary before income tax is subtracted. The reason for the existence of the female gender pay gap can also be found due to flexibility vs. Higher wages (Rho, 2021). As will be explained more in the theoretical background, there are discriminations present that affect possibilities and opportunities for females.

There is also the component of understanding the relevance of the topic of female gender pay gap, as it is very current, and still a clear issue present in the current society. Having a better understanding creates a clear overview of where the issues come from, as well as what potential solutions could be found in decreasing the Gap. There is also the importance of looking at benefits of closing the gender pay gap. Benefits include an increase in purchasing power, which in turn stimulates consumer spending and the economy. Through the study performed by PricewaterhouseCoopers, there is also an estimated gain in gross domestic product (GDP) of economies (Understanding the Gender Pay Gap, 2020). Another benefit that was found was incentives for females to be more economically active, which would advance gender equality.

The second component that will be discussed is the diversity within the board room. “Diversity refers to bringing together a range of qualified directors from different backgrounds, including gender, age, race, ethnicity etc., who can ensure that companies make sound business decisions that reflect the perspectives of the markets they serve” (Makinde, 2024). Including diversities within the Boardroom creates the added aspect of different approaches and perspectives, and also motivates innovation, creativity and better decision-making (Henry, 2023). Increasing innovation, creativity and decision-making ensures that there is a clearer view of what the company would want to achieve and what it is working towards, leading to a better functioning company. Having diversity in a boardroom also increases the breadth of personal experience, making it wider and more comprehensive, making it beneficial for all

members present within the board room. (The Benefits of Diversity in the Boardroom | Directorpoint, n.d.)

Within diversity there is the specific diversity that will be focused on during this research, being nationality diversity. Nationality diversity refers to “different nationalities among academic staff that increases language, value and information diversity in organizations” (Maximova-Mentzoni, 2019). Depending on the different diversities present, different aspects are brought to the table, as multiple nationalities have other approaches (Kaczmarek & Nyuur, 2021). Besides the added benefits of diversity in a board room there is also the relevance that should be discussed as to why it is important to discuss and have boardroom diversity. Having diversity, specifically nationality diversity is crucial as it widens the perspective of the boardroom, and creates a combination of multiple cultures. There is also a rise in diversity within the boardroom, showing that the change is happening, and what impact that change has. Investors are currently one of the pushers towards a more diverse board, as the added benefits are clearer as well as showcasing how focused and collective action can spur meaningful change (Makinde, 2024). Another clear diversity present that could be important to mention is that there is the impact of gender practices in recruitment and selection. As there is still a clear underrepresentation of women in top positions, which can be explained by going back to gender stereotypes. Having top corporate positions being almost exclusively taken up by men, has an impact on the image of the company and the possible candidates for the future positions (Blommaert & van den Brink, 2020).

After now having discussed the importance of both the gender pay gap, and the diversity in the boardroom specifically nationality, there is the third aspect which is the reason for looking specifically at the UK. The reason for looking specifically at the United Kingdom is because of the fact that there was a law instated in 2017 stating that all salaries within the UK have to be public. “The Equality Act 2010 (Gender Pay Gap Information) Regulations 2017 mandates all firms with 250 or more employees in England, Wales and Scotland (not Northern Ireland) to publish GPG reports on each year, effective from on 6 April 2017 (hence-forth as Transparency data)” (Mostak Ahamed et al., 2019). Creating pay transparency has many benefits, including trust with employees, pay equity, talent acquisition, retention of employees and productivity for employees (Schwarz, 2023). Besides the benefits of having pay transparency, it also gives access to look at the differences between genders of all employees, for this research then specifically of a company in the UK. Besides the difference in gender, the nationalities of board members in companies can also be found through the publications of board compositions on Orbis, making the comparison between companies possible. The Orbis database can be used to find financial and business information on about 200 million companies worldwide, based on annual reports (Orbis, n.d.) in which board composition with required information can also be found.

Looking at the combination there has already been some research done in the direction of the gender pay gap present within the board room, but with less focus on the diversities present. The clear combination that has already been found is comparing or researching specific aspects of each component, but not specifically the impact that nationality diversity in the boardroom would have on the gender pay gap.

Looking specifically at the research already done within this region, one of the first things to look at would be, what gender gap would be present within CEO compensation. A study was done looking specifically at CEO’s in the US, where it was found that there was “no difference in total pay, salary or bonus for

female CEOs. These findings show that if women are able to climb the corporate ladder to the very top, they face no gender bias in pay. The insignificant difference in bonuses paid to CEOs across the genders is inconsistent with the suggestion, at least for CEOs, that women are risk-averse and will be reluctant to accept performance-based compensation” (Bugeja et al., 2012). Seeing that there is no clear difference, is significant to state, as that could impact the results and research done, as the pay gap would then be more present in the boardroom as well. It is important to note that this was restricted research, which is based for the US and not the UK, therefore the same assumptions cannot be made. Another study was performed by Carter, Franco and Gine where research was also done within the gender pay gaps within executives, where a difference was found, showing that besides CEO, there is a significant difference to be noted for the other roles present within boardroom composition (Carter et al., 2016).

Then you could also take a look at how board composition affects the gender pay gap, as this is one of the areas that has also been researched, and is relevant to take into consideration when looking at the impact of boardroom diversity. A study performed by Mostak, Wen and Gupta where this topic was researched, from which was found that if a firm has a higher fraction of independent directors, gender pay gap goes up. It was also found by them that large firms, firms with higher sales growth and higher average remuneration, worsen the gender pay gap. Looking at what improves and lessens the gender pay gap is was found that having foreign directors positively contribute to firms’ performance, which in turn results in the positive performance of firms relates the gender pay gap (Mostak Ahamed et al., 2019). Having the understanding of the general influence of board composition on the gender pay gap makes the research more relevant and shows that there is an impact to be found.

Something that the Boardroom can impact is the local labor markets, therefore it can be relevant to have an understanding of the gender pay gaps present there. Industry structure goes back to the postwar rise in female participation in the labor market. There has been a rise in, also specifically the UK, share of services from about 50% to around 75% between 1940-2017 (Pentrongolo & Ronchi, 2020). Having an increase in females present in the labor market, means that the structure also has to be changed to compensate and work for females. Boards within a company are in charge of and can alter the structure of their current company, showing the relevance for both the pay gap and the Boardroom.

Having had a look at connections already made between boardroom composition and the female gender pay gap, it shows what has impacted and influences the gap, as well as the relevance of the diversity within the boardroom.

Based on what has been stated throughout the introduction and after looking at the combination of both aspects, it still is not well known what effect diversity in the boardroom has on the female gender pay gap, specifically nationality diversity hence the research question becomes:

*How does nationality diversity in the boardroom affect the female gender pay gap?*

## **2. THEORETICAL BACKGROUND**

### **2.1 Female Gender Pay Gap**

There are different types of theories that explain why the gender pay gap exists. One of the most common theories that could be applied to explain the difference is the human capital model. Within this model the focus lies on the division of labor by

gender in the family, in which women tend to accumulate less labor market experience than men. Further, as women are more likely to have shorter and more discontinuous work lives, there is a lower incentive for them to invest in the labor market. There is less incentive to follow formal education and on the job follow training, because of this, there is a lower human capital investment, leading to lowering their earnings relative to those of men (Grybaite, 2010). A study was done by Polachek, through which the human capital model has been used to predict the differences in the gender pay gap (Polachek, 2004). The difference of the pay gap was recorded and seen through the human capital model throughout the years. From this model the pay gap could be explained, justified and predicted, creating a better overview of the timeline, as well as current reasoning behind the gap. The main prediction given by the human capital model is on the gender wage ratio, and any changes that could happen.

Another explanation that could be found about the female gender pay gap, has to do with the labor market discrimination. Under labor market discrimination, there is economic discrimination which is defined as “when otherwise identical workers receive different pay doing the same job, or are given different chances of employment or promotion” (Grybaite, 2010). Then there is also value discrimination which states that “jobs performed mostly by women are paid less than those jobs that are performed primarily by men” (Grybaite, 2010). Finally there is also wage discrimination which for women is the material foundation for subordinations and lack of economic equality (Arrow, 1972). All these labor market discrimination work together to make the working environment for females less appealing than for males, creating a gap. Within that gap it is then easier to have the gender pay gap, as there are qualities and situations in which females are less valued or committed. Neumark did a study showing what effects labor market discrimination has on the gender pay gap. The production function approach in this study refers to measuring productivity, with its focus on hiring not wages (Neumark, 2018).

Internationally there is a difference between how a country approaches and deals with the gender pay gap. Depending on location the pay gap can alter, as it is also culturally and nationality based, there are countries where the impact of religion is significant. Within specific religions, the bases can be made for females to be paid less, resulting in a larger wage gap then in countries where religion is more equality based. “In nations where 95% or more of the population reported religion as an important part of their daily lives, women earn only 46% of what men do, whilst in nations where 20 percent or less of the population indicated the importance of religion, women earn 75% of men’s wages” (Campbell, 2021). A study was also done comparing the US and Sweden, by Francine Blau and Lawrence Kahn, from which it can be found that there is a larger gap in the US than in Sweden. The wage gap in the US isn’t due to traditional gender-specific factors, but due to larger penalties that are related to below average skills or are located in less favored sectors (Blau & Kahn, 1996).

### **2.2 Nationality Diversity in Boardroom**

Then looking at nationality diversity, there are theories related as to why having foreign nationalities on the board would be beneficial. The main finding that can be found is looking at the benefits for the company when having foreign nationalities on the board. There are many diversities that can be present when looking at boardroom composition and have different effects. As stated in the introduction, the specific diversity that will be discussed is nationality.

Through the research performed by Estelyi and Nisar, it was found that having foreign nationality originating from a similar legal and economic background as that of the UK will have a positive impact on firm performance (Estelyi & Nisar, 2016). Having the different nationalities can have different added benefits presented to the company. One of those benefits could be a potential increase in financial performance for companies, as there are different perspectives represented within the board room. A study performed by Alina Woschkowiak showed and confirmed that when there is more nationality diversity in the board of directors, the better the financial performance of firms (Woschkowiak, 2018). Another benefit of adding nationalities to the board would be that there is more diversity in the corporate approach of a company as well, looking specifically at corporate social activities. "With respect to corporate social activities, foreign directors could bring their cultural values and perspectives on the role of corporations in society" (Harjoto et al., 2018). Besides stating what impact nationality diversity could have Harjoto et al also performed a study to show what impact could be found, where it was found that there is both a positive and negative aspect related to the added diversity. The positive aspect that was found was that diversity could lead to more creative problem solving and solutions, consistent with intergroup contact theory and cognitive resource diversity perspective. The more negative aspect that was found was that as predicted by social categorization theory and similarity/attraction paradigm, diversity could lead to less teamwork cohesion that affects group decision making process (Harjoto et al., 2018).

Looking more specifically at theories there is one clear theory that is found to explain boardroom performance, being the agency theory. Within the agency theory, management is also referred to as agents in a business and how they act towards the principals. Board representatives are in this case referred to as the principals, and the agents work towards creating a goal that the principals agree with and want to work towards (Da Silva Rodrigues, 2014). Creating a clear overview of what principles are crucial and important to work towards, creates a better overview for the board of directors within a company. Including different nationalities in this part of the process also increases diversity by creating different viewpoints and changing approaches, as different nationalities could approach aspects in other ways. Looking at the agency theory, it was adopted in a study presented, by a group of researchers including Zaid, to look at how previous researchers understand the extent to which board diversity dimensions affect corporate sustainability performance (Zaid et al., 2020)

### 2.3 Contribution

Looking at specifically the nationality diversity which then becomes the contribution of this research, showing what impact that has on the female gender pay gap. As stated within the introduction research has already been performed to see what potential pay gaps are present within the Boardroom composition. Adding the component of nationality diversity could show the impact on the gender pay gap, and through that more explanations and possible solutions could be found to decrease the gender pay gap. There hasn't been a lot of research done looking specifically at nationality diversity and its effect on the female gender pay gap. It is significant to find what potential relationship there could be, as that could impact the necessity of diversification of the board, specifically then nationality wise. The approach of how the research will be done will be explained in the next chapter of Methodology.

## 3. METHODOLOGY

For the Methodology a data set was created to be used for the analysis performed. The combined data set is composed of two separate datasets with the relevant information regarding both the company pay gap information and the retrieved Orbis data regarding the boards of the company.

The first data set that was presented was the firm data, which included the variables about the pay gap data, company size, relevant information about the firm and other data that is present about the pay gap within the company. The main variable that will be used from this data set is `DiffMedianHourlyPercent` which is the difference in median hourly percentage. This variable has a range from negatives to positives, where the positive side is that the male gender has a higher hourly percent and the negative side is where females have a higher hourly percent. It is also relevant to state that both the mean and median of a company are stated in this data set, however the median is used, as it gives a more accurate representation of the company and less prone to skewness. The two other variables that were taken from this data set are used as control variables in the analysis. The first one is `GovInstitution`, being a variable about relevant information about the firm, which is a true false variable where a 1 means it is a governmental institution and a 0 means it is not. The second control variable taken from this data is the `CompanySize`, which has a range from 1 to 6 going from small to large respectively. The category a company falls under depends on their yearly turnover combined with the amount of employees present within a company.

Besides the firm data set, there is also the Orbis data that has been used in the merged data file. Within the Orbis data the most significant variables that should be discussed are the director count and the nationality related variables. Most variables within this data set are used to create data relevant and used in the merged data set. The variables `DirectorCount`, `NumNationalities` and `NumNonUKMembers` are both determined from this data set and are then used in the merged data set. `DirectorCount` and `NumNonUKMembers` is used to calculate `ShareNonUKMembers`, explained later on. Then `NumNationalities` is used as one of the variables to determine nationality diversity within the data set. From the variable `NumNonUKMembers` the variable `HasNonUKMembers` can also be determined, which is also present in the data set. All these different variables are just counted by person, so are a whole number present within the company. As with the firm data, there is also a constant variable that will be used from the Orbis data, the variable `HasPatents`. This variable is again a true false variable stating whether a company has patents or not, showing whether a company has innovation aspects, as they would have patents if they do. The Orbis data is mainly used to create significant analyses of possible variables in the merged data set.

From these two data sets a merged data set was created, with additional variables to use for the analysis. The crucial variables that were added in this data set are mainly `ShareNonUKMembers` and `HasNonUKMembers` and probability related variables. Firstly looking at `ShareNonUKMembers`, this variable is calculated by looking at the total number of international board members divided by the total number of board members present, which creates a percentage to use in the analysis. Then the variable `HasNonUKMembers` is a true or false variable, stated with 1 when true and 0 when false, which is determined with if there are international members present in the board. Including the aspect of probability within the data set there are the variables `BlauIndex` and `HHI` (Herfindahl-Hirschman Index) which were calculated and added into the merged data set. Where the `BlauIndex` measures the probability that two randomly selected board

members are of different nationalities, with a range from 0 to 1 going from no diversity to maximum diversity respectively (Solanas et al., 2019). This variable is calculated by the formula of  $1 - \frac{\sum(\text{proportion of directors of nationalities } i)}{N}$  with range of  $i$  to  $N$ , where  $N$  is the total number of different nationalities. Besides the Blau Index there is also the Herfindahl-Hirschman Index (HHI) which is commonly used to measure market concentration (Bromberg, 2024). In this context it is applied to diversity, where it is calculated as the sum of squares of the proportions of each nationality with lower values indicating greater diversity. The formula for HHI is the same as that of the Blau Index, but without the  $1 -$  in front, becoming the inverse of the Blau Index. The formula is then:  $\sum(\text{proportion of directors of nationalities } i)^2$  with range of  $i$  to  $N$ , where  $N$  is again the total number of different nationalities.

Looking at the analysis, quantitative research that will be performed to analyze the data. This will be done with the data including different variables and using the program R-studios in which the data can be analyzed and compared. The first analysis performed is the T-test, used for stating whether or not variables are significant in the analysis. There is a t-test with one variable which shows the significance of this variable. There is then also a t-test with two variables showing the significance and relevance of variables in comparison to one specific other variable. The mean of both groups is calculated to show what difference a significant variable can make, and what impact that variable has. This variable is a true false variable, as that is how the t-test can be performed.

The next analysis that will be done is a Linear regression model is performed to show how a dependent variable relates to the independent variable. Linear Regression assumes that there is a direct correlation between the two variables and that this relationship can be represented with a straight line, enabling the opportunity to predict the dependent variable if the independent variable is known. By performing this analysis the relationship between the variables can be presented both analytically and graphically (Grant & Whitfield, 2023). For the graphical analysis there is the general Linear Regression Plot which will be presented, after which 4 relevant plots will be generated as well.

The four graphs that will be plotted are Residuals vs Fitted, Normal Q-Q Plot, Scale-Location Plot and Residuals vs Leverage. In the first plot that will be generated, Residuals vs. Fitted, the purpose is to check for non-linearity, unequal error variance and outliers. Within this graph the goal is to have the residuals randomly scattered around the horizontal line without any systematic pattern; if there is a clear pattern present it could suggest non-linearity. The next graph presented is the Normal Q-Q Plot which has the purpose of assessing whether the residuals follow a normal distribution or not. Depending on the graph, the points should lie approximately along a straight line, where deviation presents data going away from the normality, e.g. skewness. Scale-Location Plot is the third plot that will be presented, which is meant to check for homoscedasticity, constant variance of residuals. When this graph is presented the residuals should be equally spread along the range of fitted values, where a visible pattern indicates heteroscedasticity. Finally the last graph that will be presented is the Residuals vs. Leverage, where the goal of this graph is to identify influential observations that have a disproportionate impact on the model. Within this graph Cook's distance is often added to the plot to measure the influence of each observation on the fitted values. In this graph the leverage measures how far an observation's values of the explanatory variable are from those of the other observations, where residuals that are both large and have high leverage are found to be particularly influential, being potential

outliers. These four graphs show impactful and significant evidence of the importance of a variable.

After the initial linear Regression is done, the constant variables stated earlier will be added, since this ensures that the model will be "unbiased, in other words, the mean of the residuals will be zero. By including a constant, one degree of freedom for error will be lost, but it's a small price to pay for the protection against bias" (Turgal, 2021). Within this linear regression, percentage variables can also be edited to show potential relationships within a quadratic regression. From there an analysis can be done to show the impact the diversity of a board can have on the median hourly percentage of pay gap.

To analyze this relationship it is important to understand quadratic regression and outputs. "Quadratic regression is a statistical method used to model a relationship between variables with a parabolic best-fit curve, rather than a straight line. It is ideal when the data relationship appears curvilinear" (Quadratic Regression, n.d.). If a quadratic function is added in the linear regression, and opposites of the same variable occur, it is relevant to add in the quadratic regression. For this analysis it would be the variable ShareNonUKMembers and the square variable of ShareNonUKMembers. A quadratic relationship and then show either an U function, or inverse-U function, from which either a maximum or minimum can be calculated. With this extreme it can then be determined whether this is an optimal point, with a U shaped curve, or the suboptimal point with an inverse-U shaped curve.

Through the performance of these analysis methods a clear overview can be created to show and state if and what kind of relationship between the different variables present in data.

## 4. DATA ANALYSIS

### 4.1 T-tests

#### 4.1.1 One Variable t-test

First one variable t-tests were performed to show general mean information about different variables that will be used in the analysis part. The t-test was performed for the variables DiffMedianHourlyPercent, ShareNonUKMembers and HasNonUKMembers. Below is a table stating the means of different variables, which are used in all main tests and models of the analysis.

**One Variable T-test Mean Output**

Variable	Mean
DiffMedianHourlyPercent	10.59849
ShareNonUKMembers	0.1646397
HasNonUKMembers	0.3363413

**Table 1**

As stated in chapter 3. Methodology the DiffMedianHourlyPercent has a large range, but the mean is found to be around 10.59849. As this is the average percentage of difference in hourly pay, it is seen that the average mean is still positive, showing that there is still a significant gap where males are paid more than females.

Another relevant variable in the research is ShareNonUKMembers, where the mean shows that on average a company has a share of non-UK board members. However since it is a smaller mean, and this variable is calculated as a

percentage, there is a clear proportion showing that there are significantly more UK members present within the board. There is an assumption that due to companies being in the UK that the board would consist of mostly UK members, which is through this meaning proven.

Finally the last variable that was tested with the one variable t-test is HasNonUKMembers, as this is the true/false constant used in the two-variable t-test. As can be seen in table 1, when looking at the mean of the variable HasNonUKMembers is around 0.34. From this can be deduced that around 33.63% of the companies have a Non UK member in the board of directors.

#### 4.1.2 Two Variable T-test

After having done the one variable t-test, the two variable t-test was performed. Within this analysis there were four tests performed of which the mean outputs can be seen in Table 2 below, where the variable HasNonUKMembers was used as the true or false variable as explained in Chapter 3 Methodology. The true/false variable was then used to create separate means of the variables DiffMedianHourlyPercent, ShareNonUKMembers, CompanySize and NumNationalities. From these means it can then also be determined which are relevant to discuss.

**Two Variable T-test Mean Output**

Variable	Mean when 0 for HasNonUKMembers	Mean when 1 for HasNonUKMembers
<i>DiffMedianHourlyPercent</i>	9.683725	12.403482
ShareNonUKMembers	0.000000	0.489502
<i>CompanySize</i>	2.843088	2.822222
NumNationalities	1.000000	2.170732

**Table 2**

Within the table there are two rows which have been put in italics, as these are the most essential elements to discuss when looking at the two variable t-test. For the variables ShareNonUKMembers and NumNationalities, the outputs of the mean when HasNonUKMembers where expected to be 0 and 1 respectively. With these mean outputs, there is no relevance in discussing the different means, as there is not change to be discussed.

Then looking at the other two variables, DiffMedianHourlyPercent and Company size, there are some very interesting conclusions to be made from the means found. Firstly, with the variable DiffMedianHourlyPercent it can be found in Table 2 that when there are only UK members on the board that the pay gap percentage is slightly smaller than when there are non UK members present. Through this difference of means it would seem that having the diversity of nationalities there would be a slight increase in the pay gap. Even though the range of this variable is significantly larger than the difference seen in the means, it still creates a curious output as how that can be seen in the continued research. More can be found in chapter 4.4, where the linear regression shows a different relation.

The other variable that is significant to look at in this output of means is CompanySize, as the means found are relatively similar to each other. As the range for company size is between 1 and 6,

having means so close to each other shows that whether or not a board has non UK members is not directly influenced by the size of the company. From this it also creates a clear indication that this variable can be used as a constant in the linear regression, as it has very little impact on the research variables.

Through the analysis of the T-test means were found to state significance as well as showing initial results that are now to be taken into consideration for further research when looking at the linear regression models.

## 4.2 Linear Regression

As the second part of the analysis a linear regression was performed to analyze the different variables and their relation to the variable DiffMedianHourlyPercent (DMHP). In this regression analysis the variables used for analyzing their relationship with DMHP were ShareNonUKMembers, BlauIndex, HHI and NumNationalities. As these variables can all be taken into consideration when looking at the diversity aspect of analysis. These linear regression analysis outputs can all be found appendix II.

Looking at the analysis of the Blau Index compared to the HHI it can also be seen in the table below, that the outputs of these have an inverse relationship, as variables have an inverse sign when looking at the coefficients. Then looking at the rest of the information stated with residual standard and such, these outputs are the same, as the same analysis is performed.

Below, in table 3, there are 4 different dependent variables being tested to see which variable has the most significant impact, and will be used in the linear regression with constants. The four dependent variables tested as a diversity index are ShareNonUKmembers, BlauIndex, HHI, NumNationalities, in relation to the independent variable DiffMedianHourlyPercent.

**Linear Regression Outputs**

Output	ShareNonUKmembers	Blau Index	HHI	Num Nationalities
Residuals (min)	-126.311	-	-	-
Residuals (1Q)	-9.008	-8.940	-8.940	-8.823
Residuals (Median)	-2.301	-2.048	-2.048	-1.958
Residuals (3Q)	8.102	8.042	8.042	8.046
Residuals (max)	51.649	52.095	52.095	52.159
Estimate (Intercept)	10.0506	9.6051	17.058	6.8562
Std. Error (Intercept)	0.4909	0.4971	1.753	0.9615
T-value (Intercept)	20.476	19.321	19.321	7.131
Pr(> t ) (Intercept)	<2e-16	<2e-16	<2e-16	171e-12

Signif. (Intercept)	0	0	0	0
Estimate	3.3275	7.4528	-7.4528	2.6851
Std. Error	1.4982	1.9628	1.9628	0.6199
T-value	2.221	3.797	3.797	4.332
Pr(> t )	0.0265	1.54e-4	1.54e-4	1.60e-5
Signif.	0.01	0	0	0
Residual Standard Error	17.82	14.76	14.76	14.73
Degrees of Freedom	1217	1217	1217	1217
Multiple R-squared	0.004037	0.01171	0.01171	0.01518
Adjusted R-squared	0.003219	0.0109	0.0109	0.01438
F-statistic	4.933 on 1	14.42 on 1	14.42 on 1	18.76 on 1
P-value	0.02653	1.536e-4	1.536e-4	1.601e-5

**Table 3**

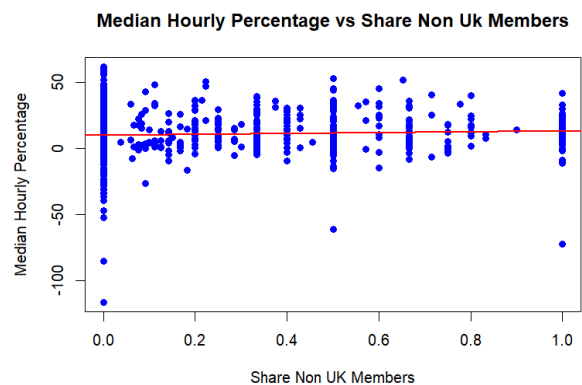
The output found in table 3 are the outputs generated from the linear regression R-code that was written. Within this table there are first the residuals stated, which have a range from min to max, showing the difference between the actual values and predicted values for the dependent variable stated above. Then first is the analysis of the intercepts, after which the same analysis but not the intercept including Estimate, Std. Error, T-value, Pr(>|t|) and Signif. For these values, each can create a linear formula of  $y = mx + b$ , where  $b$  is the intercept and  $m$  is the slope of the line. So looking for example at Estimate from the dependent variable ShareNonUKmembers, the formula would become  $y = 3.3275x + 10.0506$ . For each dependent variable a linear formula is created for the different components. Then for the residual standard error the different dependent variables show how well the model fits, relevance for comparing the variables. For the r-squared variables these show any significance in the relationship between the independent and dependent variable. Finally the f-statistic and p-value show whether or not there is a relationship present which can be investigated.

As can be seen in the table the dependent variable ShareNonUKmembers has the lowest R-squared variables and the highest p-value, it becomes a significant variable to use in the analysis with the control variables.

Looking at the linear regressions of ShareNonUKMembers and NumNationalities the outputs of these analyses seen in table 3 show that these variables show a slight significant impact on the DiffMedianHourlyPercent. The ShareNonUKMember variable is a percentage which can then also create a quadratic regression analysis which could help explain the impact it has on the DMHP.

Then looking specifically at the variable ShareNonUKMembers a graphical analysis has also been done.

### Graphical Linear Regression Analysis



In the graph of figure 1 it can be seen that the linear regression line in the analysis has a slightly positive incline, which would result in a slight positive relation between the two variables. Besides this graph 4 other graphs are presented in appendix III which show different analytical relationships between the variables. The four graphs plotted are Residuals vs Fitted, Normal Q-Q Plot, Scale-Location Plot and Residuals vs Leverage as stated in Chapter 3 Methodology. Looking at figure 3 (appendix II) firstly, Residuals vs Fitted Plot, it can be found that there are some outliers, but most values are plotted closer to the linear line present, showing that there could be a linear model visible in this data. Next looking at figure 4 (appendix II) the graph indicated that the residuals are mainly normally distributed as most values are found to be very close to the line present in the graph. For figure 5 (appendix II) it can be seen that there is homoscedasticity implied, meaning constant variance of residuals is present. In the final figure, figure 6 (appendix II), the Residuals vs Leverage Plot, can be interpreted as that there are no observations unduly influencing the model. Looking at the Cook's distance presence, as it is straight, it supports the observation of no extra influence in the model. These graphs also support the conclusion that the best variable for analysis in the linear regression model with control variables is found to be ShareNonUKMembers.

Within all analysis it is found that there is a form of relationship between each variable, however the impact one has on the other is very small. To expand on this analysis to see how the relationship can be more defined a linear regression with constants will be performed in the next subchapter.

### 4.3 Linear Regression with constraints

After the previous linear regression was performed, the addition of constants was made in the analysis, as that makes the data more unbiased. Besides the constants a variable of the squared term of the independent variable was also added to see what relationship is present and can be concluded. An analysis was done with squared terms with the index variables of ShareNonUKMembers, BlauIndex and HHI. From the outputs from this it was determined that the output of ShareNonUKMembers was best in showing the relationship and effect on the pay gap. Therefore the main focus of the data analysis presented in this chapter 4.4 Linear Regression with Constants is about the output related to ShareNonUKMembers.

In the table below the Coefficients of the Output of the Linear Regression with constants can be found

**Linear Regression with Constants Output**

<b>Coëfficiënt:</b>	<b>Estimate</b>	<b>Std. Error</b>	<b>t-value</b>	<b>Pr(&gt;  t )</b>	<b>Signif. code</b>
(Intercepts)	11.1562	1.3666	8.163	8.16e-16	0
ShareNonUKMembers	15.4727	4.7314	3,270	0.0011	0.001
ShareNonUKMembers_squared	-15.2673	5.5041	-2.774	0.0056	0.01
CompanySize	-0.8956	0.4354	-2.057	0.0399	0.05
HasPatents	2.0715	0.9387	2.207	0.0275	0.05
GovInstitution	7.8523	1.8421	4.263	2.18e-05	0

Besides these coefficients there was also the residuals as well as final information:

Min (-125.625), 1Q (-8.060), Median (-2.078), 3Q (7.958), Max (50.653)

Residual standard error: 14.65 on 1202 degrees of freedom

Multiple R-squared: 0.03039, Adjusted R-squared: 0.02636

F-statistic: 7.536 on 5 and 1202 DF, p-value: 5.597e-07

**Table 4**

Looking at the outputs stated in table 4 it can be seen that when looking at the linear term of ShareNonUKMembers, the coefficient found there is 15.4727. The coefficient represents a one unit change in the variable DiffMedianHourlyPercent when holding all the other variables constant. Therefore showing that there is a slight increase in the pay gap when the share of non UK board members increases. However when taking into consideration the quadratic term of ShareNonUKMembers\_squared, it can be seen that the coefficient is found to be -15.2673. Where in this case it also represents that a one-unit increase in the share of non UK board members results in a -15.2673 change in DiffMedianHourlyPercent, when the linear term and other variables are held constant. As these outputs can work together it is then also crucial to look at the combined effect of these two outputs, however it is also important to look at the other outputs that are relevant to discuss in the output. These points found for both variables show that there is relationship that can be found, and would be significant to state. As these are almost inverse points of each other, they are found to be a quadratic relationship, which can show us what kind of relationship there is between Share of Non-UK Members and the pay gap. Creating the squares gives the opportunity to find the roots of the relationship and where they start.

Besides the variables stated in the table, there is also a relevant list of values stated below indicating important information about the model. First here is stated what the Residual standard error is found to be 14.65. This value is found by taking the standard deviation of the residuals and represents the average amount where the observed values are seen to deviate from the fitted values. The degrees of freedom has been decreased by adding the constants, as stated in the methodology helps with making the analysis more unbiased. Another two key output components to also take into consideration are the multiple R-squared as well as Adjusted R-squared, as these values are found to be relatively low in Table 3, it indicates that the linear regression model explains only a small proportion of the variance in the dependent variable. Even though it is found that there is only a small part of the variable that explains the dependent variable, it is still significant enough to look at the model and see what potential information can be gathered from the related data. Finally there is the f-statistic which tests whether at least one of the regression coefficients is different from zero, where the p-value can be seen to be significantly small. With a small p-value it can be concluded that even though the R-squared values are found to be small, the model as a whole is seen to be statistically significant.

Going back to the squared term added as a variable, a quadratic relationship was also created as it can capture non-linear relations. The formula to explain a quadratic relationship is with the variable ShareNonUKmembers found to be:

$$\text{DiffMedianHourlyPercent} = \beta_0 + \beta_1 \times \text{ShareNonUKMembers} + \beta_2 \times \text{ShareNonUKMembers}^2 + \text{controls} + \epsilon$$

Where:

$\beta_0$ : Intercept

$\beta_1$ : Coefficient for the linear term (ShareNonUKMembers)

$\beta_2$ : Coefficient for the quadratic term (ShareNonUKMembers\_squared)

Controls: Other control variables included in the model (e.g., CompanySize, HasPatents, GovInstitution)

$\epsilon$ : Error term

For the combined effect the variables ShareNonUKMembers and ShareNonUKMembers\_squared are used to determine relationship between ShareNonUKMembers (overall) and DiffMedianHourlyPercent. Firstly there is the positive linear coefficient which indicates that initially when the share of non UK board members increases, the difference in median hourly percent also has a tendency to increase. Then looking at the negative quadratic coefficient, it indicates that the rate at which there is increase in the difference in median hourly percentage slows down when the share of non UK board members increases. From this can also be found that there could be a decrease started in DiffMedianHourlyPercent at a certain point. As there is a quadratic function, the turning point can also be found using the different ShareNonUKMembers variables with the formula:

$$\text{ShareNonUKMemberspeak} = -\beta_1/2\beta_2$$

Which when calculated with the coefficients becomes:

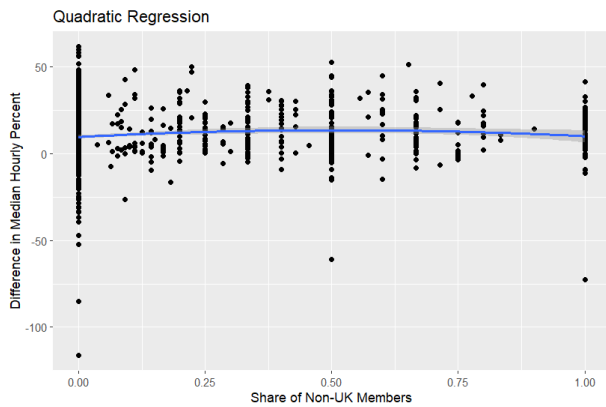
$$\text{ShareNonUKMemberspeak} = -15.4727/2 \times -152673 \approx 0.5066$$

With this output it can concluded that DiffMedianHourlyPercent reaches its maximum value when ShareNonUKMembers is approximately 0.5066

The program R was also used to create a graph, Figure 2, with the quadratic regression present and shows slight the inverse U curve present in the data.

### Regression Graph with quadratic curve





**Figure 2**

As previously calculated it is also clear to see that the point of the curve is around 0.5, showing that when there is an approximate split in the share of Non-UK members the pay gap becomes higher.

## 5. CONCLUSION

Looking back at the research done and the analysis performed it has become clear that there is not one specific outcome, but more a combination of different ones.

From the research performed it was found that the variable pay gap is defined, as in the introduction, to be the difference in average gross hourly earnings between women and men. Within the data is also crucial to show the understanding that a positive outcome shows that men are paid more, whilst with a negative pay gap it is found that women are seen to be paid more. As this is also a very current and recurring topic, it shows to be very relevant to analyze. Then looking at the review done about the diversity of the board, it is also crucial that the definition of the diversity. Defined as referring to bringing together a range of qualified directors from different backgrounds, including gender, age, race, ethnicity etc., who can ensure that companies make sound business decisions that reflect the perspectives of the markets they serve. Then the specific diversity to focus on became nationality diversity which is defined as: different nationalities among academic staff that increases language, value and information diversity in organizations. These are the two components on which the research was based.

With these two variables an analysis was done to show how these two variables relate, more specifically how the nationality diversity within the board impacts the gender pay gap within the company.

Then looking at the analysis done, there were two data sets which were merged into a quantitative data set which could then be used to look with statistical perspective. Multiple analyses were performed, including one variable t-test, two variable t-test, linear regression and finally linear regression with added constants. From these analyses multiple conclusions can be made, of which a final outcome was able to be generated with most significance by the last analysis performed.

With these two variables an analysis was done to show how these two variables relate, more specifically how the nationality diversity within the board impacts the gender pay gap within the company.

The first output that should be looked at is the two variable t-test output found when analyzing DiffMedianHourlyPercent with the true false variable of HasNonUKMembers. The result here was

found to be that when a board has non UK members present that there would be a slight increase in the pay gap. After finding this initial relation it became clear that performing a linear regression would help in explaining the relationship between these variables and showing exactly what kind of relationship there is.

Next the general linear regression analysis was performed to deduce which variable was most significant and statistically relevant to use as the nationality diversity measure for the analysis. Within this analysis it was found the ShareNonUKMembers was the best variable to use, where both the analytical and graphical outputs showed the relevance. Specifically within the graphical outputs it was shown that the values stated within the variable were correctly distributed and statistically significant. After it was made clear that this variable was best used in the future analysis, the constants presented, CompanySize, HasPatents and GovInstitution, were added to the analysis, to ensure that the analysis was more unbiased. Besides these constants, as ShareNonUKMembers was calculated as a percentage, a squared function could be made of this variable to also include as a constant in the linear regression.

The outcome of the linear regression with constants showed that there was a quadratic relationship present between the variables when including the variable ShareNonUKMembers\_squared. From this analysis both an analytical and graphical output was generated. With the analytical method the top of the inverse U curve could be calculated. From this it was found that when the share of the Non-UK board members is around half of the group, the median of the pay gap is found to be at its highest. Whilst having a smaller or larger diversity is seen to decrease the pay gap. These conclusions can also be seen in the graph, where the quadratic line of best fit is also added in, showing these points.

The theories mentioned in the chapter 2 literature review can also help explain as to why the gap is there, and the reasoning behind the difference in gap at different levels of diversity. Labor Market discrimination is used to explain the pay gap, but can also be an obstacle for boardroom nationality diversity. Seeing as that boardroom nationality diversity does have an impact on the female gender pay gap, these could influence the labor market discrimination and work towards decreasing this. One of the other theories explaining the pay gap, location and culturally wise, can then also decrease because of the relationship between boardroom diversity and the pay gap.

There are multiple reasons, a couple of which are explained below, that could be used to explain the outcome of the linear regression model which includes the constant variables. It is clear to state that even though there is a relationship to be found, this is a very small relationship, therefore alterations in board composition nationality based could impact the pay gap, but only to a certain extent.

A clear reason that could be used to explain the quadratic regression relationship is that the spread of companies is mainly at the extremes, and then all components in between are more spread out, whilst there is more uniformity when going more towards the middle as well. It can also be seen graphically to have a higher pay gap when compared to the share of non-UK board members when looking at the middle. It can also be seen graphically that towards the end of the curve, a range has been added, as there are less values present to be able to make the curve as exact as possible. The quadratic relation that has been found can be used to explain what impact the boardroom nationality diversity has on the gender pay gap. There is the component of size of a board room, and how many have an active say in the decisions process rather than a passive approach. Depending on the size, the amount of nationality diversity is also

greatly impacted, resulting in a specific share that could potentially be beneficial when being a small component.

Besides explaining the quadratic, one of the other reasons that could be used to explain that having a specific range of diversity can impact the pay gap negatively is having a split perspective. The point where it is found that having diversity is seen as the most negative impact is approximately the middle, when the share of non-UK board members is found to be 0.5066. At this point it can be found that rather than adding the benefit of including different perspectives to the board, the equal split of national vs international can potentially conflict. How different cultures approach different issues is then more likely, with the consequence as there is a split, that most points stay a discussion and cannot always result in an outcome. Therefore having either a smaller component or a very large component of diversity can create more unity and outcomes as there is a different perspective present then.

The overall conclusion made from the analysis is found to be that there are specific ranges of nationality diversity which have an impact on the pay gap present within a company.

## 5.1 Recommendation

Based on what has been concluded it would seem that there is a form of recommendation possible for potential future research, building on the existing literature. Besides building on the literature there is also the practical recommendation, where firms take into consideration what they should be looking at as a relevant possibility with the diversity to fix part of the pay gap. The diversity aspect present in the range within the quadratic analysis where it can be seen to be beneficial to have a part of diversity within the board.

### 5.1.1 Theoretical Recommendations

Looking firstly at the theoretical recommendation it can be seen that there is a clear research area about the pay gap as well as the influence of nationality diversity in a board within a company. Relevant could be within the analysis of papers about nationality diversity to add the pay gap aspect, as that could give researchers a different aspect and perspective. There were multiple theories that were mentioned in the literature research, on which advancements could potentially be made. For future research, there is the human capital theory used as one of the reasons the pay gap exists. Through the addition of nationality diversity, experimentation can be done to see how the human capital theory is impacted by that. Same would go for the labor market discrimination, as there would be less discrimination in the boardroom nationality wise, which could then be reflected in the company. It is important to note that it would take more than just the adjustment of the board to change these theories which result in the pay gap in a company. Besides future research being used to see the impact on the theories, when looking at a firm's performance based on nationality diversity, it can also go into more depth than just financial performance of the firm. The focus could then lie more about the pay gap, when data is available, and what factors within a company influence the pay gap.

### 5.1.2 Practical Recommendations

There are also practical recommendations that can be given to apply within the firm, based on the outcome of the analysis. Adding some diversity is seen to be beneficial, therefore the recommendation would be to still include some aspects of diversity to the board, but with limits, as to not to create a point of division within a board. For example looking at a group of 10 board members, there would be a benefit to either having a smaller share of non-UK board members, as it can be seen in the graph that there are where there are more points found around 0 or below the median hourly percent. Whilst looking at the end of

the curve, there are a lot less values that are able to be tested, as it is not very likely to have a share around 0.8-0.95. Having the added diversity can offer different perspectives which could result in different outcomes for the company as well. It was also found that there could be a relation between company performance financially and the pay gap as stated in the research, therefore if the perspective adds to the company, then it could also influence the pay gap to decrease.

## 5.2 Limitations and Future Research

Within the data analysis it is crucial to state which limitations are present whilst the analysis is being performed.

One of the first clear limitations that should be stated is that within the data there are quite a few variables that have significant outliers within their range of numbers. These extremes can create skewness or change the output of the analysis. One of these variables is DiffMedianHourlyPercent where there are extremes going up to the negative one hundreds ranging to the positive sixties. These outliers create a larger frame of analysis for this variable and therefore have a significant influence on analysis with means and comparisons of means. Therefore a margin of error should be taken into consideration when looking at the results of the analysis as the outliers of multiple variables can create skewness in the data.

Another significant limitation that is present is within the data of nationalities within the analysis. For the nationalities as it has to be stated whether a board member is of UK nationality or of Non UK nationality all board members have to be under divided in these two groups. However there are board members present in the research which have multiple nationalities. If a board member has multiple nationalities and the UK nationality is present then they are counted within the group of UK nationality. The question then becomes if these board members act as a UK board member would or rather the way that a non UK board member. An example would be with the difference between a board member with UK and USA nationalities and with UK, South African and Kenyan nationalities and how these would act differently. This limitation should be taken into consideration when looking at the data analysis as this is a component which can skew the data to the advantage of having UK members rather than having the diversity present in the boardroom.

Looking at future research, there are clear possibilities to add more constants in the analysis to make it more unbiased and clear, which could result in even more specific outcomes. Besides that there could also be a possibility of adding a research value about nationality. Where people with multiple nationalities can be seen as a separate variable rather than automatically be included within the UK nationality when that is stated in the list of the nationalities. Furthermore it might be interesting to also look at being able to find more information about more firms, as this research is limited to the data available in Orbis.

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## 8. APPENDIX

### 8.1 Appendix I

Full Output One Variable T-test

Outputs	DiffMedianHourlyPercent	ShareNonUKMembers	HasNonUKMembers
T-value	24.934	20.285	24.845
df	1218	1218	1218
P-value	<2.2e-16	<2.2e-16	<2.2e-16
90% CI	9.899-11.298	0.149-0.181	0.314-0.359
Mean	10.59849	0.1646397	0.3363413

Table 5

Full Output Two Variable T-test

Outputs	1	2	3	4
T-value	-3.1247	-35.102	0.35544	-34.594
df	890.79	409	826.6	409
P-value	0.001838	<2.2e-16	7.223	<2.2e-16
90% CI	-4.15 - - 1.29	-0.51 - - 0.47	-0.08 - 0.12	-1.23 - -1.11
Mean with 0	9.683725	0.000000	2.843088	1.000000
Mean with 1	12.403482	0.489502	2.822222	2,170732

Table 6

Index:

1 is DiffMedianHourlyPercent

2 is ShareNonUKMembers

3 is CompanySize

4 is NumNationalities

## 8.2 Appendix II

The Four graphs for the Linear Regression Model of DiffMedianHourlyPercent ~ ShareNonUKMembers.

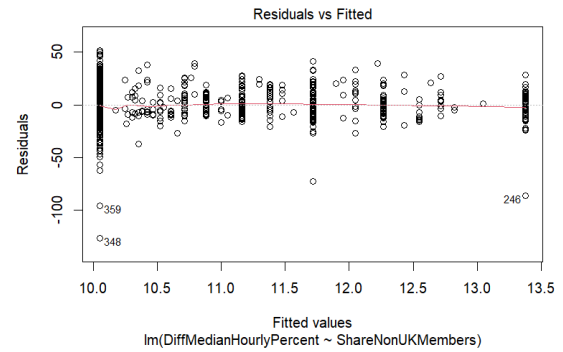


Figure 3

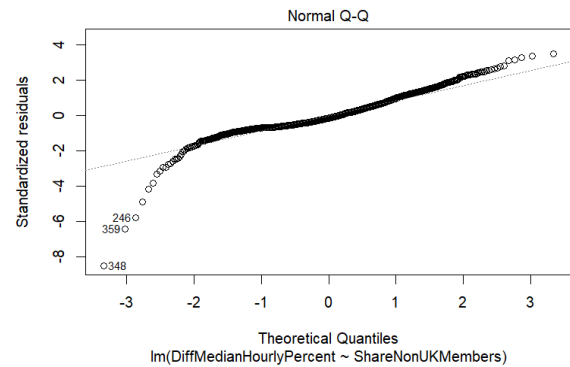


Figure 4

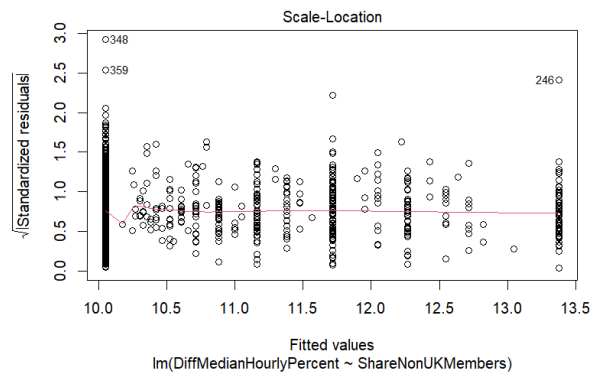


Figure 5

