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Gender quota and M&A activity

The role of networks

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Preface

Ever since I started my premaster in Economics 3 years ago, I wanted to write my master's thesis about mergers and acquisitions (M&As). Despite the fact that my choice for this specific learning journey has led to the raise of many eyebrows after a bachelor's degree in French Langue and Culture, if proved to be the right choice for me. After a long and sometimes difficult process, lies before you now the result of an interesting research into the relationship between M&As, gender (quota) and social networks, which is the final work submitted in partial fulfillment of the requirements for the degree of Master in Economics at the Radboud University Nijmegen. The combination of social, economic, cultural and sometimes even political aspects that may be hidden behind the decision of companies to enter in such deals make them so challenging, intriguing but at the same time also complicating. This exciting character of M&As, in combination with the increasing demand for gender equality, mainly in Western Europe, makes this research topic so contemporary and significant.

More specific, these past few months have been dominated by the investigation of hundreds of merger and acquisition deals that have been executed by Western European companies. More in detail, the goal of this paper has been to investigate how female directors may influence the bidding process and how their social network as well as the presence of gender quota and may moderate this relationship. The writing process of this paper has had its ups and downs, but thanks to the support of many lovely people, I am very proud to be able to present to you this final product.

As said, this master's thesis is most definitely not only the results of my own efforts. Therefore, I want to express my thanks, in particular to my supervisor dr. Katarzyna Burzynska, Assistant Professor at the Department of Economics at the Radboud University, Nijmegen. She did not only actively assist me during the writing process, but she was also very accommodating and proactive during the more difficult moments and circumstances that characterized my graduation process. Secondly, I want to thank Maarten Gubbels & Jarno Roenhorst (Radboud University Data Support Team) as well as Juul Vossen, who all helped me writing the empirical part of this paper. Moreover, a big word of thanks must go out to my lovely parents, who have been a tremendous support, not only throughout the writing process of this master's thesis, but throughout my entire school - and university career. Finally, a special word of thanks goes out to my beloved girlfriend Marlou, who has been an infinite source of support and motivation throughout this process. Without her perseverance and encouragement, this research project could not have been brought to this successful end.

Abstract

The role of gender equality plays an increasingly prominent role in the corporate leadership environment. Prior research has shown that female directors may be less prone to overconfidence and may be less prepared to take big risks compared to their male counterparts, which eventually may benefit firm performance. This could have been one of the reasons why a growing number of mainly Western European countries have adopted corporate gender quotas over the past 20 years. However, in the current literature, the potential benefits of such quota are not unanimously supported, and some researchers seriously question the effectiveness of these equality measures. Using a multilevel analysis, the goal of this paper is to investigate how the presence of female directors and the adoption of gender quota may affect mergers and acquisitions (M&As) done by European acquirers and more specific how bid premiums paid by these acquirers could be affected by the presence of female board members. Moreover, I investigate the possible moderating role of female directors' networks, as these networks may impact the information provision and therefore the ability to make better decisions regarding the potential value of a merger or an acquisition. The main findings of this research show that an increase in gender diversity negatively affects the premium in countries with a gender quota, but positively affects bid premiums paid in countries without a gender quota. The extensiveness of female directors' social networks does not appear to moderate the relationship between gender diversity and the premium paid.

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1 Introduction

In recent years, a growing body of literature has focused on the role of gender in management and corporate leadership and how gender differences can influence firm performance. Qian (2016) for example shows that the addition of two female directors to the board can positively affect future firm performance. Moreover, based on U.S. company data, Tate & Yang (2012) argue that hiring female directors may create female-friendly working environments which can be considered as a positive externality of having female leaders. On the other hand, Matsa & Miller (2013) provide evidence that the presence of female directs may be associated with higher costs and lower profits, which is in line with the findings of Ahern & Dittmar (2012) who find that gender quotas may negatively affect the firm performance of Norwegian companies.

A more specific stream of economic literature has focused on the effects of gender differences in the context of mergers and acquisitions (M&As). M&As are an ideal setting for investigating the influence of gender differences on corporate leadership, as the behavioral finance literature has shown that personal behavioral traits, such as the overconfidence and the willingness to take risk of board members and CEOs, may play a crucial role in determining the acquisitiveness of a company in terms of the number of bid initiations, the size of targets or bid premia paid. Malmendier & Tate (2008) for instance show that overconfident CEOs are significantly more likely to make value-destroying acquisitions and Hwang et al. (2020) add that this is in particular the case when the CEO in question has more power in making corporate decisions. In the context of gender differences, Croson & Gneezy (2009) provide clear evidence that men are generally more overconfident and more willing to take risk than women, which corresponds with the early work of Beyer (1990) regarding the ability of women and men to make accurate self-evaluations. The effect of these masculine and feminine behavioral traits has also been discussed in the current literature on M&As, but the results are still contradictory.

This relationship between gender differences and M&A activity has also been discussed in the light of bid initiations and the price paid for a merger or acquisition. Levi et al. (2014) for example examine acquisition bids by S&P 1500 companies and conclude that each additional female director on a company's board of directors may significantly reduce the number of bids as well as the bid premium paid. Their explanation is as a matter of fact that female directors may be more careful, less prepared to take risks related to big acquisitions and could be less optimistic about the potential future benefits of acquisitions compared to their male counterparts. Adams & Ferreira (2009) add to this by arguing that female directors are more committed when it comes to taking corporate decisions and are more effective monitors than male directors causing them to consider fewer and better acquisitions deals. However, other studies provide evidence that the presence of female directors may positively affect

the number of bids and the premium paid. Bos (2017) confirms these findings and adds to the literature by arguing that the level of education as well as the experience of female directors can be a moderating variable in this relationship. However, crucial to this study is the fact that a distinction is being made between the (voluntary) presence of female directors and the introduction of gender quota, which are accompanied by the compulsory attendance of women on corporate boards. This is an indication that the association between female board members and M&A activity could be affected by the grounds on which these female directors are being appointed. In this specific context, a higher level of education and an increase in experience may weaken the positive relationship between the presence of female directors and the acquisition bids and premiums as these female directors may be better able to distinguish potential value-enhancing deals from value-destroying deals.

In this paper, I will not merely focus on how these masculine and feminine behavioral traits such as overconfidence and willingness to take risk and the presence of female directors on boards may affect firm performance, but, in line with the study of Bos (2017), mainly on how M&A activity is influenced by the presence of gender quota. In recent years, an increasing number of countries required companies to adopt such quotas to improve gender diversity on corporate boards. Even though board diversity in terms of the presence of female directors may indeed change firm behavior and more specific the size of bid premia as a result of differences between male and female leadership, this relationship may change as the presence of female directors relates to the (mandated) adoption of gender quota. For the remainder of this paper, I will therefore distinguish between the effects of board diversity on the one hand and the effects of gender quota on the other hand. Ahern & Dittmar (2012) for instance present evidence showing that additional female directors may be associated with more bids and higher premiums, which they explain by the fact that gender quotas may lead to the hiring of younger and unexperienced boards. Consequently, I will argue that board composition and diversity may have a different impact on firm behavior and bid premia than the adoption of gender quota. Consequently, the main goal of this paper is to examine how both board diversity and gender quota could affect bid premia and firm behavior.

Additionally, the aim of this paper will be to add to the existing literature by examining another factor that could potentially affect the relationship between gender quota and the acquisitiveness of companies: networks. In this paper, acquisitiveness will be measured by the bid premium(s) paid by the companies. The role of networks, which can be described as ‘a specific set of linkages among a defined set of actors, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of the actors involved’ (Seufert et al., 1999, p. 182), has been widely discussed in the corporate leadership literature. In the M&A environment, several researchers examined the role of board networks; Etheridge (2010) for example finds that a closer network between the boards of acquiring and acquirer firms is associated with lower bid premia as

these networks 'can mitigate the information asymmetries that surround mergers and acquisitions and affect bargaining power' (p. 3). In this context, female directors' networks may influence the relationship between board diversity and M&A bid premiums; if through their networks these female directors can gain more knowledge, expertise or other information, this may allow them to have better insights in whether a deal can either create or destroy value for their company. It can be argued that the role of networks may change when female directors are appointed in the light of gender quota instead of board diversity. Contrary to the situation of voluntary board diversity and the associated usefulness of director networks, gender quota may lead to the appointment of less experienced directors, who may have less extensive and less valuable networks. This in line with Bakke et al. (2020) who provide evidence that experienced directors have more extensive and valuable board connections, and that the loss of these directors may lead to a large drop in firm value. In the context of gender differences, board diversity, gender quota and networks, I have formulated the following research question:

To what extent does board diversity affect bid premia and to what extent do gender quota and networks moderate this relationship?

On the basis of a sample of 306 deals (172 firms) involving European acquirers, I find that there is no significant relationship between gender diversity and bid premium. However, a distinction can be made between countries with and without gender quota. I provide evidence that there is a positive association between the presence of female directors and bid premium in countries without a gender quota, but a negative relationship in countries with a gender quota. Moreover, in the main regression models, no evidence can be provided that supports the idea that networks may have an influence on bid premiums regardless of the presence of a gender quota.

Finally, this paper will add to the scientific literature in several ways. First, it provides additional insights in the degree to which the presence of female board members may influence the bid premium paid for a merger or acquisition. Closely related to this, this study will show how the adoption of a gender quota may affect the size of bid premiums. Thirdly, the potential role of social networks will be investigated in relation to the importance of information asymmetry. In a practical context, this paper will be useful for policymakers, as it makes clear how the introduction of gender quota on corporate boards affects firm behavior and more specific M&A activity.

The remainder of this paper is organized as follows. In the next section, I will provide a more detailed overview of the existing literature on gender quotas, networks and M&A activity, which will result in the formulation of my hypotheses. In section 3, I will discuss the methodology, the methods used and I will describe all variables included in this research. In the fourth section, the results will be discussed.

Finally, in chapter 5 I will present my conclusions and discuss the limitations of this paper as well as potential directions for future research.

2 Literature review

In this study, I will discuss gender differences and their influence on corporate decision making, and more specific how these behavioral differences affect the acquisitiveness of European listed firms. More importantly, I will focus on how gender quota can affect M&A activity through these gender differences and how the intraorganizational networks of female directors may moderate this relationship. These differences in behavior between men and women have been extensively discussed in the (social) psychological and sociological literature. From a (social) psychological perspective, Beyer (1990) for instance concludes that men and women differ in terms of self-perception and self-evaluation when performing tasks. Closely related to this, from a sociological perspective, Simon & Nath (2004) find evidence that men and women show behavioral differences when it comes to expressing and reporting emotions: 'While men report more frequent positive feelings than women, women report more frequent negative feelings than men' (p. 1166). However, more relevant to this study is the financial context and researchers in the field of behavioral finance provided evidence of how gender differences may affect investment decisions and corporate decision making in general. Walczak & Pienkowska-Kamieniecka (2018, p. 123) infer that 'men more frequently use the products and services available on the financial market such as, for instance, a debit card, or invest funds in shares or bonds', what they explain by describing the differences between men and women in their willingness to take risks. In gender-oriented studies, one other behavioral pattern stands out that may explain how men and women may take different decisions in the corporate environment: overconfidence.

In prior literature, overconfidence has been defined as the overcome belief in one's own abilities (Kruger, 1999), and in this context it refers to the degree to which men and women have confidence in their own predictions of the future as well as their general expectations of the future. In general, it is argued that men are more positive and less uncertain about their own ability to predict the future than women (Levi et al., 2011). This may also be applicable to the M&A context: as women are commonly less positive about the potential outcomes of an M&A and their own abilities to achieve the goals related to an M&A, they might be less willing to engage in such a corporate decision. In recent years, some researchers have investigated the role of overconfidence in corporate decision making. Roll (1986) introduces the notion of hubris, which can be described as the idea of overestimation of one's own capabilities and a sense of self-sufficiency (Tang et al., 2014). Roll (1986) argues that directors subjected to hubris tend to overestimate their own ability to extract value from a merger of acquisition, and that especially male directors may suffer from this type of overconfidence. Malmendier & Tate (2008) show that overconfidence may especially have negative consequences for the acquiring firm when corporate decision-makers have abundant internal resource. They examine the role of overconfidence and hubris on the basis of a sample of publicly traded U.S. firms and they

conclude that 'a key contribution of our analysis is to directly measure which CEOs are prone to overconfidence (or hubris) and to show that those CEOs (that have abundant internal resources), in particular, destroy value for their shareholders through acquisitions' (p.42). Furthermore, Lee et al. (2017) elaborate on the individual characteristics of overconfident CEOs by suggesting that 'differences in overconfidence can be traced, at least partially, to differences in CEO type, that is, whether a CEO is a founder or a professional' (p. 766). They provide evidence, on the basis of a S&P 1500 companies sample, that founder CEOs display more overconfidence than their non-founder (professional) counterparts. In the light of director overconfidence, Kind & Twardawski (2016) provide evidence that board directors may also be prone to overconfidence, and that in particular those directors that have recently been involved in M&A deals are highly confident about the outcome of a merger or acquisition. Finally, overconfidence is often directly linked to the empire-building theory, which describes the tendency of managers to acquire other firms to increase their power, status, compensation and prestige (e.g., Jensen, 1986, Williamson, 1974). Ragon (2011) adds to this literature by showing that female directors appear less interested in empire building than their male counterparts, which is again in line with the hypothesis that men are more likely to be actively engage in merging with and acquiring other firms.

Other researchers also provided evidence of how overconfidence may directly affect bid premiums. Sheremeta (2013) for instance uses an overview of experimental literature to show that bounded rationality may influence the overbidding process. Bounded rationality, a neoclassical concept coined by Simon (1955) relates to the idea that human beings are not fully rational when making decisions and can only make decisions that are optimal within the limits of the resources and information that are available. Sheremeta (2013) shows that, despite the bounded rationality, overbidding may still occur, especially when companies have sufficient financial resources. However, as Levi et al. (2011) describe, women are generally less overconfident compared to their male counterparts and will be more aware of their own bounded rationality. Consequently, female directors will be less inclined to overbid, as they are less overconfident and more aware of their limited rationality.

A second way in which overconfidence may influence the bidding process is related to estimating synergies. Synergies are described as 'the value (i.e., incremental cash flows) created as a result of combining two businesses in excess of the sum of their individual market values' (DePamphilis, 2019, p. 389). Malmendier & Tate (2008) investigate the role of overconfidence in M&As and on the basis of an analysis of U.S. publicly traded firms, they find that as 'overconfident managers overestimate merger synergies, they misperceive some merger opportunities with negative synergies to be value-creating' (p. 22). Hwang et al. (2002) add that this is especially the case when the CEO in question has more power in making corporate decisions. Closely linked to this is the idea that mergers and acquisitions may not only lead to beneficial outcomes for the company in terms of value-enhancing

synergies, but also to personal gains. Several studies have shown that M&A completion may lead to a higher compensation for the CEO (Bugeja et al., 2012, Grinstein & Hribar, 2004) and may increase power, status and prestige (e.g., Jensen, 1986, Williamson, 1974). Similarly, Redor (2015) argues that 'M&As which are transactions requiring the approval of the board, may create an agency problem for bidding firms because directors may have an incentive to maximize their own welfare at the expense of shareholders if director compensation increases following M&As' (p. 808). In this way, a director's future reward may affect his/her decision to approve of a deal. Multiple studies have shown that men are more inclined to make corporate decisions that are favorable for their own personal interests. Glover et al. (2002) for example use decision experiments to investigate the differences between men and women when it comes to ethical decisions. They find that men are more willing to make unethical decisions and to focus on their own personal interests. As Levi et al. (2011) describe, women are generally less overconfident compared to their male counterparts, and therefore, female directors may be less prepared to overbid, in the context of both expected synergies and their own personal gains.

Given the concepts of bounded rationality, expected value-enhancing synergies and personal gains, I argue that female directors may be less inclined to pay higher bid premiums, and therefore that board diversity in terms of a higher percentage of female directors may negatively affect bid premia, which has led to the first hypothesis:

Hypothesis 1: Board diversity is negatively related to the size of bid premia.

Additionally to this, the goal of this paper is to examine how gender quota may affect bid premia and whether the introduction of these quota may have a different impact on M&A activity bid premia than board diversity and composition as described above. Erhardt et al. (2003) provide evidence that board diversity, and more specific the presence of women and minorities on corporate boards, is positively associated with return on asset (ROA) and return on investment (ROI) and therefore firms' financial performance. Finally, Nielsen & Huse (2010) also find that the adoption of the gender quota in Norway can be linked to an increase in gender equality. In a Spain-oriented study, Lucas-Pérez et al. (2015) investigate the relationship between gender quota, gender diversity and compensation of top managers in the Spanish context and conclude that 'the incorporation of women onto boards not only promotes gender equality, but increases the effectiveness of the board by creating diversity in the decision-making process' (p. 278), which supports legislative action taken by Spanish authorities. Duppati et al. (2020) present comparable findings on the relationship between gender quota and firm performance in an Indian context. They find that board diversity enhances shareholder value, which follows Indian legislation mandating female presence on corporate boards since 2013. Finally, Tyrefors & Joakim (2017) conclude that the threat of a quota law in Sweden led to an increase of female directors, which could be associated with an improvement in operational performance. In the

context of this paper, it can therefore be argued that gender quota may not only positively affect firm performance, but also yield benefits when it comes to M&As. In the light of behavioral differences between male and female directors and the observed performance improvements, it can be contended that the adoption of such quota may lead to a more cautious and a less overconfident attitude of corporate boards, resulting from the increased presence of female directors. In other words, the negative relationship between board diversity and bid premium, as depicted in the first hypothesis, may be strengthened when firms must comply to gender quota, as the benefits that the presence of female directors may yield become more prominent.

Hypothesis 2a: The negative relationship between board diversity and bid premia is stronger in countries where a gender quota is implemented.

In the existing literature, a large majority of the studies depict indeed a negative relationship between the presence of female directors and the size of bid premiums. Levi et al. (2014) find evidence, based on a S&P 1500 firms sample, that a higher fraction of female directors on a board has a negative influence on the acquisitiveness of the companies in question. Their results are in line with those of Dowling & Aribi (2013), who conclude that 'using a novel dataset, we find robust evidence that the presence of female directors in related to reduced levels of large acquisitions in FTSE 100 companies' (p. 84). However, related studies show that a higher fraction of female directors on corporate boards might rather be associated with an increase in the size of bid premia (Bos, 2017; Ahern & Dittmar, 2012), especially when the appointment of female directors follows from the adoption of a gender quota. According to this line of argument, the introduction of gender quota may cause firms to appoint unexperienced and/or lower educated female directors only to comply with regulations. These latter findings are also supported by Labelle et al. (2015, p. 353-354) who plead that their study 'confirms the intuition that an accelerated increase in the demand for more female directors can create a shortage of women with sufficient senior management-level business experience to sit as directors, compelling firms to appoint less experienced women in a short time frame', which leads to a negative relationship between board diversity (through quota) and firm performance. Smith (2014) draws a similar conclusion by noticing that companies must choose from a limited pool of female director candidates, which forces firms to either 'overburden the small number of qualified women or accept less experienced candidates' (p. 3). As a result, these female directors might be less able to make optimal decisions in the best interests of the firm and could therefore engage in value-destroying M&As and pay higher bid premia. In other words, the introduction of gender quota may rather lead to less qualified and experienced boards, which may lead to higher bid premia. Consequently, I formulated another hypothesis:

Hypothesis 2b: The negative relationship between board diversity and bid premia is weaker in countries where a gender quota is implemented.

These conflicting results and related hypotheses as described above show that the introduction of gender quota may affect bid premia in a way that differs from the influence of board diversity, as corporate boards may appoint female directors on the basis of compliance with the regulations rather than their potential beneficial corporate leadership characteristics. Moreover, in this study, I will argue that the character of this relationship may change as a result of how networks may affect female director behavior. These networks, which previously have been described as 'a specific set of linkages among a defined set of actors, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of the actors involved' (Seufert et al., 1999, p. 182) are on the other hand widely discussed in the more general corporate leadership context. In an early paper, Fama & Jensen (1983) already argue that directors as may use their networks and directorships to build a reputation of being 'experts in decision control' (p. 315), and that their well-connectedness may be used to obtain additional information and access resources which consequently may positively affect firm performance. Correspondingly, in an Indian context, Shaw et al. (2016, p. 192) conclude that 'director networks provide an important conduit of contacts, reputation, expertise and legitimacy that on balance positively affects firms' financial performance, notwithstanding the possible detrimental effects of multiple directorships arising from director's busyness and over-commitment'. Given the fact that networks may allow board members to gain additional information and knowledge about the potential value-enhancing or value-destroying consequences of a deal, it is interesting to investigate how these networks may moderate the relationship between gender quota and M&A bid premiums.

In this paper, I argue that networks may influence the bidding process in several ways. With regard to the expected synergies, I noticed that especially male directors may overestimate the expected (positive) synergy of a deal, while their female counterparts, due to their more limited overconfidence, may be less inclined to overbid. Moreover, when female directors have a richer network, they may obtain more relevant and diverse information regarding the deal in question. In that manner, networks may reduce the information asymmetry between the bidder and the target, allowing the bidder to make a more appropriate assessment of the potential value of a deal, which consequently may mitigate the overconfidence and lower the bid premium. In this way, a richer network can moderate the relationship between gender quota and M&A bid premiums; a richer network may strengthen the negative relationship between the presence of female directors and the size of the bid premium paid. In a similar way, these networks can reduce the female directors' bounded rationality. An increase in resources and information available allows them to reduce their bounded rationality and to make better informed decisions, which again may result in lower bid premia. Current research

appears to support the idea that director networks may negatively affect bid premium. For instance, Guo et al. (2019) find that socially connected bidding firms pay lower acquisition premiums as they can better rely on information advantages. Additionally, Cai & Sevilir (2012, p. 348) note that 'our results suggest that first-degree connections benefit acquirers by providing them with an information advantage about the true value of the target firm, limiting competition from outside less-informed bidders, and allowing them to acquire underperforming firms at an attractive price'. Consequently, based on above-mentioned studies, it could be stated that female directors' networks may play a moderating role in the relationship between board diversity and bid premia, which leads to the following hypothesis:

Hypothesis 3: The negative relationship between board diversity and bid premia is moderated by the networks of female directors.

In line with the above-described findings, I will contend that the relationship between gender quota and bid premia may be moderated through networks, and more specific through the reduction in information asymmetry that follows from the connections within these networks. The diffusion of information and the improved accessibility to resources that can be associated with these director networks allow these directors to make better and more accurate estimations of the true value of potential targets, giving them a better position and an opportunity to negotiate a lower bid premium. Etheridge (2010) does indeed provide evidence that acquirers may use board networks to reduce information asymmetry and that these board connections may increase the probability of deal completion and decrease the size of the acquisition premium. A related study was performed by Dionne et al. (2015), who studied the relationship between information asymmetry and acquisition price. On the basis of a sample of successful mergers and acquisitions of American bidders and targets between 1990 and 2007, they find that 'informed buyers, that is, buyers that held at least 5% of the shares of the target before the announcement of the offer, pay a significantly lower conditional premium (around 70% lower) than do buyers that do not possess privileged information' (p. 850), which shows that the access to information influence the bid premium. Thereupon, if, as depicted in hypothesis 2a, the negative relationship between board diversity and bid premium could be stronger in countries where a quota is implemented

At the same time, I argued in hypothesis 2b that the negative relationship between board diversity and bid premium may rather be weaker in countries where a gender quota is introduced, as they may lead to the appointment of less experienced and less educated directors. In addition to this, I will maintain that this (relative) inexperience of directors may also restrict the usefulness of their networks, as their networks may be less extensive. Accordingly, companies that appoint these less experienced directors may benefit less from their networks, as the information asymmetry between the bidder and target

might be less reduced. Bakke et al. (2020) conduct research into the association between director experience, board connections and firm value. They conclude that more experienced directors are generally more informed and that 'firms that lose a connection to a director with experience in the same industry, defined by being in the same 1-digit SIC, face a larger drop in firm value following the loss of a board connection' (p.28), which confirms both the value of board connections and the importance of director experience within these board networks. As the result of the prediction made in hypothesis 2b and the observed correlation between board connection and experience, I will argue that the negative relationship between board diversity and bid premium as depicted in hypothesis 1, may be weaker for companies that are located in countries where gender quota and implemented and that these companies may benefit less from the networks of their directors. Altogether, in line with hypotheses 2a en 2b and the theories on networks, I have formulated a last hypothesis.

Hypothesis 4: The relationship between the size of the network of female board members and bid premium is moderated by a country's implementation of a gender quota, as such that this relationship is stronger in countries where a gender quota is implemented, and weaker in countries where there is none.

3 Research method

In this chapter, I will explain the research method that has been used. First, I will describe the data sample and the selection criteria applied. After, I will discuss the variables and lastly, the regression models will be described and explained.

3.1 Data sample

In line with existing research, the information provided by several databases will be combined to collect the data necessary for conducting this research. First, BoardEx provides information about the board characteristics of the European listed firms included in our research, such as data concerning the gender of board members. This data source will also be used to retrieve data about the networks of the female directors. Secondly, Zephyr will be used to collect information about the M&A activity of the companies, making it possible to link the gender characteristics of these companies to their acquisitiveness. Moreover, financial, country level and directors control variables will also be taken from Eikon as well as World Bank.

In this paper I will use a quantitative research methodology to investigate the relationship between gender quota, networks and M&A activity. Our data consists of listed firms in Europe exclusively, as gender roles and the view on gender equality in these countries are comparable. More specific, I will concentrate on Western and Northern Europe, as gender equality and the role of women is more to the fore in these countries compared to Eastern Europe (PEW Research Centre, 2019), which may also explain why gender quotas are mainly introduced in this first group of countries. Moreover, the United Kingdom will be excluded from our dataset, because its institutional environment has more in common with the United States than with the other European countries in question. Norway has been the first European country to adopt a gender quota (2003) and in recent years several other countries (Spain, Iceland, France, Italy, Belgium, the Netherlands, Germany, Austria, and Portugal) followed, which led to the introduction of such quota in ten European countries by the beginning of 2018 (Yu & Madison, 2021; Mensi-Klarbach & Seierstad, 2020). In seven of these countries the gender quotas are binding, and non-compliance may lead to sanctions. In the remaining three countries, the quota is soft, meaning that companies can voluntarily adopt the quota, but non-compliance will not be punished. See Appendix A for an overview of countries with quota and the quota characteristics.

I also included several European countries that did not adopt any gender quota provisions in the same period (2003-2018), namely Luxembourg[1], Denmark and Switzerland[2]. These countries are included to be able to examine whether bid premiums are affected by gender quota (hypothesis 2a and 2b). Ultimately, the data sample is constructed on the basis of several criteria: (1) Acquirer is located in one of the thirteen countries as described above, (2) target and acquirer are listed companies and (3) the acquirer does not own 100% of the target's shares before the announcement. Furthermore, in line with existing studies, the acquirer must own at least 5% of the target's shares after the deal is completed, as directors may not be actively engaged in smaller deals (Dowling & Aribi, 2013) and consequently, the potential influence of female board members and quota may not be captured when these deals are included in the model. After merging the databases, applying all the criteria and excluding the missing values, our final sample consists of 306 deals, which are done by 172 acquirers. Unfortunately, no deals involving Icelandic or Danish acquirors remained, and therefore these two countries were removed from the sample and further analysis (See Appendix B for an overview of the sample per country and per industry).

3.2 Dependent variable

The bid premium, which can be 'measured as the difference between the bid price and stock price right before the offer announcement (Bris, 2002; p.243)' is the dependent variable. In current research on the determinants of these bid premia, most researchers use either the bid price/market price ratio 42 days prior to the announcement (Bates & Lemmon, 2003; Dionne et al. 2015) or the bid price/market price four weeks prior to the announcement (Rossi & Volpin, 2004; Hope et al. (2010). Given the fact that both calculations are common in the existing literature, I will use the latter measurement, which is also the way in which bid premium is measured according to Zephyr, the database used to collect the data on the mergers and acquisitions.

3.3 Independent variables

The independent variables included in our models are similar to those examined by Bos (2017) and Levi et al. (2014). First of all, there is a dummy variable to indicate the presence of gender quota in the countries examined (GENQ). This dummy will have a value of 0 if a country does not have a gender quota (reference category) in the year in which the deal in question took place, and a value of 1 if a country does have a gender quota in the year in which the deal took place. As Austrian and Portuguese companies only had to comply to a gender quota as of January 2018 (See Appendix A) and all the

[1] 'In 2016, a majority of the government voted to constitute a gender quota (..) expected to be implemented in 2019, and hence was not implemented in the parliamentary elections of 2018' (IDEA, 2022), as a result I will consider Luxembourg as a country not having a gender quota adopted in 2018.
[2] In 2020, new regulations were introduced and passed by the Swiss parliament that force companies to adopt gender quota, but in this study, Switzerland is still considered a country without such a quota as these regulations were not entered into force in 2018 (Deloitte, 2020).

remaining deals that involved acquirors from these countries took place before 2018, all these observations receive a value of 0, despite the introduction of a quota in these countries. Secondly, the variable (GEN) refers to the male-female ratio on corporate boards; a value of 1 indicates a board with exclusively male directors. The measurement of the independent variable network is more complicated. In this study, it will be measured using a proxy that has been studied in related studies: degree centrality (Shaw et al. 2016; Larcker et al. 2013; Croci & Grassi, 2014). In network theory, degree centrality can be 'measured by the total amount of direct links with the other nodes in the network structure' (Zhang & Luo, 2017, p. 301). In the specific context of corporate directorship, it can be defined as 'a director's degree centrality is the total number of direct relationships formed with other directors through shared board memberships, thus implying that a director with higher degree centrality is more active in the inter-corporate board network' (Shaw et al. 2016, p. 172). This implies that for each individual female director of the acquiring firms in my sample, I calculate the number of direct connections through shared directorships with the other directors identified in the sample. Using this proxy, I will maintain that the more direct connections a director has, the richer her network. Given the fact that the focus of this paper is on female directors and their networks, I will only measure the degree centrality of female directors, to avoid presenting a distorted picture of a board's network by including the influence of male directors' networks. Subsequently, the degree centrality of each female director will be measured over time (2003-2018) to compute an average centrality measure for each director. Finally, these individual centrality measures will be aggregated to the company level. Moreover, the model contains an interaction variable related to the moderating effect of networks, which can be used to measure to what degree the relationship between gender quota and female directors could affect bid premiums. An overview of the independent variables and their measurement is provided is Table 1.

Table 1: Description and measurement of the independent variables

Independent variable	**Measurement**
Gender (GEN)	Male-female directors' ratio, with a value of 1 indicating the presence of male directors only
Gender quota dummy (GENQ)	A dummy variable with either a value of 0 (no quota in the country in year of the deal) or 1 (quota implemented in country in year of the deal)
Director network	Degree centrality

3.4 Control variables

The control variables used in this study are largely in line with those implemented by Levi et al. (2014). They can be divided in three types of variables: financial, country and board specific. First of all, it is important to measure the general financial ability of companies to engage in mergers and acquisitions, which will be measured by Tobin's Q (TOQ) and leverage (LEV) which is in accordance with the paper by Levi et al. (2011). Hu & Yang (2016. P. 177) for instance conclude that 'the empirical evidence suggests that companies with higher leverage have less incentive to undertake M&A activities', as these firms have fewer financial resources to invest in these types of expensive transactions. As a result, it will be necessary to control for the financial health and competitiveness of the companies included in our sample. Secondly, in the same manner, I control for the overall economic activity in the different countries by including the GDP per capita. Finally, also in line with Levi et al. (2014), two firm-specific control variables are included. A board size control variable is included because prior research has shown that larger boards can be associated with a lower level of acquisitiveness in terms of acquisitions and restructuring activities (Cheng, 2008). Furthermore, Berger et al. (2014) show that, in a context of corporate governance in German banks, younger executives may demonstrate higher levels of risk appetite, which may also affect directors' willingness to engage in M&A, and therefore I included a director age control variable. An overview of the control variables and their measurement is provided is Table 2.

Table 2: Description and measurement of control variables

Financial control variables	**Measurement**
Tobin's Q (TOQ)	The ratio of market value to total assets
Leverage (LEV)	The ratio of total debt to total equity
Country level control variables	
GDP per capita (logGDP)	The GDP per capita for all countries included in the sample
Director control variable	
Board size (BSIZE)	The total number of directors on the board
Director age (AGE)	Average age of directors on a board

3.5 Regression model

In this research I will run four different regression models to examine the relationship between gender (quota), networks and M&A activity as measured by bid premiums. More specific, I will use a multilevel analysis, which allows the study of the same units (companies) over time. Within this type data analysis, we can identify three main types: the pooled model, the random effects model and the fixed effects model. In this study, the latter model will be used, as it allows the incorporation of variables that vary over time. Given the fact that the independent variables in our model do not remain

stable over time (percentage of women on a board, networks, even gender quota may change in the course of years) this model is best suited for this research. Moreover, I will run a multilevel analysis because the independent variables are measured at different levels of analysis; quota are for example introduced and measured on the country-level, while networks are aggregated from the individual to the board level. Initially, in line with the first hypothesis, I will investigate the relationship between board diversity and bid premia, a relationship that can be studied using the following models:

Model I: $\text{Bid premium}_{it} = \beta 0 + \beta 1\ GEN_{it} + \beta 2\ TOQ_{it} + \beta 3\ LEV_{it} + \beta 4\ \text{logGDP}_{it} + \beta 5\ BSIZE_{it} + \beta 6\ AGE_{it}$

Next, I will focus on the moderating role of female directors' networks. Accordingly, the second model contains a network variable as well as an interaction term.

Model II: $\text{Bid premium}_{it} = \beta 0 + \beta 1\ GEN_{it} + \beta 2\ DNET_{it} + \beta 3\ DNET_{it} * GEN_{it} + \beta 4\ TOQ_{it} + \beta 5\ LEV_{it} + \beta 6\ \text{logGDP}_{it} + \beta 7\ BSIZE_{it} + \beta 8\ AGE_{it}$

In the third model, the gender quota variable as well as an interaction variable are included to test whether the introduction of such quota influences the relationship between board diversity and bid premia. This model can be used to test hypothesis 2a as well as hypothesis 2a.

Model III: $\text{Bid premium}_{it} = \beta 0 + \beta 1\ GEN_{it} + \beta 2\ GENQ_{it}\ \ \beta 3\ GEN_{it} *\ GENQ_{it} + \beta 4\ TOQ_{it} + \beta 5\ LEV_{it} + \beta 6\ \text{logGDP}_{it} + \beta 7\ BSIZE_{it} + \beta 8\ AGE_{it}$

In hypothesis 4, I concentrate on the interaction between board diversity, quota and networks. Therefore, an additional model has been built which contains a triple-interaction variable to measure the influence of the interaction between board diversity, gender quota and networks on bid premia.

Model IV: $\text{Bid premium}_{it} = \beta 0 + \beta 1\ GEN_{it} + \beta 2\ DNET_{it} + \beta 3\ GENQ_{it} + \beta 4\ DNET_{it} * GEN_{it} * GENQ_{it} + \beta 5\ TOQ_{it} + \beta 6\ LEV_{it} + \beta 7\ \text{logGDP}_{it} + \beta 8\ BSIZE_{it} + \beta 9\ AGE_{it}$

4 Results

In this chapter, I will present the results of the regression analyses that are performed following the models as described in the previous chapter. Firstly, I will present the descriptive statistics of the variables that are used in the models. Secondly several variable tests related to the classical OLS regression analysis assumptions will be run. Thirdly, multilevel regression analyses will be performed to test the hypotheses. Fourthly, some robustness checks are performed. Finally, I will provide a summary of the results obtained.

4.1 Descriptive statistics

Table 3 provides the descriptive statistics of all variables included in the various models. All variables, in line with the sample description, have 306 observations (deals) which can be associated with 172 European firms. The dependent variable bid premium has a mean value of 14.64, which implies that the acquirors paid on average a bid premium of 14.64% above the market price of their targets. Moreover, this table shows that only 24% of the deals took place in countries in which there was a gender quota implemented at the moment that a deal was announced. Furthermore, the variable gender has a mean of 0.86, which shows that the boards are male dominated as 86% of the directors are men. Another significant factor that follows from this overview is that the degree network centrality of the female directors involved in these deals is 5.02, which means that the directors had on average five connections with other acquiring directors included in the sample. It must be said however, that the data shows that this aggregated number for all 306 firms contains 81 observations with a value of zero, indicating that at the aggregated firm-level, about 26% of the companies do not share any connection with the other acquirors. Finally, the meam board size in the sample is 14.25, while the average age of the directors, aggregated to the firm level, is 66 years.

Table 3: descriptive statistics of the data

Variables	*N*	*Mean*	*Std. Dev.*	*Median*	*Min*	*Max*
Bid premium	*306*	*14.64*	*35.17*	*5.88*	*-89.58*	*333.33*
Gender Quota	*306*	*0,24*	*0.43*	*0*	*0*	*1*
Gender	*306*	*0.86*	*0.14*	*0.90*	*0.46*	*1*
Network	*306*	*5.02*	*6.93*	*2.63*	*0*	*35*
Size	*306*	*14.25*	*5.45*	*14*	*4*	*34*
GDP per capita	*306*	*38184.58*	*15961.41*	*32688*	*17454*	*94898*
Average Age	*306*	*66.17*	*3.73*	*66.50*	*52.62*	*78.89*
Tobin's Q	*306*	*1.43*	*0.66*	*1.25*	*0.41*	*5.86*
Leverage	*306*	*126.75*	*334.63*	*83.54*	*-2920*	*4596.42*

4.2 OLS regression assumptions

For the statistical analysis of the data, a multilevel regression will be performed, which is an extension of the general linear model. As such, the data and the variables must comply with several classical

assumptions (Woodridge, 2012). Several tests are performed to confirm that the data and variables are suited for the best multilevel Ordinary Least Squares regression.

4.2.1 Linearity dependent and independent variables

One of the most important assumptions of OLS holds that the relationship between the dependent variable and all independent variables must be linear, otherwise, a linear regression cannot be performed (Wooldridge, 2012). This linearity can be easily checked by creating scatterplots that show the relationship between the dependent variable and all independent variables. In this research, the scatterplots (see Appendix C) do not provide clear evidence that there are non-linear effects, in terms of curving lines. Consequently, this classical assumption is met.

4.2.2 Homoscedasticity

Additionally, the assumption of homoscedasticity holds that the variance of the errors terms is constant (Korendijk et al. 2008), which can be estimated using scatterplots, and more importantly, the Breusch-Pagan test. This test, developed by Breusch en Pagan (1979), states, under the null hypothesis, that the variance of the error terms is indeed constant. In the case that this test shows that the null hypothesis must be rejected, there is evidence of heteroscedasticity, which can be a threat to the validity and fitness of the model (Breusch & Pagan, 1979). When performing this test for my models, P-values of 0.09 (model I), 0.10 (model II), 0.08 (model III) and 0.08 (model IV) are found (see Appendix D). As these values are all above the critical 0.05 alpha, the null hypothesis cannot be rejected, indicating homoscedasticity. Consequently, the homoscedasticity assumption holds as well.

4.2.3 Normal distribution of the error terms

The next classical assumption to be tested is the normal distribution of the error terms, which is generally considered a supplementary assumption, as its violation does not necessarily threaten the validity of the Ordinary Least Squares regression (Field, 2009). Kozak & Piepho (2017) show that for this assumption to be met, a diagnostic residual plot must be drawn. In Appendix E, the residual normality plots of the various models are presented. It can be concluded that all four scatterplots show some deviating observations towards both ends of the plot. However, the Central Limit Theorem (CLT) holds that for sample sizes > 30, the violation of the normality assumption does not cause major problems (Allende Alonso et al. 2019), as the distribution of sample means converge to normal distribution as sample size increases (Billingsley, 1995). The residual plots (Appendix E) show indeed that the residuals tend to approximate the line of normal distribution, thereby satisfying the assumption of normality.

4.2.4 Correlations

Finally, two tests have been performed to measure the correlation between the variables. Firstly, in Table 4, the results of the Pearson's correlation coefficient test are presented. The Pearson coefficient can vary between -1 and +1, with the former indicating a perfect negative linear relationship between the variables and the latter indicating a perfect positive linear relationship. Subsequently, a value of zero implies that there is no correlation, which implies that the relationship between variables becomes weaker when Pearson's coefficient is closer to zero (Dănăcică, 2017). In contradiction with hypothesis 1 and the current literature (Levi et al. 2014; Dowling & Aribi, 2013), this matrix indicates a negative, but weak correlation (-0.054) between the gender variable and bid premium, which suggest that a higher value of gender, corresponding with a higher percentage of male directors, is associated with a lower premium. Furthermore, a negative, but weak correlation coefficient is found for the relationship between bid premium and gender quota (-0.040). The direction of this coefficient is in accordance with hypothesis 2a: an increase in the value for gender quota, which matches a value closer to 1 and thus the presence of a quota, can be associated with a decrease in bid premium paid. Finally, Table 4 provides evidence for a negative correlation between bid premium and network (-0.057). This coefficient would support the findings of Etheridge (2010) and Dionne et al. (2015) as it can be considered as proof that a richer network of female directors can be linked to lower bid premiums.

With regard to the assumptions for OLS regression, it is important to check the extent to which the predictor variables are correlated with each other, also known as (multi)collinearity. Multicollinearity exists when independent variables are highly correlated with each other (Senaviratna & Cooray, 2019), which can cause a threat to the estimation of the model. In general, the Pearson's correlation coefficient is considered to be high, indicating a strong relationship and a potential threat for the validity of the model, if it has a value below/above -0.6/0.6 (Obilor & Amadi, 2018) or -0.7/0.7 (Ratner, 2009). Given the fact that, according to Table 4, the Pearson's correlation coefficients are all above -0.5 and below 0.5, correlation of variables does not appear to be a problem for this research. Moreover, Neter et al. (1989) use the Variance Inflation Factor to measure multicollinearity and argued that 'a maximum VIF value in excess of 10 is often taken as an indication that multicollinearity may be unduly influencing the least square estimates (p.409)'. However, several researchers have suggested that a more conservative threshod should be applied, and a critical VIF-value of 5 is often maintained (Snee, 1973; Zainodin et al. 2015). In Tables 17-20 (Appendix F), the VIF-test results of the five models are presented. It can be derived from these results that the highest VIF-value in these models is 3.12, which is well below the critical thumb rule value of 10 and also below the more conservative threshold of 5. As a result, both the Pearson correlation coefficients and the VIF-tests provide evidence that multicollinearity is not problematic in the sample.

Table 4: Pearson's correlation coefficients

	Bid premium	*Gender quota*	*Gender*	*network*	*Size*	*GDP per Capita*	*Average_Age*	*Tobin Q*	*Leverage*
Bid premium		-0.040	-0.054	-0.057	-0.010	0.090	0.096	0.132*	-0.017
Gender quota	-0.040		-0.446***	0.176**	-0.093	-0.138*	-0.120*	-0.170**	-0.063
Gender	-0.054	-0.446***		-0.220***	0.082	0.055	0.098	0.042	0.065
network	-0.057	0.176**	-0.220***		0.157**	-0.033	0.077	-0.190**	0.001
Size	-0.010	-0.093	0.082	0.157**		-0.232***	0.249***	0.086	-0.039
GDP per Capita	0.090	-0.138*	0.055	-0.033	-0.232***		-0.094	0.113	-0.081
Average_Age	0.096	-0.120*	0.098	0.077	0.249***	-0.094		-0.058	-0.049
Tobin Q	0.132*	-0.170**	0.042	-0.190**	0.086	0.113	-0.058		-0.083
Leverage	-0.017	-0.063	0.065	0.001	-0.039	-0.081	-0.049	-0.083	

Computed correlation used pearson-method with listwise-deletion.

* Significant at the 5% level
** Statistically significant at the 1% level
*** Statistically significant at the 0.1% level

4.3 Test of hypotheses

Table 5 represents the results related to the first model and therefore the first hypothesis. According to hypothesis 1, there is a negative relationship between board diversity, represented by the gender ratio, and bid premium. However, Table 5 shows that, on average, the gender variable is not statistically significant (b = -8,87, t = -1.19; P = 0.24) and therefore I cannot find evidence to support the hypothesis that gender ratio is significantly related to the level of the bid premium, which leads to the rejection of hypothesis 1. Notably, Table 5 also provides evidence that the average age control variable is positive (b = 0.60, t = 2.02, P = 0.04) and statistically significant. These findings contradict those of Berger et al. (2014) that younger executives appear to have higher levels of risk-appetite and may therefore be prepared to pay more for deals. The conditional R^2, a goodness-of-fit measure, of the first model is 0.094, meaning that 9.4% of the variance in the dependent variable bid premium can be explained by the independent variables, considering both fixed and random effects.

Table 5: Results multilevel regression model I

	Bidpremium		
Predictors	*Estimates*	*CI*	*p*
(Intercept)	-3.13 (-2.59)	-5.98 – -1.79	**0.001****
Gender	-8.87 (-1.19)	-23.60 – 5.87	0.237
Tobin Q	3.76 (2.26)	0.49 – 7.03	**0.024***
Leverage	0.00 (0.257)	-0.01 – 0.01	0.797
GDP per Capita	0.09 (1.33)	-0.00 – 0.00	0.185
Size	-0.09 (-0.41)	-0.49 – 0.32	0.679
Average_Age	0.60 (2.02)	0.02 – 1.18	**0.044***
Random Effects			
σ^2	293.36		
$\tau_{00\ CompanyID}$	17.18		
ICC	0.06		
$N_{\ CompanyID}$	168		
Observations	296		
Marginal R^2 / Conditional R^2	0.041 / 0.094		

* Significant at 5%

In the second model of this paper, a network variable has been added. The results regarding the regression analysis, including this network variable and an interaction term, have been displayed in Table 6. It can be noted that the gender variable is again not statistically significant (t = -1.38, P = 0.169), which is in line with the first model. Additionally, these results also imply that not the main effect network variable (t = -0.74, P = 0.460) nor the interaction term between network and gender (t = 1.64, P = 0.102) are statistically significant. Therefore, the hypothesis that female directors' networks may moderate the relationship between board diversity and bid premium cannot be supported and hypothesis 3 must be rejected.

Table 6: Results multilevel regression model II

	Bidpremium		
Predictors	*Estimates*	*CI*	*p*
(Intercept)	-3.50 (-3.27)	-5.61 – -1.39	**0.001****
Gender	-10.56 (-1.38)	-25.65 – 4.52	0.169
Network	-0.12 (-0.74)	-0.45 – 0.20	0.460
Tobin Q	3.30 (1.99)	0.04 – 6.56	**0.047***
Leverage	0.00 (0.24)	-0.01 – 0.01	0.808
GDP per Capita	0.08 (1.20)	-0.05 – 0.22	0.231
Size	-0.09 (-0.45)	-0.51 – 0.32	0.651
Average_Age	0.61 (2.10)	0.04 – 1.18	**0.037***
Gender:network	1.87 (1.64)	-0.37 – 4.11	0.102
Random Effects			
σ^2	299.05		
$\tau_{00\ CompanyID}$	9.50		
ICC	0.03		
$N_{CompanyID}$	168		
Observations	296		
Marginal R^2 / Conditional R^2	0.052 / 0.081		

* Significant at 5%
** Significant at 1%g

In the third model, displayed in Table 7, the dummy-coded gender quota variable as well as an interaction variable between gender and gender quota have been included. As the continuous variables are centered, the intercept (b = -3.13; t = -2.48; P = 0.014) now represents the value for the bid premium when gender ratio is zero (i.e., average gender ratio of 86% male) (see table 3) and a value of zero for the gender quota variable (deals without gender quota). In conformity with the first model, the gender variable is negative (b = -23.65, t = -2.35, P= 0.02) , but in this case this relationship is also statistically significant, indicating that an increase in male directors can be associated with lower bid premiums when the company is situated in a country that does not uphold a gender quota. Accordingly, it can be confirmed that hypothesis 2b must be rejected, as an increase in board diversity,

measured by a decrease in the gender variable, was expected to be associated with an increase, rather than a decrease, in bid premiums paid for deals that took place in countries where no quota was implemented at the time of the deal.

Interestingly, it appears that gender quota on its own does not significantly impact the level of the bid premiums that are being paid. In other words, there is no significant difference in the level of bid premiums that are being paid in countries that uphold a gender quota versus those that do not uphold a gender quota. Rather, it appears that the interaction between gender quota and diversity significantly impacts the level of bid premiums that are being paid (b = 38.75, t = 2.20, P= 0.03). The positive coefficient of the interaction term shows that the relationship between the gender ratio variable and bid premiums flips sign when the gender quota becomes 1. This indicates that in contrast to countries where no quota is implemented, an increase in board diversity (which equals an increase in female directors) below the average of 86% male directors, is associated with a decrease in bid premiums in countries with a gender quota. This supports hypothesis 2a, as countries with gender quota are indeed characterized by a negative relationship between board diversity and bid premium, and therefore, this hypothesis can be accepted. Moreover, in correspondence with the first model, the average age (b = 0.62, t = 2.09, P = 0.038) and Tobin Q (b = 3.75, t = 2.25, P = 0.026) variables are both positive and statistically significant, insinuating that companies with an average director age above the mean (66 years) and companies with an above-average Tobin Q (1.43) and therefore above-average financial resources are paying higher bid premiums. Finally, the conditional R^2 of this second model is 0.108, which gives the indication that 10.8% of the variance in bid premium can be explained by the random and fixed effects of the various independent variables.

Table 7: Results multilevel regression model III

	Bidpremium		
Predictors	*Estimates*	*CI*	*P*
(Intercept)	-3.13 (-2.48)	-5.62 – -0.65	**0.014***
Gender	-23.65 (-2.35)	-43.49 – -3.81	**0.020***
Factor (Genderquota)1	1.24 (0.42)	-4.63 – 7.10	0.679
Tobin Q	3.75 (2.25)	0.46 – 7.05	**0.026***
Leverage	0.00 (0.49)	-0.00 – 0.01	0.622
GDP per Capita	0.10 (1.47)	-0.00 – 0.00	0.144
Size	-0.08 (-0.40)	-0.49 – 0.32	0.687
Average_Age	0.62 (2.09)	0.04 – 1.19	**0.038***
Gender: factor (Genderquota)1	38.75 (2.20)	4.05 – 73.44	**0.029***
Random Effects			
σ^2	290.52		
$\tau_{00\ CompanyID}$	16.66		
ICC	0.05		
$N_{CompanyID}$	168		
Observations	296		
Marginal R^2 / Conditional R^2	0.057 / 0.108		

* Significant at 5%
** Significant at 1%

Finally, Table 8 presents the results of the regression which included a triple-interaction term between gender ratio, gender quota and network. Again, the statistically significant intercept (b = -3.02, t = -2.37, P = 0.019) represents the direction of bid premium in the case that all independent variables have a value of zero (i.e., their averages) and therefore the situation in which there is no gender quota. The main effect of the network variable (b = -0.25, t = -1.29, P = 0.199), as well as its interaction with gender (b =, t, P =) , gender quota (b =, t, P =), and the triple interaction term with gender and gender quota (b = 2.58, t = 0.98, P = 0.330) are not statistically significant. This suggests that the size of the

network does not significantly affect the level of bid premiums regardless of the level of diversity on the board, or their existence of a gender quota. Altogether, hypothesis 4 must be rejected, as there is no evidence that female directors' networks do impact the relationship between board diversity and bid premium, regardless of whet. the deals took place in country with or without a gender quota. This final model has a conditional R^2 of 0.11, suggesting that 11% of the variance in bid premium can be explained by these independent variables.

Table 8: Results multilevel regression IV

		Bidpremium	
Predictors	*Estimates*	*CI*	*p*
(Intercept)	-3.02 (-2.37)	-5.52 – -0.51	**0.019***
Gender	-25.26 (-2.46)	-45.45 – -5.06	**0.014***
factor(Genderquota)1	1.08 (0.36)	-4.85 – 7.02	0.720
network	-0.25 (-1.29)	-0.64 – 0.13	0.199
Tobin Q	3.31 (1.97)	0.01 – 6.61	**0.053***
Leverage	0.00 (0.33)	-0.00 – 0.01	0.746
GDP per Capita	0.10 (1.41)	-0.04 – 0.23	0.163
Size	-0.07 (-0.32)	-0.48 – 0.35	0.751
Average_Age	0.61 (2.10)	0.04 – 1.19	**0.038***
Gender:factor(Genderquota)1	38.55 (2.17)	3.54 – 73.56	**0.031***
Gender:network	1.43 (0.81)	-2.04 – 4.90	0.417
factor(Genderquota)1:network	0.82 (1.86)	-0.05 – 1.70	0.064
Gender:factor(Genderquota)1:network	2.58 (0.98)	-2.63 – 7.80	0.330
Random Effects			
σ^2	293.26		
$\tau_{00\ CompanyID}$	11.30		
ICC	0.04		

$N_{CompanyID}$	168
Observations	296
Marginal R^2 / Conditional R^2	0.075 / 0.110

* Significant at the 5% level

4.4 Robustness checks

Finally, I conducted a robustness check to confirm the structural validity of my models. The main goal of this type of checks is to 'examine how certain ''core'' regression coefficient estimates behave when the regression specification is modified by adding or removing regressors (Lu & White, 2013, p. 194). For this research, I performed a robustness check involving a change in the nature of the gender ratio.

4.4.1 Gender dummy

The robustness check modifies the nature of the gender diversity variable by replacing the gender ratio by a gender dummy. This dummy has a value of 0 when a corporate board has a below-average (86% male) board diversity ratio, and a value of 1 when the company has an above-average gender diversity ratio. The results of this robustness check are presented in Table 9. The gender variable has a positive and statistically significant coefficient (b = 6.09, t = 2.35, P = 0.019). Given the fact that, as opposed to model IV of the regular regressions, a higher value for the gender variable can now be associated with an above-average diversity, this robustness check confirms that an increase in the presence of female directors may be associated with a statistically significant increase in bid premium paid. Moreover, as these continuous variables are centered, this relationship applies to the situation in which gender quota has a value of zero, meaning the absence of a gender quota. These findings and the sign of the coefficient are in line with model II and affirm that hypothesis 2b must be rejected.

By introducing the gender dummy instead of the gender ratio, the interaction effect (GEN*GENQ) is now statistically significant and negative (b = -13.90, t = -2.52, P = 0.012). This indicates that the relationship between gender and bid premium is negative when the gender quota has a value of 1, thus when a gender quota is implemented. Consequently, the robustness check provides evidence that in countries with gender quota, increased gender diversity, in terms of an increase in female directors, may be associated with a decrease in bid premium paid. Again, this is in line with model II and supports hypothesis 2a.

Furthermore, in line with Table 8, there is not significant impact of the network variable, which suggests that hypothesis 3 must be rejected. When it comes to the interaction terms, the statistically insignificant interaction term (GEN * network), indicates that there is no significant impact of the interaction between network and gender on bid premium in countries without gender quota. This

would reconfirm the rejection of hypothesis 4. However, the only difference between this robustness check regression and the regular regression in Table 8 is that the robustness check provides evidence of a statistically significant positive interaction variable (GENQ * network) (b = 2.38, t = 3,74, P < 0.001) and a statistically significant negative tripe interaction (GENQ * gender * network) (b = -2.95, t = 3.65, P = <0.001). The former suggests that, in countries with gender quota, and for companies with an above-average network size, an increase of one director in the network may be associated with an increase of 2.8% in the bid premium paid, given a value of zero for the other variables, and therefore a value of zero for the gender dummy. In other words, this would imply that in these countries, an increase of one director in the network, for companies with below-average diversity, may lead to an increase in the premium paid. One explanation could be that in countries with a quota, firms may be indirectly punished for having a below-average gender diversity as other companies may require a higher bid, and that this effect may be stronger when this disobedience is more known to the other companies as result of a more extensive network. The latter triple interaction provides evidence that, in countries with a gender quota, companies with a gender value of 1, indicating an above-average gender diversity, which have an above-average network size, pay on average a 2.95% lower premium for each additional connection in the network size. In line with the explanation regarding the former interaction term, this could suggest that firms that do have an above-average gender diversity may be rewarded for their high board diversity by paying a lower premium, and this effect may again be strengthened as their reputation is better known through a higher network size. In this way, support is found for hypothesis 4.

In general, the signs of the coefficients of the robustness check model are in line with those of model IV (Table 8). Therefore, I argue that the results of the multilevel regression analysis are consistent and robust.

Table 9: Results robustness check with gender dummy

	Bidpremium		
Predictors	*Estimates*	*CI*	*p*
(Intercept)	-5.77 (-3.94)	-8.65 – -2.89	**<0.001****
dichotomize(Gender)	6.09 (2.35)	1.00 – 11.17	**0.019***
factor(Genderquota)1	8.66 (1.89)	-0.34 – 17.67	0.059
Network	-0.15 (-0.70)	-0.56 – 0.27	0.486
TobinQ	3.57 (2.06)	0.16 – 6.98	**0.040***

Leverage	0.00 (0.24)	-0.01 – 0.01	0.814
GDPperCapita	0.09 (1.32)	-0.05 – 0.23	0.189
Size	-0.040 (-0.20)	-0.47 – 0.38	0.842
Average_Age	0.63 (2.15)	0.05 – 1.22	**0.032***
dichotomize(Gender):factor(Genderquota)1	-13.90 (-2.52)	-24.77 – -3.02	**0.012***
dichotomize(Gender):network	0.13 (0.32)	-0.69 – 0.96	0.751
factor(Genderquota)1:network	2.38 (3.74)	1.13 – 3.63	**<0.001****
dichotomize(Gender):factor(Genderquota)1:network	-2.95 (-3.65)	-4.54 – -1.36	**<0.001****

Random Effects

σ^2	260.48
$\tau_{00\ CompanyID}$	32.09
ICC	0.11
$N_{\ CompanyID}$	168
Observations	296
Marginal R^2 / Conditional R^2	0.116 / 0.213

* Significant at the 5% level
** Significant at the 1% level

4.5 Summary of results

In conclusion, on the basis of this sample of 306 M&A deals between European companies in the period between 2002-2018, there is no evidence of a significant relationship between gender diversity and bid premium paid, and therefore hypothesis 1 should be rejected at a 5% level. However, the association between gender and bid premium becomes significant when the moderating role of gender quota is examined. More specific, a negative relationship between the gender ratio and the bid premium is found for deals that took place in countries where there was no quota adopted at that point in time. As an increase in the gender ratio implies an increase in the presence of male directors (above the average of 86% male directors), the significant negative sign is contrary to the expected sign as predicted in hypothesis 2b, which therefore must also be rejected. The statistically significant and positive sign of the interaction term (GENQ*GEN) in the second model shows that the relationship between gender and bid premium flips sign when the value for the gender quota increases to 1. This confirms, in line with hypothesis 2a, that the relationship between gender diversity, in terms of the

increased presence of female directors, and bid premium is indeed negative in countries where a gender quota is implemented, and consequently this hypothesis can be accepted.

The third and fourth model and hypotheses focus on the potential moderating role of female directors' networks. The network variable is statistically insignificant in the third regression, suggesting that there is no significant impact of the networks of female directors on the bid premium paid. Moreover, the interaction variable (GEN*network) does not provide evidence of such a relationship either. As a result, hypothesis 3 should be rejected. Finally, a triple-interaction term (GEN*GENQ*network) has been added to the fourth and last model. As the continuous variables are centered, the interaction term (GEN*network) represents the value of the bid premium in the case all variables are zero (i.e., their average value) and therefore a value of zero for the gender quota. Given the fact that the coefficient for this interaction term is not significant, it can be argued that there is no significant effect of the association between network and gender on bid premium in countries without quota. Moreover, the triple interaction variable represents this relationship given a value of 1 for the gender quota variable and this interaction term is not statistically significant either, implying that the interaction between gender and networks does not significantly impact the bid premium in countries with gender quota. Altogether, there is no evidence that the interaction between gender and network and its influence on bid premium differ between countries with and without quota. As a result, hypothesis 4 must be rejected.

Additionally, a robustness check has been performed, involving a dummy variable instead of the gender ratio. The main effects of networks and gender are in line with the main model (model IV, Table 8), confirming the rejection of hypotheses 1, 2b and 3, and the acceptation of hypothesis 2a. Moreover, despite the potential presence of interaction effects in the robustness check model, it can be argued that our regression models are consistent and robust.

5 Conclusion & discussion

The goal of this paper is to examine the relationship between board diversity and bid premia in the context of European listed firms. Moreover, a distinguishment has been made between voluntary board diversity and the influence of gender quota mandating the presence of female directors. Finally, I investigated the moderating role of female directors' networks measured by a proxy of degree centrality. Different regression models are built, and analyses are performed to answer the following research question:

To what extent does board diversity affect bid premia en what is the moderating role of gender quota and female director networks?

Prior research has shown that board diversity, through de presence of female directors, may positively affect firm performance (Erhardt et al. 2003; Qian, 2016) and can be associated with lower bid premia (Levi et al. 2014). Results on the influence of gender quota on M&A activity on the other hand are still conflicting. Additionally, current literature provides evidence that director networks may play a moderating role, which can mainly be explained by a reduction in information asymmetry. Therefore, the aim of this research is to delve deeper into the relationship between gender, networks and bid premia.

It is found that there is no significant relationship between gender diversity, measured as a gender ratio, and the bid premium paid by the European acquirers. This would imply that an increase of the presence of female directors on corporate boards would, on average, not significantly impact corporate leaders' M&A behavior in terms of the amount they are willing to overpay for these types of deals. These findings are largely in contrast with the existing literature (Levi et al. 2011; Ragon, 2015) as it is suggested in these papers that female directors may be less overconfident and less prepared to take risks compared to their male counterparts. However, this paper does not support the idea that gender differences may significantly impact M&A activity in terms of bid premiums paid. On the other hand, I do find evidence that the increased presence of female directors lowers the average bid premium paid in countries where a gender quota is introduced, supporting papers by Lucas-Pérez et al. (2015) and Duppati et al. (2020) that the adoption of corporate gender quota may yield benefits in terms of firm performance and M&A activity. However, in countries without quota, the sign of this relationship flips and increased gender diversity appears to be associated with an increase, rather than a decrease, in bid premium paid. In conclusion, the presence or the absence of gender quota does significantly impact the bid premium paid, and it seems that the increased demand for gender equality only benefits firms, at least in the context of M&As, in countries where a gender quota is implemented.

Furthermore, the potential moderating role of networks is investigated. However, the findings clearly show that there is no significant impact of the networks of female directors on the bid premium, suggesting that these networks do not significantly reduce the information asymmetry in a way that benefits the bidder. Moreover, the interaction terms including the network variable are not statistically significant either, demonstrating that the effect of the interaction between gender and networks on bid premium do not appear to significantly differ between countries with and without corporate gender quota.

Finally, it is very notably that a positive relationship is being found between the average age of board directors and the bid premium paid. This contradicts the findings of Berger et al. (2014) that younger executives are more risk appetite, which in the context of M&As could suggest that younger rather than older directors may be prepared to take risks and pay higher premiums. One potential explanation for these findings could be that younger directors may be dealing with greater future career concerns and could therefore be less prepared to take bigger risks. No significant effect has been found for the board size, leverage or GDP per capita variable. However, evidence has been presented for a positive impact of the Tobin Q, suggesting that firms with above-average financial resources pay on average higher bid premiums.

This paper contributes to the literature by making a distinction between the effects of (voluntary) board diversity on the one hand and the effect of the obligated presence of female directors related to the adoption of gender quota. It shows that the increased demand for gender equality may mainly make a difference in the context of the bidding process in M&As in countries with a gender quota. Moreover, a practical contribution is made as this research provides insight to policymakers of how the introduction of corporate gender quota may affect firm behavior. Finally, this study has been the first one to investigate the potential moderating role of networks in the context of gender diversity, gender quota and bid premiums. Some evidence is provided that networks, and therefore the role of information asymmetry, may not play a significant role in the relationship between gender and bid premia.

However, this research also has its limitations. First, the network variable is constructed in a simplified and limited way. Given the overwhelming amount of network data associated with this type of research, a network proxy has been created on the basis of the existing connections between the directors of all acquiring companies included in the sample. By constructing the network variable in this way, a lot of network values of zero have been found, which significantly impacts the potential interpretation of the coefficient related to this predictor. Therefore, the interpretation of its main effect as well as interaction effects can be complicated. It would have been better to create multiple network measures, which has been done in previous research.

Secondly, the gender quota variable is rather unbalanced. As can be deduced from Appendix B, 153 out of 172 firms (89%) in the sample were situated in countries where there was no quota adopted at the moment of the deal, which corresponds with 277 out of 306 (91%) deals. This may impact the results regarding this variable. Given the fact that an increasing number of countries adopt this kind of corporate gender quota, it could be useful to re-perform this study with a more balanced sample by the time that an increased number of deals have been closed in the presence of a gender quota.

Finally, this paper offers opportunities for future research. First of all, it could be interesting to perform a vertical comparison of the effects of gender quota, by examining how bid premiums are affected by gender in the years prior to the introduction of a quota and in the years after the adoption. Secondly, future research may include a variety of other dependent variables (within the context of M&As) to investigate how for example the number of bid initiations and the size of targets may be influenced by both the presence of female directors and the introduction of gender quota. Thirdly, this research only focuses on Western Europe, given the similarities in the cultural and institutional environments. It could be interesting to compare these European countries with other regions, such as the United States and United Kingdom, or for example Asia, where an increasing number of countries adopt equivalent gender quota. Moreover, the importance of cultural and institutional aspects could then be examined.

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Appendices

Appendix A

Table 10: Gender quotas and characteristics per country

Country	Type of quota	% Women required on board	Year introduced	Date of compliance
Austria	Binding*	30	2017	January 2018
Belgium	Binding	33	2011	2011-2019
France	Binding**	20 & 40	2011	20%: January 2014 40% January 2017
Germany	Binding	30	2015	January 2016
Italy	Binding	20 & 33	2011	20%: Augustus 2012 33%: January 2017
Luxembourg	-	-	-	-
The Netherlands	Soft	30	2014	January 2016
Norway	Binding	40	2003	January 2008
Portugal	Binding*	33	2017	January 2018
Spain	Soft***	40	2007	January 2015
Switzerland	-	-	-	-

* The deals involving acquirors from these countries took place before the date of compliance, therefore these deals are considered as observations that took place in countries without quota
** Only applies to listed and non-listed firms with more than 500 employees
*** Only applies to all large firms (> 250 employees and >11.4 million in assets)

(Seierstad et al. 2017, p. 241-242 ; European Commission, 2022)

Appendix B

Table 11: Sample description (country level)

Country	**Number of deals**	**Number of firms**
Austria	6	5
Belgium	12	8
France	116	59
Germany	61	33
Italy	19	10
Luxembourg*	6	2
The Netherlands	14	10
Norway	11	8
Portugal	1	1
Spain	37	19
Switzerland*	23	17
Total	**306**	**172**
Total number countries with quota	*277*	*153*
Total number countries without quota	*29*	*19*

* Countries without gender quota

Table 12: Sample description (sector level)

Sector	**Number of deals**	**Number of firms**
Automobiles & Parts	6	3
Beverages	2	1
Business Services	7	5
Chemicals	11	8
Clothing & Personal Products	8	4
Construction & Building Materials	18	12
Diversified Industrials	7	4
Electricity	11	6
Electronic & Electrical Equipment	16	6
Engineering & Machinery	8	3
Food & Drug Retailers	8	3
Food Producers & Processors	8	7
General Retailers	4	4
Health	5	4
Household Products	1	1
Information Technology Hardware	7	4
Leisure & Hotels	5	3
Media & Entertainment	18	10
Oil & Gas	10	7
Pharmaceuticals and Biotechnology	21	10
Real Estate	27	20
Renewable Energy	8	4
Software & Computer Services	24	17
Specialty & Other Finance	1	1
Steel & Other Metals	9	6
Telecommunication Services	26	9
Transport	6	2
Utilities – Other	24	8

Total	**306**	**172**

Appendix C

Figure 1: Linearity plot fitted values and residuals (model I)

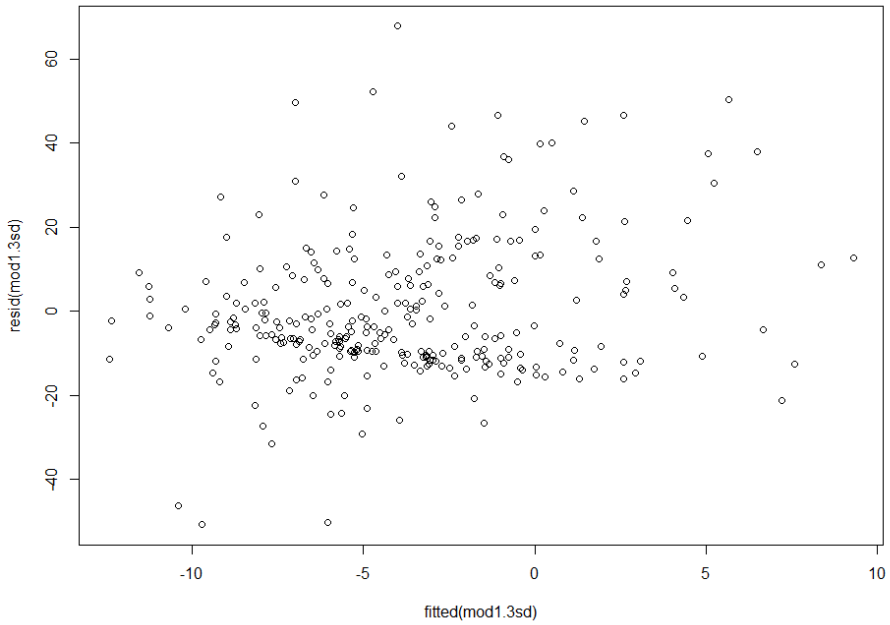


Figure 2: Linearity plot fitted values and residuals (model II)

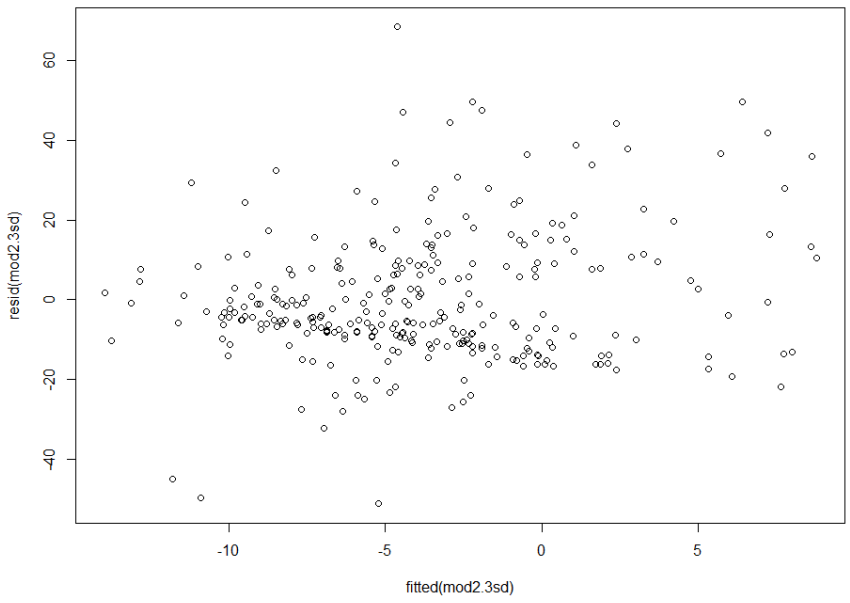


Figure 3: Linearity plot fitted values and residuals (model III)

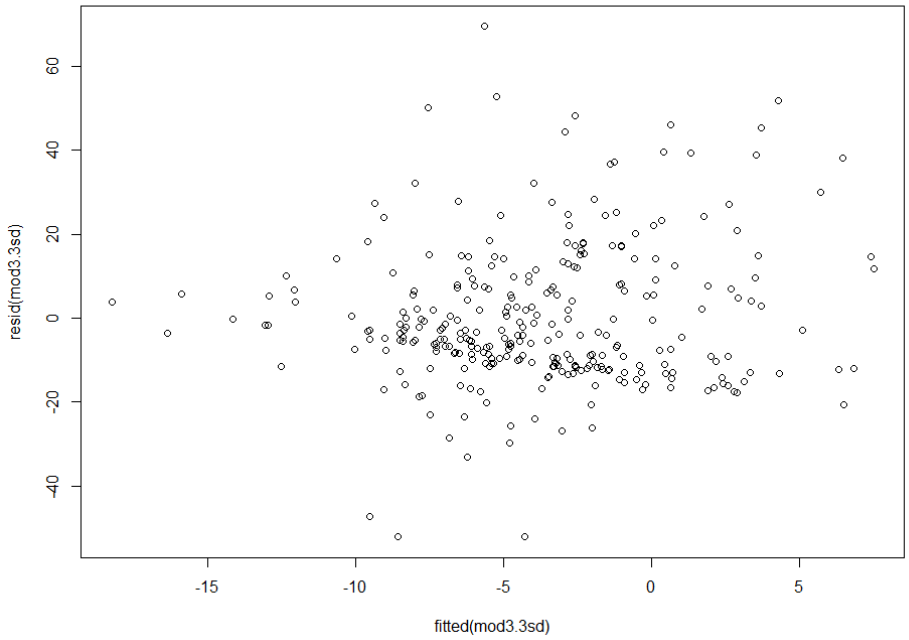
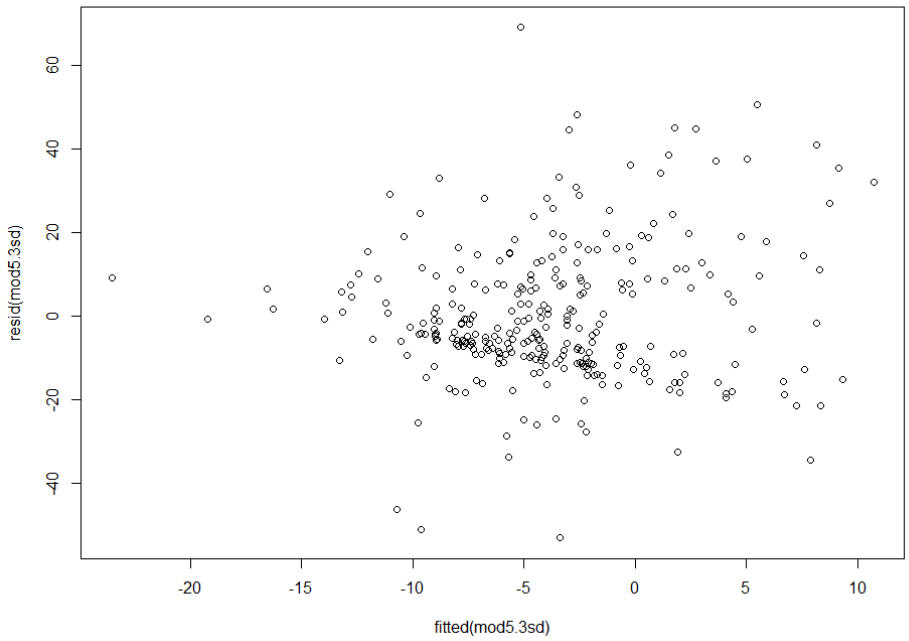


Figure 4: Linearity plot fitted values and residuals (model IV)



Appendix D

Table 13: Test for homoscedasticity (Model I)

```
> homoscedasity(mod1.3sd)
Analysis of Variance Table

Response: resid.abs.sq
                    Df   Sum Sq Mean Sq F value  Pr(>F)
data.3sd$CompanyID   1   825199  825199  2.8931 0.09002 .
Residuals          294 83857399  285229
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Analysis of Variance Table

Response: resid.abs.sq
                   Df   Sum Sq Mean Sq F value Pr(>F)
data.3sd$Country   10  3586271  358627  1.2603 0.2527
Residuals         285 81096328  284549
```

Table 14: Test for homoscedasticity (Model II)

```
> homoscedasity(mod2.3sd)
Analysis of Variance Table

Response: resid.abs.sq
                    Df   Sum Sq Mean Sq F value  Pr(>F)
data.3sd$CompanyID   1   751782  751782  2.7464 0.09854 .
Residuals          294 80478301  273736
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Analysis of Variance Table

Response: resid.abs.sq
                   Df   Sum Sq Mean Sq F value Pr(>F)
data.3sd$Country   10  3565403  356540  1.3084 0.2253
Residuals         285 77664681  272508
```

Table 15: Test for homoscedasticity (Model III)

```
> homoscedasity(mod3.3sd)
Analysis of Variance Table

Response: resid.abs.sq
                    Df   Sum Sq Mean Sq F value  Pr(>F)
data.3sd$CompanyID   1   936572  936572  3.0331 0.08263 .
Residuals          294 90783899  308789
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Analysis of Variance Table

Response: resid.abs.sq
                   Df   Sum Sq Mean Sq F value Pr(>F)
data.3sd$Country   10  3923359  392336  1.2736 0.2449
Residuals         285 87797112  308060
>
```

Table 16: Test for homoscedasticity (Model IV)

```
> homoscedasity(mod5.3sd)
Analysis of Variance Table

Response: resid.abs.sq
                    Df   Sum Sq Mean Sq F value  Pr(>F)
data.3sd$CompanyID   1   834376  834376  3.0803 0.08029 .
Residuals          294 79638346  270879
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Analysis of Variance Table

Response: resid.abs.sq
                   Df   Sum Sq Mean Sq F value Pr(>F)
data.3sd$Country   10  3695062  369506  1.3716 0.1929
Residuals         285 76777659  269395
```

Appendix E

Figure 5: Residual diagnostic plot (Model I)

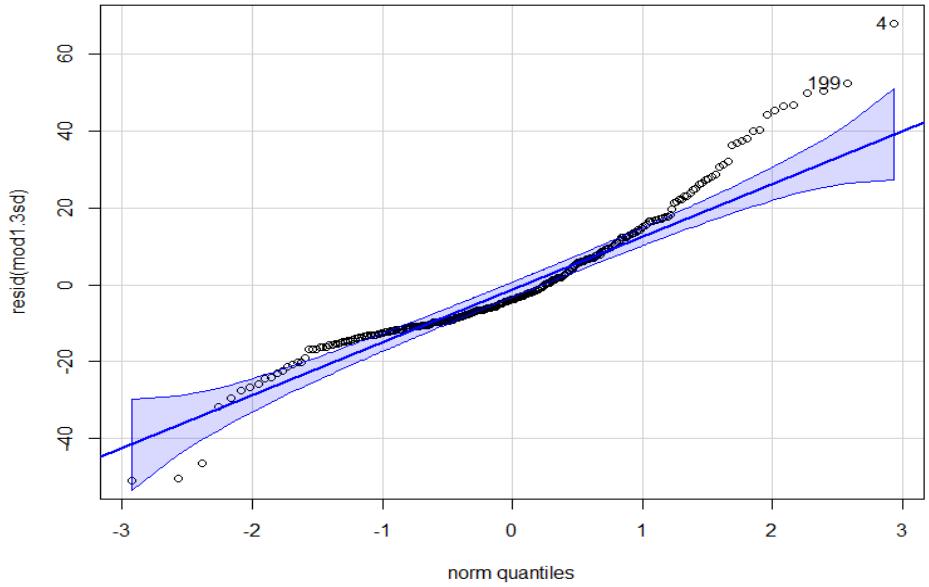


Figure 6: Residual diagnostic plot (Model II)

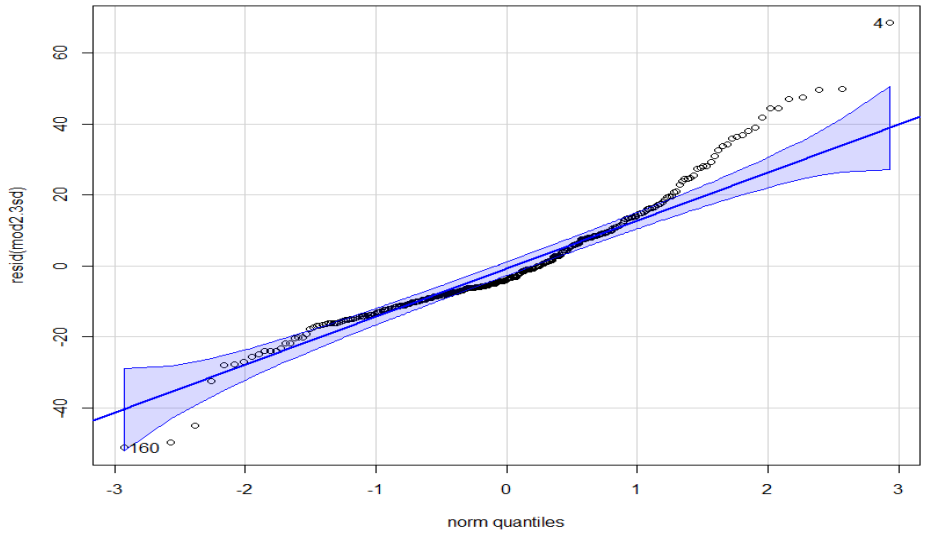


Figure 7: Residual diagnostic plot (Model III)

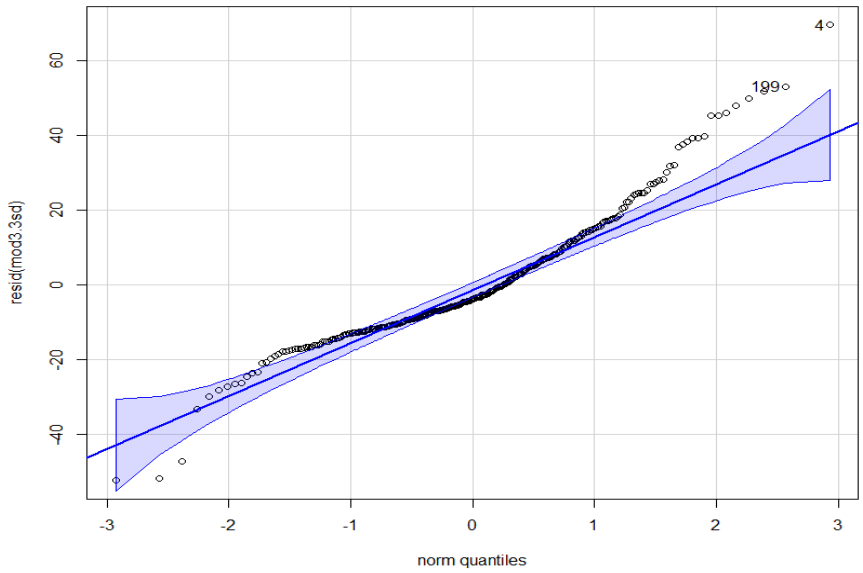
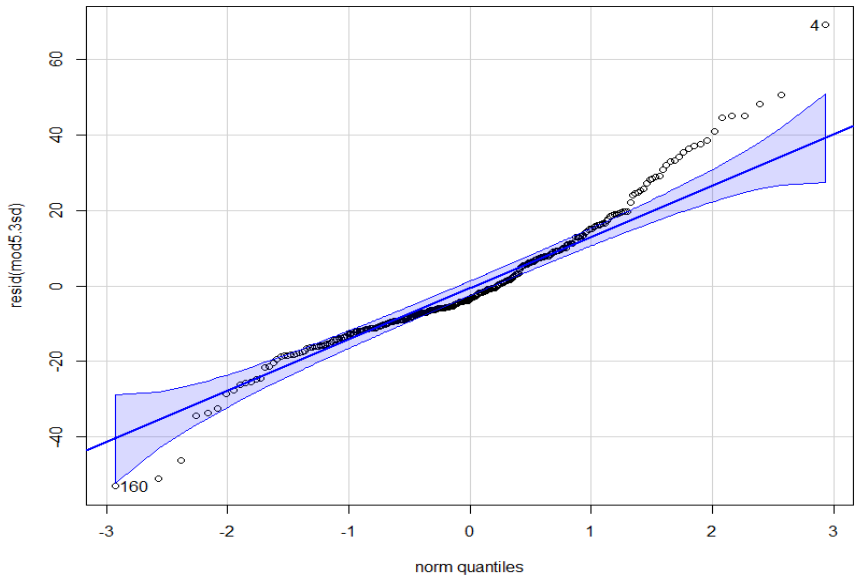


Figure 8: Residual diagnostic plot (Model IV)



Appendix F

Table 17: Variance Inflation Factor (VIF) test (Model I)

```
car::vif(mod1.3sd)
            Gender factor(Genderquota)                TobinQ
          1.239328             1.306859              1.061638
          Leverage       GDPperCapita                  Size
          1.026632             1.113558              1.149123
       Average_Age
          1.095651
```

Table 18: Variance Inflation Factor (VIF) test (Model II)

```
car::vif(mod2.3sd)
                    Gender         factor(Genderquota)
                  1.880893                    1.577367
                    TobinQ                    Leverage
                  1.063515                    1.043862
              GDPperCapita                        Size
                  1.124820                    1.149682
               Average_Age Gender:factor(Genderquota)
                  1.098702                    2.224286
```

Table 19: Variance Inflation Factor (VIF) test (Model III)

```
car::vif(mod3.3sd)
      Gender         network          TobinQ        Leverage
    1.081798        1.134632        1.077873        1.022058
GDPperCapita            Size     Average_Age Gender:network
    1.102616        1.214966        1.100402        1.031232
```

Table 20: Variance Inflation Factor (VIF) test (Model V)

```
car::vif(mod5.3sd)
                          Gender                 factor(Genderquota)
                        1.970139                            1.632994
                         network                              TobinQ
                        1.635774                            1.110051
                        Leverage                        GDPperCapita
                        1.053777                            1.151199
                            Size                         Average_Age
                        1.225946                            1.105959
     Gender:factor(Genderquota)                      Gender:network
                        2.280672                            2.497906
    factor(Genderquota):network Gender:factor(Genderquota):network
                        2.142157                            3.128354
```