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Employee representation on the board of directors and its implications on corporate risk

A quantitative study on diverging stakeholder preferences

Authors: Filip Engelholm, Lukas Nyström

UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Supervisor: Conny Overland
Examiner: Ted Lindblom
Department of Business Administration: Graduate School
Accounting and Financial Management
School of Business, Economics and Law at University of Gothenburg
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School of Business, Economics and Law at University of Gothenburg
SE-405 30 Gothenburg

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Filip Engelholm, Lukas Nyström ©
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Abstract

This study investigates how board-level employee representation (BLER) impacts the risk profile of a firm. More specifically, it investigates whether the binary presence of employees in the board room, or the relative ratio of votes allocated to employees, leads to reduced total, idiosyncratic, or systematic risk. The study extends a small, but growing, body of literature investigating the real economic impacts of the unique form of codetermination that exist in 18 European countries but that is being considered across the world. Hence, the findings have direct political implications. To the authors best knowledge, the study is the first of its kind.

The study uses a sample of 3,541 firm-years of Swedish listed firms between 2005 and 2019 to conduct a quantitative analysis. More specifically, the two stage Heckman regression model was used to answer the research question and control for the potential issue of self-selection bias. Based on theoretical arguments from financial risk-return theories, agency theory, and corporate governance mechanisms based on monitoring, information asymmetry and diversity, the study arrived at six testable hypotheses. Firstly, the study hypothesised that the binary presence of BLER would lead to a reduced total (H1) and idiosyncratic (H2) risk but that it would not have an impact on systematic risk (H3). Secondly, the study argued that the marginal effect would be proportional to the ratio of allocated votes. More specifically, it was hypothesised that increased concentration of BLER would lead to lower total (H4) and idiosyncratic (H5) risk, but that it would not impact systematic risk (H6). The study does not find evidence to confirm H1, H2, H4 nor H5. However, it supports H3 and H6. This partially contradicts the most related previous study (Lin et al. (2021)), which has found that employees act as risk-averse bondholders. The authors of this paper provide eight hypotheses that might explain this surprising finding, and argue that the most likely version is that the employee representatives are not given any de facto influence in the board room. Similar arguments have been provided in previous studies, although it is not conclusive nor unanimous.

Finally, a word of caution. Although the study rejects the hypothesised BLER-risk relationship, it finds several methodological peculiarities that make the results difficult to interpret objectively. Noteworthy is that polar-opposite results are found when making minor changes to the research design and set of control variables. Hence, the authors suggest several complementary studies that must be carried out before reliable and robust results adequate for political decisions can be derived.

Keywords: *Board level employee representation, Codetermination, Risk preferences, Stakeholder incentives, Agency conflict, Corporate governance*

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Filip Engelholm and Lukas Nyström, *Gothenburg June 2022*

Abbreviations

BLER Board Level Employee Representation
CAPM Capital Asset Pricing Model
LSA Act on Board Representation ("Lag om styrelserepresentation")
MBL Codetermination Act ("Medbestämmandelagen")
MSCI The Modern Index Strategy
OLS Ordinary Least Squares
VIF Variance Inflation Factor

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1

Introduction

In this chapter the background for the study is presented, followed by a problem discussion related to previous contradicting studies related to the topic. The ambiguous and conflicting evidence boils down to a declaration of the purpose of the study, which is finally condensed into the intended research question.

1.1 Background

This report intends to analyse how board-level employee representation impacts the total risk in a firm. Board Level Employee Representation (BLER) is a special form of a broader concept, termed codetermination, which stipulates that the control of a firm is shared between owners and employees (Jäger et al., 2021a). This is in stark contrast to the concept of *shareholder primacy*, where shareholders have full control (Blandhol et al., 2021). Board-level employee representation is the strongest form of codetermination since it awards employees a vote in the boardroom. This unique right is mandated by law in 17 EU member states and Norway (Gold and Waddington, 2019), but it does not exist anywhere else in the world (Jäger et al., 2021a). See Figure 1.1 for a geographical illustration.

The employee representation legislation differs between the European states. Gold and Waddington (2019) defines five different tiers, ranging from strong to weak employee rights. In the strongest case, the labour unions are allowed up to 50% of the board seats, whereas in the weaker cases it could be limited to a single vote or even only representation in a supervisory board (in the case of a two-tier board system). Further, in some countries, the regulation only covers state-owned enterprises (Gold and Waddington, 2019). The country with the strongest employee representation is Sweden (Vitols, 2010), which makes it an especially interesting case to study. In the Swedish context, the labour union is allowed 2 (3) seats on the board for all firms with more than 25 (1000) employees, and as many deputies (Overland and Samani, 2021). This right has strong historical and political roots, going back to the 1976 Codetermination Act ("Medbestämmandelagen", MBL) and the 1986 amended Act on Board Representation ("Lag om styrelserepresentation", LSA). Notably, the employee elected board members share the same rights and obligations as their shareholder elected counterparts (Overland and Samani, 2021).

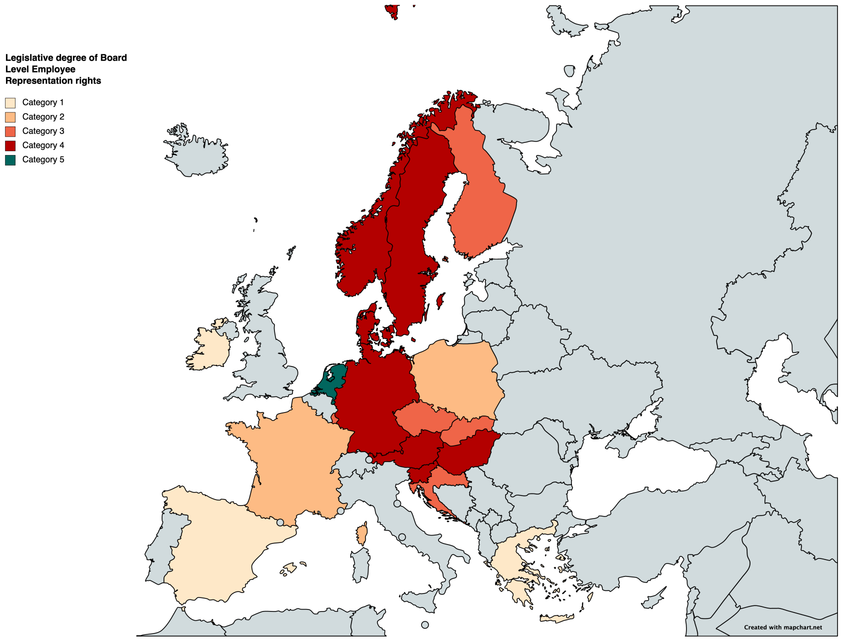


Figure 1.1: Illustration of countries with legislative rights to Board Level Employee Representation (BLER). Gold and Waddington (2019) defines a categorisation. Category 1 to 4 implies increasing level of employee rights. Category 5 is a special case for the Netherlands, since the unique legislation allows for non-employees to represent the labour union on the board of directors.

This unique phenomenon has gained increased interest in recent years. Politicians and the public in the USA and UK (Blandhol et al., 2021) and in the remaining EU states (Gold and Waddington, 2019) are lobbying for similar legislation. Proponents argue that it acts as a democratic force in the workplace since it allows workers to have a say in matters that influences their daily lives (Gold and Waddington, 2019) and that it helps to build human capital and reduces information asymmetry (Jäger et al., 2021a). Some further argue that the shared governance principle leads to improved firm performance (Conchon, 2011), whereas others argue the opposite and claim that it leads to diminished profits and should hence be avoided (Jäger et al., 2021a).

Since the concept is unique to a few European countries, limited research exists on the topic (Gold and Waddington, 2019). Due to the controversy and recent political interest, a handful of recent studies have tried to quantify the effect of employee representation. However, the results are mixed. Several papers have found that BLER does not have an impact on, for example, salary levels (Jäger et al., 2021b; Blandhol et al., 2021), rent-sharing and personnel turnover (Jäger et al., 2021b), earnings risk (Blandhol et al., 2021) nor job security and workplace health (Jäger et al., 2021a). However, other studies have found that introducing employees on the board has real economic impact and that it leads to, for example, changes in incentives, tax planning and earnings management (Gleason et al., 2021), improved quality of non-financial reporting (Overland et al., 2021), increased job satisfaction

(Jäger et al., 2021a), better earnings quality (Overland and Samani, 2021), CEO compensation packages with a higher ratio of performance-based remuneration (Dyballa and Kraft, 2020) and more conservative accounting (Lin et al., 2021).

In short, the results are inconclusive and additional research is required to better understand the real economic consequences of employee representation at the board level. One specific topic of particular interest that has yet to be examined, and is explicitly requested by Overland and Samani (2021), is how employee representation impacts the level of risk in a company. This builds upon the study by Lin et al. (2021), arguing that investors are able to diversify risk over a portfolio, whereas employees typically have their entire income tied to a single firm. Both research groups argue that this difference in risk exposure should translate into different preferences in terms of risk management at the board level. Hence, there is reason to suspect that employee representatives would vote differently than shareholder elected directors in such matters.

1.2 Problem Discussion

The preceding discussion implies that board-level employee representation could potentially have an impact on firm risk levels. Traditional financial models (Markowitz, 1952; Sharpe, 1964; Lintner, 1965; Fama and French, 2004) show that risk can further be divided into two components: idiosyncratic and systematic. Since a well-diversified investor can build a portfolio of stocks that eliminates the idiosyncratic risk, it is only the latter type that influences the investor's decision-making. However, as already discussed, employees' wealth is reliant on the individual firm and hence they will be susceptible to both types of risk. In other words, a well-diversified investor is indifferent to decisions that impact idiosyncratic risk, but rational employee representatives should vote in favour of board decisions that limit idiosyncratic risk.

A valid concern in response to the above is the bounded rationality and know-how of the agents. Behavioural finance proponents posit that even experts fail to fully understand the complex issues surrounding financial risk (Subrahmanyam, 2008). Given this, one can question whether, for example, a blue-collar representative would be able to make adequate and rational decisions concerning total risk management. Overland and Samani (2021) provides some reassurance, by showing that employee representatives are able to grasp the equally complex issue of earnings quality. Regardless, given their firm-specific knowledge (Gleason et al., 2021) they should at least be able to make accurate evaluations of operational risk. All in all, a pure argument based on risk preference thus seems to support a negative correlation between firm risk and BLER.

This statement is complicated by the fact that researchers have found conflicting evidence regarding whether employee representatives only have de jure and no de facto influence. Gold and Waddington (2019) show that some employee representatives claim to have significant influence, whereas others feel like they have no say on important decisions. In the Swedish context, they find that the representatives are generally seen as influential on local decisions but rather limited in terms of strategic matters. Similar conclusions are presented by Jäger et al. (2021a) and Blandhol et al. (2021), who argue that since employee representatives are always in the minority on the board, their influence on key firm decisions will always be limited. This would suggest that even if employee representatives would prefer to reduce the risk level, they might lack the power to do so.

One of the key roles of the board of directors is to mitigate the agency conflict and issues with information asymmetry (Jensen and Meckling, 1976; Jensen, 1993). Lin et al. (2018) show that employee representation leads to lower agency costs in relation to banks, but more generally, the evidence on whether it reduces or increases agency problems is mixed (Gold and Waddington, 2019). Similar to how evidence shows that managers might act in opportunistic ways to entrench themselves and gain personal benefits (Scheleifer and Vishny, 1989), one could imagine a scenario where employee representatives become entrenched and no longer act on behalf of the labour force. However, Jäger et al. (2021b) test this and find the opposite. Their results, and similar results presented by Gleason et al. (2021), in fact suggest that an inverse agency problem appears in which the employee representatives tend to put the interests of the workers above the best interest of the firm.

As alluded to above, researchers have claimed that one of the key merits of employee representation is that they contribute with firm-specific knowledge, which builds additional board capital and hence improves board efficiency (Fauver and Fuerst, 2006; Gleason et al., 2021; Overland and Samani, 2021; Overland et al., 2021). Similar conclusions are presented more generally by Fama and Jensen (1983) and Faleye et al. (2011), who claim that insider directors are more efficient. This can be explained by the finding that boards with greater and broader knowledge tend to perform better (Hillman and Dalziel, 2003; Bebchuk and Weisbach, 2010). Another explanation to the improved board performance given employee representation is that it increases board diversity (Pelled et al., 1999; Srinidhi et al., 2011; Li and Wahid, 2018; Arnaboldi et al., 2020; Overland et al., 2021), which in itself has been shown to improve communication, monitoring, and efficiency of the board (Adams and Ferreira, 2009; Andersson et al., 2011; Kim and Starks, 2016). Overland et al. (2021) argue that the increased diversity leads to improved task conflict, and others argue that it leads to increased creativity and lower barriers to asking questions which in turn boosts problem-solving (Carter et al., 2003; van Knippenberg et al., 2004).

The overall conclusion is that by allowing employees in the boardroom, the overall performance of the board improves. Intuitively, this should lead to better informed decisions, and hence more accurate evaluation of firm risk. However, it does not suggest whether the renewed risk profile would increase or decrease, only that it would likely change. From a contingency perspective, there is no universally best way to organise, lead, or make decisions in a company; the most efficient direction is contingent on the organisations internal and external context (Otley, 2016). One could, for example, imagine a scenario where the improved firm-specific knowledge makes the board understand that they have underestimated operational risk, and hence are forced to reduce financial risk - or the other way around, that they previously overestimated the true operational risk and hence can afford to take on for example additional financial leverage.

In addition, it is important to consider the agents in their organisational context. While DiMaggio and Powell (1983) describes that organisations are becoming increasingly homogeneous due to the influence of their institutional context, Lounsbury (2008) shows that different stakeholders might have competing institutional logics which will lead to heterogeneous preferences. As seen in Hartmann et al. (2018), different logics might even lead to dramatically different interpretations of financial statements and regulations. In the context of this study, this could mean that if the logics of the two groups are sufficiently different, they might reach different conclusions concerning issues related to the firm's risk exposure. This implies that in order to understand the outcome of allowing employees on the board, it is necessary to analyse the incentives and prevailing logics of the agents.

Firstly, as pointed out by Overland and Samani (2021), all agents are incentivized to actively engage in the board work since they all share the same obligations and face a risk of legal action. According to Dyballa and Kraft (2020), most researchers have wrongly assumed that the employee representatives have different preferences to shareholders. They argue that the common assumption that employees wish to maximise their short-term rent does not hold. Instead, they claim that both stakeholders share a common long-term interest in the firm, a finding which is widely supported (Gorton and Schmid, 2004; Lin et al., 2021). An important distinction, however, is that shareholders benefit from large upsides and hence push for profit maximisation, whereas employees are primarily interested in the survival of the firm (Lin et al., 2021). They argue that this leads employees to effectively share the same risk preferences as bondholders, which means that their risk appetite is different to shareholders (Smith and Warner, 1979).

A common conclusion is thus that employee representatives are more risk-averse (Faleye et al., 2006; Lin et al., 2018; Dyballa and Kraft, 2020). This suggests that firms with employee representation should have lower total risk. Gleason et al. (2021) offer some preliminary and partial evidence to support this. Although they do not find a difference in financial leverage, they find that firms with employee representatives tend to invest less in R&D. These expenditures are generally described to be risky investments since they are associated with a high failure rate (Saeed et al., 2021). Thus high level of R&D expenditures are associated with increased firm risk. On the other hand, low levels of R&D expenditures may also increase firm risk (e.g., default risk), as these investments are essential in order to sustain business and operations in the long term. Overland and Samani (2021) find that employee representation under certain conditions is associated with decreased R&D cuts, which thus serves as preliminary indications that how employee representatives reduce firm risk is two-folded.

As seen from the discussion above, this study is well motivated due to the currently available conflicting evidence. Financial risk models suggest that the risk should decrease as a result of non-diversified employees. Preceding studies especially indicate that the perception of operational risk would be impacted, thanks to the firm-specific insights that the workers contribute to the board discussions. Complementary arguments are drawn from the institutional logics perspective, suggesting that employees act as risk-averse bondholders. Related research based on agency theory indicates that it might lead to an inverse agency problem, at the detriment of firm profit but with reduced company risk as a consequence. Evidence from the corporate governance literature suggests that employee representations might improve board performance due to improved diversity and board capital, but it does not predict whether this has an upward or downward effect on risk exposure. Finally, opponents to the legislation argue that it does not have any impact at all because the employees are not given any de facto influence.

1.3 Purpose

The purpose of this study is thus to gain additional knowledge of the relationship between BLER and firm risk-taking by examining which of the above presented conflicting arguments prevails. More specifically, this analysis is carried out through a quantitative regression analysis on a large sample of all Swedish listed firms from 2005-to 2019. The underlying motivation for this study is the recently increased political and research interest in the unique European shared governance legislation on board-level employee representation (Gold and Waddington, 2019; Blandhol et al., 2021). Proponents are lobbying for increased codetermination and workplace democratisation, but the research community argues that insufficient evidence exists to fully comprehend the effects of such increased legislation. Researchers and policymakers alike have thus urged for more studies on the topic to better understand its real impact. More specifically, Overland and Samani (2021) explicitly state that improved insights on how employee representation impacts the risk management in firms is required. This study heeds this call and thus contributes to the open literature and aids policymakers in evaluating whether board-level employee representation should be implemented on a broader scale and what effects that would have on society and the economy.

1.4 Research Question

In line with the purpose of this study, the following research question has been formulated.

Does employee representation on the board of directors reduce risk taking in Swedish listed companies?

2

Theoretical framework

This chapter elaborates on the underlying theory and previous relevant research. In order to properly evaluate and analyse the research question, this study builds on the theoretical frameworks on financial risk, agency theory, and corporate governance mechanisms. The chapter is concluded with a hypothesis development.

2.1 Financial risk and portfolio theory

To better understand the relationship between risk and Board Level Employee Representation (BLER), we need to revisit previous research on portfolio theory and financial risk. At the base of modern portfolio theory, Markowitz (1952) found the efficient frontier of portfolios. These early theorists suggested that an individual stock's risk can be described as the standard deviation of its returns and consists of two components, company-specific (idiosyncratic) and systematic risk (Fama and French, 2004). The idiosyncratic risk, consisting of each security's combined business and financial risk, can be eliminated by creating a well-diversified portfolio. On the other hand, systematic risk cannot be eliminated through diversification as it refers to the part of the total risk reflecting movements at the macro level, i.e., the entire market or economy. However, it is not the individual risk of each security that is of main interest to an investor, but rather the total risk of the portfolio consisting of all securities. Markowitz (1959) model assumes that investors are risk-averse and hence choose a mean-variance efficient portfolio that (1) minimises the variance of portfolio returns in relation to expected return and (2) maximises expected return given its variance. Tobin (1958) extended the model by creating Tobin's separation theorem, suggesting that investors adjust their portfolios according to their risk preferences. The theorem describes that each investor can either hold risk-free assets or a combination of risk-free assets and the market portfolio and still hold an effective portfolio.

Sharpe (1964) and Lintner (1965) added two assumptions, *complete agreements* and *borrowing and lending at a risk-free rate* to Markowitz (1959) original model and created the Capital Asset Pricing Model (CAPM). CAPM is a model for pricing risky assets using risk and the current market conditions. With an underlying assumption that the market is efficient and that investors act rationally, the model only measures systematic risk since investors, through diversification, can eliminate the non-systematic firm-specific risk (Sharpe, 1964; Lintner, 1965). In the model, the beta represents the systematic risk of an asset estimated by regressing the market portfolio returns against the returns of an individual asset.

The modern portfolio theory contains many assumptions, some of which have been criticised for being unrealistic (Fama and French, 2004). Previous literature in the field has provided empirical evidence of investors acting sub-optimal deviating from the modern portfolio theory. Several behavioural biases have been found, explaining why some investors do not act accordingly. For example, studies have found empirical evidence of investor overconfidence overseeing risks connected to the investment (Weber and Camerer, 1998; Subrahmanyam, 2008), a disposition effect where investors sell winning securities and hold on to asset experience declining prices (Shefrin and Statman, 1985; Subrahmanyam, 2008) and evidence to support that herding behaviour steer investment decisions (Lakonishok et al., 1992; Wermers, 1999). In addition, Johnson and Tversky (1983) found that risk perception depends on the individual's mood, indicating that risk assessment is very complex and not always governed by rational behaviour. These irrational tendencies implies that investors are unable to identify the perfect market portfolio, which indicates that they are unable to perfectly eliminate the idiosyncratic risk. Hence, the situation is complicated by the fact that also shareholder elected investors might bare idiosyncratic risk in reality, although probably to a lower extent that employees. Furthermore, an important implication of these nuancing findings to this study is that if even seasoned investors are unable to value risk accurately and rationally, it raises the question of how, for example, blue-collar workers would be able to do so. One could posit that given the lower general competence in the field, employee representatives would be even more prone to act irrationally.

2.2 Diverging risk preferences between employees and shareholders

Compared to shareholders that can eliminate the idiosyncratic risk through diversification, meaning that they only need to evaluate and value systematic risk, the risk exposure of employees is quite different. This may have implications for their role as employee representatives on the board. Through their employment, employee representatives invest their human capital into the specific firm in which they are employed. However, due to the non-existence of long-term employment contracts, or the lack of explicitness in such, and that human capital is often non-transferable between organisations, the employee's investments of their human capital become conditional on the firm's survival, exposing them to firm-specific risk (Fauver and Fuerst, 2006). Thus, the long-term firm survival should be of primary concern for the employee representatives to a greater extent compared to shareholder elected directors (Fauver and Fuerst, 2006; Lin et al., 2021).

Moreover, the findings that individuals who may experience future liquidity constraints are significantly more risk-averse today (Gollier and Zeckhauser, 2002) further strengthens the claim that employee representatives should promote risk-reducing policies. Employees, on average, get almost their entire income from one specific firm, which creates a significant risk exposure against the firm's idiosyncratic risk and long-term survival, making them less inclined to bear risk compared to their shareholder elected peers (Lin et al., 2021). The findings from previous empirical studies on employee representatives point in the same direction, concluding that employee representatives seem to be relatively risk-averse and therefore favour risk-reducing policies (Faleye et al., 2006; Lin et al., 2018; Dyballa and Kraft, 2020).

Risk preferences can also differ between individuals. Aggarwal and Samwick (2003) find in a top management setting that individuals may have different preferences for diversifying idiosyncratic risk, that their preferences may vary over time, and that new opportunities to exploit pre-existing preferences may arise. Although Aggarwal and Samwick (2003) studies top management, it is plausible that the same conceptual findings should be valid for employee representatives as well, since the observed effect is based on human psychology and not hierarchy. Moreover, Weber and Hsee (1998) find cross-cultural differences in risk preferences. Drawing on these arguments, it is thus possible that although financial theory might indicate that employee representatives on a group level would advocate for risk-reducing policies, it is still plausible that individual employees in the board room might have dramatically different risk preferences due to unobserved individual, cultural or social factors.

2.3 Agency conflicts as a consequence of heterogeneous risk preferences

Agency theory, or the principal-agent theory, is a classic theory focusing on contractual relationships. In the generic set-up using two parties, two utility-maximising individuals identify potential gains of an exchange between the agent and the principal. The principal provides the agent with a task whose actions affect the payoff for both parties (Jensen and Meckling, 1976; Grossman and Hart, 1983; Eisenhardt, 1989). This collaboration is a contractual agreement, where the agent is paid by the principal, who in turn becomes the residual claimant (receives the net cash flow after all other obligations have been met) of the activities undertaken by the agent (Jensen and Smith, 1985). The delegation is often initiated because the principal lacks the knowledge, opportunity, or ability to perform the task efficiently. The knowledge gap and the lack of insight into the agents' work create asymmetrical information between the parties, resulting in uncertainty (and lack of trust) (Jensen and Meckling, 1976; Holmström, 1979; Grossman and Hart, 1983). Opportunistic agents may exploit this opportunity either ex-ante in the contracting phase of the relationship through "adverse selection" or "hidden information", or ex-post by diverging from the principal's preferences when executing the task (then termed "moral hazard" or "hidden action") (Eisenhardt, 1989). As a result of how these contractual relationships are shaped and the constant threat of conflict of interest between the parties, an agency cost is incurred for the principal.

In the context of this study, the documented heterogeneous risk preferences between employee representatives and shareholder elected board members thus pose a risk for agency conflicts to appear. Grossman and Hart (1983) describe a potential conflict of interest relating to a divergence of risk preferences. Investors can eliminate idiosyncratic risk through diversification while employees cannot. This has implications from a principal-agent perspective as employee representatives, in some cases, may have incentives to engage in job protectionism by maximising the firm survival chances, rather than trying to maximise value creation by taking on net present value (NPV) positive, but risky, endeavours (Gleason et al., 2021; Jäger et al., 2021a).

Just as economic theories predict agency costs as a consequence of opportunistic behaviour by management, such as empire building and rent extraction (Holmström, 1979; Jensen and Smith, 1985), a situation can arise when employee representatives enjoy private benefits at the expense of other stakeholders. Jensen and Meckling (1976) visualised a potential conflict regarding employees' task to monitor management and maximise the firm's value, with their incentives to look after wage levels and their employment security. Having employee representatives with the power to influence board decisions but without any invested capital on the board provides the employee representatives with an opportunity to consume firm assets at the expense of shareholders. On the other side of the spectrum, it is theorised that employee representatives improve monitoring and investment decisions (Fauver and Fuerst, 2006; Overland and Samani, 2021). Theoretically, this reduces the incentives of extracting private benefits in terms of payroll- and job security maximisation, as the monitoring and advisory duties do not directly conflict with their opportunistic desires (Gleason et al., 2021). This is because successful investments lead to an increased probability of firm survival, which would be favourable for both employees' job security and salary claims.

The empirical evidence of whether introducing employee representatives on the board creates agency costs, alternatively how significant they are, and whether the net benefits due to the improvements in monitoring and advisory are positive or not are mixed. In a German setting, employee representatives are shown to not significantly affect wage setting, wage levels, the degree of rent sharing, nor disinvestment (Jäger et al., 2021b), rejecting the predictions made according to hold-up and agency theories (Jensen and Meckling, 1976). On the other hand, Gleason et al. (2021) found that in a subset of transactions, the employee representatives prioritised payroll maximisation over their monitoring duties. This indicates that an inverse agency problem might exist in some situations where employee representatives act in the employees' best interests rather than the firm's. The mixed results in previous findings indicate that more research on the topic is needed.

The preceding discussion pertains to job security for employees as a group. In addition, scholars describe career concerns as a potential source of conflict of interest for the individual employee representative. As top management positions are connected with high turnover rates, they acknowledge their future labour market opportunities when making decisions, creating a short-term interest deviating from long-term investors' time horizons (Baker et al., 1994). In the context of employee representatives, we hypothesise that employees permitted to the board room might try to use this situation to build relational capital with top executives in the company to boost their labour careers. If this is the case, this could lead to an agency cost in which the elected employee representative acts opportunistically rather than representing her/his peers. For example, the employee representative might decide to conform to the other directors' opinion to avoid personal backlash, effectively eliminating her/his vote. This line of argument is analogous to the concept of Capture Theory, which is another hypothesised case where trust is being abused by elected representatives (Etzioni, 2009).

2.4 Corporate governance and the Board's role in risk management

In response to the agency-related problems outlined in the previous section, companies undertake countermeasures to eliminate the principal's difficulties in monitoring and realigning the parties' interests. Corporate governance has become an umbrella term for these initiatives, within which the board of directors is one of the most critical components. As a director on the board, employee representatives have the same obligations as the other board members. As a result, they are a natural part of the corporate governance mechanism having the task of monitoring management due to agency-related problems.

The previous literature in corporate governance identifies two core activities in the work of the board of directors. First, the board has an essential role in *monitoring* and *evaluating management* due to the agency costs arising from the separation between ownership and control, mitigating the asymmetrical information and moral hazard between management and investors (Fama and Jensen, 1983; Raheja, 2005; Adams and Ferreira, 2007). This by requesting management to justify the rationale for the decisions made and challenge their assumptions, acting as a supervisory mechanism in the firm. Secondly, the board aims to offer valuable *advisory* in matters related to strategic decisions and risk management (Helland and Sykuta, 2004; Adams and Ferreira, 2007). Through its expertise, relationships, and knowledge, the board constitutes an essential function supporting management in matters concerning e.g., implementation and formulation of business strategy, risk assessment, and advisory in risk management processes. However, the existence of a board does not lead to a reduced agency cost per se. Previous research has shown that the characteristics of the board and its directors affect their motivation and ability to perform their duties efficiently.

Various studies show that board size is related to the board's effectiveness. For example, DeAndres and Vallelado (2008) describe that board size is associated with a trade-off between the increased ability to monitor and advise and the impaired ability to coordinate, control, and make decisions, as a larger board makes it difficult to agree and govern. Moreover, (Jensen, 1993; Yermack, 1996; Eisenberg et al., 1998) provide evidence suggesting that smaller boards positively affect board efficiency due to their relatively improved ability to coordinate and make decisions. Furthermore, the study by Baulkaran and Bhattarai (2020) finds that increased board efficiency leads to lower firm risk, which links this argument to this study's main focus. The explicit reason for this is because by introducing additional board members in the form of employees, the board size increases, which according to these findings, implies worse board efficiency and hence higher risk.

Kim et al. (2014) document another trade-off linked to board efficiency, stemming from the relationship between independent and dependent directors, based on their different levels of knowledge and incentives. Through their background in the organisation, inside directors have access to firm-specific knowledge, creating a unique position as an advisory partner, mitigating the asymmetric information arising between management and the board (Fama and Jensen, 1983; Faleye et al., 2011). However, on the other hand, these director's monitoring incentives are reduced due to their dependency on the management (Fama and Jensen, 1983; Faleye et al., 2011). Quite the contrary, outside directors are well suited for monitoring activities because they are independent of management (Adams et al., 2010). However, despite their high incentive to monitor management, the lack of firm knowledge reduces their monitoring abilities. This signifies that the board composition will affect the balance between the two forces and thus the characteristics of the board as a whole, which in turn impacts the decision-making process. Through their firm-specific knowledge, together with their exposure to idiosyncratic risk, employee representatives could potentially ease up the trade-off problem between inside and outside directors described in (Kim et al., 2014). Access to information is a critical component in monitoring management (Fama and Jensen, 1983; Faleye et al., 2011). As employee representatives, compared to inside directors, have greater incentives to share their company-specific knowledge and internal networks with outside directors (Harris and Raviv, 2008), they have the potential to improve the entire board's ability to monitor management, which has also been concluded in several previous studies (Fauver and Fuerst, 2006; Gleason et al., 2021; Overland and Samani, 2021; Overland et al., 2021). As already discussed above, this improved board efficiency would then lead to a reduced firm risk by avoiding taking on value destructive projects.

The employees' firm-specific knowledge can potentially also be useful in the board's role, giving strategic guidance to the management. However, a potential issue that arises is the question of whether employees are educationally equipped to provide strategic advice linked to the complex risk area. Several authors have described that even professional investors tend to underestimate risks (Weber and Camerer, 1998; Subrahmanyam, 2008). However, previous research indicates that employee representatives appear to be capable of understanding complex business issues such as tax planning and earnings management (Gleason et al., 2021), earnings quality (Overland and Samani, 2021), and conservative accounting (Lin et al., 2021). This indicates that they should also be able to provide valuable insights within the risk area as well, thus leading to a more informed board with improved risk management as a result.

A recurring theme in the BLER literature is whether the employees are, in fact, able to influence board decision-making at all. Several authors have found that they are not de facto permitted to influence key strategic decisions (Gold and Waddington, 2019; Jäger et al., 2021a; Blandhol et al., 2021). This raises the question how BLER would practically influence risk, even if they wanted to. However, Lin et al. (2018) finds that employee representatives are, in fact, able to influence leverage. Similarly, Overland and Samani (2021) finds that they have an affect on R&D decisions. Given that several authors have established a clear link between R&D and firm risk (Coles et al., 2006; Low, 2009; Chen, 2015; Saeed et al., 2021), as well as between leverage and firm risk (Sila et al., 2016; Bernile et al., 2018; Bhat et al., 2020; Saeed et al., 2021), one plausible mechanism is thus that employee representatives can influence firm risk through these operational channels indirectly.

Another relatively new topic within the corporate governance literature that has received more attention recently is board diversity. Earlier scholars provide two arguments for why board diversity could increase board efficiency. The first is the concept of *perspective diversity*, suggesting that allowing individuals with different perspectives, experiences, and perspectives to enter the boardroom creates better conditions for enriching discussions and a better climate for communication, where individuals dare to question the current state (van Knippenberg et al., 2004). By broadening the narrative in which a problem is analysed, the resurrection of concepts such as group think can be prevented. Carter et al. (2003) similarly describe that heterogeneous directors tend to ask questions not asked in a homogeneous group and argue that this virtue of the perspective diversity brings increased independence to the board. The second argument, *better access to information and resources*, stems from the increased variation in the board members' previous experience and knowledge. Bringing together a more diverse group of individuals generates a broader set of information, new skills, and unique talent, improving the board's ability to carry out their tasks efficiently (Hillman and Dalziel, 2003; Bebchuk and Weisbach, 2010). According to Hillman and Dalziel (2003), the latter stems from the board members' combined human and relationship capital. The authors argue that the monitoring of the management should not only be understood by looking at the director's incentives and dependencies but also its ability to perform effective monitoring, in which the human and relationship capital plays a significant role.

The research on board diversity poses additional arguments for employee representatives contributing to increased board efficiency, particularly linked to the risk area. With its characteristics, employee representatives generally stand out from the shareholder elected directors, thus adding to the board diversity. By representing stakeholders who cannot diversify their risk exposure as opposed to shareholder elected directors, the employee representatives could increase the perspective diversity, thereby enriching discussions, improving communication (van Knippenberg et al., 2004), and capturing overseen questions (Carter et al., 2003). Moreover, with their different experience and knowledge, employee representatives add human and relationship capital to the board, improving the board's ability to carry out their tasks more efficiently (Hillman and Dalziel, 2003). Thus, in summary, employee representatives contribute to the board's functionality by bringing its characteristics and knowledge into the board room, providing functionality diversity to the board of directors. This, in turn, enhance for improved task conflict (Pelled et al., 1999; Overland and Samani, 2021), improving the communication and decision making and thus the board's ability to conduct their duties more efficiently. Although a more informed board does not per se lead to a lower risk preference, it should reduce the number of unnecessarily risky projects implemented influenced by poor decision-making and inadequate risk assessment.

Bringing employee representatives into the boardroom is interesting from several corporate governance aspects as their unique characteristics affect the board's ability to perform their duties more efficiently. First and foremost, the fact that they are employees and should, at least theoretically, represent their co-workers leads to increased democratisation in the company and, thereby, a better work environment. Gold and Waddington (2019) provide some empirical evidence to such a claim, arguing that employee representation enhances work experience and reduces alienation through the sensation of being heard. Similarly, Jäger et al. (2021a) show that employee representation increases job satisfaction. From an operational perspective, this could be a risk reduction per se, as a negative work environment and alienation correlates with weak work performance (Kartal, 2018).

In the Swedish context, and most other EEA countries (Gold and Waddington, 2019), the employees' are given a fixed number of seats as opposed to a fixed ratio. This structure of appointing employee representatives creates an opportunity for companies who are reluctant to give employees influence to dilute the number of seats on the board by increasing the number of shareholder elected members. However, it seems that such a dilution phenomenon has not yet been observed. The trade-off arising with an increased board size (DeAndres and Vallelado, 2008) and documented negative relationship between board size and board efficiency (Jensen, 1993; Yermack, 1996; Eisenberg et al., 1998), could pose an explanation for this as the dilution affects the functional abilities of the board. Moreover, Jäger et al. (2021a) find that managers generally favour codetermination. Among other things, their study investigated whether firms manipulate their number of employees to stay below the regulated threshold and found no evidence of such behaviour. This suggests that management at least does not perceive employee representatives as a significant detriment.

Finally, it is necessary to consider the power relations in the board composition. As discussed by Stevenson and Radin (2009), board decisions are typically preceded by interpersonal negotiations in which social capital plays a large part. This echoes the preceding argument that employee representatives, having an underdog status on the board, would have a harder time being heard and hence would have limited influence. This is further enhanced if the board consists of sub-groupings, for example, when large and powerful shareholders hold several board seats and typically vote unanimously. In this case, the employee would have to convince a large group of people. Finally, Stevenson and Radin (2009) discussed that particular members or sub-groups have a swing vote status giving them a disproportional ability to influence certain decisions through negotiations. In the context of employee representation, this enables two theoretical extremes: either they possess the swing-role, in which case they would be highly influential, or they part-take in a board where an incumbent sub-group already holds a majority, in which case their vote is effectively nulled. Realistically, an intermediate scenario is likely to happen, but this highlights the complexity of the issue and that the nominal number of votes is not necessarily the main determinant.

2.5 Hypothesis development

As seen from the preceding discussion, the financial risk perspective indicates that employee representatives should have a lower risk preference since they bear idiosyncratic risk. This suggests that BLER should lead to a lower total risk for the firm. The exact mechanisms for this are not unambiguous, but previous research indicates that total risk might be indirectly reduced primarily through operations, such as changes to leverage and R&D policies. Moreover, the findings that BLER might lead to an inverse agency problem, where employee representatives tend to vote in favour of decisions that benefit the labour force, further support arguments towards reduced total risk. In addition, evidence suggests that employee representation leads to improved board diversity, which in turn improves task conflict and board efficiency. This suggests that the risk evaluation might change, but it does not predict whether the change would be upward or downward. These two perspectives together thus lead to an inconclusive hypothesis. With that said, most findings indicate that the risk perspective prevails. To date, the most closely related study is the one by Lin et al. (2021), in which the authors find that employee representation leads to more conservative accounting. Based on these collective arguments, we conclude that a plausible first hypothesis for this study reads as follows:

H1: *Board level employee representation leads to a reduced total risk in a firm.*

Some further indications in the previous literature suggest that BLER may not only hold the potential to affect total risk but might integrate with various types of risk differently. Generally, previous research decomposes the total risk into an idiosyncratic and systematic risk component (Sharpe, 1964; Lintner, 1965). The employee representatives' exposure to firm-specific risk is not only hypothesised to result in lower risk preferences, affecting the total risk per se. In combination with its background, access to firm-specific information, and other characteristics, it may also affect what type of risk employee representatives have their primary ability and interest to influence.

Anchored in factors related to operational risk, several earlier papers provide empirical indications of that BLER may hold the potential to contribute in aspects of which some are directly linked to idiosyncratic risk, others indirectly. For example, derived from arguments that BLER improves the monitoring abilities of the board, BLER is found to significantly affect tax planning activities (Gleason et al., 2021), non-financial reporting quality (Overland et al., 2021), investment decisions (Fauver and Fuerst, 2006), accounting conservatism (Lin et al., 2018), earnings management and earnings quality (Overland and Samani, 2021), and effectiveness of performance-based compensation packages (Dyballa and Kraft, 2020), which indicates that employee representatives, at least in some areas linked to idiosyncratic risk, can make a difference through their participation on the board. Moreover, with their incentive to share the firm-specific knowledge with outside directors (Harris and Raviv, 2008), employee representatives increase the perspective diversity with their quite different backgrounds. These additional perspectives, at least in theory, should improve the board efficiency through an improved communication climate, task-conflict resolution, and improved ability to build relational capital (Carter et al., 2003; Hillman and Dalziel, 2003; van Knippenberg et al., 2004; Bebchuk and Weisbach, 2010). Thus, as a result of contributing to increased board knowledge and board functionality, the presence of BLER is theorised to e.g., improve the board's ability to avoid taking on harmful projects characterised by an unfavourable risk-return profile. This boils down to our second hypothesis, which reads as follows:

H2: *Employee representation leads to reduced idiosyncratic risk in a firm*

While BLER is hypothesised to reduce idiosyncratic risk by influencing factors linked to operations, which in turn thereby affects the total risk, we do not expect to find the same effect regarding the systematic risk. Systematic risk measures how sensitive a firm's stock returns are to movements in market factors, determined by broader macroeconomic-related factors. Thus, to significantly influence systematic risk, employee representatives must be able to influence matters concerning fundamental factors linked to the company's core business decisions. Some scholars argue that employee representatives have a limited influence on key firm decisions due to being in the minority at the board (Jäger et al., 2021a; Blandhol et al., 2021), thus pointing in the direction that they are unable to influence something so fundamental and at the core of the business. This is partly contrasted by the findings discussed in the preceding discussion, where BLER has been shown to influence important issues, at least linked to more operationally driven factors. However, there are some differences between the two contexts of being able to influence idiosyncratic and systematic risk. As the preceding theoretical section addresses, it may be questionable whether employees are educationally equipped to provide strategic advice linked to the advanced complex risk area. With its background in the company, holding firm-specific knowledge, together with the empirical evidence gained in previous studies, we see indications that it might be true regarding idiosyncratic risk areas as it lies within the employee representative's area of expertise. However, there are no direct indications in previous research that employee representatives are given the influence of impacting fundamental strategic decisions, nor that they hold the knowledge required to be able to make a significant contribution within these complex areas. Thus, due to lack of conclusive evidence, our third hypothesis reads:

H3: *Employee representation does not significantly affect systematic risk in a firm*

Our study design provides an opportunity to shed light on the relationship between employee representation and risk from different angles. While H1-H3 hypothesis answers whether the binary existence of employee representation affects various levels of risk, we can further expand our analysis and link our results to areas in which there are conflicting arguments. Although several papers argue the opposite, some studies claim that the employee representatives are not given any de facto influence on the board (Jäger et al., 2021a; Blandhol et al., 2021). This captures our interest in examining the marginal effect of employee representation at different concentration levels. We hypothesise that an increased concentration of employee representation in relation to the entire board is associated with lower risk. Situations where employee representatives collectively hold a larger share of the votes should thus lead to a greater influence of the employee representatives' individual preferences on the board's work. Moreover, again drawing on board diversity literature, adding on additional perspectives into the board room, should increase board diversity further, and thereby reduce firm risk. This is to say that if BLER is deterministic to any of our risk measures, either positively or negatively associated, the effect is expected to be more assertive with an increased concentration of employee representation. To put it plainly, we expect that any findings pertaining to the binary presence will be more pronounced when the concentration increases. Again, this due to an increased influence over the decision-making process. Thus, we complement H1-H3 with three analogous hypotheses but relating all types of risk to BLER concentration. Hypothesis H4-H6 reads as follows:

H4: *Increased employee representation concentration on the board of directors is associated with reduced total risk in a firm*

H5: *Increased employee representation concentration on the board of directors is associated with reduced idiosyncratic risk in a firm*

H6: *Increased employee representation concentration on the board of directors does not significantly affect systematic risk in a firm*

3

Method and Data

In this chapter the method, research design, model, and variable definitions are presented, discussed, and motivated. The chapter is concluded with descriptive statistics on the used data set and a discussion on the employed data management techniques. The study intends to answer the research question by conducting a quantitative panel data regression analysis on 3,541 firm-year samples of listed Swedish firms between 2005 and 2019. See Section 3.5 for a detailed description of the data set. The dependent variables measure different aspects of firm risk, and the main independent variables measure employee representation on the board. To correct for confounding factors and increase test robustness, we include a number of fundamental- and financial control variables.

The research design and model definition is analogue to the related study by Overland and Samani (2021), but naturally with different dependent variables and controls. We use the two-stage Heckman model to correct for endogeneity issues related to self-selection. A more detailed discussion and justification for this research design is provided in Section 3.1. More specifically, a first Probit regression provides insights on which firm characteristics lead to a higher chance of allowing employees in the boardroom. A detailed description of this stage is provided in Section 3.2. The second stage involves our main model, a multiple linear regression designed to explicitly identify the relationship between risk and employee representation. By including the inverse Mills Ratio as a control variable in the second stage, we also correct for potential non-random sampling. A more detailed discussion of the model definitions, together with a description of the operationalisation of our variables and controls, is provided in Section 3.3. Finally, we perform a number of robustness checks to validate our results, as discussed in Section 3.4.

3.1 Heckman's selection model - controlling for self-selection bias

The structural shape of the regulations concerning codetermination in Sweden may have statistical implications for the results of this study. Unions have the right to appoint 2-3 employee representatives on the board, but it is not compulsory, meaning that the employee's presence is voluntary and contains at least some element of self-selection. As a result, not all Swedish public companies have employee representatives on the board. Based on our data-set, approximately 41% of the observed firm years contained one or more employee representatives between 2005 to 2019. There are several motives why employee representatives may join the board. Potentially, underlying factors affect the probability of employee representation, varying with specific characteristics such as financial distress or high risk, thus creating self-selection of employee representatives into these types of organisations. As we are only able to observe the specific risk when there are employee representatives on the board or not, for each observation respectively, but the alternative remains unknown (e.g., observing the risk level without employee representation in a firm having employee representatives on the board), our regression estimates may be biased due to the truncated errors being correlated with our independent variables (Lennox et al., 2012). Using non-random variables and not treating them accordingly, the coefficients in our main model may become inconsistent. Hence, we address this issue by controlling for selection bias following the Heckman (1979) selection model.

Heckman's approach to correct for non-randomly selected sample bias consists of two steps. In the first step, we estimate the probability of having an employee representative on the board through a Probit model, controlling for well-known explanatory variables described in previous literature (Heckman, 1979). We also include two exogenous variables (instruments) in this regression, correlated with the probability of having employee representation on the board but uncorrelated with our main dependent risk variable in the second stage regression, in order to estimate the inverse mills ratio (Lennox et al., 2012). In the second stage, we extract the inverse Mills ratio from the first stage Probit model, reflecting the probability of an observation being included in the sample, using it as an explanatory variable in our main model in the second stage regression to control for the self-selection bias (Heckman, 1979). However, it is well noted in the accounting and finance literature that the so-called exclusion criteria should be satisfied to sufficiently implement the Heckman approach (Lennox et al., 2012). Thus, to avoid severe multicollinearity problems, we exclude both exogenous instrumental variables used in the first stage Probit model in our main equation in the second stage regression.

3.2 First stage Probit Model

In the first stage, we use a Probit regression to estimate the probability of having employee representation on the board. The dependent variable $ERBinary_{it}$ is a dummy taking the value one if employee representatives are present at the board and zero otherwise. We control for factors influencing the likelihood of finding employee representatives on the board, using several explanatory variables relating to board characteristics, firm characteristics, firm performance, and risk, together with two instrumental variables. The full Probit model is shown in Equation 3.1. Not shown for readability, but the model also controls for fixed year and fixed industry effects by including dummy variables for each categorical value.

$$Prob[ERBinary_{it} = 1] = \Phi[\alpha_0 + \sum_{n=1}^{N} \beta_n X_{it} + \sum_{m=1}^{2} \gamma_m Z_{it}] \tag{3.1}$$

X_{it} is a vector representing several variables considered to be explanatory to the occurrence of employee representatives on corporate boards. The first set of controls we include relates to risk, firm performance, and firm characteristics. Firms that are less risky and have bright prospects regarding their profitability and growth incorporate a reduced likelihood for employees to experience negative personal consequences due to their participation on the board, thereby increasing their willingness to participate (Berglund and Holmén, 2016). At the same time, risk factors such as e.g., financial distress may induce a need to protect the employees' interests in terms of existing terms and conditions (Jirjahn, 2009; Forth et al., 2017), which can create a need to have these perspectives represented on the board (Overland and Samani, 2021). Thus we follow Overland and Samani (2021) and control for risk- and performance-related variables to capture their relationship with the probability of having employee representation but do not, however, specify the direction in which we expect the variables to interact with our dependent variable. The variables included in the first-stage regression controlling for risk are based on four recurring themes in the previous literature: Investment and growth opportunities, maturity, firm performance, and stability. Variable definitions and a thorough discussion about each specific variable´s relationship with risk are provided in Section 3.3.2.

Moreover, we also include a proxy controlling for ownership concentration (*Ownership*), representing the accumulated holdings of large strategic investors and inside owners. More specifically, we define *Ownership* as the percentage of shares that are not publicly traded (i.e 100% minus the float). This as firms with controlling owners have been found to increase the organisational involvement of union's regarding appointing representatives in firms (Högfeldt, 2005), which quite similarly should also apply when it comes to appointing employee representatives at the board as suggested by (Overland and Samani, 2021). Lastly, we control for a set of variables relating to board characteristics which we define and discuss more in detail in Section 3.3.3.

Z_{it} refers to our exogenous instrumental variables, included in the first stage Probit model but excluded in the second stage main model. The instrumental variables used in our Probit model are first identified by Overland and Samani (2021), considered to have an explanatory value regarding the likelihood of employees being present on the board. First, industry characteristics may affect the probability of whether employee representatives sit on the board or not. Overland and Samani (2021) propose that it is more likely to find employee representation in a specific firm in cases where their industry peers have appointed representatives, which is motivated by Fauver and Fuerst (2006) arguing that, in industries influenced by a great need for coordination and information sharing, firms are more likely to benefit from incorporating employee representation on the board. Thus, we include an instrumental variable (*ERindustry*), measuring the industrial average in terms of voting ratio of employee representation within each industry classification for each observable firm-year, respectively, to capture the effect stemming from industry-specific characteristics.

Beside industrial characteristics, Overland and Samani (2021) argues that factors linked to job security may affect the degree of involvement of trade unions. In areas where job supply is less profound, e.g., the capital region, employees' costs of losing their jobs are expected to be larger due to the lower opportunity of alternative employment. As a result, unions tend to be more active in appointing employee representatives in such areas (Gregorič and Rapp, 2019; Overland and Samani, 2021). While previous studies have controlled for whether the company's headquarters are located in specifically the capital region (Gregorič and Rapp, 2019; Overland and Samani, 2021), we define our second instrument as a dummy variable (*Top4HQ*) equal to one if the firm headquarters is located in an area holding more than 200 000 inhabitants corresponding to the four largest cities in Sweden. We argue that in these urban areas, the job supply is sufficiently large to reduce the effect on the likelihood of participating stemming from non-existent alternative job opportunities, reducing the personal cost for the employees significantly. Importantly, we also argue that neither *Top4HQ* nor *ERindustry* should be correlated to firm risk, thus making them valid instruments. Indicative support in favour of this statement is provided by the univariate correlation analysis in Section 4.1, where Figure 4.2 illustrates that both variables have less than 20% correlation to the study's risk measure.

In addition to these variables that are expected to be directly correlated to the probability of appointing employee representatives, we will also include all independent variables used in the second stage model since this is a requirement of the Heckman two-stage approach (Heckman, 1979; Wooldridge, 2010). These variables are discussed and defined in-depth in Section 3.3 below.

3.3 Measuring the relationship between employee representation and firm risk

The following sections will define the dependent variables, main independent variables as well as define a set of control variables used in our main regression model investigating the relationship between BLER and firm risk.

3.3.1 Dependent variable: Measuring firm risk

Previous studies related to board characteristics and risk have suggested various ways to operationalise risk[1]. The most commonly used technique in previous litera-

[1]Some scholars have used accounting-based measures to examine the relationship between board diversity and risk, focusing on proxies relating to operational risk, financial risk, or capital risk measures. For example, Saeed et al. (2021) suggest using the Altman-Z score, leverage, and R&D expenditures. Another possibility, promoted by Wang (2012), is to use stock returns and asset

ture is to use market-based approaches. Examining the relationship between board gender diversity and firm risk-taking, the standard deviation of daily returns is a commonly used proxy for firm risk (Perryman et al., 2016; Sila et al., 2016; Bernile et al., 2018; Yang et al., 2019; Bhat et al., 2020). Low (2009) quite similarly uses the variance of annualised daily returns studying the relationship between managerial compensation and firm risk. Furthermore, and in an employee representation context linked to incentive orientation of managerial compensation, Dyballa and Kraft (2020) use the standard deviation of stock returns as a proxy for firm risk.

Using market-based measures is advocated for several reasons. First, alternative accounting-based ways of estimating risk is uncertain and contain several obstacles (Low, 2009). Second, according to the efficient market hypothesis, all public information should be reflected in equity prices, in which risk is a significant determinant (Fama, 1970). The employee representatives' impact on firm risk through its performance as a strategic advisory and monitoring function should, therefore, be efficiently reflected in prices when investors adjust their estimates. Hence, being a strategic advisor to management employee representatives can affect both the total risk level and the risk composition (Low, 2009). It should be noted that also market-based measures have their shortcomings [2]. However, in light of an efficient market and having the entire Swedish stock exchange represented over a considerable time period, we argue that a market-based approach, on average, should reflect the risk level efficiently and is therefore considered to be the most accurate risk measure.

Based on the preceding discussion, the standard deviation of annualised stock returns ($Sd1Y$) constitutes our first dependent variable aimed to capture total firm risk and thus reflect the employee representatives' impact across the whole spectrum of their tasks. However, as discussed in the theoretical sections, we hypothesise that the employee representatives' most significant potential to make a difference may lie within the operational risk area. Thus, we follow (Sila et al., 2016; Bernile et al., 2018) and utilise the capital asset pricing market model to decompose the total risk measure into two components, idiosyncratic risk and systematic risk. This allows for an extension of the analysis, gaining additional insights into how BLER relates to different types of firm risk.

Thus, our second dependent variable, systematic risk, is defined as the firm beta ($Beta$), corresponding to the coefficient on the stock market portfolio using the market model, where the MSCI world index constitutes the market portfolio. Since a Swedish data set is used, the OMX all share index is an alternative proxy for the market portfolio. However, when choosing what index to use as a proxy for the market portfolio, it is of importance to use an index that is diversified enough

turnover. de Cabo and Nieto (2012) use the standard deviation of ROA as a proxy for operational risk, while others use the standard deviation of return on equity (Mínguez-Vera and Martin, 2011), or R&D expenditures together with cost of capital measures (Chen, 2015).

[2]Being largely influenced by external events, market-based risk measures might become noisy, e.g., when the institutional environment reaches non-normal conditions such as during a financial crisis. This might, in extreme cases, skew the volatility, creating inaccurate or misleading estimates during certain periods in time.

to reflect the whole economy (Damodaran, 2012). Thus, due to being significantly more diversified, capturing the underlying fundamental macroeconomic conditions, the MSCI world index is preferred over the OMX all share index in this matter. Moreover, Damodaran (2012) describe the phenomenon of index domination, in which the estimated Beta could be biased due to the fact that some firms market capitalisation constitute a significant share of the index. This further speaks in favour of using a well-diversified index such as the MSCI world index, as it eliminates the risk of certain companies returns being correlated with the index returns, which is problematic when the aim is to isolate the systematic risk exposure. As a proxy for the risk-free rate of return, the historical yield of a ten-year US treasury bond is used.

Our third dependent variable, idiosyncratic risk, is defined as the standard deviation of the predicted residuals gained from the market model regression (*IdiocyncraticRisk*), following (Sila et al., 2016; Bernile et al., 2018). To avoid survivor bias, the panel data is allowed to be unbalanced. The total risk and idiosyncratic risk variables are annualised by multiplying the estimate with the square root of 250. To avoid noisy measures, we require each firm-year sample to have at least 150 trading days; otherwise, we regard it as a missing value.

While most previous studies have used risk measures reflecting the present state of total firm-risk (Perryman et al., 2016; Sila et al., 2016; Bernile et al., 2018; Yang et al., 2019; Bhat et al., 2020), we argue that a one-year lagged standard deviation of stock returns, in a better way, reflects the relationship between the board's work and risk. This is because activities and decisions undertaken by the board of directors related to risk are influenced by having a long-term time horizon, of which the effects are expected to be realised with a time lag. For example, implementing changes in strategic directions or making adjustments to processes, activities, and routines discovered when monitoring and guiding management are complex and need to be processed before taking action, and the effects are not visualised immediately. Using a one-year lag, we expect these effects to start becoming realised and reflected in the volatility of stock return, constituting a better proxy in displaying the relationship between board employee representation and risk. However, as discussed in Section 3.4.4 below, as a robustness check, we will repeat all regressions using the same-year risk to verify that our results are not a consequence of this decision to lag the dependent variable.

To summarise, we use three dependent variables: total risk($Sd1Y$), idiosyncratic risk (*IdiosyncraticRisk*), and systematic risk(*Beta*). For improved readability, these are jointly referred to as as ($Risk_{it+1}$) in our second stage equations 3.2 and 3.3 below. Each dependent variable is regressed separately, together with our main independent test variables (*ERBinary*) and (*ERRatio*), respectively. A total of six models are thus used. We also control for fixed year and industry effects as in the Probit model, but this is not shown in Equation 3.2 and 3.3 for improved readability.

$$Risk_{it+1} = \beta_0 + \beta_1 ERBinary_{it} + \sum_{n=1}^{N} \beta_n Control_{it} + \Upsilon \hat{\lambda_{it}} + \epsilon_{it} \qquad (3.2)$$

$$Risk_{it+1} = \beta_0 + \beta_1 ERRatio_{it} + \sum_{n=1}^{N} \beta_n Control_{it} + \Upsilon \hat{\lambda_{it}} + \epsilon_{it} \qquad (3.3)$$

where $Risk_{it+1}$ is either of our three dependent risk variables total risk (*Sd1Y*), Idiosyncratic risk (*IdiosyncraticRisk*), and Systematic risk (*Beta*). $ERBinary_{it}$ [3] and $ERRatio_{it}$ [4] represents our main independent test variables, $\hat{\lambda_{it}}$ corresponds to the inverse mills extracted from the first stage Probit model representing the predicted probability of employee representation, and $Control_{it}$ are the explanatory variables controlling for firm characteristics, performance, and board characteristics. These control variables are described in depth in the following sections.

3.3.2 Controlling for firm characteristics and performance

Following earlier studies on firm risk-taking, we control for firm characteristics attributed to being determinants of risk. First, Guay (1999) argues that companies having more significant investment and growth opportunities tend to positively correlate with increased risk-taking. Thus, we follow previous literature and include Market-to-book (*MtB*) (Sila et al., 2016; Bernile et al., 2018), as well as R&D expenses to total assets (*R&D*) and Capital expenditures to total assets (*CAPEX*) used in (Coles et al., 2006; Low, 2009), as proxy variables controlling for future growth and investment opportunities, where *MtB* and *R&D* are expected to be positively correlated to risk, and *CAPEX* negative correlated with risk.

Secondly, firm maturity has been described to affect firm risk. Previous studies have controlled for this by including some measure indicating the firm age. One option used by, for example, Sila et al. (2016), is to operationalise this measure by the time since the firm was founded. Another analogous alternative proposed by Bernile et al. (2018) is to instead define firm maturity in terms of years since the IPO. Since our sample only contains publicly listed firms, we argue that the latter is more appropriate for our case. Hence, we include *IPOage* defined as the natural logarithm of one plus years since the IPO. It is worth noting that these two options

[3] To isolate the effect of employee presence on the board of directors we created a dummy variable (*ERBinary*) indicating if the firm has BLER. We argue that statistically significant results for this variable indicates that the mere presence of employees in the board room forces the board to adopt a wider stakeholder perspective. This would indicate that a severe information asymmetry exists between employees and the board, and that employee representatives on the board alleviate this.

[4] To further analyse whether the effect of BLER is correlated to the voting strength, we created a second continuous variable (*ERRatio*) indicating how many percent of the total board seats is occupied by employee representatives. Intuitively, more votes should indicate that employee representatives are able to more strongly influence the total firm risk. However, some previous studies argue that employee representatives have no de facto influence(Jäger et al., 2021a; Blandhol et al., 2021). Thus we include a second main test variable expressing the marginal effect of employee representation concentration on total risk.

were found to be highly correlated, as expected. In conclusion, we argue that firms that have been listed for a longer time should be in a more stable phase in their business life cycle. Thus we expect to find a negative correlation between *IPOage* and risk.

Besides firm age, previous studies have included other variables to capture how firm maturity impacts risk. For example, Boone et al. (2010) show that companies being audited by one of the Big 4 agencies are associated with lower risk, stemming from a perceived improved audit quality. We argue that as firms mature, they are more likely to seek Big 4 auditing. Therefore, we also include a dummy variable controlling for whether one of the big 4 agencies audits, equal one if audited by a Big 4 firm otherwise zero (*Big4*), expected to be negatively correlated with risk. We also include a size variable (*Size*), defined as the natural logarithm of total assets. As firms mature, their balance sheet grows creating a certain inertia towards oscillations relative to small firms. Empirical evidence confirms this direction of the integration effect, finding a negative relationship between firm size and risk (Low, 2009; Sila et al., 2016; Bernile et al., 2018). Thus, we expect the coefficient to indicate a negative relationship between firm size and risk. Finally, as firms mature and enter a more stable business phase, they are more likely to start paying dividends to its owners. Hence, as a third maturity control, we include a dummy variable equal to one if dividends are paid in the current year and zero otherwise (*Dividend*). In line with previous findings (Low, 2009; Bernile et al., 2018), we expected this variable to be negatively correlated with firm risk.

Third, as discussed in Section 2.1 it is well established that risk and performance are strongly related. Hence, in line with Low (2009); Bernile et al. (2018) we control for firm performance by including return on assets (*ROA*), which has been found to be negatively correlated with firm risk. This yields a good measure of the same-year performance, but it fails to capture historical results that could also have an impact on volatility. Hence, to complement *ROA* we include a dummy variable equal one if the firm has shown a loss in any of the preceding four years (*Loss4Y*), as suggested by Overland and Samani (2021). We expect to find a positive correlation between this dummy and risk since poor historical performance should yield more uncertainty about the future. These two variables help to capture information on past and present performance. Finally, we thus need to also include a variable to capture future prospects. We argue that the sales growth (*SalesG*), defined as the average sales growth in the preceding three years, adequately gives an indication regarding future performance. And expect that high a *SalesG* should have similar impact on risk as *ROA*, since they both signal on positive performance. Hence, we expect to find a negative correlation.

Lastly, and most intuitively, we need to control for firm stability. We argue that arguably the best predictor of future volatility should be to look at past volatility. Hence, we include the standard deviation of stock returns over the last five years (*Sd5Y*). Due to inertia, we expect to find a strong and positive correlation. Another important characteristic of stock price dynamics that previous studies have found to be correlated with firm risk is the trading frequency (Sun and Liu, 2014). Thus, we include a control variable ($FREQ$) measuring the percentage of shares being traded, controlling for factors stemming from market reactions. Large trading volumes often occur as a consequence of news being released to the market, e.g., earnings announcements. As investors in the presence of uncertainty tend to place more weight on bad news than positive news (Williams, 2015), we expect the coefficient to be negatively correlated with risk. *Ownership*, as already defined in Section 3.2, is another variable that is related to the trading dynamics. We expect large strategic owners to have a longer investment horizon and thus be less prone to react to short-term effects, which would lead to a more stable share price. Hence, we expect a higher ownership concentration to be negatively correlated with volatility. All in all, we thus include three market-based stability measures. To further complement this with an accounting-based measure, we also include leverage (LEV) defined as interest-bearing debt to total assets, which is a proxy for financial stability expected to be positively correlated with risk (Coles et al., 2006; Sila et al., 2016; Bernile et al., 2018; Bhat et al., 2020).

3.3.3 Controlling for board characteristics

Considering that previous studies have found board characteristics to impact firm risk, we need to control for this. First, some studies have found that the size of the board influences board efficiency (Jensen, 1993; Yermack, 1996; Eisenberg et al., 1998; DeAndres and Vallelado, 2008), which in turn impact risk through it´s role in monitoring and advise management. Hence, we include a variable that equals the number of shareholder elected directors (*BoardSize*). We also include two dummies, (*CEOBoard*) and (*AuditC*), to indicate whether the CEO is part of the board and if an independent audit committee has been established. An important methodology note concerning the latter is that we consider an audit committee to be independent if a dedicated subset of the directors has been assigned the audit role and that this committee has independent audit meetings without the other directors present. Importantly, this excludes the rather common case where the annual report states that the board as a whole act as an audit committee.

We argue that given the CEO's exceptional firm-specific insight, she or he will most likely influence all decisions on the board, including those related to risk management. We further argue that if a separate audit organ has been established, this indicates that another line of defence against rash decisions exists, which intuitively should have an impact on risk exposure. The audit committee has an essential task in the corporate governance mechanism monitoring the financial report, internal control, and scrutinising the audit process. Empirical evidence suggests that the existence of an audit committee is associated with reduced risk-taking (Jermias and Gani, 2014), indicating that these activities may impact the risk-level of the firm. Thus, we expect the presence of an independent audit committee to be negatively correlated with risk.

Previous studies on board characteristics have described that the director's knowledge and incentives to perform specific tasks vary with its characteristics, creating a trade-off between the effectiveness of the monitoring and advisory function of the board (Kim et al., 2014). Inside directors typically have their strength in advising management due to its access to firm-specific knowledge, on the other hand, the outside directors primarily contribute to the monitoring function due to its independence of management (Fama and Jensen, 1983; Adams et al., 2010; Faleye et al., 2011; Kim et al., 2014). This indicates that the board dependencies will impact the board efficiency, which in turn is theorised to be a determinant of firm risk-taking. To this end, we include *IndepDir* defined as the percentage of shareholder elected board members that are neither the CEO nor dependent with respect to major shareholders. Since the Swedish code of corporate governance stipulates that only one executive can be part of the board, we argue that this definition of independent board members is justified. With that said, we acknowledge that a limitation with this definition is that it does not adequately capture cases where non-employed family members, previous CEO's or founders are part of the board. Due to the mixed previous evidence, we do not specify the direction in which we expect *IndepDir* to interact with risk.

Finally, although mixed evidence is provided on the topic, board diversity, and more specifically gender diversity, is argued to be determinants of firm risk-taking. Bernile et al. (2018) shows that board diversity is associated with reduced volatility and improved performance, in which gender diversity constitutes a key component in the definition of diversity. At the same time, while some other studies find a negative relationship between female directors and risk measured in stock volatility (Lenard et al., 2014; Jizi and Nehme, 2017), others find no significant relationship on the matter (Sila et al., 2016), and contradictory evidence showing that female directors are more risk-loving compared to male directors in a Swedish context (Adams and Funk, 2012). As previous research indicate that gender diversity may be a determinant of risk, we control for potential gender effects by including (*FemDir*), defined as the ratio of shareholder elected board members that are females, but do not specify any direction on the expectations of the coefficient.

It is important to note that we exclude employee representatives from the *BoardSize*, *IndepDir* and *FemDir* measures to avoid multicollinearity issues with our main independent variables. This also ensures that the control variables only capture risk responses that are related to the shareholder board characteristics, and thus we isolate the BLER effects to the main dependent variables.

3.3.4 Summary of used variables

To summarise, we use three dependent variables (*Sd1Y*, *IdiosyncraticRisk* and *Beta*), two main independents (*ERBinary* and *ERRatio*), two instruments (*Top4HQ* and *ERIndustry*) and 19 control variables. A summary of all variables is shown in Table 3.1.

Table 3.1: A summary of all variables, including the definitions.

Variables	Definition
Dependents	
Sd1Y	Annualized volatility of stock returns, year t+1
IdiosyncraticRisk	Residual return, not explained by market fluctuations and beta
Beta	Correlation with excess market returns, measured against MSCI world index and US treasury bond 10-year historical yield
Main independents	
ERRatio	Number of BLER divided by total number of board members
ERBinary	Dummy variable, equal 1 if the firm has BLER
Controls	
MtB	Total market value of the firm, divided by total book value
R&D	Annual R&D expenses divided by total assets
CAPEX	Annual capital expenses divided by total assets
IPOage	Natural logarithm of 1 + number of years since IPO
Size	Natural logarithm of total assets
Big4	Dummy variable, equal 1 if the firm has a Big-4 auditor
Dividend	Dummy variable, equal 1 if the firm paid a dividend this year
ROA	Return divided by total assets
Loss4Y	Dummy variable, equal 1 if the firm has incurred a loss in any of the preceeding 4 years
SalesG	Average growth in revenue the past 3 years
Sd5Y	Volatility of stock returns during the past 5 years
LEV	Book leverage, measured as total interest bearing debt divided by total assets
FREQ	Trading volume divided by total number of outstanding shares
Ownership	Percentage of shares that are not publicly traded (i.e 100% minus the float)
IndepDir	Percentage of shareholder elected board members that are neither the CEO nor dependent with respect to major shareholder
AuditC	Dummy variable, equal 1 if the firm has an independent audit committee
FemDir	Percentage of shareholder elected board members that are females
BoardSize	Number of shareholder elected board members
CEOBoard	Dummy variable, equal 1 if the CEO is part of the board
Instruments	
Top4HQ	Dummy variable, equal 1 if the firm's headquarter is in Stockholm, Gothenburg, Malmö or Uppsala
ERIndustry	Industrial average in terms of BLER voting ratio

3.4 Complementary robustness analysis

3.4.1 Validating the research design

The Heckman model is intended to control for endogeneity concerns related to self-selection. However, it might be the case that self-selection proves not to be a major concern. If that holds true, similar results should be retained if a simple OLS regression is used instead. Hence, we repeat all regressions using OLS as well.

3.4.2 Controlling for multicollinearity

All in all, we have collected 19 control variables and two instruments. Unless adequately managed, this large selection of controls might lead to model overfitting and multicollinearity issues. When using regression analysis as a statistical technique, the relationship of interest between the dependent and independent variables is examined under the assumption of having a relationship of dependency. However, if one or more explanatory variable is correlated to another, the issue of multicollinearity may emerge. In such a situation, the estimated coefficients will instead be based on relationships characterised by inter-dependency, which complicates the analysis and affects the ability to make statistical inferences. This is because the standard errors of the estimated coefficients increase significantly, which makes the model sensitive to small changes in the model specification (Farrar and Glauber, 1967). It is not uncommon to experience that e.g. the sign and size of the coefficients becomes inconsistent and shifts drastically depending on what variables are included in the model. Moreover, as a result of the inflated variance, it also becomes more demanding for the model to produce significant coefficients, meaning that significant relationships between variables might be overlooked and remained hidden by the noise in the model. Hence, when conducting quantitative empirical research, it is essential to address multicollinearity issues and attempt to remedy the problem if the context allows for it.

One way to handle this is to analyse the VIF scores, and another is to analyse the pairwise correlations (Alin, 2010). For completeness, both tests were carried out. More specifically, we analysed the correlation between all independent variables to ensure that they are all below the suggested accepted limit (80%) (Farrar and Glauber, 1967). Moreover, we analyse the VIF scores for both the *ERBinary* and the *ERRatio* regressions. In line with previous research, we decided to use a VIF value of ten as a threshold for indicating the occurrence of severe multicollinearity issues (Alin, 2010; Salmerón et al., 2018). To control for the effect of potentially high correlations or VIF-values, we repeated all regressions but without the problematic covariates to see if they had an impact on the result.

3.4.3 Controlling for the choice of control variables

Given that the choice of control variables is highly subjective, it is paramount that the results do not change significantly if the set of controls is slightly changed. If this is not the case, this leads to a risk of ex-post selection of controls in order to get the preferred results. This is especially true when a large number of possible controls exist, such as in this case, since it would be relatively easy to omit one covariate without raising any suspicions. To control for this, we decided to repeat all regressions 19 times: successively dropping one of the control variables at a time and recording the respective results. Concerning the Probit, the most critical results are whether the instruments remain significant, since otherwise this undermines the validity of the research design. Concerning the second stage regressions, the most critical result relates to the main independent variables *ERBinary* and *ERRatio*. More specifically, it is important that the coefficient sign and p-value are constant for all regressions.

As the reader will see in the result chapter, the results of this study are found to depend significantly on the chosen set of control variables. Hence, this raises the question: what is the "correct" set of controls? Without this answer, it is difficult to draw conclusions regarding the results of this study. Unfortunately, this question is rather challenging to answer conclusively and will always allow for subjectivity. However, one way to approach the situation is to employ dimensionality reduction techniques. Therefore, we decided to utilise a method called Least absolute shrinkage and selection operator regression (*LASSO*) (Chong and Jun, 2005). The LASSO model encourages small coefficients to be set to zero instead, thus effectively removing them from the model. This process ensures that only the strongest predictors are kept.

An alternative approach to identify the best set of control variables is to use the Stepwise regression model (Chong and Jun, 2005). This model iteratively removes the controls with the lowest statistical power until a stopping condition is reached. More specifically, the full model is run first. Then, the control variable with the highest p-value is removed, and the regression is repeated using the reduced set of controls. The entire process is repeated until no weak control variables are left. The threshold for the selection criteria utilised in previous research to decide which variable to exclude or include varies, however Chong and Jun (2005) consider a value between the range of 5% and 20% significance as a plausible cutoff value. Thus, we argue that a satisfactory condition for a control to be considered useful is if it has a p-value of at most 10%. It should be noted that the Stepwise regression model is debated and slightly controversial, with opponents arguing that it is not stringent. Although we agree with this critique, we argue that it still serves its purpose as a robustness check since dropping all insignificant control variables seems intuitively valid. Hence, to complement the LASSO we also performed a Stepwise regression.

3.4.4 Checking for causality and a delayed risk response

As discussed in Section 3.3, we argue that the BLER should have a delayed effect on firm risk since board decisions naturally take time before they materialise and effectively change the daily operations. Hence, contrary to most previous studies, we use a 1-year lagged risk measure in all regressions. An additional upside of using a lagged dependent variable is that it explicitly imposes a causality constraint between BLER decision making and firm risk, which means that any results from this study are by default also causal. With that said, given that most previous studies have used the same-year risk response, we decided to repeat all regressions using the same-year risk as well. This additional robustness check strengthens our findings by streamlining the analysis relative to established research, thus improving comparability. Moreover, it ensures that methodological discrepancies do not drive our results. We further acknowledge that some board decisions might, in fact, have a more timely response than one year, not least since we have opted for a market-based measure of risk and according to the efficient market hypothesis, the effect of employee representation should thus be immediate. Although we argue that some form of delay has to occur, it is arbitrary at best to definitively say that it would be one year. Hence, by conducting these repeated regressions, we also allow for faster risk responses to be captured.

3.5 Collection, cleaning and description of data

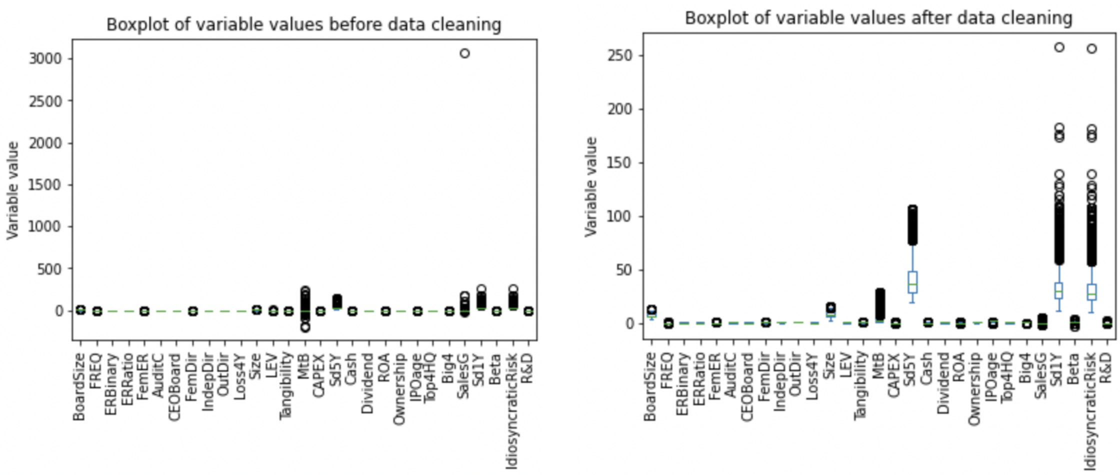
The regression was carried out on a large sample of all Swedish listed firms from 2005 to 2019. Each firm-year sample was represented using the above defined 19 control variables, the two instruments, the two main independents, and the three risk measures. All financial variables - such as firm characteristics used as control variables, and the risk measures used as our dependent variables - were extracted from CapitalIQ using an Excel Plug-In. However, the board characteristics and information on board-level employee representation had to be hand-collected from annual reports. The bulk of this data was provided from previous research. The samples from 2006 to 2014 were used by Overland and Samani (2021), and the samples between 2015 and 2018 were used by Overland et al. (2021). The same research group also provided us with samples from 2005. To complement and extend this data set, we manually collected 244 observations from 2019 and filled in approximately 50 missing samples between 2005 and 2018.

Manual collection of samples might lead to subjective or low quality data, if the collection process is inadequate. Hence, the authors took great care when planning and carrying out the data gathering phase. Before collecting the data, the authors and representatives from the research group had a meeting to create a uniform view of the procedure and working method to ensure that the manual data collection was conducted accurately. The large majority of the data collected is found in a standardised box in the corporate governance chapter of the annual report, making it rather straightforward to retrieve. In the few cases where this box was not provided, the information was retrieved from the text in the same chapter. Throughout the process, great care was taken to avoid any mistakes. Moreover, at an initial stage, a security check was conducted by a third party to ensure that the information was collected in accordance with the agreed-upon procedure. Thus, we argue that the reliability of the data collection process is high. In total, this yielded 3,541 firm-year samples between 2005 and 2019. A discussion on employed data cleaning techniques is provided in Section 3.5.1, followed by descriptive statistics on board characteristics in Section 3.5.2 and firm characteristics in Section 3.5.3.

It is worth mentioning that since the data covers a large time span (14 years) it is inevitable that exogenous shocks such as the financial crisis 2008, or the Euro crisis in 2012, dramatically changes the institutional setting. These shocks, for example, would likely lead to significantly higher volatility during those years. Such a change in characteristics makes comparability across years more difficult. In this study this is partially remedied by including fixed year effects. An alternative approach could have been to exclude certain years, such as 2008, to mitigate this impact. For brevity, this additional robustness check was not carried out in this study but the authors recommend that this is done as a future work.

3.5.1 Data management and cleaning

It was observed that the data contained missing values and severe outliers. To deal with this, we used Python to clean the data set prior to the statistical inference in STATA. Firstly, we had to deal with the observed outliers. More specifically, we identified that *SalesG*, *LEV*, *MtB*, *Sd1Y*, *Beta*, *IdiosyncraticRisk*, *R&D*, *Sd5Y* and *ROA* all had unacceptable outliers that most likely represented noise since they were illogical (e.g negative market value, and 307186% sales growth). We decided to winsorize these variables at 1% and 99%, in line with how previous literature in the field has treated outliers (Coles et al., 2006; Low, 2009; Sila et al., 2016). Although winsoring can lead to distorted and biased results, the effect is limited if only a small trim as in our case is imposed (Lien and Balakrishnan, 2005). This minor clipping indeed removed all obvious outliers, as seen when comparing Figure 3.1a to Figure 3.1b.



(a) The data before cleaning

(b) The data after cleaning

Figure 3.1: Boxplots to illustrate the effectiveness of the data cleaning process. The winsorizing effectively removed the observed severe outliers.

As the last step before starting the statistical inference we dropped all observations with one missing value or more. This is not ideal since it reduces the sample size. However, since the remaining sample contains around 2,000 firm-years, the sub-sample is assessed to be sufficiently large to be able to make statistical inferences about the population. We argued that arbitrary replacement of missing values with, for example, the mean would have introduced more noise to the model and hence reduced the robustness of our results. Thus, as a result of this, displayed in the subsequent sections 4.3.1 & 4.3.2 presenting our results, the sample size deviates when running our Probit and main regressions. When running the Probit regression N=2,120, while the comparative sample size used when running the main regressions is N=1,824. The reason is that the dependent variable contains missing values, included when estimating the probability of having employee representatives on the board but excluded in our main regressions. The data points constituting the difference between the two samples could have been excluded, forming a uniform final dataset. However, due to the minor difference between the two, we opted to include as many data points as possible since the effects stemming from the discrepancy between the data sets were considered small, albeit nearly negligible.

3.5.2 Descriptive statistics - Board characteristics

The board characteristics of our sample is illustrated in Table 3.2. Note that we include an additional variable (*FemER*), defined as the percentage of employee representatives for a given firm-year that are female. This variable is not used in the subsequent regressions, but we still include it here since it provides additional interesting nuances to how the BLER concept materialises in our sample.

Table 3.2: Descriptive statistics of the used data set, after winsorising and dropping missing values.

Variables	Count	Mean	Std	Min	Max
Dependents					
Sd1Y	2777	32.92	14.40	14.32	94.08
Beta	2777	0.71	0.43	-2,61	2.89
IdiosyncraticRisk	2777	31.28	14.36	13.01	92.86
Main independents					
ERBinary	3541	0.41	0.49	0	1
ERRatio	3541	0.09	0.12	0	0.44
FemER	3541	0.11	0.26	0	1
Controls					
AuditC	3425	0.65	0.48	0	1
CEOBoard	3541	0.43	0.49	0	1
FemDir	3538	0.25	0.14	0	0.8
IndepDir	3283	0.61	0.22	0	1
Loss4Y	3541	0.42	0.49	0	1
Size	3478	7.94	2.12	2.09	14.85
LEV	3427	0.22	0.18	0	0.69
MtB	3270	3.35	4.25	0.25	28.39
CAPEX	3541	0.03	0.04	0	0.55
Sd5Y	2626	40.66	17.18	18.96	105.8
R&D	3541	0.04	0.08	0	0.52
Dividend	3541	0.66	0.47	0	1
ROA	3437	0.03	0.09	-0,38	0.25
Ownership	3228	0.35	0.21	0	0.96
IPOage	3299	2.37	0.75	0	3.69
Big4	3382	0.96	0.21	0	1
SalesG	3485	0.19	0.70	-1,35	5.29
BoardSize	3541	6.62	1.52	3	13
FREQ	3184	0.003	0.008	0	0.30
Instruments					
ERIndustry	3541	0.09	0.05	0	0.29
Top4HQ	3541	0.74	0.44	0	1

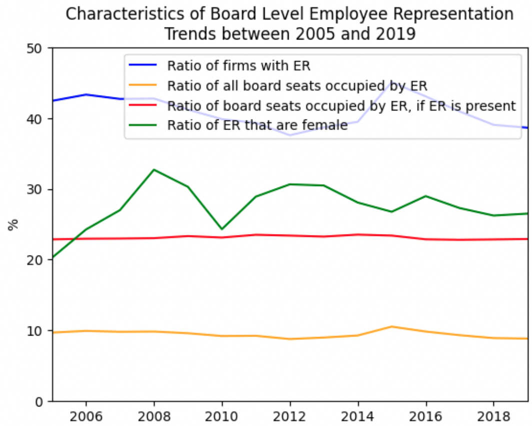
Table 3.2 shows that all boards have between 3 and 13 directors, of which between 0-44% are employee representatives. More specifically, it shows that 41% of our sample has employee representation on the board of directors and that the employees hold on average 9% of the voting rights across the full sample. When only considering firms that do have employee representation, an average of 23% of seats are allocated to employee representatives. Furthermore, it shows that only 25% of shareholder elected directors are female on average. The situation is only slightly more balanced for employee representatives, where 27% are found to be female. Several cases exist where no directors at all are females, both for firms with and without employee representation. Concerning independence, the sample shows that more than half of the directors are independent (61%). For the most extreme samples, the board is composed of only independent outsiders. We note that at least one firm defies the Swedish code of corporate governance by having a fully dependent board. Finally,

the Table shows that 43% of boards include the CEO and that 65% have established an independent audit committee.

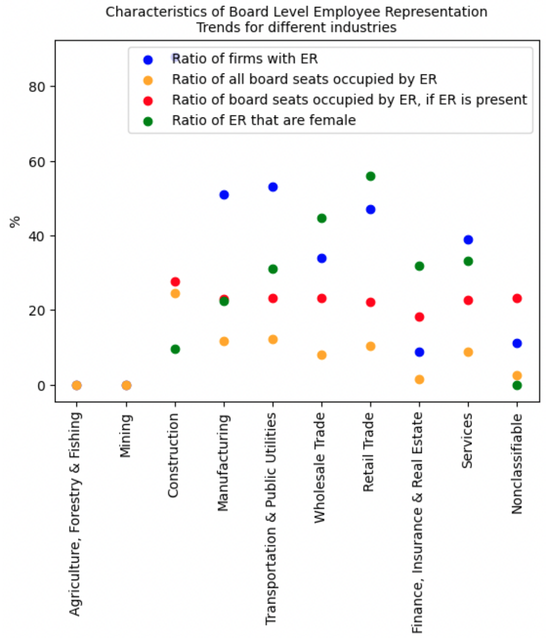
The table further highlights that the prevalence of BLER differs significantly across industries. The latter further supports the choice of *ERIndustry* as an instrument in the first regression, defined in Equation 3.1. Similarly, preliminary support for the choice of the second instrument (*Top4HQ*) is found (not shown in the Table). The data reveals that 37% of firms that are headquartered in the major cities have BLER, compared to 52% of firms based in smaller cities. When only considering firms that do have employee representation, it shows that they are given on average 23% of seats regardless of where the headquarter is. However, it seems that firms in the major cities allocate more seats to female employees. In the major cities, 30% of employee representatives are female compared to 22% in smaller cities.

Figure 3.2a further shows that the characteristics of BLER has barely changed over time. The graph shows that between 38% and 45% of firms have had employee representation each year, that between 20% and 33% of these have been female, that employees are allocated on average 23% of seats when they are allowed in the board room, and that a total of between 9% and 11% of the board seats have been occupied by employees during the last two decades. This suggests that the concept is mature and stationary in Sweden. This is further supported by the fact that of the 3541 samples, a mere 50 occurrences exist where a company changes from having BLER to not having BLER, or the other way around. More specifically, there are 24 occurrences where a company starts to have BLER and then keeps it, there are 14 cases where a firm used to have BLER but suddenly stopped, and there are 12 cases where the firm has changed the BLER status back and forth at least twice. Notable is that this limited subset, unfortunately, prohibits research designs based on discontinuity regressions, which otherwise might have yielded insights regarding whether the introduction of BLER has an immediate and timely impact. However, the upside is that the stationary characteristics might yield more robust inferences across years.

To gain further insight into what influences employee representation, we investigate what impact the industry type has. We partition our sample into eleven industry categories by each firm's two-digit SIC code. Our data contains firms from all categories except from *Public Administration*, albeit only one *Agriculture, Forestry & Fishing* sample. All other industries have between 40 and 1564 samples, with *Manufacturing* being the most common. As seen in Figure 3.2b, it turns out that BLER looks very different for different industries. Whereas 88% of firms in *Construction* has employee representation, none of the *Mining* firms do. As a consequence, the ratio of all board seats that are occupied by employees ranges between 0% to 24% across industries. When only considering the cases where employees are present in the board room, they are allocated between 18 and 27% of the votes depending on the industry. Concerning gender inequality, it turns out that men are in the majority among the employee representatives in all industries except for *Retail Trade*. The worst case is *Nonclassifiable* where none of the employee representatives are female.



(a) Neither the occurrence of BLER, the number of employee votes nor the gender composition has changed markedly over time.



(b) The characteristics and prevalence of BLER is dependent on the industry.

Figure 3.2: Illustration of how the traits and prevalence of board level employee representation has changed over the study's time frame, and how it differs across industries.

3.5.3 Descriptive statistics - Firm characteristics

Descriptive statistics of firm characteristics is shown in Table 3.2. We see that the coverage remains relatively good, and all variables except the five year stock volatility measures have less than 15% missing values. It is worth commenting that by including a five-year historical variable, we are implicitly dropping all firms that are younger than five years. This could in principle lead to a minor sample bias towards larger, more established firms. However, we do not expect that this will have an effect on our results.

Table 3.2 shows that the vast majority of firms (96%) has a Big 4 auditor, and that 74% of firms are headquartered in one of the four largest Swedish cities. We can see that the average firm listed its shares 10 years ago (relative to the sample year). The most recent IPO happened in 2019, and the earliest listing occurred 39 years prior to the sample year. The table further reveals that a dividend was paid out in more than half (66%) of the firm-year observations. We can see that some shares have not been traded at all during the year, whereas others were traded extensively, peaking at 30% turnover. In addition, we can see that the ownership structure differs significantly across our sample. In one case 96% of shares were held by insiders or strategic owners, but in another, all stocks were publicly traded, signifying a low concentration. On average, 35% of shares are kept from the float.

The Table further shows that the average firm-year has a market value that exceeds the book value by a factor of three, with an extreme case being valued at 28 times the book value. Related to the market value, we see that the 5 year stock price annual volatility averages at 41%, but that there is a large spread between the most and least volatile instrument. Related to this notion of risk, we see that 42% of our sample has incurred a loss in the last four years. The average firm-year has a modest 3% return on assets, with some performing a lot better (25%) and others suffering a loss (-38%). The capital and R&D expenditures exhibit similar traits. Some firms spend nothing in either category, whereas the most extreme cases spend more than half of their total assets on CAPEX or R&D. On average, firms spend a handful percent of their total assets in these categories. Furthermore, the capital structure is found to differ across the sample. Although the average leverage is 22%, we see that some firms are fully equity financed.

Lastly, Table 3.2 reveals that sales growth is a rather noisy measure with a high variance and significant outliers. On average, however, our sample grows their revenue by 19% on an annual basis. It further illustrates that the total stock volatility and the volatility of residuals relative to the market model exhibit similar traits in our sample. Both volatility measures average around 31-33%, and range from 13% to above 94%. Concerning systematic risk, we note that the average firm has a beta of 0.71, meaning that their stock price moves less than the market index. The most exposed firms experience almost 3 times higher fluctuations than the index, with some firms being procyclic and others countercyclic. In addition, since our sample includes both small, medium, and large cap companies, the difference in total assets is significant. The largest firm has close to three billion SEK in assets compared to the smallest which has a mere 8 million SEK on the balance sheet.

4

Results

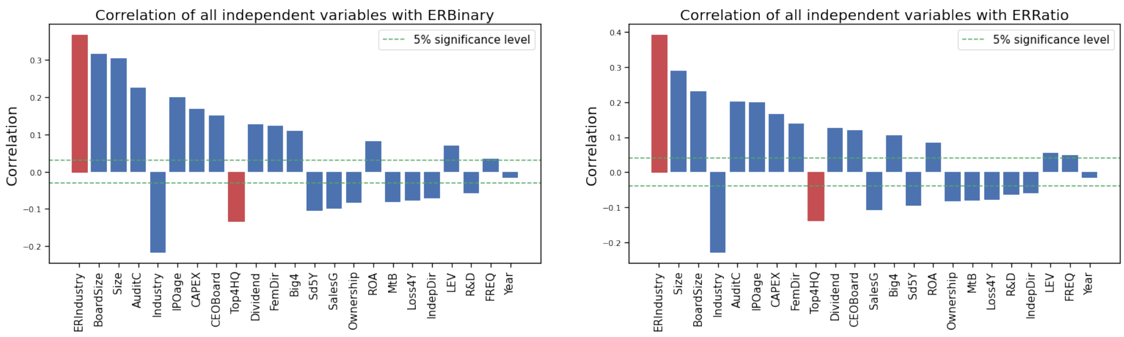
In this chapter, the results of the study is presented. In the leading section, a univariate analysis is presented to provide initial insights. This is followed by more stringent multiple linear regression models to correct for confounding factors and control variables. Firstly, the first-stage Heckman Probit results are shown to illustrate which factors influence the choice of electing employee representatives on the board of directors. Subsequently, the results from the six main regressions are presented. These aim to display what effect on different types of firm risk the binary presence of employee representatives has and if their relative voting strength has an impact, respectively.

4.1 Univariate analysis

4.1.1 Firm characteristics influencing employee representation

Figure 4.1 illustrates which firm characteristics are most strongly correlated with employee representation. More specifically, Figure 4.1a shows which variables lead to the election of BLER and Figure 4.1b shows which variables influence the ratio of votes the employees are allocated. Notable is the close resemblance between the two figures, which indicates that similar predictors exist for *ERRatio* and *ERBinary*. In fact, the two different BLER measures are found to be 95% correlated, which explains this similarity. This result is intuitive since firms with BLER will, by definition, also have a higher ratio of employee board seats than firms without representation.

From Figure 4.1, it is important to note that both instruments are found to be strongly correlated to BLER. This provides indicative support in favour of this choice of instruments. Besides that industry and location of the headquarter is a key predictor, the graphs indicate that larger and more mature firms are more likely to appoint employee representatives. Lastly, the univariate analysis reveals that several of the classical risk measures such as leverage, historical volatility, and past performance seems to have limited correlation with BLER. This suggests that the decision to join the board or not does not seem to be overly related to the firm's risk exposure in recent years.



(a) Correlation between *ERBinary* and all independent variables.

(b) Correlation between *ERRatio* and all independent variables.

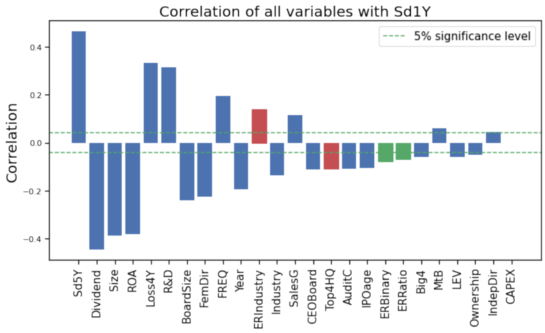
Figure 4.1: Bar plots illustrating how the main independent variables, quantifying BLER, are related to firm characteristics. These results are the univariate analogue of the first stage Probit regression.

4.1.2 Firm characteristics influencing firm risk

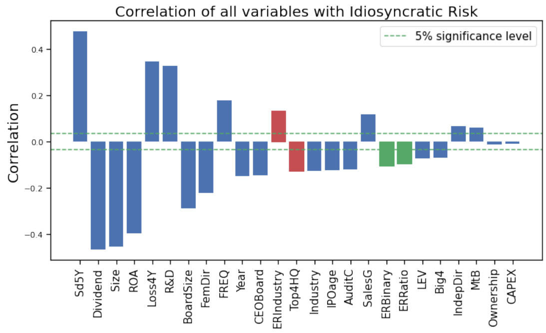
Figure 4.2 illustrates which firm characteristics are most strongly correlated with different types of firm risk. More specifically, Figure 4.2a shows which variables impact the total volatility, Figure 4.2b shows which variables impact the idiosyncratic risk and Figure 4.2c shows which variables impact the firm's systematic risk.

Figure 4.2 shows that the same predictors are valid for both the total and idiosyncratic risk. Again, this is intuitive since if a firm has a high specific risk, they will also by definition have a high total risk. As expected, the results shows that high historical volatility and poor performance tend to lead to elevated levels of future total and idiosyncratic risk. Similarly, mature firms are seen to have lower total and idiosyncratic risk. What is more surprising, however, is that the results for systematic risk seem to be almost reversed. For example, mature firms seems to have higher betas but lower volatility. Moreover, both leverage and stock volatility are found to be virtually unrelated to the systematic risk.

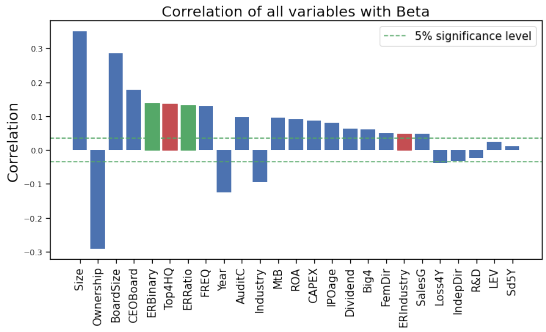
An important assurance to the research design is that neither of the instruments are found to be strongly correlated with any of the risk measures, which is a required condition for the Probit regression to be valid. In line with the results in Figure 4.1, these graphs further suggests that neither of the BLER measures are strongly correlated with risk. This speaks in favour of hypotheses H3 and H6, but provides an initial indication that insufficient evidence exist to support hypotheses H1, H2, H4 and H5. However, it is important to remember that these results only provide indications and are not robust since they do not control for alternative effects through control variables.



(a) Correlation between the 1-year lagged *Sd1Y* and all independent variables.



(b) Correlation between the 1-year lagged *IdiosyncraticRisk* and all independent variables.



(c) Correlation between the 1-year lagged *Beta* and all independent variables.

Figure 4.2: Bar plots illustrating how the dependent variables quantifying total, idiosyncratic and systematic firm risk, are related to firm characteristics. These results are the univariate analogue of the second stage regressions.

4.2 First stage regression

The results from the Probit regression in the first Heckman stage are illustrated in Table 4.1. More specifically, the results show which firm characteristics are the determinants for whether employee representatives have been elected. Notable is the high Wald-Chi2 score and the relatively high pseudo-R-squared, which indicates a good model fit.

As already eluded to in Figure 4.1, both instruments are found to be related to the decision to appoint employee representatives (albeit *ERIndustry* at a mere 6% confidence level). The Probit further indicates that large firms with audit committees, strong strategical owners, high capital expenditures, who have suffered a recent loss, are more likely to have BLER. On the contrary, highly leveraged firms with high ROA and market-to-book valuation, are less likely to have employees on the board. Of special interest to this study is that the decision to appoint employee representatives seems to be unrelated to historical stock volatility (*Sd5Y*).

Table 4.1: Results from the first stage Probit regression in the Heckman model.

Heckman First Stage: Probit on ERBinary			
	Coefficient	z-score	p-value
MtB	-0.036***	-3.73	0.000
IPOage	0.184*	1.71	0.087
Size	0.444***	13.60	0.000
ROA	-1.126**	-2.44	0.015
Sd5Y	-0.002	-0.85	0.395
LEV	-0.658***	-2.76	0.006
IndepDir	-0.445**	-2.09	0.036
AuditC	0.258***	3.27	0.001
R_D	-0.408	-0.83	0.404
Big4	0.426**	2.34	0.019
Loss4Y	0.580***	5.94	0.000
FREQ	1.997	0.62	0.534
FemDir	0.627**	2.28	0.023
BoardSize	0.074**	2.29	0.022
CAPEX	9.989***	7.44	0.000
Dividend	-0.049	-0.47	0.637
SalesG	-0.020	-0.32	0.747
Ownership	0.844***	4.10	0.000
CEOBoard	-0.050	-0.54	0.586
Top4HQ	-0.646***	-7.67	0.000
ERIndustry	6.739*	1.88	0.060
Intercept	-7.378***	-11.99	0.000
Year effects	Yes		
Industry effect	Yes		
Wald-Chi2-score	728.33		
Prob > chi2	0.0000		
Pseduo R-squared	0.366		
N	2120.000		

4.3 Main regressions

4.3.1 Firm risk in relation to employee presence in the board room

Table 4.2 shows the result when running the first of our main models, which examines whether the binary presence of BLER affects total risk, idiosyncratic risk, and systematic risk, respectively. Using a research design controlling for potential issues of selection bias and commonly accepted determinants of risk, we find no significant relationship between employee representation and the various types of firm risk, contradicting our H1 and H2 but supporting our H3. Notable is the high F-score and adjusted R-squared for all three regressions, which indicates a good model fit. The model fit for *SystematicRisk* is slightly lower but still deemed sufficient.

Table 4.2: Results from the first multiple linear regression model used in the second Heckman stage. The main independent variable *ERBinary* is regressed against the three different risk measures.

Heckman Second Stage: Risk in relation to ERBinary									
Dependent		*Sd1Y*			*Idiosyncratic Risk*			*Beta*	
	Coefficient	***t-score***	***p-value***	***Coefficient***	***t-score***	***p-value***	***Coefficient***	***t-score***	***p-value***
ERBinary	-1.099*	-1.67	0.094	-0.973	-1.50	0.133	-0.021	-1.04	0.299
MtB	-0.115	-1.37	0.170	-0.156*	-1.93	0.054	0.011***	3.71	0.000
IPOage	0.387	0.47	0.639	0.443	0.55	0.581	-0.023	-0.79	0.432
Size	-0.903***	-2.62	0.009	-1.571***	-4.63	0.000	0.126***	11.31	0.000
ROA	-23.672***	-5.03	0.000	-23.615***	-5.09	0.000	0.299*	1.88	0.060
Sd5Y	0.209***	6.12	0.000	0.199***	5.86	0.000	0.003***	3.77	0.000
LEV	9.070***	4.51	0.000	10.030***	5.10	0.000	-0.178***	-3.06	0.002
IndepDir	-4.066**	-2.51	0.012	-3.910**	-2.46	0.014	-0.044	-0.82	0.414
AuditC	0.949	1.29	0.199	0.671	0.92	0.357	0.023	1.01	0.312
R_D	10.686*	1.67	0.095	11.307*	1.79	0.074	-0.050	-0.29	0.768
Big4	-0.985	-0.60	0.547	-0.987	-0.61	0.544	0.047	0.69	0.492
Loss4Y	1.238*	1.76	0.078	0.988	1.43	0.153	0.070***	2.96	0.003
FREQ	131.108	1.31	0.190	125.970	1.34	0.180	2.420*	1.65	0.099
FemDir	-0.823	-0.32	0.749	-0.913	-0.36	0.717	0.191**	2.20	0.028
BoardSize	-0.034	-0.14	0.887	-0.041	-0.17	0.861	0.016**	1.96	0.050
CAPEX	-1.019	-0.10	0.922	-2.312	-0.23	0.818	0.598*	1.68	0.093
Dividend	-5.248***	-5.72	0.000	-5.168***	-5.66	0.000	-0.049*	-1.84	0.066
SalesG	-0.272	-0.53	0.598	-0.329	-0.66	0.510	0.030	1.44	0.151
Ownership	-1.526	-0.78	0.434	-0.686	-0.36	0.722	-0.203***	-3.41	0.001
CEOBoard	-1.969***	-2.94	0.003	-2.257***	-3.41	0.001	0.028	1.24	0.216
invmills	0.802	0.67	0.504	0.398	0.34	0.734	0.104***	2.74	0.006
Intercept	35.218***	6.34	0.000	38.964***	7.12	0.000	-0.444**	-2.36	0.018
Year effects	Yes			Yes			Yes		
Industry effect	Yes			Yes			Yes		
R-Squared	0.481			0.500			0.343		
Adj. R-Squared	0.470			0.489			0.328		
Prob > F	0.000			0.000			0.000		
F-score	29.869			32.077			27.943		
N	1824.000			1824.000			1824.000		

Examining the results when using total risk as a dependent variable answering our *H1: Board-level employee representation leads to a reduced total risk in a firm*, Table 4.2 show that the estimated coefficient *ERBinary* (coeff.= -1.099, p>.05) is rejected as being a significant determinant of total risk at a 5% confidence level. With a p-value of 0.094, the coefficient is statistically significant at a 10% level, which albeit weakly, might indicate that an interaction effect between the two variables may exist. However, we cannot support such a claim with certainty as our regression reject any statically relationship between *ERBinary* and total risk at the 5% significance level. Moreover, Table 4.2 shows that the variables *Size*, *ROA*, *IndepDir*, *Dividend*, and *CEOBoard* are significantly (p<.05) associated with reduced total risk. While past volatility *Sd5Y* and leverage *LEV* opposite are significantly (p<.05) associated with increased total risk. An interesting aspect is that none of the control variables (*MtB, R&D, and CAPEX*) gained significant coefficients at a 5% confidence level, which suggests that growth potential is not a significant predictor of risk. However, the *R&D* shows a positive relationship with total risk (significant at a 10% level), which may serve as an indication that growth opportunities can pose at least some predictive value to total risk after all.

Looking at the results gained using Idiosyncratic risk as the dependent variable, answering our *H2: Employee representation leads to reduced idiosyncratic risk in a firm*, Table 4.2 the estimated coefficient for *ERBinary* (coeff.= -0.973, p>.05) are insignificant, meaning that we cannot find any statistically significant relationship between the binary existence of BLER and idiosyncratic risk. Moreover, when examining the control variables in the second regression using idiosyncratic risk as the dependent variable, the sign and statistical strength is almost identical to the ones gained in the first regression using total risk. However, we see that the results when regressing idiosyncratic risk deviate from the ones gained using total risk regarding two of the variables. First, the coefficient for *MtB* shows a significant negative relationship at the 10% level when using idiosyncratic risk as dependent variable, providing additional indications for a deterministic relationship between growth potential and risk. Second, we see that the coefficient of *Loss4Y* is significant at the 10% level when using total risk while insignificant when using idiosyncratic risk as the dependent variable. Overall the result suggests that similar traits are determinants for both idiosyncratic and total risk. And hence, one interpretation might be that the results gained when using total risk are largely driven by idiosyncratic risk.

The last regression presented in Table 4.2 examines the relationship between BLER and systematic risk answering our *H3: Employee representation does not significantly affect systematic risk in a firm.* Also in this case the estimated coefficient of *ERBinary* (coeff.=-0.021, p>.05) returns insignificant. Noteworthy is that different control variables loads as significant determinants when using systematic risk as dependent variable compared to the results gained when using total- and idiosyncratic risk. The results reveal that although the variables *Sd5Y*, *Loss4Y* and *Dividend* seem to interact with risk in the same direction for all three risk measures, the impact of *Size*, *ROA*, *LEV*, *MtB* remains significant but with a reversed sign when using systematic risk compared to the first two regressions using total risk and idiosyncratic risk. Moreover, *FemDir* and *BoardSize* are found to be positively, and *Ownership* negatively, correlated with beta but unrelated to the other risk measures. Lastly, compared to the two previous regressions, the estimated coefficients for *IndepDir* and *CEOBoard* are both insignificant. This discrepancy suggests that different variables seem to be determinants for the various risk measures. Moreover, the mechanisms for how the variables interact with each type of risk seem to work differently depending on the risk category.

Lastly, Table 4.2 shows that the coefficient for the inverse mills ratio is insignificant in the first two regressions examining total risk and idiosyncratic risk but significant (p<.01) when regressing systematic risk. This might indicate that selection bias is not a severe problem in our setting. However, a more thorough discussion on the matter is left for Chapter 5, together with an in-depth analysis of the relationship between our test variable and dependent variables, aimed to discuss how the results relate to our purpose and research question.

4.3.2 Firm risk in relation to BLER voting strength

Table 4.3 shows the results from the second main regression examining the relationship between employee representatives' relative voting strength and the three risk measures total risk, idiosyncratic risk, and systematic risk. The results display that the relationship between the relative voting strength and all three risk measures is insignificant, contradicting our *H4: Increased employee representation concentration on the board of directors is associated with reduced total risk in a firm* and *H5: Increased employee representation concentration on the board of directors is associated with reduced idiosyncratic risk in a firm*, but supporting *H6: Increased employee representation concentration on the board of directors does not significantly affect systematic risk in a firm.* Notable is the high F-score and adjusted R-squared for all three regressions, which indicates a good model fit. The model fit for *SystematicRisk* is slightly lower but still deemed sufficient.

Table 4.3: Results from the second multiple linear regression model used in the second Heckman stage. The main independent variable *ERRatio* is regressed against the three different risk measures.

Heckman Second Stage: Risk in relation to ERRatio

Dependent		*Sd1Y*			*Idiosyncratic Risk*			*Beta*	
	Coefficient	***t-score***	***p-value***	***Coefficient***	***t-score***	***p-value***	***Coefficient***	***t-score***	***p-value***
ERRatio	-4.348	-1.56	0.120	-3.621	-1.31	0.190	-0.137	-1.58	0.113
MtB	-0.115	-1.38	0.169	-0.156*	-1.92	0.054	0.011***	3.69	0.000
IPOage	0.397	0.48	0.632	0.449	0.56	0.576	-0.022	-0.77	0.444
Size	-0.876**	-2.53	0.012	-1.553***	-4.55	0.000	0.127***	11.40	0.000
ROA	-23.735***	-5.03	0.000	-23.661***	-5.09	0.000	0.295*	1.86	0.064
Sd5Y	0.210***	6.12	0.000	0.199***	5.86	0.000	0.003***	3.78	0.000
LEV	8.994***	4.44	0.000	9.973***	5.04	0.000	-0.181***	-3.13	0.002
IndepDir	-4.097**	-2.52	0.012	-3.934**	-2.47	0.014	-0.046	-0.85	0.397
AuditC	0.933	1.27	0.204	0.653	0.90	0.367	0.023	1.04	0.299
R_D	10.665*	1.67	0.096	11.296*	1.79	0.074	-0.052	-0.31	0.758
Big4	-0.992	-0.61	0.544	-0.992	-0.61	0.542	0.047	0.68	0.494
Loss4Y	1.229*	1.76	0.079	0.976	1.41	0.157	0.071***	3.00	0.003
FREQ	132.360	1.32	0.185	126.981	1.35	0.177	2.467*	1.69	0.092
FemDir	-0.718	-0.28	0.781	-0.833	-0.33	0.742	0.196**	2.26	0.024
BoardSize	-0.086	-0.36	0.721	-0.085	-0.36	0.720	0.014*	1.78	0.075
CAPEX	-0.613	-0.06	0.953	-2.093	-0.21	0.836	0.638*	1.78	0.075
Dividend	-5.244***	-5.71	0.000	-5.163***	-5.65	0.000	-0.049*	-1.84	0.065
SalesG	-0.277	-0.54	0.590	-0.333	-0.67	0.505	0.030	1.41	0.157
Ownership	-1.542	-0.79	0.428	-0.714	-0.37	0.711	-0.201***	-3.36	0.001
CEOBoard	-1.981***	-2.95	0.003	-2.268***	-3.42	0.001	0.028	1.22	0.221
invmills	0.839	0.70	0.487	0.438	0.37	0.710	0.102***	2.71	0.007
Intercept	35.268***	6.34	0.000	39.006***	7.12	0.000	-0.442**	-2.35	0.019
Year effects	Yes			Yes			Yes		
Industry effect	Yes			Yes			Yes		
R-Squared	0.481			0.500			0.343		
Adj. R-Squared	0.470			0.489			0.329		
Prob > F	0.000			0.000			0.000		
F-score	29.906			32.110			28.224		
N	1824.000			1824.000			1824.000		

Starting with the first regression in Table 4.3 examining the relationship between voting strength and total risk, the estimated coefficient *ERRatio* (coeff.=-4.348, p>.05) shows a negative but insignificant relationship with total risk. According to our results, firms that have experienced high historical volatility *Sd5Y* and largely indebted firms *LEV* are associated with higher total risk. The variables *Size*, *ROA*, *IndepDir*, and *Dividend*, on the other hand, show on a negative relationship with total risk, suggesting that preceding good performance, maturity, and independence on the board of directors all lead to lower total risk.

The second regression examining the relationship between voting strength and idiosyncratic risk similar to the first regression examining total risk, and also returns an insignificant coefficient (coeff.= -3.621, p>.05) for our test variable *ERRatio* at a 5% significance level. As with our results using *ERBinary* as dependent variable in the preceding section 4.3.1 the sign and level of significance when using *ERRatio* as a test variable remain robust and do not shift when moving from examining total risk to idiosyncratic risk. Again, this indicates that the same predictors are valid for both risk measures.

Lastly, as previously indicated, the estimated coefficient of *ERRatio* examining the relationship between voting strength and systematic risk is insignificant in the third regression as well (coeff.= -0.137., p>.05). Moreover, as in the preceding section 4.3.1 examining the binary effect of BLER, the determinants of systematic risk differ from the ones gained when regressing total risk and idiosyncratic risk. Table 4.3 shows that the variables *MtB*, *Size*, *Sd5Y*, *Loss4Y*, and *FemDir* are positively correlated with systematic risk. Whereas the variables *LEV*, and *Ownership* gained negative coefficients and are, thus, associated with lower systematic risk. The coefficient of the inverse mills ratio turned out insignificant when using total risk and idiosyncratic risk as dependent variable, but significant (p<.01) using systematic risk, similar to the results gained in the preceding section using *ERBinary* as test variable.

5

Analysis and discussion

In this chapter, the results are analysed and discussed in relation to the study's purpose, research question, and hypotheses. The first section investigates which firm characteristics are the strongest predictors to foresee whether employees are permitted in the board room. Although this is not explicitly linked to the research question, it provides important qualitative evidence that can guide policymakers when defining relevant codetermination laws. The following sections, in turn, directly tie back to the hypotheses. First, the statistical inference in relation to *ERBinary* is presented, followed by the results concerning *ERRatio*. Finally, the chapter is concluded with an extensive complementary robustness analysis to validate and nuance the study's results.

5.1 Firms with BLER share several common traits

The univariate analysis indicates that several firm characteristics are significantly correlated with whether employees are admitted to the board room or not, and how many votes they are allocated. Figure 4.1 shows that firms exhibit a herding behaviour, in which they largely follow the industrial average. Similarly, the Figure shows that firms in smaller cities tend to have BLER to a larger extent. These two findings are supported by the Probit regression, see Table 4.1, which supports the use of these variables as instruments. The findings are also consistent with the ones presented in the analogue study by (Overland and Samani, 2021), which provide some further indications that our instruments are accurate and valid. Finally, Figure 4.1 show that BLER is not correlated with the year variable, which provides additional support in favour of the argument that the concept is stationary and mature.

The two graphs in Figure 4.1 further show that the traits' correlation coefficients have the same sign and approximate magnitude for both *ERBinary* and *ERRatio*. A plausible interpretation of this is that the shareholders and the union both always settle for allocating the 2 (3) seats that are legally mandated and never push for fewer or more seats. For clarity of argument, the alternative finding could have been that, for example, firms who have suffered a loss tend to always over-allocate seats to protect the employees. However, according to our results, this is not the case.

Several intuitive results are found from the Probit results in Table 4.1. Firstly, BLER is more common in mature firms with strong owners, as predicted (Högfeldt, 2005). Here, maturity is defined as older firms with a Big-4 auditor and a larger board, where the latter can be seen as a proxy for firm maturity since young firms with few stakeholders are unlikely to appoint a large board. Another finding related to the board structure is that firms with more female directors and an independent audit committee are more likely to have BLER, despite that these are both indicators that are predicted to lead to a lower inherent board risk appetite. We postulate that this might be related to corporate culture. We argue that an audit committee would likely favour a broader stakeholder presence in the board room to facilitate the monitoring task and that boards with more diversity (measured by gender) are more open to new colleagues with different backgrounds. This implies that employees might see the board as less hostile, and thus are more likely to seek a board seat. Finally, the Table indicates that employee representatives might be seen as a substitute for increasing the independence of the ordinary board but that the decision to appoint them is unrelated to whether the CEO is a part of the board.

Before turning to the main regressions in the second Heckman stage, it is insightful to analyse what role historical risk and past performance play concerning the appointment of BLER. This is directly related to the research question, since it is the temporally reversed relationship. Hence, it can shed some light on the causality of the relationship between risk and BLER. Firstly, the analysis shows that firms that have previously suffered a loss are more likely to appoint BLER. This is in line with the argument that the union appoints employees to the board if they feel that they are needed to protect the labour force during bad times, as indicated by (Jirjahn, 2009; Forth et al., 2017). However, and in stark contrast to the study's hypotheses, the results do not indicate that high historical risk itself is reason enough for employee representatives to be appointed. This is in line with the findings by Overland and Samani (2021). This suggests that the union's decision might be reactive rather than proactive. Another interpretation, offered by Berglund and Holmén (2016), is that the personal cost for the employee is seen as higher than the potential upside of protecting the labour force if, e.g., the risk of default or litigation is present, which would thus deter entry to the board room.

The preceding discussion is inconclusive, but some indications exist to support the conclusion that the strongest drivers regarding the BLER decision might, in fact, not be financial, but rather based on structural factors such as industry, geography, and organisational variables. Fauver and Fuerst (2006) provides some support for this, arguing that the benefits of introducing BLER vary with, e.g., the need for coordination and information sharing. This would suggest that the union's decision is a consequence of procedure and industrial isomorphism rather than a strategy to protect labour interests.

Lastly, a comment on research design. It is instructive to note that although the univariate analysis in Figure 4.1 largely coincides with the findings in Table 4.1, there are some important discrepancies. For example, the Probit shows that higher leverage leads to a lower chance of BLER at a 1% significance level. This should be compared to the pairwise correlation, suggesting that higher leverage is just weakly, but in fact, positively correlated to BLER. This further highlights the importance of controlling for confounding factors, and the dangers of relying too much on simplified modelling.

5.2 Employee presence in the board room does not seem to impact firm risk

Drawing on previous literature, our main conjuncture is that BLER improves information availability, increases board diversity, which positively affects board efficiency. Thus, BLER can constitute an asset for the board of directors, improving its decision-making process, monitoring abilities, and ability to provide strategic guidance to management, which in turn affects the risk-taking behaviour, especially in matters that are connected to operational risk. Decomposing total firm risk into two components, idiosyncratic and systematic risk, we hypothesise that the occurrence of BLER reduces idiosyncratic risk, through which the total risk is affected, while systematic risk remain unchanged with the presence of BLER. However, as shown in the preceding results sections, no significant effects of these traits are found. In the theoretical section, we discuss that our hypotheses might be inconclusive because arguments found in previous literature on the topic are ambiguous. The cause-effect relationships between BLER and risk are dynamic due to the many mechanisms in play, making the building of hypothesises complex. The theoretical arguments of these mechanisms are, in some respect, contradictory. Thus, we will revisit some of these theoretical arguments to explain and contrast why our result did not turn out as expected according to our hypothesis development.

First, we draw upon classical financial theory where employee representatives should be incentivized to push for risk-reducing policies due to their personal stake and exposure to idiosyncratic risk in the firm. However, based on our findings in Table 4.2, it might be the case that employee representatives, in contrast to utility-maximising theories, act sub-optimal. Previous literature provides evidence of several behavioural biases in which bounded rationality guides behaviour (Johnson and Tversky, 1983; Shefrin and Statman, 1985; Lakonishok et al., 1992; Weber and Camerer, 1998; Wermers, 1999; Subrahmanyam, 2008). Hence, employee representatives might wish to reduce risk but lack the knowledge and tools to effectively propose policies that have the desired outcome, or they simply act irrationally with opposite results as an outcome.

Another explanation for our results could be that the risk preferences among employee representatives hypothesised to be homogeneous are instead heterogeneous. The individuals that become employee representatives may share certain characteristics making their risk preferences diverge from their peer employees not participating on the board. Aggarwal and Samwick (2003) provide some support for that this could be the case, describing that preferences for eliminating idiosyncratic risk may differ between individuals. For example, the fact that the employee representatives are prepared to expose themselves to a situation where they share the obligations it entails to join the board with the other directors might indicate that they are not as risk-averse as their employee peers. Thus, employee representatives may share some common characteristics, which makes them less inclined to reduce risk than what first expected. This logic implies that our result can potentially be explained by the fact that even if the employee representatives are able to influence firm risk, their risk preferences are not as risk-averse compared to employees in general. Thus their presence does not lead to a significant difference between companies having BLER or not.

Furthermore, although mixed evidence exists from studies conducted on, among other things, payroll maximisation see e.g. (Jäger et al., 2021b; Gleason et al., 2021), we argued that an inverse agency relationship might arise. According to this view, employee representatives might push for risk reductions further than a pure financial risk perspective would suggest, to a level where reasonable risk-reward investments for which shareholders are compensated for are simply put aside, reducing the risk level opportunistically at any cost (Jensen and Meckling, 1976). However, our results in Table 4.2 indicate that such a scenario does not appear to have occurred, and hence they coincide with the ones obtained in Jäger et al. (2021b). Instead, other agency-related arguments provided in the theoretical section may serve as an alternative explanation to why BLER does not seem to affect firm risk. Potentially, it could be that the employee representatives themselves are the object of acting opportunistically, creating an agency conflict, not in the form of an inverted one, but rather according to the classic theorem as suggested in Jensen and Meckling (1976). For example, future career concerns, where employee representatives intend to nurture their new contacts on the board for future gain, can constitute a motive to be accommodating and agree with share-elected board members, and thus make the employee representative's participation fruitless in terms of representing employees. Such opportunistic influenced behaviour is well documented in a management context (Baker et al., 1994); hence, it is not unimaginable that the same would also apply in an BLER context.

Another interesting aspect when scrutinising Table 4.2 is the interaction effect between having the CEO on the board and the risk measures total risk and idiosyncratic risk. *CEOBoard* shows coefficients of -1.969 $p<.01$ and -2.257 $p<.01$ when using total risk and idiosyncratic risk, respectively. This suggests that the CEO presence on the board is significantly associated with reduced total and idiosyncratic risk. What is interesting with these findings in the context of analysing BLER is that some of the mechanisms through which employee representatives affect risk also applies the CEO. The results, however, suggest that the estimated coefficient for having the CEO on the board seems to be significantly stronger. One potential reason for this is that the CEO might have access to even more firm-specific knowledge than the employee representatives, and hence she or he can thereby improve the board's functionality further by bringing these virtues into the boardroom. One interpretation of our results is thus that having a CEO on the board can constitute a more potent substitute for BLER. Both the CEO and the employee representatives have the potential to reduce risk through their firm-specific knowledge. Hence, if this turns out to be a main driver of reduced company risk, the effect stemming from BLER might not be visible if the CEO is present on the board. If this hypothesis holds true, one could further argue that the CEO would in fact as a stronger risk reduction tool due to her/his stronger influence, since previous studies have suggested the employees are in fact not allowed a strong voice in the board room (Jäger et al., 2021a; Blandhol et al., 2021). A counterargument to the CEO substitution effect might be that employees are in fact more independent, and that the CEO through performance-based compensation might stand more to gain from choosing a higher risk level. A subsequent study could analyse which of these effects prevail, by removing all samples where the CEO is part of the board, and check the coefficient on BLER. Alternatively, construct a study design examining the interaction effect between having BLER and the CEO on the board.

While the results have been highlighted through the lens of alternative theoretical explanations, the argument that the employee representatives do not get any de facto influence in the work of the board as suggested by (Jäger et al., 2021a; Blandhol et al., 2021) remains unhandled. It may be that the employee's characteristics, knowledge, and incentives are compatible with reduced risk, but since they are in the minority on the board (As shown in Table 3.2 employee representatives, on average, hold 23% of the votes in Swedish listed firms between 2005-2019), their participation do not have a significant impact on firm risk. More in-depth analysis regarding how the relative voting strength of the employee representatives affects risk will be presented in the subsequent section, answering our fourth hypothesis. However, the relative strength comes into play also in the discussion of the binary occurrence of BLER. One interpretation of our results is that since the employee representatives are in the minority, their binary existence becomes idle, and they are not allowed to influence risk at all. To put it plainly, the employees might want to reduce risk but find themselves incapable of doing so.

On the other hand, the argument that BLER leads to increased perspective diversity speaks against the claim that employee representatives due to being in the minority cannot influence firm risk. According to this view, despite the inferiority in pure voting power, employee representatives can nevertheless impact risk by increasing board functionality, especially by sharing firm-specific information with the other directors, improving the communication climate, and task conflict resolution (Carter et al., 2003; Hillman and Dalziel, 2003; van Knippenberg et al., 2004; Bebchuk and Weisbach, 2010). However, due to the insignificant results shown in Table 4.2, we find that perspective diversity is at least not the dominant mechanism driving our results. We find several alternative explanations for our findings relating to board diversity. It could be that board diversity is a significant determinant of risk but that BLER does not increase board diversity to the extent that it affects firm risk. It might be that the characteristics of the employee representatives are not as diverse concerning firm risk as the previous literature indicates. For example, as alluded to before, representatives who choose to sit on the board with the legal obligations it entails may not be so different from shareholder elected representatives after all, and the role of being an informational intermediary might be reduced by the fact that the CEO already sits on the board. Moreover, it might be that the theoretical arguments of perspective diversity leading to improved board efficiency and thus reducing firm risk are true for other board diversity traits such as gender, educational background, ethnicity, or age, but that BLER does not per se share the same mechanism. Alternatively, BLER does increase board diversity, but board diversity, in turn, might not be a determinant for firm risk. As previously mentioned, besides the theoretical arguments of which has contributed to the formation of our hypothesis, the empirical evidence presented on the topic, in particular gender diversity is ambiguous. Our results in Table 4.2 shows that female directors are negatively but insignificantly associated with total and idiosyncratic risk while significantly associated with increased systematic risk. The latter supports the findings of Adams and Funk (2012) arguing that female directors are more risk-loving compared to their male peers, but contradicts the results in other studies finding a negative relationship between female directors and risk measured in stock volatility (Lenard et al., 2014; Jizi and Nehme, 2017). The fact that both our test variable and the control for female directors (in two of the cases) are insignificant predictors of firm risk, thus might serve as an indication that the diversity mechanism which they both share, is not a significant determinant of firm risk. Thus, the alternative conclusion is that board diversity itself does not affect risk, meaning that even if BLER increases board diversity, it does not affect risk through the diversity mechanism.

Moreover, a dilution effect, where the size of the board is regulated to ensure that the shareholder-representing board members have a voting advantage, may serve as an alternative explanation to our results. If so, these results open up for a debate about whether the statutory maximum number of 2 (3) employee representatives is compatible with the overarching purpose of having them represented in the first place. However, this issue rather belongs to the political discussion and will thus not be elaborated upon in further detail within this thesis.

Based on our results regressing *ERBinary* against our three risk measures, there does not seem to exist a significant direct relationship. Due to the many alternative explanations of the insignificant results deviating from our hypotheses H1 and H2 concerning total risk and idiosyncratic risk, we can only provide theoretical, speculative discussions about the drivers of our results. As a continuation of the analysis, we will, after analysing the results regarding relative voting power in the subsequent Section 5.3 expand the analysis and examine the sensitivity and robustness of our results in section 5.4.

5.3 The relative voting strength of employees does not seem to impact firm risk either

The univariate analysis in Figure 4.2 shows a significant relationship between *ERRatio* and all three types of risk, however, when controlling for confounding factors, the significance is lost as seen in Table 4.3. The latter shows that our test variable *ERRatio* is insignificant in all three regressions using total risk, idiosyncratic risk, and systematic risk as dependent variables at both a 5% & 10% level of confidence. This contradicts our hypothesis H4 and H5, but supports H6. Given that the binary presence has already been found to be insignificant, it is not surprising that the ratio also comes out insignificant. This similarity further means that the arguments for alternative effects against our stated hypothesis discussed above, also apply to this BLER measure. Hence, for brevity, we do not re-iterate them again.

With that said, there are some aspects of *ERRatio* that are still interesting to analyse due to its difference compared to the binary case. Taken together with the preceding section, analysing the binary presence of employee representatives, the results indicate that BLER does not affect firm risk. However, the factors driving the result are not unambiguous. As presented in the data descriptives, the maximum value for the employee representation ratio is 44 %, averaging 23 %, meaning that the Employee representatives are dependent on other directors to win a vote in all firm-year observations throughout our data set. Hence, it might be that the effect of the voting strength is not visible since they are always in a minority. This would suggest that the binary presence captures the full effect, which explains why the results from the two regressions are so similar. To properly evaluate whether an incremental BLER effect exists due to the ratio of votes, a complementary study would thus need to identify a subset of companies where employees are given a majority (or where they are a minority, but the shareholder elected member votes can be separated into smaller interest groups which effectively gives the employees a swing vote, a concept discussed by Stevenson and Radin (2009). This scenario is discussed in a subsequent paragraph). As discussed above, however, such a sample is likely difficult to collect since unions tend to always allocate the mandated 2 (3) seats, which almost always leads to a minority role.

The preceding argument assumes that employees are only able to influence the board through raw voting power, thus requiring a majority. An alternative hypothesis would be that even in the case of BLER minority, having more colleagues in the board room would boost the employees confidence to wield soft power in the form of argumentation, thus enabling them to sway shareholder elected members to vote in favour of their propositions. One could imagine a scenario where employees in the board room allow for more discussions on employee-centric concerns and hence a stronger stakeholder perspective in decision-making. However, as discussed above, previous studies have found that BLER has limited influence, suggesting that it is unlikely that employees would be able to steer the conversation. Hence, we argue that the most likely effect of voting strength is whether they are a majority (or swing vote). Hence, a future study could potentially replace the continuous ratio variable with a categorical variable that indicates this.

As eluded to above, it is instructive to nuance the minority vs. majority discussion by also considering the case of swing votes. The appointment of the employee representatives may, for a subset of observations, open up for, e.g., negotiation-like relationships between shareholder-elected members and employee representatives counteracting the differences. Especially in settings where shareholder-elected representatives cluster (e.g., represents larger owners with different interests), it might be that the employee representatives are given the balance of power. This because their vote is needed to win a vote in cases where a conflict of interest between subgroups of shareholder elected directors exists, a scenario discussed by Stevenson and Radin (2009). Thus it might be that silent negotiations of votes take place latently, giving the employee representatives the ability to directly or indirectly influence board decisions relating to risk. Of course, this type of interpersonal relational aspect does not solely or directly explain our results. Nevertheless, it illustrates the complexity of the mechanisms underlying our results.

Besides the arguments on influence, we posit that the ratio could have an effect on board diversity which in turn would yield a different result than in the *ERBinary* case. As discussed in the theory section, a higher concentration of employee representatives could, for example, boost task conflict (Pelled et al., 1999; Overland and Samani, 2021), which in turn has been found to have implications for board efficiency and risk. Task conflict could, for example, arise if the characteristics of the employee representatives are controversial or radically different from the shareholder-elected representatives. Given that the employee representatives are theorised to differentiate themselves from the other board members regarding, among other things, their education and risk preferences (Fauver and Fuerst, 2006; Lin et al., 2021), such a scenario is not entirely unimaginable. In addition to reduced risk through improved task conflict, there are arguments to support a risk reduction due to that BLER leads to improved perspective diversity (van Knippenberg et al., 2004), human capital Hillman and Dalziel (2003) and improved ability to capture overseen questions (Carter et al., 2003). Our study does not find evidence to support these board diversity arguments as a determinant of risk. Either this is because the previously reported diversity effects are not conclusive, or perhaps we overestimate the difference between traits of employee and shareholder elected board members. To unravel which of these answers is correct, a future study would need to include board member characteristics in the regression.

5.4 Robustness tests

As discussed in the preceding section, the study does not find evidence to support the stated hypotheses. In order to understand more in-depth why this is the case and to ensure that this conclusion is robust, the primary regressions were complemented with a more nuanced analysis. In the subsequent sections, the results from these robustness tests are presented. As will be seen, it turns out that the results are highly dependent on the choice of research design and data.

5.4.1 Validating the research design

Our results presented in Section 4.3.1, Table 4.2, proclaim that BLER does not significantly reduce idiosyncratic risk, nor total risk, contradicting our hypotheses

H1 and H2. However, the results show that the coefficient for the binary existence of BLER is insignificant in determining systematic risk as well, supporting our H3. Furthermore, as previously denoted in the results section, Table 4.2 shows that the sign and significance levels of the coefficients when regressing total risk and idiosyncratic risk are quite similar to each other. This suggests that the variables used in the model specification are similar in the way they are explanatory for total risk and idiosyncratic risk, respectively. Thus, starting with analysing what characteristics that are determinants of total risk and idiosyncratic risk in Figure 4.2. We see that large, well-performing, dividend-paying companies that have independent directors and the CEO on the board are significantly associated with lower risk regarding both risk measures. Moreover, highly leveraged companies that have experienced high risk in the preceding period are, on the other hand, significantly associated with higher total- and idiosyncratic risk. These results are in-line with the findings presented in previous studies within the corporate risk literature (Coles et al., 2006; Low, 2009; Sun and Liu, 2014; Sila et al., 2016; Bernile et al., 2018), and thus provide an indication of some form of validity to our results.

Comparing the results of the significant estimated coefficients in Table 4.2 with their comparatives in the correlation graphs provided in Figure 4.2, the results are generally quite coherent, showing the same sign and strength of predictability of risk in both illustrations. However, the output displays that the variable R&D seems to constitute an outlier, showing a high predictive value in the univariate analysis but is rejected at a 5% level of confidence in the multivariate regression analysis when controlling for other confounding factors. Quite the opposite, *LEV* despite its relatively low correlation with risk in the univariate analysis, turns out to be a significant determinant showing a negative relationship with both total risk and idiosyncratic risk in the multivariate regression analysis. This inconsistency in sign highlights the necessity to control for confounding factors to gain robust results.

Analysing the results in Figure 4.2, another in advance unexpected finding is the positive correlation between our test variables ERBinary and ERRatio and systematic risk, suggesting that firms with BLER are associated with higher systematic risk compared to firms without. Generally speaking, the relationship between BLER and corporate risk is expected to be negative, although our hypothesis predicts that the employee representatives lack the ability to influence specifically systematic risk. However, as seen in Table 4.2 the binary existence of BLER gain a insignificant negative coefficient (coeff. = -0.021, $p > .05$) after controlling for other confounding factors. The fact that we obtain results where BLER is negatively correlated with systematic risk in the univariate, while in the multivariate regressions, insignificant negative coefficients, thus indicate that our initial hypothesis that BLER does not significantly affect systematic risk seems to be relatively accurate. This is because multivariate regression is considered the more reliable of the two.

Turning our attention to the control variables, the sign and strength of the coefficients in Table 4.2 when using systematic risk as dependent variable deviates from the ones gained in previous regressions using total- and idiosyncratic risk. In this context, are large firms with big boards, that possess future investment opportunities, have experienced high risk and losses in the preceding period, and have female directors appointed on the board, associated with higher systematic risk. In contrast, highly leveraged firms with strategic ownership are found to be associated with lower systematic risk. Notable is that the direction for how some of these variables interact with our systematic risk variable contradicts findings from other studies within the research field. For example, previous studies have found ROA to be negatively correlated with systematic risk (Low, 2009) and that large leverage is associated with increased systematic risk (Sila et al., 2016), while Table 4.2, reports our comparative statistics to be ROA (coeff.= 0.299, $.05 < p < .1$) and LEV (coeff.= -0.178, $p < .01$).

At first glance, we find no obvious reasons explaining why the estimated coefficients above differ from the findings presented in previous research. However, market characteristics may constitute a partial explanation of the differences. While this study uses a purely Swedish data set, other comparative studies data set includes international markets such as the US, or combine several international markets. It might be that these markets hold other characteristics. Thus factors such as differences in the institutional setting may contribute to the differences between our results and those gained in comparative studies. Alternatively, the contradictory evidence could simply be due to differences in research design or the controls used. For example, while this study utilises Heckman´s two-stage approach to address endogeneity concerns, Bernile et al. (2018) uses IV regressions, and Sila et al. (2016) Generalised Method of Moments (GMM) techniques, which may contribute to explaining some of the differences in the results.

Disparities in the set of control variables used constitute another alternative explanation. Although all control variables are collected from previous research, the combination of our controls constitutes a unique set of variables. The controls are collected from several previous papers within the risk area considered relevant to our setting and research question. Thus, our controls constitute an accumulated combination of the ones used in various selected papers. These variables may be more or less appropriate as determinants of risk and hence show different interaction effects between papers depending on the combinations of controls used. This insight is relevant as a robustness check. For example, suppose subsequent articles examine the same research question as in this paper. Then, employing a different research design might gain different signs and magnitude of the main variables, just as with the controls in this article.

5.4.2 Complementary OLS to check if self-selection is a concern

As shown in the results, Section 4.3.1 & 4.3.2, the inverse mills is found to be insignificant in all regressions on total and idiosyncratic risk, and return significant only in the case of systematic risk. This discrepancy yields an inconsistent conclusion concerning whether selection bias in this setting is a concern or not [5]. Hence, to analyse the matter further, the inference was repeated but using the simple OLS regression model. Given that four out of six of our Heckman models indicated that self-selection might not be a concern, we expected to retain similar results using both Heckman and OLS. This prediction turned out to be true. For the case of *ERRatio* the OLS gives a p-value of 15.5%, 25.6%, and 9.7% for total risk, idiosyncratic risk, and systematic risk, respectively. The corresponding numbers for Heckman are 12%, 19%, and 11.3%. Similarly, for the case of *ERBinary* the OLS gives a p-value of 12.9%, 19.1%, and 23.5% for total risk, idiosyncratic risk, and systematic risk, respectively. The corresponding numbers for Heckman are 9.4%, 13.3%, and 29.9%. Importantly, the sign and magnitude of the BLER coefficients remain the same for both model choices. The results indicate that self-selection is, in fact, not a severe issue in this setting. Moreover, the fact that the coefficients are agnostic to the model choice provides some reassurance to the robustness of the results.

5.4.3 The risk response exhibits a lagged characteristic

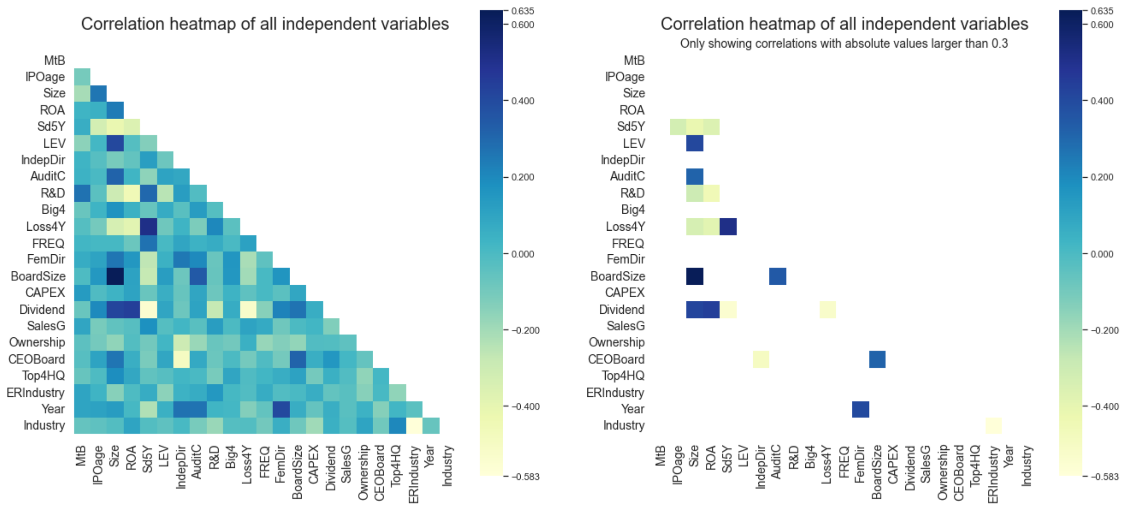
As discussed in Section 3.4.4, the entire Heckman model was repeated but using the same-year risk measure as opposed to the 1-year lagged risk. The repeated regression used all control variables and controlled for fixed year- and industry effects. Note that the first-stage Probit is unchanged by this, and the reader is referred to Table 4.1 to see those results. The results from the second stage regression on *ERBinary* against the unlagged risk is reported in Appendix A.1 in Table A.1, and the analogous regression but on *ERRatio* is shown in Table A.2. The two tables show how the two measures of BLER impact the total, idiosyncratic and systematic risk in less than one years time. Comparing the results to the lagged equivalents, see Table 4.2 and Table 4.3 respectively, it can be seen that the p-value for both main independents is weaker for all three types of risk. This indicates that if there is a relationship between BLER and risk, it seems to have at least a one-year delay. Hence the possibility that the results are driven by the choice of using a lagged risk measure is ruled out. Taken together, this strengthens the decision to employ a lagged dependent variable.

5.4.4 Checking for multicollinearity

Figure 5.1 serves as a robustness analysis to check for multicollinearity between all independent variables by analysing the pairwise correlations. For increased readability, two heatmaps are provided: Figure 5.1a which presents all values, and Figure 5.1b which only presents the strongest correlations. As seen, most variables are weakly correlated which indicates limited multicollinearity concerns. The strongest correlation is 64%, which can be considered below the limit of acceptance (Farrar and Glauber, 1967). However, given the large number of covariates, this univariate

[5] An insignificant inverse mill is often seen as an indication that sample selection bias may not exist. However, as highlighted by Certo et al. (2016), sample selection can exist despite an insignificant coefficient for inverse mills ratio, indicating that this rule of thumb is associated with uncertainty. Thus, inferences regarding the significance of this ratio should be drawn with some caution.

analysis is insufficient to conclusively determine whether multicollinearity poses a problem since a large number of individually low correlations might still add up to a complex multivariate relationship between several controls. To account for this, a dimensionality reduction test was performed to verify if the results are robust to the subjective choice of control variables. The findings from this additional analysis is presented in Section 5.4.5. Finally, one especially notable case in the correlation heatmap in Figure 5.1 is *Size*, which is seen to correlate with several covariates, hence it could potentially be the source of such a multivariate concern. This is analysed in more depth in Section 5.4.8.2.



(a) All correlations. **(b)** Excluding weak correlations.

Figure 5.1: Heatmap showing the pairwise correlation between all independent variables. As seen, most variables are weakly correlated which indicates that the regressions are not subject to severe multicollinearity issues. However, the result is insufficient to reach this conclusion and more nuanced analysis had to be performed, see Section 5.4.5 and Section 5.4.8.

5.4.5 Checking if results are robust to the choice of control variables

As discussed in Section 3.4.3, it is important that the results are independent of minor changes to the set of control variables. As seen in Table 5.1, the *Top4HQ* instrument remain significant for all such subsets. The *ERIndustry* instrument is slightly more volatile, and looses significance at the 10% level for two subsets. However, the p-value for both instruments remain relatively robust and the sign of the two coefficient (not shown) remains constant for all subsets. Hence, in conclusion the instruments are deemed to be adequately robust and are thus concluded to be valid.

Table 5.1: To verify that the instruments are robust to the choice of control variables, the Probit model was repeated 19 times. More specifically, each time one control variable at a time was dropped and the p-value for the two instruments was recorded. The table shows that the instruments are adequately robust to the choice of control variables.

Instrument validity for different control subsets		
	ERIndustry	*Top4HQ*
Full model p-values	**6**	**0**
Drop one control	*P-value*	*P-value*
MtB	10	0
IPOage	6.8	0
Size	6.8	0
ROA	6.3	0
Sd5Y	0	0
LEV	8.1	0
IndepDir	1.1	0
AuditC	4.5	0
R&D	6	0
Big4	10.1	0
Loss4Y	3.3	0
FREQ	4.6	0
FemDir	6.2	0
BoardSize	5.6	0
CAPEX	3.9	0
Dividend	6.1	0
SalesG	5.8	0
Ownership	3.4	0
CEOBoard	6	0

Having established that the instruments are robust to the choice of control variables, it is instructive to analyse if the same holds for the two main independents: *ERBinary* and *ERRatio*. Table 5.2 reveals that this is not the case. Although the sign of the coefficient remains negative for all cases (untabulated), the corresponding p-value changes dramatically. To exemplify, if all control variables except *Size* is used the conclusion at 1% significance level would be that *ERBinary* and *ERRatio* both lead to a reduction on all three types of risk. However, if all control variables except *Sd5Y* is used, the verdict would be that BLER does not have any impact on either type of risk. Hence, Table 5.2 highlights that even minor modifications changing one variable can significantly affect the statistical inferences drawn from the result. Hence, it should be pointed out that the results are sensitive to the choice of control variables. This, despite that our main results, presented in sections 4.3.1 & 4.3.2 using all control variables is produced using the model specifications considered, based on previous research, best describe the relationship between BLER and total, idiosyncratic, and systematic risk, respectively.

Table 5.2: To verify that the results from the second stage regressions are robust to the choice of control variables, the six models were repeated 19 times each. More specifically, each time one control variable at a time was dropped and the p-value for the main independent variable was recorded. The table reveals that the relationship between the two main independent variables (*ERBinary* and *ERRatio*) and the three dependent risk variables is not robust to the choice of control variables, since the p-value changes dramatically if a single control variable is omitted.

Heckman Second Stage: Results for different control subsets						
	Regression on ERBinary			Regression on ERRatio		
Dependent	*Sd1Y*	*Idiosyncratic Risk*	*Beta*	*Sd1Y*	*Idiosyncratic Risk*	*Beta*
Full model	**9**	**13**	**30**	**12**	**19**	**11**
Drop one control	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*
MtB	12	19	10	15	26	3
IPOage	9	13	30	13	20	10
Size	0	0	1	0	0	0
ROA	18	25	25	23	34	9
Sd5Y	54	54	83	61	66	86
LEV	5	7	38	5	8	17
IndepDir	9	13	30	14	22	7
AuditC	11	14	50	13	19	28
R&D	8	11	30	10	16	11
Big4	10	13	40	13	19	16
Loss4Y	9	13	30	15	23	14
FREQ	9	13	30	16	25	14
FemDir	9	13	30	10	17	17
BoardSize	9	13	30	13	20	9
CAPEX	6	9	30	8	13	12
Dividend	9	13	30	12	19	11
SalesG	9	13	30	12	20	9
Ownership	6	10	10	9	17	4
CEOBoard	9	13	30	12	19	11

5.4.6 Investigating the mechanism through which BLER impacts risk

It is instructive to study Table 5.2 in more depth within the discussed theoretical lens of cause-effect mechanisms related to BLER and risk. Previous studies by Lin et al. (2018) illustrates that employee representatives are able to influence firm leverage, and Overland and Samani (2021) find that they can impact R&D policies. However, Gold and Waddington (2019) claims that they are unable to influence strategic decisions. Given these findings, it is plausible that BLER might, in fact, only have an impact on operational decisions, such as leverage and R&D, and not on market volatility directly. With that said, it is still possible that BLER can influence volatility indirectly, but through effects caused by modified leverage and R&D policies.

Partial support in favour of this argument is found in Table 5.2, since the main independent variables load more strongly if either of those two control variables are excluded. This might indicate that our control variables already captured some of the potential effects BLER has on risk. The interaction effect with leverage seems to be the most pronounced, which might suggest that the underlying risk-influence mechanisms (if there indeed is one) is that employees manage to reduce financial leverage, which in turn reduces other measures of risk including market volatility. On the other hand, the Probit results in Table 4.1 might offer an alternative explanation for this. More specifically, the Probit shows that high leverage is a significant negative predictor of employee representation, which could indicate that the reason for this seeming interaction is due to firm characteristics. One could posit that risk-averse employees would only accept to enter low-leverage board rooms, since the personal risk is otherwise too high. Hence, from these partial results we are unable to confirm if BLER leads to low leverage, or if low leverage leads to BLER. To clarify these cause-effect relationships, future studies could extend our research by examining the interaction effects of leverage, R&D and BLER.

5.4.7 Dimensionality reduction techniques

Given that the results are highly dependent on the choice of control variables, see Table 5.2, additional robustness checks using LASSO and Stepwise regressions were conducted. This allows for examining how results are affected when relaxing the model specification by letting a more objective model select the variables with the best predictive value for the underlying relationships.

5.4.7.1 LASSO regression

Firstly, as discussed in Section 3.4.3, a LASSO regression was carried out. Considering the potential issues related to variable selection highlighted in the preceding section, we argue that conducting a LASSO regression can provide some additional insights contributing to a better understanding and ability to explain what factors are driving our results. More specifically, we argue that the key determinant for which control variables to include in each model is whether they are good predictors of that specific type of risk. The research design forces us to include the inverse mills ratio from the Probit, the main independent BLER variable, and fixed year and industry effects. However, all other control variables are optional. Hence, we decided to run a LASSO OLS regression including all these optional control variables on each type of risk (*SD1Y*, *IdiosyncraticRisk* and *Beta*) respectively.

When performing the LASSO OLS on *SD1Y*, the model discarded all control variables except *IPOage*, *ROA*, *Sd5Y*, *FREQ*, *FemDir*, *BoardSize* and *Dividend*. This indicates that all other control variables are redundant and unnecessary covariates to adequately describe the total risk in a firm. We then took this new subset and repeated the entire Heckman procedure. Both instruments remained significant (p-value = 0.0000) in the Probit. More importantly, *ERBinary* and *ERRatio* both became significant (p-value of 0.002 and 0.001, respectively) and had negative coefficients. This provides some support in favour of the hypothesis that both the presence and voting strength of BLER leads to a lower total risk.

Secondly, we repeated the LASSO procedure for *IdiosyncraticRisk* as well. The model selected all variables from the *Sd1Y* LASSO, except *BoardSize*. However, it also added *Size*, *MtB*, *LEV*, and *R&D*. This suggest that the latter subset are good predictors of firm-specific risk, but are poor predictors of total risk. Importantly, the two instruments stay significant in the subsequent Probit regression (p-value 0.0000). In the second stage regression against *IdiosyncraticRisk*, we find a weak relationship with *ERBinary* (p-value 0.089), but no relationship with *ERRatio* (p-value 0.217). This indicates that the presence of BLER might have a minor impact on the firm-specific risk, but the voting strength of the employees does not matter.

Finally, when repeating the LASSO procedure but using *Beta* instead of *Sd1Y* as the dependent variable, the model selected all controls above, except *FemDir*, but it also included *Size*, *MtB*, *LEV*, *Loss4Y*, *Big4*, *CAPEX*, *SalesG*, *Ownership* and *CEOBoard*. This indicates that most firm characteristics that are required to predict total risk are also valid predictors of systematic risk, but that the converse is not necessarily true. Just as in the previous case, using the LASSO control variables in the Heckman model both instruments get p-value 0.0000 in the Probit. However, the second stage regression comes back insignificant for both *ERBinary* and *ERRatio* (p-value of 0.46 and 0.20, respectively). This provides support in favour of the hypothesis that BLER does not impact the systematic risk of the company.

5.4.7.2 Stepwise regression

Secondly, to complement the LASSO we also conducted a Stepwise regression. Again, since the variable selection bias appears in the second stage regression we impose the selection criteria in the second stage. More specifically, we used the following approach. First, the original Probit using all controls was used to get a first estimate of inverse mills. Then, Stepwise regression with a 10% threshold was done on the second stage OLS. The research design forces us to include the inverse mills ratio from the Probit, the main independent BLER variable, and fixed year and industry effects and hence these were exempt from the threshold. After the selection process, we repeated both the Probit and the second stage regression using the reduced set of control variables. This process was repeated for both *ERBinary* and *ERRatio* against all three risk measures, meaning that a total of six Stepwise regressions were performed and consequently six new sets of control variables was identified. Notable is that the two instruments remained significant in all six cases, providing further proof that the instruments are valid and robust.

When using total risk as the dependent variable, the Stepwise regression process only kept *Size*, *ROA*, *Sd5Y*, *LEV*, *IndepDir*, *AuditC*, *CEOBoard*, *Dividend* and *Loss4Y*. Note that the same subset was chosen for both *ERBinary* and *ERRatio*. Using this subset of controls, the p-value for *ERBinary* and *ERRatio* in the second stage regression was 2.3% and 5.4%, respectively. In line with the LASSO regression, this indicates that employee representation does in fact lead to a reduction in total firm risk, when using variable selection techniques to decide the set of control variables used.

Repeating the Stepwise regression but using systemic risk as the dependent variable, the resulting subset was the same as for *Sd1Y* above except that *IndepDir* and *AuditC* where replaced by *FemDir*, *MtB* and *Ownership* (and in the case of *ERBinary* it also included *BoardSize*). Using these subset of controls, the p-value for *ERBinary* and *ERRatio* in the second stage regression was 47.7% and 22.8%, respectively. In line with all previous results this indicates that employee representation does not have any impact on the systematic risk.

Finally, when repeating the process for *IdiosyncraticRisk* virtually the same set of control variables was found as in the total risk case. The only exception was that *AuditC* and *Loss4Y* were replaced with *MtB* and *R&D* in the *ERRatio* case, and by just *MtB* in the *ERBinary* case. Using these subset of controls, the p-value for *ERBinary* and *ERRatio* in the second stage regression was 10.1% and 22.7%, respectively. In line with most previous results this indicates that employee representation does not have any impact on the firm-specific risk.

Notable is that both all different varieties of the the LASSO and the Stepwise regressions tended to result in similar subsets of control variables. This robustness provides some reassurance as to the validity of the methodology. Moreover, the selected subsets tend to include all the classical risk predictors which serves as a good sanity check of the methodology.

Some interesting findings emerge after contrasting the results gained introducing dimensionality techniques with the ones presented in section 4.3.1 & 4.3.2. In our main regressions in section 4.3.1 examining *ERBinary* relationship with total risk, the coefficient returned insignificant at the 5% confidence level. However, showing a coefficient of -1.099 with an associated p-value=9.4%, *ERBinary* is thus significantly associated with reduced total risk at the 10% level. Alone, this should be considered an insignificant result as the commonly used limit for statistical evidence is 5%. However, the additional insights gained introducing LASSO and Stepwise regression techniques, presents comparative figures of 0.2%, 0.1% and 2.3%, 5.4%, when regressing *ERBinary* and *ERRatio*, respectively. This might serve as an indication that, if any, a weak negative relationship between BLER and total risk may exist. However, it is unexpected that the same tendency is not found in the case of idiosyncratic risk, speaking against such an argument. In the hypothesis development, we predicted the major contribution of BLER to lie within the operational areas. Thus, we expected a connection in which employee representatives affect total risk primarily through the influence on idiosyncratic risk. Hence, our interpretation is that one of the following two explanations, theoretically, should hold: either BLER leads to lower risk, but the mechanism is not in line with the operations' hypothesis, or the indicative results in this chapter are a fallacy and no true causal relationship between BLER and total risk exist after all. Regarding the regressions using systematic risk as dependent variable, the additional insights gained using LASSO and Stepwise, as previously alluded to, provide additional reassurance that our H3 of BLER not being a significant determinant of systematic risk is accurate.

5.4.8 Analysing the variance inflation factor

To further analyse the potential multicollinearity issue, a VIF analysis was carried out. For completeness, the analysis was repeated for both the analysis of *ERBinary* and *ERRatio* and all dependent variables, respectively. The results gained from the second-stage regression using *Sd1Y* are shown in Table A.3 in Appendix A.2. The results using *IdiosyncraticRisk* and *Beta* as dependent variable gained identical results and are untabulated to improve readability.

As seen in Table A.3, the VIF scores for each variable generally lies well below the commonly used threshold value of 10, ranging between 2.74 and 1.13, with an associated average VIF score of 2.52 and 2.53 for each model, respectively. Thus, there are no obvious indications of severe multicollinearity present looking at the model as a whole. However, Table A.3 also shows that the variables *Size*, *invmills*, and *Industry 8* lie quite close to or exceed the threshold (VIF scores > 10), ranging between 8.93 to 12.11, which may indicate that one of the variables may create disturbances to the results.

First, we see that the variable *Size* shows on VIF scores of 8.93 & 9.06. The way in which *Size* is defined may potentially contribute to explain the results. Since *Size* is defined as the natural logarithm of total assets collected from the balance sheet, it is not entirely unreasonable that *Size* is highly correlated with the other independent variables controlling for firm characteristics, also collected from the balance sheet. If the assets base is large, it is also conceivable that other items will be characterised by, or vary with certain characteristics of which *Size* could be a significant determinant for their shape due to a certain dependency between the variables.

Turning our attention to *invmills*, showing VIF scores of 12.11 & 12.07, there are some potential explanations to what we see. As *invmills* is a probability prediction of employee representation based on a set of independent variables which are also included in the second stage model, a correlation between *invmills* and the predictors is somewhat expected. However, the high VIF scores indicate that the inclusion of *invmills* may create disturbance to our results. Thus, the expansion of the analysis conducted in section 5.4.2, running the model using an standard OLS regression excluding *invmills* controlling for the effect of including the inverse mills is further motivated.

Lastly, Table A.3 shows that *Industry 8* constituting of *Finance, Insurance & Real Estate* companies, gain VIF scores of 9.48 & 9.52, respectively. The high VIF scores could potentially arise as a result of financial firms having fundamentally different characteristics compared to non-financial firms. Some previous studies opted to exclude this category see e.g (Sila et al., 2016; Bernile et al., 2018). For example, financial firms generally show on relatively larger leverage ratios compared to non-financial firms, stemming from differences regarding some of their balance sheet items, which makes them a quite special case (Fama and French, 1992).

The effect of having high variance inflation is, among other things, that the significance of the estimated coefficient can be understated. Hence, to address and ensure that issues with multicollinearity do not drive our results, we repeat our regressions but exclude the variables *Size* and *Industry 8* one at the time, for which the results are presented in the subsequent sections 5.4.8.1 and 5.4.8.2.

5.4.8.1 Excluding Finance, Insurance & Real Estate firms

As seen from the VIF analysis, See Table A.3, *Finance, Insurance & Real Estate* companies are found to inflate the variance significantly, which might impact our results. While some other scholars have excluded these firms, we decided to include them in our main second-stage regression models. Thus, we control for whether this data selection option has an impact on the result, by performing an additional robustness check by repeating the entire Heckman procedure but without the *Finance, Insurance & Real Estate* firms. The results are shown in Table 5.3 & 5.4.

Table 5.3: Results from the first multiple linear regression model used in the second Heckman stage, excluding *Finance, Insurance & Real Estate* firms. The main independent variable *ERBinary* is regressed against the three different risk measures.

Heckman Second Stage: Risk in relation to ERBinary (Excl. financial firms)									
Dependent	*Sd1Y*			*Idiosyncratic Risk*			*Beta*		
	Coefficient	*t-score*	*p-value*	*Coefficient*	*t-score*	*p-value*	*Coefficient*	*t-score*	*p-value*
ERBinary	-0.977	-1.41	0.159	-0.881	-1.28	0.199	-0.016	-0.74	0.458
MtB	-0.133	-1.62	0.105	-0.165**	-2.06	0.040	0.011***	3.72	0.000
IPOage	1.269	1.31	0.192	1.178	1.24	0.214	-0.016	-0.47	0.640
Size	-0.787**	-2.13	0.033	-1.486***	-4.08	0.000	0.118***	9.77	0.000
ROA	-25.167***	-4.88	0.000	-25.064***	-4.91	0.000	0.302*	1.71	0.087
Sd5Y	0.204***	5.45	0.000	0.194***	5.21	0.000	0.003***	3.48	0.001
LEV	8.825***	3.47	0.001	9.877***	3.95	0.000	-0.185**	-2.48	0.013
IndepDir	-5.394***	-3.04	0.002	-5.261***	-3.00	0.003	-0.037	-0.62	0.533
AuditC	0.311	0.42	0.676	0.131	0.18	0.859	-0.014	-0.58	0.562
R_D	9.838	1.53	0.125	10.439	1.64	0.101	-0.077	-0.44	0.657
Big4	-0.231	-0.13	0.898	-0.296	-0.16	0.869	0.049	0.65	0.517
Loss4Y	2.755***	3.22	0.001	2.311***	2.72	0.007	0.083***	2.90	0.004
FREQ	121.703	1.28	0.201	116.963	1.30	0.194	2.223*	1.65	0.099
FemDir	1.205	0.44	0.660	0.902	0.34	0.738	0.202**	2.15	0.031
BoardSize	-0.230	-0.93	0.354	-0.275	-1.13	0.259	0.025***	2.81	0.005
CAPEX	13.134	1.26	0.209	9.657	0.95	0.343	0.543	1.49	0.136
Dividend	-4.642***	-4.79	0.000	-4.616***	-4.76	0.000	-0.036	-1.29	0.198
SalesG	-0.969	-1.29	0.198	-0.897	-1.22	0.223	0.041	1.40	0.160
Ownership	-3.091	-1.50	0.134	-2.534	-1.23	0.218	-0.241***	-3.70	0.000
CEOBoard	-2.244***	-3.13	0.002	-2.608***	-3.67	0.000	0.031	1.24	0.214
invmills	2.175	1.59	0.112	1.411	1.04	0.296	0.085*	1.87	0.061
Intercept	30.902***	5.07	0.000	36.154***	6.00	0.000	-0.470**	-2.23	0.026
Year effects	Yes			Yes			Yes		
Industry effect	Yes			Yes			Yes		
R-Squared	0.483			0.498			0.332		
Adj. R-Squared	0.471			0.486			0.316		
Prob > F	0.000			0.000			0.000		
F-score	26.911			28.655			23.561		
N	1589.000			1589.000			1589.000		

Table 5.4: Results from the second multiple linear regression model used in the second Heckman stage, excluding *Finance, Insurance & Real Estate* firms. The main independent variable *ERRatio* is regressed against the three different risk measures.

Heckman Second Stage: Risk in relation to ERRatio (Excl. financial firms)									
Dependent		*Sd1Y*			*Idiosyncratic Risk*			*Beta*	
	Coefficient	**t-score**	**p-value**	**Coefficient**	**t-score**	**p-value**	**Coefficient**	**t-score**	**p-value**
ERRatio	-3.820	-1.33	0.185	-3.292	-1.16	0.248	-0.117	-1.31	0.191
MtB	-0.134	-1.63	0.104	-0.166**	-2.06	0.040	0.011***	3.72	0.000
IPOage	1.270	1.31	0.192	1.178	1.24	0.215	-0.016	-0.46	0.647
Size	-0.757**	-2.04	0.041	-1.462***	-3.99	0.000	0.119***	9.82	0.000
ROA	-25.239***	-4.89	0.000	-25.124***	-4.91	0.000	0.299*	1.70	0.090
Sd5Y	0.204***	5.46	0.000	0.194***	5.22	0.000	0.003***	3.51	0.000
LEV	8.756***	3.43	0.001	9.820***	3.92	0.000	-0.187**	-2.52	0.012
IndepDir	-5.433***	-3.04	0.002	-5.295***	-3.01	0.003	-0.039	-0.64	0.520
AuditC	0.303	0.41	0.684	0.123	0.17	0.867	-0.014	-0.58	0.564
R_D	9.833	1.53	0.125	10.436	1.64	0.101	-0.077	-0.45	0.653
Big4	-0.241	-0.13	0.894	-0.304	-0.17	0.866	0.048	0.64	0.523
Loss4Y	2.735***	3.20	0.001	2.292***	2.70	0.007	0.083***	2.91	0.004
FREQ	122.797	1.29	0.198	117.898	1.31	0.191	2.259*	1.69	0.092
FemDir	1.319	0.48	0.631	0.998	0.37	0.712	0.206**	2.20	0.028
BoardSize	-0.283	-1.14	0.255	-0.321	-1.32	0.188	0.023***	2.65	0.008
CAPEX	13.581	1.29	0.198	10.002	0.97	0.331	0.571	1.56	0.118
Dividend	-4.647***	-4.78	0.000	-4.620***	-4.76	0.000	-0.037	-1.29	0.196
SalesG	-0.976	-1.30	0.194	-0.904	-1.23	0.220	0.041	1.39	0.164
Ownership	-3.092	-1.50	0.134	-2.540	-1.24	0.217	-0.239***	-3.66	0.000
CEOBoard	-2.273***	-3.16	0.002	-2.634***	-3.69	0.000	0.031	1.22	0.222
invmills	2.215	1.61	0.107	1.459	1.08	0.282	0.081*	1.80	0.071
Intercept	30.964***	5.07	0.000	36.196***	5.99	0.000	-0.464**	-2.20	0.028
Year effects	Yes			Yes			Yes		
Industry effect	Yes			Yes			Yes		
R-Squared	0.483			0.498			0.332		
Adj. R-Squared	0.471			0.486			0.316		
Prob > F	0.000			0.000			0.000		
F-score	26.902			28.631			23.822		
N	1589.000			1589.000			1589.000		

Contrasting our main results presented in section 4.3.1 & 4.3.2, with those shown in Table 5.3 & 5.4, where financial companies are excluded, we see that for both *ERBinary* & *ERRatio* the significance is stronger in our main models, this regarding all risk measures. In the case of *ERBinary*, our main regression showed negative coefficients for all risk measures, with an associated p-value of 9.4%, 13.3%, and 29.9%, whereas the comparatives excluding have the same sign *Finance, Insurance & Real Estate* with an associated p-value 15.9%, 19.9%, and 45.8%, for total risk, idiosyncratic risk, and systematic risk, respectively. Regarding *ERRatio* the main results show a negative coefficient for all risk measures, with an associated p-value of 12.0%, 19.0%, 11.3%, whereas the comparatives excluding *Finance, Insurance & Real Estate* also, in this case, have the same sign as in the main models, with an associated p-value of 18.5%, 24.8%, and 19.1% for total risk, idiosyncratic risk, and systematic risk, respectively. Moreover, regarding the controls, the same variables are deterministic for risk showing similar signs and significance levels when including and excluding *Finance, Insurance & Real Estate* firms. However, with one exception, that *Loss4y* is considered to have explanatory value, in the latter case excluding the *Finance, Insurance & Real Estate* firms.

These results clearly demonstrate that the insignificance of our results is not driven by the choice of including *Finance, Insurance & Real Estate* firms. Our results indicating a stronger relationship between BLER and the various risk measures when including *Finance, Insurance & Real Estate* firms is interesting in the light of the methodology chosen by Sila et al. (2016) & Bernile et al. (2018), which has chosen to exclude them. Specifically, why BLER seems to be more predictive when these firms are included remains unknown. However, for the purpose of this study, we are content with concluding that the choice does not seem to have biased our result.

5.4.8.2 Excluding Size

The VIF analysis revealed that the *Size* covariate is potentially problematic, see Table A.3. The high VIF-score could be explained by examining the correlation analysis in Figure 5.1, which shows that the *Size* variable is strongly related to several other covariates. Hence, we have reason to suspect that the results might change if this covariate is excluded. As an additional robustness check, we thus repeat the entire Heckman procedure but without the *Size* control.

Table 5.5: Results from the first multiple linear regression model used in the second Heckman stage, excluding the *Size* control variable. The main independent variable *ERBinary* is regressed against the three different risk measures.

Heckman Second Stage: Risk in relation to ERBinary (Excl. *Size*)									
Dependent	*Sd1Y*			*Idiosyncratic Risk*			*Beta*		
	Coefficient	t-score	p-value	Coefficient	t-score	p-value	Coefficient	t-score	p-value
ERBinary	-1.972***	-3.02	0.003	-2.259***	-3.49	0.000	0.052**	2.45	0.014
MtB	-0.047	-0.51	0.613	-0.074	-0.81	0.419	0.007**	2.20	0.028
IPOage	-0.541	-0.62	0.538	-0.860	-0.99	0.321	0.055*	1.76	0.078
ROA	-25.403***	-5.36	0.000	-26.909***	-5.71	0.000	0.588***	3.75	0.000
Sd5Y	0.218***	6.33	0.000	0.211***	6.19	0.000	0.003***	2.75	0.006
LEV	6.200***	3.24	0.001	5.543***	2.96	0.003	0.134**	2.21	0.027
IndepDir	-2.861*	-1.65	0.098	-2.340	-1.37	0.171	-0.127**	-2.15	0.032
AuditC	0.300	0.34	0.732	-0.119	-0.14	0.891	0.061**	2.23	0.026
R_D	11.989*	1.84	0.065	13.202**	2.05	0.040	-0.181	-1.08	0.280
Big4	-1.506	-0.93	0.353	-1.573	-0.98	0.330	0.063	0.92	0.359
Loss4Y	1.469**	2.05	0.040	1.582**	2.22	0.027	0.010	0.39	0.699
FREQ	113.760	1.22	0.224	99.796	1.18	0.238	4.184**	2.05	0.041
FemDir	-2.587	-0.95	0.343	-3.101	-1.15	0.252	0.301***	3.17	0.002
BoardSize	-0.717**	-2.23	0.026	-1.045***	-3.25	0.001	0.082***	7.79	0.000
CAPEX	-7.469	-0.68	0.498	-7.898	-0.74	0.461	0.611	1.44	0.149
Dividend	-5.445***	-6.00	0.000	-5.511***	-6.07	0.000	-0.021	-0.76	0.447
SalesG	-0.330	-0.64	0.521	-0.404	-0.80	0.422	0.033	1.56	0.119
Ownership	-0.545	-0.32	0.748	1.505	0.90	0.370	-0.420***	-7.54	0.000
CEOBoard	-1.994***	-2.97	0.003	-2.337***	-3.49	0.000	0.039*	1.65	0.100
invmills	-0.695	-0.44	0.657	-1.027	-0.66	0.507	0.124**	2.39	0.017
Intercept	37.125***	6.89	0.000	38.701***	7.21	0.000	-0.129	-0.66	0.509
Year effects	Yes			Yes			Yes		
Industry effect	Yes			Yes			Yes		
R-Squared	0.475			0.486			0.278		
Adj. R-Squared	0.464			0.475			0.263		
Prob > F	0.000			0.000			0.000		
F-score	30.245			31.359			21.332		
N	1824.000			1824.000			1824.000		

The results are illustrated in Table 5.5 & 5.6. More specifically, the results show how *ERBinary* & *ERRatio* influences total risk, idiosyncratic risk, and systematic risk, respectively, if all firms are assumed to be the same size. As already alluded to in section 5.4.5 examining how the exclusion of one control variable at a time affected our results, we showed that the result is sensible for the variable selection. More specifically, Table 5.2 showed that the inclusion or exclusion of the variable Size significantly impacts the result.

Table 5.6: Results from the second multiple linear regression model used in the second Heckman stage, excluding the *Size* control variables. The main independent variable *ERRatio* is regressed against the three different risk measures.

Heckman Second Stage: Risk in relation to ERRatio (Excl. *Size)*									
Dependent	*Sd1Y*			*Idiosyncratic Risk*			*Beta*		
	Coefficient	t-score	p-value	Coefficient	t-score	p-value	Coefficient	t-score	p-value
ERRatio	-8.493***	-3.14	0.002	-9.839***	-3.65	0.000	0.234***	2.71	0.007
MtB	-0.046	-0.51	0.613	-0.074	-0.81	0.417	0.007**	2.19	0.029
IPOage	-0.515	-0.59	0.558	-0.828	-0.95	0.340	0.054*	1.74	0.083
ROA	-25.375***	-5.35	0.000	-26.876***	-5.70	0.000	0.587***	3.75	0.000
Sd5Y	0.219***	6.33	0.000	0.212***	6.18	0.000	0.003***	2.73	0.006
LEV	6.145***	3.21	0.001	5.482***	2.93	0.003	0.135**	2.23	0.026
IndepDir	-2.911*	-1.68	0.094	-2.400	-1.40	0.162	-0.126**	-2.12	0.034
AuditC	0.256	0.29	0.768	-0.168	-0.19	0.846	0.062**	2.27	0.023
R_D	11.928*	1.84	0.066	13.128**	2.05	0.041	-0.179	-1.07	0.286
Big4	-1.538	-0.95	0.343	-1.609	-1.00	0.319	0.064	0.93	0.353
Loss4Y	1.411**	1.98	0.048	1.517**	2.13	0.033	0.011	0.45	0.655
FREQ	116.745	1.24	0.214	103.294	1.22	0.224	4.098**	2.01	0.044
FemDir	-2.428	-0.89	0.374	-2.913	-1.08	0.281	0.296***	3.11	0.002
BoardSize	-0.807**	-2.53	0.012	-1.148***	-3.61	0.000	0.084***	8.07	0.000
CAPEX	-7.000	-0.64	0.524	-7.300	-0.68	0.494	0.592	1.40	0.160
Dividend	-5.428***	-5.97	0.000	-5.492***	-6.04	0.000	-0.022	-0.78	0.437
SalesG	-0.343	-0.67	0.504	-0.419	-0.84	0.403	0.034	1.58	0.114
Ownership	-0.693	-0.41	0.683	1.338	0.80	0.425	-0.416***	-7.49	0.000
CEOBoard	-2.010***	-2.99	0.003	-2.355***	-3.52	0.000	0.039*	1.67	0.096
invmills	-0.802	-0.51	0.611	-1.156	-0.74	0.458	0.128**	2.46	0.014
Intercept	37.822***	6.96	0.000	39.512***	7.31	0.000	-0.148	-0.76	0.448
Year effects	Yes			Yes			Yes		
Industry effect	Yes			Yes			Yes		
R-Squared	0.475			0.486			0.279		
Adj. R-Squared	0.464			0.475			0.263		
Prob > F	0.000			0.000			0.000		
F-score	30.244			31.365			21.287		
N	1824.000			1824.000			1824.000		

Hence, contrasting the results gained in our main regressions to the ones gained excluding *Size*, we see that the coefficients for our two test variables *ERBinary* & *ERRatio* in all regressions is significant at 1% level of confidence. This except in the case of regressing *ERBinary* against systematic risk where the coefficient is significant at a 5% level of confidence. Furthermore, in terms of the direction of the interaction effect, we see that BLER is negatively associated with total- and idiosyncratic risk both in the case of *ERBinary*& *ERRatio*, while quite unexpected positively associated with systematic risk. The results thus contradict those presented in our main result in section 4.3.1 & 4.3.2 and indicate that our hypothesis H1-H2(BLER reduces total- and idiosyncratic risk) is correctly specified. Moreover, that our H3 (BLER is not a significant determining factor of systematic risk) is wrong, also contradicting our previously presented findings.

The fact that the result of our test variables changes so drastically between our main results shown in Table 4.2 & 4.3, and when excluding *Size* shown Table 5.5 & 5.6 is an indication that our result is non-robust. However, are the differences created as a result of the high VIF? The answer is not unequivocal. The case where we exclude the *Finance, Insurance & Real Estate* firms clearly illustrates that a high VIF value does not automatically mean that the results become significant in the event of excluding a control with high VIF value. In the case of the *Size* variable, we choose to follow and put our trust in the previous research, in which *Size* is a classic variable to determine risk (Coles et al., 2006; Low, 2009; Sila et al., 2016; Bernile et al., 2018; Bhat et al., 2020). Thus, we want to highlight to the reader that our main results are considered to best express the relationship between BLER and risk. At the same time, this chapter is aimed to contrast and show that the results can change drastically, even with small adjustments. Lastly, although we can not claim that BLER is a determinant of risk, the findings that *ERBinary* in our main model returned significantly at a 10% level of confidence, together with the findings using dimensionality reductions techniques, and the insights gained in this chapter, provides some indication that a relationship, after all, might exist. Thus, our result may provide justifications to further research the relationship between BLER and risk using other research designs or contexts.

5.5 Summary of analysis

Before concluding the study, we end the chapter with a brief summary of the findings in relation to the extensive analysis and robustness check. The main model does not show any significant relationship between BLER and risk, measured at the 5% significance level. This implies that the study has to reject H1, H2, H4 and H5, but can support H3 and H6. However, the preceding nuancing of the analysis provides partial evidence to suggest that BLER and risk might still be weakly related. For example, total risk is found to be negatively related to *ERBinary* at the 10% significance level in the main model, and at the 5% and the 1% level in the Stepwise and LASSO regression models, respectively. Hence, partial evidence exists to support H1. In addition, total risk is found to be negatively related to *ERRatio* at the 10% and 1% level for the Stepwise and LASSO regressions, respectively, which provides partial evidence to support H4.

Moreover, when dropping one control variable at a time, we find several subsets that produce widely different results. For example, excluding *Size* provides evidence at the 1% level in the complete different direction to the main model: it supports H1, H2, H4 and H5, but rejects H3 and H6. Several other control subsets also exist that give statistically significant results at the 1%, 5%, and 10% level. This makes the results difficult to interpret since it implies that the presented outcome depends on the rather subjective choice of research design and control set. Frankly, this level of variance in the outcome means that a dishonest researcher could custom her or his results in virtually any direction by tweaking the modelling and variable selection. The general conclusion is thus that the results can not be seen as robust, and caution should be taken during interpretation.

With that said, given the research design and control set that was chosen the final answer to our research question still has to be, and is, that we do not find that BLER leads to lower risk in firms. Based on the theoretical framework and the empirical findings, we arrive at eight different hypotheses to explain this unexpected finding. These have already been discussed at length above, but are listed in a more concise form below for clarity.

1. Employee representatives are more risk-averse than shareholder elected board members, but lack influence on the board.

2. Employee representatives have influence on the board, but they are not more risk-averse than shareholder elected board members.

3. Diversity on the board leads to lower risk, but BLER does not increase diversity.

4. BLER leads to increased diversity, but diversity on the board does not lead to a decreased risk preference.

5. Employee representatives do not represent the labour force, instead they vote with the shareholder elected members to build personal relationship capital.

6. Employee representatives lacks the competence to adequately evaluate, and hence impact, risk

7. CEO and BLER presence on the board are substitutes due to similar firm-specific knowledge, and both lead to lower risk, but the effect of the former overshadows the latter.

8. BLER impacts an operational measure, such as leverage, R&D or capital expenditures, which in turn affect firm risk. Hence, an alternative research design examining these interaction effects would be needed to identify the explicit effect of BLER.

6

Conclusions and implications

This chapter concludes the report by re-iterating the main findings, tying them back to the theoretical framework, and contrasting them to previous studies. Secondly, the economical and political implications of the results are discussed together with a description of the study's contribution to the literature. Finally, suggestions for future research directions are provided to extend the insights gathered through this study.

6.1 Findings related to risk and BLER

Based on financial theory, ill-diversified and rational employees should favour risk-reducing policies when given a vote in the board room. Secondly, agency theory posits that employees would act as bondholders, which further strengthens this statement. Importantly, this is the conclusion drawn by Lin et al. (2021), which is the most closely related study to date. Hence, this study thus hypothesised (H1) that the total risk in firms with BLER should be decreased. Due to the employees' superior firm-specific knowledge, the authors more specifically posits that employee representation primarily reduces risk through decisions in close relation to operations. Hence, the second hypothesis (H2) was that BLER leads to reduced idiosyncratic risk. However, the study did not find sufficient statistical evidence to support either of these claims, and hence the hypotheses were rejected. Support for the third hypothesis (H3) was found however, which stated that BLER does not have any impact on systematic risk. The authors argue that due to the documented (e.g (Jäger et al., 2021a; Blandhol et al., 2021)) limited de facto influence on strategical matters that employees are permitted in the board room, they lack the ability to influence systematic risk. In fact, the authors argue that this limited influence might be the reason to why H1 and H2 were also rejected.

The fourth, fifth and sixth hypothesis (H4-H6) extended the study to elaborate on the suspicion of limited influence. More specifically, the authors hypothesised that the effect of BLER would be stronger if employees were allocated a higher ratio of votes in the board room. This should be contrasted to the binary case investigated in H1-H3, which only captures exposure effects. The authors argue that limited de facto influence could be countered by the stronger de jure influence caused by additional votes. Hence, this study hypothesised that increased BLER concentration on the board leads to reduced total risk (H4) and idiosyncratic risk (H5). However, the study did not find sufficient statistical evidence to support either of these claims, and hence the hypotheses were rejected. The last hypothesis (H6) stated that even if the BLER concentration was increased, they would still be incapable of impacting systematic risk. The results of the study supported this hypothesis. A potential reason for why BLER concentration did not turn out to be a significant determinant for any of the three risk measures could be that the employees were in a minority in all samples, and hence the shareholder elected board might still be able to overlook the unions interests. Another mechanism that complicates the inference is that the introduction of more employees also alters the human capital of the board, which has implications for board efficiency and perspective diversity. Previous literature has found inconsistent implications for risk in relation to such corporate governance traits. Hence, if the study's set of controls fails to capture all these complex social effects, the omitted variable bias would lead to skewed misinterpretations of the results, potentially clouding the true causality.

6.2 Implication and contribution

To the author's best knowledge, the study is the first to study if BLER has a direct and causal effect on firm risk. Several previous studies have argued the opposite: that risk is a precursor to employee appointment to the board. Hence, this study provides a natural extension of this line of reasoning. In fact, the study finds that BLER is not significantly related to risk in either of the two causal directions, thus directly questioning the validity of said previous research designs. In addition, the study contributes to the growing body of literature related to corporate governance, board diversity, and board efficiency.

Moreover, the study highlights that the political goal of increased codetermination thanks to increasing levels of BLER might have limited real-world effect. Although ample theoretical arguments exist to support that employees in the board room should help reduce the firm's risk to the benefit of the labour force, this effect is not seen, which indicates that it is a de jure and not a genuine gesture. In other words, if unions wish to protect the workers, they might have to consider other avenues than pushing for more board-level representation - at least not in the current form.

Besides the political aspects, the study has real financial implications. Opponents to BLER have suggested that the employees would bereave shareholders of value based on the argument that they would not vote in line with traditional wealth maximisation objectives. Although this study can not conclusively say whether this is not the case in general, it can at least state that employees are not able to reduce the idiosyncratic risk of the firm (which would have been at the expense of the shareholders, since they do not bear this risk and hence it is free). On the flip-side, the labour force has to bear excessive risk - at the detriment of their private finances.

It is worth mentioning that although the study is unable to confirm that BLER leads to lower risk, it still found partial results to indicate that the conclusion might be dependent on the research design. Most importantly, the study found that it was possible to get polar-opposite results by slightly altering the set of control variables in the regression. This highly sensitive behaviour signals that the research design is not robust, and hence all inherently subjective choices of control variables carries a risk of biased inference. This highlights an important drawback of empirical studies since researchers might steer the results in a desired direction by omitting and adding variables as they see fit. A direct implication of this is that seemingly similar studies would produce different results, making bench-marking and comparison difficult. A plausible scenario is that union-sponsored research would yield very different results compared to a study carried out by a politician that favours free and unregulated markets, for example.

6.3 Suggested future research

Given the ambiguity of the findings, due to the research design being non-robust, future repeated studies on other data sets should be carried out to complement and clarify these findings. The authors suggest using, for example, data from the other European countries with BLER legislation in place.

Moreover, the study hypothesised that employees influence total risk primarily through idiosyncratic risk. This mechanism was assumed to be driven through operational risk. However, this explicit link was never tested. A subsequent study could thus explicitly study whether BLER impacts operational risk, which would help shine a light on how employees impact the overall company risk profile (if they, in fact, do so).

Finally, in Section 5.5 the authors explicate eight alternative hypotheses as to why the study failed to support that employee representation leads to lower risk. All of these topics merit further scrutiny to better understand the complex BLER-risk interplay.

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Appendix

A.1 Results from the regressions on unlagged risk

Table A.1 and Table A.2 shows the results from the second stage regression for *ERBinary* and *ERRatio*, respectively, when an unlagged dependent variable is used instead. These results are discussed in depth in Section 5.4.3.

Table A.1: Results from the second multiple linear regression model used in the second Heckman stage, but using the same-year risk response. The main independent variable *ERBinary* is regressed against the three different risk measures.

Heckman Second Stage: Risk in relation to ERBinary (without lagging risk)

Dependent	*Sd1Y*			*Idiosyncratic Risk*			*Beta*		
	Coefficient	t-score	p-value	Coefficient	t-score	p-value	Coefficient	t-score	p-value
ERBinary	-0.772	-1.39	0.166	-0.706	-1.28	0.202	-0.017	-0.89	0.372
MtB	-0.029	-0.38	0.706	-0.064	-0.86	0.391	0.009***	3.16	0.002
IPOage	1.224*	1.77	0.078	1.318*	1.95	0.051	-0.022	-0.83	0.405
Size	-0.624*	-1.87	0.062	-1.269***	-3.89	0.000	0.128***	12.03	0.000
ROA	-17.515***	-3.98	0.000	-17.642***	-4.08	0.000	0.459***	3.07	0.002
Sd5Y	0.262***	8.31	0.000	0.242***	7.80	0.000	0.006***	7.06	0.000
LEV	7.549***	4.39	0.000	8.588***	5.06	0.000	-0.209***	-3.81	0.000
IndepDir	-4.922***	-3.60	0.000	-4.688***	-3.51	0.000	-0.079	-1.54	0.125
AuditC	1.620**	2.55	0.011	1.436**	2.29	0.022	0.003	0.14	0.890
R_D	4.054	0.78	0.435	4.825	0.94	0.347	-0.051	-0.34	0.733
Big4	-1.340	-1.04	0.298	-1.372	-1.07	0.286	0.082	1.32	0.187
Loss4Y	1.360**	2.27	0.023	1.125*	1.93	0.054	0.055**	2.42	0.015
FREQ	318.853	1.46	0.144	316.303	1.50	0.133	0.922	0.51	0.608
FemDir	-2.459	-1.16	0.246	-2.722	-1.31	0.192	0.153*	1.94	0.052
BoardSize	0.091	0.44	0.663	0.050	0.24	0.811	0.018**	2.42	0.015
CAPEX	-10.066	-1.10	0.271	-11.903	-1.34	0.181	0.557*	1.76	0.079
Dividend	-5.990***	-7.87	0.000	-5.994***	-8.02	0.000	-0.050**	-2.00	0.046
SalesG	-0.028	-0.06	0.952	-0.008	-0.02	0.987	0.004	0.21	0.835
Ownership	1.550	0.92	0.356	2.538	1.54	0.124	-0.279***	-5.09	0.000
CEOBoard	-1.546***	-2.80	0.005	-1.761***	-3.24	0.001	0.008	0.37	0.714
invmills	2.050*	1.96	0.050	1.675	1.63	0.103	0.094***	2.70	0.007
Intercept	26.630***	5.61	0.000	31.130***	6.62	0.000	-0.367**	-2.21	0.027
Year effects	Yes			Yes			Yes		
Industry effect	Yes			Yes			Yes		
R-Squared	0.566			0.580			0.378		
Adj. R-Squared	0.557			0.572			0.365		
Prob > F	0.000			0.000			0.000		
F-score	43.504			46.442			32.334		
N	2038.000			2038.000			2038.000		

Table A.2: Results from the second multiple linear regression model used in the second Heckman stage, but using the same-year risk response. The main independent variable *ERRatio* is regressed against the three different risk measures.

Heckman Second Stage: Risk in relation to ERRatio (without lagging risk)									
Dependent	*Sd1Y*			*Idiosyncratic Risk*			*Beta*		
	Coefficient	t-score	p-value	Coefficient	t-score	p-value	Coefficient	t-score	p-value
ERRatio	-3.271	-1.40	0.162	-2.858	-1.23	0.220	-0.091	-1.15	0.251
MtB	-0.029	-0.38	0.701	-0.065	-0.86	0.389	0.009***	3.15	0.002
IPOage	1.231*	1.77	0.076	1.324*	1.96	0.051	-0.022	-0.82	0.412
Size	-0.602*	-1.79	0.074	-1.252***	-3.81	0.000	0.129***	12.07	0.000
ROA	-17.584***	-3.99	0.000	-17.698***	-4.09	0.000	0.456***	3.06	0.002
Sd5Y	0.262***	8.30	0.000	0.242***	7.79	0.000	0.006***	7.07	0.000
LEV	7.490***	4.34	0.000	8.540***	5.00	0.000	-0.211***	-3.85	0.000
IndepDir	-4.945***	-3.61	0.000	-4.705***	-3.51	0.000	-0.080	-1.55	0.120
AuditC	1.611**	2.54	0.011	1.425**	2.28	0.023	0.003	0.14	0.886
R_D	4.037	0.78	0.437	4.813	0.94	0.348	-0.052	-0.35	0.728
Big4	-1.336	-1.04	0.299	-1.368	-1.07	0.287	0.082	1.32	0.186
Loss4Y	1.361**	2.28	0.023	1.123*	1.93	0.054	0.055**	2.45	0.014
FREQ	319.906	1.47	0.143	317.203	1.51	0.132	0.955	0.53	0.596
FemDir	-2.380	-1.12	0.262	-2.656	-1.27	0.204	0.156**	1.98	0.048
BoardSize	0.054	0.26	0.798	0.017	0.08	0.936	0.017**	2.28	0.023
CAPEX	-9.667	-1.06	0.290	-11.623	-1.31	0.191	0.579*	1.83	0.068
Dividend	-5.986***	-7.86	0.000	-5.990***	-8.02	0.000	-0.050**	-1.99	0.046
SalesG	-0.034	-0.07	0.943	-0.012	-0.03	0.980	0.004	0.20	0.843
Ownership	1.544	0.92	0.358	2.526	1.53	0.126	-0.278***	-5.08	0.000
CEOBoard	-1.553***	-2.80	0.005	-1.767***	-3.24	0.001	0.007	0.36	0.721
invmills	2.066**	1.97	0.049	1.694*	1.65	0.100	0.094***	2.69	0.007
Intercept	26.680***	5.61	0.000	31.175***	6.62	0.000	-0.365**	-2.21	0.028
Year effects	Yes			Yes			Yes		
Industry effect	Yes			Yes			Yes		
R-Squared	0.566			0.580			0.378		
Adj. R-Squared	0.557			0.572			0.366		
Prob > F	0.000			0.000			0.000		
F-score	43.566			46.521			32.398		
N	2038.000			2038.000			2038.000		

A.2 Results from the VIF analysis

Table A.3 shows the VIF scores from the two main regressions, as discussed in depth in Section 5.4.8.

Table A.3: VIF scores for the two main regressions in the second Heckman stage. The results are only shown for the full model against *Sd1Y*. Hence, the results are complementary to the entries in Table 4.2 and Table 4.3, respectively.

VIF main regression: Sd1Y		
	Sd1Y vs. ERBinary	*Sd1Y vs. ERRatio*
	VIF score	**VIF score**
ERBinary	1.63	
ERRatio		1.61
MtB	1.56	1.56
IPOage	1.56	1.56
Size	8.93	9.06
ROA	1.76	1.76
Sd5Y	2.17	2.17
LEV	1.51	1.52
IndepDir	2.14	2.14
AuditC	1.54	1.54
R&D	1.73	1.73
Big4	1.13	1.13
Loss4Y	2.32	2.32
FREQ	1.17	1.17
FemDir	1.58	1.58
BoardSize	2.28	2.30
CAPEX	1.90	1.91
Dividend	2.05	2.05
SalesG	1.13	1.13
Ownership	2.13	2.13
CEOBoard	1.97	1.97
invmills	12.11	12.07
Year		
2007	1.84	1.84
2008	2.01	2.01
2009	2.03	2.03
2010	2.03	2.03
2011	2.09	2.09
2012	2.28	2.28
2013	2.39	2.39
2014	2.26	2.26
2015	2.32	2.32
2016	2.50	2.50
2017	2.62	2.62
2018	2.73	2.74
Industry		
5	1.73	1.74
6	1.29	1.29
7	1.26	1.26
8	9.48	9.52
9	1.41	1.41
11	1.93	1.93
Mean VIF	2.52	2.53