

When Owners Take Control

How Ownership Structure Shapes Financial Distress in Private SMEs

Authors

Emilio Martinez

Wiktor Granat

Supervisor

Katerina Hellström

Examinator

Holmer Kok

Submitted

May 19, 2026

Stockholm School of Economics

Retail Management Program

Abstract

Financial distress is becoming increasingly relevant as insolvencies continue to rise globally. While prior research examines how ownership structure relates to financial distress, much of this research focuses on publicly listed companies. To bridge this gap, this report examines how ownership concentration and owner involvement in management are associated with the probability of financial distress in private Small and Medium-sized Enterprises (SMEs). Building on agency theory, we hypothesize that ownership concentration is associated with a higher probability of financial distress, while owner involvement in management is associated with a lower probability of financial distress. We also examine whether the relationship between owner involvement in management and financial distress depends on the level of ownership concentration. Using a panel dataset of 4438 UK private independent SME manufacturing firms covering the period 2018-2025, and applying logistic regression models, we find that owner involvement in management is associated with a lower probability of financial distress, with no evidence that this association changes depending on the level of ownership concentration. Ownership concentration is not associated with financial distress in the full sample. However, when removing observations where the largest owner owns 100% of the firm, we find that higher ownership concentration is associated with a lower probability of financial distress, contrary to our hypothesis. Based on these findings, we discuss how agency theory mechanisms may operate differently in private SMEs than in listed firms and highlight the need for further research on ownership structures, agency problems, and financial distress in private firms.

Keywords: Agency Theory, Bankruptcy, Financial Distress, Private SMEs, Ownership Concentration, Owner Involvement in Management

Acknowledgments

We would like to say a special thank you to our supervisor Katerina Hellström. She spent a lot of time and effort into helping us approach our thesis in the right way and was always fast at answering any questions we had. When we struggled, she helped us find the right direction and approach our work with greater clarity and confidence.

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1. Introduction

1.1 Background

Corporate insolvencies, which occur when firms are unable to meet their financial obligations, have risen steadily in recent years. However, there are limited signs that this trend is slowing down. Allianz's Global Insolvency Index, measuring the developments in corporate insolvency rates, indicated that global insolvencies grew by 10% in 2024, 6% in 2025, and are expected to grow by further 6% in 2026. This trend is particularly pronounced in the Eurozone, where insolvency rates surged by 19% in 2024 (Allianz Research, 2025; Allianz Research, 2026). Contributing to the growing insolvency rate are primarily rising interest rates and heightened economic uncertainty, which place substantial financial pressure on firms. However, the consequences of the growing corporate insolvencies extend far beyond the financial losses experienced by the firms themselves. Insolvencies may also destabilize society by increasing the risk of unemployment. The rising rate of insolvencies has already put 2.1 million jobs at risk in 2025 and will put another 2.2 million at risk in 2026 (Allianz Research, 2025; Allianz Research, 2026). Yet, the annual growth in global insolvencies cannot solely be explained through a macroeconomic perspective.

Understanding what drives insolvency at a firm level is therefore equally important. Prior empirical studies have linked weak profitability, capital structures, and constrained liquidity with the risk of financial distress and bankruptcy, both of which, like corporate insolvency, reflect a firm's inability to meet its financial obligations (Altman, 1968; Ohlson, 1980; Zmijewski, 1984; Shumway, 2001; Chava & Jarrow, 2004). Beyond financial metrics, research also shows that ownership structures play a role in determining a firm's performance and the ability to meet its financial obligations (Gogineni et al., 2022; Udin et al., 2017; Gerged et al., 2023). Higher ownership stakes, for instance, have been associated with reduced firm profitability, as dominant shareholders may pursue personal interests at the expense of the firm's operating performance (Gogineni et al., 2022). Similarly, when ownership and management overlap, firm performance is also influenced. When managers hold an ownership stake in the firm, their own financial outcomes become more directly tied to firm performance. This incentivizes a more careful and long-term decision-making approach and alignment of their interests with those of the firm, which research suggests decreases the probability of financial distress (Jensen & Meckling, 1976; Donker et al., 2009).

While prior research has established links between ownership structures and financial distress, this work has largely focused on publicly listed firms (Donker et al., 2009; Udin et al., 2017; Gerged et al., 2023). Private Small and Medium-sized Enterprises (SMEs), however, represent a critical yet overlooked context. In fact, SMEs account for 60% of employment and generate around 50-60% of the value added on average within the OECD area (OECD, 2017). Given the rising number of jobs at risk due to corporate insolvencies and the fact that SMEs account for a high proportion of employment, corporate insolvencies in this sector have a significant impact on economic stability and employment (OECD, 2017). Despite this, the relationship between ownership concentration, owner involvement in management, and financial distress within private SMEs remains empirically underexplored. To bridge this gap, this study examines the relationship between the largest owner's ownership concentration, owner's involvement in management, and financial distress in private SMEs.

1.2 Purpose

The purpose of this study is to further advance the understanding of how ownership structures relate to the probability of financial distress. As existing research has predominantly been conducted on publicly listed firms, despite the economic significance of private SMEs, this study aims to extend the existing literature by examining the relationship within a private firm setting. More specifically, the study examines whether the largest-owner's ownership concentration and the largest-owner's involvement in management are associated with financial distress. The study further examines whether the relationship between owner involvement in management and financial distress depends on ownership concentration level of the largest shareholder. This leads us to the following research questions:

RQ1: Is the ownership concentration of the largest shareholder associated with the probability of financial distress in private SMEs?

RQ2: Is owner involvement in management associated with the probability of financial distress in private SMEs, and does this relationship depend on the ownership concentration of the largest shareholder?

1.3 Contribution

This study aims to contribute to previous literature by further examining the relationship between ownership structures and financial distress in three different ways. First, it contributes to the mixed literature on ownership structures and financial distress, where prior research provides a two-folded view. Some argue that ownership concentration reduces distress risk, while others argue it increases it. By examining the relationship between ownership concentration and financial distress, this study aims to provide additional evidence to the two-sided debate.

Second, this study contributes by moving beyond ownership concentration alone and incorporating owner involvement in management as a distinct dimension of ownership structure. Rather than treating these as separate mechanisms, the study also examines whether the relationship between owner involvement in management and financial distress depends on the ownership concentration of the largest shareholder. This provides a clearer understanding of how the overlap between ownership and managerial authority relates to financial distress.

Lastly, by focusing on private SMEs, this study extends existing research on the relationship between ownership structures and financial distress beyond the publicly listed firm context. Despite most research being made on this topic in a public firm setting, private SMEs, representing the majority of employment and value added across OECD economies, remain underrepresented in literature. Due to its macroeconomic relevance, adding research within the gap can deepen the understanding of how ownership structures in private firm settings relate to jobs at risk and broader economic outcomes. Through this study, we contribute to the growing body of literature aimed to generalize findings from publicly listed firms to the economically important private-firm landscape.

1.4 Delimitations

To ensure feasibility and conceptual clarity, we have established three core delimitations. First, this study is delimited to independent private SMEs. Independent SMEs are enterprises that are not controlled by another enterprise and do not themselves control another enterprise (European Commission, 2003). As OECD (2019) highlights, SMEs differ not only by size, but also by ownership, control, financial conditions, and productivity, making the distinction conceptually important. Notably, independent firms differ from dependent firms in that they are not part of a broader corporate group. As a result, ownership and control are not mediated

through pyramid ownership or cross-holdings, where ultimate owners may influence firm decisions indirectly through other groups (OECD, 2019; Claessens et al., 2000).

Second, the study is delimited to the United Kingdom (UK) as a specific geographic context. The UK is particularly suitable for this study due to its extensive transparency of publicly filed financial statements through the Companies House (Companies House, 2026a), which is uncommon in many other European countries.

Lastly, to maintain comparability across the sample, this study is delimited to the manufacturing industry. Limiting the study to a specific industry helps reduce heterogeneity and increase comparability across the study. Since this study examines the probability of financial distress, consistency across financial statements is important. Selecting firms from the same industry improves comparability, as firms operating in homogeneous industries are facing similar economic events, which tends to produce more comparable financial statements (De Franco et al., 2011).

1.5 Disposition

The study moves from theoretical background to empirical evidence and conclusions, divided across seven sections. Following the introduction and research questions, Section 2 develops the theoretical foundation of the thesis by reviewing literature on financial distress, agency theory, ownership concentration, owner involvement in management and corporate governance theory. This provides an overview of previous research and forms the basis for the hypotheses. Section 3 presents the method used throughout the study, covering data collection, sample construction, outlier treatment, and regression models. Section 4 presents the empirical analysis, including descriptive statistics, correlation diagnostics, full-sample regression results, an additional analysis excluding observations with 100% ownership, and robustness checks. Section 5 discusses the findings in relation to the theoretical framework and previous research, which is later concluded in Section 6. Finally, Section 7 presents the limitations of the study and proposes directions for future research.

2. Literature review and hypothesis development

2.1 Literature review

2.1.1 Bankruptcy and financial distress

Bankruptcy refers to a legal situation a firm enters when it is permanently unable to meet its financial obligations. In such situations, insolvency laws govern formal procedures under their national legal frameworks (Armour et al., 2008). In the UK, this process is regulated by the Insolvency Act, which provides a legal framework for dealing with firms that are unable to repay their debts (Insolvency Act, 1986). Beyond the legal dimension, bankruptcies carry significant consequences for all stakeholders involved, including potential losses for creditors and employees facing job losses (Huynh et al., 2017; Branch, 2002). For this reason, a large part of the literature examines broader concepts indicating poor firm performance prior to bankruptcy, including default risk (Ciampi et al., 2021), liquidity shortage (Saridakis et al., 2012), credit risk (Altman & Saunders, 1997), and risk of financial distress (Udin et al., 2017; Gerged et al., 2023).

Notably, bankruptcy is not solely determined by a firm's underlying financial conditions but may also be influenced by managerial and owner incentives. Owners may strategically accelerate or postpone bankruptcy to a time horizon that suits them best (Adler et al., 2013). As a result, trying to find correlations or patterns in bankruptcy can be unreliable, as subjective external variables play a pivotal role in determining the timing of bankruptcy. However, as bankruptcy only represents the final stage of firm failure, it fails to capture the entire deterioration process, as many firms may experience financial weakness long before they file for bankruptcy (Shumway, 2001).

Financial distress, encompassing the deterioration process before formal bankruptcy proceedings are required, has therefore emerged as a broader concept in research on poor firm performance (Udin et al., 2017; Gerged et al., 2023). This makes it one of the most commonly used metrics for identifying firms at greater risk of bankruptcy before filing formal proceedings. However, financial distress lacks a universally accepted definition in the literature and is often measured using different key indicators depending on the study's purpose and context. For instance, Jostarndt & Sautner (2008) define a firm as financially distressed when, in any of two consecutive years, it has greater interest expense than EBIT, while Whitaker (1999) defines financial distress as the first year where a company's cash flows are lower than its current maturities of long-term debt.

Because financial distress can be operationalized in multiple ways, many studies have been relying on model-based approaches aimed at using financial and/or performance metrics to identify firms that are at risk of bankruptcy (Altman, 1968; Ohlson, 1980; Zmijewski, 1984; Shumway, 2001; Chava & Jarrow, 2004). The Altman Z-score (Altman, 1968) is one of the earliest and most widely used bankruptcy prediction models. It uses several different financial statement data to create a single score (Z-score) that can be used to classify firms as either being financially healthy or at risk of bankruptcy. Ohlson (1980) introduces the logistic regression-based model that differs from the Altman Z-score by providing a probabilistic interpretation of the binary outcome (bankruptcy). In turn, instead of generating a discriminant score (Z-score), the Ohlson model estimates the probability of bankruptcy, using accounting-based variables. Similar to Ohlson (1980), Zmijewski (1984) developed a probabilistic model of failure risk and argued that bankruptcy prediction models may be affected by methodological issues such as sample-selection bias. Finally, Shumway (2001) introduced a hazard-based model that, instead of focusing on a single period, views bankruptcy prediction as a time-dependent process, in which the risk of bankruptcy evolves over time, suggesting that static methods may produce inconsistent estimates. While these bankruptcy prediction models rely exclusively on financial variables to predict the risk of financial distress, modern empirical studies often include soft measures such as board composition and ownership structure when explaining financial distress and bankruptcy (Elloumi & Gueyié, 2001; Daily & Dalton, 1994a).

2.1.2 Variables impacting bankruptcy and financial distress

While the preceding models provide tools for measuring financial distress, understanding what drives firms towards distress in the first place requires examining the variables associated with firm failure. Historically, extensive research has examined the key financial, operational, and governance-related factors associated with bankruptcy and financial distress. Prior literature has consistently shown that weak profitability, strained liquidity, high leverage, and limited cash flow capacity are closely related to the risk of financial distress and bankruptcy (Altman, 1968; Ohlson, 1980; Zmijewski, 1984; Shumway, 2001; Chava & Jarrow, 2004). At the same time, other research shows that financial variables are not the only cause of firm failure.

From an operational perspective, Hua et al. (2011) argue that bankruptcy can be caused by interaction with other firms in a supply chain network, where operational decisions (e.g., pricing, order allocation, and competitive behavior) create financial pressure on firms. Strategic

capabilities have also been linked to bankruptcy, where Mazaheri et al. (2023) argue that one of the most common intangible factors of bankruptcy in publicly listed firms is the inability to reduce the size of a company when they become too large and asset-heavy for its current market position, business cycle, and product life cycles.

Beyond operational and financial factors, corporate governance, the mechanisms and systems through which a firm is directed and managed, has also been recognized as a significant determinant of distress risk and bankruptcy. Daily & Dalton (1994b) show that CEO duality, in which the same person serves as CEO and board chair, is associated with higher bankruptcy risk, as this structure may weaken the board's ability to monitor management effectively. Gales & Kesner (1994) further showed that firms approaching bankruptcy tend to reduce the number of outside directors and overall board size, and that bankrupt firms significantly differ in board structure relative to comparable non-bankrupt firms. Similarly, governance characteristics such as smaller boards, greater board independence, and higher insider-director ownership, have a significant negative effect on a firm's risk of financial distress or bankruptcy (Fich & Slezak, 2008).

2.1.3 Agency Theory

An established theoretical framework closely connected to financial distress is agency theory. Agency theory explains how conflicts of interest arise from the separation of ownership and control, focusing on the relationships between shareholders, managers, and the board of directors (Fama & Jensen, 1983). The theory is structured around two central parties: the principal and the agent. The principal is commonly defined as the owner or shareholder of the firm, while the agent is a manager of the firm hired on behalf of the principal. The principal enters a contractual relationship with the agent, where the agent receives decision-making authority to perform service(s) on behalf of the principal (Jensen & Meckling, 1976). Within agency theory, conflicts are often distinguished through two main dimensions: vertical and horizontal agency problems. Vertical agency problems arise between the owner and manager (principal-agent) and are often linked to the separation of ownership and control. Horizontal agency problems arise between controlling and minority shareholders (principal-principal) and are linked to unequal ownership and control among owners (Gogineni et al., 2022).

2.1.3.1 Vertical Agency problems

Vertical agency problems arise when ownership and control are separated, implying that the firm is not fully owner-managed. In such settings, a distinction between decision management and decision control emerges. Owners typically delegate decision management to managers, giving them authority over the implementation of decisions, whereas decision control is typically retained by owners or boards to monitor those decisions. Consequently, owners bear the economic consequences of decisions they do not directly control (Fama & Jensen, 1983). This separation of ownership and control often creates a conflict between the principal and the agent, as both parties act as individual utility maximizers whose interests may not align. Such separation also gives rise to information asymmetry, as managers develop superior knowledge about the firm's operations relative to the owners. Managers may therefore act in their own interests rather than those of the owners, giving rise to opportunistic behavior, prioritizing decisions that benefit themselves over those that maximize firm value for the principal (Jensen & Meckling, 1976).

While vertical agency problems are often associated with large public firms, they also exist within private firms, despite their typically concentrated ownership structures (Berle and Means, 1932; Jensen & Meckling, 1976; Gogineni et al., 2022). This is important, as it implies that private ownership and concentrated ownership structures do not automatically eliminate conflicts between principals and agents. At the same time, Gogineni et al. (2022) find that overall agency costs are higher in comparable public firms than in private firms.

2.1.3.2 Horizontal Agency problems

Horizontal agency problems represent another form of agency conflict, where problems stem from conflicting interests between owners. These problems arise when ownership is highly concentrated around a single shareholder, granting them enough control to influence firm decisions at the expense of minority shareholders (Gogineni et al., 2022). In such situations, the controlling shareholder might use its position to extract private benefits, pursue strategies that primarily benefit themselves, or try to undermine the position of smaller shareholders. Claessens et al. (2002) describe this as the entrenchment effect.

Horizontal agency problems may also be particularly prevalent in private firms. Gogineni et al. (2022) show that they occur in the majority of nonsingle-owner private firms, where unequal ownership structures might allow controlling shareholders to exploit minority

shareholders. Similarly, Nagar et al. (2011) argue that majority ownership in private firms makes it easier for the controlling shareholder to pursue private benefits at the expense of other shareholders. Compared to publicly listed SMEs, private SMEs also face higher information asymmetry and stronger financing constraints, making them more financially vulnerable (Gupta & Gregoriou, 2018).

The severity of horizontal agency problems also depends on whether the controlling shareholder is monitored by other owners. Gogineni et al. (2022) and Pagano & Röell (1998) argue that the presence of more than one large shareholder, where the gap between the largest and the second largest shareholder is small, can limit the largest shareholder's ability to exploit their dominant position for private benefits. Similarly, Gogineni et al. (2022) find that, while horizontal agency problems persist when a second large shareholder is present, these agency costs are significantly lower in situations where ownership is concentrated around a single dominant shareholder.

2.1.3.3 Corporate governance as a solution to agency problems

To mitigate agency problems, corporate governance is a commonly implemented mechanism that monitors agents to ensure they act in shareholders' best interests. It is established internally within the firm to ensure that agents fulfill their contractual obligations toward principals, prioritizing shareholders' interests over their own (L'Huillier, 2014; Jensen & Meckling, 1976).

One corporate governance mechanism commonly referenced in research is the board of directors (L'Huillier, 2014). The board of directors acts as an information mechanism controlling managerial behavior. This function enables principals to monitor and verify agents' behavior and decision-making, making it less likely that agents act opportunistically and more likely that they behave in the interests of the principal (Eisenhardt, 1989).

2.1.4 Owner-related agency mechanisms and financial distress

The preceding sections have outlined how agency problems may arise through conflicts between owners and management, as well as between owners. Building on this literature, this section reviews how the study's two owner-related variables, ownership concentration and owner involvement in management, may relate to financial distress through these agency-theory mechanisms.

2.1.4.1 Ownership concentration and financial distress

In literature on ownership structure, concentration is commonly measured by either the equity held by large blockholders or the ownership share held by the largest owner of the firm (Manzaneque et al., 2016; Gerged et al., 2023; Gryko et al., 2024; Aluchna & Kaminski, 2017). From an agency theory perspective, ownership concentration is important since it determines both the incentives and the ability of the largest shareholder to influence firm decisions (Shleifer & Vishny, 1997).

From a theoretical standpoint, the relationship between ownership concentration and financial distress is ambiguous. On the one hand, concentrated ownership may strengthen monitoring incentives as large shareholders bear a greater share of the firm's financial outcomes and may therefore have a stronger incentive to monitor management, preserve firm value, and reduce managerial opportunism (Shleifer & Vishny, 1997). On the other hand, concentrated ownership could also increase horizontal agency problems between controlling and minority shareholders. As discussed in section 2.1.3.2, this can occur when a dominant shareholder gains enough control to influence firm decisions at the expense of minority shareholders. Claessens et al. (2002) analyse this relationship by distinguishing between the incentive- and entrenchment effects of large ownership. In their research, they argue that while larger cash-flow rights may align the controlling shareholder's interest with firm value, excessive controlling ownership may cause horizontal agency problems through entrenchment effects. Consistent with this mechanism, Gogineni et al. (2022) found that horizontal agency problems are associated with weakened operating performance, measured through proxies such as sales-to-asset, operating expenses-to-sales, and EBITD. This is particularly relevant since both operating performance and profitability are closely linked to financial distress risk (Jostarndt & Sautner, 2008).

This theoretical ambiguity is also reflected in previous empirical research on the direct relationship between ownership concentration and financial distress. Manzaneque et al. (2016), studying Spanish listed firm, find no statistically significant relationship between ownership concentration and financial distress, arguing that large owners might act as passive monitors or may lack incentives to prevent financial distress. In contrast, Gerged et al. (2023), studying UK FTSE 350 (index of the 350 largest publicly listed firms on the London Stock Exchange) manufacturing firms, find that ownership concentration is positively associated with financial

distress. They argue that this is driven by the entrenchment effect, where ownership concentration may give dominant shareholders greater ability to pursue private benefits at the expense of minority shareholders. Related evidence from research on firm performance also points towards entrenchment effects, where Gryko et al. (2024), studying Polish listed firms, find that ownership concentration by the largest shareholder is associated with lower firm performance.

2.1.4.2 Ownership-management overlap and financial distress

In agency theory, vertical agency problems arise when decision-making authority is separated from the economic consequences of those decisions (Fama & Jensen, 1983). In some firms, however, the owner may also hold a managerial role, implying that decision-making authority and economic consequences are held by the same individual.

Much of the related literature examines this mechanism through managerial ownership. Jensen & Meckling (1976) argue that when managers hold an equity stake (owner-manager), they bear a greater consequence of the firm's financial performance, which might reduce the incentives to pursue opportunistic behaviour. In financial distress literature, Donker et al. (2009) find that high levels of managerial ownership reduce the probability that a firm becomes financially distressed. They argue that this is caused by the alignment effect, in which managerial ownership aligns managers' incentives with those of shareholders.

However, the relationship between managerial ownership and firm outcomes should not be treated linearly. Morck et al. (1988) show that managerial ownership can create both alignment and entrenchment effects. In their study, they show that firm value increases as managerial ownership rises from 0-5%, decreases between 5-25%, and increases again at ownership levels above 25%. They interpret these results as suggesting that managerial ownership align managers' interests with shareholders at some ownership levels, while increasing entrenchment at others. This suggests that overlapping ownership and management may reduce vertical agency problems, but that the relationship depends on the level of ownership.

2.2 Hypothesis Development

As shown in our literature review, ownership concentration can affect financial distress through different agency-theory mechanisms. While some literature suggests that ownership concentration can reduce vertical agency problems through stronger monitoring and aligning owners' incentives with firm value (Shleifer & Vishny, 1997), other studies emphasize that concentrated ownership can create horizontal agency problems through entrenchment and minority shareholder expropriation (Claessens et al., 2002; Nagar et al., 2011; Gogineni et al., 2022).

In this study, the horizontal agency mechanism is expected to be particularly relevant, since the sample consists of private independent SMEs, where ownership and control may be closely linked. Prior literature suggests that horizontal agency problems may weaken operating performance, which is closely related to financial distress risk (Gogineni et al., 2022; Jostarndt & Sautner, 2008). This expectation also aligns with Gerged et al. (2023), who find that ownership concentration is positively associated with financial distress in UK-listed manufacturing firms. Therefore, we hypothesize:

H1: In private SMEs, a higher ownership share held by the largest shareholder is associated with a higher probability of financial distress

When decision-making authority is separated from the economic consequences of those decisions, vertical agency problems may arise, creating incentives for managers to act in their own interests rather than those of the firm (Fama & Jensen, 1983). Owner involvement in management may reduce this separation, as the largest owner then has both decision-making authority and direct exposure to the financial consequences of those decisions. Related research on this topic suggests that this overlap may reduce opportunistic behaviour by aligning managerial incentives more closely to economic consequences (Jensen & Meckling, 1976). In alignment with Donker et al. (2009), who found that managerial ownership is reduced with a lower risk of financial distress, we hypothesize:

H2: In private SMEs, owner involvement in management is associated with a lower probability of financial distress.

While H2 expects owner involvement in management to reduce the probability of financial distress, this relationship may depend on the ownership share held by the largest shareholder. As Morck et al. (1988) show, the relationship between managerial ownership and firm outcomes is non-linear, causing both alignment and entrenchment effects. The association between owner involvement in management and financial distress may therefore depend on the level of ownership concentration. Thus, we hypothesize:

H2a: *The relationship between owner involvement in management and financial distress is moderated by the ownership concentration of the largest shareholder*

3. Method

3.1 Data collection

This study is based on a panel dataset of UK independent SME manufacturers covering the period 2018-2025. Previous research on variables impacting financial distress often uses panel data since it decreases the risk of estimation biases and lowers the severity of multicollinearity (Udin et al., 2017; Gerged et al., 2023). To collect the data, we utilize two primary sources: *Valu8* and *Orbis*. *Orbis* functioned as the initial source for identifying companies that aligned with the broader design limits of this study. *Valu8* was later used to complement the *Orbis* extraction with ownership-related information, including the identity and ownership share of the largest shareholder, owner type, parent-company links, and management information relevant for the study's governance variables.

Selecting the UK as the empirical setting provides strong availability of both financial statement data and ownership-related information. The study requires financial data to measure distress risk, as well as ownership and management data to measure ownership concentration and owner involvement in management. Most UK companies must file annual accounts through Companies House, which provides public access to financial information such as balance sheets and income statements (Companies House, 2026a). In addition, most UK companies are required to report information about people with significant control (PSC), which implies that owners, board members, and management teams are publicly available (Companies House, 2026b).

The initial sample was extracted from *Orbis* using three broad screening criteria aligned with the research questions. The firm's location was set to the United Kingdom, in line with the study's geographical scope. Firms classified as manufacturing companies were used as a filter. Selecting manufacturing firms as the industry scope aligns with previous empirical research on financial distress, where manufacturing firms are widely used (Udin et al., 2017; Altman, 1968; Altman, 1983). For example, Altman's original Z-score model was designed for publicly traded manufacturing firms (Altman, 1968), while the later Z'-score adaptation was developed for private manufacturing firms (Altman, 1983). Beyond alignment with prior literature, the manufacturing sector was specifically chosen because it offers strong consistency across financial statements and is broadly regarded as representative of overall economic development (Marconi, Reis and Araújo, 2016). While sub-segments within the manufacturing sector exist and vary in terms of asset intensity, cyclicity and capital structure, we chose not to delimit the sample to specific sub-sectors. These differences could independently influence

both ownership structures and financial distress. Separating the sample by SIC NACE Codes could help to control for the sub-sector differences. However, doing so would have substantially reduced the sample size and potentially affected the statistical significance of the results. This limitation should therefore be considered when interpreting the results.

The firms also had to align with the definition of an SME. According to the European Commission, an SME is a firm with between 10 and 250 employees, and either turnover between 2mEUR and 50mEUR or balance sheet assets between 2mEUR and 43 mEUR (European Commission, 2003). A total of 34199 firm-year observations met these criteria and were extracted from Orbis, including company information and financial statements.

In a second step, the Orbis sample was matched with Valu8 to collect ownership and managerial variables, including the identify and ownership share of the largest shareholder, the percentage owned by the largest shareholder, the type of owner, and information on parent-company relationships and broader ownership structures.

3.2 Sample construction and adjustment of data

After the initial sample was collected, a cleaned dataset was created, including the relevant variables needed for the study: *financial metrics required for calculating Altman Z'-score, data on owners and ownership stakes, and data on managers and roles*. The sample was filtered to only include independent firms. Under the EU SME definition, an enterprise is autonomous (i.e., independent) if it is either completely independent or has a minority partnership with other enterprises, each with less than a 25% ownership stake (European Commission, 2003). This restriction was applied to focus on standalone private SMEs, reducing the risk that parent-company relationships influence the relationship between ownership structure and financial distress. Applying these filters reduced the initial raw sample from 34199 observations to 7840 firm-year observations based on private independent SMEs.

Thereafter, the sample was screened for missing data required for the analysis. In the United Kingdom, financial reporting requirements vary across firm sizes and legal forms under the Companies Act 2006. In turn, some SMEs are allowed to file abridged accounts, excluding some parts of the income statements required for the study. Accordingly, firms were excluded if any of the financial variables necessary to calculate the financial distress measure were missing. In addition, observations for which net sales growth could not be calculated were removed, as this variable requires financial data from the preceding year. Together, these

exclusions reduced the sample to 4571 firm-year observations. Finally, we ensured that ownership structure variables were available and consistent with the study design; this required both a largest shareholder and disclosure of the ownership percentage. After excluding firms with missing ownership data, the final analysis sample consisted of 4438 observations. No firms had missing data related to the board composition. Table 1 summarizes the filtering and selection process.

Table I. Selection criteria

<i>Criteria</i>	<i>Number of Observations</i>
Full exported raw data	34199
<i>Private Independent UK manufacturing SMEs</i>	<i>7840 (-26 559)</i>
<i>Missing data related required for financial distress calculation</i>	<i>5961 (-1879)</i>
<i>Missing data related to growth in sales</i>	<i>4571 (-1390)</i>
<i>Missing data related to ownership structures</i>	<i>4438 (-133)</i>
<i>Missing data related to board composition</i>	<i>4438 (-0)</i>
Final sample	4438

The final sample is considerably smaller than the full exported raw data. The main reason for this is that the exported raw data was based on the broad geographical, industry, and size criteria in the study: UK based manufacturing firms that met the SME definition. However, the export did not capture our third delimitation; that the firms had to be independent. The largest reduction therefore occurs when the independent firm restriction is applied. While this explains the majority of removed observations, the final sample is still smaller than the private independent UK manufacturing SME sample. We therefore conduct a sample selection comparison between the final sample and observations removed following the private independent UK manufacturing SME filter using an independent-samples Welch t-test.

As shown in Appendix 1, Table VII, the final sample does not differ meaningfully compared to excluded observations in terms of ownership concentration. However, the final sample consists of firms that are, on average, larger, older, and have high sales growth. This can be expected based on the data requirements of the study, as larger and more established firms may be more likely to provide sufficient data required for the analysis. The final sample also consists of a lower share of observations where the largest owner is involved in management, which can be caused by larger firms hiring external management teams. Finally, at the 10% significance level, the final sample consists of a slightly lower share of financially distressed observations. This is consistent with previous research indicating that larger firms are less probable to be financially distressed (Udin et al, 2017; Gerged et al, 2023). Overall,

the final data should therefore be understood as a larger and more stable subset of the private independent SME landscape and should be considered when interpreting the findings and their generalisability.

3.3 Usage of AI

During the research process, AI tools were used as supportive tools, including ChatGPT, Claude, Gemini, and Grammarly. In the analytical process, Python was used to calculate descriptive statistics, estimate regression models, and visualization of tables. The AI tools were used to support this process by helping identify coding errors, explain error messages, and check whether the code logic matched the intended regression specifications. For example, the AI tools were used to review whether the code for winsorization, variable construction, and regression estimations functioned as intended. The full description of the AI usage, including example prompts and identified risks, is found in Appendix 6.

3.4 Variables

3.4.1 Dependent variable

To measure the risk of financial distress, different methods can be used. However, one of the most prominent in research on financial distress is the Altman Z-score (Altman, 1968; Udin et al., 2017). The Altman Z-score combines accounting-based ratios that capture dimensions of financial health, including liquidity, profitability, operating performance, solvency, and asset turnover (Altman, 1968). Since the present study focuses on private manufacturing firms, financial distress is measured using the Altman Z'-score, which is a revised version of the original Z-score model, specifically adapted for private manufacturers (Altman, 1983). Although the Ohlson O-score is designed for probabilistic bankruptcy prediction (Ohlson, 1980), it is not used since it requires operational cash-flow data which removes a substantial portion of our sample. The Z'-score (Altman, 1983) is based on five key financial ratios, and is calculated as follows:

$$Z' - score = 0,717X_1 + 0,847X_2 + 3,107X_3 + 0,420X_4 + 0,998X_5$$

where:

X_1 = Working Capital / Total Assets

$X_2 = \text{Retained Earnings} / \text{Total Assets}$

$X_3 = \text{EBIT} / \text{Total Assets}$

$X_4 = \text{Book Value of Equity} / \text{Total Liabilities}$

$X_5 = \text{Sales} / \text{Total Assets}$

According to Altman (1983), firms with a Z'-score below or equal to 1.23 are classified as financial distressed, firms with a Z-score between 1.23 and 2.9 are classified to be in a “grey zone”, while firms with a Z'-score above 2.9 are classified to be in a safe zone. To create a binary variable, we label it Financial Distress (FD). Observations below or equal to 1.23 are coded as financially distressed and are assigned the value of $FD = 1$. Observations with a Z'-score above 1.23, which are in the grey zone or safe zone, are coded as non-distressed and given the value $FD = 0$. This aligns with the lower-bound classification used by Udin et al. (2017), in which only firms below the financially distressed threshold are classified as financially distressed.

3.4.2 Independent variable related to ownership concentration

In literature, ownership concentration is commonly defined as the extent to which equity ownership (or voting rights) is concentrated among shareholders holding the larger majority of equity shares (Manzaneque et al., 2016; Gerged et al., 2023; Gryko et al., 2024; Aluchna & Kaminski, 2017). However, this concept can be interpreted and measured differently depending on the setting, data availability, and research design. Manzaneque et al. (2016) and Gerged et al. (2023) use an aggregate blockholder approach, defining ownership concentration as the percentage of shares held by large shareholders who each hold more than 3% of shares each. In contrast, Gryko et al. (2024) and Aluchna & Kaminski (2017) examine concentration through the ownership stake of the largest shareholder, capturing concentration and control of a single owner.

In this study, we define ownership concentration as the share held by the firm's largest equity holder. The variable is measured on a scale of 0 to 1 and is labeled Largest-owner Ownership Concentration (LOC). Based on H1, the expected coefficient sign for LOC is positive, as a higher ownership share held by the largest shareholder is expected to be associated with a higher likelihood of financial distress.

3.4.3 Independent variable related to owner involvement in management

To test H2, we include a binary variable indicating whether the largest owner is involved in management or not. The variable, labeled Owner Involvement in Management (OIM), is constructed from management and role information extracted through Valu8. OIM takes on the value of 1 if the largest shareholder is a member of the firm's listed management roles, including director, managing director, CEO, operations manager, or any other management roles. If the largest owner is not a part of any management role, the OIM assigns the value 0. Based on H2, we expect that the coefficient for OIM to be negative. This would mean that the largest owner's involvement in management would be associated with a lower probability of financial distress.

3.4.4 Interaction term

To test H2a, an interaction term between ownership concentration and the presence of the owner in management is included. The interaction term is labelled OIM * LOC and is created by multiplying OIM by LOC. The interaction term examines whether the relationship between owner involvement in management and financial distress is dependent on the level of ownership concentration. Since H2a is formulated as a non-directional hypothesis, no specific coefficient sign is predicted for OIM * LOC. Instead, H2a is supported if the interaction term is statistically significant.

3.4.5 Control variables

To isolate the relationship between ownership concentration, owner involvement in management, and financial distress, the study includes several firm-level control variables. These variables are included because firm characteristics such as size, age, and growth may independently affect the risk of financial distress, independent of ownership concentration.

The first control variable included is Firm Size (FS), since larger and smaller firms may differ in their financial stability, access to external financing, and ability to withstand economic shocks. Firm size is also commonly used as a control variable when analyzing the relationship between independent variables and financial distress (Udin et al., 2017; Gerged et al., 2023). Previous research, including firm size as a control variable in financial distress analysis, has found that it is negatively associated with the probability of financial distress (Udin et al., 2017; Gerged et al., 2023). According to Udin et al. (2017), this indicates that when firms' operating

activity becomes larger, it may decrease the risk of financial distress due to their experience and operational efficiency. We therefore expect the coefficient for FS to be negative, indicating that larger firm sizes decrease the risk of financial distress. Similar to Gerged et al. (2023), we measure Firm Size as the natural logarithm of total assets:

$$FS = \ln(\text{Total Assets})$$

Firm Age (FA) is included as a control variable since the number of years a firm has been operating may influence the probability of financial distress. Over time, firms can build legitimacy through stronger relationships with relevant key stakeholders, which may increase resilience during times of financial pressure (Suddaby et al., 2017; Rachid Achbah & Fréchet, 2024). On the contrary, younger firms are shown to be less resistant to major internal and external challenges due to a less developed operational structure, weaker financial routines, and more limited industry knowledge (Kücher et al., 2018). Firms with shorter period of operations may therefore be at greater risk of financial distress during unexpected macroeconomic situations, such as increased interest rates, which is commonly cited as increasing the risk of financial distress (Allianz Research, 2025; Whitaker, 1999). Based on this, the expected coefficient sign for FA is negative, implying that as Firm Age increases, the probability of a firm being in financial distress decreases. Similar to firm size, we measure firm age as the natural logarithm of the number of years between the observation year and the incorporation year:

$$FA = \ln(\text{observation year} - \text{incorporation year})$$

Finally, Sales Growth (SG) is included as a control variable because it captures firm dynamics that may affect financial health over time. Sales Growth reflects whether a firm's revenue has increased or decreased compared to the previous year. If a firm's sales increase, this might indicate that it has improved operational profitability and might be able to better handle financial pressure. In contrast, negative Sales Growth may indicate worse operating performance, increasing the probability of financial distress. We therefore expect the coefficient sign for SG to be negative, indicating that higher Sales Growth decreases the probability that a firm is in financial distress. Sales growth is calculated as the percentage change in sales from the previous year:

$$SG = \frac{Sales_t - Sales_{t-1}}{Sales_{t-1}}$$

3.5 Robustness and Outliers

A very common issue in empirical research is extreme outliers that may disproportionately influence regression estimates. To reduce the influence of outliers, they are often managed to increase the robustness of model estimation. If the model were not to be adjusted, such outliers could bias the results and make it less representative of the full sample. The method used to manage outliers is winsorization, where we winsorize all continuous variables at the 1st and 99th percentiles. This means that observations below the 1st percentile are replaced with values at the 1st percentile, while observations above the 99th percentile are replaced with the value at the 99th percentile. By capping extreme values, the winsorization allows us to treat outliers without removing any firm-year observations and keeping our original sample size.

The continuous variables to which winsorization is applied to are: Largest-owner Ownership Concentration (LOC), Firm Size (FS), Firm Age (FA), and Sales Growth (SG). The binary variables in our sample are not winsorized, since they take only the values of 0 and 1 and therefore do not contain continuous extreme values. This applies to the dependent variable, Financial Distress (FD), and the Owner Involvement in Management variable (OIM). The interaction term OIM * LOC is created after the winsorization of LOC.

To assess whether the results are sensitive to this outlier treatment, the study also incorporates a robustness test in which the regression models are analysed using an alternative winsorization threshold of 2.5%. This allows us to examine whether the estimated relationships are robust to a stricter treatment of extreme values. The results from this robustness test are presented in Section 4.5.

3.6 Regressions

Since the dependent variable, Financial Distress (FD), is binary, the hypotheses are tested using logistic regression models. Logistic regressions are commonly used in financial distress research when the dependent variable distinguishes between distressed and non-distressed firms, as they allow estimation of which variables impact the probability that firms are classified as financially distressed. For example, Udin et al. (2017) use panel logistic regression to examine the relationship between different types of ownership structures and financial distress. At the same time, Gerged et al. (2023) apply a random-effects logistic regression model to examine how board composition and ownership structures affect the likelihood of financial distress.

The regressions are estimated using firm-year observations from the panel dataset. As the same firm may appear in several years, standard errors are clustered at the firm level, allowing the same firm to be correlated with itself over several years without risking overstating statistical significance. Furthermore, the models are estimated both with and without year fixed effects. Year-fixed effects are used to account for economy-wide effects that may affect the individual firms in a given year. During the sample period, such effects may stem from Covid-19, the Ukraine War, and regulatory changes, and could influence all firms. Including year-fixed effects reduces the risk that our results are driven by events affecting all firms in a given year.

Notably, the regressions are not estimated using firm-fixed effects. Firm fixed effects control for stable and time-irrelevant heterogeneity within the same firm by allowing each firm to have its own baseline and comparing each firm to itself over time. One reason for not including firm fixed effects is because the dependent variable is binary. A fixed effect logistic regression would only include observations where the firm change financial distress status during the sampling period, thereby significantly reducing the usable sample size. We could eliminate this limitation by using the Z'-score as the dependent variable, making it continuous. However, the main independent variables Largest-owner Ownership Concentration (LOC) and Owner Involvement in Management (OIM) are effectively time invariant, since ownership structures rarely change. Using firm fixed effects, which controls for everything that is unique and fixed about the firm, would therefore absorb the ownership variance needed to estimate the relationship between LOC, OIM, and financial distress. For this reason, firm fixed effects are not included and the risk of stable firm-level confounders is acknowledged as a limitation.

For all regression equations, i denotes the firm and t denotes the year. $FD_{i,t}$ is the binary financial distress variable, and γ_t represents the year fixed effects in the specifications where year fixed effects are included.

3.6.1 Regression Model 1

Model 1 tests H1 by examining whether the ownership share held by the largest shareholder is associated with the probability of financial distress. The model includes Largest-owner Ownership Concentration (LOC) as the main independent variable, while controlling for Firm Size (FS), Firm Age (FA), and Sales Growth (SG). H1 is supported if β_1 is positive and

statistically significant, indicating that higher ownership concentration is associated with a higher probability of financial distress. Model 1 is specified in Equation 1:

$$\log\left(\frac{P(distress_{i,t}=1)}{1-P(distress_{i,t}=1)}\right) = \beta_0 + \beta_1 LOC_{i,t} + \beta_2 FS_{i,t} + \beta_3 FA_{i,t} + \beta_4 SG_{i,t} + \gamma_t \quad (1)$$

3.6.2 Regression Model 2

Model 2 tests H2 by examining whether firms where the largest owner is involved in management have a lower probability of financial distress. The model extends Model 1 by including Owner Involvement in Management (OIM) as an independent variable. H2 is supported if β_2 is negative and statistically significant, meaning that owner involvement in management is associated with a lower probability of financial distress. Model 2 is specified in Equation 2:

$$\log\left(\frac{P(distress_{i,t}=1)}{1-P(distress_{i,t}=1)}\right) = \beta_0 + \beta_1 LOC_{i,t} + \beta_2 OIM_{i,t} + \beta_3 FS_{i,t} + \beta_4 FA_{i,t} + \beta_5 SG_{i,t} + \gamma_t \quad (2)$$

3.6.3 Regression Model 3

Model 3 is used to test H2a, which examines whether ownership concentration moderates the relationship between owner involvement in management and the probability of financial distress. The model extends Model 2 by adding the interaction term between Owner Involvement in Management and the Largest-owner Ownership Concentration (OIM * LOC). H2a is supported if β_3 is statistically significant, indicating that the relationship between largest owner's involvement in management and financial distress depends on the level of ownership concentration. A significant negative β_3 would indicate that when ownership concentration increases, owner involvement in management is associated with an even lower probability of financial distress. In contrast, a significant positive β_3 would indicate that as ownership concentration increases, the hypothesized distress-reducing association of owner involvement in management becomes weaker. Model 3 is specified in Equation 3:

$$\log\left(\frac{P(distress_{i,t}=1)}{1-P(distress_{i,t}=1)}\right) = \beta_0 + \beta_1 LOC_{i,t} + \beta_2 OIM_{i,t} + \beta_3 (LOC_{i,t} \times OIM_{i,t}) + \beta_4 FS_{i,t} + \beta_5 FA_{i,t} + \beta_6 SG_{i,t} + \gamma_t \quad (3)$$

4. Analysis

4.1 Description of data

The final regression sample consisted of 4438 firm-year observations across the financial years 2018-2025. As shown in Appendix 2, Table VIII, the panel dataset is unbalanced, with the majority of observations concentrated around the financial years 2020-2024. This reflects differences in data availability across firms and reporting years and is considered when interpreting the results.

Table II presents the descriptive statistics of the variables included in the regression models. The largest owner held an average equity stake of 54.7%, with a median of 50.00%. This is slightly higher than previous studies using similar definitions of ownership concentration definitions. Aluchna & Kaminski (2017) report an average largest-owner share of approximately 35%, while Gryko et al. (2024) report an average of 45.1%. However, this difference is expected, as both studies examine listed firms, while this study focuses on private SMEs, where ownership is typically more concentrated.

When comparing distressed and non-distressed observations, ownership concentration is similar across the groups. Distressed firms have an average largest-owner ownership of 53.6%, compared to 54.9% for non-distressed firms. The descriptive difference is more visible for owners' involvement in management. The mean value of OIM is 0.463, meaning that the largest owner is involved in management in 46.3% of the observations. Among distressed observations, the mean is 0.246, compared to 0.487 among non-distressed observations. This indicates that owner involvement in management is less common among financially distressed observations. However, these patterns are descriptive and do not account for ownership concentration, firm characteristics, or year fixed effects.

Moving on to control variables, the difference between distressed and non-distressed observations is most visible for Firm Age (FA). Since FA measures the natural logarithm of Firm Age, lower values indicate younger firms. Distressed firms have a lower average FA of 2.727 compared to 3.234 for non-distressed firms, suggesting that distressed firms are younger on average. For Firm Size, the difference is smaller, where distressed firms have a mean FS of 9.363, whereas non-distressed firms have a mean of 9.279. Sales Growth has a less clear pattern. Distressed firms have a higher mean SG of 10.2%, compared to 7.7% for non-distressed firms. However, the median sales growth is lower for distressed firms at -1.9%, compared to 4.7%

for non-distressed firms. This suggests that the mean sales growth among distressed firms may be affected by large variations within the sample.

TABLE II: Descriptive Statistics

<i>Variable</i>	<i>Obs</i>	<i>Mean</i>	<i>Std. dev</i>	<i>Min</i>	<i>Median</i>	<i>Max</i>	<u><i>Distress</i></u>		<u><i>Non-distress</i></u>	
							<i>Mean</i>	<i>Median</i>	<i>Mean</i>	<i>Median</i>
<i>LOC (%)</i>	4438	54.7	26.5	11.9	50.0	100.0	53.6	49.0	54.9	50.0
<i>OIM*</i>	4438	0.463	0.499	0	0	1	0.246	0	0.487	0
<i>FS</i>	4438	9.287	0.662	7.103	9.252	10.994	9.363	9.382	9.279	9.240
<i>FA</i>	4438	3.184	0.794	1.099	3.258	4.654	2.727	2.773	3.234	3.332
<i>SG (%)</i>	4438	8.0	30.1	-52.3	4.3	165.4	10.2	-1.910	7.733	4.700
<i>FD*</i>	4438	0.098	0.297	0	0	1	1	1	0	0

NOTE: Table II shows descriptive statistics for the variables included in the full sample regression models.

LOC and *SG* are reported in percentages. Variables marked with * are binary variables, where the mean represents the share of observations. The final four columns report the mean and median separately for financially distressed and non-distressed observations.

4.2 Correlation matrix

Since we use both independent and control variables that could plausibly explain financial distress, there is a risk that some of the explanatory variables are correlated with one another. Such multicollinearity can make it hard to isolate the individual effects of each variable and can inflate the standard errors of the coefficients. As a rule of thumb, correlation between two independent and/or control variables above 0.8, and Variance Inflation Factors (VIF) above 10, may indicate potential multicollinearity concerns.

Table III presents the correlation matrix and VIF values for all the variables included in the regression models. The two independent variables, Largest-owner Ownership Concentration (*LOC*) and Owner Involvement in Management (*OIM*), are positively and statically significantly correlated. However, the correlation is weak, with a coefficient of 0.038. The remaining correlations between the independent and control variables are also low. For instance, *LOC* has a statistically significant negative correlation with Firm Age (*FA*), but the coefficient is only -0.034.

The strongest correlations are between the interaction term (*OIM * LOC*) and the variables used to construct it. The interaction term is strongly correlated with *OIM*, with a coefficient of 0.847, and positively correlated with *LOC*, with a coefficient of 0.381. This is expected, since the interaction term is mechanically related, created by multiplying *OIM* with

LOC. This higher correlation is also reflected in the VIF values, which is highest for OIM and OIM * LOC, which have values of 5.370 and 6.275 respectively. However, these values still remain below the threshold of 10. Therefore, although multicollinearity increases when the interaction term is included, it remains within an acceptable range.

Table III. Pearson correlation matrix and VIF

<i>Variable</i>	<i>FD</i>	<i>LOC</i>	<i>OIM</i>	<i>LOC * OIM</i>	<i>FS</i>	<i>FA</i>	<i>SG</i>	<i>VIF</i>
<i>FD</i>	1,000	-0,014	-0,114***	-0,120***	0,038***	-0,190***	0,024	
<i>LOC</i>		1,000	0,038**	0,381***	0,000	-0,034**	0,010	1,770
<i>OIM</i>			1,000	0,847***	-0,022	-0,013	-0,050***	5,370
<i>OIM * LOC</i>				1,000	-0,001	-0,034**	-0,041***	6,275
<i>FS</i>					1,000	0,078***	0,089***	1,018
<i>FA</i>						1,000	-0,101***	1,021
<i>SG</i>							1,000	1,023

NOTE: Table III shows the Pearson correlation coefficients and Variance Inflating Factors (VIF) for the variables included in the full sample regression models.

Correlations between variables above 0.8 and VIF values above 10 are often considered indicators of potential multicollinearity concerns. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

4.3 Regression Results

We start off by running the baseline regression for H1 using the full sample, excluding year fixed effects. As reported in Table IV, Column 1, the coefficient for LOC is not statistically significant. This indicates that, across the full sample, there is no evidence that the ownership concentration of the largest shareholder is associated with the probability of financial distress. To assess whether the result is sensitive to year-specific effects, we estimate the same model using year fixed effects. As shown in Table IV, Column 2, LOC remains to be not statistically significant, suggesting that the results are not driven by year-specific effects. Accordingly, H1 is not supported in the baseline full-sample results.

To examine H2, we extend the regression model by adding the independent variable Owner Involvement in Management (OIM). As reported in Table IV, Column 3, the coefficient for OIM is negative and statistically significant at the 1% level. This means that firms where the largest owner is involved in management are associated with a lower probability of financial distress. As reported Table IV, Column 4, the result remains the same when year fixed effects are included, meaning they are not driven by year-specific effects. Accordingly, H2 is supported in the full-sample regression results.

Finally, we test H2a by including the interaction term between Owner Involvement in Management and Largest-owner Ownership Concentration ($OIM * LOC$). As reported in Table IV, Column 5, the interaction term is not statistically significant. This means that the relationship between owners' involvement in management and financial distress does not vary with the level of ownership concentration. Importantly, the inclusion of the interaction term does not change the main findings from the previous models; LOC remains to be not statistically significant, while OIM remains negative and statistically significant. As reported in Table IV, Column 6, the same pattern is observed when year fixed effects are included. Accordingly, H2a is not supported in the full-sample regression.

The control variables have a relatively consistent pattern across the models. Firm Size shows no statistically significant relationship with financial distress. This differs from Gerged et al. (2023), who found a negative relationship between firm size and probability of financial distress. As expected, Firm Age has a statistically significant negative relationship with the probability of financial distress across all six regressions at the 1% significance level, aligning with previous research suggesting that older firms are less likely to enter bankruptcy through better industry knowledge and greater shareholder relationships (Suddaby et al., 2017; Rachid

Achbah & Fréchet, 2024; Kücher et al., 2018). Sales Growth is not statistically significant across all six regressions, indicating that last-year revenue growth does not affect the probability of financial distress.

In terms of model fit, the Cox and Snell pseudo- R^2 for our models ranges from 0.036 to 0.061 across the models. Importantly, the Cox and Snell pseudo- R^2 is capped below 1 in logistic regressions and should not be interpreted like ordinary R^2 . The values are therefore used as descriptive indicators of relative model fit rather than a way of explaining variance. This is appropriate given that the aim of the study is not to construct a comprehensive financial distress prediction model, but rather to test whether ownership concentration and owner involvement in management are associated with financial distress risk.

Table IV. Regression results

<i>Variables</i>	(1) <i>distress</i>	(2) <i>distress</i>	(3) <i>distress</i>	(4) <i>distress</i>	(5) <i>distress</i>	(6) <i>distress</i>
<i>LOC</i>	-0.207 [0.367]	-0.212 [0.367]	-0.099 [0.353]	-0.105 [0.352]	-0.119 [0.427]	-0.126 [0.426]
<i>OIM</i>			-1.120*** [0.186]	-1.118*** [0.187]	-1.164*** [0.446]	-1.166*** [0.447]
<i>LOC*OIM</i>					0.080 [0.733]	0.085 [0.733]
<i>FS</i>	0.243 [0.171]	0.253 [0.170]	0.222 [0.153]	0.232 [0.151]	0.221 [0.153]	0.232 [0.151]
<i>FA</i>	-0.771*** [0.092]	-0.754*** [0.093]	-0.802*** [0.094]	-0.786*** [0.095]	-0.802*** [0.094]	-0.785*** [0.095]
<i>SG</i>	-0.013 [0.248]	0.072 [0.246]	-0.105 [0.226]	-0.024 [0.224]	-0.105 [0.226]	-0.023 [0.224]
Constant	-2.065 [1.592]	-2.978 [1.848]	-1.422 [1.430]	-2.304 [1.719]	-1.409 [1.433]	-2.294 [1.720]
Year FE	No	Yes	No	Yes	No	Yes
Winsorization	1%	1%	1%	1%	1%	1%
N	4438	4438	4438	4438	4438	4438
Log Likelihood	-1341.241	-1332.952	-1299.758	-1282.970	-1290.742	-1282.952
Pseudo- R^2 (CS)	0.036	0.040	0.058	0.061	0.058	0.061
Sample	Full	Full	Full	Full	Full	Full

NOTE: Table IV reports the logistic regression coefficients. Standard errors are clustered at the firm level and displayed in brackets under the coefficients. Columns (1) - (2) estimate model 1, which includes LOC and control variables. Columns (3) - (4) estimate Model 2, which adds OIM. Columns (5) - (6) estimate model 3, which adds the interaction term LOC*OIM. Each model is estimated both without and with year fixed effects. All continuous variables are winsorized at the 1% level. Pseudo- R^2 (CS) refers to Cox-Snell Pseudo- R^2 . *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

4.4 Additional analyses: Excluding 100% ownership

Although the full-sample regression shows no statistically significant relationship between ownership concentration and financial distress, this sample includes observations where the largest shareholder owns 100% of the firm. These observations are conceptually different from firms in which the largest shareholder holds a high ownership share but less than 100%, as full ownership eliminates the presence of minority shareholders. This distinction is important, since a central part of our theoretical argument behind H1 is based on horizontal agency problems (Section 2.1.3.2), where conflicts may arise between a controlling and minority shareholders. When the largest owner owns 100% of the equity, this specific agency theory mechanism cannot arise.

Based on this theoretical distinction, we choose to develop a sample that excludes all firm-year observations where the largest shareholder owns 100% of the firm's equity. This restricted sample allows us to re-estimate the relationship between the Largest-owner Ownership Concentration and financial distress in a setting where horizontal agency problems can theoretically arise. Importantly, the purpose is not to test whether the restrictive full samples are statistically different, but to estimate the same theoretical relationship in a situation where the agency mechanism underlying H1 is relevant. After removing observations with a 100% equity holder, the restricted sample consists of 3885 firm-year observations. Descriptive statistics and correlation matrix with VIF values for the restricted sample are reported in Appendix 3 and Appendix 4, respectively.

Table V reports the regression results for the restricted sample. In Columns (1) and (2), which estimate Model 1, Largest-owner Ownership Concentration (LOC) is negative and statistically significant at the 1% level, both with and without year fixed effects. This differs from the full-sample results, where LOC was not statistically significant. When Owner Involvement in Management (OIM) and later the interaction term (OIM * LOC) are added in Columns (3) - (6), LOC remains negative and statistically significant, although at the 5% level rather than the 1% level. Overall, the restricted-sample results indicate that, after excluding observations with 100% ownership, higher ownership concentration is associated with lower of financial distress.

The results for Owner Involvement in Management (OIM) and the interaction term (OIM * LOC) are broadly consistent with the full-sample regression. As shown in Columns (3) - (6), OIM is negative and statistically significant at the 1% level, whilst the interaction term

(OIM * LOC) is not statistically significant. This means that Owner Involvement in Management remains associated with a lower probability of financial distress in the restricted sample, while there is still no evidence that this relationship depends on the level of ownership concentration.

The control variables remain broadly consistent with those from the full-sample regression. Firm Age is negative and statistically significant at the 1% level across all regressions, while Sales Growth remains insignificant. However, for the restricted sample, Firm Size is positive and weakly significant at the 10% level. The pseudo-R² remains similar to the full-sample regressions, ranging from 0.046 to 0.065.

Table V. Regression results for restricted sample

<i>Variables</i>	(1) <i>distress</i>	(2) <i>distress</i>	(3) <i>distress</i>	(4) <i>distress</i>	(5) <i>distress</i>	(6) <i>distress</i>
<i>LOC</i>	-1.512*** [0.533]	-1.502*** [0.534]	-1.253** [0.520]	-1.248** [0.521]	-1.558** [0.661]	-1.562** [0.663]
<i>OIM</i>			-1.015*** [0.206]	-1.012*** [0.207]	-1.467*** [0.516]	-1.476*** [0.519]
<i>LOC * OIM</i>					0.516 [0.995]	1.022 [1.059]
<i>FS</i>	0.333* [0.188]	0.346* [0.188]	0.310* [0.174]	0.323* [0.174]	0.304* [0.173]	0.316* [0.173]
<i>FA</i>	-0.796*** [0.102]	-0.781*** [0.103]	-0.819*** [0.103]	-0.806*** [0.104]	-0.815*** [0.103]	-0.801*** [0.105]
<i>SG</i>	-0.156 [0.323]	-0.052 [0.323]	-0.228 [0.301]	-0.128 [0.301]	-0.232 [0.303]	-0.132 [0.303]
Constant	-2.804 [1.771]	-2.938 [2.033]	-1.792 [1.642]	-2.451 [1.912]	-1.618 [1.653]	-2.261 [1.919]
Year FE	No	Yes	No	Yes	No	Yes
Winsorization	1%	1%	1%	1%	1%	1%
N	3885	3885	3885	3885	3885	3885
Log Likelihood	-1080.956	-1076.269	-1047.560	-1043.235	-1046.308	-1041.920
Pseudo-R ² (CS)	0.046	0.048	0.062	0.064	0.062	0.065
Sample	Restricted	Restricted	Restricted	Restricted	Restricted	Restricted

NOTE: Table V reports the logistic regression coefficients for the restricted sample, excluding observations where the largest shareholder owns 100% of the firm. Standard errors are clustered at the firm level and displayed in brackets under the coefficients. Columns (1) - (2) estimate Model 1, which includes LOC and control variables. Columns (3) - (4) estimate model 2, which adds OIM. Columns (5) - (6) estimate model 3, which adds the interaction term LOC * OIM. Each model is estimated without and with year fixed effects. All continuous variables are winsorized at the 1st and 99th percentiles. Pseudo-R² (CS) refers to Cox-Snell Pseudo-R². *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

4.5 Robustness checks

To assess whether the main results are sensitive to the treatment of extreme values, we conduct a robustness check using an alternative winsorization threshold. While the main regression winsorized continuous variables at the 1% level, the robustness models apply a 2.5% winsorization threshold. This allows us to examine whether the results are driven by outliers in the continuous variables that are included in the baseline regression models.

As shown in Appendix 5, Table XII, the robustness results are broadly in line with the main findings. In the full sample, LOC remains to be not statistically significant, while OIM remains negative and statistically significant at the 1% level. In the restricted sample, both LOC and OIM remain negative and statistically significant. Across both samples, the interaction term (OIM * LOC) remains to be not statistically significant. Overall, the robustness test does not alter the interpretation of the results, suggesting that neither the main analysis nor the additional restricted-sample analysis is driven by the original 1% winsorization threshold.

Some differences appear among the control variables. In particular, Firm Size becomes positively significant at the 5% level, while Sales Growth becomes negative and weakly significant across parts of the robustness analysis. This suggests that some control variables are sensitive to the treatment of extreme values. However, these changes do not alter the main empirical conclusions regarding the relationship between the independent variable and financial distress.

5. Discussion

The purpose of this thesis was to examine whether ownership concentration and owner involvement in management are associated with the probability of financial distress in private SMEs, and whether the distress-reducing effect of owner involvement in management varies with the level of ownership concentration.

The results do not support the expected positive relationship between ownership concentration and financial distress, which was hypothesized based on literature suggesting that concentrated ownership may create horizontal agency problems through entrenchment effects and minority shareholder expropriation (Claessens et al., 2002; Nagar et al., 2011; Gogineni et al., 2022). The full-sample regressions show no significant relationship between largest owner's ownership concentration and the probability of financial distress. This contrasts with studies such as Gerged et al. (2023), who find that ownership concentration increases financial distress risk in UK-listed manufacturers. Since their interpretation is closely linked to horizontal agency problems and entrenchment effects, our findings may suggest that these agency-theory mechanisms might not translate directly to private independent SMEs.

At first, this interpretation appears consistent with Gogineni et al. (2022), who find that private firms experience lower agency costs than comparable public firms. However, it would be too simplistic to treat this difference as an absolute cause of our contradicting results, as prior literature suggests that many private firms still face substantial horizontal agency problems, particularly due to weaker external monitoring and higher information asymmetries compared to publicly listed firms (Nagar et al., 2011; Gupta & Gregoriou, 2018). The private firm setting might therefore not remove agency problems entirely but rather alter how they translate into financial distress. In other words, for private firms, higher ownership concentration may create horizontal agency problems, but the agency costs of these problems might not increase the probability of financial distress to the same extent as they might do in publicly listed firms.

The additional analysis on the restricted sample provides further insight into this interpretation. When excluding firms where the largest shareholder owns 100% of the firm, we found that higher ownership concentration levels were associated with lower probability of financial distress. As Shleifer & Vishny (1997) discuss, large shareholders bear a greater share of the firms' financial outcomes. As a result, they might be more incentivized to reduce managerial opportunism through increased monitoring. Our results might therefore indicate

that, for private SMEs that don't have a sole owner, the increased monitoring incentives of ownership concentration may outweigh the negative entrenchment effects, causing higher ownership concentration to be associated with a lower probability of financial distress.

Interestingly, the negative relationship between ownership concentration and probability of financial distress only appears after excluding firms with a sole owner. This suggests that ownership concentration might operate differently in firms with several shareholders than in firms where one owner controls the entire equity. When designing the restricted sample, we believed that the difference between these two ownership structures was horizontal agency problems. Since horizontal agency problems arise between separate owners (Gogineni et al., 2022), sole ownership would not allow for these problems to arise. If horizontal agency problems were the main driver of financial distress, we would therefore expect the relationship between financial distress and ownership concentration to become stronger and positive in the restricted sample. However, since the results show the opposite, the difference in results between the full-sample and restricted sample might be driven by another mechanism.

One possible explanation to this is that firms with more than one owner might not only create room for horizontal agency problems; they might also create room for monitoring between owners. As discussed by Gogineni et al. (2022) and Pagano & Röell (1998), the presence of a second large shareholder can add monitoring over the largest shareholder and limit their ability to extract private benefits. Although this research primarily show that horizontal agency problems might differ between these ownership constructs, it also highlights a broader point: firms with several shareholders may operate under a different governance logic than firms with a sole shareholder. In these firms, the largest shareholder may still have incentives to pursue private benefits, but the other shareholders can observe, challenge, or constrain decisions that harm firm value (Pagano & Röell, 1998; Gogineni et al., 2022). Therefore, the restricted sample results may not only reflect the removal of firms without horizontal agency problems. Instead, it may capture a firm setting where concentrated ownership gives the largest owner stronger incentives to preserve firm value, while the presence of other owners limits the most harmful forms of entrenchment.

Beyond insights on ownership concentration, we find that the largest owner's involvement in management is associated with a lower probability of financial distress for private SMEs. As discussed by Jensen & Meckling (1976), when the decision-maker also bears

the economic consequences of their decisions, incentives become more closely aligned with firm value, thereby reducing opportunistic behaviour. In our setting, this means that owner involvement in management may reduce the distance between ownership and control, as the person influencing operating decisions also carries a part of the financial consequences of those decisions. This can make the largest owner more likely to monitor problems early, protect firm value, and avoid decisions that increase financial distress risk. The findings also connect to Donker et al. (2009), who find that higher managerial ownership reduce the probability of financial distress. Although managerial ownership is not identical to the largest owner's involvement in management, both point to the same mechanism: when financial exposure and decision-making become more closely connected, firms may be less exposed to financial distress.

After establishing this relationship, the next question is whether ownership concentration changes how owner involvement in management relates to financial distress. Our results do not show such a moderating relationship. This is important since Morck et al. (1988) show that managerial ownership does not work as a simple linear alignment mechanism. Instead, managerial ownership can create both alignment and entrenchment effects, depending on the level of ownership. In our private SME setting, the result suggests that a larger ownership stake held by the largest owner does not, by itself, change how the owner's involvement in management relates to financial distress. We argue that once the largest owner is involved in management, the central agency mechanism may already be activated: decision-making and financial exposure are brought closer. In other words, once the largest owner is already involved in management, it may be the owner-management role itself, rather than the size of the ownership stake, that matters for financial distress.

6. Conclusions

This study has researched whether ownership concentration and owner's involvement in management influences the probability of financial distress in private independent SMEs, and whether ownership concentration changes how owner involvement in management relates to financial distress. The study is based on a panel dataset with 4438 firm-year observations of private independent UK manufacturing firms during the period 2018-2025.

Our results show that ownership concentration does not increase the probability of financial distress in private independent SMEs, contrary to what was expected based on agency theory. In the full-sample, ownership concentration is not associated with financial distress, while the restricted sample analysis shows that higher ownership concentration is associated with a lower probability of financial distress when sole-owner firms are excluded. We also find that the largest owner's involvement in management is associated with lower probability of financial distress, and that this relationship is not dependent on the level of ownership concentration.

More importantly, this study contributes not only by addressing an underexplored area in the literature on ownership concentration and financial distress, but also by highlighting the practical relevance of this relationship. Since private SMEs account for a large share of employment and economic value, understanding how ownership structures relate to financial distress may provide useful insights for entrepreneurs, owners, and investors when considering how ownership should be structured. In particular, the study sheds light on how ownership concentration and owner involvement in management are associated with the probability of financial distress in private SMEs. Although the study does not establish causality, the findings suggest that ownership structure may be relevant for how firms manage financial challenges. In the long run, a better understanding of these relationships may contribute to reducing financial distress, bankruptcies, and the number of jobs placed at risk due to corporate insolvencies. Contributing to such topic does not only maintain relevance in literature, but also the broader economy.

Overall, we contribute to the understanding of how ownership concentration and owner's involvement in management can influence the probability of financial distress within the context of private firms. This is a setting that, until now, has remained relatively underexplored compared to literature on publicly listed firms. Our findings may also contribute to discussions of how ownership structures and decision-making should be structured within

the association to financial distress. With results contradictory to previous research on financial distress and ownership structures, we also propose that ownership structures and agency problems play a different role in a private firm setting.

7. Limitations and future research

This study, as any other, has limitations. First, the generalisability of the study is limited by both the study's delimitations and the data requirements of the analysis. Studying the relationship between ownership concentration and probability of financial distress on private independent UK manufacturing firms may limit how far the findings can be generalised to other industries, countries, or firm types. For example, ownership structures and financial distress mechanisms may operate differently in service firms, larger firms, or firms operating under different institutional conditions. In addition, the final regression sample represents a subset of independent private UK SME manufacturers that are on average larger, older, and less financially distressed than excluded observations. The results may therefore be less applicable to smaller, younger, or more financially vulnerable SMEs. Finally, although the focus on manufacturers improves comparability, manufacturing is still a broad category, and the results may not be generalisable equally across all manufacturing sub-sectors. Future research should therefore examine whether the relationships found in this study hold across other industries, countries, and manufacturing sub-sectors.

Second, measuring ownership concentration as the largest equity shareholder may not fully capture actual influence or control within private firms. For instance, voting agreements among smaller shareholders may grant decision-making authority that is not reflected in the ownership alone. As a result, important ownership relationships that could impact the probability of financial distress may remain unobserved. Future research should therefore incorporate broader measurements of ownership influence, not only formal equity ownership.

Third, owner involvement in management is measured as a binary variable. This captures whether the largest owner is involved in management but does not distinguish between different types of management roles. This matters since different roles may provide different levels of decision-making authority. For example, an owner with strong operational responsibility might have a greater ability to reduce vertical agency problems than an owner with a more limited management role. Accordingly, future research should therefore distinguish between different types of owner-management roles, such as CEO, board member, operational manager, or passive managerial title.

Fourth, it should be noted that while the study identifies the associations between ownership concentration and the probability of financial distress, the causal relationship is not proven. The findings should therefore be interpreted as indicative of relationships rather than

causal findings. This means that higher ownership concentration is associated with lower probability of financial distress, but not that increasing ownership concentration will lead to reduced probability of financial distress. Thus, as managers or owners of private firms may come across this study, increasing the ownership concentration of the largest shareholder does not translate into lower probability of financial distress. We therefore urge future research to investigate if there exist a causal relationship between ownership structures and financial distress in private SMEs.

Fifth, the analysis is limited by potential unobserved firm-level confounding. Although the regression includes firm-level control variables and year-fixed effects, stable differences between firms may still influence the estimated relationship. For example, managerial quality, risk culture, and business model may affect both ownership structure and financial distress risk. As a result, the findings, particularly the restricted sample results that contrasts with previous research, may partly reflect underlying firm-level differences rather than ownership structure alone. Future research should therefore be designed to better separate ownership effects from stable firm-level characteristics, for example by having a longer time horizon in the dataset to gather observations where ownership structures change over time.

Sixth, our regression model treats ownership concentration as a linear relationship. Morek et al., (1988) show that managerial ownership may have a non-linear relationship with firm outcomes. This means that the relationship between ownership concentration and financial distress, might also differ across low, medium, and high ownership levels. Future research should therefore test non-linear specifications, such as ownership intervals or squared terms, to examine whether the effects of ownership concentration changes at different levels.

More broadly, future research should examine whether agency mechanisms translate into financial distress differently in private and listed firms. This study suggests that ownership concentration may not increase financial distress risk in private SME in the same way as publicly listed firms. A direct comparison between private and public firms within the same industry would make it possible to test whether the same agency mechanisms operate differently across these firm settings. Such research would deepen the understanding of when and why ownership structure matters for firm survival. It would also have practical relevance given the rising rate of jobs at risk and increasing corporate insolvency rates which both impact global employment and economic stability.

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9. Appendices

Appendix 1: Sample selection

Table VII: Sample selection comparison

Variable	Included N	Excluded N	Included mean	Excluded mean	Difference	t-statistic	p-value
<i>LOC (%)</i>	4438	3177	54.7	55.1	-0.429	-0.699	0.485
<i>OIM</i>	4438	3402	0.463	0.527	-0.063	-5.562	<0.001***
<i>FS</i>	4438	3402	9.284	8.656	0.628	24.096	<0.001***
<i>FA</i>	4438	3393	3.182	2.995	0.187	9.410	<0.001***
<i>SG (%)</i>	4438	627	32.6	4.9	27.7	2.083	0.037**
<i>FD</i>	4438	1523	0.098	0.114	-0.016	-1.679	0.093*

NOTE: Table VII reports independent-samples Welch t-test comparing the final regression sample with observations excluded after restricting the dataset to private independent SMEs. LOC and SG are reported in percentages. OIM and FD are binary variables, where the mean represents the share of observations. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Appendix 2: Additional descriptive statistics

Table VIII. Distribution of observations by year

Year	Obs	Percentage
2018	13	0,29%
2019	31	0,70%
2020	516	11,63%
2021	835	18,81%
2022	893	20,12%
2023	1014	22,85%
2024	1087	24,49%
2025	49	1,10%
Total	4438	100%

NOTE: Table VIII represents the distribution of the firm-year observations for the full sample

Appendix 3: Descriptive statistics for restricted sample

Table IX. Distribution of observations by year - restricted sample

Year	Obs	Percentage
2018	10	0,26%
2019	25	0,64%
2020	445	11,45%
2021	732	18,84%
2022	784	20,18%
2023	893	22,99%
2024	954	24,56%
2025	42	1,08%
Total	3885	100%

NOTE: Table IX represents the distribution of the firm-year observations for the restricted sample, excluding firm-year observations where the largest owner owns 100% of the firm.

Table X. Descriptive statistics - restricted sample

Variable	Obs	Mean	Std. dev	Min	Median	Max	Distress		Non-distress	
							Mean	Median	Mean	Median
LOC (%)	3885	48.3	21.7	11.1	49.4	99.9	42.0	36.8	48.9	50.0
FS	3885	9.283	0.632	7.256	9.247	10.880	9.386	9.366	9.273	9.233
FA	3885	3.205	0.798	1.099	3.296	4.644	2.714	2.773	3.254	3.367
SG (%)	3885	7.3	26.5	-48.0	4.2	121.7	8.5	-1.370	7.177	4.630
OIM	3885	0.471	0.499	0.000	0.000	1.000	0.259	0.000	0.491	0.000
FD	3885	0.090	0.286	0.000	0.000	1.000	1.000	1.000	0.000	0.000

*NOTE: Table X shows descriptive statistics for the variables included in the restricted sample regression models, excluding firm-year observations where the largest owner owns 100% of the firm. LOC and SG are reported in percentages. Variables marked with * are binary variables, where the mean represents the share of observations. The final four columns report the mean and median separately for financially distressed and non-distressed observations.*

Appendix 4: Correlation matrix for restricted sample

TABLE XI. Pearson correlation matrix and VIF - restricted sample

<i>Variable</i>	<i>FD</i>	<i>LOC</i>	<i>OIM</i>	<i>LOC*OIM</i>	<i>FS</i>	<i>FA</i>	<i>SG</i>	<i>VIF</i>
<i>FD</i>	1.000	-0.091***	-0.133***	-0.120***	0.051***	-0.193***	0.014	
<i>LOC</i>		1.000	0.086***	0.420***	-0.013	-0.016	-0.010	1.900
<i>OIM</i>			1.000	0.862***	-0.028*	-0.017	-0.039**	6.075
<i>LOC*OIM</i>				1.000	-0.010	-0.025	-0.035**	7.324
<i>FS</i>					1.000	0.083***	0.083***	1.019
<i>FA</i>						1.000	-0.094***	1.021
<i>SG</i>							1.000	1.019

NOTE: table XI shows the Pearson correlation coefficients and variance inflating factors (VIF) for the variables included in the restricted sample regression models where excluding firm-year observations where the largest owner owns 100% of the firm. Correlations between variables above 0.8 and VIF values above 10 are often considered indicators of potential multicollinearity concerns. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Appendix 5: Robustness check

TABLE XII. Robustness check with 2.5% winsorization

<i>Variables</i>	(1) <i>distress</i>	(2) <i>distress</i>	(3) <i>distress</i>	(4) <i>distress</i>	(5) <i>distress</i>	(6) <i>distress</i>
<i>LOC</i>	-0.215 [0.369]	-0.108 [0.355]	-0.126 [0.430]	-1.531*** [0.543]	-1.274** [0.530]	-1.578** [0.678]
<i>OIM</i>		-1.120*** [0.188]	-1.160*** [0.450]		-1.013*** [0.208]	-1.461*** [0.526]
<i>LOC * OIM</i>			0.073 [0.736]			0.988 [1.076]
<i>FS</i>	0.353** [0.171]	0.323** [0.155]	0.323** [0.155]	0.424** [0.188]	0.397** [0.176]	0.390** [0.176]
<i>FA</i>	-0.803*** [0.096]	-0.831*** [0.099]	-0.831*** [0.099]	-0.821*** [0.107]	-0.843*** [0.108]	-0.838*** [0.108]
<i>SG</i>	-0.534* [0.299]	-0.592** [0.279]	-0.592* [0.279]	-0.572 [0.350]	-0.624* [0.333]	-0.630* [0.335]
<i>constant</i>	-3.474* [1.895]	-2.637 [1.757]	-2.637 [1.757]	-3.234 [2.069]	-2.658 [1.934]	-2.469 [1.943]
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Winsorization	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
N	4438	4438	4438	3885	3885	3885
Log Likelihood	-1325.546	-1275.440	-1275.427	-1071.041	-1038.027	-1036.830
Pseudo-R ² (CS)	0.043	0.064	0.064	0.050	0.066	0.067
Sample	Full	Full	Full	Restricted	Restricted	Restricted

NOTE: table XII reports the logistic regression coefficients using an alternative winsorization threshold of 2.5%. Standard errors are clustered at the firm level and displayed in brackets under the coefficients. All models include year fixed effects. Columns (1) - (3) use the full sample, while columns (4)-(6) use the restricted sample, excluding firm-years observations where the largest owner owns 100% of the firm. Pseudo-R² (CS) refers to Cox-Snell Pseudo-R². *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Appendix 6: Use of AI

During the creation of this thesis, we used the following AI tools; ChatGPT, Claude, Gemini, Grammarly. The tools were used to give us critique on our ideas, language improvements, spelling checks, and coding assistance. Importantly, it was only used as a supportive tool, where all final decisions regarding theoretical framing, empirical analysis, interpretation of results, and written content were made by ourselves.

ChatGPT was used during the design thinking and idea development, where we asked it to constantly critique our ideas, helping us remain within the scope of a bachelor thesis project. It also helped us for linguistic support, sentence structure, and clarity improvement. Some example prompts are: “Does this sentence work?”, “What is your interpretation of this”, “What makes these sentences not work together?”. Grammarly was used to check spelling, grammar, and minor language errors.

Gemini was used through its built-in functions in Google Colab (the program used for coding of descriptives and regression). It supported the coding process by helping us identify errors in the code. When errors occurred, the build-in “explain error” function was used to understand where the error was and get inspiration of how to solve it. Claude was thereafter used to review and confirm the functionality of the code. Since we developed the code with prior experience from data analysis courses, prior experience with coding, and online manuals, Claude was used to ensure that the code was viable and function as expected. Example prompts include: “Will [code] function to [expected behaviour]”, or “What type of result would [code] produce”

The use of AI improved the thesis by helping us identify unclear formulations, improve our language, and troubleshoot/confirm consistency of code. The most significant improvement was Claude and Gemini's error handling with the code. Without them, we would have had to spend a lot more time reading manuals. In turn, we were able to focus our time on the development of other parts of the thesis.

However, we also identified risks with using AI. Firstly, when suggesting solutions for error handling in codes, we noticed that both Gemini and Claude significantly overcomplicated their output. To handle this, we always asked the AI what each and every part of the code did. Through this we could use our knowledge from that to create our desired results without overcomplication. Example of prompt for handling this risk: “What does this [code]

do?”. Secondly, we also noticed early on that AI often generated incorrect linguistic recommendation for sentence structuring involving sources. For example, ChatGPT occasionally suggested reformulations that made the sentence sound better but also changed the meaning of the source or implied a stronger/slightly different empirical support to the cited research article. To manage this risk, we used AI solely as a recommendation, where the writing was in our own words and always double checked to be empirically correct.

Overall, by using AI, we have learned that it can function as a very helpful tool in brainstorming ideas, criticising text, linguistic improvements, and debugging code. However, we also learned that while AI suggestions might sound convincing, they might be incorrect or inconsistent. We believe that by using it in the correct ways, and at appropriate places, it can help rather than harm, both in creating better content and having higher efficiency.