The Interplay between Institutional Investors, Debt and Firm Value: Evidence from France, Germany and the UK

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This study investigates the interaction effect between institutional ownership and debt ratio on firm value. Analyzing a large sample consisting of 9,998 observations from 1,351 distinct non-financial firms listed in France, Germany, and the United Kingdom (UK) over the 2002-2018 period, it is documented that the interaction variable exerts a positive effect on firm value. This finding is robust to various firm characteristics, industry and year fixed effects, and it also extends to alternative measures of ownership and firm value. Identification analyses suggest that the effect is causal. This study further finds a stronger impact during times of financial turmoil and that there exists a heterogeneity across different types of institutional ownership. Distinguishing between bank-based and market-based financial systems does not affect the inferences.

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I. Introduction

The relationship between debt and firm value is still one of the most prominent research areas in corporate finance and has been studied in different countries and across various industries (DeAngelo, 2022; Orlova et al., 2020). The trade-off theory postulates that an optimal mix of debt and equity maximizes firm value. While interest payments on debt provide a tax shield, they also enhance a firm's probability of going bankrupt. The firm's value increases if the tax advantages exceed the bankruptcy risk (Modigliani and Miller, 1963; Kraus and Litzenberger, 1973; Miller, 1977).

In addition to these financial aspects, debt affects firm value as a corporate governance mechanism (Gillan and Starks, 2003; Lemmon and Lins, 2003). In the framework of agency theory, the agent (i.e., the manager) is expected to maximize the welfare of the principal (i.e., the shareholders) by increasing the value of the firm (Jensen and Meckling, 1976). However, diverging objectives spark conflicts of interest between managers and shareholders, and information asymmetries prevent the principal from observing the agents' true efforts. In the absence of governance mechanisms, the separation of ownership and control in modern firms allows managers to act in their own interests and at the expense of the firm's shareholders (Berle and Means, 1932). Jensen's (1986) free cash flow theory postulates that interest payments related to debt enhance firm value by curbing managerial cash misuse.

Besides debt, another useful instrument to limit managerial discretion is monitoring by institutional investors. This line of research postulates that institutional ownership (IO) affects firm value through improvements in corporate governance (Balachandran and Williams, 2018; Borochin and Yang, 2017; Witasari and Cahyaningdyah, 2021). Enhancements in firm value can arise through two mechanisms: direct and indirect monitoring. Direct monitoring involves investors actively asserting shareholder interests against management and is exemplified by activities such as exercising voting rights during annual general meetings and participating in management sessions. Indirect monitoring entails investors collaborating to collectively divest shares in the company. This collective action elevates the company's cost of capital, intensifying the pressure on management to achieve success (Ferreira and Matos, 2008; Gillan and Starks, 2003).

Existing literature treats debt ratio and IO as separate determinants of firm value. However, their interaction may actually be a key driver of firm value. Investor monitoring has the potential to substitute for debt in disciplining managers (Grier and Zychowicz, 1994). Institutional investors may adjust their monitoring efforts at specific debt ratios or increase a firm's total debt holdings via credit provision or the execution of voting rights for monitoring purposes (Chung and Wang, 2014). Likewise, changes in debt ratio affect the need for institutions to limit managerial discretion via their own monitoring. This interplay between debt and IO may even lead to a more effective cross-monitoring effect on firm value (Datta et al., 1999). It is, hence, essential to analyze the interaction between debt ratio and IO (henceforth referred to as the interaction variable) rather than treating them as separate determinants of firm value, as has been done in previous studies.

Existing literature suggests that the influence of debt ratio on firm value increases during times of financial turmoil as firms face credit restraints and higher insolvency risks (Buchanan et al., 2018; Demirgüç-Kunt et al., 2020; Demirgüneş, 2017; Fosu et al., 2016). Moreover, existing literature (Díez-Esteban et al., 2016; Liu et al., 2012; McNulty and Nordberg, 2016) underscores the proactive engagement of institutional investors in monitoring, which is particularly effective in alleviating financial constraints. Drawing upon these insights, an amplification of the impact of the interaction variable on firm value, particularly in periods of crisis marked by increasing information asymmetry, is expected. Consequently, the research in this study is framed by the following questions: To what extent does the interaction variable of IO and debt ratio influence firm value, and how does this impact change during times of financial turmoil?

This study is based on 9,998 firm-year observations from 1,351 non-financial stock-listed firms in France, Germany, and the United Kingdom (UK). In order to take a comprehensive approach, the 2002–2018 study period is chosen. This period includes years of financial turmoil in the subperiod from 2008 to 2012. Data on firms' fundamentals and security prices is obtained from Compustat. IO data came from FactSet (formerly Lionshares). Firms based in France, Germany, and the UK were chosen for three reasons. First, all three European countries used in this study have developed markets characterized by high regulation and monitoring standards. Second, Europe provides a stable capital market and various options for debt and equity financing. Third, a cross-country setting allows this study to compare results between countries with bank-based (i.e., France and Germany) and market-based (i.e., UK) financial systems.

This study finds that the interaction variable between IO and debt ratio exerts a positive effect on firm value. The finding is not only statistically significant but also economically meaningful: a one-standard-deviation increase in the interaction variable raises firm value by 0.350% relative to the sample mean. This finding is robust to various firm characteristics and country, industry, and year fixed effects, and it also extends to alternative measures of ownership and firm value. The endogeneity concern, which is a common objection in corporate governance research, is also addressed in this study. To do this, this study runs the two-step system generalized method of moments (GMM) estimation and the difference-in-difference GMM, as well as two Granger causality tests. Overall, the results suggest a causal effect of the interaction variable on firm value.

Next, this study examines whether the impact of the interaction on firm value exhibits heterogeneity based on the level of financial turmoil in the markets. Structural break tests suggested significant differences for the crisis period (i.e., 2008–2012) vis-à-vis the pre-crisis period (i.e., 2002–2007) and the post-crisis period (i.e., 2013–2018). Comparing the economic magnitudes of the coefficient estimates across periods of time, it is found that the positive impact of IO is stronger in the crisis period than in the pre-crisis period. This effect seems to continue in the post-crisis period as well.

Finally, this study builds on literature that indicates heterogeneity in monitoring intensity across various institutional investor types. The effect of the interaction variable on firm value seems to differ among independent and grey as well as active and passive institutions, but not across domestic and foreign institutions.

This investigation complements the literature in several key ways. First, it builds on existing studies of institutional investors and corporate governance (Aggarwal et al., 2011; Buchanan et al., 2018; Ferreira et al., 2017; Lin and Fu, 2017). Notably, this is the first study to examine the interaction effect between IO and debt ratio towards firm value, bridging the gap left by previous research that focused solely on stand-alone effects. The findings demonstrate that this interaction also influences firm value. Additionally, the effect is analyzed over a longer timeframe, revealing that the monitoring strength of different investor types varies during pre-crisis, crisis, and post-crisis periods. This insight may help explain the inconsistent results found in prior studies.

Second, this investigation extends existing studies on financial crises and capital structure determinants (Amato, 2020; Harrison and Widjaja, 2014; Fosu et al., 2016; Iqbal and Kume, 2014; Witasari and Cahyaningdyah, 2021). Unlike previous studies' definitions of financial turmoil periods, this study employs a multiple structural break test to analyze these time segments. Therefore, it is assumed this is the first investigation to provide empirical evidence of multiple structural breaks in the relationship between ownership, leverage, and firm value during financial turmoil. This procedure complements previous research by Chipeta et al. (2013) and Demirgüneş (2017). While Chipeta et al. (2013) observe structural breaks for firm-specific capital structure determinants during political turmoil in South Africa, Demirgüneş (2017) finds structural breaks for the capital structure and firm value relation in Turkey.

Third, this study builds upon research that underscores the significance of country and financial-system monitoring contexts (Antoniou et al., 2008; Venanzi and Naccarato, 2017). The results emphasize that the impact of the interaction variable on firm value holds for different financial systems, namely bank-based and market-based economies. This finding supports the view that each setting enables monitoring by institutional investors. Moreover, this study amplifies international investigations on institutional investor monitoring (Aggarwal et al., 2011; Ferreira and Matos, 2008; Ferreira et al., 2017). Previous studies have had shorter time frames, typically ranging from five to ten years. This analysis reveals a long-term trend of increasing institutional investor monitoring.

The implications of these findings hold significance for both the academic and practitioner communities. They offer valuable guidance to investors and managers in their quests to determine the optimal blend of debt and equity at specific levels of IO to enhance firm value. Furthermore, the findings provide policymakers with insights to help them evaluate the adequacy of existing funding strategies, particularly during periods of financial turmoil. Lastly, they aid researchers in fostering a more holistic comprehension of corporate governance practices, thereby enriching the foundation for future studies.

The remainder of this paper proceeds as follows: Section II summarizes the existing literature on the relationship between corporate governance and firm value. Section III describes the data used in this study. Section IV develops the methodology. Section V presents and discusses the results of the main analysis and robustness checks. Finally, Section VI concludes this paper.

II. Literature Review

The relationship between debt and firm value is one of the most controversial topics in corporate finance (DeAngelo, 2022). The trade-off, pecking order, signaling, free cash flow, and market timing theories all attempt to find the optimal debt level that maximizes firm value. In this process, the literature has also identified other firm-specific factors that might impact firm value. The most important ones include profitability, growth, liquidity, tangibility, risk, tax shield, and firm size (Amato, 2020; Baek et al., 2004; Erkens et al., 2012; Iqbal and Kume, 2014; Lambrinoudakis, 2016). Another area of research addresses information asymmetries between managers and shareholders, which also affect firm value (Jensens and Meckling, 1976). The literature suggests that these problems can be resolved either through debt or through corporate governance practices carried out by institutional investors (Gillan and Starks, 2003). Therefore, this literature review focuses on the interaction between both variables and their combined and separate impacts on firm value.

From a corporate governance perspective, the free cash flow theory postulates that debt has an exclusively positive effect on firm value (Jensen, 1986). In contrast, when viewed through a financial lens, the trade-off theory predicts that changes in the debt ratio can either have a positive or negative effect on firm value (Kraus and Litzenberger, 1973; Miller, 1977). In light of these divergent perspectives, extensive research has been conducted to examine the intricate relationship between debt ratio and firm value, leading to a body of empirical evidence marked by variability and inconsistency. Some studies find positive impacts of debt (Demirgüneş, 2017; Ruiz-Mallorqui and Santana-Martin, 2011; Witasari and Cahyaningdyah, 2021), while others observe negative respective effects (Drobetz et al., 2021; Elyasiani and Jia, 2010; Lin and Fu, 2017).[1]

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1. This study will not summarize the extensive literature regarding debt and firm value relation. Therefore, the authors would recommend the reviews by DeAngelo (2022) and Orlova et al. (2020).

Moreover, institutional investors not only impact firm value through their corporate governance practices (Aggarwal et al., 2011; Ferreira and Matos, 2008; Ferreira et al., 2017; McNulty and Nordberg, 2016) but also by adjusting the debt ratio, for instance, through debt provision or the execution of voting rights. Information asymmetries between management and shareholders can alter the relationship between debt ratio and IO, as both serve monitoring functions (Grier and Zychowicz, 1994). In cases of agency conflicts during crises, institutions intensify monitoring at a specific debt ratio or alter the debt ratio to limit managerial discretion (Chung and Wang, 2014). Conversely, institutional investors may adapt their monitoring strategies to changing debt ratios, potentially leading to enhanced cross-monitoring (Datta et al., 1999). The correlation between debt and agency costs motivates debt financing over equity financing.

Finally, both debt ratios and IO are influenced by external economic factors. For instance, mergers, inflation, and interest rates affect a firm's debt ratio (Fosberg, 2012), while frequent changes in index composition and regulatory requirements impact IO (Schmidt and Fahlenbrach, 2017). Given that these variables can substitute for each other in terms of their corporate governance functions, there may be an interplay between them. However, the effect of their interaction on firm value depends significantly on the strength of institutional investor monitoring. This dynamic may be especially relevant in civil law (i.e., France and Germany) compared to common law (i.e., UK) countries. The high ownership concentration (e.g. by large shareholders such as families, institutions or management) is more likely to lead institutional investors to pursue private benefits at the expense of other shareholders (Crane et al., 2019), potentially reducing minority shareholders' commitments to monitoring. Table 1 provides an overview of different monitoring theories. These form the basis for the next section, which explores how institutional investors shape corporate governance.

TABLE 1. Institutional Investor Monitoring Theories

Theory	Author(s)	Explanation	Impact on Firm Value
		Institutional Investor Monitoring Theory	
Institutional Investor Monitoring Theory	Gillan and Starks (2003); Lemmon and Lins (2003)	Institutional investors exercise monitoring of management. The intensity depends on their objectives, preferences, and abilities.	Increase
		Institutional Investor Heterogeneity	
Grey Institutions Monitoring Theory	Brickley et al. (1988); Ferreira and Matos (2008)	Grey institutions (i.e., banks and insurance firms) have better cross-monitoring abilities.	Increase
Independent Institutions Monitoring Theory	Brickley et al. (1988); Ferreira and Matos (2008)	Independent investors (i.e., mutual funds and investment advisors) perform more active monitoring due to fewer business ties.	Increase
Hometown Advantage Theory	Ferreira et al. (2017); Kim et al. (2016)	Domestic institutional investors are good monitors due to better information access.	Increase
Global Investor Theory	Ferreira et al. (2017); Kim et al. (2016)	Foreign institutional investors are good monitors due to superior standards.	Increase

Note: This table presents an overview of the most important monitoring theories regarding the relationship between IO and firm value.

A. Institutional investor monitoring

Corporate governance is one means of reducing information asymmetry and agency costs. Gillan and Starks (2003, p. 5) define it as "the system of laws, rules and factors that control operations at the company." Institutional investors can improve corporate governance in several ways. First, they can engage in monitoring, thereby affecting executive compensation, mergers and acquisitions, and earnings management (Çelik and Isaksson, 2013). Second, they can reduce managerial discretion and improve information efficiency (Maama et al., 2019; Witasari and Cahyaningdyah, 2021). Third, they can impact strategic corporate decisions by exercising voting rights or providing funding or expert knowledge (Baek et al., 2004; Borochin and Yang, 2017). These points suggest that institutional investors can enhance firm value. In line with these contentions, existing studies find positive effects of IO on firm value (Aggarwal et al., 2011; Elyasiani and Jia, 2010; Ferreira and Matos, 2008; Lin and Fu, 2017).

However, there are also factors that could prevent institutional investors from increasing the value of a company. For example, the investors may also be interested in portfolio optimization. If investors prefer short-term returns over long-term firm value development, it is conceivable that they will exert little or no influence on firm value (Elyasiani and Jia, 2010; Lin and Fu, 2017). They may even collaborate with management to pursue self-serving interests, thereby diminishing firm value (Claessens et al., 2002; Ruiz-Mallorqui and Santana-Martin, 2011). Supporting these notions, other studies have documented negative or insignificant impacts of IO on firm value (Rhee and Wang, 2009; Wei et al., 2005; Witasari and Cahyaningdyah, 2021).

Existing literature considers both IO and firms' debt ratios as stand-alone determinants of monitoring, thereby neglecting potential interaction effects. This investigation enhances the literature by focusing on the interplay between IO and firms' debt ratios. Moreover, given the robust investor protection initiatives, strong regulation, and efficient banking system in Europe (Levine, 2002; Venanzi and Naccarato, 2017), it is expected that most institutional investors engage in monitoring. It is, therefore, hypothesized that the interaction variable positively affects firm value. This effect might increase during financial turmoil when credit restraints occur (Ivashina and Scharfstein, 2010) and information asymmetry is high. Accordingly, the two parts of the first hypothesis are as follows.

Hypothesis 1_a : The interaction variable between IO and debt ratio has a positive influence on firm value.

Hypothesis 1_b : The influence of the interaction variable on firm value increases during times of financial turmoil.

B. Institutional investor heterogeneity

Existing literature highlights that institutional investors have no formal roles in shaping corporate governance (Wessels et al., 2016) but are heterogeneous in terms of their objectives and the characteristics of their firms. Hence, their motivation and willingness to engage in monitoring likely varies (Aggarwal et al., 2011; Almazan et al., 2005; Borochin and Yang, 2017; Buchanan et al., 2018; Ferreira and Matos, 2008; Kim et al., 2016; Lin and Fu, 2017). It is, therefore, expected that the interaction variable also varies across different investor types. In particular, its effect might be stronger in institutions with comparative advantages in monitoring.

In addition, previous studies frequently have distinguished between grey and independent institutional investors (Ruiz-Mallorqui and Santana-Martin, 2011). Grey institutions include banks and insurance firms, whereas independent institutions comprise all other institutional investors such as mutual funds, investment advisors, private equity offices, real estate managers and foundations (Ferreira and Matos, 2008).[2] The literature highlights that grey institutions have comparative monitoring advantages due to their superior access to information through regular attendance at management meetings and economies of scale (Gillan and Starks, 2003). However, business ties with managers tempt grey institutions to collaborate with managers to pursue their own interests, thereby preventing them from engaging in monitoring (Aggarwal et al., 2011). Accordingly, the literature also refers to grey and independent institutions as "pressure-sensitive" and "pressure-insensitive", respectively (Brickley et al., 1988).

2. Some researchers deviate from this segmentation: For instance, Borochin and Yang (2017), Bushee (2001) and Buchanan et al. (2018) classified institutions into quasi-indexer, dedicated and transient investors. Elyasiani and Jia (2010) and Almazan et al. (2005) distinguished between active and passive investors. Not least, Drobetz et al. (2021) suggests a higher activism for long- term compared to short-term institutional investors.

Empirical evidence points to a stronger monitoring role for independent versus grey institutions. For instance, Lin and Fu (2017) observe a positive effect of independent and grey institutional investors on Tobin's Q, which is commonly used as a proxy for firm value and performance. The effect is stronger for independent than for grey institutions. Moreover, Ferreira and Matos (2008) find that independent institutions have a positive effect on Tobin's Q, but there is no such effect for grey institutions. These results align with those of Aggarwal et al. (2011), who document similar results for different proxies of corporate governance.

The literature further distinguishes between domestic and foreign institutional investors. According to the hometown advantage theory, domestic institutions perform superior monitoring due to advantages in information gathering and processing (Ferreira et al., 2017; Kim et al., 2016). However, they may also have stronger business ties and loyalty to management that hinder their monitoring (Ferreira and Matos, 2008; Gillian and Starks, 2003). The global investor theory posits that foreign institutions are better monitors due to their stronger proclivity to activism and change (Kim et al., 2016). In addition, they use control mechanisms from abroad that complement the corporate governance standards customary in the firms' countries of domicile. Their cross-monitoring with other shareholders might enhance management supervision (Aggarwal et al., 2011; Gillan and Starks, 2003).

Empirical evidence on the relationship between domestic versus foreign IO and firm value is mixed. Ferreira and Matos (2008) find a positive influence on Tobin's Q for foreign institutions but not for domestic institutions outside the US. Moreover, Lin and Fu (2017) attribute a stronger impact of foreign institutions compared to domestic institutions on Tobin's Q for Chinese firms. Both studies are in line with Aggarwal et al. (2011), who suggest that foreign institutions enhance corporate governance and reduce information asymmetries. In contrast, Ferreira et al. (2017) show that both investor types are equal with respect to portfolio performance, indicating that there are no monitoring differences. Finally, Rhee and Wang (2009) illustrate that foreign investors have negative influences on the liquidity of the Indonesian stock market, indicating that foreign investors facilitate information asymmetry. Overall, theory and empirical evidence suggest that there are differences in monitoring between independent versus grey institutions as well as between domestic and foreign institutions. Therefore, the two parts of the second hypothesis are as follows.

Hypothesis 2_a : The influence of the interaction variable on firm value is heterogenous across independent and grey institutions.

Hypothesis 2_b : The influence of the interaction variable on firm value is heterogenous across domestic and foreign institutions.

III. Data

The sample includes data on stock-listed firms from France, Germany, and the UK over the 2002–2018 period. Year-end data on firm fundamentals and stock information is obtained from Compustat. Information on institutional shareholdings is collected from FactSet (formerly: Lionshares).

Furthermore, the following adjustments are made to the sample. First, financial firms are excluded due to higher leverage, severe regulation standards, and specific asset compositions (Elyasiani and Jia, 2010; Ruiz-Mallorqui and Santana-Martin, 2011). Second, only firms with at least five firm-year observations are considered to enhance the stability of the regression models, especially when analyzing subsamples. This is important given that the influence of ownership variables on firm value and performance is more reliable when measured in the long run (Driffield et al., 2007; Elyasiani and Jia, 2010). Third, only firms with at least 5% total IO are considered because lower aggregated ownership levels are likely to lack statistical significance (Baek et al., 2004; Lin and Fu, 2017).

The final sample consists of 9,998 firm-year observations and comprises 1,351 distinct stock-listed non-financial firms over the 2002–2018 period. This timeframe is chosen to compile three comparable subsamples with a five or six-year time range. The pre-crisis subsample period (i.e., 2002–2007) includes 2,934 observations from 1,009 distinct firms, the crisis period (i.e., 2008–2012) encompasses 3,334 observations from 1,055 distinct firms, and the post-crisis period (i.e., 2013–2018) contains 3,730 observations from 1,008 distinct firms. Furthermore, 4,144 firm-year observations are from 574 distinct firms in France and Germany. This subsample represents the bank-based financial system. In contrast, 5,854 observations are from 777 distinct firms in the UK and represent the market-based financial system.

TABLE 2. Description of Variabless

Variable	Definition	Source
AT	Sum of total assets in the balance sheet. The natural logarithm of total assets is used as firm size measurement.	Baek et al. (2004); Erkens et al. (2012); Ruiz-Mallorqui and Santana-Martin (2011)
BREAK	Break points regarding pre- and post-crisis periods.	Okui and Wang (2021)
GROWTH	Asset growth ratio as measure for growth opportunities, defined as the annual growth rate of total assets.	Iqbal and Kume (2014); Erkens et al. (2012)
IO	Percentage total IO, calculated as shares hold by institutional investors divided by shares outstanding.	Ferreira and Matos (2008); Gillan and Starks (2003)
IO_DOM	Percentage domestic inst. ownership, calculated as shares hold by domestic institutions (geographic region) divided by shares outstanding.	Ferreira et al. (2017); Kim et al. (2016)
IO_FOR	Percentage foreign inst. ownership, calculated as shares hold by foreign institutions (geographic region) divided by shares outstanding.	Ferreira et al. (2017); Kim et al. (2016)

(Continued)

TABLE 2. (Continued)

Variable	Definition	Source
IO_IND	Percentage of independent ownership, calculated as total shares hold by independent investors divided by shares outstanding.	Brickley et al. (1988); Ferreira and Matos (2008)
LIAB	Assets to liabilities as liquidity measure, defined as current assets divided by current liabilities.	Amato (2020); Liu et al. (2012)
MCAP	Market capitalization of the firm as size measure, defined as stock price multiplied by the number of outstanding shares.	Baek et al. (2004); Ruiz-Mallorqui and Santana-Martin (2011)
NDTS	Non-debt tax shields as measure for tax advantages, defined as the ratio of depreciation to total assets.	Amato (2020); Boubaker et al. (2017)
RISK	Business Risk as risk measure, defined as the absolute difference between the annual profitability of a firm i in year t and the average annual profitability of this firm across the sampled period.	Amato (2020); Antoniou et al. (2008)

(Continued)

TABLE 2. (Continued)

Variable	Definition	Source
ROA	Return on assets as measure for profitability, defined as earnings before interest taxes depreciation and amortization divided by total assets.	Amato (2020); Erkens et al. (2012); Iqbal and Kume (2014); Liu et al. (2012)
TANG	Asset tangibility as measure for tangibility, defined as total property, plant and equipment divided by total assets.	Iqbal and Kume (2014)
TDA	Debt ratio as measure for capital structure, defined as long-term debt plus debt in current liabilities divided by total assets.	Baek et al. (2004); Driffield et al. (2007); Lambrinoudakis (2016)
TOBINS_Q	Tobin's Q is defined as the sum of the market value of equity and debt divided by total assets. The market value of equity is calculated as the number of shares outstanding times the share price. All other variables are directly abstracted from Compustat database.	Buchanan et al. (2018); Witasari and Cahyaningdyah (2021)

Note: This table reports the definitions of the variables included in the descriptive statistics as well as regression models.The calculation of the ratios follows previous studies on capital structure research, always taking the most prominent definition in literature.

IV. Methodology

This study investigates the impact of the interaction variable between IO and debt ratio on firm value. Before testing the hypotheses, a methodology must be selected to examine the time frame segmentation. To avoid inconsistent slope coefficient estimates, it is important for subsequent regression analyses to take structural breaks into account (Okui and Wang, 2021). Break dates are expected in 2008 and 2012. A multiple structural break test with predetermined break dates is a specialized instrument used in corporate governance and capital structure research. This study estimates the following two equations to test for pre-crisis and post-crisis structural breaks:

$$Y_{it} \log(\text{TOBINS\_Q}) = \beta_0 + \beta_1 \log(\text{IO}) \times \log(1 - \text{TDA})_{it} + \beta_2 \text{BREAK\_PRE}_{it} + \beta_3 \text{BREAKX}_{it} + \varepsilon_{it} \quad \text{(a)}$$

$$Y_{it} \log(\text{TOBINS\_Q}) = \beta_0 + \beta_1 \log(\text{IO}) \times \log(1 - \text{TDA})_{it} + \beta_2 \text{BREAK\_POST}_{it} + \beta_3 \text{BREAKY}_{it} + \varepsilon_{it} \quad \text{(b)}$$

where, $\log(\text{TOBINS\_Q})$ as the proxy for firm value, is calculated as the natural logarithm of the market value of the equity and debt divided by the total assets (Buchanan et al., 2018; Witasari and Cahyaningdyah, 2021). Both equations include the interaction variable[3] as the main explanatory variable. This is calculated as the natural logarithm (log) of the total percentage of IO, *IO* (Ferreira and Matos, 2008; Gillan and Starks, 2003), times the natural logarithm of one minus the debt ratio, , defined as the long-term debt plus the debt in current liabilities divided by the total assets (Baek et al., 2004; Driffield et al., 2007). We thereby follow Aggarwal et al. (2011), Bushee (2001), Ferreira and Matos

3. This study follows Ferreira and Matos (2008) and captures interaction effects as products of two variables. A comparable calculation is also used by Drobetz et al. (2021), even for the interaction term between institutional investors ownership and firm specifics. In this case it is calculated between total IO and one minus debt ratio to include zero-leverage firms in the analysis.

(2008), and Ferreira et al. (2017), who also use the percentage of fund holdings by institutional investors as a variable to measure monitoring strength. The interaction variable is denoted by $\log(10) \times \log(\text{TDA})$ in subsequent analyses.[4]

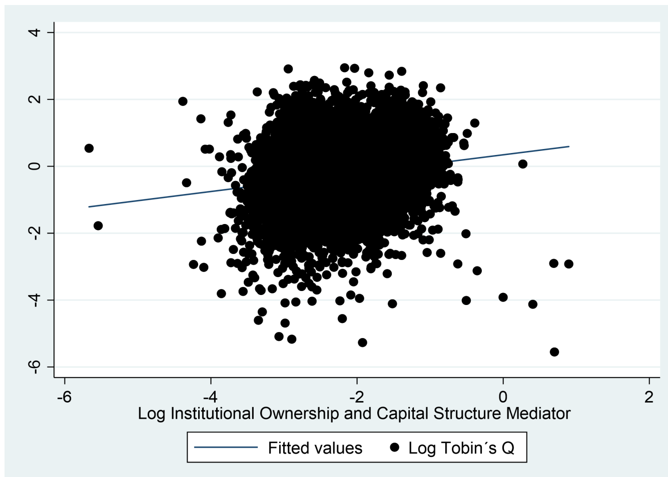

FIGURE 1.— Scatter Plot: This figure shows a Scatter Plot which illustrates the relation between Tobin's Q and the interaction variable of IO and debt ratio. The data is based on the basic regression sample with 9,998 firm year observations from 1,351 stock listed non-financial firms from France, Germany and the UK over the 2002-2018 period (Software: Stata).

In the first model, (1), *BREAK_PRE* is a dummy variable that equals one for the years 2002–2007 and zero otherwise. It measures the slope of the total sample estimation for the 2002–2018 period. In contrast, *BREAKX* is the product of the pre-crisis dummy and the $\log(10) \times \log(\text{TDA})$ variable. It measures the regression slope for the pre-crisis estimates. In the second model (2), *BREAK_POST* is a dummy variable which equals one for the years 2013–2018 and zero otherwise. It also measures the slope of the total sample estimates. Finally, *BREAKY* is the product of the post-crisis dummy and the $\log(10) \times \log(\text{TDA})$ variable. This variable measures the regression slope of the post-crisis estimates.

4. The economic rationale for the log transformations follows below in this chapter.

Next, the hypotheses are tested for all time periods *using the ordinary least squares estimator* (OLS). When investigating the relationship between debt, IO, and company value, existing literature repeatedly introduces squared values or log transformations of the variables before performing regression analyses (Díez-Esteban et al., 2014; Driffield et al., 2007; Kim et al., 2016). A reason for this might be a possible non-linear relationship between the three variables. The additional monitoring effort of institutional investors might first increase and then decrease with each extra level of ownership (Liu et al., 2012; Wei et al., 2005). Moreover, according to the trade-off theory, debt enhances firm value due to tax advantages. However, higher debt ratios increase the risk of bankruptcy and, thus, firm value suffers (Modigliani and Miller, 1963; Kraus and Litzenberger, 1973; Miller, 1977). Building on the above literature, a U-shaped relationship is assumed.

Due to the aforementioned reasons, it should be empirically tested which transformation addresses these issues. Therefore, a statistical test designed by Frahm (2024) is performed to examine the validity of the regression models for different log transformations. This novel test is chosen because it is designed for an arbitrary number of regressors and works reliably with small and large sample sizes. All four combinations (linear/linear, linear/log, log/linear, and log/log) are taken into consideration. The test indicates that a log transformation of the independent variable or a log transformation of both the independent and dependent variables increases the validity of the regression model. This result is in line with proposals from pioneering literature. Since Brailsford et al. (2002) also emphasize the advantage of a log/log transformation to address problems with the sample distribution, this transformation should be used for subsequent analyses. Finally, a visual inspection of Figure 1 supports the assumption that a log/log transformation addresses a possible non-linear relation between debt, IO, and firm value. The basic regression equation to test hypothesis H_1 is stated as follows:

$$\begin{aligned} Y_{it}\text{TOBINS\_Q} = {} & \beta_0 + \beta_1 \log(\text{IO}) \times \log(\text{TDA})_{it} + \beta_2\text{IO}_{it} \\ & + \beta_3 \log(\text{TDA})_{it} + \beta_4\text{ROA}_{it} + \beta_5\text{GROWTH}_{it} \\ & + \beta_6\text{LIAB}_{it} + \beta_7\text{TANG}_{it} + \beta_8\text{RISK}_{it} \\ & + \beta_9\text{NDTS}_{it} + \beta_{10}\text{AT}_{it} + \alpha_{it} + \iota_{it} + \delta_{it} + \varepsilon_{it} \quad (1) \end{aligned}$$

Subsequently, the next two equations test the second hypothesis, H_2, regarding investors' monitoring heterogeneity across independent and grey as well as domestic and foreign institutions. The two models state the following:

$$\begin{aligned} Y_{it} \log(\text{TOBINS\_Q}) = \beta_0 &+ \beta_1 \log(\text{IO\_IND}) \times \log(\text{TDA})_{it} \\ &+ \beta_2 \log(\text{IO\_GREY}) \times \log(\text{TDA})_{it} \\ &+ \beta_3 (\text{IO\_IND})_{it} + \beta_4 (\text{IO\_GREY})_{it} \\ &+ \beta_5 \log(\text{TDA})_{it} + \gamma C_{it} + \alpha_{it} + \iota_{it} + \delta_{it} + \varepsilon_{it} \end{aligned} \quad (2)$$

$$\begin{aligned} Y_{it} \log(\text{TOBINS\_Q}) = \beta_0 &+ \beta_1 \log(\text{IO\_DOM}) \times \log(\text{TDA})_{it} \\ &+ \beta_2 \log(\text{IO\_FOR}) \times \log(\text{TDA})_{it} \\ &+ \beta_3 (\text{IO\_DOM})_{it} + \beta_4 (\text{IO\_FOR})_{it} \\ &+ \beta_5 \log(\text{TDA})_{it} + \gamma C_{it} + \alpha_{it} + \iota_{it} + \delta_{it} + \varepsilon_{it} \end{aligned} \quad (3)$$

where $\log(\text{TOBINS\_Q})$ is the proxy for firm value (Ferreira and Matos, 2008). In model (1), the main explanatory variable is the interaction effect between total IO and debt ratio, denoted by $\log(10) \times \log(\text{TDA})$. The stand- alone effects of the $\log(10) and \log(\text{TDA})$ are also included in this model. All variables are measured in t since Tobin's Q relies on the market values of equity and debt. Consequently, any adjustment processes are expected to occur predominantly within the same year (French and Role, 1986; Sloan, 1996), coinciding with the regular publication of information related to IO and changes in the debt ratio. Therefore, this study adheres to the approach employed by Baek et al. (2004), Witasari and Cahyaningdyah (2021), and Sharma and Singh (2018) by conducting the main regression analyses with all variables measured in it.

Furthermore, all models also consider profitability, growth, liquidity, tangibility, risk, tax shields, and size as other firm-specific variables influencing firm value to avoid endogeneity due to omitted variable bias. These variables are related to other capital structure theories, such as the trade-off, pecking order, signaling, and market timing theories. This study considers all these factors in a comprehensive set of firm-specific control variables (see also the overview in Table 2) from previous studies to develop a new regression model.[5]

In particular, return on assets (ROA) as a measure of profitability is calculated as earnings before interest, taxes, depreciation, and amortization divided by total assets (Amato, 2020; Erkens et al., 2012; Liu et al., 2012). Asset growth (GROWTH) measures growth opportunities and is defined as the growth rate of total assets (Erkens et al., 2012; Iqbal and Kume, 2014). The assets-to-liabilities ratio (LIAB) as a liquidity measure is calculated as the current assets divided by the current liabilities (Amato, 2020). Asset tangibility (TANG) is defined as the total property, plant, and equipment value divided by the total assets (Iqbal and Kume, 2014). Business risk (RISK) is defined as profit volatility and calculated as the absolute year differences of profitability to the average values across the entire period (Amato, 2020; Antoniou et al., 2008). Non-debt tax shields (NDTS) capture tax advantages and are defined as the ratio of depreciation to total assets (Amato, 2020). Finally, the natural logarithm of total assets (AT) is used as a common measure for firm size (Baek et al., 2004).

Finally, country fixed effects (α_{it}) industry fixed effects (ι_{it}), and year fixed effects (δ_{it}) are added to the model (1) to control for unobservable heterogeneity.

The next model,(2), divides total IO into independent and grey institutions. The interaction variable between independent IO and the debt ratio is calculated as the natural logarithm of independent IO times one minus the debt ratio, denoted by $(IO\_IND) \times \log(\textit{TDA})$. The interaction variable between grey IO and the debt ratio is calculated as the natural logarithm of grey IO times 1 minus the debt ratio. This variable is denoted by $(IO\_GREY) \times \log(\textit{TDA})$.

The last model,(3), divides total IO into domestic and foreign ownership. The calculation follows the same pattern as the other models. The interaction variable with domestic ownership is denoted by $\log(\textit{IO\_DOM}) \times \log(\textit{TDA})$ and the one with foreign ownership by Furthermore, the stand-alone effects of institutional ownership and debt and the vector of control variables (C_{it}) as well as country fixed effects, (α_{it}) industry fixed effects (ι_{it}), and year fixed effects (δ_{it}) are also included. Additionally, the Wald Test is conducted to examine for significant differences between the coefficients of the ownership

5. In comparison to other studies using other additional ownership control variables, this study uses a distinct set of firm specific variables that might also influence firm value.

variables.

However, the regression models do not consider possible endogeneity resulting from simultaneity like the Granger causality test, the GMM, or the two-stage least squares (2SLS) estimator used in previous studies (Amato, 2020; Díez-Esteban et al., 2016; Fosu et al., 2016; Maama et al., 2019; Ruiz-Mallorqui and Santana-Martin, 2011). This study considers all three opportunities for the analyses, and the 2SLS may be an excellent econometric tool to tackle the reverse causality issue. Nevertheless, an exogenous variation that is strongly correlated with both variables of the interaction effect $\log(\mathit{IO}) \times \log(\mathit{TDA})$ and uncorrelated with the dependent variable $\log(TOBINS\_Q)$ would be required. Since this exogenous variation is very difficult to find and implement even with the help of event studies, there is still a high risk of an endogeneity problem in the previous regression models (1) through (3) when using the 2SLS. In addition, to the best of the author's knowledge, there is no other investigation that introduces such a model to investigate the influence of interaction variables on firm value and could, therefore, serve as a guide.

Due to the aforementioned factors, this study additionally performs two Granger causality tests (Granger, 1969) with lags in t-1 and t-2 and as well as the difference-in-difference GMM estimator and the two-step system GMM estimator for the baseline regression model. It is assumed that the adjustment processes of Tobin's Q continue to occur in the year following the change in the interaction variable. Methodically closest to this procedure are Aggarwal et al. (2011), Fosberg (2012), Kahle and Stulz (2013), Kim et al. (2016), and Li et al. (2009), which also use lagged values of the explanatory variables to account for endogeneity. The basic model is as follows:

$$\begin{aligned} Y_{it}\text{TOBINS\_Q} = {} & \beta_0 + \beta_1 \log(\text{IO}) \times \log(\text{TDA})_{it-1} + \beta_2 \log(\text{IO})_{it-1} \\ & + \beta_3 \log(\text{TDA})_{it-1} + \gamma C_{it-1} + \alpha_{it} + \iota_{it} + \delta_{it} + \varepsilon_{it} \end{aligned} \tag{4}$$

where the independent variable of interest is the logarithm of the lagged interaction variable $\log(\text{IO}) \times \log(\text{TDA})$, and the dependent variable is the logarithm of the present Tobin's Q, denoted by $\log(\text{TOBINS\_Q})$. The stand-alone effects and all control variables denoted by the vector of control variables (C_{it-1}) are also lagged in t-1. In addition to the two Granger causality tests, the GMM uses lagged variables from t-1 to t-5 of all explanatory variables as instruments. The

TABLE 3. Summary Statistics Total Sample

	N	Mean	SD	P25	Median	P75
TOBINS_Q	9,998	1.302	1.228	0.645	0.959	1.514
TDA	9,998	0.162	0.141	0.033	0.143	0.248
ROA	9,998	0.100	0.136	0.068	0.109	0.153
GROWTH	9,998	0.121	5.861	-0.021	0.053	0.165
LIAB	9,998	2.254	12.196	1.046	1.445	2.096
TANG	9,998	0.209	0.202	0.053	0.145	0.300
RISK	9,998	-0.002	5.493	-0.181	0.009	0.214
NDTS	9,998	0.040	0.051	0.020	0.033	0.051
AT	9,998	6.006	2.310	4.371	5.813	7.475
MCAP in Mio. €	9,998	3,826.670	12,429.596	70.215	307.198	1,591.634
IO	9,998	0.153	0.098	0.083	0.127	0.199
IO_DOM	9,998	0.087	0.086	0.033	0.067	0.117
IO_FOR	9,998	0.066	0.072	0.005	0.047	0.101
IO_IND	9,998	0.148	0.096	0.080	0.123	0.192
IO_GREY	9,998	0.005	0.015	0.000	0.000	0.005

(Continued)

TABLE 3. (Continued)

Note: This table represents the descriptive statistics, including the number of observations (N), mean (Mean), standard deviation (SD), 25 th percentile (P25), median (Median) as well as the 75 th percentile (P75). The total sample includes 9,998 observations from 1,351 stock listed non-financial firms form France, Germany and the UK. Timeframe ranges from 2002 to 2018. FactSet Database has been used in order to calculate IO for each firm and year. For categorization of investor types, the authors follow Ilhan et al. (2023), using "entity_sub_type" variables. The group of independent investors includes all investors except banks, insurance companies as well as pension funds, which are summarized as Grey Institutions. The FactSet entity "entity_sub_types" are called "Bank Investment Devision", "Investment Banking" and "Private Banking/Wealth Management", "Insurance Companies" and "Pension Fund Manager". Other institutional investors summarized as Independent Institutions are for instance investment advisors, private equity offices or mutual funds. For separating domestic from foreign institutions, the authors always compare the headquarter location of the firm with the headquarter location of the institutional investor.

Hansen test and the Arellano-Bond (AR) tests will be performed to check the validity of the model. As in the previous regressions, country (α_{it}), industry (ι_{it}), and year fixed effects (δ_{it}) are also considered.

V. Empirical results

A. Descriptive statistics

Table 3 presents summary statistics for the total sample of 9,998 observations and 1,351 distinct firms from France, Germany, and the UK. The average Tobin's Q amounts to 1.302, and the average debt ratio is 16.2%. The average market capitalization is 3,826 million €, while the median is 307 million euros. This indicates that most companies are small and medium-sized enterprises (hereafter, SMEs). The average total IO amounts to 15.3%. With respect to investor types, 14.8% belong to the group of independent institutions and 0.5% to the group of grey institutions. In total, 8.7% of institutional investors are classified as domestic and 6.6% as foreign. These ownership values are comparable to the studies of Ferreira and Matos (2008) and Ilhan et al. (2023), which are also based on FactSet ownership data.

Table 4 shows the descriptive statistics for the three subsamples: the pre-crisis period, the crisis period, and the post-crisis period. Tobin's Q falls from 1.346 in the pre-crisis period to 1.067 in the crisis period. After the crisis, it rises again to 1.480. The debt ratio rises from 15.5%

TABLE 4. Summary Statistics Pre- to Post-Crisis Subsamples

	Total Sample		Pre-Crisis		Crisis Period		Post-Crisis	
	N	Mean	N	Mean	N	Mean	N	Mean
TOBINS_Q	9,998	1.302	2,934	1.346	3,334	1.067	3,730	1.480
TDA	9,998	0.162	2,934	0.155	3,334	0.174	3,730	0.160
ROA	9,998	0.100	2,934	0.109	3,334	0.099	3,730	0.093
GROWTH	9,998	0.121	2,934	0.096	3,334	0.108	3,730	0.152
LIAB	9,998	2.254	2,934	2.234	3,334	2.512	3,730	2.035
TANG	9,998	0.209	2,934	0.214	3,334	0.211	3,730	0.203
RISK	9,998	-0.002	2,934	0.194	3,334	-0.095	3,730	-0.076
NDTS	9,998	0.040	2,934	0.045	3,334	0.038	3,730	0.039
AT	9,998	6.006	2,934	5.647	3,334	6.047	3,730	6.243
MCAP in Mio. €	9,998	3,826.670	2,934	3,178.087	3,334	3,232.845	3,730	4,862.442
IO	9,998	0.153	2,934	0.117	3,334	0.153	3,730	0.182
IO_DOM	9,998	0.087	2,934	0.072	3,334	0.083	3,730	0.103
IO_FOR	9,998	0.066	2,934	0.046	3,334	0.070	3,730	0.079
IO_IND	9,998	0.148	2,934	0.111	3,334	0.147	3,730	0.179
IO_GREY	9,998	0.005	2,934	0.006	3,334	0.006	3,730	0.003

(Continued)

TABLE 4. (Continued)

Note: This table represents the descriptive statistics for the pre- to post-crisis subsamples of IO in Germany, France and the United Kingdom. The first column shows the total sample with 9,998 firm year observations from 1,351 stock listed non-financial firms from France, Germany and the UK. The other columns show the three subsamples. The pre-crisis subsample includes 2,934 observations (from 1,009 firms), the crisis period 3,334 observations (from 1,055 firms) and the post-crisis subsample 3,730 observations (from 1,008 firms).

before the crisis to 17.4% during the crisis and falls to 16.0% after the crisis. Hence, the table illustrates a slight increase in the debt ratio over time. The total IO increases from 11.7% before the crisis to 15.3% during the crisis and 18.2% in the post-crisis period. With respect to independent institutions, this study finds an increase from 11.1% to 14.7% and then to 17.9%. In contrast, grey IO stays constant at 0.6% in the pre-crisis and crisis periods and decreases to 0.3% in the post-crisis period. Regarding domestic and foreign IO, this study finds that domestic institutional IO increases from 7.2% before the crisis to 8.3% during the crisis and to 10.3% in the post-crisis period. Foreign IO rises from 4.6% before the crisis to 7.0% during the crisis and to 7.9% after the crisis.

Table 5 shows the correlation matrix. The coefficients are moderate and indicate that the assumption of independence between the explanatory variables in the regression models is not violated. However, one exception is the ownership type variables. Their correlation coefficients partially exceed the 0.60 threshold, raising concerns over multicollinearity. These concerns are addressed by estimating three different regressions where 1) total IO, 2) grey versus independent IO, and 3) domestic versus foreign IO are used, respectively. As in Ruiz-Mallorqui and Santana- Martin (2011), the variance inflation factor (VIF) for all independent variables is also included in the models. Given average VIFs below 5, it is concluded that multicollinearity is not a threat to the inferences.

B. Structural break test

When investigating the effect of the interaction variable on firm value during times of financial turmoil, it is important to take structural breaks into account. This is because events such as the financial crisis have the potential to influence the relationship between economic variables (Okui and Wang, 2021). Table 6 shows the structural break test for two predetermined break dates. Column 1 tests the break in the year 2008 for the pre-crisis subsample from 2002–2007. Moreover, column 2 tests the break date in the year 2012 for the post-crisis subsample from 2013–2018. The pre-crisis and the post-crisis break dates are statistically significant at the 1% level. These results indicate that the regression slopes of the three pre-crisis, crisis, and post-crisis subsamples exhibit significant differences. Hence, the influence of the interaction variable on firm value might differ during financial turmoil compared to pre- and post-crisis periods. This result partly supports the first hypothesis, H_1.

C. Multiple linear regression

If institutional investors monitor management, a positive influence on firm value is expected (Gillan and Starks, 2003). The first hypothesis, H_1 , states that the influence of the interaction variable on firm value is positive and increases during times of financial turmoil. Table 7 presents the results of the first multiple linear regression model (1). The coefficient of the interaction variable $\log(IO) \times \log(TDA)$ is significantly positive at the 1% level. The effect is also economically relevant. A 1% increase in the independent variable leads to a 0.350% increase in the average Tobin's Q. Moreover, this study finds a significant influence of IO on firm value in all three subperiods at the 1% level. The increasing magnitudes of the coefficients underpin a significant rise in institutional investors' monitoring activity over time, as already identified by the structural break analysis. In non-tabulated analyses, this study follows other investigations, such as those by Amato (2020) and Demirgüç-Kunt et al. (2020), in distinguishing between short-term and long- term debt. Differentiation of the results according to debt maturity might be crucial for this analysis since short-term debt is characterized by greater flexibility in times of crisis. The results show a significantly positive influence for this variation.[6] Thus, the two parts of the first hypothesis, H_{1a} and H_{1b}, are not rejected.

However, not all institutional investors perform monitoring on the same level (Ferreira and Matos, 2008). The two parts of the second hypothesis, H_{2a} and H_{2b}, state that the influence of the interaction variable on firm value is heterogeneous between independent and grey institutions as well as between domestic and foreign institutions. Table 8

6. Additional results can be obtained on request from the authors.

TABLE 5. Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) TDA	1.000												
(2) ROA	0.032***	1.000											
	(0.001)												
(3) GROWTH	-0.007	-0.002	1.000										
	(0.494)	(0.805)											
(4) LIAB	-0.074***	-0.055***	-0.000	1.000									
	(0.000)	(0.000)	(0.991)										
(5) TANG	0.270***	0.134***	-0.002	-0.047***	1.000								
	(0.000)	(0.000)	(0.858)	(0.000)									
(6) RISK	0.009	0.002	-0.003	-0.003	-0.002	1.000							
	(0.340)	(0.820)	(0.730)	(0.772)	(0.848)								
(7) NDTS	0.077***	0.073***	-0.004	-0.036***	0.156***	-0.009	1.000						
	(0.000)	(0.000)	(0.656)	(0.000)	(0.000)	(0.388)							
(8) AT	0.349***	0.241***	-0.002	-0.055***	0.200***	0.002	-0.046***	1.000					
	(0.000)	(0.000)	(0.868)	(0.000)	(0.000)	(0.824)	(0.000)						
(9) IO	0.011	0.076***	-0.014	-0.010	-0.007	-0.007	-0.009	0.203***	1.000				
	(0.265)	(0.000)	(0.144)	(0.307)	(0.464)	(0.463)	(0.371)	(0.000)					
(10) IO_DOM	-0.137***	-0.013	-0.010	0.002	-0.051***	0.002	0.014	-0.220***	0.686***	1.000			
	(0.000)	(0.188)	(0.293)	(0.816)	(0.000)	(0.851)	(0.164)	(0.000)	(0.000)				
(11) IO_FOR	0.173***	0.116***	-0.007	-0.016	0.049***	-0.012	-0.028***	0.525***	0.544***	-0.238***	1.000		
	(0.000)	(0.000)	(0.461)	(0.103)	(0.000)	(0.232)	(0.005)	(0.000)	(0.000)	(0.000)			
(12) IO_IND	-0.009	0.072***	-0.015	-0.008	-0.015	-0.008	-0.005	0.170***	0.989***	0.694***	0.519***	1.000	
	(0.345)	(0.000)	(0.140)	(0.440)	(0.143)	(0.441)	(0.607)	(0.000)	(0.000)	(0.000)	(0.000)		
(13) IO_GREY	0.136***	0.029***	-0.000	-0.017*	0.047***	0.002	-0.026***	0.235***	0.173***	0.013	0.216***	0.024**	1.000
	(0.000)	(0.004)	(0.966)	(0.080)	(0.000)	(0.870)	(0.009)	(0.000)	(0.000)	(0.188)	(0.000)	(0.017)	

Note: This table shows the correlations between all variables in order to detect multicollinearity. All variables with correlation values above 0.60 won´t be included in one regression model at the same time. Significance levels of the results will be distinguished on a 1%***, 5%** and 10%* level.

shows the results of the second regression model (2). The coefficient of the interaction variable with independent IO $\log(IO\_IND) \times \log(TDA)$ is positive and statistically significant at the 1% level. The effect is also economically relevant. A 1% change in the independent IO interaction variable leads to a 0.137% increase in the average Tobin's Q. For the model with grey IO, a positive coefficient estimation on $\log(IO_GREY) \times \log(TDA)$is observed, which is significant at the 10% level. A 1% change in the grey IO interaction variable leads to a 0.016% increase in the average Tobin's Q. With an F-statistic of 7.94, the Wald test rejects the null hypothesis of no differences in the coefficients at the 5% level. Hence, it is concluded that the impact of the interplay between independent institutions and the debt ratio on firm value is stronger than that between grey institutions and the debt ratio.

TABLE 6. Multiple Structural Break Test

	First Break (1) log(TOBINS_Q)	Second Break (2) log(TOBINS_Q)
log (IO) x log (TDA)	0.355 ***	0.218 ***
	(11.09)	(10.73)
BREAK_PRE	-0.366 ***	
	(-4.11)	
BREAKX	-0.057	
	(-1.52)	
BREAK_POST		0.286 ***
		(4.03)
BREAKY		0.051
		(1.60)
F-Statistic (Breaks)	70.78	45.72
Significance	(0.000)	(0.000)

Note: This table shows the result of the Structural Break Test for the total sample. The first column (1) shows the break test results for the structural break at the predetermined year 2008 and the second column (2) for the structural break at the predetermined year 2012. The F-Statistic below the result tables are indicators if there are break dates for pre- as well as post-crisis values. Their p-values show the significant levels of each break on a 1%***, 5%** and 10%* level.

TABLE 7. Regression Results Total Institutional Ownership

	OLS (1) log(TOBINS_Q)	OLS (2) log(TOBINS_Q)	OLS (3) log(TOBINS_Q)	OLS (4) log(TOBINS_Q)
log (IO) x log (TDA)	0.350 ***	0.347 ***	0.440 ***	0.606 ***
	(6.38)	(3.82)	(7.71)	(11.33)
log (IO)	1.698 ***	2.793 ***	1.966 ***	1.797 ***
	(4.92)	(4.11)	(6.45)	(6.94)
log (TDA)	1.196 ***	1.128 ***	1.068 ***	0.818 ***
	(6.71)	(6.78)	(7.72)	(6.24)
ROA	1.195 ***	1.645 ***	1.348 ***	1.334 ***
	(4.79)	(15.15)	(12.16)	(14.99)
GROWTH	0.000 ***	0.000	0.197 ***	-0.018 **
	(3.81)	(1.04)	(6.00)	(-2.08)
LIAB	0.003 ***	0.009 ***	0.001	0.006
	(6.82)	(4.28)	(0.94)	(1.38)
TANG	-0.590 ***	-0.329 ***	-0.077	-0.195 **
	(-4.16)	(-4.25)	(-0.90)	(-2.50)

(Continued)

TABLE 7. (Continued)

	OLS (1) log(TOBINS_Q)	OLS (2) log(TOBINS_Q)	OLS (3) log(TOBINS_Q)	OLS (4) log(TOBINS_Q)
RISK	0.001	0.008 **	0.005	0.000
	(0.56)	(2.30)	(1.12)	(0.07)
NDTS	-0.485 *	-0.092	-0.193	2.001 ***
	(-2.08)	(-0.60)	(-0.37)	(4.13)
AT	-0.257 ***	-0.070 ***	-0.063 ***	-0.099 ***
	(-7.37)	(-9.72)	(-7.91)	(-13.13)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Adjusted R-squared	0.77	0.31	0.28	0.34
Observations	9,998	2,934	3,334	3,730

Note: This table tests the first hypothesis H_1 in the first regression model (1). Results in column (1) are based on the total sample of 9,998 firm year observations and 1,351 different firms for the period from 2002- 2018, using the OLS estimator. Additionally, column (2) shows the results for the pre-crisis subsample with 2,934 observations, including 1.009 firms between 2002-2007 and column (3) for the crisis subsample with 3,334 observations and 1.055 firms from 2008-2012. Not least, column (4) shows the results for the post-crisis subsample from 2013-2018, including 3,730 observations and 1.008 firms. The results are calculated with robust standard errors clustered at the firm level. Significance levels of the results will be distinguished on a 1%***, 5%** and 10%* level.

Next, this study accounts for financial turmoil. The coefficients of the interaction variable with independent IO on firm value are positive and statistically significant at the 5% and 1% levels during the crisis period as well as the post-crisis period. For the interaction variable with grey IO, a significant impact on firm value is found for all three subperiods. When comparing the three subperiods, this study ascertains that the coefficient for the crisis period is larger than that for the pre-crisis period for both independent and grey institutions. However, the coefficient of the crisis period is smaller than that of the post-crisis period for the interaction variable with grey institutions as well as independent institutions. The regression coefficients of the interaction variables with grey institutions are also distinctly smaller than those with independent institutions over all subperiods. A Wald test rejects the null hypothesis of no differences in the coefficients for the post- crisis period at the 1% significance level with an F-statistic of 8.85. Overall, there appear to be differences in the interaction of independent as well as grey institutional investors with the debt ratio and, therefore, their monitoring strength over time. Hence, the hypothesis H_{2a} is not rejected.

This study also distinguishes between domestic and foreign institutions. Table 9 presents the results of the third regression model (3). The coefficient of the interaction variable with domestic institutions $\log(\mathit{IO\_DOM}) \times \log(\mathit{TDA})$, is positive but statistically insignificant for the total period, while the corresponding effect for foreign IO, $\log(\mathit{IO\_FOR}) \times \log(\mathit{TDA})$, is positive and statistically significant at the 5% level. In terms of economic significance, a 1% change in the foreign IO interaction variable leads to a 0.024% increase in the average Tobin's Q. With regard to domestic institutions, this study finds significant effects for the pre-crisis, crisis, and post-crisis subperiods. Regarding the interaction variable with foreign institutions, this study finds statistically significant coefficients for all three subperiods. However, the Wald test solely rejects the null hypothesis of no significant differences between the coefficients for the post-crisis period at the 1% level with an F-statistic of 9.80. These results suggest that both institutional investor types perform similar monitoring during times of financial turmoil. The hypothesis H_{2b} is, therefore, rejected. Overall, it is concluded that the influence of the interaction variable on firm value is only heterogeneous across independent and grey institutions but not across domestic and foreign institutions.[7]

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7. Additionally, we also run all regression models with alternative calculations of the interaction variable and find significantly positive effects.

TABLE 8. Regression Results: Independent vs. Grey Institutions

	OLS (1) log(TOBINS_Q)	OLS (2) log(TOBINS_Q)	OLS (3) log(TOBINS_Q)	OLS (4) log(TOBINS_Q)
log (IO_IND) x log (TDA)	0.137 ***	0.051	0.138 **	0.317 ***
	(3.17)	(0.83)	(2.18)	(3.88)
log (IO_GREY) x log (TDA)	0.016 *	0.024 **	0.037 ***	0.068 ***
	(1.94)	(2.11)	(3.09)	(5.17)
log (IO_IND)	0.210	0.178	0.035	0.758 *
	(0.80)	(0.30)	(0.08)	(1.69)
log (IO_GREY)	0.063	0.819	0.145	0.708
	(0.09)	(0.91)	(0.16)	(0.38)
log (TDA)	1.333 ***	1.266 ***	1.324 ***	1.014 ***
	(6.85)	(8.61)	(8.32)	(6.20)
ROA	2.415 ***	4.236 ***	2.729 ***	3.780 ***
	(3.09)	(24.56)	(17.24)	(22.28)
GROWTH	0.000	0.001	0.252 ***	0.279 ***
	(0.04)	(1.16)	(4.74)	(5.86)
LIAB	0.011 **	0.031 ***	0.015 ***	0.047 ***
	(2.78)	(4.07)	(3.15)	(4.80)
TANG	-0.507 **	-0.180 *	-0.128	-0.247 ***
	(-2.66)	(-1.86)	(-1.27)	(-2.67)
RISK	0.014	-0.004	-0.012 *	-0.004
	(1.22)	(-0.48)	(-1.66)	(-0.38)

(Continued)

TABLE 8. (Continued)

	OLS (1) log(TOBINS_Q)	OLS (2) log(TOBINS_Q)	OLS (3) log(TOBINS_Q)	OLS (4) log(TOBINS_Q)
NDTS	-3.027 **	-1.478 ***	-0.889	-0.223
	(-2.49)	(-2.89)	(-1.37)	(-0.32)
AT	-0.199 ***	-0.079 ***	-0.103 ***	-0.142 ***
	(-4.26)	(-9.24)	(-10.12)	(-14.04)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Adjusted R-squared	0.83	0.47	0.42	0.56
Observations	5,676	1,652	2,018	2,006
Wald Test (IO)	7.94	0.20	2.49	8.85
Significance	(0.013)	(0.658)	(0.115)	(0.003)

Note: This table tests the second hypothesis H_2 in the second regression model (2). Results in column (1) are based on a sample of 5,676 firm-year observations from 789 different firms for the period from 2002-2018. Furthermore, column (2) shows the regression results for the pre-crisis period wit H_1,652 observations between 2002-2007 and column (3) for the crisis subsample with 2,018 observations from 2008-2012. Column (4) shows the results for the post-crisis period from 2013-2018, including 2,006 observations. The total number of observations deviates from total IO, because this regression only considered firm-year observations where both independent and grey IO variables have no missing values. The results are calculated with robust standard errors clustered at the firm level. Significance levels are indicated as 1%***, 5%**, and 10%*.

Finally, this study looks at the coefficient estimates of the remaining explanatory variables of the models in Table 7. With respect to the firm-specific determinants, the results show that return on assets, growth, and the assets to liabilities ratio have significantly positive influences on firm value. In contrast, the impacts of assets tangibility, non-debt tax shield, and firm size on Tobin's Q are statistically significant and negative. Finally, the control variable of business risk is insignificant and does not exhibit clear patterns across the three regression models.

D. Robustness checks

Several robustness tests are performed to validate the findings. The strategy to tackle concerns over endogeneity due to simultaneity contains two successive steps. First, the results are verified by performing two distinct Granger causality tests (Granger, 1969) with lags in t-1 as well as in t-2 of the explanatory variables. The results are presented in Table 10 and indicate a positive impact of the interaction variable on firm value for both estimations. However, the effect is only significant at the 1% level for the estimation with lags in t-1. Second, the difference-in-difference GMM and the two-stage system GMM are performed. By simultaneously using lagged values of the explanatory variables, the GMM allows endogeneity in the error term to be explicitly addressed (Wintoki et al., 2012). The baseline model is re-estimated using lags of the explanatory variables from t-1 to t-5 as instruments for the equations in differences. For the equations in levels, only one instrument is used (Blundell and Bond, 1998). Reconfirming all inferences, the interaction term remains positive and statistically significant at the 1% level for both estimations. The insignificant values of the Hansen and AR tests are pivotal, as they indicate a high validity of the GMM models. Therefore, the baseline effect seems to be causal.

In further non-tabulated analyses, this study continues by exploring whether the results are sensitive to variations in the type of financial system, that is, bank-based or market-based. Several studies emphasize differences in bank-based and market-based economies (Antoniou et al., 2008; Enikolopov et al., 2014; Sakawa and Watanabel, 2020; Venanazi and Neccarato, 2017). However, no consensus exists on which financial system provides better monitoring mechanisms. Therefore, the sample is divided into bank-based and market-based financial systems to test the two hypotheses, H_1 and H_2. The results show that the effect of the

TABLE 9. Regression Results Domestic vs. Foreign Institutions

	OLS (1) log(TOBINS_Q)	OLS (2) log(TOBINS_Q)	OLS (3) log(TOBINS_Q)	OLS (4) log(TOBINS_Q)
log (IO_DOM) x log (TDA)	0.022	0.057 ***	0.054 ***	-0.030 *
	(1.32)	(2.67)	(2.77)	(-1.95)
log (IO_FOR) x log (TDA)	0.024 **	0.027 **	0.055 ***	0.028 **
	(2.60)	(2.07)	(3.69)	(2.39)
log (IO_DOM)	0.019	1.398 ***	1.265 ***	-0.008
	(0.09)	(3.24)	(3.86)	(-0.04)
log (IO_FOR)	0.616 *	0.417	1.320 ***	1.542 ***
	(2.08)	(1.18)	(4.59)	(6.68)
log (TDA)	1.304 ***	1.365 ***	1.355 ***	1.460 ***
	(7.21)	(11.38)	(11.72)	(13.22)
ROA	2.581 ***	2.525 ***	2.459 ***	2.969 ***
	(9.83)	(19.25)	(18.21)	(23.66)
GROWTH	0.000	0.000	0.146 ***	0.180 ***
	(0.77)	(0.92)	(4.58)	(6.70)
LIAB	0.002 ***	0.027 ***	0.000	0.026 ***
	(5.25)	(5.66)	(0.62)	(4.40)
TANG	-0.716 ***	-0.288 ***	-0.100	-0.330 ***
	(-3.97)	(-3.38)	(-1.17)	(-4.26)

Continued

TABLE 9. (Continued)

	OLS (1)	OLS (2)	OLS (3)	OLS (4)
	(1)	(2)	(3)	(4)
	log(TOBINS_Q)	log(TOBINS_Q)	log(TOBINS_Q)	log(TOBINS_Q)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Adjusted R-squared	0.80	0.38	0.38	0.47
Observations	8,053	2,322	2,720	3,011
Wald-Test (IO)	0.01	1.55	0.00	9.80
Significance	(0.927)	(0.213)	(0.962)	(0.002)

Note: This table tests the second hypothesis H_2 in the third regression model (3). Results in column (1) are based on a sample of 8,053 firm-year observations from 1,050 different firms for the period from 2002–2018. Column (2) shows the regression results for the pre-crisis period with 2,322 observations between 2002–2007, and column (3) for the crisis subsample with 2,720 observations from 2008–2012. Column (4) shows the regression results for the post-crisis period from 2013–2018, including 3,011 observations. The total number of observations deviates from total IO because this regression only considered firm-year observations if both domestic and foreign IO variables have no missing values. The results are calculated with robust standard errors clustered at the firm level. Significance levels of the results are distinguished at the 1% ***, 5% **, and 10% * levels.

interaction variable on firm value is positive and statistically significant in both subsamples. When considering institutional investor heterogeneity, a Wald test suggests a significant difference between grey and independent institutions in both settings at the 1% level. However, the difference between domestic and foreign institutions is significant for France and Germany at the 1% level but insignificant for the UK. In total, the findings support the hypotheses H_1 and H_2 for different country settings.

Next, robustness tests with regard to the use of alternative investor type classifications are conducted. Borochin and Yang (2017), Bushee (2001), and Buchanan et al. (2018) distinguish between quasi-indexer, dedicated, and transient investors. Almazan et al. (2005) and Elyasiani and Jia (2010) differentiate between active and passive investors. This investigation addresses these studies by using another investor type classification at a more granular level. Grey institutions are divided into banks and insurance firms. Complementarily, independent institutions are divided into mutual funds, pension funds, and other funds. Mutual funds are expected to be more active and rather dedicated investors with less diversification. Pension funds might be more passive and tend to be quasi-indexers due to high diversification. The results show an insignificant influence of bank ownership and a significantly positive impact of insurance ownership on firm value. Furthermore, the results indicate a significantly positive influence of pension funds as well as mutual funds and a significantly negative influence of other funds. A Wald test suggests significant differences at the 1% level for both distinctions. These results support the hypothesis H_2, assuming institutional investor heterogeneity.

Lastly, despite some criticisms of Tobin's Q as a measure of firm value (Chung and Pruit, 1994; Smirlock et al., 1984), it remains widely used in corporate finance literature. Consequently, this study conducts a comparative analysis of the results using different Tobin's Q variations employed by other researchers. Following Buchanan et al. (2018) and Witasari and Cahyaningdyah (2021), Tobin's Q is calculated as the market value of equity and debt divided by total assets. Some studies calculate it differently, defining Tobin's Q as the market value of equity plus the total balanced debt divided by the total assets (e.g., Baek et al., 2004; Ruiz-Mallorqui and Santana- Martin, 2011) or as the book value of total assets minus the book value of equity plus the market value of equity divided by the total assets (e.g., Aggarwal et al., 2011; Ferreira and Matos, 2008). These alternative calculations incorporate balanced

TABLE 10. Regression Results Endogeneity due to Simultaneity

	Granger Causality Test with t-1	Granger Causality Test with t-2	Two-Step System GMM	Difference-in-Difference GMM
	(1)	(2)	(3)	(4)
	log(TOBINS_Q)	log(TOBINS_Q)	log(TOBINS_Q)	log(TOBINS_Q)
log(IO) x log(TDA)	0.122 ***	0.034	0.277 ***	0.277 ***
	(3.52)	(0.83)	(113.74)	(377.56)
log(IO)	0.222	0.235	1.130 ***	1.623 ***
	(1.20)	(1.09)	(79.24)	(338.31)
log(TDA)	0.993 ***	1.350 ***	1.605 ***	0.768 ***
	(13.52)	(13.90)	(180.18)	(257.84)
ROA	1.474 ***	1.397 ***	1.306 ***	0.593 ***
	(20.93)	(18.41)	(243.70)	(494.16)
GROWTH	0.000	0.000	0.011 ***	0.000 ***
	(0.60)	(0.45)	(30.94)	(127.25)
LIAB	0.002 ***	0.001 *	0.001 ***	0.002 ***
	(3.35)	(1.71)	(276.31)	(3.165.41)
TANG	-3.53 ***	-0.335 ***	-0.237 ***	-0.819 ***
	(-6.65)	(-5.93)	(-27.85)	(-466.15)
RISK	0.000	0.002	-0.001 ***	-0.000 ***

(Continued)

TABLE 10. (Continued)

	Granger Causality Test with t-1 (1) log(TOBINS_Q)	Granger Causality Test with t-2 (2) log(TOBINS_Q)	Two-Step System GMM (3) log(TOBINS_Q)	Difference-in-Difference GMM (4) log(TOBINS_Q)
	(0.21)	(0.803)	(-27.87)	(-31.35)
NDTS	0.552 **	0.679 ***	-2.779 ***	-0.760 ***
	(2.14)	(4.23)	(-96.78)	(-154.75)
AT	-0.726 ***	-0.058 ***	-0.022 ***	-0.559 ***
	(-15.26)	(-10.95)	(-21.52)	(-1.715.89)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Adjusted R-squared	0.29	0.30	n/a	n/a
Observations	8,107	6,889	9,998	9,998
AR 1 Test	n/a	n/a	Yes	Yes
AR 2 Test	n/a	n/a	Yes	Yes
Hansen Test	n/a	n/a	Yes	Yes

Note: This table shows the results for the fourth regression model (4) by using two Granger causality tests with lags in t-1 and t-2 as well as the two-step system GMM and the difference-in-difference GMM. All estimations are based on the total sample of 9,998 firm year observations and 1,351 different firms for the period from 2002-2018. The column (1) shows the results for the first Granger Causality test with lags in t-1, the column (2) for the second Granger Causality test with lags in t-2, the column (3) for the two-step system GMM and the column (4) for the difference-in-difference GMM. Significance levels of the results will be distinguished on a 1%***, 5%** and 10%* level.

total debt or non-financial liabilities as additional components in the numerator. The findings consistently reveal a significantly positive influence of the interaction variable on all three Tobin's Q variations. Hence, the results remain robust across various specifications of the dependent variable.[8]

E. Discussion

The empirical literature provides mixed findings on the monitoring capabilities of institutional investors and their impact on firm value (Borochin and Yang, 2017; Driffield et al., 2007; Ferreira and Matos, 2008; Gillan and Starks, 2003; Ruiz-Mallorqui and Santana-Martin, 2011; Sakawa and Watanabel, 2020). However, these studies overlook the potential influence of the interaction variable between debt ratio and IO on firm value. This research reveals a significantly positive impact of the interaction variable and thereby contributes to the literature by enhancing the comprehension of corporate governance dynamics concerning debt and IO across France, Germany, and the UK. Furthermore, the results demonstrate robustness across both bank-based and market-based economies, aligning with Levine's (2002) viewpoint, which diminishes the significance of the financial system perspective. These findings also align with Faruqi et al. (2019), who demonstrate strong governance mechanisms across developed countries. To expand these insights, future research may benefit from examining an institutional investor stability metric for measuring monitoring (Callen and Fang, 2013) instead of using institutional investors' fund holdings. This may even allow researchers to investigate the extent to which the positive effect on firm value is attributable to monitoring by institutional investors or the debt ratio.

Additionally, this study sheds light on the heterogeneity among institutional investors. It reveals that independent institutions are more likely than grey institutions to act as substitutes for debt in terms of management monitoring. These findings align with the results of Brickley et al. (1988) and Ferreira and Matos (2008), which suggest that independent institutions exhibit superior monitoring capabilities. Interestingly, this study does not uncover a significant difference between domestic and foreign institutions during financial turmoil. This

8. All additional robustness checks can be obtained on request from the authors.

observation aligns with prior research by Aggarwal et al. (2011), Ferreira et al. (2017), and Kim et al. (2016) indicating that both investor types display similar levels of monitoring quality. However, it is important to note that this study does not consider the impacts of other shareholders. Future research should consider various dimensions, including family and non-family firms, managerial ownership, CEO characteristics (Chen and Lin, 2013), foundations, government entities, and their interactions. Furthermore, forthcoming studies may explore the monitoring dynamics within SMEs characterized by higher levels of information asymmetry.

Lastly, this study contributes methodologically by introducing a novel approach. Existing research typically analyzes distinct pre-crisis, crisis, and post-crisis subsamples. This is seen in studies by Amato (2020) and Iqbal and Kume (2014), who define crisis periods from 2008 to 2009 and from 2009 to 2012. However, these studies do not use statistical methods to segment time frames. In contrast, the main analysis of this study is preceded by a structural break test that uncovers significant differences in regression slopes during financial turmoil lasting from 2008 to 2012. These findings will help future researchers classify time periods more consistently in studies on financial crises. They also align with the work of Chipeta et al. (2013), which identifies structural breaks in capital structure determinants associated with political change, and Demirgüneş (2017), which considers structural breaks between debt ratio and firm value. However, future studies could also consider volatility measures for investigating financial turmoil and qualitative methods such as interviews to validate the empirical findings of this study.

VI. Conclusion

This study delves into the interaction between debt ratios and IO and explores its impact on firm value, particularly during times of financial turmoil. It contributes to the literature in several key ways. First, this study provides empirical evidence demonstrating a positive impact of the interplay between IO and debt ratio on firm value. Second, the findings indicate that this influence is more pronounced during financial turmoil. The impact also varies among different investor types. Additional empirical tests indicate significant differences between independent and grey as well as active and passive institutions but not between domestic and foreign institutions. Third, including a multiple structural break analysis methodologically enhances the existing body of research on financial crises. All findings exhibit robustness across various financial system subsamples, different investor types, and variations in Tobin's Q measurement.

The findings carry significant implications for academia, investors, managers, and policymakers alike. Future research in the field of corporate governance and firm value should incorporate IO as a crucial factor, especially during crisis periods. Furthermore, a deeper understanding of the interplay between IO and debt ratios provides valuable insights for investors and financial managers seeking to optimize monitoring levels to enhance firm value. Lastly, this understanding of the interaction variable's impact on firm value can assist policymakers in formulating effective funding strategies. The results support them in anticipating future credit demand, engaging with investors, and, ultimately, facilitating optimal firm value development, particularly during times of financial turmoil.

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