

FIRM SIZE MODERATOR: LINKAGE OF FIRM AGE AND FIRM'S VALUE IN INDONESIAN MANUFACTURING FIRMS AFTER COVID-19 PANDEMIC (SECTORS B AND C)



 Siti Wardah Pratidina Nasution ^{(a)1}  Kamilah Sa'diah ^(b)

^(a) Lecturer, Department of Management, University of AlWashliyah, Medan, Indonesia; E-mail: pratidina.bachrain@gmail.com

^(b) Lecturer, Department of Accounting, University of Binaniaga Indonesia, Bogor, Indonesia; E-mail: sadihakamila@gmail.com

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ABSTRACT

"Dual Performance" phenomenon and the contraction of the Manufacturing Purchasing Managers' Index (PMI) underscore the importance of understanding how firms' internal characteristics respond to economic volatility and the pressures of digitalization. This study aims to analyze the linkage between firm age and firm value, with firm size as a moderating variable, in sector B and C manufacturing firms listed on the Indonesia Stock Exchange (IDX) during the post-COVID-19 pandemic period of 2022-2024. Tobin's Q was used in this study to examine the impact of the linkage before and after moderation, while Firm Age and Firm Size were measured using natural logarithms. The research type is causal-comparative, with a quantitative analysis approach. The sample was selected using purposive sampling, resulting in 75 firms meeting the criteria from a total population of 228 manufacturing firms during 2024. This study employs secondary data from the Indonesian Standard Industrial Classification (KBLI) criteria on IDX. Moderated regression analysis (MRA) was used for data analysis and hypothesis testing. The results show that Firm Age has a significant negative relationship with Firm Value. This confirms the phenomenon of "Aging," or organizational rigidity, where older firms tend to be less competitive and slower to adapt to digital technology than younger firms. Furthermore, Firm Size was found to be unable to moderate the relationship between Firm Age and the Firm's Value, nor to serve as a pure moderator. This finding indicates that substantial assets alone do not automatically protect mature firms unless they are accompanied by operational agility and transparency to minimize agency conflicts in the post-pandemic era.

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INTRODUCTION

In the aftermath of the COVID-19 pandemic, the metrics for evaluating firm value have undergone a fundamental transformation. Investors no longer measure a company's worth solely by its net profit; instead, operational resilience and technological adaptability have become the primary benchmarks. Following the tumultuous period of 2020–2021, the Indonesian manufacturing industry demonstrated a significant rebound characterized by rapid growth in market value. The success of companies in implementing strategic cost-saving measures during the crisis served as a major catalyst for investor confidence. This sentiment subsequently drove a surge in stock prices, particularly within the consumer and automotive sectors, mirroring the broader global economic recovery trend (Jacksen & Yantiana, 2025). However, this recovery has been challenged by new macroeconomic headwinds emerging in 2023 and early 2024. Bank Indonesia's policy of maintaining high interest rates (BI Rate) to 6.25% in April 2024 to maintain currency stability and curb inflation has put direct pressure on the manufacturing sector. This situation creates an urgency for companies to manage their capital structure effectively, as rising debt costs risk eroding shareholder value and hampering the growth momentum they have achieved (Sahara, 2025). Amidst this economic volatility, internal characteristics such as firm age become crucial factors in determining market risk perceptions. Long-established companies are often perceived as having strong reputations and experience navigating crises (Hidayat, Badaruddin, & Widiawati, 2025). However, this maturity is often hampered by organizational rigidity, which hinders digital agility compared to younger corporations (Loderer & Waelchli, 2010). Some studies have found that firm age has a positive influence on value due to experience-based efficiency (Chen & Srinivasan, 2024), while others argue that

¹Corresponding Author: ORCID ID: 0000-0003-1528-378X

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older firms are often trapped in organizational rigidity, which can actually reduce value in the eyes of investors during technological disruption.

The role of firm size in this context emerges as a crucial yet ambiguous moderating variable. There is debate over whether larger firm size strengthens the positive effect of firm age on market value through asset stability or weakens it by creating organizational inertia (Celestin, Vasuki, Kumar, & Boakye, 2019). Large, mature firms may have a financial cushion to cushion the impact of rising interest rates, but overly massive structures often hinder digital agility. Conversely, smaller, agile firms may demonstrate better market performance in adapting to technology, despite being vulnerable to liquidity pressures amid tight monetary policy.

The latest economic indicators signal conflicting trends in Indonesia's manufacturing sector in 2024-2025. Despite national data showing 52 consecutive months of economic expansion, the Manufacturing Purchasing Managers' Index (PMI) in August 2025 stood at 47.2%, remaining in the contraction zone (Fiore, 2024). A "Dual Performance" phenomenon has occurred, in which the automotive and downstream sub-sectors continue to grow, while labour-intensive sectors such as textiles are actually slumping due to the onslaught of imports and weakening purchasing power (Business-Indonesia, 2025).

In the latest classification, the 2020 Indonesian Standard Industrial Classification (KBLI, in Indonesia), which is frequently used on the Indonesia Stock Exchange (IDX), the manufacturing sector can generally be classified as follows: Sector B (Mining & Quarrying), although often separated from "Pure Manufacturing," many companies here have processing lines (upstream manufacturing). Sector C (Processing/Manufacturing Industry) encompasses textiles, chemicals, food and beverages, and automotive (IDX, 2021). This phenomenon is heavily influenced by fluctuations in global commodity prices, the post-COVID-19 green energy transition, supply chain disruptions, and accelerated digitalization (*Industry* 4.0).

This performance disparity based on economies of scale underscores the relevance of research on the extent to which company size moderates the relationship between company maturity and firm value in the investor outlook. The gap phenomenon in this study stems from the contradiction between national macroeconomic growth and the operational realities of manufacturing, which contracted after the COVID-19 pandemic. This uncertainty raises a critical research question: Does Firm size serve as a protective buffer that enhances company value through asset stability, or does it act as a barrier that slows adaptation amid technological shifts and high-interest-rate pressures? The anomaly in which small firms exhibit greater digital agility than rigid large corporations creates a pressing need to re-examine the role of Firm Size as a moderator in maintaining and enhancing firm value in the post-pandemic era of uncertainty. This study aims to analyze the linkage between firm age and firm value, with firm size as a moderating variable, in sector B and C manufacturing firms listed on the Indonesia Stock Exchange (IDX) in the post-COVID-19 pandemic period (2022-2024). The period of 2024 will be used for the analysis because the financial information for the next period has not yet been fully published by companies listed on the stock exchange.

The paper structure in this study is as follows: Section 1 covers the introduction and background. Section 2 provides a prior literature review in the context of agency theory and firm characteristics (firm size and age), especially focusing on the prediction before or after a moderate function of a variable related to the Firm's Value implication. Section 3 presents the materials and methods for the judgment data population and the final sample, followed by the data processing technique used in this study, Moderated Regression Analysis (MRA). Section 4 explores the findings from output calculation statistic programs, their interpretation results, and the discussion session. Finally, Section 5 summarises the overall findings and briefly describes our key contributions. We also outline the limitations and a future research plan in this section and highlight avenues from the developed concept research interests.

LITERATURE REVIEW

Agency Theory

In Scott's (2015, p. 340) conceptualization, agency theory posits an inherent disparity of interests between principals and agents. This phenomenon is triggered by information asymmetry, where the unequal distribution of knowledge allows agents to act opportunistically, deviating from the principal's primary goals for personal gain.

Firm age is a crucial variable because it represents accumulated experience, reputation, and resources. Long-established companies tend to have more mature reporting systems and a more widely recognized reputation, thereby reducing information asymmetry between the principal and the agent. Loderer and Waelchli (2010) identified an "ageing" phenomenon in which company performance can decline with age due to organizational rigidity and increasing agency costs. Larger companies have greater resources to hire qualified external auditors (such as the "Big Four") to minimize agency costs (Husain & Syniuta, 2020). Furthermore, large company size provides stability, but also a higher potential for agency conflicts if internal controls are not strengthened with technological innovation (Faisal et al., 2020).

Agency Theory provides an essential framework for understanding how interactions between owners (principals) and management (agents) influence firm value, particularly in the Indonesian manufacturing sector, which is struggling to recover amidst global and domestic pressures following the Covid-19 pandemic (Business-Indonesia, 2025). Corporations that align agents' interests with shareholders' through transparency tend to have higher market value.

Firm Age

The Firm's age is the time from the company's founding to the present or future, with no limits. According to Stinchcombe (1965), older companies certainly have sufficient resources, which leads them to take more risks and therefore reduce their failure rate. In contrast, younger companies have limited resources, inexperienced employees, and limited external networks,

which will make them weak in facing risks. Thus, the company will achieve a higher failure rate (Ahlstrom, Bruton, & Yeh, 2008). It establishes a competitive advantage by giving corporations new ways to outperform their competitors. It spawns new businesses, often from within an existing one (Porter & Millar, 1985).

Many things can be associated with the Firm's age, such as the amount of experience, expertise, and risk reduction experienced because old companies are expected to have a large market share, high customer satisfaction, customer loyalty, good logistics channels, and business partners with various production factors (Mahajan & Singh, 2013). Firms measure age based on the terms of their initial business registration or on when they started trading. Ageing processes can occur at many levels (employee, Firm, and cohort levels, etc.), and deducing that age effects occur within the first 5-7 years, with most occurring in at least young firms, underscores the importance of available datasets (Coad, 2018). A long-established firm would have more experience in its industrial sector and be better known to the broader community than new entrants. Chen and Srinivasan (2024) highlight that the process of "going digital" has significant implications for a firm's value and performance. Older companies must undergo technological transformation to remain competitive with younger, more agile firms.

Firm's Value

Modigliani and Miller (M&M) (1958) conceptualized a theory of capital structure and a firm's market value. They proposed that market value is determined by the Firm's business earnings and the underlying asset's risk. M&M's capital structure irrelevance proposition does not assume taxes or bankruptcy costs. The main idea of corporate value is value creation, meaning a firm must add value to its resources to sustain them. If a corporation cannot create value, then its existence has no purpose (Kraaijenbrink & Spender, 2014). Brigham and Houston (2019, p. 518) state that the Firm's value is the present value of future free cash flows, discounted at a weighted-average cost of capital. In light of globalization, the global financial crisis, and rapid technological change, the need to transition from traditional to contemporary methods for measuring a firm's value has emerged, particularly amid the rise of manipulation and fraud.

In the post-pandemic economic context, firm value reflects a business entity's adaptability and resilience to market fluctuations. Chen and Srinivasan (2024) emphasize that in the modern era, firm value is measured not only by physical assets but also by how the corporation implements digital transformation to improve operational efficiency and performance. In accounting and financial research, there are several commonly used ratios as outlined in Table 1 below:

Table 1. Several Ratios for Measuring a Firm's Value

Ratio	Abbreviated with	Formula/Description (Source)	Relevance
Price-to Book Value	PBV	$\frac{\text{Stock Price}}{\text{Book Value per Share}}$ (Zutter & Smart, 2022)	Assess how much the market values a firm's book value
Tobin's Q	TQ	$\frac{\text{Market Price of Outstanding Shares}}{\text{Total Assets}}$ (Klapper & Love, 2004)	Measuring management performance and market growth potential more comprehensively
Price-to Earnings Ratio	PER	$\frac{\text{Price per Share}}{\text{Earnings per Share}}$ (Brigham & Houston, 2019)	Assess how much the market values a firm's book value

Source: Recapitulation from literature and previous research (2026)

Relevant Research and Hypothesis Proposed

Research on firms' value in the Indonesian manufacturing sector (especially Sectors B and C) post-COVID-19 is crucial given the global and domestic pressures affecting economic stability. Based on Stinchcombe's (1965) Newness Theory of liability, younger firms often face legitimacy challenges and resource constraints compared to established firms. Similarly, Pervan *et al.* (2017) and Rwakihembo *et al.* (2023), from a firm life-cycle perspective, suggest that firm age reflects accumulated experience and reputation, which can boost investor confidence. However, post-pandemic challenges demand high efficiency, and older firms that are too rigid (Loderer & Waelchli, 2010) risk value loss if they fail to adapt to digitalization (Chen & Srinivasan, 2024). In Indonesia, a corporation's ability to mitigate agency conflicts and maintain transparency in financial reporting significantly determines how the market values the entity (Faisal *et al.*, 2020). Considering the dynamics of economic recovery and fluctuations in the manufacturing index (Fiore, 2024). A first hypothesis is proposed: Firm Age has a significant association with Firm Value in sectors B and C among Indonesian manufacturing firms post-COVID-19 pandemic.

Furthermore, the relationship between firm age and firm value is not independent; it is influenced by the company's operational scale or size (Firm Size). According to Brigham and Houston (2019) and Zutter and Smart (2022), larger companies have access to competitive advantages through cost efficiency and more stable capital availability, enabling them to retain profits for long-term growth (Celestin *et al.*, 2019). In the post-pandemic context, larger companies have greater resilience in the face of market shocks due to the support of a more established governance structure (Klapper & Love, 2004). Firm size acts as a catalyst; long-established companies are perceived as significantly more valuable by the market if supported by substantial assets, as this size validates their stability and capacity for technological innovation in the digital era (Hidayat, Badaruddin, & Widiawati, 2025). Conversely, older, smaller companies may be perceived as less competitive in absorbing high post-crisis operating costs (Jacksen & Yantiana, 2025). Therefore, it is believed that firm size can

strengthen the positive impact of maturity on market value appreciation. Based on this logic, the second hypothesis is proposed: Firm Size moderates the relationship between Firm Age and Firm Value, such that the influence of Firm Age on Firm Value will be stronger in large-scale firms.

MATERIALS AND METHODS

This study is a causal-comparative type with a quantitative analysis. This type uses a non-experimental quantitative method to identify causal relationships among variables by comparing two or more groups after the event has occurred (ex post facto). Researchers do not manipulate the independent variable; instead, they analyze existing differences to determine causal factors (Brewer & Kubn, 2010).

The population of this study comprises all manufacturing firms registered at the Indonesian Stock Exchange (IDX) during 2022-2024. Based on data from the IDX (<https://idx.co.id/en/listed-companies/company-profiles>), there are 228 firms in the general manufacturing industry. The initial sampling was based on criteria (judgment) within the research scope, specifically manufacturing firms based on the Indonesian Standard Industrial Classification (KBLI) criteria in Sectors B and C. Further criteria were then established: the period observed was companies that consistently reported financial information as of the end of the fiscal year, December 31. The following interpretation computes the overall measurement of variables utilizing a ratio scale as outlined in Table 2 below:

Table 2. Operational Variable Measuring

Variable Name	Dimension	Symbol Abb.	Proxy	
			Calculation	Sign
Firm Age (X)	Log Naturals of Firm Age	FAGE	$\ln(\text{Fiscal Year} - \text{Year of Firm Establishment})$	-
Firm's Value (Y)	Tobin's Q	TQ	$\frac{\text{Market Price of Outstanding Shares} + \text{Debt}}{\text{Total Assets}}$	+
Firm Size (M)	Log Naturals of Total Assets	FSIZE	$\ln(\text{Total Assets})$	+

Source: Recapitulation from literature and previous research (2026)

Data collection methods are an integral part of the research design, using indirect observation and documentation techniques. In this study, secondary data were used based on the Annual and Financial Reports available on the official websites of each corporation in the targeted industry, corresponding to Sectors B and C.

Data were analyzed using descriptive statistics, classical assumption testing, and hypothesis-appropriate model verification. The moderated regression analysis (MRA) proposed in this study utilizes Firm Size as a Pure Moderator. Pure Moderator testing is conducted by computing an interaction regression, but the moderator variable's effect is not based on the independent variable (Ghozali, 2021, p. 221). The proposed moderated regression test equation in this study is:

$$TQ = \alpha + \beta_1 FAGE + \epsilon \quad \dots (1)$$

$$TQ = \alpha + \beta_2 (FAGE * FSIZE) + \epsilon \quad \dots (2)$$

Following the calculations, the research was interpreted, and conclusions were drawn.

RESULTS

There were 228 manufacturing firms registered at the Indonesian Stock Exchange (IDX) in 2024. Based on the recapitulation conducted in this study, 75 of them fulfil the requirements for further data processing by Sector B and Sector C. The Firm's eliminated met the following criteria: (i) not listed during the 2022-2024 observation period; (ii) Firm is not delisted from the Indonesian Stock Exchange and is not experiencing stock suspension, thus preventing them from publishing annual reports and financial statements to the public (lacking complete data); and (iii) Firm is using a reporting period other than December 31st. These variables were measured by descriptive analysis without generating conclusions for each variable in Table 3 below:

Table 3. Descriptive Analysis

Variable	n	FAGE (X)	Firm's Value (Y)	FSIZE (as Moderating)
Earned Score				
Minimum	225	8.0087	0.3413	10.7680
Maximum	225	10.7209	2.1936	14.2795
Mean	225	9.49954	0.9513	12.3433
Deviation (Std.)	225	0.42946	0.3822	0.68728

Source: Author's Elaborated (2026)

Information regarding the earned score for the descriptive analysis of Table 2: the minimum and maximum scores for Firm Age (X) are 8.0087 and 10.7209, respectively, with a mean score of 9.49954. The std. deviation score compared to the mean score outcome of 0.045, indicating that the variation in the Firm Age variable is normally distributed around the mean score (less than 30 per cent). The minimum and maximum scores for Firm's Value (Y) range from 0.3413 to 2.1936, with a mean of 0.9513. The std. deviation score compared to the mean score outcome of 0.4017, indicating that the variation in the Firm's Value variable is moderate, normally distributed around the mean score (less than 50 per cent). The minimum and maximum scores for Firm's Size (as a Moderator) range from 10.7680 to 14.2795, with a mean score of 12.3433. The std. deviation score compared to the mean score outcome of 0.056, indicating that the variation in the Firm's Size variable is normally distributed around the mean score (less than 30 per cent). The results of the statistical application indicate that the scatter diagram pattern in the regression model indicates heteroscedasticity (Ghozali, 2021, p. 134). A multicollinearity test can be carried out by examining variance inflation factors (VIFs) and tolerance scores; VIFs should be less than 10 and tolerances greater than 0.1 (p. 104). Then, the required dU/dL score is $dW < 4-du$ (for "no autocorrelation" criteria) (p. 108). Figure 1 and Table 4 summarise and present the results of the classic assumption testing and their interpretation.

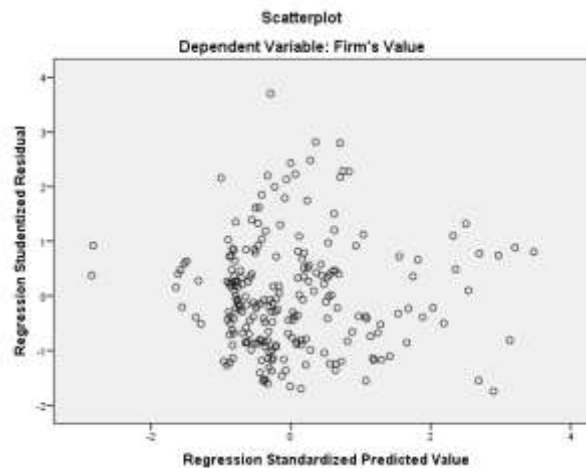


Figure 1. Heteroscedasticity Graphs: Scatter Diagram

Information regarding the scatterplot graphs on the Firm's Value (Y variable) (Figure 1), i.e., the data points are dispersed above and below the number 0 on the Y axis without forming an assured pattern or accumulating at a certain point, so it is inferred that there are no indications of heteroscedasticity.

Table 4. Summary of the Multicollinearity and Autocorrelation Test Results

Variable Testing	VIF; Tolerance Score	Inferred from Test Results	dW Score	Inferred of Autocorrelation Results
FAGE (X)	1.960; 0.510	< 10 and > 0.1, there is no multicollinearity	1.041	dW < 1.5981 (dL), positive autocorrelations*
FAGE*FSIZE (as Moderating)	1.000; 1.000	< 10 and > 0.1, there is no multicollinearity	0.982	
FAGE (X)	*) Lag_e (data transformation) on residual variables		1.896	1.6521 < dW < (4-1.6521), No autocorrelations concluded
FAGE*FSIZE (as Moderating)			1.896	1.6521 < dW < (4-1.6521), No autocorrelations concluded

Source: Calculating from Statistic Application (2026)

Table 4 above represents a multicollinearity test on the independent variables. Based on the autocorrelation test results, the Durbin-Watson statistic is 1.896. This score is among the du and (4-dU) scores at k = 1 and n = 75 (Ghozali, 2021, hal. 458), which were previously transformed using the Cochrane Orcutt technique. Finally, the assumption of no autocorrelation symptoms can be accepted. The proceeds of statistics have been obtained from their processing to answer the research problem based on the two alternative hypotheses proposed, as summarised in the following Table 5:

Table 5. Summary of the Hypothesis Results

Path Variable	H ₁ : FAGE → TQ	H ₂ : FAGE*FSIZE → TQ (as Moderating)
Earned Score		
Constant		4.497
Regression Coefficients (β)	-0.398	0.002
p-Value (α: 0.05)	0.000	0.587
Inferred from Hypothesis Results	H ₁ is Accepted	H ₂ is Rejected
R-Square (R²)		0.173

Source: Calculating from Statistic Application (2026)

Table 5 summarises the statistical testing results in this study. It creates the following moderated regression equation for each of:

$$TQ = 4.497 - 0.398FAGE + 0.002FAGE * FSIZE + \varepsilon \dots (2)$$

The Firm Age (X variable) coefficient of minus 0.398 indicates that every increase or decrease of one unit of the Firm Age variable has an impact on decreasing the Tobin's Q score by 39.8 per cent, assuming the other variables are equal to zero. Furthermore, the Firm Size (moderating variable) coefficient score of the interaction variable is 0.002, indicating that every increase or decrease of one unit of the Firm Age and Firm Size causes the linkage between the Firm Age and the Firm's Value to increase by 0.002 (not significant), assuming the other variables are equal to zero. The application output clearly shows that the Firm Age variable has a significantly negative influence on the Firm's Value, with a regression coefficient of -0.398 and a p-value of 0.000 (H_1 Accepted). The interaction variable (FAGE*FSIZE) provides a coefficient of 0.002 and is not significant with a p-value of 0.587 (H_2 Rejected), meaning that the Firm Size variable is not a pure moderator.

DISCUSSIONS

Based on the statistical analysis results, this study shows that Firm Age has a significant negative relationship with Firm Value in Indonesian manufacturing sectors B and C after the Covid-19 pandemic (H_1 Accepted). This is evidenced by a regression coefficient of -0.398 and a p-value of 0.000, indicating that every increase in Firm Age is associated with a decrease in the Tobin's Q score of 39.8 per cent (significant). From the perspective of Agency Theory, this phenomenon can be explained by information asymmetry and agency costs that arise as the firm ages. Scott (2015) stated that agency theory arises from differences in interests between the principal (owners) and the agent (management), in which agents tend to act opportunistically for personal gain. In the context of Indonesian manufacturing firms struggling to recover from the pandemic, older firms tend to exhibit an "ageing" phenomenon characterised by organisational rigidity and higher agency costs. This rigidity hinders the digital agility that is much needed in the post-pandemic era, so investors perceive these mature firms as less competitive than younger, more agile firms.

The results of this study also revealed that Firm Size did not moderate the relationship between Firm Age and Firm Value (H_2 was rejected). Although, in theory, large firms are thought to have more resources to hire high-quality auditors to reduce agency costs, in reality, an overly massive organizational structure creates inertia that slows innovation. The interaction between Firm Age and Firm Size variables only has an insignificant influence of 0.002 (p-value is 0.587). This indicates that the stability of assets owned by large firms does not automatically strengthen investor confidence if the corporation is caught in internal agency problems and fails to carry out digital transformation.

In relation to previous research, these findings support and enrich the literature: Loderer and Waelchli (2010) argue that firm performance can decline with age due to organizational rigidity. Chen and Srinivasan (2024) confirm that in the modern era, firm value is largely determined by digital transformation; older firms that fail to transform will lose value in the market's eyes. Faisal et al. (2020) strengthen the relevance of agency theory in Indonesia, where the business's ability to mitigate agency conflicts and maintain transparency is the main determinant of market valuation. Stinchcombe (1965) and Ahlstrom et al. (2008) state that young firms are riskier, but the study results show that, in the post-pandemic context in Indonesia, maturity (age) becomes a burden if it is not accompanied by flexibility.

CONCLUSIONS

This study concludes that Firm Age has a significant negative association with Firm Value (Tobin's Q) for sector B and C manufacturing firms in Indonesia after the Covid-19 pandemic (2022-2024). This confirms the "ageing" phenomenon, in which older companies tend to experience declining performance due to organizational rigidity. The practical implication is that long-established manufacturing companies must immediately undertake digital transformation and increase operational agility to remain competitive compared to younger, more technologically adaptable companies. Furthermore, Firm Size was found to be unable to moderate the relationship between age and firm value, indicating that large asset size does not automatically guarantee protection (a buffer) for mature companies facing post-pandemic economic pressures. Theoretically, the results of this study support Agency Theory, which posits that organizational rigidity and rising agency costs in older companies can reduce company performance. These findings also strengthen the argument that digital transformation is a key determinant of company value in the modern era. As a managerial implication, long-established manufacturing companies are recommended to immediately undertake digital transformation and increase operational flexibility to remain competitive against more technologically agile competitors. Furthermore, management needs to prioritise transparency to minimise agency conflicts that could erode investor confidence.

Although it provides important insights, this study has a major weakness: it fails to detect positive autocorrelation in the initial test, requiring the researchers to transform the data using the Cochrane-Orcutt technique to meet classical assumptions. Furthermore, the Firm Size variable in this study was not a pure moderator, as its interaction effect was insignificant. Given these limitations, suggestions for future research include developing the variables by adding other factors, such as a corporate governance index or technological innovation. Further research is also recommended to expand the sample to other industrial sectors and to employ panel-data analysis or dynamic models to more fully capture changes in corporate behaviour.

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