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Deciphering Financial Health and Risk: Hierarchical Relationships and Interdependencies among Key Factors

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Abstract. This study examines the hierarchical relationships and interdependencies of financial factors impacting companies' health, using Total Interpretive Structural Modelling and Matrice d'Impacts Croisés Multiplication Appliquée à un Classement analyses. It identifies key financial factors and their influences. Findings reveal credit risk as a pivotal factor with substantial impact on other parameters. Solvency, capital adequacy, and Tier 1 capital ratios are also key determinants of financial health. The study further categorizes factors into independent, linkage, autonomous, and dependent categories. This research offers valuable insights for managers, policymakers, and investors aiding decision-making.

Keywords: financial health, credit risk, TISM, MICMAC, interdependent financial factors

JEL Classification: G32, G33, M10

1. Introduction

A company's financial health is crucial for its overall performance, long-term viability, and sustainability (Altman, 2000). A myriad of factors, such as credit risk management (Berger and DeYoung, 1997; Ranjita and Nishant, 2020), solvency (Vodová, 2011), liquidity (Mishra and Aspal, 2011), and profitability (Olson and Zoubi, 2008), significantly influence a company's financial well-being and might even lead to bankruptcy, which makes it very important to model the financial failure and equity failure of the companies and markets as done in previous research (Jitender, 2021). Despite the extensive literature on these individual factors, the complex hierarchy and interdependence among various financial factors impacting companies have not yet been adequately explored.

In the field of bankruptcy prediction studies, there has been a multitude of models developed since Altman's influential work. The study by Bellovary et al. (2007) traces the evolution of bankruptcy prediction studies from the 1930s to the present and examines the different methods, factors, and specific uses of models. The analysis of 165 bankruptcy prediction studies published from 1965 to the present reveals trends in model development, showing a shift from discriminant analysis to logit analysis and neural networks as the primary methods. Interestingly, the study finds that the number of factors utilized in models has varied over time but tends to average around 10 overall. Furthermore, the accuracy analysis suggests that multivariate discriminant analysis and neural networks are the most promising methods for bankruptcy prediction, indicating that higher model accuracy is not necessarily guaranteed with a greater number of factors.

In the domain of business failure prediction, classical statistical methodologies have been extensively applied, particularly through cross-sectional methods such as multivariate discriminant models and logit models (Balcaen and Ooghe, 2006). However, the application of these methods has not been comprehensively analysed in relation to the diverse problems encountered in corporate failure prediction. Balcaen and Ooghe (2006) discuss various issues related to the classical paradigm of failure prediction, including the definition of failure, non-stationarity and data instability, sampling selectivity, and the choice of optimization criteria. They also highlight the neglect of the time dimension of failure and the limited focus on failure prediction modelling. Moreover, the paper addresses problems associated with the use of linear classification rules, reliance on annual account information, and the oversight of the multidimensional nature of failure. By integrating insights from the bankruptcy prediction and business failure prediction literature, this study fills the gap in research on financial health and risk analysis. It employs the unique methodology of Total Interpretive Structural Modelling (TISM) and Matrice d'Impacts Croisés Multiplication Appliquée à un Classement (MICMAC) analyses to explore the hierarchical relationships and interdependencies among key factors. This unique approach offers a comprehensive understanding of the influences and interactions among financial factors, contributing to the development of effective strategies for financial management and decision-making.

The gap in the literature regards the hierarchical relationships and interdependencies between the financial factors that affect companies' financial health (Kosmidou, 2008). A comprehensive understanding of these relationships and their implications is indispensable for managers, policymakers, and investors, who must make well-informed decisions to ensure organizational stability and growth.

The primary objective of this study is to examine the hierarchical relationships and interdependencies between financial factors affecting companies' financial health. To achieve this goal, the study employs the TISM and MICMAC analyses,

which enable the identification of key financial factors and the understanding of their mutual influences. TISM enhances ISM by utilizing expert opinions to identify hierarchical relationships and determine the strength and direction of relationships (Gahlot et al., 2023), as ISM provides a systematic and comprehensive method but at the same time was found to be inflexible (Watson, 1978). Additionally, the MICMAC analysis aids in recognizing the most significant factors that affect a system and comprehending their interdependencies (Azadnia et al., 2021).

In this research study, several key research questions are addressed to explore the factors that significantly impact a company's financial health. Firstly, the study aims to identify the critical financial factors that have a substantial influence on a company's financial well-being. Secondly, it investigates the interrelationships among these financial factors and examines how they form a hierarchical structure that ultimately affects a company's financial health. Lastly, the research delves into the classification of financial factors into independent, linkage, autonomous, and dependent categories, aiming to enhance our understanding of a company's financial health by employing this categorization framework.

By addressing these research questions, this study aims to contribute to the existing literature on financial health by providing a comprehensive understanding of the hierarchical relationships and interdependencies between financial factors. Through a novel approach of combined TISM and MICMAC analysis, this study aims to augment the existing financial health literature by unravelling the intricate hierarchical relationships and interdependencies among financial factors. While prior studies (Horobet et al., 2021; Spuchľáková et al., 2015; Arora, 2021; Banu et al., 2021) have shed light on the individual power of these factors in assessing a company's credit risk capabilities, a comprehensive framework that integrates all these factors to evaluate risk is lacking. Therefore, this study endeavours to provide a hierarchical framework that systematically assesses the credibility of a company while establishing interrelationships and interactions among these factors. The practical implications of the study's findings extend to managers, policymakers, and investors, empowering them to make informed decisions by prioritizing critical factors such as credit risk, solvency, and liquidity. Furthermore, the results of this study serve as a foundation for developing effective financial management strategies and policies, facilitating better risk assessment and management in various organizational contexts.

This paper is structured to provide a detailed analysis. It commences with Section 1, the *Introduction*, setting the stage and emphasizing the importance of the study. Section 2, the *Theoretical Background*, has two components: a literature review that amalgamates existing research and forms the theoretical basis and a segment establishing the connections between principal variables. Section 3,

Methodology, details the research approach. In Section 4, the results are showcased. Finally, Section 5 showcases *Discussions and Conclusions* and also includes the limitations and *Further Research*.

2. Theoretical Background

A company's financial health is a complex and multifaceted construct that requires a thorough understanding of the various financial factors and their interrelationships. Several theories and frameworks have been proposed to provide insights into these factors and their relationships. This study draws upon four relevant theories and frameworks to understand companies' financial health better.

Firstly, financial ratio analysis, a fundamental tool for evaluating a company's performance and financial position, identifies the key factors affecting companies' financial health. This approach enables the comparison of different companies within the same industry and facilitates the identification of strengths and weaknesses in a firm's financial performance (Rhyne and Brigham, 1979).

Secondly, credit risk management theory emphasizes managing risk exposure to ensure financial stability (Berger and DeYoung, 1997). The study incorporates this theory as an independent and pivotal factor, highlighting its importance in financial management. Effective credit risk management can reduce potential losses due to defaults and improve the company's overall financial health. Thirdly, the resource-based view (RBV) theory underscores the role of tangible and intangible resources in determining a firm's competitive advantage and performance (Barney, 1991). In the context of this study, the effective management of resources, including assets and capital, plays a crucial role in a company's financial health. Companies that can efficiently allocate and utilize resources are more likely to achieve better financial outcomes.

Lastly, the agency theory emphasizes the importance of financial performance measures, such as return on assets and equity, indicators of managerial performance, and aligning the interests of managers and shareholders (Jensen and Meckling, 1976). By using these performance measures, companies can assess the effectiveness of their management and ensure that managers are working towards the company's and its shareholders' best interests.

By drawing upon these theories and frameworks, this study provides a comprehensive understanding of the financial factors and their relationships, enabling effective financial management practices and contributing to the stability and success of companies and draws upon the conceptual framework depicted in *Figure 1*.

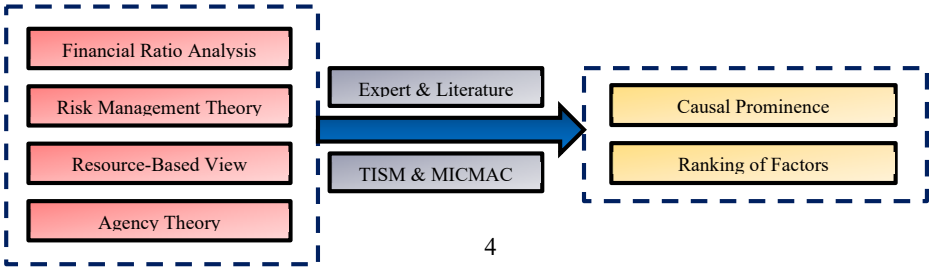


Figure 1. *Conceptual framework*

2.1. Literature Review

A considerable body of literature underscores the significance of credit risk management in promoting companies' financial stability. Berger and DeYoung (1997) maintain that credit risk, which arises from potential defaults on loans or other financial obligations, constitutes a critical factor that influences a company's financial health. Managing credit risk exposure to minimize potential losses and maintain stability is particularly pertinent to financial institutions. Altman et al. (2017) posit that effective credit risk management practices can contribute to an organization's overall risk management strategy, safeguarding its financial well-being. In this regard, the literature emphasizes the interconnectivity of long-term solvency and short-term liquidity in shaping a company's financial health. Vodová (2011) argues that an organization must strike an adequate balance between long-term obligations and short-term liquidity to ensure financial stability. Rajan and Zingales (1995) contend that companies must manage their capital structure, including solvency and liquidity ratios, to optimize their financial performance and minimize the risk of insolvency. Additionally, the Basel Committee on Banking Supervision (2012) highlights the significance of capital adequacy and solvency ratios for banks, emphasizing their role in promoting financial stability.

Several studies have explored the relationship between profitability measures and other financial parameters. Olson and Zoubi (2008) demonstrate that profitability measures, such as Return on Assets (ROA) and Return on Equity (ROE), are contingent upon a company's efficiency and liquidity position. Naceur and Omran (2011) corroborate these findings by showing that higher operating efficiency and optimal liquidity management can lead to improved profitability. Moreover, Kosmidou (2008) emphasizes the importance of linkage factors, which mutually influence one another and significantly impact a company's financial well-being. These factors include Operating Efficiency Ratio (OER), Funding Structure (FS), Capital Adequacy Ratio (CAR), Tier 1 Capital Ratio (T1CR), and Solvency Ratio (SR). By examining the interrelationships between these factors, researchers can better understand the dynamics of a company's financial health and provide

valuable insights for financial management practices. Deloof (2003) investigates the role of autonomous factors, such as Asset Turnover Ratio (ATR), in determining a company's financial health. Autonomous factors independently influence financial health and are not substantially affected by other financial parameters. Conversely, Mishra and Aspal (2011) identify Liquidity Ratio (LR) as a dependent factor, suggesting that it is an outcome of various other financial parameters and a key indicator of short-term financial stability. In summary, these studies underscore the significance of a comprehensive approach to financial management that considers multiple factors and their interrelationships in promoting financial stability and success.

The paper has employed an extensive literature review of various literature published in the context of credit risk in the databases of Scopus, Web of Science, and DOAJ using the PRISMA method (*Figure 2*). The study employs TISM and MICMAC analyses to formulate the relationships and drive and dependence power of each factor to form a Causal Prominence of factors and ranking of factors (Vimal et al., 2022). One expert from the industry was also asked to help to validate the formation of this initial reachability matrix. The reachability matrix was accepted after the study only following expert review. *Table 1* presents the factors identified and their definitions.

Table 1. *Definition of the factors*

S. no	Factor	Definition
D1	Credit Risk Indicator (CRI)	A measure of the likelihood of a borrower defaulting on loan obligations, considering credit history and financial position.
D2	Funding Structure (FS)	A company's mix of debt and equity used to finance its operations and growth.
D3	Liquidity Ratio (LR)	A metric to assess a company's ability to meet short-term obligations by converting assets into cash.
D4	Solvency Ratio (SR)	A financial ratio evaluating a company's long-term stability by measuring its ability to meet long-term debt obligations.
D5	Asset Turnover Ratio (ATR)	A measure of a company's efficiency in using its assets to generate revenue.
D6	Operating Efficiency Ratio (OER)	A financial ratio comparing a company's operating expenses to its net income to evaluate operational efficiency.
D7	Return on Assets (ROA)	A measure of a company's profitability relative to its total assets, indicating asset use effectiveness.

S. no	Factor	Definition
D8	Return on Equity (ROE)	A financial ratio measuring a company's profitability relative to shareholder's equity, indicating equity use effectiveness.
D9	Capital Adequacy Ratio (CAR)	A financial metric evaluating a bank's ability to absorb losses and meet capital requirements.
D10	Tier 1 Capital Ratio (T1CR)	A financial ratio measuring a company's core capital relative to its total risk-weighted assets, indicating financial strength.

2.2. Establishing Relationships

2.2.1. Driver 1 – Credit Risk Indicator

The interdependence between CRI and various financial factors, such as FS, LR, SR, CAR, and T1CR, is crucial for financial stability and risk management in companies. Research highlights that an organization's FS affects its credit risk and credit rating (Kosmidou, 2008; Kanno, 2014), while credit risk influences funding structure (Hagelmayer, 1994; Harasztosi and Kátay, 2020). The relationship between CRI and LR is evident as firms with higher credit risk struggle to maintain liquidity due to funding constraints (Vodová, 2011), and adequate credit risk management helps maintain liquidity levels (Wang and Zhang, 2023).

Higher credit risk is associated with lower solvency ratios due to increased financial leverage (Berger and DeYoung, 1997), while solid solvency positions signal lower default likelihood (Olson and Zoubi, 2008). The relationship between CRI and CAR is significant, as banks with higher capital adequacy ratios exhibit lower credit risk (Kosmidou, 2008), and maintaining adequate capital levels enhances financial stability (Altman, 2000). Similarly, the link between CRI and T1CR is established, with banks having higher Tier 1 capital ratios showing lower credit risk (Kosmidou, 2008) and a strong Tier 1 capital position ensuring long-term stability (Altman, 2000).

2.2.2. Driver 2 – Funding Structure

The financial literature extensively investigates the interdependence among funding structure, credit risk indicators, and liquidity ratio. The funding structure, comprising a company's debt and equity, is crucial for determining financial stability and risk exposure (Brusov et al., 2022). A diversified funding structure minimizes financial risk and enhances a company's resilience during economic uncertainties (Frank and Goyal, 2008). The CRI reflects the default probability and

loss exposure in a company's lending activities (Berger and DeYoung, 1997). Higher values indicate a greater likelihood of default and negative impacts on profitability and stability (Jarrow and Turnbull, 2000). A company's funding structure and credit risk indicator are interdependent, as increased leverage raises the default probability and credit risk indicator (Giesecke and Kim, 2011). The liquidity ratio, measuring a company's capacity to fulfil short-term financial obligations, indicates better financial health (Chaudhury, 2020; Vodová, 2014). A robust liquidity position reduces credit risk by providing a buffer against unforeseen financial shocks (Diamond and Rajan, 2001).

2.2.3. Driver 3 – Liquidity Ratio

The interconnectedness between liquidity ratios and factors like funding structure and credit risk indicators is evident in financial studies. A company's mix of debt and equity influences its vulnerability to risks (Brusov et al., 2022). Companies with a diversified funding strategy are better positioned during economic fluctuations (Frank & Goyal, 2008). Credit risk indicators highlight the potential for default in a firm's credit operations (Berger & DeYoung, 1997). Elevated values in these indicators can affect profitability and stability (Jarrow & Turnbull, 2000), with increased leverage escalating the probability of default (Giesecke & Kim, 2011).

Central to this is the liquidity ratio, which gauges a firm's ability to meet short-term financial commitments (Chaudhury, 2020). Superior liquidity ratios indicate good financial health (Vodová, 2011), and a strong liquidity position can counteract credit risk (Diamond & Rajan, 2001).

Studies have examined the interdependence between funding structure, credit risk indicator, and liquidity ratio. Diamond and Rajan (2001) argue that firms with higher leverage and credit risk require higher liquidity ratios for financial stability. Fama and French (2002) find that firms with higher credit risk indicators tend to have lower liquidity ratios, indicating challenges in meeting short-term financial obligations. Additionally, Gertler and Kiyotaki (2010) suggest that firms heavily relying on short-term debt may face higher credit risk due to rollover risk and possible liquidity crises, incentivizing them to maintain higher liquidity ratios to mitigate credit risk to ensure financial stability.

2.2.4. Driver 4 – Solvency Ratio

The financial literature has extensively examined the interdependence between liquidity ratio, funding structure, and solvency ratio, critical factors determining a company's financial health and stability. The liquidity ratio, reflecting a company's ability to meet short-term obligations, is linked to funding structure, as it represents the composition of capital sources (Chaudhury, 2020). Firms with

higher proportions of short-term debt may face liquidity challenges (Diamond and Rajan, 2001), while those reliant on debt financing can encounter refinancing risks impacting liquidity (Gatev and Strahan, 2006).

Solvency ratio measures a company's ability to meet long-term obligations. Its relationship with liquidity ratio is significant, as higher solvency ratios often correlate with better short-term liquidity management (Vodová, 2011; Acharya et al., 2007). Solvency ratio is also associated with funding structure, as firms balancing debt financing benefits and costs can affect solvency (Modigliani and Miller, 1958). Companies with higher long-term debt proportions will likely have higher solvency ratios (Frank and Goyal, 2008).

The interdependence between the solvency ratio and other financial ratios, such as liquidity ratio, ROA, ROE, CAR, and Tier 1 capital ratio, is crucial for understanding financial stability, performance, and resilience. Firms with higher solvency ratios tend to maintain higher liquidity ratios (Vodová, 2011), better profitability performance (Olson and Zoubi, 2008), and improved reputations (Jensen and Meckling, 1976). Additionally, the literature reports strong relationships between solvency ratio and CAR (Kosmidou, 2008) and between solvency and Tier 1 capital ratios (Demirgüç-Kunt et al., 2013), indicating that companies with more substantial capital positions maintain higher solvency ratios.

2.2.5. Driver 5 – Asset Turnover Ratio

The financial literature has investigated the interdependence between asset turnover ratio, operating efficiency ratio, and return on assets (ROA). The asset turnover ratio measures a company's ability to generate sales revenue from its assets and is a crucial determinant of firm performance (Deloof, 2003). The operating efficiency ratio, reflecting resource utilization efficiency in generating revenue, is closely related to asset turnover ratio (Kallberg and Liu, 2000). Studies show that firms with higher operating efficiency ratios have higher asset turnover ratios, indicating effective asset use for sales generation (Liu and Hung, 2006; Kosmidou, 2008).

ROA, a widely used profitability metric, measures a company's efficiency in generating profits from its assets (Olson and Zoubi, 2008). Higher asset turnover ratios suggest better asset utilization, increasing profitability as measured by ROA (Chen and Shimerda, 1981). A positive association between asset turnover ratio and ROA has been observed, indicating that firms with efficient asset management tend to exhibit higher profitability (Zhang, 2017).

2.2.6. Driver 6 – Operating Efficiency Ratio

The interdependence between Operating Efficiency Ratio and financial ratios, such as Asset Turnover Ratio, Return on Assets, and Return on Equity, has been

extensively studied in corporate finance to gain an improved understanding of the factors influencing a company's financial performance and their relationships. A well-established link between OER and ATR exists, with higher OER associated with higher ATR, suggesting that efficient operations contribute to effective asset utilization (Deloof, 2003; Lazaridis and Tryfonidis, 2006).

Similarly, numerous studies have demonstrated the connection between OER and ROA, highlighting the importance of efficient operations in enhancing overall profitability (Olson and Zoubi, 2008; Sufian and Habibullah, 2009). Lastly, the literature has documented the relationship between OER and ROE, indicating that higher operational efficiency leads to improved company performance and higher equity returns (Kosmidou, 2008; Athanasoglou et al., 2006).

2.2.7. Driver 7 – Return on Assets

The financial literature has extensively discussed the interdependence between return on assets and various financial ratios, such as funding structure, solvency ratio, operating efficiency ratio, return on equity, capital adequacy ratio, and Tier 1 capital ratio. ROA measures the efficiency with which a company generates profits from its assets (Olson and Zoubi, 2008).

Studies suggest that firms with an optimal balance of debt and equity tend to exhibit higher ROA levels (Rajan and Zingales, 1995; Titman and Wessels, 1988). Companies with higher solvency ratios generally have better financial health and higher ROA (Vodová, 2011; Kosmidou, 2008). A positive relationship exists between the operating efficiency ratio and ROA, indicating better asset utilization and profitability (Kallberg and Liu, 2000; Liu and Hung, 2006).

ROA and ROE have also established a positive relationship, two key profitability measures (Olson and Zoubi, 2008). Although the relationship between capital adequacy ratios, Tier 1 capital ratios, and ROA is less direct, banks with higher capital adequacy ratios tend to exhibit higher ROA levels, as they can better manage risks and maintain profitability (Kosmidou, 2008; Basel Committee on Banking Supervision, 2010).

2.2.8. Driver 8 – Return on Equity

The literature widely explores the interdependence between Return on Equity and other financial ratios, providing insights into a company's financial performance and stability. Optimal funding structures are crucial for maximizing ROE while minimizing financial risk (Goddard et al., 2004; Frank and Goyal, 2009). Solvent firms with higher solvency ratios tend to have higher ROE due to more favourable borrowing terms (Vodová, 2019; Kosmidou, 2008).

Efficient asset utilization, as measured by the asset turnover ratio, can lead to higher profitability and ROE (Deloof, 2003). The operating efficiency ratio is also essential for enhancing a company's profitability, including ROE, with firms having lower operating expenses than their revenue-generating higher ROE (Sufian and Habibullah, 2009; Athanasoglou et al., 2008).

A strong correlation exists between Return on Assets and ROE, as the efficient use of assets contributes to both profitability ratios (Olson and Zoubi, 2008; Sufian and Habibullah, 2009). Well-capitalized banks with higher capital adequacy ratios and Tier 1 capital ratios tend to have higher ROE, as adequate capital buffers help maintain investor confidence and absorb losses (Berger, 1995; Demirgüç-Kunt and Huizinga, 1999).

2.2.9. Driver 9 – Capital Adequacy Ratio

The interdependence between financial ratios, such as Return on Equity (Goddard et al., 2004), Solvency Ratio (Vodová, 2011), Return on Assets (Olson and Zoubi, 2008), and Tier 1 Capital Ratio (Berger, 1995), is crucial for understanding a company's financial health and performance. A positive association exists between ROE and Solvency Ratio, as higher solvency indicates better capital management and financial strength, ultimately leading to higher shareholder returns (Athanasoglou et al., 2006). A consistently positive correlation has been observed between ROA and ROE in the literature, with higher asset efficiency typically resulting in increased overall profitability (Sufian and Habibullah, 2009).

Analysing the dynamics of ROE, influenced by factors such as company size, industry, and macroeconomic conditions (Frank and Goyal, 2009), provides valuable insights into factors driving changes in a company's profitability. The relationship between the Tier 1 Capital Ratio and ROE has been confirmed in various studies, emphasizing the importance of maintaining an adequate capital buffer to ensure sustainable growth and profitability (Kosmidou, 2008).

2.2.10. Driver 10 – Tier 1 Capital Ratio

The Tier 1 Capital Ratio is a critical indicator of a bank's financial strength and stability, reflecting its ability to absorb losses and maintain operations during adverse economic conditions (Basel Committee on Banking Supervision, 2010). Studies have found positive relationships between T1CR and various financial performance measures, including

solvency ratio (Berger, 1995; Goddard et al., 2004), return on assets (Sufian and Habibullah, 2009; Athanasoglou et al., 2006), and capital adequacy ratio (Sufian and Habibullah, 2009).

The interdependence between T1CR and return on equity is more complex, with some researchers arguing that higher T1CR leads to lower ROE due to reduced leverage (Frank and Goyal, 2009), while others have found a positive association between the two variables, suggesting that well-capitalized banks are better positioned to maximize shareholder value (Goddard et al., 2004).

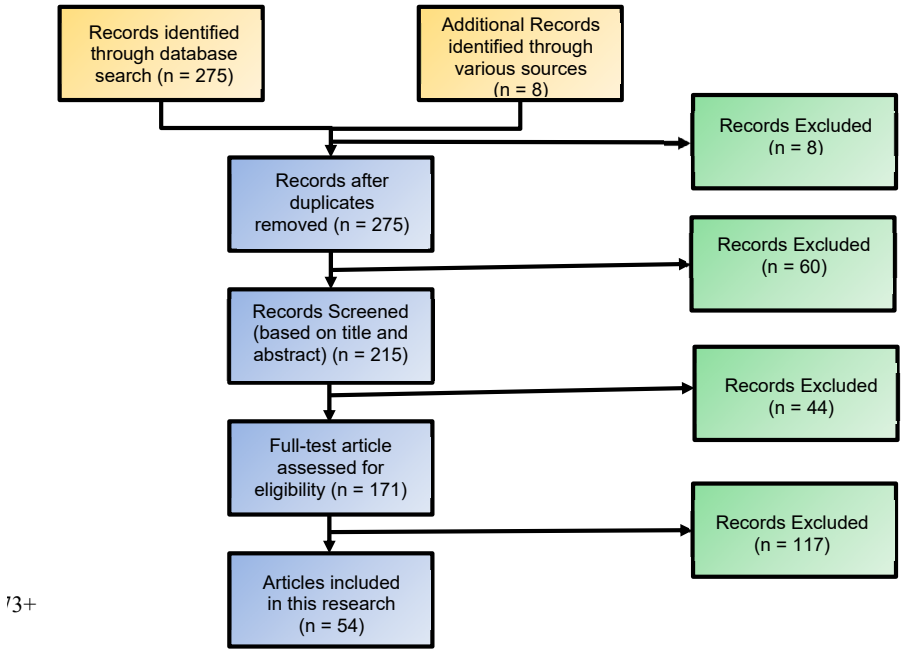


Figure 2. *PRISMA Analysis*

3. Methodology

The Total Interpretive Structural Modelling and Matrice d'Impacts Croisés Multiplication Appliquée à un Classement analyses are employed in this study. These are used to examine the hierarchical relationships and interdependencies between financial factors affecting companies' financial health.

3.1. Interpretive Structural Modelling (TISM)

Total Interpretive Structural Modelling is a methodical approach to analysing intricate relationships among factors within a system (Janes, 1988). TISM is an extension of the Interpretive Structural Modelling (ISM) technique that integrates expert opinions and interpretations to construct a hierarchical model of the factors under scrutiny. The TISM process involves the following steps:

Firstly, a comprehensive literature review was conducted to identify the critical financial factors influencing a company's financial health. This identification of financial factors was then validated through expert opinions from professionals in the field of finance, leading to the identification of ten factors. Secondly, an expert was consulted to establish the contextual relationships between the identified financial factors. These relationships were expressed using binary relations, and the identified factors were validated as relevant to the study.

Thirdly, the relationships between the financial factors were represented in the Initial Reachability Matrix (IRM), with entries in the matrix representing the influence of one factor on another. This matrix represented relationships derived from the literature with the help of the expert and then validated by the expert. *Table 2* presents the Initial Reachability Matrix.

Table 2. *Initial Reachability Matrix*

Driver	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
D1	1	1	1	1	0	0	0	0	1	1
D2	1	1	1	0	0	0	0	0	0	0
D3	0	1	1	1	0	0	0	0	0	0
D4	0	0	1	1	0	0	1	1	1	1
D5	0	0	0	0	1	1	1	0	0	0
D6	0	0	0	0	1	1	1	1	0	0
D7	0	1	0	1	0	1	1	1	1	1
D8	0	1	0	1	1	1	1	1	1	1
D9	0	0	0	1	0	0	1	1	1	1
D10	0	0	0	1	0	0	1	1	1	1

Fourthly, the Final Reachability Matrix was created and checked for transitive links. Transitive and significant transitive links were formed in this step, identifying three significant transitive relationships and 32 transitive links. *Table 3* presents the final reachability matrix. (*) signifies transitive link and (**) signifies a significant transitive link.

Table 3. *Final Reachability Matrix*

Driver	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
D1	1	1	1	1	0	0	1**	1**	1	1
D2	1	1	1	1**	0	0	1*	1*	1*	1*
D3	0	1	1	1	0	0	1*	1*	1*	1*
D4	0	1*	1	1	1*	1*	1	1	1	1
D5	0	1*	0	1*	1	1	1	1*	1*	1*
D6	0	1*	0	1*	1	1	1	1	1*	1*
D7	1*	1	1*	1	1*	1	1	1	1	1
D8	1*	1	1*	1	1	1	1	1	1	1
D9	0	1*	1*	1	1*	1*	1	1	1	1
D10	0	1*	1*	1	1*	1*	1	1	1	1

The Binary Interaction Matrix was constructed using direct and significant transitive links. This matrix formed the basis for the level partitioning step of TISM and also the input matrix for MICMAC analysis. *Table 4* presents the Binary Interaction matrix.

Table 4. *Binary Interaction Matrix*

Driver	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**D10**
D1	1	1	1	1	0	0	1	1	1	1
D2	1	1	1	1	0	0	0	0	0	0
D3	0	1	1	1	0	0	0	0	0	0
D4	0	0	1	1	0	0	1	1	1	1
D5	0	0	0	0	1	1	1	0	0	0
D6	0	0	0	0	1	1	1	1	0	0
D7	0	1	0	1	0	1	1	1	1	1
D8	0	1	0	1	1	1	1	1	1	1
D9	0	0	0	1	0	0	1	1	1	1
D10	0	0	0	1	0	0	1	1	1	1

Sixthly, the Binary Interaction Matrix was used for level partitioning, where the factors were assigned levels based on their dominance over other factors and their importance. *Table 5* presents the Level Partitioning, which was performed using Knime Data Analytics Software.

Table 5. *Level Partitioning*

	Driver	**Reachability Set**	**Antecedent set**	**Intersection Set**	**Level Assigned**
D1	Credit Risk Indicator	1,2,3,4,7,8,9,10	1,2	1,2	V
D2	Funding Structure	1,2,3,4	1,2,3,7,8	1,2,3	I

	Driver	Reachability Set	Antecedent set	Intersection Set	Level Assigned
D3	Liquidity Ratio	2,3,4	1,2,3,4	2,3,4	III
D4	Solvency Ratio	3,4,7,8,9,10	1,2,3,4,7,8,9,10	3,4,7,8,9,10	IV
D5	Asset Turnover Ratio	5,6,7	5,6,8	5,6	I
D6	Operating Efficiency Ratio	5,6,7,8	5,6,7,8	5,6,7,8	III
D7	Return on Assets	2,4,6,7,8,9,10	1,4,5,6,7,8,9,10	4,6,7,8,9,10	II
D8	Return on Equity	2,4,5,6,7,8,9,10	1,4,6,7,8,9,10	4,6,7,8,9,10	II
D9	Capital Adequacy Ratio	4,7,8,9,10	1,4,7,8,9,10	4,7,8,9,10	IV
D10	Tier 1 Capital Ratio	4,7,8,9,10	1,4,7,8,9,10	4,7,8,9,10	IV

Seventhly, the Initial Relationship Diagram was constructed using level partitioning, and the diagram was checked for any bottom-up links. *Figure 3* presents the initial reachability digraph.

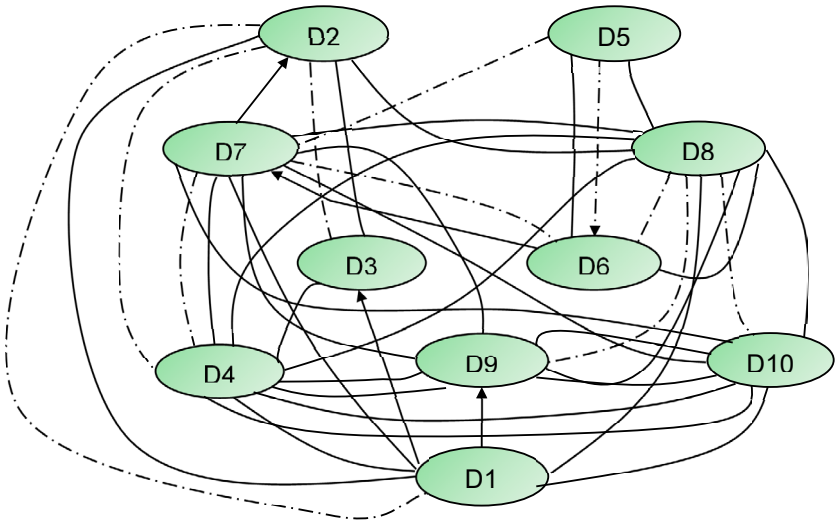


Figure 3. *Initial digraph of drivers*

Finally, the TISM Relationship Diagram was constructed by eliminating the 19 bottom-up links and mirror links found (e.g. links 4-7 and 7-4 are mirror links, only one of them being kept in the final TISM model), as the TISM methodology nullifies any bottom-up link if found. However, these links are considered for the MICMAC analysis. *Figure 4* presents the TISM relationship diagraph.

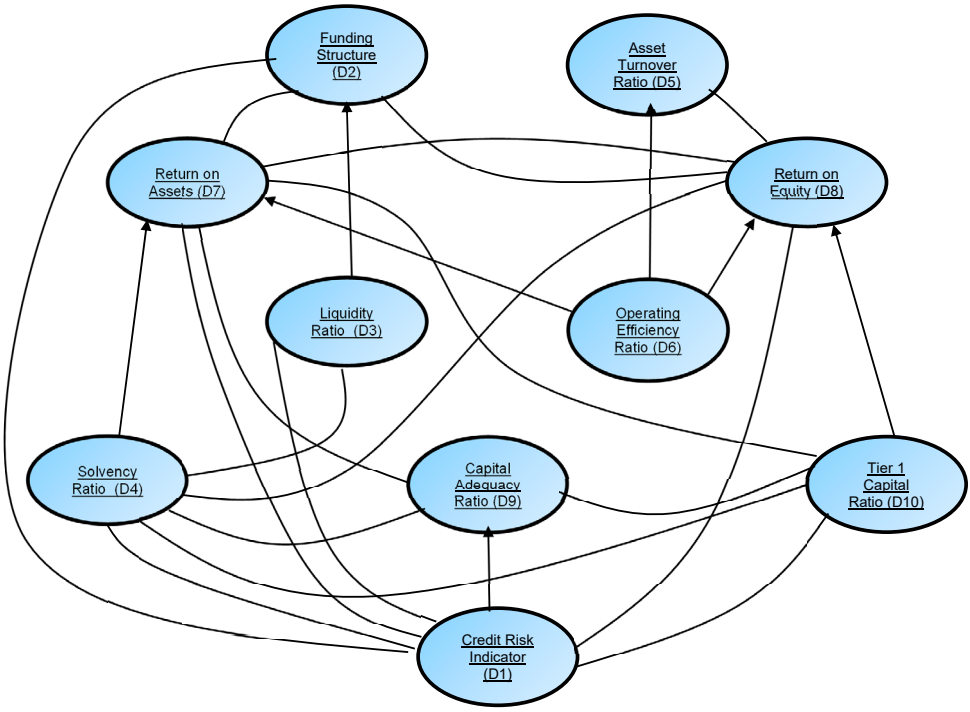


Figure 4. *Validated Total Interpretive Structure Model*

3.2. MICMAC Analysis

Table 6. *Driving and dependence powers*

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
DRIVING POWER	8	4	3	6	3	4	7	8	5	5
DEPENDENCE POWER	2	5	4	8	3	4	8	7	6	6

The MICMAC analysis is a cross-impact matrix technique that classifies factors into four categories: independent, linkage, autonomous, and dependent (Ahmad et al., 2019). The analysis helps to identify the driving forces and dependencies among the factors under investigation. It divides the factors into 4 categories, as depicted in *Figure 5*, using the driving and dependence powers obtained from the Binary Interaction Matrix, as depicted in *Table 6*.

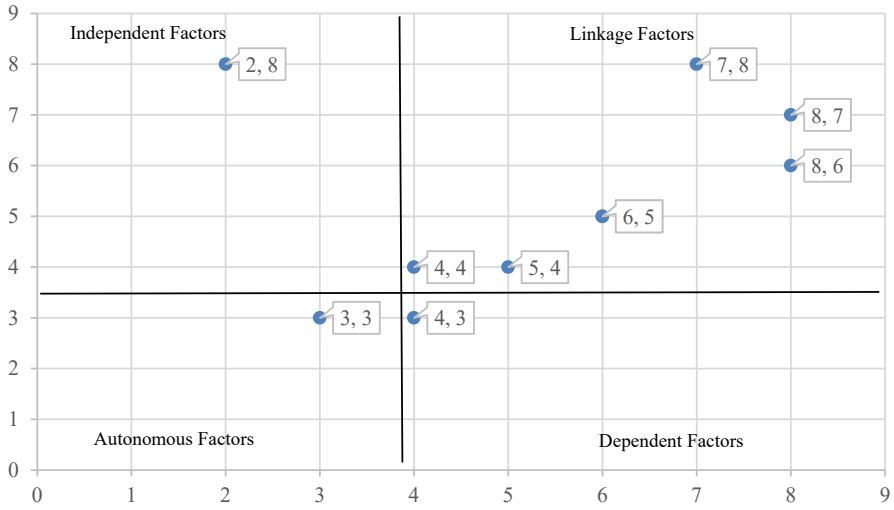


Figure 5. *MICMAC analysis*

Autonomous factors in the bottom-left quadrant have low driving and dependence power, with minimal relation to other factors. Dependent factors in the bottom-right quadrant possess strong dependence but weak driving power. Linkage factors, occupying the top-right quadrant, are crucial for analysis due to their high driving and dependence power, influencing and being influenced by other factors. Independent factors in the top-left quadrant have low dependence power but high driving power.

The TISM and MICMAC analyses provide a comprehensive understanding of the hierarchical relationships and interdependencies between financial factors, enabling the investigation of the research questions posed in this study. The results of these analyses are presented in the section below.

4. Results

The outcomes of the TISM and MICMAC analyses unravel the sophisticated hierarchy and interdependence among diverse financial determinants influencing companies. The findings underscore that credit risk, embodied by the Credit Risk Indicator (D1), surfaces as a paramount, independent factor that considerably impacts other financial aspects while remaining relatively unswayed by them (Berger and DeYoung, 1997). This accentuates the necessity for organizations to assiduously manage their credit risk to

guarantee stability and strong performance. At the financial hierarchy's bedrock, Solvency Ratio (D4), Capital Adequacy Ratio (D9), and Tier 1 Capital Ratio (D10) emerge as cardinal determinants of a company's financial health, signifying their capacity to fulfil long-term obligations (Basel Committee on Banking Supervision, 2010). These factors substantially shape Operating Efficiency Ratio (D6) and Liquidity Ratio (D3), demonstrating the interrelation between enduring financial stability and short-term liquidity management (Vodová, 2011).

Within the hierarchy, profitability measures, such as Return on Assets (D7) and Return on Equity (D8), hinge upon the efficacy and liquidity stance of the companies (Olson and Zoubi, 2008). Subsequently, Asset Turnover Ratio (D5) and Funding Structure (D2) are influenced by the company's profitability, emphasizing the role of asset utilization and proficient funding management in revenue generation (Chen and Shimerda, 1981).

The MICMAC analysis exposes the classification of financial determinants into four distinct categories: independent, linkage, autonomous, and dependent. Factors such as Operating Efficiency Ratio (D6), Funding Structure (D2), Capital Adequacy Ratio (D9), Tier 1 Capital Ratio (D10), Return on Equity (D8), Return on Assets (D7), and Solvency Ratio (D4) are pinpointed as linkage factors, underscoring their reciprocal influence and importance in moulding a company's financial well-being (Kosmidou, 2008). Asset Turnover Ratio (D5) surfaces as an autonomous factor, suggesting its relatively independent bearing on the company's comprehensive financial health (Deloof, 2003). Lastly, Liquidity Ratio (D3) emerges as a dependent factor, intimating that it is a crucial indicator of short-term financial stability and a consequence of numerous other financial parameters.

5. Discussions and Conclusions

5.1. Theoretical Implications

The TISM and MICMAC analyses have yielded valuable insights into financial management and offer theoretical implications for understanding the financial health of companies. The study reveals credit risk as a central factor, emphasizing the significance of credit risk management in organizational stability and performance. The hierarchical relationships among long-term and short-term financial stability parameters indicate their interdependence. The study also highlights the dependency of profitability measures on efficiency and liquidity positions, underscoring the need to consider the interrelationships with other financial factors. Identifying linkage factors in the MICMAC analysis highlights

their mutual influence and significance. Additionally, categorizing Asset Turnover Ratio as an autonomous factor and Liquidity Ratio as a dependent factor provides insights into their roles in a company's financial health. Overall, these findings contribute to the existing body of knowledge on financial management and offer several theoretical implications for developing comprehensive financial management frameworks.

5.2. Managerial/Practical Implications

The TISM and MICMAC analyses have provided valuable insights into the financial factors affecting companies, with implications for both theoretical understanding and practical application. Specifically, managers can leverage these findings to improve their financial management practices by focusing on credit risk management, balancing long-term solvency and short-term liquidity, enhancing profitability through efficiency and liquidity management, leveraging linkage factors for financial well-being, and understanding the role of autonomous and dependent factors. Credit risk management is pivotal, and managers should prioritize regular assessment, robust credit policies, and risk mitigation techniques. Balancing long-term solvency and short-term liquidity requires adequate capital buffers and effective cash management practices. Enhancing profitability involves improving efficiency and maintaining optimal liquidity levels. Managers should also consider linkage factors and regularly review financial policies. Recognizing the distinct roles of autonomous and dependent factors, such as Asset Turnover Ratio and Liquidity Ratio, can inform better decision-making related to financial management practices.

5.3. Conclusions

This study explored the intricate hierarchy and interdependence among various financial factors impacting companies by employing TISM and MICMAC analyses. The findings revealed the pivotal role of credit risk as an independent factor and emphasized the importance of long-term solvency and short-term liquidity management. Furthermore, the study uncovered the interrelationships between profitability measures, linkage factors, and other financial parameters, ultimately offering valuable insights into the financial health of companies.

These insights can assist managers, policymakers, and investors in making well-informed decisions and develop comprehensive financial management strategies. By understanding the hierarchical relationships and interdependencies between financial factors, stakeholders can focus on vital factors such as credit risk, solvency, and liquidity to ensure organizational stability and robust performance.

5.4. Limitations and Further Research

This study has identified certain limitations that suggest several avenues for further research. Firstly, researchers could expand the scope of financial factors under investigation by including additional parameters that may influence a company's financial health. This approach would provide a more comprehensive understanding of the financial dynamics. Finally, future research could investigate the impact of macroeconomic factors and market conditions on the relationships between financial factors, providing insights into how external conditions shape a company's financial health.

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