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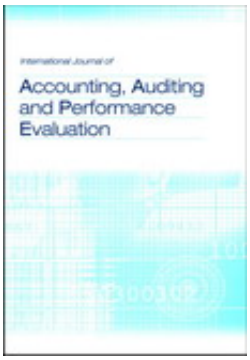

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The moderate role of national culture and prosperity index on the effectiveness of the fraud triangle to prevent financial statement fraud: a cross-country meta-analysis approach

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Abstract: This research paper aims to achieve three objectives, identify effective fraud triangle risk factors for detecting financial statement fraud (FSF), assess the role of country characteristics in detecting FSF risk factors, and evaluate variations in fraud scores between countries with comparable cultural and prosperity levels. Using a meta-analysis approach following PRISMA guidelines, the study uncovers effective proxies for fraud triangle risk factors and highlights the significant role of a nation's characteristics in determining FSF risks. The findings contribute to the behavioural forensics literature by providing a comprehensive assessment of reputable studies, offering insights into the moderate effect of countries' specific features on FSF occurrence, and clustering countries with similar attributes to analyse differences in fraud scores. This research advances our understanding of FSF detection and prevention and can be used to develop tailored financial fraud prediction models and strategies on a global scale.

Keywords: fraud triangle; SAS No. 99; meta-analysis; Hofstede's cultural dimension; prosperity index.

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1 Introduction

1.1 Description of the research topic

The focus on public accounting and integrity has risen in recent years, driven by the increased awareness of shareholders and creditors regarding transparency, integrity, and accountability in both the public and private sectors. Governments facing budget constraints and citizens seeking better value for their tax payments have led to a heightened emphasis on public accountability and transparent, efficient use of limited resources. As world markets become increasingly globalised and interconnected, investors demand greater transparency to prevent the harmful effects of spreading poor governance across markets. In response to past failures, such as the Enron scandal, lawmakers have introduced new regulations and guidelines, including the statement on auditing standards (SAS), the Sarbanes-Oxley Act in US, and the Corporate Governance Code in UK.

The recent adversities such as the COVID-19 pandemic and the insolvency of Silicon Valley Bank in 2023, have significantly strained organisational resources, prompting a sharper focus on anti-fraud mechanisms to ensure financial integrity. The COVID-19 pandemic, as highlighted by Harding and Thorps (2020), has intensified external threats like cyber fraud and identity theft, primarily due to reduced oversight stemming from physical restrictions and travel limitations. These conditions potentially diminish transparency and increase opportunities for fraudulent activities to go unnoticed. On a similar note, the failure of Silicon Valley Bank unveiled a scenario where significant losses were concealed from stakeholders, exemplifying the grave risks associated with corporate fraud. This incident underscores the imperative for enhanced risk management

and oversight within the financial ecosystem (Tsipursky, 2023). Such occurrences illustrate how external crises can foster an environment conducive to financial misstatements, such as overstated revenue, operating cash flow, and book value, which are detrimental to the accurate assessment of an organisation's financial health. This paper primarily aims to delve into the risk assessment of accounting misstatements to augment our comprehension of the determinants that could facilitate the detection and prevention of financial statement fraud (FSF). Although financial analysts lack direct access to company records, they can leverage publicly available information to gauge the likelihood of accounting misstatements, thereby contributing to the broader endeavour of mitigating financial fraud amidst evolving external challenges.

There is no universally accepted definition of FSF. The International Federation of Accountants defined 'intention' as the characteristic that distinguishes fraud from error (Soltani et al., 2023; Spathis, 2002). Additionally, the Association of Certified Fraud Examiners has defined fraud as the intentional misstatement of the organisation's financial conditions through omission of monetary value or disclosure in the financial statement to deceive users of financial reports (ACFE, 2020).The idea of FSF can be traced back to the 1950s, when Donald Cressey's paper identified pressure, opportunity, and rationalisation as the key factors contributing to fraud. This early work laid the foundation for subsequent academic investigations specifically targeting the detection and prevention of such fraudulent activities. However, to our knowledge, no attempts have been made to quantify and identify the cause of conflicting results within the current knowledge of FSF literature. Meta-analysis serves as a crucial tool in reconciling inconsistent findings in financial fraud risk factor research, such as the inconsistent impact of financial instability, operational inefficiencies, and aggressive financial targets on fraud likelihood. For instance, Skousen et al. (2009) provided evidence supporting financial instability as a contributing factor to FSF while Nakashima (2017) does not support this relationship. It synthesises diverse results from studies that variously support or refute these relationships, providing a consolidated view of the data. This methodological approach thus clarifies the overall patterns and strength of associations between risk factors and the incidence of FSF across multiple studies. Therefore, for the first objective we apply meta-analysis as a quantifying method that works by combining the results of multiple studies to provide a more precise estimate of the effectiveness of the fraud triangle to detect FSF.

Furthermore, it is crucial to identify the reasons for discrepancies in findings when multiple studies address the contributing factors to FSF. These discrepancies may arise from several factors, including country-specific attributes in the sample, varying sample sizes, distinct research methodologies, and different timeframes for measuring fraud risk factors. As a result, our second objective will be to investigate the reasons behind the differences in research outcomes, focusing on the country-related characteristics of the study sample that impact the detection of FSF.

Finally, the incidence and magnitude of financial fraud vary globally due to variations in legislation, economics, and society among nations. According to the ACFE report (2020), Latin America has the highest percentage of discovered cases at 19%, followed by Asia at 14%, Western Europe at 11%, Sub-Saharan Africa at 11%, and North America at 10%. Consequently, the study's third objective is in harmony with its second one. Since our findings indicate that national characteristics moderately influence the determination of FSF risk factors, it becomes essential to develop a classification system that sorts countries on a global scale according to their features, thereby clustering those

with analogous financial risks. Based on these explanations, this research will contribute to the FSF literature from the following three perspectives.

Firstly, by employing a meta-analysis approach it will offer a comprehensive assessment of multiple studies, allowing for a more precise estimation of the fraud triangle's effectiveness in detecting FSF. This approach will further our understanding of the effective elements that contribute to FSF and enable organisations to adopt better practices and policies to minimise its occurrence.

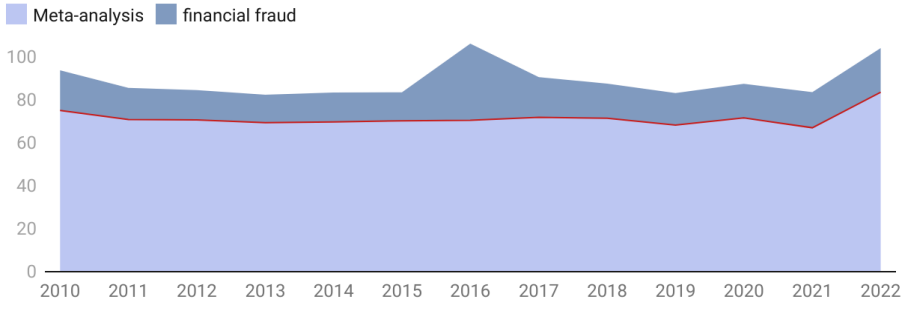
Secondly, by providing insights into the moderate effect of countries' specific features, including national culture and prosperity factors, on FSF occurrence, our results will contribute to behavioural forensics. Behavioural forensics is a subfield of forensic accounting that focuses on understanding the human aspects. By examining countries' specific factors, the research contributes to a deeper understanding of the complex interplay between human behaviour and the environment with financial fraud.

Finally, by clustering countries with similar attributes, including culture and prosperity indices, and analysing the differences in fraud scores between these groups, it will enhance our understanding of how various factors contribute to the incidence and magnitude of financial fraud across the globe. This knowledge can be used to develop more accurate financial fraud prediction models tailored to each cluster of countries, ultimately assisting in the development of more effective strategies for fraud detection and prevention on a global scale.

1.2 Research innovation

Figure 1 shows the interest of researchers from 2010 to 2022 concerning the keywords of meta-analysis and financial fraud based on Google trends.[1]

Figure 1 Trend of interest in financial fraud and meta-analysis (see online version for colours)



Source: Author contribution

This study stands distinct from previous analogous research in several ways, primarily through the employment of meta-analysis as a final step in a systematic review, which serves to mitigate counting bias. For instance, Homer's 2020 study shows 32 papers, revealing that at least one of the factors among pressure, opportunity, and rationalisation plays a significant role in the occurrence of financial fraud, with 27 papers affirming the influence of all three factors. Unlike Homer's counting approach, our study delves deeper by considering the precision of the studies (i.e., sample characteristics, sample size) by applying meta-analysis. This approach facilitates a more accurate synthesis of results, providing a clearer insight into the dynamics of financial fraud. In addition, to the best of

our knowledge, the research most akin to our own is that of Salehi et al. (2019). In their study, a meta-analysis was employed to scrutinise the impact of audit factors on audit quality. Our research, on the other hand, ventures beyond this singular focus by encompassing a broad spectrum of factors associated with financial fraud. We delve into aspects including but not limited to auditing, corporate governance, financial reporting, and managerial accounting. This expansive approach broadens the investigative lens and also provides a more comprehensive understanding of the multifaceted dynamics contributing to financial fraud.

The innovation of this study lies in three main areas: First, it summarises the findings of various reputable academic sources to identify effective risk factors for FSF. Second, it uses comprehensive proxies that cover auditing, corporate governance, financial reporting, and management accounting. In addition, this research examines the effect of country-specific characteristics on the propensity to commit fraud by using Hofstede's cultural indicators[2] and prosperity indices[3] from the Legatum Institute, to cover gaps in FSF literature.

This study employs three methodological approaches, bibliometric analysis, systematic review, and meta-analysis, each tailored to address distinct challenges outlined below:

Overwhelming volume of literature: The vast amount of existing literature in well-established fields like FSF necessitates an efficient method for initial review. Databases such as Scopus have eased access to numerous research papers, yet the traditional manual selection of papers based on topic or keywords, using a coding sheet, can introduce bias (Asmussen and Møller, 2019). Bibliometric analysis emerges as a valuable tool to navigate through the extensive literature in FSF fields efficiently. It's particularly useful in the initial stage of a literature review when the scope is broad and the data volume is too large for manual review, as substantiated by Donthu et al. (2021). With a wide scope in the early stage (i.e., risk factors related to FSF), and a high number of papers available in the database, employing bibliometric analysis is a suitable approach for this stage.

Interdisciplinary interactions: Examining financial statements for potential misstatements, which could range from unintentional accounting errors to fraud, requires a comprehensive approach due to the interdisciplinary nature of FSF. Our approach integrates insights from auditing, corporate governance, financial reporting, and managerial accounting to enhance the understanding and mitigation of FSF risk factors. Unlike traditional literature reviews, meta-analysis quantitatively integrates results from varying studies, accounting for sample size and study variance, thus aiding in summarising diverse findings with higher precision. This approach helps to overcome the counting bias, ensuring that the identification of effective risk factors associated with financial fraud is grounded on the strength and validity of evidence, not merely on the frequency of their occurrence in the literature (Card, 2015).

Diverse research outcomes: The heterogeneity in research findings concerning FSF, as evidenced by the divergent outcomes in studies like those by Holda (2020) and Kamal et al. (2016), poses a challenge in synthesising a coherent narrative. Meta-analysis facilitates the investigation of potential moderating variables, such as cultural dimensions and prosperity indices, that might explain the observed heterogeneity. Utilising meta-regression, a statistical tool, helps identify the source of variation (e.g., sample

characteristics, sample size), providing a better understanding of the relationship between main variables at different levels of the moderator (Card, 2015).

2 Literature review

2.1 Fraud determinants

Under IFRS, relevance and reliability are fundamental to the usefulness of financial information. Financial information lacking relevance may fail to meet the needs of users for decision-making, and without reliability, users cannot trust the information presented to them (Kythreotis and Soltani, 2023; Saxunová and Chorvatovičová, 2016; Doukakis, 2014). Fraud models have progressed from focusing on fraudster characteristics and motivations to a more comprehensive understanding of criminal activity. Donald Cressey's significant contribution, the 'fraud triangle' theory (1950s), has gained popularity even though he did not originally coin the term. Despite facing critique, the theory has served as a foundation for further development in fraud research. Table 1 outlines the evolution of fraud theory over the years.

Table 1 The development of fraud theory

Model	*Authors and year*	*Focus*
Fraud triangle	Cressey (1950)	The factors that contribute to fraud are Pressure; Opportunity; Rationalisation
Fraud scale	Albrecht et al. (1984)	A scale to measure the likelihood of fraudulent
Fraud diamond model	Wolfe and Hermanson (2004)	Expands on the Fraud Triangle by adding capability, to emphasise the abilities needed to commit fraud
The pentagon fraud model	Marks (2012)	An additional element, arrogance, adds to the diamond model
Heat triangle	Garefalakis and Dimitras (2016)	An analogy comparing fraud elements to fire elements, highlighting the importance of isolating elements to prevent fraud
Meta-model of fraud	Garefalakis et al. (2018)	Focuses on the characteristics of the criminal activity itself, rather than the fraudster

Source: Author contribution

The American Institute of Certified Public Accountants (AICPA) introduced Statement of Auditing Standards No. 99 (SAS No. 99) in 2002, based on the fraud triangle theory. This statement emphasises three main factors that increase an organisation's fraud risk and provides guidance for auditors (Skousen et al., 2009). The factors are outlined in Table 2. Therefore, in this study we investigate the effectiveness of fraud triangle risk factors based on SAS No. 99 indicators using a meta-analysis approach.

Table 2 Fraud risk factors related to SAS No. 99

Fraud risk factors	*SAS No. 99 indicators*	*Definition*
Pressure	Financial stability	Financial stability of the organisation is endangered by changes in the economy, technology, and operating conditions
	Financial targets	The situation involves managers facing pressure to meet set goals, such as satisfying shareholder expectations
	Personal Financial need	When the management compensation is highly dependent on the performance
	External pressure	The pressure increases due to the need for external financing, mainly for debt payment obligations
Opportunity	Ineffective monitoring	Opportunities for fraud occur due to the inability of external auditors to effectively monitor financial statements for fraudulent activity
	Insufficient board oversight	The opportunities arisen as a result of ineffective monitoring within the organisation to commit fraud
	Nature of industry	Inherent risks within an industry that may provide managers the opportunity to FSF
Rationalisation	Rationalisation	It refers to the fraudulent person's attitude to justify their criminal actions

Source: Skousen et al. (2009)

3 Hypotheses development

This study employs a comprehensive approach to fraud prevention by utilising proxies from four key areas – auditing, corporate governance, financial reporting, and management accounting – to measure the fraud triangle risk factors as outlined by SAS indicators. While auditing assesses the accuracy and compliance of an organisation's financial records, corporate governance refers to the guiding rules and processes. Financial reporting presents a company's financial position through financial statements, and management accounting supplies both financial and financial data to internal stakeholders for decision-making. The research emphasises the importance of considering non-financial factors for a thorough understanding of a company's financial health and integrity, as relying solely on financial ratios is inadequate. The subsequent section dives into the existing knowledge and inconsistency findings concerning pressure, opportunity, and rationalisation factors.

3.1 Pressure

In this section we are going to investigate what are the management incentives that under certain conditions might motivate or pressure management to engage in improper accounting. The initial factor regarding pressure is financial instability. When a company grows rapidly, it may face challenges in managing this growth effectively. This can lead to inefficiencies, cash flow issues, or inadequate internal controls. Rapid expansion might also pressure management to engage in aggressive accounting practices or fraud to

maintain the appearance of continuous growth and meet investor expectations (ISA 240, 2009). The results of Skousen et al. (2009) show that fraudulent and non-fraudulent companies have different average gross profits, changes in sales, and changes in assets. This result aligns with the findings of Abbott et al. (2000) and Kamal et al. (2019). However, this relationship was not supported by the studies of Spathis et al. (2002) and Nakashima (2017). For this reason, we include GPM, SCHANGE, and AHANGE in the meta-analysis.

$$GPM = \frac{Revenue - COGS}{Revenue}$$

$$SCHANGE = Change\,in\,sales - Industry\,average\,change\,in\,sales$$

$$ACHANGE = \frac{Total\ Asset(t) - Total\ Asset(t-1)}{Total\ Asset(t)}$$

The subsequent research focus explores cash flow as a proxy to evaluate an organisation's financial instability. Signs of financial instability may include negative operating cash flow accompanied by positive earnings growth (ISA 240, 2009). A lack of cash generation from primary business operations could be attributed to declining revenues, increased operating expenses, or poor working capital management. Continuous negative operating cash flow may suggest financial instability and liquidity problems, hindering the organisation's capacity to meet financial obligations. Although positive earnings growth is generally perceived as beneficial, signalling profit generation and business growth, it can cast doubt on earnings quality and the dependability of financial performance when paired with negative operating cash flow. While Wang and Lou (2009) and Lin et al. (2015) discovered that firms experiencing persistent negative operating cash flow are more prone to fraud, Skousen et al. (2009) did not establish a significant connection. As a result, our meta-analysis incorporates CATA.

$$CATA = \frac{operating\,income - Cash\ flow}{Total\ Assets}$$

Furthermore, an organisation's financial instability can be influenced by operational inefficiencies (ISA 240, 2009). To assess the link between a company's performance and fraud risk, numerous ratios, including sales to accounts receivable, sales to total assets, and inventory to total sales, have been utilised in various studies. A lower sales to accounts receivable ratio may signal difficulties in collecting payments, potentially leading to cash flow issues. A low sales to total assets ratio could imply ineffective asset utilisation, resulting in operational inefficiencies. A high inventory to total sales ratio might suggest excess inventory or slow inventory turnover, both indicative of operational inefficiencies. Suryani et al. (2022) and Ariyanto et al. (2021) identified a significant relationship between sales to total assets and inventory to total sales ratios and the probability of FSF. However, this association is not corroborated by other studies, such as Spathis et al. (2002) and Kamal et al. (2019). Consequently, we incorporate SALAR, SALTA and INVSAL into our meta-analysis.

$$SALAR = \frac{Sales}{Account\ Receivable}$$

$$SALTA = \frac{Sales}{Total\ Asset}$$

$$INVSAL = \frac{Inventory}{Sales}$$

Hypothesis 1-1: A positive relationship exists between financial instability and FSF commitment.

Financial targets are crucial not only as internal performance benchmarks but also as key components of a firm's external communication strategy, particularly with investors. These targets embody the company's aspirations and are often seen as a pledge to stakeholders. The disclosure of financial targets can strengthen investor confidence by showcasing management's positive outlook on future performance (Tamplin, 2023). A realistic financial target aligns with the SMART framework, being Specific, Measurable, Achievable, Relevant, and Time-bound, ensuring clarity and attainability within a designated time frame, which is vital for effective financial planning (Forbes, 2023). On the flip side, an aggressive financial target is defined as a financial goal or benchmark that significantly surpasses industry averages, historical company performance, or what might be reasonably anticipated given the prevailing market and economic conditions. While such targets may emerge from an optimistic stance, they can also place excessive pressure on management to meet these benchmarks, potentially leading to manipulative practices in financial reporting (ISA 240, 2009).

In a bid to meet aggressive financial targets or maximise compensation, managers may resort to inflating financial statements, thereby affecting key financial ratios such as return on equity (ROE), return on assets (ROA), and net profit margin (NPM). These ratios are instrumental in evaluating performance and determining managerial compensation (Skousen et al., 2009). For instance, manipulative practices may entail revenue inflation or expense understatement, resulting in a NPM significantly higher than industry benchmarks or historical performance, which could be indicative of fraud. Research indicates variability in average ROE and ROA ratios between fraudulent and non-fraudulent companies (Huang et al., 2017; Suryani et al., 2022; Noble, 2019; Kartini, 2018), although some studies present no significant findings between fraudulent and non-fraudulent companies (Ozcelik, 2020; Spathis et al., 2010). Given this backdrop, our model incorporates ROA, ROE, and NPM to examine the relationship between aggressive financial targets and FSF commitment.

$$ROA = \frac{Net\ income(t-1)}{Asset(t)}$$

$$ROE = \frac{Net\ income}{Shareholder\ equity}$$

$$NPM = \frac{Net\ Profit}{Sales}$$

Consequently, we propose the following sub-hypothesis:

Hypothesis 1-2: A positive relationship exists between aggressive financial targets and FSF commitment.

The third category relates to personal financial needs, where managers with significant financial stakes in the organisation or compensation heavily reliant on company performance may be more susceptible to committing fraud when performance declines (ISA 240, 2009). Compensation packages often feature performance-based incentives, such as bonuses and stock options, which can pressure/motivate managers to manipulate financial statements. Skousen et al. (2009) found differences in ownership percentages between fraudulent and non-fraudulent companies, prompting the inclusion of OSHIP and COMP variables in the meta-analysis to account for this aspect.

OSHIP = The percentage of ownership held by insiders

COMP = The dollar change in the value of CEO's stock

Hypothesis 1-3: A positive relationship exists between personal financial need and FSF commitment.

The fourth category, external pressure, is related to the financial pressures faced by organisations from external sources, such as debt covenants, investors, or creditors. When an organisation relies heavily on debt financing due to its inability to fulfil financial needs through equity, it becomes subject to certain conditions imposed by the debt covenant. These conditions may include maintaining specific financial ratios or performance indicators that reflect the organisation's financial health and ability to repay its debt (ISA 240, 2009). As a result, we have included FINANCE in meta-analysis. This formula can be used to assess how well a company can fund its current operations and obligations without needing to secure additional funding or financing.

$$Finance = \frac{\left(Cash\ flow(t) - Capital\ expenditure\right)}{(Current\ asset(t-1)}$$

Thus, sub-hypothesis is as follows:

Hypothesis 1-4: A positive relationship exists between external pressure and FSF commitment.

As such, Table 3 summarises the sub-hypotheses related to the pressure factor based on SAS No. 99 categories and the proxies for measuring the factors and studies that have used the proxies.

3.2 Opportunity

In this section we are going to investigate what opportunities in the company's financial statements are there for management to engage in improper accounting. The first category related to opportunity is ineffective monitoring. Auditors play a secondary role in detecting financial fraud, with their main duty being to ensure financial statements are free from material misstatement (ISA 240, 2009). High-quality audits, conducted by experts with industry knowledge and independence, can reduce fraud opportunities by enhancing monitoring effectiveness. Larger audit-size organisations are believed to offer superior services that lower fraud chances (Ozcelik, 2020). Previous research

(Skousen et al., 2009; Nindito, 2018) found a negative correlation between financial fraud, audit expertise, and audit independence, which have been included in the meta-analysis.

AUD_SIZE = A dummy variable of 1 when a firm engages with Big Four auditor; otherwise zero

Audit independent = The percentage of audit committee members who are independent of the firm

Audit expert = A dummy variable of one if audit committee includes no directors with financial expertise.

Table 3 Fraud risk factor proxies for pressure

SAS No. 99 indicators	*Abbreviation*	*Proxies*	*Related topic*
H1–1: Financial instability	GPM	Gross profit margin	Financial Report
	SCHANGE	Sales change	Financial Report
	ACHANGE	Asset change	Management accounting
	DISTRESS	Bankruptcy risk	Management accounting
	GOING_CONCERN	Going concern opinion	Auditing
	CATA	Recurring negative cash flows	Financial Report
	SALTA	Asset turnover ratio	Management accounting
	SALAR	Account receivable turnover ratio	Management accounting
	INVSAL	Inventory to sales ratio	Management accounting
H1–2: Financial target	ROA	Return on asset	Management accounting
	ROE	Return on equity	Management accounting
	NPM	Net profit margin	Income statement
	TOBIN	Tobin's Q	Management accounting
H1–3: financial need	OSHIP	Ownership	Corporate governance
	COMP	Compensation	Management accounting
H1–4: External pressure	FINANCE	Financing	Management accounting

Source: Author contribution

Consequently, sub-hypotheses are stated as follows:

Hypothesis 2-1: A positive relation exists between ineffective monitoring under opportunity, and FSF commitment.

The second category pertains to inadequate board oversight, which is crucial for monitoring financial statement quality and preventing fraud (ISA 240, 2009). A lack of diligence in fulfilling their responsibilities may lead to an environment that enables or even encourages fraudulent activities. A larger board can provide diverse skills, expertise, and perspectives, thereby enhancing oversight quality. Beasley (1996) and Du (2020)

utilised board size and the number of board meetings as proxies to gauge the effectiveness of board oversight, which we will incorporate into our meta-analysis.

CEO Duality occurs when an individual serves as both the Chief Executive Officer (CEO) and Chairman of the Board, which can lead to weak oversight and increase fraud likelihood due to the concentration of power. Skousen et al. (2009) and Lou and Wang (2009) found that such managers exert significant control over critical decisions. Kamal et al. (2019) utilised the corporate governance index as a proxy to assess the effectiveness of organisational controls, with better governance indicating more proactive measures to reduce fraud risk. Therefore, the meta-analysis incorporates proxies for CEO Duality and the Corporate Governance index.

CEO_DUAL = A dummy variable one if the chairperson of the board holds the managerial positions of CEO; zero otherwise.

Based on that explanation sub hypothesis 2-2 is as follows:

> *Hypothesis 2-2: A positive relation exists between insufficient board oversight and FSF commitment.*

Certain industries may have inherent risks or characteristics that make it easier for managers to manipulate financial statements or engage in fraudulent activities. The complexity of these industries may make it difficult for external auditors or regulators to detect financial manipulation, providing managers with more chances to engage in fraudulent activities (ISA 240, 2009). To measure the nature of industry risk, research proxies such as average inventory and accounts receivable have been used. Industries with complex inventory management, such as manufacturing or retail, may have a higher potential for inventory manipulation. For example, managers might inflate inventory levels, change valuation methods, or delay write-offs of obsolete or slow-moving items to improve financial performance. In certain industries, such as technology or construction, companies might have long and complex sales cycles, which can lead to higher accounts receivable balances. Managers may manipulate accounts receivable by recording fictitious sales, recognising revenue prematurely, or not providing appropriate allowances for doubtful accounts. Summers and Sweeney (1998) found a significant discrepancy in the average inventory and accounts receivable accounts between fraudulent and non-fraudulent companies. This finding aligns with the study conducted by Suryani et al. (2022). As a result, we include inventory and receivables as proxies of the nature of the industry.

$$Receivable = \frac{Receivable}{Sales}$$

According to Skousen et al. (2009), organisations that operate in multiple countries with diverse international regulations increase the risk of fraud since these companies are subject to varying laws and regulations, some of which may provide opportunities for financial fraud to occur. For example, a company operating in a country with weaker financial regulations may be more susceptible to fraudulent activities. Therefore, we use foreign operations as a proxy for the nature of the industry.

$$FOPS = \frac{Foreign\ sales}{Total\ sales}$$

Accordingly, sub-hypothesis 2-3 is as follows:

Hypothesis 2-3: A positive relation exists between nature of industry risk and FSF commitment as such.

Table 4 summarises the sub-hypotheses related to the opportunity factor.

Table 4 Fraud risk factor proxies for opportunity

SAS No. 99 indicators	*Abbreviation*	*Proxies*	*Topic*
H2–1: Ineffective Monitoring	AUD_SIZE	Audit size	Auditing
	AUD_IND	Audit independent	Auditing
	AUD_EXPERT	Audit expert	Auditing
H2–2: Insufficient board oversight	AUD_COMM	Audit commission	Auditing
	BOARD_SIZE	Board size	Corporate governance
	BOARD_MEET	Board meeting	Corporate governance
	CEO_DUAL	CEO duality	Corporate governance
	CGI	Corporate Governance Index	Corporate governance
H2–3: Nature of industry	RECEIVABLE	The account receivable to sales ratio	Management accounting
	ASY_INFO	BID-ASK	Management accounting
	INVENTORY_ TURNOVER	Inventory to sales ratio	Management accounting
	FOPS	Foreign operation	Corporate governance

Source: Author contribution

3.3 Rationalisation

In this section we are going to investigate how management may display any behaviour that is similar to the behaviour of those managers who in the past have misstated financial statements. Measuring financial fraud risk is difficult because of rationalisation on managers' behaviour. Researchers have used the frequency of prior violations as a measure of rationalisation. Studies such as those conducted by Kamal et al. (2019) have demonstrated a strong correlation between a history of financial statement restatements and the likelihood of committing fraud. Financial restatements occur when a company needs to correct errors or misstatements in its previously issued financial statements. The presence of such errors may indicate that the company's internal controls and financial reporting processes are weak, increasing the risk of fraudulent activities going undetected. This finding is further supported by the work of Lou and Wang (2009),

Lin et al. (2015), and Ghafoor et al. (2018). Therefore, we include historical restate frequency. Also, Skousen et al. (2009) argue that excessive discretionary accruals can lead to a qualified audit opinion. Discretionary accruals are the portion of total accruals that management can influence or manipulate at their discretion, and they can be used as a tool to artificially inflate or deflate reported earnings. However, the study by Nakashima (2017) found a negative relationship between qualified audit opinions and the probability of committing fraud in Japanese companies. This result could be due to various factors such as cultural differences, regulatory frameworks, or specific industry practices. Therefore, we have used audit opinion and total accrual in the model.

HRF = Number of earnings-affected restatements in two years before event year

AUDCHANGE = A dummy variable for change in auditor

TACC = The difference between net income before extraordinary items and cash flow from operations in proportion to total assets.

As such, the hypothesis is as follows:

Hypothesis 3: A positive relationship exists between rationalisation and financial fraud commitment.

Table 5 shows the sub-hypotheses related to the rationalisation factor based on related proxies. As such, Table 5 summarises the sub-hypotheses related to the rationalisation factor.

Table 5 Fraud risk factor proxies for rationalisation

SAS No. 99 indicators	*Proxies*	*Measure*	*Topic*
H3: Rationalisation	HRF	Historical restate frequency	Corporate governance
	AUDCHANGE	Audit change	Auditing
	TACC	ACCRUALS	Auditing

Source: Author contribution

3.4 Moderating variables

Pursuing the research's second objective, we aim to determine if the heterogeneity in literature results can be attributed to varying characteristics of the countries in the sample. Consequently, we employ cultural indicators and the prosperity index to examine the moderating influence of a country's attributes.

In the present research, the Hofstede model is employed, encompassing six core dimensions: Power Distance, Indulgence, Individualism, Masculinity, Uncertainty Avoidance, and Long-term Orientation. These dimensions are assessed on a scale from 1 to 100, with higher values signifying more pronounced cultural characteristics (Hofstede and Hofstede, 2001). Subsequently, we describe each of these indicators and their relationship with the potential for fraud.

- *Individualism*: Individualism refers to a cultural aspect where individuals prioritise their self-reliance and independence in making decisions. In contrast, collectivist cultures place emphasis on group values and loyalty, leading to decisions being made to safeguard the interests of the group. This can result in an agency problem where the interests of the group are superseded by others (Yamen et al., 2019).
- *Uncertainty avoidance*: In countries with high uncertainty avoidance, managers feel pressured by uncertain situations. Therefore, organisations may commit financial violations to overcome crisis (Yamen et al., 2019).
- *Masculinity*: In societies where masculinity is highly valued, material success is more important than the quality of life. By only focusing on achieving the goal without considering ethical principles, the risk of fraudulent activities increases (Yamen et al., 2019).
- *Long-term orientation*: In societies with a long-term culture, decision making is focused on preparing for the future and disregards immediate concerns. Managers prioritise sustainable profits over quick gains, reducing the risk of fraudulent activities (Yamen et al., 2019).
- *Power distance*: Societies with high power inequality, a small group of people hold decision-making power, while employees have limited involvement in strategic decisions. This increases the risk of fraud (Yamen et al., 2019).
- *Indulgence*: Societies with high indulgence culture emphasise natural human drive such as enjoying life and having fun. An extreme attitude may facilitate the possibility of justifying the fraud (Yamen et al., 2019).

The Prosperity Index (PI) is a tool used in this study to measure the prosperity level of countries, which covers various aspects such as economy, education, health, security, and others. The PI score ranges from 1 to 100, with a higher score indicating a higher level of prosperity. In countries with higher prosperity, there is greater access to resources which can contribute to fraud (Dimant and Tosato, 2017). Accordingly, the fourth hypothesis is as follows:

> *Hypothesis 4-1: The characteristics of the countries (including cultural indices and prosperity index) in the research samples lead to heterogeneity in the studies' results related to FSF.*

Financial distress and fraudulent financial reporting are distinct phenomena that necessitate careful differentiation. Financial distress may arise from external or internal challenges, prompting firms to adopt specific financial policies to navigate through such periods without any fraudulent intentions. On the other hand, fraudulent financial reporting involves intentional misrepresentations aimed at deceiving stakeholders.

Companies often employ various strategies to mitigate financial distress, including cost reduction, debt restructuring, and diversification. For instance, zero-based budgeting

is a strategy aimed at cost reduction and efficiency improvement, exemplified by Dell's initiative to simplify its product portfolios (Mankins and Gottfredson, 2022). Similarly, debt restructuring, as employed by General Motors during the 2008 financial crisis, is aimed at strengthening a company's financial position (Bigman, 2013). Diversification, as pursued by Apple, helps mitigate risks associated with market volatility.

To accurately differentiate between financial distress and fraudulent behaviour, we introduce the leverage ratio (debt-to-equity) as a moderating variable. A higher leverage ratio often signifies higher credit risk, providing a lens to examine the likelihood of FSF amid financial distress. We hypothesise that leverage ratios have a moderate effect on companies to engage in FSF when facing financial distress, influenced by factors such as pressure, opportunity, and rationalisation. This hypothesis is grounded in the analysis of effect sizes from studies that employed the debt-to-equity ratio as a moderating variable to understand its influence on the relationship between independent variables and FSF. Therefore, we propose the following hypothesis:

Hypothesis 4-2: The leverage ratio (debt-to-equity) has a moderating effect on the likelihood of engaging in financial statement fraud when facing financial distress, as measured by the interaction between independent variables (Pressure, Opportunity, and Rationalisation).

3.5 Clustering of world nations based on fraud risk

The third objective of the study is to group countries with similar financial fraud risk based on factors such as culture, prosperity index, and corruption perception score. The corruption perception score measures the financial fraud risk in the public sector and is published by Transparency International with a range of 1 to 100, with a higher score indicating a lower risk due to higher transparency (Transparency International, 2020). As such, the fifth hypothesis is as follows:

Hypothesis 5: The corruption perception score among countries varies significantly, taking into account the unique attributes of each country including national culture and prosperity index.

4 Methodology

In this study we have made sequential use of bibliometric analysis, systematic review, and meta-analysis to provide a structured and comprehensive approach to FSF literature review. This progression allowed us to have comprehensive coverage, addressing heterogeneity and reducing bias (Donthu et al., 2021). To this end, we navigate the vast volume of literature (i.e., bibliometric analysis), integrate insights from diverse financial fraud risk factors (i.e., systematic analysis), and quantify the results from varied studies (i.e., meta-analysis) to arrive at a cohesive and evidence-based understanding of the challenges and risk factors associated with FSF. Based on this explanation the motivations for the methodological approaches and the relationship between the methods have summarised in Table 6.

Table 6 Comparison of review methods

	Review type	*Goal*	*When to use*	*Scope*	*How results are interrelated*
Stage 1	Bibliometric analysis	Summarises large quantities of papers related FSF to emerging trends of a research topic	When the scope of the review is broad and the dataset is too large for manual review	Keywords related Fraud Triangle; Diamond Fraud Model; Pentagon Fraud Model; SAS No. 99	-It helps in identifying the core themes and trends in the field of financial statement fraud (FSF). These themes then guide the systematic review to focus on specific areas of interest. -The network graph from the bibliometric analysis provides a visual representation of the research landscape. This visualisation helps to structure the systematic review by showing which areas have been extensively researched and which areas need further exploration
Stage 2	Systematic literature review	To provide a comprehensive and accurate picture of the prevailing research related FSF risk factors	When the scope of review is specific	The scope is Specific (i.e., FSF risk factors)	The data extracted during the systematic review is then used in the meta-analysis to quantify relationships between variables
Stage 3	Meta-analysis	The meta-analysis builds on this understanding by quantitatively summarising the relationships between variables, providing a more complete picture of the research landscape	When the focus is on summarising results rather than engaging with content, and when studies in the field are heterogeneous with a sufficiently high number of studies available	The scope is Specific (i.e., FSF risk factors)	Quantitative (evaluation and interpretation

Source: Donthu et al. (2021)

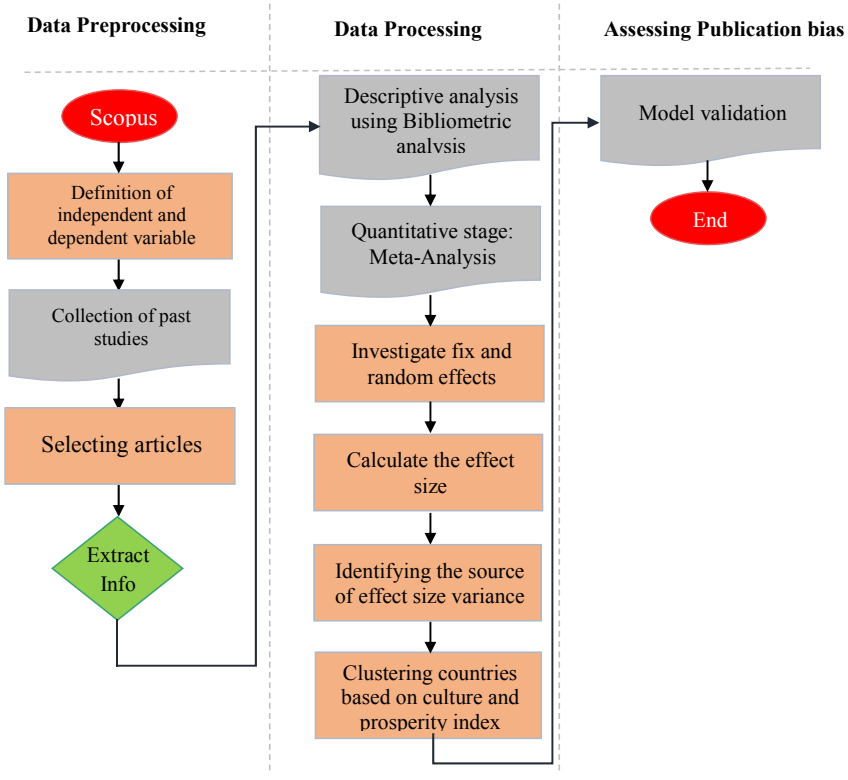
Table 7 Definition of dependent and independent variables

Variables	*Main criteria*
Financial statement fraud risk factors	Audit quality, Corporate Governance, Financial Reporting, Managerial Accounting
Financial Statement Fraud	Earnings management, F-score model, the annual reports issued by the Financial Markets Authority (AMF), Beneish model, Altman Z Score, The audit opinion

Source: Author contribution

A summary of the methodology is shown in Figure 2.

Figure 2 Research methodology (see online version for colours)



Source: Author contribution

For the methodology part we have used the PRISMA approach.[4] The PRISMA checklist is a tool used to improve the reporting of systematic reviews and meta-analyses. PRISMA stands for Preferred Reporting Items for Systematic Reviews and Meta-Analyses. This checklist is designed to ensure that such reviews and analyses are reported with transparency and clarity. The methodology of PRISMA consists of five steps as follows:

1 *Definition of dependent and independent variables*: Based on Table 7, the dependent variable is the probability of committing financial fraud, and the independent variables are proxy measures used in past studies to identify risk factors for fraudulent financial statements.

2 *Information sources*: The two main databases for scientific publications are Web of Science (WoS) and Scopus. According to Agarwal et al. (2016) and Saba et al. (2020) Scopus database is more comprehensive. Therefore, in the current study we focus on the Scopus database. In addition to Scopus to expand the scope and capture the breadth of literature, we include Google Scholar as well. Our motivation

for incorporating Google Scholar was to capture any relevant studies that could provide additional insights to our investigation of the moderating effect of cultural and prosperity indices of countries on FSF. This approach not only enhanced the comprehensiveness of our literature review but also increased the variety of countries represented in our sample, ultimately facilitating a more robust test of the hypothesis.

3 *Study selection*: Our study selection has been based on keyword filter, subject area filter, document type. The keywords used to search for papers include fraud triangle OR diamond fraud OR pentagon fraud model OR SAS. No 99 which are widely recognised frameworks and standards in the analysis of the risk factors associated with financial fraud. Our search was limited to the subject area in the field of business management OR social science, OR economics to maintain a focused examination of topics directly associated with financial fraud and its underlying risk factors. Time constraint was not applied to assure a comprehensive coverage of the literature across various time frames, crucial for understanding the evolution and the current state of financial fraud analysis. We limited the studies to papers published in English. Finally, 397 papers were collected by applying the described filters as below:

(ALL (fraud AND triangle) OR TITLE-ABS-KEY (diamond AND fraud) OR TITLE-ABS-KEY (pentagon AND fraud AND model) OR TITLE-ABS-KEY (sas AND no.99)) AND (LIMIT TO (PUBSTAGE, "final")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (SUBJAREA, ECON")) AND (LIMIT-TO (LANGUAGE, "English"))

To expand the scope and increase the variety of countries, we included 24 papers from Google Scholar. The final count of papers used in our study reaches 421.

Table 8 shows the journal quality from the initial sample of 421 papers based on H-index to high quality, moderate and not ranked journals.

4 *Heterogeneity analysis*: To ensure the homogeneity of the combined studies in our meta-analysis, we focused on the topic of the studies and the statistical methods used. Although the studies vary in terms of topic, industry, and company size, we prioritised the topic to achieve homogeneity. Specifically, we considered factors that contribute to fraud risk, namely pressure, opportunity, and rationalisation, collectively known as the 'fraud triangle'. Cressey argues that these three elements are typically present in instances of fraud. Similarly, AICPA states that the presence of just one of these factors can potentially lead to fraudulent activities. Under SAS No. 99, auditors are required to incorporate several new methods to scrutinise the organisational environment and assess vast quantities of information, aiming to identify indications of pressure, opportunity, and/or rationalisation that could signal fraud risk. In SAS No. 99, Table 9 is included as a reference, listing various scenarios and conditions that are emblematic of each category of fraud risk. In our meta-analysis, we selected papers that use proxies in relation to SAS No. 99. These papers provide valuable insights into the factors contributing to fraud risk and help to ensure the homogeneity of our study.

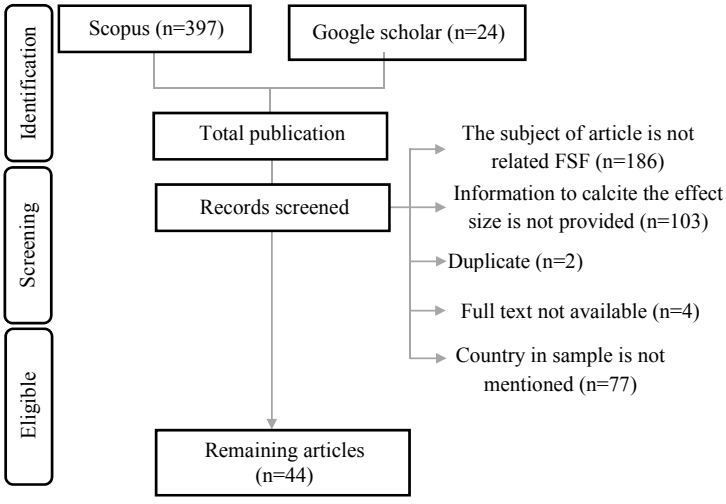
Table 8 Rank of journals based on H-index

Source title	*Count*
High quality	**Total = 225**
Journal of Business Ethics	50
Accounting, Auditing and Accountability Journal	9
Auditing	14
Critical Perspectives on Accounting	8
Managerial Auditing Journal	11
Accounting Forum	7
Journal of Financial Crime	62
Journal of Money Laundering Control	9
Other	55
Medium-quality	**Total = 192**
Journal of Asian Finance, Economics and Business	5
International Journal of Business Science and Applied Management	6
Contaduría y administración	2
Australasian Accounting, Business and Finance	6
Risk Governance and Control: Financial Markets and Institutions	2
International Journal of Financial Research	9
Journal of Governance and Regulation	7
Other	155
Not- ranked	**Total = 4**
The Indonesian Accounting Review	1
JURNAL AKUNTANSI DAN AUDITING	1
International Conference on Accounting Studies	1
International Conference of the Japanese Accounting	1

Source: Author contribution

Secondly, to verify the appropriate model for analysing the combined studies, we utilised Cochran's Q test, as suggested by Card (2015), to evaluate homogeneity. This statistical test helps to determine whether the effect sizes vary significantly among studies due to factors (e.g., industry or company size) that we do not consider in our analysis. If the Q test indicates significant heterogeneity (i.e., p-value < 0.05), it suggests that the effect sizes vary significantly among studies, and a random-effects model will be used. Conversely, if the Q test does not indicate significant heterogeneity, it suggests that the effect sizes are relatively consistent, and a fixed-effects model will be used. Therefore, some studies were found to be unsuitable for meta-analysis as per the standards outlined in sample selection process describe as in Figure 3 as follows:

Figure 3 Literature search of study selection



Source: Author contribution

Table 9 Fraud risk factors from SAS No. 99 Relating to Financial Statement Fraud

Pressure	*Opportunities*	*Rationalisations*
1-Economic or operational challenges threaten profitability or stability, such as intense competition or shrinking profit margins	1-Industry-specific opportunities, such as extraordinary related-party dealings and a dominant market position	1-Management, board, or employee mindset justifying fraudulent actions, such as poor ethics promotion or enforcement
2-Overwhelming demands on management to satisfy third-party expectations, including the pressure to meet profitability trends and secure more debt or equity funding	2-Lack of effective managerial oversight, including inadequate supervision by the board or audit committee	2-History of legal violations and overemphasis on stock prices or aggressive projections
3-Management or the board's personal finances are at stake, including substantial monetary involvement in the company and compensation largely based on performance	3-Organisational complexities, such as challenges in identifying who controls the entity and complicated organisational structures	3-Strained relationships or conflicts with current or previous auditors

Source: Skousen et al. (2009)

At this stage 44 papers have been selected for meta-analysis.

5 *Extract info*: Based on Table 10, to conduct a meta-analysis, we extracted general information about the papers, data to determine the size of the effect, and information to examine the moderating variables. This process resulted in 192 instances being extracted from 44 papers.

It is important to note that the presented studies usually report more than one effect size. For example, some studies have reported up to 20 or more effect sizes. In our meta-

analysis process, the 44 studies used comprised a total of 192 effect sizes, which means that on average, each study included approximately 4 effect sizes. For instance, a study might have examined the effect of a specific fraud risk indicator in 6 countries, resulting in 6 effect sizes for that study.

6 *Data analysis process*: Effect size is a standard measure used to assess the strength or relationship between two variables for each field study conducted. The scale and statistics of this measure are independent of the studies conducted and can be used to combine the results of the studies and compare them with each other. The calculated effect size in this research is the effect size 'r' in which a value of zero indicates no effect while values closer to positive or negative one indicate a greater impact on financial fraud risk. The research method, analysis approach, analysis tool and statistic are reported in Table 11.

Most proxies associated with fraud risk factors exhibit a consistent directionality, indicating that a higher proxy value corresponds to a greater fraud risk. However, the ten proxies utilised in this research has inverse scales, meaning that an increased value decreases the likelihood of fraud. To ensure result consistency, these proxies have been multiplied by negative one. Proxies necessitating reversal encompass Sales to Accounts Receivable Ratio, Audit Size, Audit Independence, Audit Expert, Audit Commission, Board Size, Board Meeting, Corporate Governance Index Score, Asset Turnover Ratio, Accounts Receivable Ratio.

Table 10 Information extracted from the selected papers

General information about the paper	*Data related to calculating the effect size*	*Information related to moderating variables*
Author's name, year of publication	Correlation coefficient of independent and dependent variables; sample size; p-value; average fraud risk of the control group; average fraud risk of the experimental group; sample size of the experimental group; sample size of the control group; mean difference between the experimental and control groups; common variance of the two groups; t-test value	Country in the statistical sample to examine cultural indicators and welfare, credit risk

Source: Author contribution

Table 11 Statistic for calculating effect size

Row	*Research method*	*Analysis tool*	*Statistic*
1	Correlation regression	Regression equation	t
2	Correlation	Pearson Correlation Coefficient	r
3	Comparison of two population	Mean difference	z-test
4	Comparison of two population	Mean difference	t-test
5	Correlation Regression	Regression equation	R square value from regression
6	Comparison of populations	Variance analysis	F-statistic

Source: Card (2015)

7 Additional analysis

- *Identifying the source of effect size variance*: In order to uncover the source of the variation, we will examine the country characteristics within the study samples, including cultural and prosperity indices. Additionally, given that cultural and prosperity indices are of a continuous-ratio type, we will employ the meta-regression technique (Card, 2015).
- *Clustering of world nations based on financial fraud risk*: The third research objective aims to group nations into clusters based on cultural indicators and prosperity index and analyse the variation in corruption perception index between the clusters using the K Means clustering method and the Elbow method. The Anova Tukey test in Python will be used to show the difference in average corruption perception index values between the clusters (Tan et al., 2016).
- *Model validation*: Publication bias can impact the validity of results in meta-analysis. To detect publication bias, statistical methods (the Duval and Tweedie's Trim). The method is known as 'Trim and Fill' as the method initially trims the asymmetric studies from the left-hand side to locate the unbiased effect (in an iterative procedure), and then fills the plot by re-inserting the trimmed studies on the left as well as their imputed counterparts to the right of the mean effect (Card, 2015).

5 Data analysis

5.1 Descriptive analysis

A bibliometric analysis of 421 papers was conducted using cooccurrence criteria to create a network diagram representing top 40 keywords in Figure 4. Yellow nodes represent recent keywords and darker coloured nodes indicate keywords with a long history. The proximity of two keywords indicates simultaneous usage in different papers.

The network diagram reveals 'fraud' and 'fraud triangle' as the most frequent terms in the studied papers. Two main fraud detection approaches are human-driven systems like whistleblowing and technology-based methods such as AI, machine learning, logistic regression, and support vector. While whistleblowing has a history, AI advancements have attracted researchers in financial fraud lately. From 421 papers examined, 44 met the meta-analysis criteria and are summarised in Table 12.

Table 12 Studies included in the meta-analysis

Authors, year	*Country, Sample size*	*Method*	*Results*
Huang et al. (2017)	Taiwan, 11	AHP	Pressure is the most critical factor in the fraud triangle; top 5 measurements contributing to fraud identified
Chen et al. (2016)	China, 409	Logistic regression	Increased analyst coverage linked to lower likelihood of corporate fraud in emerging economies with weaker investor protection
Macedo et al. (2022)	Portuguese companies,163	Logistic regression	Positive relationship between FSF and companies' need for financing, operations ineffectiveness, and higher management turnover

Table 12 Studies included in the meta-analysis (continued)

Authors, year	*Country, Sample size*	*Method*	*Results*
Khoufi and Khoufi (2018)	France, 50	Logistic regression	Outside board members enhance monitoring ability and reduce the likelihood of FSF
Suryani et al. (2022)	Indonesia, 420	The artificial neural network (ANN)	Financial stability and factors like industry nature, inventory to sales ratio, gross profit to total assets, and firm liquidity impact FSF
Du (2021)	China,154	Logistic regression	Recommends improving internal control system, enhancing external auditing competence, and increasing governmental agencies' monitoring intensity
Noble (2019)	Indonesia, 36	Multi linear regression	Pressure (financial targets) and rationalisation (change in auditors) affect FSF
Achmad et al. (2022)	Indonesia, 180	Logistic regression	External pressure and rationalisation significantly impact fraudulent financial reporting
Yusrianti et al. (2020)	Indonesia, 56	Logistic regression	Variables significantly affect FSF are financial stability, financial target, and nature of the industry
Indarto and Ghozali (2016)	Indonesia, 149	Logistic regression	External pressure, financial stability, and capability influence FSF
Ghafoor et al. (2019)	Malaysia, 76	Logistic regression	Aggressive tax reporting and financial difficulties increase fraud likelihood; active monitoring and oversight decrease fraud occurrence
Handoko et al. (2019)	Indonesia, 190	Logistic regression	Pressure, proxied by Changes in Total Assets, significantly affects FSF detection
Kamal et al. (2019)	Malaysia, 504	Logistic regression	significant relation between FSF and pressure (negative operating cash flows, fast growth, abnormal profitability, financing needs) and opportunity (corporate governance index)
Ibrani et al. (2019)	Indonesia, 42	Logistic regression	Pressure and capability are primary factors leading to non-GAAP earnings management; independent audit committees and frequent meetings effectively prevent it
Pamungkas et al. (2018)	Indonesia, 44	Logistic regression	Change in director significantly affects accounting fraud
Kartini (2018)	USA,131	Structural equation modelling	Pressure, opportunity, and rationalisation positively and significantly affect fraud prevention
Siregara (2018)	Indonesia, 35	ANOVA test	Pressure and opportunity impact red flags for fraud detection; rationalisation has no effect
Ariyanto et al. (2021)	Indonesia, 40	Logistic regression	Industry characteristics positively affect FSF; changing top management positions can indicate FSF

Table 12 Studies included in the meta-analysis (continued)

Authors, year	*Country, Sample size*	*Method*	*Results*
Nugraheni and Triatmoko (2017)	Indonesia, 105	Logistic regression	Financial targets, external pressure, and personal financial need influence FSF
Omukaga (2021)	Kenya, 35	Logistic regression	All four elements of the fraud diamond triangle influence FSF in Kenya
Yulianti et al. (2019)	Indonesia, 124	Logistic regression	Various factors including financial targets, financial stability, external pressure have no impact on FSF
Ozcelik (2020)	Turkey, 26	Logistic regression	Negative correlation between borrowing level, asset profitability, independent audit firm, auditor exchanges, institutionalisation level, and FSF
Lin et al. (2015)	Taiwan, 129	Data mining techniques	ANNs and CART are more accurate than logistic model in assessing fraud presence
Fitri et al. (2019)	Indonesia, 810	Multi linear regression	Detected fraud companies experienced higher pressure, lower numbers of independent commissioners, more receivables, and more frequent auditor changes
Nakashima (2017)	Japan, 280	Logistic regression	Significant differences in pressure, opportunity, and rationalisation factors between fraud and non-fraud firms
Spathis et al. (2002)	Greece, 76	multicriteria decision aid (MCDA)	The study highlights the importance of financial ratios such as the total debt to total assets ratio, inventories to sales ratio, net profit to sales ratio, and sales to total assets ratio in identifying FSF
Manurung and Hadian (2015)	Indonesia, 11	Anova test	Rationalisation (turnover of auditor) and capability (change of directors) significantly affect FSF
Skousen et al. (2009)	USA, 172	Logistic regression	The study finds that rapid asset growth, increased cash needs, and external financing are positively related to the likelihood of fraud, while internal ownership of shares, control of the board of directors, and the expansion of independent members on the audit committee are negatively related to the occurrence of fraud
Bahrami et al. (2019)	Iran, 98	Multi linear regression	Pressure from financial instability (change in total assets ratio) positively affects FSF

Source: Author contribution

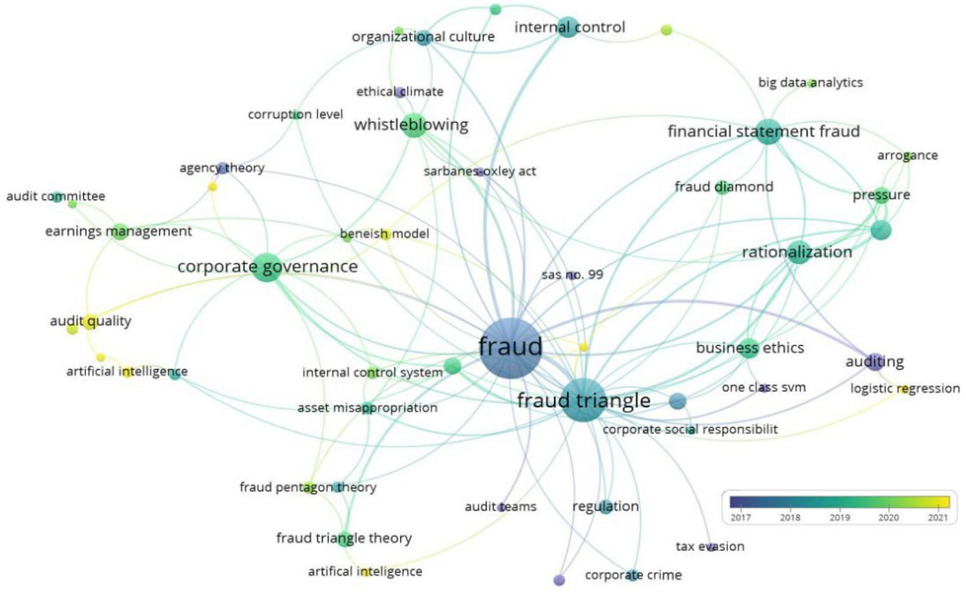
5.2 Quantitative analysis

5.2.1 Calculation of the effect size

To determine the effect size, we first examine the type of model (fixed or random) to be employed for analysing the first to third hypotheses and eight sub-hypotheses. Table 13 determines the type of model (fixed or random) to be used for analysing the first to third

hypotheses and eight sub-hypotheses based on the number of instances (N) and the P values. If the P value is less than 0.05, a random effects model should be used, otherwise a fixed effects model will be used.

Figure 4 Network graph presenting top 40 keywords (see online version for colours)



Source: Author contribution

Table 13 Effect size heterogeneity test and random effects model for hypotheses

Fraud risk factors	*Hypothesis*	*N*	*Q statistic*	*p-value*	*Result*
H1: Pressure	H1–1: Financial stability	44	217.72	0.00	Random
	H1–2: Financial target	24	176.66	0.00	Random
	H1–3: Personal financial need	14	60.76	0.00	Random
	H1–4: External pressure	37	497.62	0.00	Random
H2: Opportunity	H2–1: Ineffective monitoring	14	19.96	0.04	Random
	H2–2: Insufficient board oversight	21	94.56	0.00	Random
	H2–3: Nature of industry	10	106.95	0.00	Random
H3: Rationalisation	H3–1: Rationalisation	28	95.66	0.00	Random

Our findings reveal that the effect sizes are heterogeneous for all groups under SAS No. 99, necessitating the use of a random effects model to calculate the effect sizes for all hypotheses.

Subsequently, we compute the effect size, with Table 14 displaying the results of the analysis for the first to third hypotheses. The Z test's significance level dictates whether the estimated confidence interval contains zero. A significance level below 0.05 for the Z test indicates a significant relationship between the research variables.

According to the results in Table 14, all the categories related to SAS No. 99, except personal financial needs and the nature of the industry, have a significant relationship with FSF. Also, fraud risk factors, including pressure, opportunity, and rationalisation, have a positive and significant effect on committing financial fraud.

Table 14 Hypothesis test results

SAS No. 99 categories	***Proxies***	***Correlation***	***Confidence interval***	***Z statistic***	***P-value***
H1: Pressure		**0.07**	**(0.03-0.11)**	**3.60**	**0.00*****
H1-1: Financial instability		**0.06**	**(0.01-0.11)**	**2.58**	**0.01*****
Pressure due to Rapid growth	GPM	0.07	(0.004-0.136)	1.75	0.07*
	SCHANGE				
	ACHANGE				
Pressure due to financial stability	DISTRESS	0.1	(0.00-0.20)	1.95	0.05**
	GOING_CONCERN				
	CATA				
Pressure due to Operating conditions	SALTA	0.03	(–0.05-0.11)	0.72	0.47
	SALAR				
	INVSAL				
H1-2: Financial target		**0.08**	**(–0.01-0.18)**	**1.68**	**0.09***
Pressure due to Meet profitability target	ROA	0.08	(–0.01-0.18)	1.68	0.09*
	ROE				
	NPM				
	TOBIN				
H1-3: Personal financial need		**0.06**	**(–0.04-0.17)**	**1.10**	**0.26**
Pressure due to Personal financial need	OSHIP	0.06	(–0.04-0.17)	1.10	0.26
	COMP				
H1-4: External pressure		**0.09**	**(0.002-0.18)**	**1.92**	**0.05****
Industrial pressure	FINANCE	0.09	(0.002-0.18)	1.92	0.05**
H2: Opportunity		**0.12**	**(0.07-0.17)**	**4.94**	**0.00*****
H2-1: Ineffective monitoring		**0.19**	**(0.13-0.24)**	**6.51**	**0.00*****
Ineffective monitoring	AUD_SIZE	0.19	(0.13-0.24)	6.51	0.00***
	AUD_IND				
	AUD_EXPERT				
H2-2: Insufficient board oversight		0.15	(0.08-0.21)	4.60	0.00**
Insufficient board oversight	AUD_COMM	0.15	(0.08-0.21)	4.60	0.00**
	BOARD_SIZE				
	BOARD_MEET				
	CEO_DUAL				
	CGI				
H2-3: Nature of Industry		**0.06**	**(–0.08-0.20)**	**0.87**	**0.38**
Nature of Industry	RECEIVABLE	0.06	(–0.08-0.20)	0.87	0.38
	ASY_INFO				
	INVENTRY_TURN OVER				
	FOPS				

Table 14 Hypothesis test results (continued)

SAS No. 99 categories	***Proxies***	***Correlation***	***Confidence interval***	***Z statistic***	***P-value***
H3: Rationalisation		0.09	(0.03-0.15)	3.05	0.002***
Rationalisation	HRF	0.09	(0.03-0.15)	3.05	0.002***
	AUDCHANGE				
	TOTAL_ACCRUAL				

Variable definition: GPM, Gross profit margin; SCHANGE, Sales change; ACHANGE, Asset change; DISTRESS, Bankruptcy risk; GOING_CONCERN, Going concern opinion; CATA, Recurring negative cash flows; SALAR, Account receivable turnover ratio; INVSAL, Inventory to sales ratio; ROA, Return on equity; ROE, Return on equity; NPM, Net profit margin; TOBIN, Tobin's Q; OSHIP, Ownership percentage; COMP, Executive compensation; LEV, Leverage ratio; CCRI, Corporate credit risk index; NEW_REG, Changing accounting regulation; FINANCE, Free cash flow from operation; AUD_SIZE, Audit size; AUD_IND, Audit independent; AUD_EXPERT, Audit expert; AUD_COMM, Audit commission; BOARD_SIZE, Board size; BOARD_MEET, Board meeting; CEO_DUAL, CEO duality; CGI, Corporate governance index; RECEIVABLE, The receivable to sales ratio; ASY_INFO, Asymmetric information; INVENTORY_TURNOVER, Inventory to sales ratio; FOPS, Foreign operation; HRH, Historical restate frequency; AUDCHANGE, Audit change; TACC. Total accruals. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

5.2.2 Identifying the source of effect size variance

In regard to Hypothesis 4-1, Table 15 uses the meta-regression method to study the effect of cultural indices and prosperity index on fraud risk factors. The beta value measures the strength of the impact, and a p value below 0.05 shows a significant effect. A positive beta means fraud is facilitated while a negative beta means it is impeded.

Table 15 Statistical researches sample based on country characteristics

Hypothesis	*Estimate value*	*PD*	*IND*	*MASC*	*UNC*	*LONG*	*INDUL*	*PI*
H1: Pressure	Beta	0.004	0.001	0.001***	–0.007**	–0.001***	0.005	–0.001*
H2: Opportunity	Beta	–0.005	0.001***	–0.002	–0.001***	–0.001***	0.001**	–0.001
H3: Rationalisation	Beta	–0.003***	0.001**	0.009	0.002***	–0.001**	0.004***	0.008***

Definition: PI, Prosperity index. PD, Power distance cultural index. IND, Individualism cultural index. MASC, Masculinity cultural index. UNC, Uncertainty avoidance cultural index. LONG, Longitude cultural index. INDUL, Indulgence cultural index. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$

Table 15 highlights a significant connection between cultural indicators (masculinity, uncertainty avoidance, and longitude) and the impact of the pressure factor on the occurrence of FSF. A negative relationship is observed between uncertainty avoidance and longitude with FSF, while a positive relationship is present between masculinity and FSF. Additionally, the prosperity index (PI) has a significant negative influence on the pressure-FSF relationship, implying that as PI increases, the probability of committing FSF due to pressure decreases.

Regarding the opportunity factor, cultural indicators such as individualism, uncertainty avoidance, longitude, and indulgence demonstrate a significant relationship

and, consequently, moderate the connection between opportunity and FSF. Uncertainty avoidance and longitude exhibit a negative relationship with FSF, while indulgence and individualism indicators display a positive relationship. For the rationalisation factor, cultural and prosperity indices significantly impact FSF, with power distance and longitude negatively affecting FSF, and uncertainty avoidance, individualism, and indulgence positively impacting it. The prosperity index also positively correlates with rationalisation, leading to increased FSF likelihood due to rationalisation as the prosperity index rises. Thus, the fourth hypothesis posits that differences in the cultural and prosperity indices of countries in the research sample have moderate effect has been accepted.

In regard to Hypothesis 4-2, in a similar way Table 16 uses the meta-regression method to study the effect of debt-to-equity ratio on fraud risk factors.

Table 16 The moderate effect of credit risk on FSF risk factors

Fraud risk factors	*Estimate value*	*p-Value*
Pressure	0.02	0.061
Opportunity	0.02	0.130
Rationalisation	0.01	0.580

The analysis suggests that credit risk does not significantly moderate the likelihood of engaging in FSF. These findings align with the notion that financial distress and fraudulent financial reporting are distinct phenomena, as the financial distress represented by credit risk does not significantly impact the dynamics of FSF risk factors.

Pressure: The estimate value of 0.02 with a p-value of 0.061 suggests a marginal effect of credit risk on the relationship between pressure and FSF. Although this effect is not statistically significant at the 95% confidence level, it approaches significance, indicating that there might be a slight moderating effect of credit risk on the pressure to commit FSF.

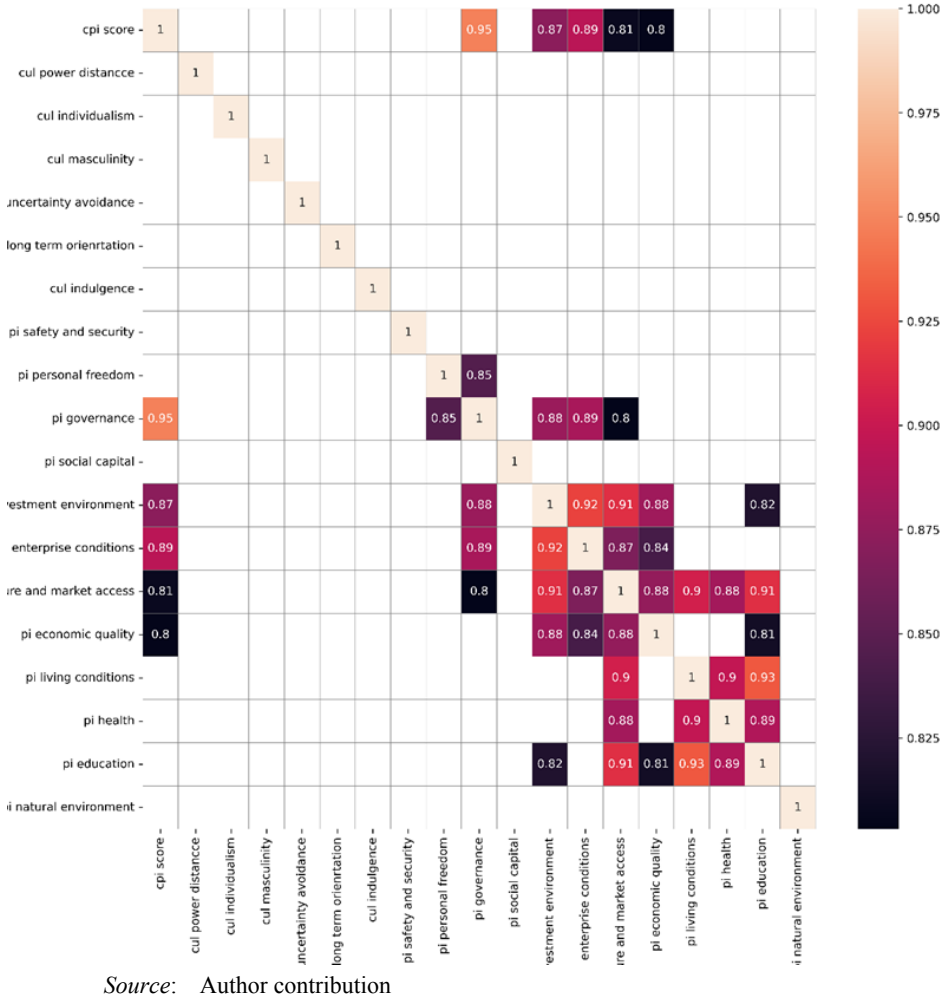
Opportunity: With an estimate value of 0.02 and a p-value of 0.130, the effect of credit risk on the relationship between opportunity and FSF is not statistically significant. This suggests that credit risk may not significantly alter the opportunities to engage in FSF.

Rationalisation: The estimate value of 0.01 and a p-value of 0.580 indicate a weak and statistically non-significant moderating effect of credit risk on the relationship between rationalisation and FSF.

5.2.3 Clustering countries based on cultural indicators and prosperity index

Hypothesis 5 explores the development of a framework to categorise countries with comparable fraud risk levels. We first calculated the correlation between cultural indicators (6 criteria) and prosperity indicators (12 criteria). Figure 5 shows the correlation values for cultural and prosperity indicators with CPI score when its value is greater than 0.7.

Figure 5 Correlation between cultural indicators and prosperity index with CPI score (see online version for colours)



Source: Author contribution

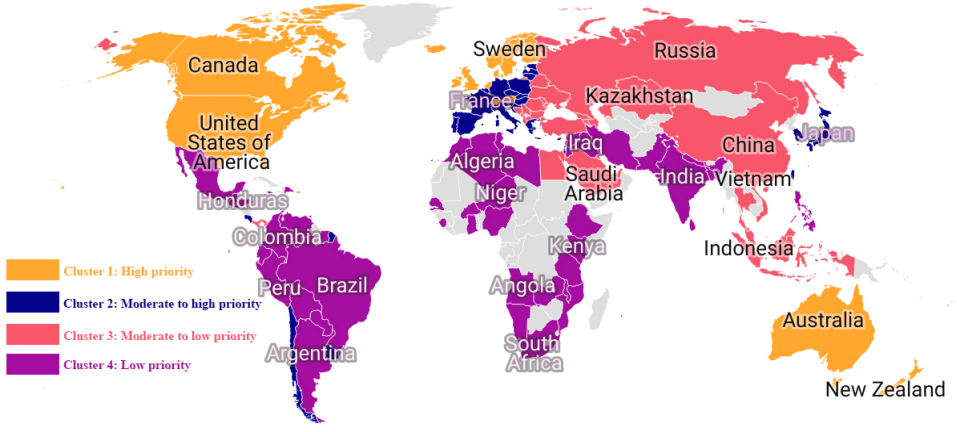
Then by employing the K Means technique and the elbow method, countries are segmented into four clusters according to cultural and prosperity indices. The Anova Tukey test is utilised to evaluate significant differences in CPI scores across the clusters, resulting in a global classification of countries based on fraud risk. The worldwide clustering of countries according to fraud risk is depicted in Figure 6.

Cluster 1 countries prioritise fraud prevention highly, while Cluster 2 has a moderate to high priority. Cluster 4 has a low priority, and Cluster 3 focuses on fraud prevention with a moderate to low priority.

5.3 Model validation

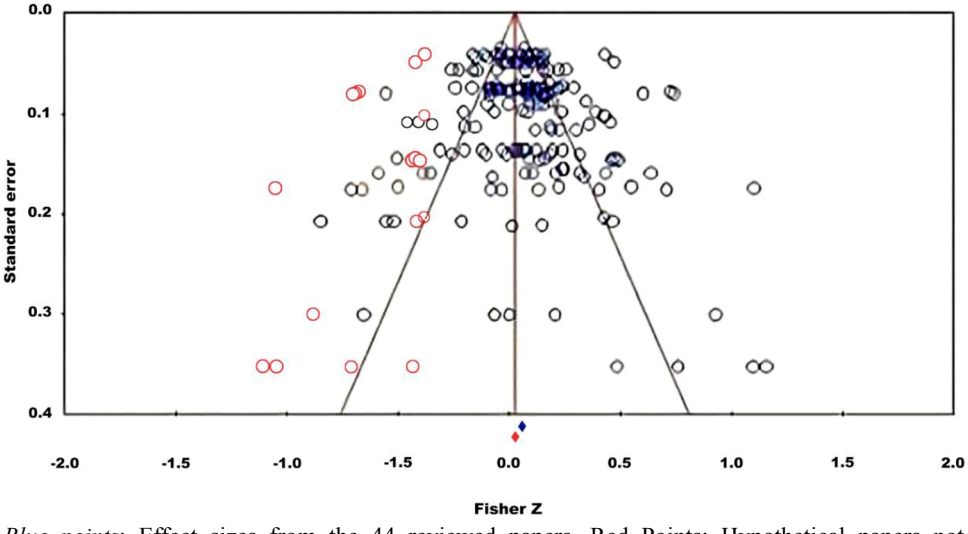
In this section, we have visualised the degree to which our results were influenced by publication bias. Figure 7 presents the funnel plot depicting the validity of the results.

Figure 6 Cluster analysis of country characteristics based on varied CPI scores across clusters (see online version for colours)



Source: Author contribution

Figure 7 The funnel plot of standard error by Fisher's Z (see online version for colours)



Blue points: Effect sizes from the 44 reviewed papers. Red Points: Hypothetical papers not included potentially due to publication bias. Blue Diamond: Represents the aggregated effect size symmetry. Red Diamond: Indicates the point of complete symmetry with the inclusion of hypothetical papers

Source: Author contribution

The blue points on the plot represent the effect sizes derived from the 44 papers, with the blue diamond at the base of the graph indicating the symmetry of these sizes. On the

other hand, the red points show papers that might have contributed to the current research but were not included, possibly due to publication bias. The alignment of the blue and red diamonds on a single line demonstrates complete symmetry in the analysis of various paper results. Yet, as observed in Figure 6, the outcomes of the present study exhibit a minor bias towards the right side of the funnel plot. To delve into whether this bias is statistically significant enough to challenge the authenticity of the current study's results, we employed the Duval and Tweedie's Trim and Fill method. Under the random effects model the point estimate and 95% confidence interval for the combined studies is 0.04103 Using Trim and Fill these values are unchanged. The unchanged values indicate that the meta-analysis is robust against potential publication bias.

6 Results and discussion

The causes of financial statement misstatements can range from unintentional accounting errors to fraud. Since financial analysts do not have access to company records, it is unlikely that a financial analyst would identify specific accounting misstatements. Rather, the analyst must use public information to assess the likelihood that accounting misstatements may be present. Therefore, in the first to third hypotheses we have investigated the financial risk factors associated with FSF. Following SAS No99, our accounting risk assessment framework consists of three assessments (see Figure 8). Each assessment focuses on answering a particular question relevant to assessing misstatement risk.

- *Pressure*: Are there any management incentives that under certain conditions might motivate or pressure management to engage in improper accounting?
- *Opportunity*: If management chose to do so, what opportunities in the company's financial statements are there for management to engage in improper accounting?
- *Rationalisation*: Has management displayed any behaviour that is similar to the behaviour of those managers who in the past have misstated financial statements?

Our result supports all three elements that significantly affect the likelihood of committing FSF. More specifically the incentive step of the framework requires the analyst to identify those management incentives that might, under certain conditions, result in pressure upon management to engage in improper accounting actions. Such incentive-related risk factors might include the following:

- management reputation is dependent on achieving rapid growth
- the securities market has reacted adversely toward the securities of firms
- senior management sets unrealistic targets for operating managers.

Some significant proxies based on literature review to investigate incentive/pressure are rapid growth (GPM, Sales change, Asset change); financial targets (Return on asset, ROE, NPM), and external pressures (Negative cash flow), which are significantly different among fraudulent and not fraudulent companies.

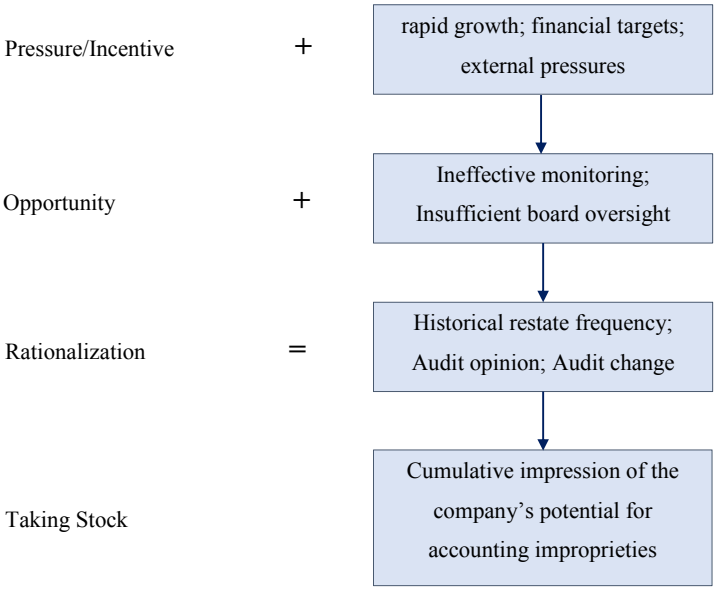
The next step in the framework requires an identification of management's opportunities for accounting improprieties. The focus of the analysis here is on the

potential for material improprieties, not on whether they are present. Such opportunity-related risk factors might include the following:

- management tolerates internal control weaknesses
- domination of management by a single person or close group of people
- management operates in a weak corporate governance environment.

Some significant proxies based on literature review to investigate opportunity are audit size, audit independent and audit expert.

Figure 8 FSF risk assessment framework (see online version for colours)



An examination of past instances of accounting improprieties strongly suggests that certain management behaviour is often associated with questionable and fraudulent accounting. Financial analysts and investors should be aware of these behavioural risk factors, which include the following:

- poor relations with former auditing firms or frequent auditor changing
- assets, liabilities, revenues, or expenses based on significant estimates that involve unusual judgements or uncertainties
- material changes in accruals
- significant related-party transactions not in the ordinary course of business, or with related entities not audited, or audited by firms other than the reporting entity's auditor
- frequent restatements of past earnings figures.

Some significant proxies based on literature review to investigate rationalisation are Number of earnings-affected restatement; Frequent change in auditor; Accrual earning quality.

To fulfil the second objective, the results of the fourth hypothesis show country context including culture and prosperity of index can increase the probability of fraud commitment.

- Cultures with a high Uncertainty Avoidance and longitude tend to lower the chances of committing fraud under pressure, while those with high masculinity index raise it. When it comes to opportunities, cultures with individualistic and indulgent traits raise the likelihood of committing fraud, while Uncertainty Avoidance and longitude lower it. The power distance and longitude of a culture increase the probability of committing fraud under rationalisation, while individualistic, uncertainty avoidance and indulgent traits raise it as well.
- The prosperity index in a country tends to reduce the likelihood of committing fraud under pressure but increases it under rationalisation risk factor.

Furthermore, our analysis reveals that credit risk does not significantly alter the relationship between the identified risk factors and the likelihood of fraudulent financial reporting. This suggests that while financial distress, as indicated by credit risk, may be a concern for creditors and investors, it does not necessarily increase the probability of FSF. These insights underscore the importance of distinguishing between the drivers of financial distress and those of fraudulent reporting. They imply that monitoring systems and risk assessment processes should be tailored differently when addressing credit risk vs. when mitigating the risk of FSF.

To fulfil the third objective, we have attempted to establish a framework that demonstrates the varying fraud risks among countries with similar attributes. To accomplish this, we grouped the world's countries into four clusters based on the cultural and prosperity indices. Then by applying the Anova Tukey test, our results revealed significant differences in the corruption perception index values among the four groups. Based on this framework, researchers can propose a tailored financial fraud detection model for each group. Therefore, the fifth hypothesis is supported. This result shows country context is likely to facilitate accounting misstatements due to factors such as:

- weak security markets regulations and regulators
- corruption is accepted or at least tolerated in the country
- there is little incentive for potential whistle blowers
- A financial analysers or financial press are not independent.

Based on this explanation countries in Cluster 4 have a higher risk for financial fraud commitment and Cluster 1 have a lower risk.

7 Limitations of the study and future study suggestions

The present study is subject to five primary limitations. Firstly, the criteria employed for effect size calculation led to the exclusion of certain studies that did not meet the set

parameters. This could potentially affect the comprehensiveness of the analysis. Secondly, the study exhibits a language bias as it only includes papers written in English, thereby possibly overlooking valuable insights from non-English literature. Thirdly, there are limitations inherent to the databases utilised for sourcing the literature, as some relevant studies might not have been included due to database restrictions. Finally, in this study, the variables we have selected for meta-analysis are based on the most commonly used variables in the literature. These variables, as detailed in Tables 3–5, are applicable to various industries, including both service and producing companies. However, we acknowledge that industry-specific characteristics may influence the occurrence and detection of FSF. For example, service sectors typically have lower tangible assets (e.g., inventory) and different revenue recognition processes compared to producing companies. In the case of a service company, revenue may be recognised over the period of a contract, while a manufacturing company may recognise revenue upon the sale of goods. These differences in revenue recognition can affect the applicability and interpretation of variables such as inventory to sales ratios and account receivables to sales ratios. To address this limitation, we suggest future studies to provide a more comprehensive understanding of the risks and challenges associated with the service industry. Finally, in meta-analysis we include variables with high frequency (i.e., at least 10 instances), this could affect the accuracy of our results.

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Notes

[1]https://trends.google.com/trends/

[2]http://prisma-statement.org/Extensions/NetworkMetaAnalysis

[3]https://hi.hofstede-insights.com/national-culture

[4]https://www.prosperity.com/

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