Internally generated intangible assets
The vaccine for UK listed finance industry financial contagion?

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ABSTRACT

Context: Internally generated non-capitalised intangible assets (IGNIAs) are not included in companies' balance sheets per international accounting standards, as they do not contribute to providing firms with resilience during crises. However, some companies gain a competitive advantage by continuously investing in IGNIAs , which management and investors should prioritize to foster resilience during unforeseen crises.

Purpose: This study aims to determine whether investment in IGNIAs provided resilience, proxied by Return on Assets (ROA), during the COVID-19 crisis for 257 UK-listed finance firms from 2016-2023. The focus is on the UK finance industry due to its significant role in global financial contagion during crises.

Research Design: This study used quantitative methods, employing firm-specific variables to test the hypotheses developed from existing theories. A longitudinal design was used with cross-sectional data from various firms in the finance industry. The study reviewed the relationship between UK finance firms' investment in IGNIAs and their resilience. It compared the resilience of firms that invested more in IGNIAs before the COVID-19 crisis to those that invested less, to determine if these assets contributed to their resilience.

Main Findings: The study did not find a statistically significant relationship between investment in IGNIAs and resilience measured by ROA for the entire sample of 257 UK finance firms from 2016-2023. However, a somewhat statistically significant relationship was found between IGNIAs and resilience in the financial services industry only after the COVID-19 pandemic period, 2020-2023.

Contribution: This study provides insights into the importance of IGNIAs in fostering resilience, especially for the finance industry, and contributes to the ongoing debate on whether these intangible assets should be included in firms’ balance sheets. It highlights the need for industry-specific measures to resolve the contentious issue of capitalising IGNIAs.

Recommendations and Implications: Management should prioritise continuous investment in IGNIAs to foster resilience and provide protection against unforeseen

market crises. Standard-setting bodies should reconsider disclosing IGNIAs, as they are important factors for investors to consider when making informed investment decisions.

KEY WORDS

Intangible Assets. Resilience. UK Finance industry. Capitalising intangible assets. Financial Contagion. Financial Crises. Financial Stability. Continuous investment in intangibles. Management control over intangibles.

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LIST OF ABBREVIATIONS

Abbreviation	Description
B	Bottom portfolio
BICS	Bloomberg Industry Classification System
BSC	Balanced Scorecard
CASH	Cash
CASHTA	Cash as a percentage of TA
COVID / COVID-19	Coronavirus disease
DCC	Dynamic Conditions Correlations
DW	Durbin-Watson
EBITDA	Earnings Before Tax, Depreciation, And Amortisation
EGLS	Estimated Generalised Least Squares
ESG	Environmental, Social and Governance
EVA^{TM}	Economic Value Added
EX^{int}	External
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
H	High portfolio
IAS	International Accounting Standard
IFRS	International Financial Reporting Standards
IGNIAs	Internally Generated Non-Capitalised Intangible Assets
INT	Intangible Assets, sum of KC and OC
INTTA	Intensity of Intangible Assets as INT divided by sum of INT and TA
KC	Knowledge Capital
LEV	Leverage
LSE	London Stock Exchange
M	Middle portfolio
OC	Organisational Capital

OLS	Ordinary Least Squares
ONS	The UK Office for National Statistics
R&D	Research and Development
ROA	Return on Assets
ROE	Return on Equity
SG&A	Selling, General and Administrative
TA	Total Assets
TBTF	Too Big To Fail
UK	United Kingdom
US	United States
VAIC	Value-Added Intellectual Coefficient
VIF	Variance Inflation factor

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INTRODUCTION

Resilience can be closely linked with sustained competitive advantage. Barney (1991) proposes that sustained competitive advantage is achieved when current and potential competitors cannot duplicate the advantage created by a company (Barney, 1991). Carvalho et al. (2016) contributes to this and explains competitive advantage when companies resist and manage to compete during uncertain times by implementing innovation. This ability to withstand unexpected changes and adapt to risks through strategy, operations and management through innovation leads to resilience. Resilience for the banking industry is a measure of its capacity to absorb and recover from crises or the ability of the industry to withstand unexpected changes and adapt to risks in the environment within which it operates (Abiwodo et al., 2023; Carvalho et al., 2016).

The COVID-19 crisis disrupted economies worldwide, leading to many bankruptcies (Didier et al., 2021). Indices worldwide recorded record plunges following the declaration of the COVID-19 pandemic exceeding 20% (Akhtaruzzaman et al., 2021; Didier et al., 2021). This instability leads to financial contagion, where financial shocks are transmitted across countries (Akhtaruzzaman & Shamsuddin, 2016). Resolving distressed financial institutions in financial crises is crucial to prevent spillover effects on other industries reliant on financial providers, as liquidating them could worsen instability (Didier et al., 2021). Most alarming is that UK finance firms were found to be the most contagious during the COVID-19 crisis period (Akhtaruzzaman et al., 2021).

Delayed share price reactions during the crises where investors failed to capture excess returns were found, concluding that the efficient market hypothesis did not hold in the months directly after the pandemic ensued (Pástor et al., 2020). This highlights the importance of stakeholder theory in creating value, which is created by various firm resources, including processes, knowledge, capabilities, and assets. Investment in intangibles contains predictive information on companies' ability to generate cash and profits and withstand market fluctuations.

Various authors find that measuring intangible assets is a controversial topic and that various definitions and measurements have been proposed over the years by multiple bodies, including the International Financial Reporting Standards (IFRS), the

International Valuation Standard Committee and other national regulation organisations (Banker et al., 2019; Haji & Ghazali, 2018; Lev & Sougiannis, 1996; Lim et al., 2020; Manikas et al., 2019; Martin, 2019; Nichita, 2019; Peters & Taylor, 2017; Uddin et al., 2022). The biggest issue with intangibles seems to be the ability to measure them accurately (Nichita, 2019).

By making use of the resource theory that suggests that firm performance is a result of firm resources, whether tangible or intangible, Haji and Ghazali (2018) conclude that firms with intangible assets that are not recorded on the balance sheet have a direct relationship with their performance and that the inclusion of this information as part of the financial results is necessary for investors to make informed decisions. A solution to the above-mentioned concerns is making use of the income statement to derive a value for intangibles (Haji & Ghazali, 2018).

Various other authors use a similar approach in identifying expense items that generate future returns to determine the value of Internally Generated Non-capitalised Intangible Assets (IGNIA's), as discussed in the IGNIA's measurement section (Banker et al., 2019; Lim et al., 2020; Manikas et al., 2019). This view is supported by Uddin et al. (2022), which include R&D and selling, general, and administrative (SG&A) expenditure, denoted as knowledge capital (KC) and organisational capital (OC), respectively. This study will use a similar approach to determine the value of IGNIAs, by making use of KC derived from R&D expenditure and OC derived from SG&A expenditure.

Background and relevance of the study

This study analyses the effect that UK finance firms' (IGNIAs) had on their resilience during the COVID-19 pandemic. It aims to address the role that IGNIAs play in contributing to the stability of the UK financial sector, which could potentially limit the effects of global financial contagion.

This study will contribute to existing literature on the role that intangibles play in creating resilience for firms in times of crisis. The research builds on the findings of Uddin et al. (2022), who found that intangibles provide resilience for US firms during pandemic shocks and lead to positive investor sentiment. It aims to fill a gap identified

by Danisman et al. (2021) who examined how banking market structure impacts market resilience during the COVID-19 crisis and calls for an investigation of specific indicators, in this case, intangibles, in the UK finance industry and how this impacts a firm's resilience and recovery from the COVID-19 pandemic. It also contributes to the debate on the exclusion of intangible assets as a corporate asset due to the current issues with the recognition and measurement of intangibles in line with International Accounting Standard (IAS) 38, where Nichita (2019) found that market prices are considered the current solution to capture the full value of intangibles. Finally, this study aims to fill a gap where the finance industry has been excluded from studies that looked at intangibles and their impact on resilience during crises (Demers et al., 2021; Duho, 2022; Kasoga, 2020; Uddin et al., 2022).

Problem Background and Statement

Intangible assets are a significant factor for investors to consider when determining firms' value and future performance in investment decisions. Firms with higher investments in intangible assets have significantly higher average returns (Uddin et al., 2022). Like Uddin et al. (2022), various other studies have excluded the finance industry in papers addressing resilience during the COVID-19 crisis. Danisman et al. (2021) also note the gap in literature on the banking industry and resilience, who examines the resilience of the banking industry through a market structure lens. Danisman et al.'s (2021) study was also limited to the 2020 period only and calls for an extended period after COVID-19. In addition, Akhtaruzzaman et al. (2021) found that UK finance firms were the most contagious during the COVID-19 crises of all G7 countries per the literature review. Contagion is when local financial shocks are transmitted across countries (Akhtaruzzaman & Shamsuddin, 2016). This study aims to determine if IGNIA's may be contributing to firm resilience, which in turn may limit the impact of cross-country financial contagion.

This study will aim to address this gap by sampling the UK finance industry and investigating whether these firms' investment in IGNIAs creates resilience during crises. Nichita (2019) found that market mispricing exists when not all intangible assets are disclosed on financial statements because there is information asymmetry between a firm and stakeholders. This asymmetry can be attributed to the limited scope of what is allowed to be disclosed for listed firms per the International Financial Reporting

Standards (IFRS). Managers of firms have control over IGNIAs that create resilience during crises in line with stakeholder theory, but the value created is not recognised on the balance sheet, contributing to information asymmetry leading to market mispricing (Barney, 1991; Donaldson & Preston, 1995; Freudenreich et al., 2020; Manikas et al., 2019; Sjödin et al., 2020).

This study will address the following research problem: Given the importance that the finance industry in the UK plays in financial stability, ergo avoiding financial contagion, do finance firms' investment in IGNIAs create resilience? This is especially relevant during crises, to reduce financial contagion. Do they provide stability and enable investors to make correct capital allocation decisions and managers to direct firm resources to create long-term value effectively?

Statement

This study aims to show that the resilience of UK-listed financial firms resulted from their investment in IGNIAs during the COVID-19 crisis, as shown by their relative performance compared to firms that did not invest in IGNIAs at the same rate. It addresses the research problem that investing in IGNIAs creates resilience during crises. This enables the UK finance industry to provide stability during crises, avoid financial contagion and create long-term value for stakeholders.

Objective

The objective of this study is to highlight the importance of UK finance firms' investment in IGNIAs to preserve value during crises, reduce financial contagion and foster firm resilience. This is important for investors to make capital allocation decisions and for management to prioritise intangible assets as part of their value creation strategy to foster resilience in times of crisis. Finally, the study aims to contribute to the limited literature on the finance industry due to their general exclusion from studies conducted on IGNIAs and their impact on resilience (Demers et al., 2021; Duho, 2022; Kasoga, 2020; Uddin et al., 2022).

As part of the literature review, this study will review the theoretical framework of how competitive advantage, together with stakeholder and resource theory, contributes to resilience by proxy of IGNIAs. It will then explore the issues with measuring intangibles

as an important factor for investors and management to be disclosed on financial statements. The study will argue that these can be measured to some degree. The study will then briefly confirm why it is important for the market sentiment that these are disclosed before exploring what it means for a firm to be regarded as resilient. Before concluding the literature review, the study will review the effect of financial crises and close off with the importance of the UK finance industry for this study.

The method to conduct the study will then be provided, followed by the analysis, interpretation, and discussion of the findings before concluding with the study's contribution and recommendations.

LITERATURE REVIEW

Introduction

This literature review will outline the theory that supports the idea of value creation leading to resilience from firm resources other than current capitalised assets. It will then outline the difficulties that companies face in disclosing their IGNIAs due to the inability of current standards to provide accurate measurement criteria. Following this, it will outline the importance that IGNIAs play in resilience and the impact it has on management and investors to capture value and ultimately avoid market mispricing. Thereafter, the study will reflect on the current literature regarding IGNIAs and their effect on firms' resilience. Finally, this study will highlight the impact that financial crises have on the economy and the importance that the finance industry, especially the UK, plays in creating stability.

Theoretical Framework

Companies achieve a competitive advantage when they implement strategies to utilise firm resources that improve efficiency and effectiveness (Barney, 1991). Barney (1991) indicated that creating this value leads to sustained competitive advantage and concluded that companies cannot buy sustained competitive advantage from the market but that these advantages are created by 'firm resources'. It's worth mentioning that Barney (1991 p. 101) included "…all assets, capabilities, organisational processes, firm attributes information, knowledge, etc. controlled by a firm…" to describe the term. Stakeholder theory states that all stakeholders create value (Donaldson & Preston, 1995). Resource theory explains that firm performance,

because of sustained competitive advantage, is a result of firm resources (Donaldson & Preston, 1995).

Resilience can be closely linked with sustained competitive advantage. Barney (1991) proposes that sustained competitive advantage is achieved when current and potential competitors cannot duplicate the advantage created by a company. This advantage only holds value to the extent that it is perceived to generate value by various stakeholders (Barney, 1991). Carvalho et al. (2016) contributes to this and explains competitive advantage when companies resist and manage to compete during uncertain times by implementing innovation. This ability to withstand unexpected changes and adapt to risks through strategy, operations and management through innovation leads to resilience. Carvalho et al. (2016) explains that innovation that leads to resilience is closely linked with performance by proxy of profit or returns generated. Carvalho et al. (2016) found that innovative companies that can competitively adapt to change showed higher performance in terms of return on equity (ROE), return on assets (ROA), and earnings before tax, depreciation, and amortisation (EBITDA).

Stakeholder theory states that all stakeholders create value (Donaldson & Preston, 1995). Donaldson and Preston (1995) state that value results from the interconnectedness of all stakeholder activities and the various outcomes each stakeholder receives because of a company's activities and interactions with stakeholders (Donaldson & Preston, 1995). These stakeholders include customers, communities, employees, suppliers, governments, investors, political groups and trade associations. These players interact with a company regarding resources provided or their influence on the outcomes and potential benefits for themselves and the company (Donaldson & Preston, 1995).

Sjödin et al. (2020) favour the explanation of value in terms of value creation and value capture from the perspective of outcome-based business models. Value creation is achieved by combining companies' expertise and customers' knowledge to deliver 'higher use value'. Value capture is realised by extracting profits from the initial value creation and sharing these between 'participating actors' or stakeholders (Sjödin et al., 2020). Freudenreich et al. (2020) found that conventionally, value creation, from 'The business model perspective', was seen as a symbiotic relationship between a

company and its customers. Value is created for customers in exchange for economic value to a company (Freudenreich et al., 2020).

The performance of a company is closely linked to how it can compete in an uncertain environment and create value for stakeholders. Resilience is the result of being able to generate value by all stakeholders in terms of profits or performance measures, as found by Carvalho et al. (2016). Management and employees also contribute to this value-creation process by generating IGNIAs for companies, as discussed below.

IGNIAs measurement

Various authors find that measuring intangible assets is a controversial topic and that various definitions and measurements have been proposed over the years by multiple bodies, including the International Financial Reporting Standards (IFRS), the International Valuation Standard Committee and other national regulation organisations (Banker et al., 2019; Haji & Ghazali, 2018; Lev & Sougiannis, 1996; Lim et al., 2020; Manikas et al., 2019; Martin, 2019; Nichita, 2019; Peters & Taylor, 2017; Uddin et al., 2022). The biggest issue with intangibles seems to be the ability to measure them accurately, whether this is based on historical cost, which may be an unreliable indicator of current value or fair value, where the asset may be unique, and an active market does not exist (Nichita, 2019). Even though some authors argue that the capital markets work well as they do, not disclosing internally generated intangible assets can lead to hesitation in investor decision-making, increasing the information asymmetry between the company and stakeholders (Nichita, 2019). This highlights the need for management to identify intangibles to motivate expenditure on these to create value. Investors similarly want to identify companies that invest in intangibles which can be an indicator of future value creation.

Haji and Ghazali (2018) found that the main concerns with not disclosing IGNIAs are as follows:

1. These intangibles are significant in value and importance.

2. Omitting these from the balance sheet is misleading to investors.

3. Stakeholders place tremendous value on non-financial information, especially concerning intangibles.

IFRS Foundation (2023) clearly defines how companies recognise and measure intangible assets, referring to IAS 38. Intangible assets should be identified as separable items from the entity that can be sold or transferred and arise from contractual or legal rights. The entity should control these items from which it can derive future financial benefits protected by legal rights and from which the cost can be measured reliably. IAS38 explicitly excludes staff skills, management talent, advertising, expenses related to conducting business in new locations or customers, general overheads and customer relationships or loyalty, arguing that there is insufficient control over expected continuing benefits.

In contrast, some of the aforementioned intangibles are accounted for when companies are acquired. The fair value of these intangible assets is realised in the form of goodwill as they are not identifiable, i.e. ‘not separate’ or do not arise from a contractual right (IFRS Foundation, 2023). This appears contradictory as it enforces the idea that these items should indeed be recognised as assets. These intangibles are expressly excluded as the value cannot be accurately measured until the company is acquired and a fair value is attached. IAS38 notes that internally generated assets are excluded as there are problems distinguishing these assets' maintenance and initial generation. (IFRS Foundation, 2023).

Lev and Sougiannis (1996) advocated for reform in the measurement of intangible assets they notably only used research and development (R&D) to demonstrate a relationship between R&D expenditure and ensuing stock returns. They also concluded that this leads to regular mispricing of shares, confirming their view that investors need to be aware of intangibles that contribute to company value (Lev & Sougiannis, 1996). While this study reflects the long-standing viewpoint that intangibles play an essential role in company value, various studies have subsequently addressed its limitation of only including R&D as found by Uddin et al. (2022). Banker et al. (2019) note that previous papers mainly focus on R&D and advertising expenditure to identify expensed items that contribute to value creation.

Peters and Taylor (2017) found that the US economy has moved toward service and technology-based industries with a higher reliance on intangible assets like human capital, innovative products, brands, customer relationships, distribution systems, etc., and that research has excluded these assets when testing investor theories. These include intellectual capital that can be divided into human, structural and relational capital (Pastor et al., 2017). By making use of the resource theory that suggests that firm performance is a result of firm resources, whether tangible or intangible, Haji and Ghazali (2018) conclude that, firms with intangible assets that are not recorded on the balance sheet have a direct relationship with their performance and that the inclusion of this information as part of the financial results is necessary for investors to make informed decisions.

A solution to the above-mentioned concerns is making use of the income statement to derive a value for intangibles (Haji & Ghazali, 2018). Banker et al. (2019) found that from their sample of 214 115 firm-year observations between 1970 to 2011, an average of approximately 37 percent of a company's assets consists of selling, general, and administrative (SG&A) expenditure compared to only four percent attributable to R&D.

The UK Office for National Statistics (ONS) includes official expenditure measures that are easily identifiable, such as software and R&D (Martin, 2019). The ONS gives a detailed breakdown of how companies can determine the value of their investments in internally generated intangibles: branding (advertising and market research), organisational capital (improvements in efficiency, processes, structure, and culture) and training (firm-specific knowledge creation that leads to higher productivity and wages) (Martin, 2019). Two surveys conducted by the ONS found that companies expect these expenditures to generate returns over a period longer than a year. This enforces that some expenses could be regarded as investments (Martin, 2019).

Various other authors use a similar approach in identifying expense items that generate future returns to determine the value of IGNIAs. Banker et al. (2019) include product promotion, brand development and distribution, channel management, information technology, human capital and customer relationship improvement. Manikas et al. (2019, p. 120) includes "…brand, knowledge, culture, employee

relations, patents and copyrights…". Lim et al. (2020) include three types of identifiable intangible assets:

1. Technology-related intangibles, such as patents, R&D and developed technology.

2. Marketing-related intangibles include but are not limited to trademarks and customer-related assets.

3. All other identifiable intangibles, such as mineral rights, coal supply agreements, and leasehold interest. Unidentifiable intangible assets only arose due to an acquisition in the form of goodwill (Lim et al., 2020).

This view is supported by Uddin et al. (2022), which include R&D and selling, general, and administrative (SG&A) expenditure, denoted as knowledge capital (KC) and organisational capital (OC), respectively.

The literature above highlights the importance that IGNIA's play in creating resilience. However, it also underlines the limited recognition of IGNIA's under IAS 38 and inconsistent definitions by authors. While authors recognise the value IGNIAs hold for investors and contributes to firm performance their value in fostering resilience is not clear yet and will be discussed later in the literature review. This study aims to address this gap by using a broader valuation approach by using KC and OC linking IGNIAs to long-term performance and resilience.

EVA™, Balanced scorecard and Value-added intellectual coefficient

Various other interpretations of IGNIAs have been evaluated, including Economic Value Added (EVA™), the balanced scorecard (BSC), and the Value-Added Intellectual Coefficient (VAIC) (Pulic, 2004). They were found not to be suitable due to various criticisms by Pulic (2004) , Ståhle et al. (2011) and Marzo (2022) as discussed below.

Pulic (2004) recognises the role knowledge and intellectual capital play in creating value for companies. Pointing out that employees should be treated as key resources equal to financial and tangible assets. Pulic (2004) acknowledges that EVA™ can be used to measure efficient resource usage. However, it only focuses on capital

employed as the main resource. Similarly, the balanced scorecard (BSC) has also been used but criticised by Pulic (2004) as a strategy describing technique rather than a measuring system. The main issue with using EVA^{TM} and BSC is their limitations in applying them to various companies for comparability and scope. The methods are useful for internal management but contain various non-transparent indicators unavailable on a macro level (Pulic, 2004). Pulic (2004) developed the value added intellectual coefficient (VAIC) in response.

VAIC can be described as a measure of intellectual capital efficiency (Marzo, 2022). VAIC is derived from three types of capital: human, structural and physical, and financial capital. Each of these capitals is expressed as a ratio through the combination of the value added-and summed together to derive a company's VAIC (Marzo, 2022). An increase in a company's VAIC points to improved efficiency of a firm's resources and, therefore, the ability of the company to create new value. The VAIC model is widely used as it is based on publicly available financial information (Marzo, 2022).

El-Bannany (2008) conducted a study from 1995 to 2005 on UK banks' capital performance and intellectual capital, also using VAIC. El-Bannany (2008) concluded that investments in intellectual capital and the coefficients on bank profitability were statistically significant. Zéghal and Maaloul (2010) conducted a study of 300 UK-listed companies and found a significant positive correlation between the companies' VAIC and financial performance including all industries listed at the time. Even though both these studies were conducted in the UK, neither looked at the significance of intangibles in the light of resilience during crises.

Ståhle et al. (2011) found a weak correlation between VAIC and company performance arguing that VAIC is an efficiency measure of a company's labour and capital investment rather than giving an accurate representation of a company's intellectual capital (Ståhle et al., 2011). Marzo (2022) also found that various studies have detected theoretical inconsistencies and, more pertinent, unexpected results between VAIC and company performance. Marzo (2022) concludes in his comprehensive theoretical analysis that using VAIC as a measure to regress it against profitability measures leads to ambiguous and inconsistent results. VAIC is found to be

theoretically inconsistent and unsuitable as a measure of a company's intellectual capital (Marzo, 2022).

The literature discussed above highlights the significance of IGNIAs in creating resilience for firms. However, there seems to be a gap in a consistent practical approach to measure them and provide accurate information about a firm's potential for resilience. Studies that have relied solely on R&D or SG&A expenses or models like VAIC face theoretical and practical limitations. In light of the criticism above, this study will use a similar approach to determine the value of IGNIAs that was followed by Peters & Taylor (2017) and Uddin et al. (2022). This study makes use of KC derived from R&D expenditure and OC derived from SG&A expenditure. By combining R&D and SG&A expenses and applying a depreciation rate they study aims to more accurately assess the value and impact of IGNIAs.

IGNIAs role in creating value

Investment in intangibles contains predictive information on companies' ability to generate cash and profits and withstand market fluctuations. This is an important sign for investor sentiments to buy or hold these shares, especially during times of crisis (Uddin et al., 2022). Various studies point out that managers play an essential role in a company's value-creation process for any of the stakeholders (Barney, 1991; Donaldson & Preston, 1995; Freudenreich et al., 2020; Manikas et al., 2019; Sjödin et al., 2020), as managers control firm resources, optimise processes, and create firm knowledge (Uddin et al., 2022).

Banker et al. (2019) found that investment portfolios with high selling, general and administrative (SG&A) expenditure in a long position and low SG&A expenditure in a short position generate annualised excess returns of 7.27 percent. Eisfelt et al. (2020) found the same relationship using data from 1975 to 2018 across 12 industries. These excess returns result from market mispricing rather than risk explanations, as this excess value does not persist over time but reverses in subsequent years in line with mispricing explanations supported by findings from Eisfeldt et al. (2020). Even though financial analysts recognise the value created by SG&A, they fail to fully recognise it, leading to "…under forecasting of future earnings and positive forecast errors." (Banker et al., 2019 p. 63).

Pástor et al. (2020) found that stakeholder-centric firms, those that did not reduce employee costs and protected stakeholder relationships, experienced lower stock price declines following the pandemic. They were seen as valuing long-term relationships more than short-term shareholder maximisation (Pástor et al., 2020). Delayed share price reactions during the crises where investors failed to capture excess returns were found, concluding that the efficient market hypothesis did not hold in the months directly after the pandemic ensued (Pástor et al., 2020). This highlights the importance of stakeholder theory in creating value, where value is created by various firm resources, which can include processes, knowledge, capabilities, and assets.

Uddin et al. (2022) attribute the creation of these intangibles to management's ability to generate high returns from the resources under their control. Studies have found a positive correlation between company value and management ability that translates into innovation through culture, efficient processes and systems that guide companies' actions (Uddin et al., 2022). Investor sentiment, customer loyalty and managerial ability are important factors in creating firm value through various forms of intangible assets to ensure stability and resilience during market shocks (Uddin et al., 2022).

Resilience

Carvalho et al. (2016) explains resilience as the ability to withstand unexpected changes and adapt to risks in the environment within which it operates. Similarly, Abiwodo et al. (2023), found that the banking sector can be regarded as resilient if it can absorb shocks without reliance on government support. Secondly, it can continue to sustainably provide economic functions as an intermediary institution by collecting funds from and providing credit to the market. Concluding resilience is a measure of the sector's capacity to absorb and recover from crises (Abiwodo et al. 2023).

Didier et al. (2021) found that the market recovered relatively quickly after COVID-19 due to effective policies in the US, with most industries recovering two-thirds of their value within six months of the initial pandemic. Europe and the UK had similar policies to reduce the economic effect of the crises (Didier et al., 2021). Didier et al. (2021) highlight the importance of knowledge within the firm, workers' skills, processes and brand play in creating value for them that can be considered intangible assets. Preserving these assets during crises can help firms recover quicker and avoid costly

exercises of recruitment and training, staving off long-term value erosion (Didier et al., 2021). Mithani et al. (2021) found resilience in a firm is a long-term incremental commitment that is not necessarily dependent on available company resources. Resilience develops because of a robust sensitivity to threats, and companies that experience more significant threats more often become less vulnerable to failure (Mithani et al., 2021). Altomonte et al. (2022) found that continuous investment in intangible assets is associated with firm resilience

Demers et al. (2021) also found that investments in intangible assets provided resilience during the pandemic. Uddin et al. (2022) found that both internally generated and externally acquired intangibles consistently contribute to resilience, with a positive correlation to value during pandemic shocks over a long period, covering multiple pandemics. Uddin et al. (2022) point out that studies have found intangible assets to make up to 85 percent of a company's total value, including brand, human capital and intellectual property. Furthermore, companies invest at a higher rate in intangibles during crises (Nemlioglu & Mallick, 2020; Uddin et al., 2022; Venieris et al., 2015). Investing in intangibles makes firms more robust when experiencing external shocks that affect firms unfavourably. Firms can create resilience and withstand crises better because they are able to make use of reserve intangibles during crises. Managers in these firms are more optimistic of future sales growth and continue to invest in intangibles whereas other firms reduce expenses in response to lower sales in crises (Nemlioglu & Mallick, 2020; Venieris et al., 2015).

Duho (2022) found that intangible assets positively affect firm performance, measured by the ROA ratio, albeit this relationship was found to be insignificant for non-finance firms. Several other studies found that intangible assets have a significantly positive impact on financial services companies' financial performance (Alipour, 2012; Kasoga, 2020; Lu et al., 2014; Ousama et al., 2019; Soewarno & Tjahjadi, 2020). While these studies used various performance measures, ROA is the most widely used measure.

Carvalho et al. (2016) found that resilience can be measured by companies' performance, including ROE and ROA. Higher performance in terms of ROE and ROA is the result of resilient companies as they can adapt to the changing environment in which they operate. The importance of intangibles was further supported by Nawaz

and Ohlrogge (2023), who found that human capital efficiency, more so than capital employed or structural capital, drives the performance of Deutsche Bank, especially during economic crises. Their study focussed on the relationship of intellectual capital and financial performance of Deutsche Bank from 1957-2019. Nawaz and Ohlrogge (2023) used return on assets (ROA) and return on equity (ROE) to measure performance.

The above findings highlight the importance of managers investing in suitable, unique intangibles. This creates a competitive advantage and the potential to protect shareholder interest in times of crisis by creating resilient companies. This study, in line with the above literature, will also use ROE and ROA as a measure of the resilience of UK finance firms.

The finance industry's role in containing financial contagion in crises

The COVID-19 crisis disrupted economies worldwide, leading to many bankruptcies (Didier et al., 2021). Indices worldwide recorded record plunges following the declaration of the COVID-19 pandemic (Didier et al., 2021). The Dow Jones Industrial Average dropped by 3%, the Standard and Poor's (S&P) 500 by 29%, and the Financial Times Stock Exchange (FTSE) 100 experienced a drop of 24.80%, see figure 1 (Akhtaruzzaman et al., 2021).

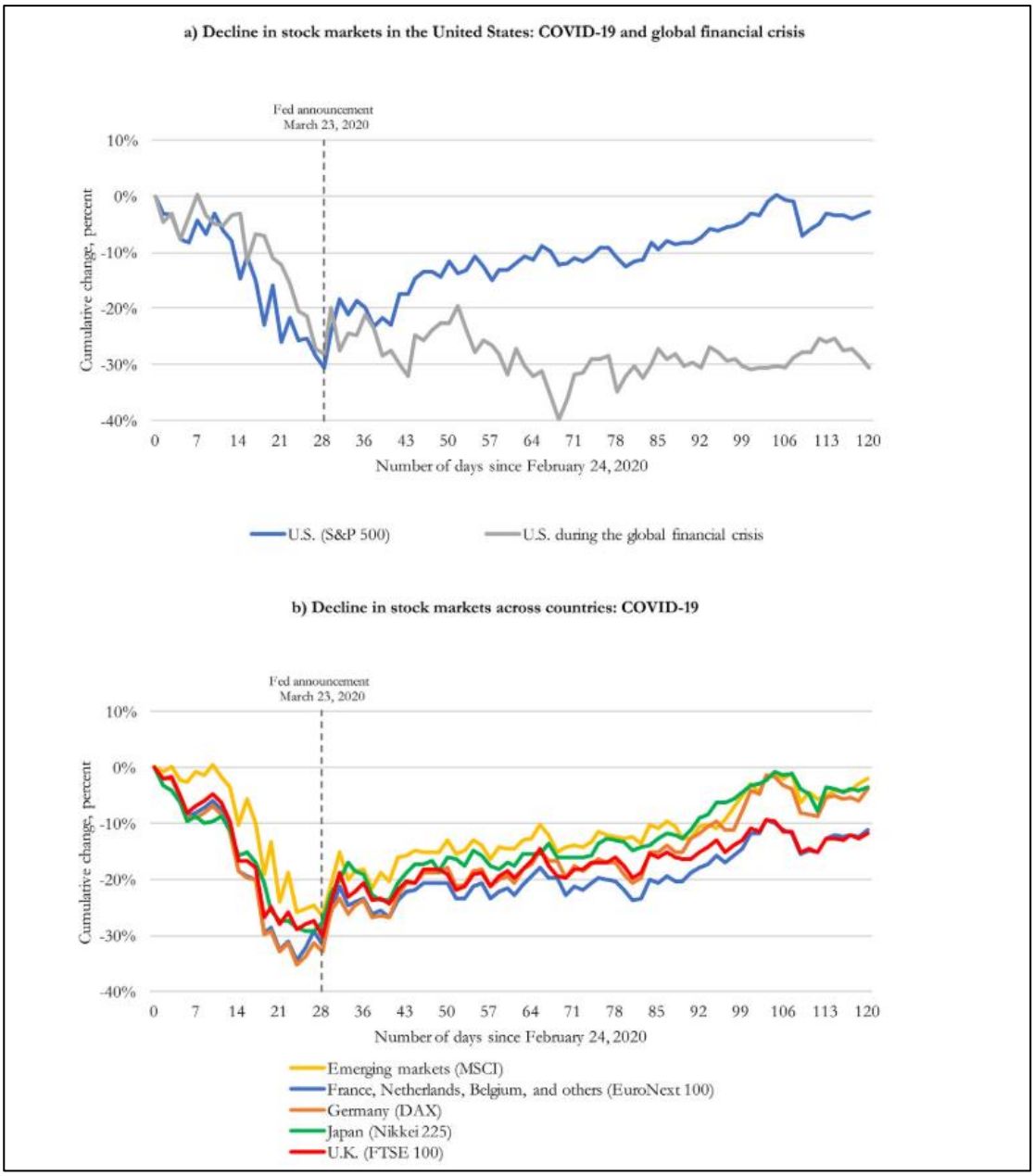

Figure 1: The impact of the COVID-19 pandemic on financial markets.
Source: *(Akhtaruzzaman et al., 2021)*

Financial crises are more adverse than typical normal recessions, leading to stagnant wages, unemployment, low investments and social damage, polarising political sentiments and erosion of trust in institutions, to name a few (Sufi & Taylor, 2022)

In short, the COVID-19 pandemic had a major effect on financial markets globally (Akhtaruzzaman et al., 2021). In typical financial crises, the problem lies with financial institutions that need to be resolved (Didier et al., 2021). Policymakers aim to ring-fence the financial firms in distress and liquidate them to avoid other finance firms being

affected. Policymakers do this as the remaining financial firms provide a lifeline to other industries to borrow during crises (Didier et al., 2021). Liquidating financing firms during the COVID-19 pandemic based on previous crises, would only have exacerbated the problem by creating spillovers or contagion in other industries relying on financial providers for finance (Didier et al., 2021).

The World Bank broadly defines financial contagion as the transmission of shocks across countries (Akhtaruzzaman & Shamsuddin, 2016). More specifically, contagion can also happen beyond the scope of common shocks and fundamental economic linkages. A more restrictive definition is, contagion ensues when cross-country correlations increase during times of crisis compared with non-crises periods (Akhtaruzzaman & Shamsuddin, 2016).

Akhtaruzzaman et al. (2021) used dynamic conditions correlations (DCCs), which found that the financial contagion between Chinese and G7 stock returns is much higher for financial firms than non-financial firms. In addition, UK finance firms were found to be the most contagious during the COVID-19 crisis period (see figure 2 below). As seen in figure 2, panel B, for non-finance firms, the UK had a difference in DCC from before COVID-19 to after of 0.064 which was almost three times that of the world of 0.025. Although Germany's difference in DCC from before to after COVID-19 was found to be higher at 0.077, the UK's mean DCC was still higher at 0.26 compared to Germany's 0.24. The effect was more pronounced for finance firms as per figure 2, panel A. The world's DCC difference is 0.025 between non finance firms and 0.077 between finance firms. In addition, the UK had a difference in DCC from before COVID-19 to after of 0.11 compared to 0.077 for the world and 0.079 for France the second highest.

Table 2
DCCs between China and G7 countries and the World.

Panel A: Between financial firms

	Canada	France	Germany	Italy	Japan	UK	US	World
Pre-COVID19 Mean DCC	0.1420	0.1512	0.1502	0.1146	0.1951	0.1956	0.0758	0.2686
COVID19 Period Mean DCC	0.2134	0.2309	0.1988	0.1476	0.2719	0.3066	0.0939	0.3459
Difference in DCC^	0.0714	0.0797	0.0486	0.0330	0.0768	0.1110	0.0181	0.0773
t–stat difference	–30.25***	–49.12***	–31.80***	–24.98***	–60.60***	–80.00***	–6.55***	–32.93**
Diagnostic Tests:								
Tse (2000) test	2.26**	2.27**	2.66***	2.87***	2.99***	4.60***	5.02***	3.12***
Hosking (1980) test	40.42	34.98	47.78	40.59	40.03	44.60	35.96	43.20
Li and McLeod (1981) test	40.43	34.97	47.73	40.57	40.04	44.58	35.97	43.19

Panel B: Between nonfinancial firms

	Canada	France	Germany	Italy	Japan	UK	US	World
Pre-COVID19 Mean DCC	0.1480	0.1589	0.1713	0.1576	0.1812	0.1959	0.1199	0.2253
COVID19 Period Mean DCC	0.1737	0.1783	0.2489	0.1532	0.2314	0.2602	0.1506	0.2511
Difference in DCC^	0.0257	0.0194	0.0776	–0.0044	0.0502	0.0643	0.0307	0.0258
t–stat difference	–8.61***	–3.81***	–14.80**	0.88	–19.77***	–24.64***	–11.42***	–5.12***
Diagnostic Tests:								
Tse (2000) test	3.58***	5.33***	5.50***	6.47***	5.62***	5.59***	3.75***	4.45***
Hosking (1980) test	45.65	19.35	34.25	34.34	30.09	23.88	50.01	43.57
Li and McLeod (1981) test	46.30	21.39	34.11	35.21	31.61	25.56	49.64	43.43

^ Difference is calculated from COVID19 mean minus pre-COVID19 mean.

Notes:

1. Tse (2000) tests the null hypothesis of constant correlation: H_0: $\delta_{ij} = 0$ for the equation: $\rho_{ij,t} = \rho_{ij} + \delta_{ij}\varepsilon_{i,t-1}\varepsilon_{j,t-1}$, where $\varepsilon_{i,t-1}$ and $\varepsilon_{j,t-1}$ are the standard residuals in Chinese (i), G7 and World (j) financial stock returns, respectively from the best fit GARCH (1,1) process.
2. Hosking (1980) test checks the null hypothesis of no serial correlation.
3. Li and McLeod (1981) test checks the null hypothesis of no misspecification in the model.
4. t-test for the difference in mean DCC is conducted.

*, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively.

1. *The UK has the highest DCC (contagion) of all G7 countries*
2. *Finance firm's contagion is higher than non-financial firms, especially UK*

Figure 2: Contagion of markets during the COVID-19 crises
Source: *(Akhtaruzzaman et al., 2021)*

Governments have limited resources to assist during crises, and they cannot assist everyone over undetermined periods of time (Didier et al., 2021). In additional large pay-outs by governments during crises can increase debt to Gross Domestic Product (GDP) ratios. This public debt can lead to new financial crises as high levels of debt can increase cost of borrowing as well (Didier et al., 2021). Akhtaruzzaman et al. (2021) concluded that financial firms play a more significant role in financial contagion during economic crises. During crises, banks reduce their risk-taking, leading to slower growth of markets across the globe due to reduced financing. Banks reduce risk taking as volatile markets during crises makes hedging more expensive and currency mismatches are more prevalent in portfolios, increasing credit risk (Akhtaruzzaman et al., 2021).

UK finance industry

As noted above financial contagion is most pronounced for UK finance firms. Economic crises like the one caused by the COVID-19 pandemic can spread financial contagion, where financial shocks are transmitted across countries (Akhtaruzzaman & Shamsuddin, 2016). It is usually up to the finance industry to provide stability and a lifeline to companies. The finance firms provide credit to firms during crises to assist until the economy recovers (Didier et al., 2021). The UK is regarded as the global financial hub, so ensuring these entities are resilient is of global interest (Bush et al., 2014). Implicit subsidies, where market participants expect public authorities to provide bailouts have continued to exist, even though there is no explicit commitment for them to do so. They exist for these institutions that are regarded as too important to be allowed to fail (Schich, 2018). However, they create economic costs and may only provide benefits in the short term. In addition, these implicit subsidies encourage increased risk taking by banks.

The UK banking system experienced tremendous growth between 1975 and 2013, where the system's total assets dwarfed the nominal GDP of the UK, growing from 100% of GDP in 1975 to 450% of GDP in 2013 (Bush et al., 2014). Bush et al. (2014) estimate that it will double in size by 2050 to 950 percent of the GDP, although this was before Brexit. With the UK banking system being very internationalised, London is considered the global financial hub, hosting a significant presence of foreign banks (Muzzupappa, 2024).

Bush et al. (2014) found that the ability of these banks to be more efficient creates a comparative advantage compared to other countries, which is one of the factors that led to the size of the UK banking system. The UK banking system is seen as one of the most profitable, with a primary focus on profit generation and a tendency for high risk-taking (Muzzupappa, 2024). The sentiment of 'too big to fail' (TBTF) because of implicit subsidies is also identified by Bush et al. (2014) to explain the UK banking system size. Bush et al. (2014) concluded that less resilient banks are more likely to suffer, by having to endure increased output and fiscal costs, after a financial crisis. While these implicit subsidies, ergo guarantees, may benefit stakeholders in the short term, they weaken market discipline, leading to increased bank leverage and risk-

taking, increasing the economic cost for taxpayers by creating contingent liabilities and affecting income distribution (Schich, 2018).

As a result, policymakers want to pursue reforms to improve resilience and remove or at least limit implicit subsidies (Bush et al., 2014; Schich, 2018). Ensuring financial sector companies survive the pandemic is essential for post-crisis recovery, as these firms play a pivotal role in enabling other sectors to recover (Didier et al., 2021).

Summary of expectations from literature

As seen from resource- and stakeholder-theory, firms are able to create sustained competitive advantage from firm resources. In addition, companies that manage to compete during uncertain times do so by innovation that leads to increased performance as measured by ROA. These firms are regarded as resilient (Carvalho et al., 2016). IGNIAs which are not capitalised due to measurement issues have been found to provide resilience, in addition, they can be measured by using the income statement (Uddin et al., 2022). It is important that these IGNIAs are disclosed as they provide predictive information to stakeholders. Moreover, management needs to be aware of the role IGNIAs play in providing resilience (Barney, 1991; Donaldson & Preston, 1995; Freudenreich et al., 2020; Manikas et al., 2019; Sjödin et al., 2020).

By prioritising IGNIAs, firms can recover quicker without relying on external support (Abiwodo et al., 2023). However, this investment in IGNIAs should be prioritised continually to provide suitable resilience and especially during crises (Altomonte et al., 2022; Mithani et al., 2021; Nemlioglu & Mallick, 2020; Venieris et al., 2015). Resilience should be a priority for finance firms as they provide support to the rest of the market during crises. With UK finance firms being the most contagious during crises it is imperative that they are resilient (Akhtaruzzaman et al., 2021).

METHODOLOGY

Introduction

This study will use a deductive approach where existing theory is used to test the rationality by making use of the hypothesis from the theory discussed above (Bell et al., 2022). The study develops its hypothesis from the theory discussed, observe the results from the data and consider if the hypothesis based on the theory was sound (Bell et al., 2022). This study will make use of quantitative methods, by using firm specific variables to test the study's hypothesis developed from existing theories (Bell et al., 2022). A longitudinal, or time series, design will be employed by collecting data over different periods and analysing changes over time. In addition, the study uses cross-sectional data from various firms in the finance industry, explained in the research design section. Furthermore, the study will use secondary data solely obtained from the Bloomberg Terminals located in the University of Cape Town's library.

This study is concerned with business research and therefore, consideration has been given to reliability, replication and validity as the most important criteria identified by Bell et al. (2022). The data for this study uses historical secondary market data collected from Bloomberg, a reliable source, ensuring that the study can be replicated. This study can be regarded as reliable as the results represented herein can be repeated to generate similar results (Bell et al., 2022).

This study will also follow similar research done by Peters and Taylor (2017) and Uddin et al. (2022) to demonstrate replicability. By using an existing study, the validity of variables have been established. Validity aims to ensure that the variables and data points used to measure what it was intended to measure (Bell et al., 2022).

This study has considered ethical issues that could arise from the research. Since the data used in this study is publicly available, this is not regarded as a concern. There are no conflicts of interest or associations with the data used in this study, and therefore, there is no risk of bias. The study's research aims to determine if investment

IGNIAs for UK-listed finance firms have contributed to their resilience during the COVID-19 crisis.

Hypothesis

H_0: IGNIAS for UK finance firms are not significant in explaining the resilience measured by ROA of financial firms (2016-2023).

H_1: IGNIAS for UK finance firms are significant in explaining the resilience measured by ROA of financial firms (2016-2023).

H_2: UK finance firms with higher investment in IGNIAs, portfolio H did not result in an improved resilience measured by ROA after the COVID-19 crisis, having no explanatory power on resilience as a result (2020-2023).

H_3: UK finance firms with higher investment in IGNIAs, portfolio H, resulted in an improved resilience measured by ROA after the COVID-19 crisis, making them more resilient as a result (2020-2023).

Pástor et al. (2020), defines the start of the COVID-19 crisis as February 20, 2020, as the market peaked on February 19, 2020, before experiencing a significant decline. For H_0 and H_1, the four years before the crises, 2016-2019 will be used. For H_2 and H_3, the four years since the crises started, 2020-2023 will be used.

Data Collection

This study used a quantitative research design and obtained data from the Bloomberg terminal specifically for the finance industry listed on the London Stock Exchange (LSE) from 2016 to 2023. At the time of writing this was classified on the Bloomberg Industry Classification System (BICS) with sector code 52 and Industry group code 5210. At the writing date, the initial sample will consist of 366 listed entities. After excluding 109 firms with missing data the final sample consist of 257 firms. Refer to Table 3 included in the research design for a breakdown of the firm types. This included asset management, speciality finance, insurance, institutional finance services and banking firms. Bloomberg provided the financial results of entities in this industry to quantify the variables. It also included market information such as market capitalisation and other control variables to conduct the study.

Research Design

This dataset above will enable the examination of expenditure on internally generated intangible assets and firm resilience measured by proxy of ROA, comparing UK LSE finance firms' resilience before the COVID-19 crisis and their recovery thereafter. This follows similar research designs done by Peters and Taylor (2017) and Uddin et al. (2022). Investment in IGNIAs is measured as the total value of calculated IGNIAs as a factor of the firms Total Assets (TA) plus total IGNIAs.

The dissertation will determine the relationship between firm performance and investment in IGNIAs during a period of no crises (H_0 and H_1) for all sampled firms. If H_1, where IGNIAS are significant in explaining the resilience measured by ROA of financial firms are confirmed, H_2 and H_3 will be tested. To test H_2 and H_3, the sampled firms will be split into three portfolios, bottom (B), middle (M), and high (H), for investment in IGNIAs for the years before COVID-19 of 2016-2019. A regression was used on the portfolios, B, M and H portfolios for 2016-2019 which will address H_1 or H_0 for the H portfolio only. Which will serve as the control variable to test H_2 and H_3.

The results will be used to determine if finance firms with higher investment in IGNIAs, portfolio H, resulted in an improved resilience measured by ROA after the COVID-19 crisis, 2020- 2023 compared to the period before COVID-19, 2016-2019 to address H_2 or H_3.

Intangible assets are defined following Peters and Taylor (2017) and Uddin et al. (2022) as set out below. Firm resilience will be measured by its operational performance by proxy from ROA (Carvalho et al., 2016; Uddin et al., 2022) as set out below.

Intangible assets

The replacement cost of a firm's IGNIAs is defined as the sum of knowledge capital (KC) and organisational capital (*OC*). Knowledge capital is measured as the accumulated past R&D expenditures per Peters and Taylor (2017), employing the perpetual inventory method as follows;

$$KC_{i,t} = (1- \delta_{KC})KC_{i,t-1} + (R\&D_{i,t} * \theta_0) \quad (1)$$

Where $KC_{i,t}$ denotes firm-level stock of knowledge capital at time t, δ_{KC} is the depreciation rate of KC, $R\&D_{it}$ represents the firm's R&D expense at time t, and θ_0 denotes the portion of R&D expenses that are invested in KC. It is assumed that 100% of R&D is invested in KC as per Peters and Taylor (2017). The depreciation rate used is 15% following Peters and Taylor (2017).

OC includes promotions and advertising expenses, expenditures for distribution systems, employee training and workshops and payments to key talents following Uddin et al. (2022). OC is estimated by accumulating past selling, general and administrative (SG&A) expenditures employing the perpetual inventory method as follows:

$$OC_{it} = (1- \delta_{OC})OC_{i,t-1} + (SG\&A_{i,t} * \varphi_0) \quad (2)$$

Where OC_{it} represents the firm-level stock of organisational capital at time t, δ_{OC} is the depreciation rate of OC, $SG\&A_{it}$ denotes the firm's SG&A expenditure at time t and φ_0 denotes the portion of SG&A invested in OC is assumed to be 30% and a depreciation rate of 20% was applied in line with Peters and Taylor (2017). The intensity of intangibles is measured as a scale of classified intangible assets by the firm's total assets. This is denoted by INTTA where:

$$INTTA_{it} = INT_{it} / (INT_{it} + TA_{it}) \quad (3)$$

Where,

$$INT_{it} = KC_{it} + OC_{it} \quad (4)$$

and TA_{it} is the value of total assets of the firm at time t, collected from Bloomberg data.

This model assumes that all firms have disclosed and recognise R&D and SG&A expenses on their financial results. This model is therefore limited by firms that do disclose these figures as found in the number of observations made in the descriptive statistics and regression results.

Firm Resilience

Firm resilience will be measured by its operational performance by proxy from ROA (Box et al., 2018; Carvalho et al., 2016; Uddin et al., 2022). A set of risk factors and controls, including leverage and TA per prior literature to account for size and liquidity are included in the regression (Chuan 'Chewie' Ang et al., 2019; Ding et al., 2021; Duho, 2022; Fahlenbrach et al., 2021; Fama & French, 1993, 2012). Firm size is measured by TA where higher TA is associated with larger firms (Duho, 2022). Firms with higher leverage will experience lower performance per the pecking order theory. While the trade-off theory suggests a positive relationship between leverage and performance (Duho, 2022). Controls for firm fundamentals affecting operating performance, Earnings Before Interest, Tax, Depreciation and Amortisation (EBITDA) and cash of firms will be included per prior literature (Box et al., 2018; Yang & Zhao, 2014).

Sample selection

Total number of companies	366
Less:	
Companies with no average total assets for initial period of 2016-2019	109
Total number of firms in final sample:	257

Firms with no assets that were excluded from the sample can be attributed to either listing during the sampled period of 2016-2023 or not disclosing this information correctly to be captured on Bloomberg.

Portfolio classification

This study used the 33rd percentile method to classify the sampled firms into the three portfolios used to test the hypotheses; bottom (B), middle (M), and high (H). The method first calculates the firms' average investment in INTTA across the entire period of 2016 -2023. Portfolios were only calculated for the final sample of 257 firms that disclosed values for total assets. The average INTTA of each firm is then compared to the values of the 33rd and 66th percentiles to determine their portfolio classification. B

portfolio includes firms that had average INTTA ≤ the 33rd percentile of 0. M portfolio includes firms with an average INTTA of > the 33rd percentile of 0 and ≤ the 66th percentile of 0.0627. Where the 66th percentile of 0.0627 represents firms that had an average INTTA greater than 0.0627 over the entire period of 2016-2023. Finally, H portfolio included firms with an average INTTA > the 66th percentile of 0.0627. This method was chosen as the data was not normally distributed and its robust nature to handle skewed data(Davydov et al., 2021; Ialongo, 2019). Even though the data was skewed it provides a meaningful segmentation for this study in three portfolios to identify three separate portfolios.

The portfolio breakdown for the 257 firms contained in the sample per the sample selection are reflected below.

Table 1: Portfolios breakdown

	Average INTTA
Percentile 66	0.06277
Percentile 33	0.00000

Portfolio	**n firms**	**%**
B	109	42%
M	63	25%
H	85	33%
	257	**100%**

The table above displays the average INTTA for the 33rd and 66th percentile to determine the portfolio classification as B, M or H. It also reflects the spread of firms from the sample in each portfolio. The majority of the portfolios fall within the B category, followed by H and then M. Source: Compiled by author.

Variables

The dependent variable is resilience measured by firm performance as ROA. The independent variable is the replacement cost of a firm's IGNIAs is defined as the sum of (KC) and (OC) divided by the total assets plus IGNIAs as INTTA. Control variables for firm-specific characteristics are included per prior studies. These are TA as a control for size. Earnings before interest, tax, depreciation and amortisation are used as a control variable for profit since the finance industry does not disclose a gross margin.

Finally, Leverage (LEV) is used for debt, and Cash (CASH) is used for liquidity, as provided by Bloomberg. CASH is scaled by total assets to facilitate meaningful comparison between firms (Box et al., 2018).

Table 2: List of Variables

Variable	**Definition**
Dependent Variables	
ROA	Annual return % on asset values as provided by Bloomberg
Independent Variables	
$INTTA_{it}$	Intensity of investment in intangible assets as an expression of total assets, which includes intangibles and total assets as provided by Bloomberg.
Portfolio	Portfolio type denoted as bottom (B), middle (M), and high (H) based on the portfolio classification
Control Variables	
LEV	Annual Leverage by Bloomberg
CASHTA	Annual Cash divided by TA provided by Bloomberg
TA	Annual Total Assets Value provided by Bloomberg
EBITDA	Annual Earnings Before Interest, Tax, Depreciation and Amortisation provided by Bloomberg

Source: Compiled by author.

Regression formula

The initial regression was formulated per below. However, after testing, the model was updated as discussed in the results sections;

$$ROA_{i,t} = \alpha + ß_{1\ INTTA} + ß_{2\ TA} + ß_{3\ EBITDA} + ß_{4\ LEV} + ß_{5\ CASHTA} \quad (5)$$

ANALYSIS, INTERPRETATION AND DISCUSSION OF RESULTS

Introduction

This section of the study will present the analysis, interpretation and discussion of the results. Initially, the descriptive statistics will be presented. Thereafter, preliminary testing results will be discussed. The purpose of the preliminary testing is to ensure that accurate assumptions can be made from the regression model and that an appropriate regression model is chosen. Finally, this section will conclude with an analysis of the regression results.

Descriptive Statistics and sample

Table 3 below contains a breakdown of the sampled firms. This reflects the Bloomberg Industry Classification System (BICS) industry groupings for financial firms which includes Banking, Financial Services and Insurance firms. Financial services constitute 225 of the 257 sampled firms, while banking and insurance are only represented by 14 and 18 firms, respectively.

Sample breakdown per industry

Table 3 below reflects the finance industry-specific categories per the Bloomberg Industry Classification System (BICS). This groups firms into economic activities (level 1), industry groups (level 2), specific industries (level 3) and specific sub-industries (level 4). All the firms sampled are part of the “Financials” industry level 1 per Bloomberg:

Table 3: Sample breakdown per industry

Industry L2	Industry L3	Industry L4	Total
Banking	Banking	Banks	10
		Diversified Banks	4
Banking Total			**14**
Financial Services	Asset Management	Investment Companies	77
		Investment Management	45
		Private Equity	21
		Wealth Management	13
	Asset Management Total		**156**
	Institutional Financial Services	Institutional Brokerage	15
		Intuitional Trust, Fiduciary and Custody	1
		Security and Commodity Exchanges	3
	Institutional Financial Services Total		**19**
	Specialty Finance	Commercial Finance	12
		Consumer Finance	7
		Mortgage Finance	5
		Other Financial Services	26
	Specialty Finance Total		**50**
Financial Services Total			**225**
Insurance	Insurance	Insurance Brokers and Services	1
		Life Insurance	8
		Property and Casualty Insurance	8
		Reinsurance	1
Insurance Total			**18**
Grand Total			**257**

Source: Compiled by author.

The descriptive statistics are contained in Table 4 below. The descriptive statistics include the abovementioned variables for the entire dataset from 2016 – 2023, the four years before COVID-19 from 2016-2019, and the four years after from 2020-2023. One would expect a total number of 2,056 observations for 257 firms over eight years. However, not all firms disclosed all variables listed in Table 2 for each observed period, either because the numbers were not disclosed or the entity did not trade for the full sampled period. The descriptive statistics and regression results reflect the number of firms that could be observed for each sample, considering the aforementioned limitation. A total of 698 observations were observed for all variables in Table 4 below.

Additional descriptive statistics as set out in Table 5 and 6 are also briefly discussed. Table 5 includes industry-specific analysis per BICS level 2 for the entire period 2016-

2023, pre COVID-19, 2016-2019 and post COVID-19, 2020-2023. However, these are only in relation to the financial services and insurance industries based on the number of observations for which meaningful descriptive statistics could be calculated. The results remain in line with the complete statistics due to the sample being largely made up of the financial services industry.

Table 6 sets out the descriptive statistics per portfolio breakdown for B, M and H portfolio firms. This includes descriptive statistics for the entire period 2016-2023, pre COVID-19, 2016-2019 and post COVID-19, 2020-2023 for H and M portfolios. B portfolios only include descriptive statistics for the entire period 2016-2023, and post COVID-19, 2020-2023 for which meaningful statistics could be derived.

Descriptive Statistics

Table 4: Descriptive statistics entire sample

Descriptive statistics 2016 -2023						
	ROA	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.77	0.17	-3,400.53	0.21	4.14	1,212.77
Median	0.00	0.11	23.08	0.15	1.58	95.05
Maximum	187.15	0.86	123,894.40	0.98	139.23	52,065.00
Minimum	-8.15	0.00	-1,820,079.00	0.00	0.69	0.10
Std. Dev.	8.41	0.17	72,252.40	0.21	12.58	3,852.82
Skewness	18.08	1.17	-23.48	1.32	8.57	6.69
Observations	698	698	698	698	698	698
Descriptive statistics 2016 -2019						
	ROA	INTTA	EBITDA	CASHTA	LEV	TA
Mean	1.11	0.18	-2,077.99	0.22	3.78	1,353.68
Median	0.00	0.14	22.13	0.14	1.50	82.00
Maximum	187.15	0.86	927.86	0.95	139.23	52,065.00
Minimum	-6.86	0.00	-563,176.20	0.00	0.69	0.10
Std. Dev.	11.38	0.17	32,775.03	0.21	13.21	4,870.88
Skewness	15.06	0.96	-17.04	1.19	9.23	6.58
Observations	296	296	296	296	296	296
Descriptive statistics 2020 -2023						
	ROA	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.53	0.17	-4,374.34	0.21	4.42	1,109.01
Median	0.00	0.10	23.81	0.15	1.64	108.32
Maximum	96.47	0.85	123,894.40	0.98	136.93	23,287.28
Minimum	-8.15	0.00	-1,820,079.00	0.00	1.00	0.10
Std. Dev.	5.26	0.18	91,002.13	0.20	12.11	2,884.83
Skewness	16.11	1.32	-19.83	1.43	7.92	4.25
Observations	402	402	402	402	402	402

Source: Compiled by author.

Descriptive statistics industry-specific

Table 5: Descriptive statistics industry specific

Financial Services 2016 - 2023						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.64	0.17	- 3,440.47	0.21	4.16	1,199.28
Median	0.00	0.11	22.63	0.15	1.57	91.91
Maximum	187.15	0.86	123,894.40	0.98	139.23	52,065.00
Minimum	- 8.15	0.00	-1,820,079.00	0.00	0.69	0.10
Std. Dev.	7.63	0.17	72,669.69	0.21	12.66	3,872.96
Skewness	21.67	1.16	- 23.35	1.31	8.51	6.68
Observations	690	690	690	690	690	690
Financial Services 2016 - 2019						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	1.11	0.18	- 2,106.95	0.22	3.80	1,336.53
Median	0.00	0.14	21.86	0.14	1.47	81.35
Maximum	187.15	0.86	927.86	0.95	139.23	52,065.00
Minimum	- 6.86	0.00	- 563,176.20	0.00	0.69	0.10
Std. Dev.	11.46	0.17	32,998.58	0.21	13.30	4,901.97
Skewness	14.95	0.94	- 16.92	1.17	9.16	6.55
Observations	292	292	292	292	292	292
Financial Services 2020 - 2023						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.28	0.17	- 4,418.83	0.21	4.43	1,098.58
Median	0.00	0.10	23.43	0.15	1.62	104.43
Maximum	38.16	0.85	123,894.40	0.98	136.93	23,287.28
Minimum	- 8.15	0.00	-1,820,079.00	0.00	1.00	0.10
Std. Dev.	2.16	0.18	91,458.34	0.20	12.17	2,897.41
Skewness	13.83	1.31	- 19.73	1.42	7.88	4.25
Observations	398	398	398	398	398	398
Insurance 2016 - 2023						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	12.58	0.09	44.10	0.06	2.92	2,376.20
Median	0.54	0.09	36.78	0.05	2.77	2,312.80
Maximum	96.47	0.10	72.33	0.10	4.19	2,752.10
Minimum	0.41	0.08	24.11	0.03	2.21	1,977.70
Std. Dev.	33.90	0.01	19.83	0.02	0.69	290.85
Skewness	2.27	- 0.27	0.41	0.96	0.67	0.10
Observations	8	8	8	8	8	8
Insurance 2016 - 2019						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.52	0.08	35.87	0.04	2.39	2,605.50
Median	0.46	0.08	26.78	0.04	2.33	2,673.35
Maximum	0.76	0.10	65.83	0.05	2.68	2,752.10
Minimum	0.41	0.08	24.11	0.03	2.21	2,323.20
Std. Dev.	0.16	0.01	20.02	0.01	0.21	192.95
Skewness	1.07	0.65	1.14	0.50	0.76	- 0.99
Observations	4	4	4	4	4	4
Insurance 2020 - 2023						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	24.63	0.10	52.34	0.07	3.45	2,146.90
Median	0.83	0.10	50.39	0.07	3.39	2,153.75
Maximum	96.47	0.10	72.33	0.10	4.19	2,302.40
Minimum	0.41	0.09	36.24	0.05	2.85	1,977.70
Std. Dev.	47.89	0.01	18.33	0.03	0.55	141.25
Skewness	1.15	- 0.86	0.11	0.06	0.40	- 0.13
Observations	4	4	4	4	4	4

**The table excludes the BICS level 2 industry "Banking" due to insufficient number of observations.*
Source: Compiled by author.

Descriptive statistics per portfolio and breakdown

Table 6: Descriptive statistics per portfolio breakdown

Portfolio High (H) 2016 -2023						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.79	0.25	- 1,512.07	0.26	2.78	526.57
Median	0.01	0.22	17.47	0.20	1.53	45.61
Maximum	187.15	0.86	3,505.64	0.98	77.29	11,422.00
Minimum	- 8.15	0.00	- 563,176.20	0.00	0.69	0.10
Std. Dev.	10.08	0.16	26,829.84	0.22	5.83	1,671.95
Skewness	16.31	0.92	- 20.83	1.06	9.27	4.89
Observations	442.00	442.00	442.00	442.00	442.00	442.00
Portfolio High (H) 2016 -2019						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	1.09	0.26	- 3,110.73	0.27	2.15	459.40
Median	0.01	0.24	16.71	0.20	1.44	35.65
Maximum	187.15	0.86	89.98	0.95	15.49	11,422.00
Minimum	- 6.86	0.00	- 563,176.20	0.00	0.69	0.10
Std. Dev.	13.36	0.15	39,964.54	0.23	1.76	1,448.31
Skewness	13.70	0.82	- 13.94	0.88	4.30	5.08
Observations	199	199	199	199	199	199
Portfolio High (H) 2020 -2023						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.54	0.24	- 202.88	0.25	3.31	581.58
Median	0.01	0.22	19.42	0.20	1.55	55.21
Maximum	96.47	0.85	3,505.64	0.98	77.29	11,418.00
Minimum	- 8.15	0.00	- 7,000.00	0.00	1.00	0.10
Std. Dev.	6.25	0.17	1,086.95	0.21	7.66	1,836.07
Skewness	14.97	1.02	- 3.91	1.23	7.19	4.67
Observations	243	243	243	243	243	243
Portfolio Medium (M) 2016 -2023						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.79	0.04	- 8,190.52	0.13	6.49	2,462.48
Median	0.00	0.02	46.30	0.08	1.71	261.93
Maximum	38.16	0.77	3,392.65	0.81	139.23	52,065.00
Minimum	- 5.43	0.00	-1,820,079.00	0.00	1.00	0.18
Std. Dev.	4.49	0.08	122,157.50	0.15	20.25	6,107.59
Skewness	7.09	5.76	- 14.80	2.07	5.71	4.49
Observations	222	222	222	222	222	222
Portfolio Medium (M) 2016 -2019						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	1.13	0.02	40.72	0.11	7.12	3,188.33
Median	0.00	0.02	52.23	0.07	1.72	308.16
Maximum	34.75	0.10	927.86	0.62	139.23	52,065.00
Minimum	- 0.14	0.00	- 994.19	0.00	1.01	0.48
Std. Dev.	5.48	0.02	192.72	0.13	22.64	7,970.02
Skewness	5.52	1.21	- 0.91	1.68	5.20	3.89
Observations	97	97	97	97	97	97
Portfolio Medium (M) 2020 -2023						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.52	0.05	- 14,577.97	0.14	5.99	1,899.21
Median	0.00	0.02	40.57	0.09	1.70	246.13
Maximum	38.16	0.77	3,392.65	0.81	136.93	23,287.28
Minimum	- 5.43	0.00	-1,820,079.00	0.00	1.00	0.18
Std. Dev.	3.55	0.10	162,792.90	0.17	18.25	4,071.04
Skewness	9.71	4.43	- 11.05	2.10	6.19	3.32
Observations	125	125	125	125	125	125

Portfolio Bottom (B) 2016 -2023						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.48	0.08	3,325.27	0.14	6.55	1,973.44
Median	0.00	0.01	24.81	0.06	2.01	900.17
Maximum	7.31	0.59	123,894.40	0.50	34.14	11,904.20
Minimum	- 0.86	0.00	- 11,369.00	0.00	1.00	5.26
Std. Dev.	1.40	0.15	21,393.47	0.16	8.82	2,991.08
Skewness	3.78	2.61	5.49	1.12	1.86	2.11
Observations	34	34	34	34	34	34
Portfolio Bottom (B) 2020 -2023						
	ROAP	INTTA	EBITDA	CASHTA	LEV	TA
Mean	0.48	0.08	3,325.27	0.14	6.55	1,973.44
Median	0.00	0.01	24.81	0.06	2.01	900.17
Maximum	7.31	0.59	123,894.40	0.50	34.14	11,904.20
Minimum	- 0.86	0.00	- 11,369.00	0.00	1.00	5.26
Std. Dev.	1.40	0.15	21,393.47	0.16	8.82	2,991.08
Skewness	3.78	2.61	5.49	1.12	1.86	2.11
Observations	34	34	34	34	34	34

Source: Compiled by author.

Discussion of descriptive statistics

ROA

For the entire period of 2016-2023, ROA has a mean of 77%, this suggests a high profitability to assets on average. The ROA mean more than halved from 111% to 53% from 2016-2019 to 2020-2023, indicating that the COVID-19 pandemic significantly impacted returns. The median of 0% across all three panels may suggest that many firms are breaking even or are not profitable. The high skewness of 18.08 and 15.06 for 2016-2023 and 2016-2019, respectively, and a high maximum of 187.15 for both periods indicate that a small number of firms have exceptionally high returns. The maximum decreasing to 96.47 from 187.15 for 2020-2023 reflects the negative impact on the ability of firms to generate returns measured as ROA after COVID-19.

This decrease in maximum was more pronounced for the financial services sector compared to insurance per Table 5, where the financial services industry the maximum decrease in ROA from 187.15 to 38.16 from 2016-2019 to 2020-2023. The insurance industry experienced an inverse increase in maximum ROA from 0.76 to 96.47 across the same period. Per Table 5, the Insurance industry had a significantly larger average ROA of 12.58 compared to 0.68 for financial services for the entire period 2016-2023. This is largely contributable to the post-COVID-19 period where the average ROA

dramatically increased from 0.52 to 24.63 from pre-COVID-19 period which could suggest that this industry benefited tremendously from the pandemic.

The descriptive statistics for ROA for 33% of firms in the H portfolio classification is in line with the overall descriptive statistics per Table 6. Firms in the H portfolio classification had a mean ROA of 79% which was the same for firms in the M portfolio but significantly in excess of the bottom portfolio's mean for ROA at 48%. While the ROA for M and H portfolios are the same at 79% the mean intensity in investment of IGNIAs measured by INTTA is 25% for firms in the H portfolio compared to a meagre 4% for firms in the M portfolio. In addition, the maximum ROA for H portfolio firms are 187.15 with a maximum INTTA of 86% compared to a maximum ROA of 38.16 with a 77% maximum INTTA for M portfolios. This could initially suggest that investment in IGNIAs does not have a significant impact on net returns for financial firms suggesting that H0 is true.

INTTA

INTTA's mean of 17 - 18% across the panels indicates that, on average, 17-18% of the firms' total assets are IGNIAs, indicating a moderate investment in these. Although the pre-COVID-19 period's mean is slightly higher at 18%, it may indicate higher reliance on IGNIAs pre-COVID-19 and, subsequently, a reduction in spending on R&D and SG&A. The skewness increased post-COVID-19 to 1.32 from 0.96, indicating greater variability in investment. This could indicate that firms did not prioritise continuous investment in IGNIAs. The median of 11% and skewness of 1.17 suggest that most have lower investments in IGNIAS over the entire period of 2016-2023. However, there is also a limitation where not all firms disclose values for R&D and SG&A, most notably in the observation split between the periods. The maximum of 85% - 86% does indicate that some firms hold much higher IGNIAS and perhaps prioritise these as an essential expenditure.

Per Table 5, the insurance industry's mean, maximum and minimum INTTA remained relatively constant between 9-10% over all three periods, compared with the financial services mean of around 17%. Together with an insignificant skewness for the insurance industry, it suggests that the insurance industry does not prioritise investment in IGNIAs to the same degree as financial services.

The 33% firms in the H portfolio have a mean investment in IGNIAs of 25% per Table 6. The M and B portfolios has a mean of 4% and 8% respectively. However, the high skewness of 5.76 for M portfolio sample and 2.61 for the B portfolio samples suggest that the median of 2% for M portfolio firms and 1% for B portfolios is more representative of investment in IGNIAs for these portfolios.

EBITDA

For the control variable EBITDA, the negative average of -3 400.53 indicates widespread unprofitability during the sample period of 2016 – 2023. The negative EBITDA mean more than doubled for the period before COVID-19 to after, from -2 077.99 to -4,374.34, reflecting the financial impact of the pandemic on profitability. Most notably, the maximum for the 2016-2019 period was 927.86 compared to a maximum of 123,894.40, which may indicate that some firms could have benefited from the pandemic or that their investment in IGNIAs could have provided them with resilience to withstand the economic impacts of the pandemic. However, the dominating negative skewness for all three periods indicates that most firms have significant challenges in achieving operational profitability.

Per Table 5 the insurance industry had no negative mean EBITDAs across the entire, pre-COVID-19 and post-COVID-19 periods with relative low skewness. Notably the EBITDA for the insurance industry increased from the pre-COVID-19 period to after the COVID-19 period, suggesting the pandemic had a positive impact on their operational returns in line with the findings in the ROA. Even though there is an increase in mean EBITDA for the insurance industry, from the pre-COVID-19 to the post-COVID-19 period, the positive increase had an insignificant impact on the overall significant decrease in EBITDA irrespective of industry, as mentioned above. This can be attributable to the relatively small EBITDAs of the insurance industry compared with that of the financial services industry.

The mean EBITDA of firms in the H portfolio dramatically improved from pre-COVID-19 period to post-COVID-19 from -3,110.73 to -202.88 per Table 6. Similarly, the minimum decreased from -563,176.30 to -7,000 and the maximum increased from 89.98 to 3,505.64, over the same period, suggesting that investments in IGNIAs may have a positive impact on operation returns.

The decrease in mean EBITDA for the M portfolio firms from 40.72 to -14,577.97, coupled with a minimum increase from -994.19 to -1,820 079, over the same periods enforces this observation. However, the maximum increase from 927.86 to 3,392.65 coupled with the high skewness in M portfolios of -3.91 and -14.80 for 2016-2023 and 2016-2023, respectively, may indicate that only a small number of firms experienced a negative impact on EBITDA from the pre- to post-COVID-19 periods. This is reflected in the insignificant median increase from 46.30 to 52.23 over the same periods.

The B portfolio's median of 24.81 compared with 46.30 for M portfolios and a median of 17.47 for H portfolios across the entire period suggests that H portfolios have high variable EBITDAs but that investments in IGNIAs may play a role in operation efficiency where H portfolios have a negative mean compared to the positive means for M and B portfolios over the entire period.

CASHTA

Cash as a percentage of total assets (CASHTA)'s mean indicates that firms typically hold around 21-22% of their total assets as cash across all three-period ranges, unaffected by the COVID-19 period. This may be due to minimum regulatory cash requirements in specific financial industries included in the sample. This is evident from the minimum of 0 coupled with a high skewness of 1.32 for the entire period. The increase in skewness from 1.19 for 2016-2019 to 1.43 for 2020-2023 indicates that some firms experienced liquidity pressures after COVID-19, while the other indicators remained relatively constant. Finally, the exceptionally high maximum above 90% indicates that some firms maintain high cash reserves that could be attributable to industry requirements for risk management and cautious liquidity strategies.

Per Table 5, the insurance industry had a significantly lower total cash mean of 6% compared to the financial services industry mean of 21% over the entire period, in line with the complete sample's mean. This suggests that the insurance industry's cash holdings have an insignificant impact on the overall sample. The insurance industry's mean, maximum and minimum cash increased from 4% to 7%, 5% to 10% and 3% to 5%, respectively from 2016-2019 to 2020-2023. Whereas the financial services industry's mean, maximum and minimum also slightly increased from 20-21%, 95-98% and 0-3%, respectively. These slight increases suggest that firms increased their cash

holdings after COVID-19 due to financial pressure which was funded by debt as discussed in the LEV figures below.

Per Table 6, CASHTA for firms in the H portfolio means was slightly higher at 26% for the entire period compared to the 21% for the entire sample over the entire period. In contracts CASHTA for M and B portfolios were significantly lower at 13% and 14% respectively. This could suggest that firms that prioritise investment in IGNIAs as reflected by INTTA only do so when they have significant cash to do so. The reduction in mean CASHTA for H portfolios firms from 27% to 25% from pre- to post-COVID 19 period coupled with a similar decrease in INTTA from 26% to 24% suggests that firms cut expenditure on IGNIAs in relation to cash generated. Similarly, M portfolio's firms experienced an increase in CASH and INTTA from 11-14% and 2-5% respectively. Firms in the H & M portfolios' both have minimums of 0% and maximums in excess of 80% suggesting that some firms may fund investment in IGNIAs with debt.

LEV

The mean (LEV) of 4.14 for the entire period indicates a high reliance on debt compared to equity, which is typical for financial firms. Similar to CASH, the high skewness across periods and extreme maximum in excess of 130 shows that firms are highly leveraged, typical of finance firms, which could increase their financial risk. Notably, a minimum leverage of 1 is observed post-COVID-19, increasing from 0.69 pre-COVID-19. This indicates that more debt was incurred due to financial pressures, as reflected by the liquidity pressures discussed above.

Per Table 5 the insurance industry's average leverage was 2.92 for the entire period compared with a higher expected financial services industry LEV of 4.16. In line with the overall sample the financial services and insurance industry means' leverage increased from 3.80 to 4.43 and 2.39 to 3.45, respectively, from pre-COVID-19 to after. This suggests that firms increased debt to assist with liquidity requirements post-COVID-19. This is evident in the maximum and minimum increased for the insurance industry from 2.68 to 4.19 and 2.21 to 2.85 respectively. While the finance services industry minimum also increased from 0.69 to 1 the maximum insignificantly decreased from 139.23 to 136.93 suggesting that debt plays a significant role for this industry.

The mean LEV for firms in the H portfolio increased from 2.15 to 3.31 and decreased for the M portfolios firms from 7.12 to 5.99 respectively from the pre- to post-COVID-19 periods per Table 6. While mean INTTA decreased for H portfolio's and increased for M portfolio's suggesting that firms in the H portfolio incurred additional debt for expenditure other than IGNIAs whereas M portfolio firms may have used reserves to increase investment in IGNIAs as mean LEV decreased and CASHTA increased or that there was a divestment in assets for M portfolio firms to fund investment in IGNIAs. Maximum LEV remained relatively constant for M portfolios firms while H portfolio's firms experienced a significant increase from 15.49 to 77.29 from the pre-COVID-19 to the post-COVID-19 period. This suggest that H portfolio firms required the additional debt to maintain levels of INTTA investment.

TA

For TA, a high standard deviation of 3,852.82 is observed, together with a skewness of 6.69 for the entire period. This indicates that a few large firms dominate the sample, which could be attributed to industry-specific requirements in the financial sector. The mean of TA decreases from 1,353.68 pre-COVID-19 to 1,109.01, indicating a smaller total assets base for firms or that smaller firms were dominating post-COVID-19. The decrease in total assets could also indicate the downsizing of firms or divestitures during the COVID-19 period of 2020-2023. This is echoed by the maximum more than halving to 23,287.28 from 52,065 for the period before COVID-19 to after.

Per Table 5 the insurance industry had an average TA of 2,376.20 compared with the finance services industry's mean of 1,199.28 for the entire period. However, the variability was only 0.10 for the insurance industry compared to 6.68 for the finance industry. This is indicative of the financial service industry that has a higher appetite for risk with a minimum to maximum ranging from 0.1 to 52,065 compared to a range of 1,997.70 to 2,752.10 for the insurance industry. Both the insurance industry and financial services industry experienced a decline in mean and maximum TA from the pre- to post-COVID-19 periods. This suggests that both industries prioritised divestment of assets to alleviate financial pressures experienced by the pandemic.

In contrast H portfolio firms have a slight increase in mean TA from the pre- to post-COVID-19 period compared to M portfolio firms that reduced significantly from

3,188.33 to 1,899.21 over the same period per Table 6. This may suggest that firms that prioritise investment in IGNIAs places increased importance on their capitalised assets or that they selectively only acquire assets that are an integral part of their business. This may also suggest that firms with lower investment in IGNIAs had to sell assets in order to meet financial obligations post COVID-19 suggesting that higher investment in IGNIAs may provide protection of assets for a firm during periods of crises.

Preliminary Tests and results

Before analysing the regression results several preliminary tests were conducted. This included a test for heteroskedasticity. Heteroskedasticity ensures that regression estimates are efficient and that standard errors calculated are accurate for t-statistics and p-values. Additionally, the Hausman test is also performed to determine whether a random effects model or fixed effects model would be most suitable for the panel regression.

Test for Multicollinearity

Multicollinearity occurs when two or more variables are highly correlated. This can lead to issues in estimating coefficients in the regression model (Tsao, 2023). These issues include unstable coefficient estimates, as regression coefficients can be highly sensitive to small changes in the data. Additionally, standard errors can be inflated, determining statistically significant variables that are unreliable. Finally, it can become challenging to determine the contribution of each variable to the dependent variable (Tsao, 2023).

This study used a coefficient covariance matrix, per Table 7 below, to review the covariances between the estimated coefficients of the independent variables in the model. This allows the regression model to estimate coefficients for the independent variable of INTTA more reliably. The regression model can isolate the effect of each variable more accurately on the dependent variable when they are not highly correlated. This ensures a robust model as coefficients are less sensitive to changes in the data (Ortiz et al., 2023; Tsao, 2023).

Table 7: Coefficient Covariance Matrix

Coefficient Covariance Matrix							
	C	INTTA	EBITDA	CASHTA	LEV	TA	ROA (-1)
C	0.0874	-0.1870	0.0000	-0.0332	0.0028	-0.0000	-0.0054
INTTA	-0.1870	0.5225	-0.0000	0.0050	-0.0075	0.0001	0.0114
EBITDA	0.0000	-0.0000	0.0000	-0.0000	0.0000	-0.0000	-0.0000
CASHTA	-0.0332	0.0050	-0.0000	0.0709	-0.0025	-0.0000	0.0026
LEV	0.0028	-0.0075	0.0000	-0.0025	0.0002	-0.0000	-0.0004
TA	-0.0000	0.0001	-0.0000	-0.0000	-0.0000	0.0000	0.0000
ROA(-1)	-0.0054	0.0114	-0.0000	0.0026	-0.0004	0.0000	0.0005

Table 7 displays the coefficient covariance matrix of the regression model. Diagonal values represent the variances of the individual variables in the regression models' coefficients. Off-Diagonal values indicate the covariances between matches of coefficients reflecting if they have a liner relationship. It includes a lagged variable ROA(-1) as per formula 7 that was ultimately used as the final regression formula. The lagged variable of ROE(-1) helps to capture dynamic effects where past events can impact current outcomes. This was added to account for autocorrelation as discussed in the autocorrelation test section. Source: Compiled by author.

The low coefficients in relation to the control variables to the independent variable of INTTA may suggest that limited interdependence exists between them. INTTA has a negative covariance with EBITDA and LEV, suggesting that as INTTA increases, LEV and EBITDA will decrease. In contrast, INTTA has a positive covariance with CASHTA, TA and ROA(-1), implying that as INTTA increases, so would these variables. Although EBITDA has covariances close to zero for all variables, which may indicate limited interaction between EBITDA and the other variables, the study will consider the correlation coefficients and review the Variance Inflation Factors (VIF) to test multicollinearity further.

For robustness, the study also used a correlation matrix. Per Table 8 below, none of the correlations with the independent variable of INTTA exceeds +-0.8, suggesting that multicollinearity is not a concern (Prakash & Sindhasha, 2016).

Table 8: Correlation Matrix

Correlation Matrix						
	INTTA	EBITDA	CASHTA	LEV	TA	ROA
INTTA	1.000000	0.015780	0.405504	-0.120029	-0.216809	-0.029147
EBITDA	0.015780	1.000000	0.016915	0.002718	0.014889	0.004614
CASHTA	0.405504	0.016915	1.000000	-0.122544	-0.190375	-0.045843
LEV	-0.120029	0.002718	-0.122544	1.000000	0.428461	0.039617
TA	-0.216809	0.014889	-0.190375	0.428461	1.000000	0.280779
ROA	-0.029147	0.004614	-0.045843	0.039617	0.280779	1.000000

The correlation matrix shows linear relationships between variables. Values range from -1 to 1, where values closer to 1 (-1) indicates a strong positive (negative) correlation. Source: Compiled by author.

INTTA has a slight positive correlation with EBITDA at 0.015 and a strong positive correlation with CASHTA at 0.405, suggesting that an increase in investment in IGNIAs will lead to an increase in CASHTA. INTTA has a weak negative correlation with TA and LEV suggesting higher levels of INTTA will lead to a slightly lower value of TA and LEV, however the effect may be minimal. While INTTA has a low negative correlation with ROA it may suggest that an increase in INTTA will have a negative effect on ROA, this weak correlation may confirm H0. The dependent variable ROA has the strongest correlation TA, which is expected, as an increase in assets should result in additional returns generated by those assets. From Table 8 above, it seems that INTTA has moderate predictive power for CASHTA but has a limited impact on the other variables. A VIF test will also be performed to confirm there is no hidden multicollinearity. The correlation matrix was initially used and added for robustness before the regression formula was updated as set out in the autocorrelation test section below.

The Variance Inflation Factor (VIF)

The Variance Inflation factor (VIF) measures how high the correlation between independent variables is in the regression model. A high VIF can indicate that variables are strongly correlated with others, which, can destabilise coefficient estimates, and lead to a less robust regression model (De Jongh et al., 2015; Duho, 2022). Reviewing the VIF to ensure it's at an acceptable level addresses multicollinearity to ensure results that can be interpreted and are robust. Table 9 below displays the VIF for the independent variables. The VIF for each independent variable was calculated as:

$VIF_{var} = 1 / (1-R_j^2)$, *(6)*

Where the R^2 value was obtained by running the regression on each independent variable only. The values are all below five, which indicates low multicollinearity, and therefore, there is little to no concern (De Jongh et al., 2015).

Table 9: Variance Inflation factors of the independent variables

Variable	R^2	VIF
INTTA	0.0397	1.04
EBITDA	0.0002	1.00
CASHTA	0.0756	1.08
LEV	0.1983	1.25
TA	0.1753	1.21

Table 9 displays the R^2 values and VIF for each independent variable, where R^2 indicates the proportion of variance for each variable explained by the other variables. The VIF values indicate severity of multicollinearity with higher values indicating more multicollinearity. Source: Compiled by author.

Test for heteroskedasticity

When running the regression model, the residuals were plotted against the actual and fitted values to identify the spread between residuals and fitted values (Astivia & Zumbo, 2019). As per Figure 3 below, the residuals show a large spread for the years 2017 and 2021 onwards, indicating that residuals are more dispersed and suggest heteroskedasticity (Astivia & Zumbo, 2019).

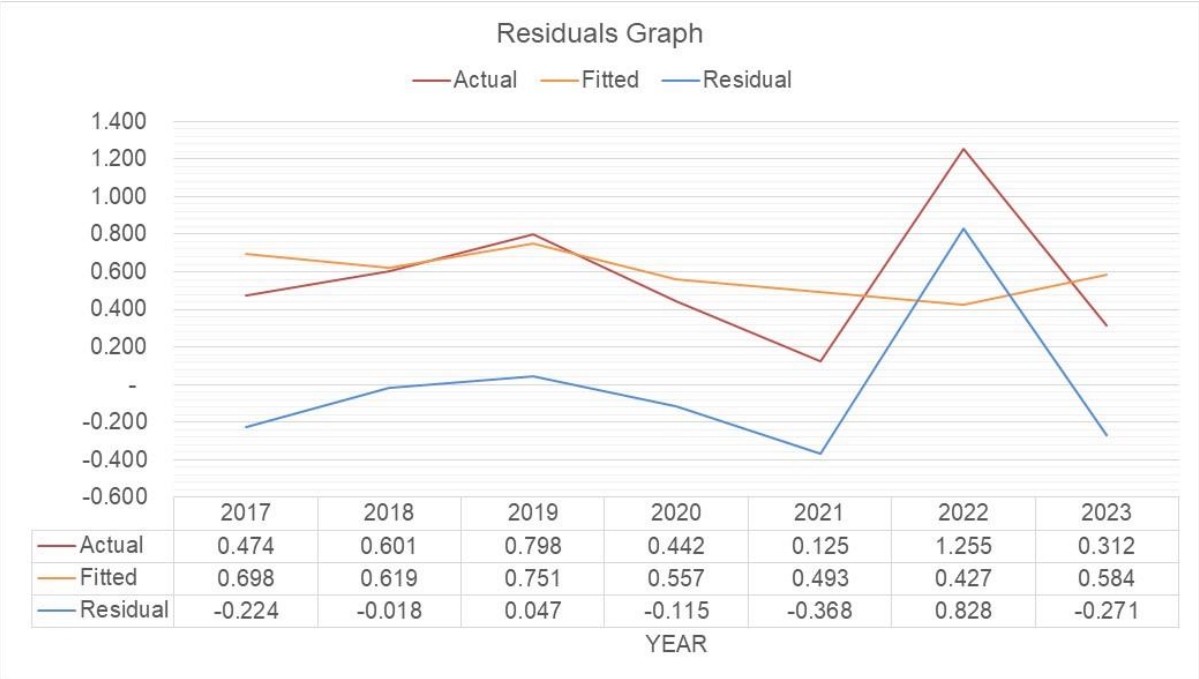

Figure 3: Residuals graph
Source: Compiled by author.

The residuals were, therefore, found not to be homoscedastic or that the residuals do not have a constant variance, in line with ordinary least squares regression, which ensures that regression estimates are efficient.

Additionally, this confirms that standard errors calculated on the model are not accurate for t-statistics and p-values. This indicates that an Estimated Generalised Least Squares (EGLS) method will be more appropriate to use. The EGLS will account for the non-constant variance, leading to more reliable estimates than the Ordinary Least Squares (OLS) model (Astivia & Zumbo, 2019). In order to correct this, the EGLS model was used with a white two-way cluster to account for heteroskedasticity and serial correlation in the panel data. Using EGLS allowed for heteroskedasticity and serial correlation across both cross-sectional units and time periods, as the raw data has multiple entities across multiple periods. The EGLS will adjust for both time and cross-sectional variance and autocorrelation. (Astivia & Zumbo, 2019)

Serial and Autocorrelation test

A Durbin-Watson (DW) test was used to test for serial correlation in the residuals of the regression model. It is used to check if the error is correlated across observations

(Turner, 2020; Wang & Lee, 2024). Values range from zero to four, with a value of two indicating no autocorrelation (Turner, 2020; Wang & Lee, 2024). A value of four suggests negative autocorrelation, and a value of zero indicates positive autocorrelation. ROA has a DW of 1.57 in order to correct for this, a lagged variable was added, ROA(-1), and the regressions formula was modified to:

$$ROA_{i,t}/= \alpha + ß_{1\ INTTA} + ß_{2\ TA} + ß_{3\ EBITDA} + ß_{4\ LEV} + ß_{5\ CASHTA} + ß_{6\ ROA(-1)} \quad (7)$$

This led to a Durbin-Watson statistic of 2.28. Adding the lagged variable, $ROA_{(-1)}$, introduces an additional variable which help correct non-normality in the residuals leading to more normally distributed error term enhancing the validity of the regression (Wang & Lee, 2024). Using $ROA_{(-1)}$, the test indicates that data is positively autocorrelated. Errors in one period are correlated to errors in the following periods. Being close to two suggests that autocorrelation is not strong and that, in most cases, residuals are roughly independent (Turner, 2020; Wang & Lee, 2024). The study will, therefore, use ROA as its dependent variable.

Endogeneity Robustness: Regression results using GMM EGLS and Hauman Test

The Hausman test was conducted to determine if there would be any significant variances in using either a Fixed Effects model or a Random Effects Model. The Hausman test evaluates if there is a correlation between the independent variables and the error term (Otekunrin et al., 2021). If there is a correlation, a fixed effects model would suffice, if no correlation a random effects model is appropriate. The null hypothesis is that the Random Effects model is appropriate and that the individual-specific effects (unobserved heterogeneity) are not correlated with the regressors.

We found the null hypothesis to be true be true with a high p-value, see Table 10. The test result was a Chi-Squared statistic of zero, with a probability of 1, indicating that there is no correlation between the independent variable and the error term. This study used random effects as a result. Endogeneity is, therefore, not an issue with the data sample.

Table 10: Correlated random effects: Hausman test

	Chi-squared statistic	Chi-squared difference	Probability
Cross-section random	0.0000	6	1.0000

Source: Compiled by author.

Table 10 above displays the results of the Hausman test for correlated random effects. This suggest there is no significant difference between the fixed effects and random effects models

In addition, the regression model was run using a Generalised Method of Moments (GMM) EGLS panel model as well reflected in Table 11. With the results of the GMM being almost identical, this indicates that endogeneity is not an issue in the model and that the standard EGLS model is appropriate in addressing heteroskedasticity and serial correlation.

Table 11: Panel regression results comparing models

	EGLS		GMM EGLS	
Variables	2016-2023		2016-2023	
	Coefficient	Standard error	Coefficient	Standard error
INTTA	1.2209	0.7229	1.2209	0.7496
EBITDA	-0.0000	0.0000	-0.0000	0.0000
CASHTA	-0.5099*	0.2663	-0.5099	0.3039
LEV	-0.0345**	0.0144	-0.0345*	0.0149
TA	0.0005**	0.0002	0.0005**	0.0002
Constant	-0.0222	0.2956	-0.0222	0.2994
Observations	598		598	
R-squared	0.1488		0.1488	
F-test	17.22		-	
J-statistic	-		591	

**** p<0.01, **p<0.05, *p<0.1 Source: Compiled by author.*

Results of the regression model

The panel regression results from formula 7 for 2016 -2023 are displayed in Table 12 below. The panel regression includes results for the normal EGLS, which were found

to be appropriate in addressing heteroskedasticity and any serially correlated errors. The results display each of the coefficients for the variables and their signs. This reflects the impact each variable has on the ROA and vice versa. The signs of the coefficients reflect the relationship each variable has on ROA, whether it's positive or negatively correlated.

Table 12: Panel regression results

	EGLS	
Variables	2016-2023	
	Coefficient	Standard error
INTTA	1.2209	0.7229
EBITDA	-0.0000	0.0000
CASHTA	-0.5099*	0.2663
LEV	-0.0345**	0.0144
TA	0.0005**	0.0002
Constant	-0.0222	0.2956
Observations	598	
R-squared	0.1488	
F-test	17.22	

**** p<0.01, **p<0.05, *p<0.1*

The asterisks in the results present the significance where three asterisks indicate a probability value below 1%, two, a probability value below 5% and three, a probability value below 10%. Variables with no asterisks suggest that they have no impact on firm ROA. Source: Compiled by author.

From the panel regression, INTTA or investment in IGNIAs was found to have an insignificant positive relationship with ROA. This implies we are unable to reject our null hypothesis, and hypothesis zero is confirmed. This aligns with findings from Duho (2022), who also found that investment in intangibles had a statistically insignificant positive effect on ROA. However, the study was limited to non-finance firms and used VAIC to measure intangibles. This is in contrast with the findings from various other studies, which found a significant positive impact on financial services companies' performance measured by ROA and investment in intangibles (Alipour, 2012; Kasoga, 2020; Lu et al., 2014; Ousama et al., 2019; Soewarno & Tjahjadi, 2020). It should be noted that all of the aforementioned studies used VAIC to determine the value of intangibles, and none included the UK market. Uddin (2022) also found a significant relationship between investment in IGNIAs and firm resilience however, he specifically excluded financial firms, as they have different regulations and accounting practices

than other firms. Demers et al. (2021), also excluded finance firms on this basis for US firms in their study finding that Environmental, Social and Governance (ESG) scores did not protect stock prices during the COVID-19 crises but rather investment in intangibles. The insignificant positive relationship of INTTA to resilience contrasts with various studies indicating that intangibles create value for stakeholders (Carvalho et al., 2016; Freudenreich et al., 2020; Sjödin et al., 2020).

This may indicate that the UK finance firms sampled do not accurately disclose values for OC and KC as important considerations or that using OC and KV may not be suitable for measuring IGNIAs for finance firms. These findings contribute to existing studies indicating that measuring intangibles is complex, and one method may not fit all industries (Banker et al., 2019; Haji & Ghazali, 2018; Lev & Sougiannis, 1996; Lim et al., 2020; Manikas et al., 2019; Martin, 2019; Nichita, 2019; Peters & Taylor, 2017; Uddin et al., 2022). Either new proxies for calculating IGNIAs should be developed, or industry-specific proxies should be researched to estimate these accurately. Martin (2019), also recognises a need for industry-specific data to estimate investment in intangibles more robustly. While other methods like VAIC, EVA^{TM} and BSC have been explored as alternatives, these have been found not to be suitable by various authors for intangibles (Marzo, 2022; Pulic, 2004; Ståhle et al., 2011). Consideration should be given that financial firms typically get support from the government during crises which could also have impacted the contrasting results between resilience and investing in IGNIAs (Abiwodo et al., 2023).

It can also be observed that total assets have a moderate positive significant impact on the finance industry's resilience from all the variables included in the regression. This is in line with other studies suggesting firms that have higher investments in tangible assets are more resilient (Ding et al., 2021; Uddin et al., 2022).

It is interesting to observe that leverage has a negative relationship with resilience, indicating that lower-leveraged firms would be more resilient. This is in line with Ding et al.'s (2021) findings that less debt experience better stock price reactions to the COVID-19 pandemic, indicating that this is an essential metric for stakeholders when evaluating the resilience of companies to crises. Cash has a negative, somewhat significant relationship with resilience, suggesting that firms with less cash may invest

in other aspects of the business to improve leverage. This may also indicate that firms use cash to improve performance during crises by leveraging IGNIAs. This is in line with studies that found that mispricing of stocks exists for firms with high expenditure on SG&A rather than risk explanations that are reversed in subsequent years when the value of these is reflected on financials (Banker et al., 2019; Eisfeldt et al., 2020). Pástor et al. (2020) had similar findings where investors failed to capture excess returns for firms that continued expenditures during crises on employees and stakeholder relationships that were not capitalised. Nemlioglu and Mallick, (2020) and Venieris et al., (2015), attributed this to optimistic management expecting sales to recover and continually investing in IGNIAs as a result.

Table 13 contains results for all firms sampled before COVID-19, 2016-2019 and the period thereafter, 2020-2023. The regression results for the period split also confirmed H0, where IGNIAs has no significant relationship with resilience.

Table 13: Regression results for period before and after COVID-19

	EGLS		
Variables	2016-2023	2016-2019	2020-2023
INTTA	1.2209	1.6411	0.2468
	(0.7229)	(0.8451)	(0.4201)
EBITDA	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)
CASHTA	-0.5099*	-0.6774	-0.6738
	(0.2663)	(0.6364)	(0.4812)
LEV	-0.0345**	-0.0289	-0.0044
	(0.0144)	(0.0146)	(0.0077)
TA	0.0005**	0.0003	0.0002*
	(0.0002)	(0.0002)	(0.0000)
Constant	-0.0222	-0.1155	0.4013)
	(0.2956)	(0.1692)	(0.4032)
Observations	598	210	388
R-squared	0.1488	0.7739	0.0175
F-test	17.22	115.82	1.13

**** p<0.01, **p<0.05, *P<0.1*

Standard errors in parentheses. Source: Compiled by author.

Per Table 14, the same regression for the financial services industry does indicate a somewhat significant positive relationship between investments in IGNIAs and ROA for the entire period samples 2016-2023 and the period after COVID-19 2020-2023. This suggests that investment in IGNIAs became an important consideration for these firms only after or during the COVID-19 period. This is echoed by other studies which found that companies invest more in intangibles during crises (Nemlioglu & Mallick, 2020; Uddin et al., 2022; Venieris et al., 2015), and that management is responsible for recognising the value IGNIAs play during these periods to create value (Barney, 1991; Donaldson & Preston, 1995; Freudenreich et al., 2020; Manikas et al., 2019; Sjödin et al., 2020; Uddin et al., 2022).

Table 14: Regression results in the financial services industry

	Financial Services		
Variables	2016-2023	2016-2019	2020-2023
INTTA	1.5399*	1.3556	0.5400*
	(0.6898)	(0.5595)	(0.1807)
EBITDA	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)
CASHTA	-0.0590	-0.5832	-0.1727
	(0.2365)	(0.4982)	(0.1637)
LEV	-0.0271*	-0.0277	0.0032
	(0.0141)	(0.0155)	(0.0074)
TA	0.0005***	0.0003	0.0002*
	(0.0001)	(0.0002)	(0.0000)
Constant	-0.3007**	-0.0578	0.0130
	(0.0927)	(0.1754)	(0.0000)
Observations	591	207	108
R-squared	0.2828	0.7012	0.0827
F-test	38.38	78.22	5.67

**** p<0.01, **p<0.05, *P<0.1*

Standard errors in parentheses. Source: Compiled by authorr.

It seems some management recognise the value that intangibles play during crises and continue expenditure on these items, as found by various studies to contribute to resilience (Banker et al., 2019; Eisfeldt et al., 2020; Pástor et al., 2020; Uddin et al., 2022). It may also suggest that the regression needs to be performed over a longer period before and after COVID-19 to capture the excess returns that have not been realised by investment in IGNIAs for the entire sample. This is echoed by other studies

suggesting that resilience is a long-term commitment and continuous investment is required (Altomonte et al., 2022; Mithani et al., 2021). However, measuring IGNIAs and appropriate depreciation rates to determine an applicable period for mispricing remains a contentious issue (Martin, 2019; Nichita, 2019).

The regression could not be applied to the insurance and banking industries due to the limited number of firms that form part of the sample. This may suggest that the banking and insurance firms' requirements to hold large asset reserves may impact their ability to appreciate the value of IGNIAs when valuing IGNIAs in relation to tangible assets.

CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

Conclusion

Firms invest in knowledge and organisational capital, expecting these to create resilience during crises. However, these expenses are not capitalised on financial statements due to the difficulty of measuring them accurately and defining how long they will provide future economic benefits. Not accurately disclosing these internally generated intangibles may lead to mispricing or management not prioritising investment in these non-capitalised intangible assets. The UK finance industry plays a pivotal role during crises by providing financial support for other sectors, thereby limiting global financial contagion. In addition, governments are becoming more aware of the economic cost of providing subsidies to support finance firms. As such, the UK finance industry must ensure they are resilient during crises without additional support to provide an environment where economies can recover when crises strike. Did investment in internally generated non-capitalised intangible assets (IGNIAs) serve as a vaccine by contributing to resilience for UK finance firms during the COVID-19 crisis?

This study used a quantitative research design to determine if investment in IGNIAs provided resilience to UK finance firms during the COVID-19 crisis. The study calculated the value of IGNIAs as the sum of their knowledge capital (KC) and organisational capital (OC). KC was measured as a firm's expenditure on R&D using a 15% depreciation rate. OC was measured by including 30% of a firm's SG&A expenditure with a depreciation rate of 20%. In addition, investment intensity was considered where the value calculated for the IGNIAs was scaled to firms' total assets. Finally, the study measured resilience by proxy of ROA. Control variables, including total assets, cash, leverage and EBITDA, were included to control for firm-specific characteristics. In addition, several preliminary tests were conducted to ensure the robustness of the regression applied. These included tests for multicollinearity, heteroskedasticity, serial and autocorrelation and endogeneity. As a result of these tests, the study used an Estimated Generalised Least Squares (EGLS) regression to determine the significance of the relationship between investment in IGNIAs, and resilience denoted by ROA.

This study proposed that investment of UK finance firms in IGNIAs is not significant in explaining resilience for firms measured by ROA (H_0), or they may be (H_1) from before to after the COVID-19 crisis, 2016-2023. In addition, this study aimed to determine if firms that invested more in IGNIAs before the COVID-19 crisis, 2016-2019, showed a significantly higher resilience measured by ROA after the COVID-19 crisis, 2020-2023 than firms that did not invest at the same rate (H_2) or not (H_3).

Prior literature indicates that there should be a significant positive relationship between IGNIAs and resilience for both finance and non-finance firms. Most studies using OC and KC used US firms in their sample and excluded US finance firms, which do not fully disclose the financial information used to calculate KC and OC. Other studies measuring the impact of IGNIAs on resilience for finance firms used VAIC or EVA™, which other authors found not to be suitable for measuring IGNIAs. In addition, studies on finance firms' investment in IGNIAs and the impact on resilience did not include the UK finance industry.

It seems there is almost no dispute that IGNIAs, using OC and KC, does create value for stakeholders and contribute to resilience from literature. The biggest issue from literature is the ability to measure IGNIAs accurately and has been an ongoing debate since the mid-nineties to the present. This study expected to find a significant positive relationship between investment in IGNIAs and resilience measured by ROA by using established proxies for IGNIAs for UK finance firms. In addition, the researcher expected to find that UK finance firms that invested more in IGNIAs before COVID-19 would show a higher level of resilience after COVID-19 than those that did not invest at the same rate. The study expected that UK finance firms would invest in IGNIAs throughout the measured period, to contribute to resilience, as these UK firms play a major role in limiting financial contagion globally.

In contrast to most other studies, this study found no statistically significant relationship between investment in IGNIAs and resilience for the UK finance firms before COVID-19 started and thereafter, 2016 – 2023 confirming H_0. Based on the regression results, firms' resilience has a negative relationship with leverage, which aligns with other studies suggesting firms with lower leverage are more resilient. Furthermore, the results indicate that firms with lower cash reserves may be more resilient. Some

studies indicated that firms use excess cash during crises to continue expenditure on KC and OC to provide resilience during crises, expecting sales to recover at some point in the future and having capacity to deal with increased demand after recovery of crises. Studies contribute this behaviour to optimistic management that has control over these reserves during crises, emphasising the role they play in being able to identify IGNIAs as a source of resilience. Literature indicates that firms with higher disclosed tangible assets are expected to be more resilient during crises. This study's results support this literature as displayed in Table 12, indicating a somewhat significant relationship between total assets and resilience for UK finance firms.

Per Table 14, this study found that financial firms in the financial services industry did indicate a somewhat significant relationship between investment in IGNIAs and resilience after the COVID-19 period, 2020-2023. Which is supported by literature and may indicate that a study needs to be done over a longer period of time to capture the value of IGNIAs more accurately as prior studies used extensive periods in their tests. In addition, it may indicate that measurement of investment for IGNIAs may be different for unique industries as found in literature. This also highlights the impact that the insurance and banking industries' capital structure and reliance on tangible assets had on the overall results albeit they only constituted a small part of the overall sample.

The results in Table 14 indicate that after the disruptions of the COVID-19 pandemic, some industries have realised the benefits of investing in IGNIAs to provide resilience during crises, which is in line with literature indicating that management tends to spend more during crises to preserve resilience in anticipation of recovery. This signals a strong message to investors and managers that measuring and prioritising investment in IGNIAs in future can provide resilience to finance firms in an ever-changing landscape where firms need to adapt to provide long-term returns for investors. Several studies found that investors failed to capture excess returns as they were not able to identify investment in IGNIAs during crisis periods, and mispricing was only corrected once financials disclosed the value created by IGNIAs through profitability measures like ROA.

It seems that finance firms may only be waking up to the benefits of investing in IGNIAs after the pandemic. In return, this could provide a vaccine for the spread of financial

contagion into other markets and industries globally, reducing the impact for the majority of investors across markets.

Limitations and future research recommendations

This study focused on the UK finance industry investment in IGNIAs and its impact on resilience measured by ROA. The study sample contained mainly financial services firms, with only a handful of banking and insurance firms. Although descriptive statistics were explained for specific industries in the finance BICS classification, a study can be conducted to confirm if there are industry variances in investment in IGNIAs and their impact on resilience.

Alternative measures for resilience can also be considered, especially for finance firms, as their capital structure may have an impact on measuring resilience as seen with the exclusion of Banking and Insurance in Table 14. This study only considered the COVID-19 pandemic. A broader study can be conducted to span over a more extended period for UK finance firms to ascertain if IGNIAs provide resilience for other types of crises. The study also had to exclude firms that did not disclose total assets, and the lack of disclosure on KC and OC meant that fewer observations were considered in the panel regression.

Extending the sampled entities across regions and not just the UK could impact the results in determining if there are regional differences in investments in IGNIAs. Alternative measures for IGNIAs can also be considered, especially for finance firms, as their disclosing practices and applicability of expenditures (like R&D) may have an impact on measuring IGNIAs accurately, as described in the literature review. Future research can also explore the intensity of investment in IGNIAs and its impact on resilience irrespective of industry in the UK, specifically as studies have been mainly done on US firms. Future studies can also explore the impact investment on IGNIAs has on other metrics, specifically cash and EBITDA, as these positively correlate with IGNIAs.

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