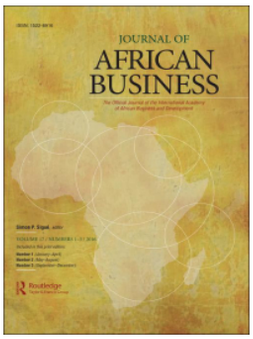

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Intellectual Capital Efficiency and Risk-Taking Behaviour of Insurance Companies in Ghana

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ABSTRACT

Our study focused on the link between intellectual capital efficiency (ICE) and its individual components and underwriting risk. It examined the effect of ICE, and structural (SCE) and human capital (HCE) efficiency on the underwriting risk of Ghanaian life and non-life insurers. It used panel data of 31 insurance firms in Ghana, of which 14 and 17 were life and non-life insurers, respectively, from 2008 to 2019. A generalized least squares estimation technique was used to examine the relationship between ICE and underwriting risk in life, non-life, and the entire insurance sector. The results suggest that there is a significant negative relationship between HCE and underwriting risk in the Ghanaian insurance sector. However, there was no relationship between ICE and underwriting risk and between SCE and underwriting risk. As the first to examine ICE and risk-taking behavior in any African country, our study is significant in managerial decision-making and insurance policy formulation to reduce risk in the insurance industry.

KEYWORDS

Intellectual capital; underwriting risk; human capital efficiency; structural capital efficiency

1. Introduction

Insurance firms play a significant role in risk management (Ivanovna et al., 2018). A core part of this role involves risk-taking. Akotey and Abor (2013) posited that underwriting risk is major and faced by all insurers in Ghana. Underwriting risk is the potential loss to an insurer emanating from faulty underwriting. This may affect the solvency and profitability of an insurer adversely (Adams & Buckle, 2003). Therefore, the criticality of this risk and its high likelihood of causing failure indicates its relevance in determining a firm's profitability and productivity. Therefore, insurers are effective and successful when they can maintain their risk exposure within proper and acceptable parameters. There is growing interest in intangibles, including intellectual capital efficiency (ICE) and its components, namely human (HCE) and structural (SCE) capital efficiency, in the business world. ICE is the aggregate of all HCE and SCE. Thus, employee expertise, organizational processes, and other intangibles contribute to a company's profitability.

Ulrich (1998) found two important reasons for the importance of ICE in the service economy. These are the increasing demand for knowledge workers (HCE) and the growing importance of maintaining proper structures and procedures (SCE). Insurance

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firms whose managers have the requisite knowhow in the insurance environment can apply professional judgment to make better decisions and ensure that the firm is profitable, efficient, and has minimum exposure to risks (Alhassan & Asare, 2016).

Kusi et al. (2019) highlighted that an insurer with good management can easily identify, measure, monitor, and mitigate underwriting risk. They noted that well-established systems help insurers identify the sources of underwriting risk to minimize losses. These are indications of the central role that ICE plays in minimizing an insurer's exposure to risks and the associated effects of firm failure.

Empirical evidence supports the view that high exposure to risks is a major cause for financial firms' insolvency and failures (Njanike, 2009). The cruciality of risk and its high likelihood of causing firm failure has necessitated the examination of factors that affect risks. The factors identified include macroeconomic factors such as inflation, unemployment, exchange rate, economic growth, and productivity (Ali & Daly, 2010; Castro, 2013; Louzis et al., 2012; Waemustafa & Sukri, 2015). Few studies have identified firm-specific determinants of risks in financial institutions. These include efficiency, firm size, capital adequacy, profitability, and ICE (Louzis et al., 2012).

Studies on the impact of ICE and its components have focused on the sustainable development of healthcare (Dalwai et al., 2023), fraud and money laundering (Salehi et al., 2022), firm performance and bankruptcy risk (Dalwai & Salehi, 2021), annual report readability (Dalwai, Mohammadi, et al., 2021), fraud in financial statements (Lotfi et al., 2021), corporate value-creation and growth (Salehi & Zimon, 2021), shariah governance (Nawaz et al., 2021), and related party transactions on contractual costs (Salehi, Ahmadzadeh, et al., 2020). Evidence on the role of ICE in the financial sector have focused on firm performance (Asare et al., 2017; Firer & Mitchell Williams, 2003, Uadiale & Uwuigbe, 2011; Kweh et al., 2014; Nourani et al., 2018; Olarewaju & Msomi, 2021; Oppong et al., 2019; Zakery & Afrazeh, 2015).

However, in the banking industry, Nguyen et al. (2021), Dalwai, Singh, et al. (2021), Azmi and Kurniawan (2021), Zheng et al. (2018), Ghosh and Maji (2014), and Nawaz (2019) investigated the influence of ICE on risk. They discovered a substantial positive connection between ICE and risk. Mwangi and Iraya (2015), Angima, Mwangi, Kaijage, and Ogutu (2017), Makau and Okeyo (2021), and Deyganto and Alemu (2019) found a negative link between underwriting risk and company performance. Relatedly, Abbas et al. (2021) found a negative link between capital ratio and risk. Al-Maliki et al. (2022) found a negative relationship between COVID-19 and risk-taking behavior. Salehi et al. (2021) found a negative association between managerial characteristics and risk. Salehi, Naeini, et al. (2020) discovered a positive relationship between managers' narcissism and risk.

Given the significance of ICE and its implications for risk, little research has been conducted to examine its impact on insurer risk. Yu et al. (2008) conducted the only study in the literature that investigated how incentives to safeguard intangible assets affect the risk-taking behavior of property and liability insurers in the property and liability insurance markets of industrialized countries. Thus, we looked into the impact of ICE and its components on the risk-taking behavior of insurers in Ghana.

Most African countries' steady economic growth, combined with a largely underdeveloped insurance industry, has propelled the continent to the second fastest-growing insurance market after Latin America. Before COVID-19, the African insurance market

was predicted to grow at a compound annual growth rate of 7% between 2020 and 2025, about twice as quickly as North America, more than thrice that of Europe, and faster than Asia's 6% (McKinsey & Company, 2020). Thus, growth will undoubtedly be supported by the risk-taking behavior of insurance firms across the continent, and, to a lesser extent, the sum of employee expertise, organizational processes, and other intangibles that add up to ICE, and how these variables contribute to an insurance company's profitability. We aim to fill the gap in the literature by investigating the impact of ICE, HCE, and SCE on risk-taking behavior in Ghanaian insurance firms.

Recent key market drivers such as economic growth, rising government spending, technological innovations, and increased consumer awareness of insurance products in Ghana have reinforced the need to investigate the relationship between ICE (and its individual components) and risk-taking behavior in Ghanaian insurance firms. The growing number of digital distribution channels makes it easier for insurers to get insurance coverage. Insurtech, messaging platforms, and online sales channels all contribute to Ghana's insurance scene and carry risk (Ghana Insurance Market Report, 2019).

We add to the literature by investigating the influence of ICE and its components, specifically HCE and SCE, on the underwriting risk of Ghanaian insurers. We investigated the following issues. What is the relationship between ICE and the underwriting risk of Ghanaian insurers? How do HCE and SCE affect their underwriting risk?

We focused on Ghana because insurance growth is catching up to GDP growth. The Ghanaian life insurance market and bancassurance premium share have nearly doubled from 7% in 2015 to 13% in 2019 (McKinsey & Company, 2020). The expansion of Ghana's insurance sector has underlined the need for employee and managerial creativity and value-creation skills. Investment in HCE, SCE, and ICE is critical for the insurance industry to support long-term growth (Joshi et al., 2013). As the insurance industry necessitates the intensive application of human knowledge and abilities and capital structures, it was considered acceptable to set this study in the insurance industry. Knowledge of the impact of ICE and its components on risk-taking behavior will help insurance industry participants in making managerial decisions. Our conclusions will support the regulator in policy formulation.

Our work adds to the literature in two ways. First, it is the only study to investigate the influence of ICE on underwriting risk in Ghana's life and non-life insurance markets, and to a lesser extent, in any other African country. Second, to the best of our knowledge, it is the only study to break down ICE into HCE and SCE and investigate their impact on the underwriting risk of insurance firms in general.

We assessed the influence of ICE and its components on the underwriting risk of Ghanaian insurance companies using a generalized least squares estimator. We used data from the National Insurance Commission (NIC) on 31 insurance businesses, of which 14 and 17 were life and non-life insurers, respectively. According to the NIC (2020) annual report, the 14 life businesses chosen constituted 77% of Ghana's total life insurance market, whereas the 17 non-life companies chosen represented 75% of Ghana's total non-life insurance market. We focused on data from 2008 to 2019 owing to availability.

The findings suggest a significant negative relationship between HCE and underwriting risk for the Ghanaian insurance industry. However, there was no relationship between ICE and SCE on the one hand, and underwriting risk on the other. At a minor

level, our results show that other factors that influence underwriting risk include firm size, profitability, type of insurer, and age. The findings highlight the need for managers of insurance firms to improve their HCE as it has a negative impact on their exposure to underwriting risk.

This study is crucial because it may provide insights on prospective policy improvement routes. As using HCE to minimize underwriting risk is critical, policymakers can affect the trajectory of the Ghanaian insurance business environment by making adjustments to existing policies to foster the development of HCE in the insurance industry. This will have a favorable impact on the insurance industry's contribution to Ghana's economic growth. The rest of this paper is organized as follows: Section 2 reviews the literature, Section 3 presents the methodology, Section 4 presents the data, Section 5 presents the findings, and Section 6 concludes the paper.

2. Literature review and hypothesis development

2.1. The Resource-Based View (RBV)

The RBV of a company, as formulated by Penrose (1959), explains why certain organizations perform better than others. According to the RBV, a firm with specific resources can obtain a competitive edge over another firm (Wernerfelt, 1984). Assets are either tangible or intangible resources that a company employs in order to develop products or services that generate value. According to Barney (1991), organizations whose strategies are based on leveraging intangible assets outperform those based on tangible ones. However, as other organizations may quickly reproduce tangible assets, the competitive advantage acquired from them is not sustainable for lengthy periods of time. Intangible assets are scarce and difficult to replicate, and thus provide a long-term advantage. The preceding arguments emphasize that organizations do well when they have, properly manage, and use intangible resources (mainly managerial skills, knowledge, experience, and competence). Thornhill and Amit (2003) argued that the RBV is appropriate in corporate bankruptcies. They contended that managerial shortcomings can lead to insolvency and corporate failure. Given that underwriting risk is a leading cause for insurer failure, it stands to reason that managerial skill may influence insurers' exposure to underwriting risks.

2.1.1. Intellectual capital efficiency

Pulic (1998, 2000) created a value-added intellectual coefficient (VAIC) model to quantify the value added by tangible and intangible assets. HCE, SCE, and capital employed efficiency are components of the VAIC model. This model is widely considered the standard measurement approach for comparing industries and nations. Given the ease with which information from financial accounts can be applied, this model has been widely employed in various empirical studies (Mohammadi & Taherkhani, 2017; Xu & Wang, 2018). Pulic (1998, 2000) decomposed ICE into HCE and SCE using the VAIC. Employees' expertise, abilities, experience, and training constitute HCE, whereas organizational resources such as management measures, techniques, strategies, and databases constitute SCE. Several studies have examined the influence of ICE on financial performance in the

insurance industry. Oppong et al. (2019), for example, argued that there is a considerable positive association between ICE and the productivity of the Ghanaian insurance market from 2008 to 2016. They also discovered that HCE significantly impacts insurance company productivity. Chen et al. (2014) discovered that ICE, HCE, and SCE had a favorable impact on general insurance firm productivity in Malaysia from 2008 to 2011. Alipour (2012) discovered that value-added ICE, HCE, and SCE have a considerable beneficial effect on insurance company profitability in a study of 39 Iranian insurance firms. When Zakery and Afrazeh (2015) evaluated the impact of ICE on the Iranian insurance industry, they corroborated this outcome. They discovered that HCE has a considerable favorable impact on insurers' efficiency. However, SCE has a negative effect on the efficiency of insurers. In their analysis of Indian insurance companies, Smriti and Das (2018) confirmed the considerable positive relationship between ICE and financial performance.

Another body of scholarship has concentrated on the impact of underwriting risk on the performance of insurance companies. Adams and Buckle (2003) discovered a negative relationship between underwriting risk and performance in their analysis of the Bermudan insurance market. This finding was supported by Wani and Dar (2015), who studied the Indian insurance market and Zainudin, Mahdzan, and Leong (2018), who examined Asian insurance firms. Kusi et al. (2019) found a negative relationship between underwriting risk and performance in Ghana's insurance business. From 1999 to 2012, Ghosh and Maji (2014) investigated the influence of ICE, HCE, and SCE on the risks of Indian commercial banks. They discovered that ICE was inversely related to risk and that among the components, HCE was adversely related to risk. Lin, Yu et al. (2008) discovered similar results when they analyzed corporations in the US property and liability insurance markets. The literature shows that, on average, ICE and its components affect performance positively, whereas underwriting risk does so negatively. However, there has been little discussion on the relationship between ICE, HCE, and SCE and underwriting risk in the literature. Nuryaman (2015) contended that ICE can offer value to a company. Thus, the ICE of a firm will boost investor trust, which may increase the company's worth. However, research has proven that risk has a negative impact on company value and that risk management has a beneficial impact on firm value (Bohnert et al., 2017; Faisal et al., 2021; Krause & Tse, 2016). As a result, we hypothesize as follows:

Hypothesis 1. ICE has a negative effect on underwriting risk in insurance companies in Ghana.

HCE comprises a firm's intangible assets, which include its employees' intellectual aptitude, creativity, and invention. Zheng et al. (2018) and Hasnaoui et al. (2021) found that HCE reduced risk in firms. Thus, we hypothesize as follows:

Hypothesis 2. HCE has a negative effect on underwriting risk in insurance companies in Ghana.

Hardware, software, trademarks, patents, licenses, and other things that can improve employee productivity are examples of SCE. They are the infrastructure that supports employee performance. No study has linked SCE to risk. Popoola et al. (2019) and Pedraza Melo and Gala Velásquez (2022) discovered a link between SCE and company performance. As Nuryaman (2015) argued that SCE is a component that adds value to the firm, we propose the following:

Hypothesis 3. SCE has a negative effect on underwriting risk in insurance companies in Ghana.

3. Methodology

This section is divided into three subsections. The first sub-section discusses underwriting risk. Over the study period, underwriting risk was utilized as a proxy for risk-taking behavior in insurance firms in Ghana. Pulic's (1998) VAIC model was used to explain the independent variables in the second sub-section. The control variables are described in the third sub-section. Table 1 presents detailed information on all factors included in this study. The last sub-section describes the regression model that was used to investigate the link between underwriting risk and ICE and its components.

3.1. Dependent variables

3.1.1. Underwriting risk

This work builds on prior research (Adams & Buckle, 2003; Akotey et al., 2013; Alhassan et al., 2015; Kusi et al., 2019) by measuring underwriting risk as a ratio of losses incurred to premiums earned (loss ratio). This metric quantifies the risk that premiums received will not be sufficient to cover losses sustained under the policies covered (Charumathi, 2012). Sound underwriting concepts and criteria, according to Adams and Buckle (2003), are critical to the financial performance of insurance companies. They are affected by insurance companies' risk appetite. Insurers that insure risky businesses (e.g. catastrophe coverage) must ensure that appropriate management practices are followed to reduce their exposure to underwriting losses and maximize returns on invested assets.

3.2. Independent variables

3.2.1. Ice

The VAIC coefficient was proposed by Pulic (1998, 2000) as a quantitative instrument for predicting future capacities. We used financial data from the annual reports of insurance businesses as submitted to the NIC in Ghana during the study period to calculate the efficiency of their IC and asset values. Following Pulic (1998, 2000), we computed ICE in the following stages using the VIAC model:

Table 1. Summary of variables and measures.

Number	Variable	Variable name	Codes	Measurement Method	References	Data Source
1	Dependent	Underwriting Risk	Urisk	Ratio of incurred losses to earned premiums (loss ratio)	Adams and Buckle (2003), Akotey et al. (2013), Kusi et al. (2019), Alhassan et al. (2015)	National Insurance Commission annual reports
2	Independent	Human Capital Efficiency	HCE	VA/HC, where VA is valued added, and HC is employees' annual salaries and wages. VA = *Depreciation (D) + Amortisation (A) + Operating Profit (OP) + Employees Cost (EC)*	Olarewaju and Msomi (2021), Oppong et al. (2019), Nourani et al. (2018)	National Insurance Commission annual reports
3	Independent	Structural Capital Efficiency	SCE	SC/VA where SC includes hardware, software, trademarks, patents, licenses, and all other factors that can enhance employee productivity. VA = *Depreciation (D) + Amortisation (A) + Operating Profit (OP) + Employees Cost (EC)*	Olarewaju and Msomi (2021), Oppong et al. (2019), Nourani et al. (2018).	National Insurance Commission annual reports
4	Independent	Intellectual Capital Efficiency	ICE	HCE+SCE	Olarewaju and Msomi (2021), Oppong et al. (2019), Nourani et al. (2018).	National Insurance Commission annual reports
5	Control	Firm size	Size	Natural logarithm of total assets	Salas and Saurina (2002)	National Insurance Commission annual reports
6	Control	Profitability	ROA	Log of earnings before interest and tax/total assets	Ahmed, Ahmed and Usman (2011), Connelly and Limpaphayom (2004)	National Insurance Commission annual reports
7	Control	Leverage	Lev	Ratio of total liability and total asset	Alhassan et al. (2015), Biener et al. (2016) Aslam and Haron (2020)	National Insurance Commission annual reports
8	Control	Age	Age	Age is measured as the time from the insurer's inception to the current year	Biener et al. (2016)	National Insurance Commission annual reports
9	Control	Type of Insurer	Type	Dummy	Biener et al. (2016)	Self

VA and HC denote value added (total revenue minus total expenses) and human capital (total staff cost), respectively. HCE, SCE, and ICE denote human, structural, and intellectual capital efficiency, respectively.

(1) Value added (VA) was first computed in order to determining ICIE. Thus, VA = *Depreciation (D) + Amortisation (A) + Operating Profit (OP) + Employees Cost (EC)*
(2) HCE = *VA/HC*, where VA is valued added, and HC is employees' annual salaries and wages. This model determines the contribution of human resources to the creation of additional value.
(3) SCE = *SC/VA*, where SC includes hardware, software, trademarks, patents, licenses, and all other factors that can enhance employee productivity structural capital as derived from subtracting HC from VA. Thus, SC includes everything, except for human resources, that creates firm value.
(4) ICE is the sum of HCE and SCE. Thus, *ICE = HCE+SCE*
(5) VAIC is the sum of HCE, SCE, and CEE. Thus: *VAIC = HCE + SCE + CEE*. This implies that, *VAIC = ICE + CEE.*
(6) CEE = *VA/CE*, where CE denotes capital employed, which is measured by deducting the intangible assets from total assets.

3.3. Control variables

Control variables are included to account for the influence of other factors that may explain insurance underwriting risk. These variables are provided to avoid model misspecification. Firm size, proxied as the natural logarithm of total assets, is used to control for the impact of firm size on the insurer's underwriting risk (Salas & Saurina, 2002). Profitability is used to control for the impact of profitability on underwriting risk, as assessed by return on asset (the ratio of profit before taxes to total assets; Ahmed, Ahmed & Usman, 2011; Connelly & Limpaphayom, 2004). A dummy is used to distinguish between different types of insurers: 1 if the company is engaged in life insurance, and 0 if it is engaged in other domains of insurance. Leverage is calculated as the ratio of total liabilities to total assets (Alhassan et al., 2015). This is used to mitigate the impact of leverage on underwriting risk. Age is measured as the time from the insurer's inception to the current year, which is employed as a control variable (Biener et al., 2016).

3.4. Model specification

The relationship between ICE and insurance underwriting risks was investigated using a generalized least squares regression model. The first and second equations estimate the impact of HCE and SCE, and ICE on underwriting risk, respectively. Thus,

$$URisk_{it} = \beta_0 + \beta_1 HCE_{it} + \beta_2 SCE_{it} + \beta_3 Size_{it} + \beta_4 ROA_{it} + \beta_5 Type_{it} + \beta_6 Lev_{it} + \beta_7 Age_{it} + \varepsilon_{it} \quad (1)$$

$$URisk_{it} = \beta_0 + \beta_1 ICE_{it} + \beta_2 Size_{it} + \beta_3 ROA_{it} + \beta_4 Type_{it} + \beta_5 Lev_{it} + \beta_6 Age_{it} + \varepsilon_{it}, \quad (2)$$

where, URisk, ICE, HCE, SCE, Size, ROA, Type, Lev, and Age denote underwriting risk, ICE, HCE, SCE, firm size, profitability, insurer type, leverage, and insurer age, respectively. Owing to the presence of multicollinearity between ICE and its components (HCE and SCE), their impact on underwriting risk is not analyzed in a single equation. We anticipated a positive link between business size and underwriting risk. We contend that as firms grow, managers may find it difficult to personally supervise underwritten policies. As organizations grow, they may fail to invest in managerial capacity to control

costs and boost profitability. When organizations invest in managerial capacity, there is always a lag between growth and investment. Altuntas and Rauch (2017) supported this claim.

We anticipated a negative link between profitability and underwriting risk. When insurance risk rises, so do the costs associated with underwriting, thus reducing profitability. We predicted leverage and underwriting risk to be negatively related as leverage is associated with borrowing to invest in a firm. We expected firm size to affect underwriting risk negatively. This effect was achieved by leveraging the firm's asset size. Finally, we anticipated that age will have a negative impact on underwriting risk. This is a result of experience honed over the years in underwriting policies properly.

4. Data

As seen in Table 2, 31 insurance companies out of the 44 life and non-life insurance companies currently operating in Ghana were surveyed over a 12-year period (2008 to 2019), as several firms lacked yearly financial data during the study period. Some insurers engaged in mergers or acquisitions, and some ceased operations during the study period. Data from the yearly reports given by insurance firms in Ghana to the NIC were used, as NIC is the insurance regulatory organization, and all insurers must submit annual reports to it. Most research on insurance in Ghana have used NIC data (Akotey & Abor, 2013; Alhassan & Asare, 2016, Owusu-Ansah et al., 2010; Ansah-Adu et al., 2011; Kusi et al., 2019).

4.1. Descriptive statistics on variables used

Table 3 presents the descriptive statistics for the variables used. Underwriting risk had an average of 41.6% for the cross-section of 31 insurance firms in Ghana evaluated between 2008 and 2019, implying that 41.6% of net premiums were subject to underwriting risk. This amount is slightly higher than the figure published by Kusi et al. (2019) for the same market in a previous era (40.68%). Alhassan et al. (2015) estimated a somewhat lower value of 36 and 18.1% for the Ghanaian life and non-life insurance markets, respectively. The industry saw a low and high of 2.2 and 223.3%, respectively. However, underwriting risk appears to be high in the industry on average. The HCE of Ghanaian insurers was 1.689 on average, with a standard deviation of 2.147. This means that for every cedi spent on human resources, the insurer generated a value of GH 1.689. HCE calculated the amount of value created per Ghana cedi spent on workers. During the study period, the SCE of Ghanaian insurers averaged 0.46. This means that Ghanaian insurers generated a value of GH 0.46 for every cedi spent on structural capital. ICE has an overall mean of 2.146. This means that for every cedi spent on intellectual capital, Ghanaian insurers generated GH 2.146. These values were slightly lower than those published in Oppong et al. (2019), where the average HCE and SCE were 2.127 and 0.524, respectively. There was substantial evidence that insurers' ICE depended more on HCE than did SCE. Size was calculated as a natural log of insurers' total assets and indicated an average growth rate of 17.298%. Kusi et al. (2019) found an average size of 16.88%, which is comparable to our findings. The average return on assets, which represents

Table 2. List of insurance operators in Ghana.

Type of Insurance Operators	Total Number (2021)	Number Sampled
Life	17	14
Non-life	27	17

Source: NIC (2020).

Table 3. Descriptive statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Urisk	372	0.416	0.259	0.022	2.233
HCE	372	1.686	2.147	−6.291	28.651
SCE	372	0.46	4.345	−43.366	64.778
ICE	372	2.146	4.831	−43.344	64.762
Size	372	17.298	1.326	12.597	20.542
ROA	372	0.036	0.155	−1.035	1.411
Age	372	28.887	0.508	1	95
Type	372	0.452	0.498	0	1
Leverage	372	0.647	0.508	.015	7.128

Urisk, HCE, SCE, ICE, Size, ROA, Type, and Leverage denote underwriting risk, human, structural, and intellectual capital efficiency, Firm size, profitability, insurer type, and leverage, respectively.

stakeholder returns, was 3.6%, whereas Kusi et al. (2019) and Akomea-Frimpong, Andoh, and Ofosu-Hene (2016) found average returns on assets of 1.19 and 1.12%, respectively. This distinction was also because of the industry's expansion. The period's smallest and largest return on assets was 103.5 and 141.1%, respectively. The average leverage for insurance firms in Ghana was 0.647. This is slightly lower than the average leverage discovered by Alhassan et al. (2015). According to them, while non-life insurers reported an average of 0.765, life insurers reported an average of 0.67. For the study period, the average age of enterprises was 28.89 years, with minimum and maximum ages of 1 and 95 years, respectively.

Figure 1 depicts the underwriting risk trend in the insurance business. Underwriting risk peaked in 2018, at 53.53%. This tendency could be the result of faulty policy underwriting or the underwriting of riskier businesses throughout the era.

4.2. Preliminary statistical analysis

When the independent variables used in the regression analysis are highly linearly correlated, multicollinearity exists. The Pearson correlation and Variance Inflation Factor (VIF) are used to test for multicollinearity. According to Kennedy (2008), the criterion for multicollinearity is 0.7. According to Tables 4 and 5, the absolute values of all correlation coefficients are less than 0.7, indicating that none of the variables were multicollinear. The VIF verifies the eligibility of all variables used.

We used the Wooldridge (2002) test for autocorrelation in panel data from Table 6 and found strong first-order serial correlation in the series. The Breusch-Pagan-Godfrey Lagrange multiplier test revealed heteroscedasticity in the series.

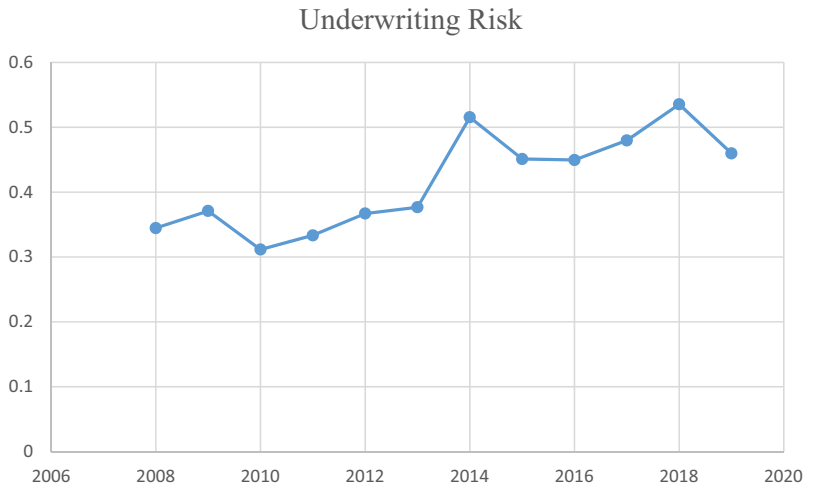

Figure 1. The trend of underwriting risk from 2008 to 2019.

Table 4. Correlation matrix for variables in equation (1).

Variables	Risk	HCE	SCE	Size	ROA	Type	Leverage	Age	VIF
URisk	1.000								
HCE	0.005	1.000							1.396
SCE	−0.038	−0.008	1.000						1.008
Size	0.300	0.242	0.043	1.000					1.321
ROA	−0.158	0.472	−0.012	0.164	1.000				1.458
Type	0.188	−0.026	0.010	0.069	−0.136	1.000			1.620
Leverage	−0.020	−0.092	−0.049	−0.040	0.152	.105	1.000		1.100
Age	0.050	0.152	−0.010	0.449	0.246	−.035	−0.047	1.000	1.337

Urisk, HCE, SCE, Size, ROA, Type, Leverage, and Age denote underwriting risk, human and structural capital efficiency, Firm size, profitability, insurer type, leverage, and age, respectively.

Table 5. Correlation matrix for variables in equation (2).

Variables	Risk	ICE	Size	ROA	Type	Leverage	Age	VIF
URisk	1.000							
ICE	−0.032	1.000						1.078
Size	0.300	0.147	1.000					1.292
ROA	−0.158	0.199	0.164	1.000				1.181
Type	0.188	−0.003	0.069	−0.136	1.000			1.620
Leverage	−0.020	−0.085	−0.040	0.152	.105	1.000		1.072
Age	0.050	0.058	0.449	0.246	−.035	−0.047	1.000	1.334

Urisk, ICE, Size, ROA, Type, Leverage, and Age denote underwriting risk, intellectual capital efficiency, Firm size, profitability, insurer type, leverage, and age, respectively.

Table 6. Tests for autocorrelation and heteroscedasticity.

Equation (1)		Equation (2)	
Test	P-value	Test	P-value
Breusch-Pagan test for heteroskedasticity	.000	Breusch-Pagan test for heteroskedasticity	.000
Test for first-order autocorrelation	.006	Test for first-order autocorrelation	.006

5. Empirical results and analysis

5.1. Regression results: ICE and underwriting risk

We used the generalized least squares (GLS) estimation methodology to determine the influence of ICE on underwriting risk. It corrected the serial correlation and heteroscedasticity in the early statistical examination of our data. It is acceptable as it addressed heteroskedasticity and autocorrelation. The GLS estimation methodology is effective in decreasing estimation errors.

Tables 7 and 8 show how ICE and its components affect underwriting risk. For the combined data on life and non-life insurance, individual life insurance, and non-life insurance companies, our results in Table 7 reveal a significant negative relationship between HCE and underwriting risk. This suggests that increasing HCE in insurance firms reduces underwriting risk. From Table 8, it is clear that there is no significant relationship between ICE and underwriting risk, and between SCE and underwriting risk. The analysis found a substantial positive relationship between underwriting risk and company size for the control variables. Profitability and age were negatively related to underwriting risk. Insurance type was discovered to have a significant positive effect on underwriting risk.

6. Discussion

Given the scarcity of research on ICE and its components on risk-taking behavior in the insurance industry, we analyzed our findings in the context of the finance industry. According to Ghosh and Maji (2014) and Dalwai, Singh, et al. (2021),

Table 7. GLS regression results.

	All Insurers	Non-Life Insurers	Life Insurers
URisk	Coefficient (Standard Error)	Coefficient (Standard Error)	Coefficient (Standard Error)
HCE	−0.003**	−0.007**	−0.029**
	(0.007)	(0.005)	(0.017)
SCE	−0.003	0.004	−0.003
	(0.003)	(0.009)	(0.004)
Size	0.067**	0.049**	0.066**
	(0.011)	(0.011)	(0.018)
ROA	−0.327**	−0.368**	−0.362
	(0.096)	(0.079)	(0.242)
Type	0.071**		
	(0.025)		
Leverage	0.003	0.009	0.022
	(0.025)	(0.021)	(0.064)
Age	−0.001	0.001**	−0.002**
	(0.001)	(0.001)	(0.001)
Constant	−0.755**	−0.483**	−0.674
	(0.176)	(0.187)	(0.298)
Number of Obs.	372	204	168
Number of groups	31	17	14
Prob>chi2	0.000	0.000	0.000
Log-likelihood	7.761	−35.435	89.787
Mean dep. var	0.416	0.370	0.470
SD dependent var	0.259	0.179	0.322

**denotes 5% significance levels. Urisk, HCE, SCE, Size, ROA, Type, Leverage, and Age denote underwriting risk, human, structural, and intellectual capital efficiency, firm size, profitability, type of insurer, leverage, and age, respectively.

Table 8. GLS regression results.

	All Insurers	Non-Life Insurers	Life Insurers
URisk	Coefficient (Standard Error)	Coefficient (Standard Error)	Coefficient (Standard Error)
ICE	−0.002	−0.004	−0.003
	(0.003)	(0.004)	(0.004)
Size	0.069**	0.051**	0.077**
	(0.011)	(0.011)	(0.017)
ROA	−0.289**	−0.391**	−0.07
	(0.086)	(0.076)	(0.191)
Type	0.072**		
	(0.025)		
Leverage	0.001	0.009	−0.035
	(0.025)	(0.021)	(0.057)
Age	−0.001	0.001	−0.002**
	(0.001)	(0.001)	(0.001)
Constant	−0.769	−0.501	−0.777**
	(0.176)	(0.187)	(0.297)
Number of Obs.	372	204	168
Number of groups	31	17	14
Prob>chi2	0.000	0.000	0.000
Log-likelihood	7.351	−37.283	89.233
Mean dep. var	0.416	0.370	0.470
SD dependent var	0.259	0.179	0.322

**denotes 5% significance levels. Urisk, ICE, Size, ROA, Type, Leverage and Age denote underwriting risk, human, structural, and intellectual capital efficiency, firm size, profitability, type of insurer, leverage, and age, respectively.

who investigated the impact of HCE on risk in the banking industry, HCE has a negative effect on the underwriting risk of insurance companies in Ghana. The findings support Thornhill and Amit's (2003) case for a risk-based approach to company bankruptcy. They contended that managerial deficiencies can lead to corporate collapse. Given that risk is a major reason for insurer failure, it stands to reason that managerial competence may influence insurers' exposure to underwriting risks.

The significant inverse relationship between HCE and underwriting risk for Ghanaian insurance (including life and non-life insurers) means that as insurance firm employee knowledge, skills, and competence improve, so too will their underwriting risk. This supports the conclusions of Ghosh and Maji (2014) and Nawaz (2019), who suggested that financial institutions must rely on their knowledge, professional experience, and skillsets to achieve efficiency in their business operations. These would allow the firm's workers to appropriately recognize and analyze potential signals of default throughout the proposal and screening processes, when the decision to underwrite a business is made. They emphasize that financial institutions rely on the knowledge of their staff to cope with problems that may surface in the underwriting process.

This finding shows that insurers must be cautious about the quality of the personnel they hire and guarantee the efficient utilization of staff talents and capabilities. This can have a significant impact on their underwriting risk management and exposure. As the insurance industry is knowledge-intensive, considerable investments in HCE are essential for insurers to survive (Kweh et al., 2014). Dalwai, Singh, et al. (2021) studied banks in 12 rising Asian nations and found that ICE had an insignificant negative effect on underwriting risk. They stated

that ICE had no relationship with bank risk-taking or stability. Our study lends credence to the resource-based approach, which contends that tangible and intangible assets drive corporate performance. Azmi and Kurniawan (2021) demonstrated that ICE has a detrimental impact on the risk of the banking sector. However, Zheng et al. (2018) found a positive relationship between risk-taking behavior and ICE in Bangladesh's banking sector.

SCE has a negative but minor effect on underwriting risk. It has the least impact on insurance underwriting risk. Chen et al. (2014) discovered that SCE leads to knowledge generation in a firm. Insurance companies in Ghana are evidently not making the best use of their organizational resources to ensure proper policy underwriting. The results could be attributed to the fact that the impact of SCE on underwriting risk may not be realized immediately owing to delays (Sydler et al., 2014).

This study found a significant positive relationship between the firm size of all insurers and the sub-divisions (life and non-life insurers) and underwriting risk. This aligns with Altuntas and Rauch (2017), who asserted that large insurers are more likely exposed to the risk than are their small counterparts. As insurers become large, it becomes difficult for managers to directly monitor individual policies underwritten, which may increase their underwriting risks.

Profitability, measured by return on assets, was found to have a significant negative connection with underwriting risk. Our findings support Ahmed, Ahmed, and Usman (2011), who demonstrated that underwriting risk influences insurance firms' return on assets. Connelly and Limpaphayom (2004) discovered a negative association between underwriting risk and insurance profitability.

The type of insurer had a considerable positive association with underwriting risk. Thus, assuming that all other things remained constant, the insurer's underwriting risk was projected to be 0.071 and 0.072 units for a life and non-life insurer, respectively. This could be related to the higher claims paid by life insurers relative to non-life insurers throughout the time. Akotey et al. (2013) confirmed that life insurers experience high underwriting losses owing to overtrading and price undercutting. Age, defined as the time the insurer was founded to the current year, had a considerable negative impact on the insurer's underwriting risk for life and non-life insurers. This is expected, as older insurers have greater expertise in adequately underwriting their products. This greatly reduces their underwriting risk.

In line with Kweh et al. (2014) and Oppong et al. (2019), we found that underwriting risk negatively impacts profitability. Our findings align with those of Kusi et al. (2019), Wani and Dar (2015), Adams and Buckle (2003), and Zainudin, Mahdzan, and Leong (2019). Independent of managerial skill enhancement, an incorrect underwriting of insurance policies may reduce profitability. However, research from the banking sector indicates that advancements in ICE and its components minimize the risk of these financial organizations (Ghosh & Maji, 2014; Nawaz, 2019; Nguyen et al., 2021). The significance of the findings cannot be understated. Given that HCE is negative and statistically significant, managers and policymakers in Ghana must devise strategies and policies to raise HCE over the life of non-life insurance enterprises. Alhassan and Asare (2016) discovered that investing in staff training can boost productivity and creativity.

7. Conclusion

The link between underwriting risk, ICE, and its components is absent in the literature on the insurance sector, despite the numerous studies in the banking sector examining them. Our study fills this gap in the literature. We examined the impact of ICE, HCE, and SCE on the underwriting risk of insurers in Ghana. The GLS estimation methodology was applied to panel data from 31 insurance companies (14 and 17 life and non-life insurers, respectively) from 2008 to 2019. This was after our preliminary statistical analysis indicated that the GLS estimation methodology was appropriate. We discovered a substantial negative connection between HCE and underwiring risk. Therefore, we recommend that insurers be cautious about who they hire because this can affect their exposure to underwriting risks. All insurers should ensure that their policy underwriting team is highly qualified, competent, and knowledgeable. Highly skilled personnel can appropriately recognize and analyze possible symptoms of default in the first phase when the choice to underwrite a policy is taken and then deal with concerns in the policy term. The analysis demonstrates that an insurer's size positively affects its underwriting risk. As insurers grow, the quantity and quality of staff should be increased to provide for direct control of underwriting activities. Insurance company executives must ensure that their underwriting efforts are adequately managed and drastically minimized. Periodic staff training should be encouraged to improve job efficiency. The regulator may implement incentives that promote insurers' HCE in Ghana. This can be accomplished by mandating a minimum set of academic and professional qualifications and certain years of relevant experience for core roles.

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