# Does intellectual capital have any influence on stock price crash risk?

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**Submission date:** 08-Dec-2022 03:22PM (UTC+0700)
**Submission ID:** 1975163798
**File name:** 10-1108_JIC-09-2020-0306-1-10.pdf (329.25K)
**Word count:** 5269
**Character count:** 27720

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https://www.emerald.com/insight/1469-1930.htm



# Does intellectual capital have any influence on stock price crash risk?

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Received 18 September 2020
Revised 5 January 2021
1 April 2021
Accepted 10 May 2021

## Abstract

**Purpose** – This paper explores the influence between intellectual capital (IC) and the risk of stock price crashes by using company performance as an intervening variable.

**Design/methodology/approach** – This study empirically analyzes the impact of the efficiency of IC on stock price crash risk using a sample size of 152 companies listed on the Indonesia Stock Exchange (IDX) during 2018. To test the research hypotheses, regression analysis and path analysis were applied. In addition, the researchers added exploration to several studies to strengthen the results of this study.

**Findings** – This study's findings indicate that investors' optimistic (pessimistic) sentiment regarding stock price volatility has obscured aspects of the financial performance of listed companies. This finding implies that investor sentiment has dominated influence on stock price crash risk so that the aspects of IC are obscured.

**Originality/value** – This research provides new information that IC disclosure in the stock market needs to include knowledge of the volatility of stock prices in order to reveal stock price crash risk.

**Keywords** Intellectual capital, Stock price crash risk, Firm performance, Disclosure, Social capital, Corporate governance convergence

**Paper type** Research paper

## 1. Introduction

Companies nowadays are being replaced with a knowledge-based, fast-changing and technology-intensive economy, including in Indonesia. Most companies use technology to enhance the efficiency of company activities and depress expenses incurred. In this modern economy, for many firms, the most important and essential asset is intellectual capital (IC), in sharp contrast to times when physical capital was the power of companies. Previous studies have shown that company value and capability are often based on the intangible IC that it possesses (Berzkalne and Zelgalve, 2014; Huang and Huang, 2020). Liu and Jiang (2020) have also proven that IC has a positive impact on business progress, such as increasing brand equity and social networking. In addition, IC provides various positive benefits for companies such as employees' job satisfaction and retention (Longo and Mura, 2011), increasing business innovation (Ornek and Ayas, 2015; Adesina, 2019), increasing the relevance of accounting information (Hayati *et al.*, 2015) and cost efficiency (Martinez *et al.*, 2020). In this study, we propose that the application of IC in the company is expected to reduce the risk on stock price crashes.

The purpose of this study is to find out the relationship between efficiency of IC and stock price crash risk in the future by using firm performance as the mediating variable. Clarke *et al.* (2011) stated that IC has a positive influence on firm performance, which is characterized by three components of IC efficiency (ICE): human capital efficiency (HCE), structural capital efficiency (SCE) and capital employed efficiency (CEE). These factors could be a good indicator for company shareholders because a company with good ICE indicates that they have been using their resources efficiently. Several studies have proven that IC reflects good

Journal of Intellectual Capital
Vol. 23 No. 6, 2022
pp. 1161-1174

1469-1930
DOI 10.1108/JIC-09-2020-0306

competence, skills and knowledge, which can improve financial performance and increase stock returns (Lentjushenkova and Lapina, 2014; Zhou and Pan, 2018). Thus, the company can disclose information in accordance with the needs of the shareholders.

Based on a Taiwanese study by Chen *et al.* (2005), this study uses the quantitative measure, value-added intellectual coefficient (VAIC), developed by Pulic (1998) as a measure of ICE. Data are collected for firms listed on the Indonesia Stock Exchange (IDX) in 2018. We used path analysis to determine whether there is any relation between IC, firm performance and stock price crash risk. Prior VAIC studies have investigated the direct relationship between IC and performance, but there is no research on the relationship between IC and stock price crash risk. This study contributes to the literature by bridging this gap in the knowledge, that is, the relationship between IC and stock price crashes.

This paper proceeds as follows. Section 2 reviews the relevant literature and develops our hypotheses. Section 3 describes the data and research design. Section 4 presents the main empirical results. Section 5 discusses the findings. Section 6 concludes the paper.

## 2. Literature review and hypothesis

### *2.1 Strengths and weaknesses of measuring intellectual capital*

Basically, IC is measured by various elements such as human capital, physical capital, structural capital, social capital and relational capital. However, previous studies have shown that there are several drawbacks to IC measurement. Adesina (2019) measured IC with three components, namely human capital, physical capital and structural capital; however, only human capital is positively related to all the three efficiencies (technical, allocative and cost). Castillo *et al.* (2019) proved that capabilities of human resources are relevant for these organizations, as well as the internal processes and relationships with customers. On the issue of environmental protection, Yong *et al.* (2019) revealed that green human capital and green relational capital were influenced by green human resource management, but green structural capital was not significantly related to green human resource management. Yusoff *et al.* (2019) also revealed that green human capital does not have a positive relationship with business sustainability.

Although IC possesses weaknesses, its advantages, demonstrated in previous studies, outweigh them. Barrena-Martínez *et al.* (2020) proved that the three components of IC (relational capital, human capital and structural capital) positively affect open innovation performance. Salvi *et al.* (2020) suggested a significantly positive relationship between all three components of IC and firm value, generating multiple implications for reporting entities, investors, regulators and managers. Mahmood and Mubarik (2020) showed that specific policies aimed at developing the IC of a firm, which in turn can enable a firm to maintain a balance between innovation and market exploitation activities. Yusliza *et al.* (2020) indicated the contribution of green IC to be an intangible resource for organizations in achieving sustainable performance, providing a competitive advantage for future researchers. Dubic *et al.* (2021) revealed that the intellectual agility of employees positively influences the innovativeness of micro and small businesses, but this effect is strongly mediated through entrepreneurial leadership, meaning that human capital has an important role in business innovation. This study will explore the efficiency of IC using three measures (human capital, structural capital and capital employed).

### *2.2 The determinant of information efficiency*

Internationally, the efficiency of share price information is influenced by investors' understanding of the long-term relationship between stock market volatility and the uncertainty of international economic policy (Belcaid and Ghini, 2019). A study in France also

shows that stock exchanges find it difficult to maintain the efficiency of stock information during global macroeconomic events (Boya, 2019). Hu *et al.* (2020) revealed that board reforms reduce crash risk by improving financial transparency and enhancing investment efficiency. In Indonesia, sub-optimal financial positions play a role in corporate share repurchase decisions, while the enactment of the regulations has a significant effect on firms undertaking share repurchase programs (Moin *et al.*, 2020). In China, regulations that promote the efficiency of share prices also play an important role in controlling stock prices (He and Fang, 2019). Thus, external factors, namely the ability of investors to analyze stock price volatility, macroeconomic events, financial transparency and government regulations, play a greater role in controlling the risk of stock price crashes, while IC does not play an important role in controlling stock prices.

Luo and Zang (2020) have proven that economic policy uncertainty is significantly and positively associated with aggregated stock price crash risk at the market level. Meanwhile, Wen *et al.* (2019) revealed that higher quality auditing can mitigate the impact of retail investor attention on firms' future crash risk. Lee *et al.* (2020) revealed that a supplier firm with a concentrated customer base experiences a higher crash risk, which is attenuated by lower switching costs and accentuated when the degree of information asymmetry is high. Another study shows that Chinese investor sentiment also affects stock price volatility (Li, 2019). Likewise, Ma *et al.* (2020) suggest that exposure to an undiversified corporate customer base can have a negative bearing on a firm's crash risk. The five studies indicate that economic policy, investor sentiment and audit quality have a significant effect on the risk of stock price crashes.

### *2.3 Intellectual capital efficiency*

IC represents a company's intangible knowledge assets in the form of information and knowledge resources (Kitts *et al.*, 2001). Several studies have revealed that ICE can improve the performance of companies (see, e.g. Clarke *et al.*, 2011; Gogan *et al.*, 2016; Asiaei and Jusoh, 2017; Mustapha and Abdelheq, 2018; McDowell *et al.*, 2018; Sardo *et al.*, 2018; Huang and Huang, 2020). Investors are quite interested in buying shares when the company has implemented ICE. Lin *et al.* (2015) and Ozkan *et al.* (2017) show that the greater the ICE, the more it reduces stock price crashes.

Jerzak (2015) shows that human capital constitutes inborn skills and acquired skills, which, if invested efficiently, can strengthen the company's position, helping it gain competitive advantage. This means that HCE represents a selection of superior IC to be employed in the company's business. Meanwhile, Asiaei *et al.* (2018) have proven that there is a significant positive relationship between HCE levels and the use of a balanced performance measurement system. Dženopoljac *et al.* (2016) also revealed that HCE has a direct positive impact on the financial performance of companies. Therefore, companies that have a higher HCE are more likely to have a higher return on equity (ROE), a higher return on asset (ROA), a higher return on invested capital (ROIC) and tend to be more profitable.

In general, various strategies have been carried out by many companies to regulate structural capital in order to optimize the overall business performance. IC plays a central role in determining the structural capital model used in companies. Gogan *et al.* (2015) posit that determining the right model in structural capital is essential to obtain a competitive advantage in the market. This study indicates that IC plays an important role in determining efficient structural capital so that the organization's desire to be competitive in the market can be achieved. In addition, Ciprian *et al.* (2012) explained that IC is not sufficient to determine the accuracy of structural capital sizes; it is necessary to complement positions on intangible assets that can help to determine company policies and decisions.

Andersson *et al.* (2006) revealed that shareholder demand is a higher return on capital employed, meaning that CEE represents IC, which can perform accurate calculations in capital investment in order to obtain optimal returns. Mørch *et al.* (2017) explained that CEE plays an important role in making investment decisions because accurate calculations are needed regarding the fitness of operations and the financial performance of investments. Thus, ICE plays an important role in investment decisions.

### *2.4 Intellectual capital efficiency measurement model on stock price risk*

Basically, the efficiency of ICE plays a role in the application of HCE, SCE and CEE. This study will examine the effect of ICE on stock price risk. In the testing process, we combine the measurement model of the performance of intellectual potential in the knowledge economy developed by Pulic (1998) and the calculation of the negative coefficient of firm-specific daily returns (NCSKEW) developed by Chen *et al.* (2017). ICE is calculated using three components, namely value-added human capital efficiency (VAHU), value-added structural capital (STVA) and value-added capital employed (VACA). Meanwhile, stock price risk is calculated using NCSKEW. More detailed calculations are explained in the methods section.

Several studies have used this model, which shows mixed results as well. Hejazi *et al.* (2016) found that increasing IC should increase firm value. Meanwhile, Kamukama and Sulait (2017) showed a positive and significant relationship between human capital, relational capital and structural capital on competitive advantage. Another study shows that the three sub-constructions of IC together have a positive and substantive relationship with business performance (Huang and Liu, 2005; Sharabati *et al.*, 2010). The four studies indicate that innovation and creation play a dominant role in describing the latent constructs of IC. Based on the discussion above, hypothesis (H1) is as follows:

*H1a.* HCE is positively related to firm performance.

*H1b.* SCE is positively related to firm performance.

*H1c.* CEE is positively related to firm performance.

Chen *et al.* (2005) have confirmed that investors place higher value on companies with better ICE. Furthermore, Song (2015) has shown that the management tends to hide some negative information and suddenly release negative information in the future if the company has a higher level of accounting disclosure of IC. Dong and Zhang (2016) have also shown that environmental control, information and communication and monitoring components significantly reduce the risk of accidents, while risk assessment and control activity components do not show any relation to the risk of a stock price crash. Ben-Nasr and Ghouma (2018) explained that employee welfare is also a factor that contributes to the risk of stock price crashes. Further analysis shows that a strong corporate governance mechanism can reduce the risk of rising stock price crashes in less unionized companies and that there is a negative impact of union strength on the risk of stock price crashes (Liao and Ouyang, 2017). Meanwhile, Anifowose *et al.* (2017) showed a positive relationship between IC as a whole and the market capitalization value of a company. Some of these studies imply that IC can reduce the risk of stock investment. Based on the above discussion, hypothesis (H2) is as follows:

*H2a.* HCE is negatively related to stock price crash risk.

*H2b.* SCE is negatively related to stock price crash risk.

*H2c.* CEE is negatively related to stock price crash risk.

Bennett *et al.* (2020) explained that the management, directly or indirectly, learns from its firm's stock price so that more informative stock prices should make the firm more

productive. This means that the informativeness of stock prices indicates that the company's performance is better. Martani *et al.* (2009) mentioned that a company's financial performance is shown by the profitability ratio, and the market value ratio significantly influences returns in the company. Based on this, the following hypothesis (H3) can be formulated as

*H3.* Firm performance is negatively related to stock price crash risk.

IC owned by the company is expected to create added value so that it can improve company performance. Good firm performance is an indicator that will be considered by investors in making investment decisions. Cenciarelli *et al.* (2018) show that bankruptcy prediction models that include IC have superior predictive capabilities over standard models. Meanwhile, stock price crashes are very likely to occur if the organization's internal controls are ineffective. The effectiveness of internal control depends on the research and development (R&D) conducted by the company. Zhou and Pan (2018) explained that companies that develop IC require capital for R&D, so they are faced with financing constraints. This means that ICE supports the effectiveness of internal control. In addition, the level of social trust also plays a role in the risk of stock price crashes. According to Cao *et al.* (2016), social trust, as a socioeconomic factor, is negatively correlated with accident risk. Companies in areas of high social trust tend to hide bad news. The management tends to disclose more related information to acquire investors. Thus, ICE is needed as a corporate strategy to increase information transparency and financial performance, which will result in increasing investor confidence. Based on the discussion above, we can hypothesize (H4) that

*H4a.* HCE is negatively related to stock price crash risk by using firm performance as an intervening variable.

*H4b.* SCE is negatively related to stock price crash risk by using firm performance as an intervening variable.

*H4c.* CEE is negatively related to stock price crash risk by using firm performance as an intervening variable.

## 3. Research design

### *3.1 Sample*

This study uses companies from various sectors as research objects and sample for the research. The sample was collected from IDX's annual report data for 2018. We also obtained weekly stock data from Yahoo Finance. We then used the following selection criteria: First, similar to Khan and Watts (2009), we required that total assets and book values of equity for each firm be greater than zero. Second, to be included in the sample, a firm must have at least 20 weekly returns for each fiscal year. We also excluded incomplete company data and financial information. Finally, we obtained samples from 152 companies to apply to the study.

### *3.2 Measurement of independent variables*

Chen *et al.* (2005) argue that VAIC and its three components, HCE, SCE and CEE, represent the independent variables. In order to calculate VAIC, we have to know the amount of HCE, SCE and CEE. This can be expressed in Formula (1).

$$\text{VAIC} = \text{HCE} + \text{SCE} + \text{CEE} \qquad \text{Formula 1}$$

To measure VAIC, we need value added (VA) to be calculated. In its simplest form, VA is the difference between output and input. Output represents net sales revenues and input contains all the expenses incurred in earning the sales revenues except labor costs, which are

considered to be a value-creating entity (Tan *et al.*, 2008). This VA is also defined as the net value created by firms during the year (Chen *et al.*, 2005). VA can be calculated using Formula (2).

$$\mathrm{VA} = S - B = \mathrm{NI} + T + \mathrm{DP} + I + W \qquad \text{Formula 2}$$

$S$ is sales; $B$ is cost of goods sold; NI is net income after tax; $T$ is taxes; DP is depreciation; $I$ is interest expense and $W$ is employee wages and salaries.

*3.2.1 Human capital efficiency.* Human capital factors consist of skills, knowledge, productivity, competence and all aspects that pertain to an employee in the work place. HCE can be calculated using a calculation developed by Pulic (1998), where HCE is calculated using the formula VAHU. VAHU calculations can be seen in Formula (3).

$$\mathrm{VAHU} = \mathrm{VA}/\mathrm{HC} \qquad \text{Formula 3}$$

*3.2.2 Structural capital efficiency.* Structural capital is an element in IC and consists of organizational networks, patents, strategy and brand names. Based on Pulic (1998), we calculated SCE as in Formula (4). Meanwhile, SCE is calculated using STVA as in Formula (5).

$$\mathrm{SC} = \mathrm{VA} - \mathrm{HC} \qquad \text{Formula 4}$$

$$\mathrm{STVA} = \mathrm{SC}/\mathrm{VA} \qquad \text{Formula 5}$$

SCE is the dollar of SC within the firm, for every dollar of VA, and as HCE increases, SCE increases. If the efficiency measures for both HCE and SCE were calculated with VA as the numerator, a logical inconsistency would remain (Pulic, 1998).

*3.2.3 Capital employed efficiency.* CEE is the efficiency that SCE and HCE fail to capture. Pulic (1998) argues that IC cannot create value on its own, and so it must be combined with capital (physical and financial) employed (CE). CEE shows how much VA is created by a dollar spent on CE. We could calculate CE as the total assets minus intangible assets and CEE is defined as VACA. VACA calculations can be seen in Formula (6).

$$\mathrm{VACA} = \mathrm{VA}/\mathrm{CE} \qquad \text{Formula 6}$$

### *3.3 Measurement of dependent variable*

The risk of stock price crash is the risk of a significant stock price decline after the price had soared (Kim and Zhang, 2016). This variable was developed using a model developed by Chen *et al.* (2017), which can be seen in Formula (7).

$$\mathrm{NCSKEW} = \frac{-\left[\frac{n(n-1)^3}{2}\sum_{T=1}^{n}\left(w_{i,T,t} - \overline{w}_{i,t}\right)^3\right]}{\left[(n-1)(n-2)\left(\sum_{T=1}^{n}\left(w_{i,T,t} - \overline{w}_{i,t}\right)^2\right)^{3/2}\right]} \qquad \text{Formula 7}$$

$W_{i,T,t}$ is the company's weekly specific stock returns for $T$ weeks in year $t$, $\overline{wi}$, $t$ is the average weekly return of the company's specific stock for year $t$ and $n$ is the number of weeks for year $t$. The larger NCSKEW represents a greater negative slope rate of return, which means a greater risk of stock price crashes that can occur.

### *3.4 Measurement of intervening variable*

This study uses firm performance as the intervening variable. We use ROE to analyze firm performance. We calculate this ratio with Formula (8).

$$\text{ROE} = \frac{\text{Earning after tax}}{\text{Equity}} \qquad \text{Formula 8}$$

*3.5 Empirical models*

This study uses path analysis that produce two model regressions to test our hypotheses.

$$\text{ROE} = \alpha + \beta 1\ \text{VAHU} + \beta 2\ \text{STVA} + \beta 3\ \text{VACA} + \beta 4\ \text{SIZE} - \mu \qquad \text{Model I}$$

$$\text{NCSKEW} = \alpha - \beta 1\ \text{STVA} - \beta 2\ \text{VACA} - \beta 3\ \text{AHU} + \beta 4\ \text{SIZE} - \beta 5\ \text{ROE} - \mu \qquad \text{Model II}$$

ROE is the ratio for measuring firm performance, NCSKEW is the negative coefficient of firm-specific daily returns as a proxy for stock price crash risk, VAHU is value-added human capital, STVA is value-added structural capital, VACA is value-added capital employed and SIZE is firm size as the control variable in this study.

## 4. Results

*4.1 Normality test*

Table 1 shows the significance value of Asymp. The Sig (two-tailed) is 0.200. The value is greater than 0.1. According to the basis of decision making in the Kolmogorov–Smirnov normality test above, it can be concluded that the data are normally distributed so that the assumptions or statements of normality in the regression model have been fulfilled for the data above.

*4.2 Multicollinearity test*

The basis for decision-making from the multicollinearity test is the value of tolerance (Tol) and variance inflating factor (VIF). Based on the output table, it is known that the tolerance value of each variable is greater than 0.1. While the VIF value for each variable is less than ten. Then, according to the basis for the multicollinearity test decision-making, we can conclude that there are no symptoms of multicollinearity in the regression model. Table 2 shows the results of the multicollinearity test.

One-sample Kolmogorov–Smirnov test

| | | Unstandardized residual |
|---|---|---|
| *N* | | 152 |
| Normal Parameters[a,b] | Mean | 0.000 |
| | Std. deviation | 0.924 |
| Most extreme differences | Absolute | 0.059 |
| | Positive | 0.037 |
| | Negative | −0.059 |
| Test statistic | | 0.059 |
| Asymp. Sig. (two-tailed) | | 0.200[c,d] |

**Note(s)**: a. Test distribution is normal; b. Calculated from data; c. Lilliefors significance correction and d. This is a lower bound of the true significance

**Table 1.** Normal probability test result

*4.3 Heteroskedasticity test*

Based on Figure 1, we know that data dots spread above and below or around the number 0. We can then see that the dots are not just clustered above or below. The distribution of data points does not form a wavy pattern, widening then narrowing and then widening again. We can also see that the dots do not make a certain pattern. According to the analyses, we can conclude that there is no heteroscedasticity problem; so a good and ideal regression model can be fulfilled.

*4.4 Path analysis*

In Table 3, Model 1 shows that the STVA and VACA coefficients have a significant positive effect on ROE at a significance level of 1% with a significance value of 0.015 and 0.000, respectively. While, based on Table 2, there is no significant relationship between VAHU and ROE at the 1% significance level; so we can conclude that H1(a) is rejected. Based on a beta test, VACA is the variable that most influences changes in ROE. The value of Sig. *F*-statistics shows that at a significance level of 1%, VAHU, VACA and STVA simultaneously influence

| Model 1 | Unstandardized coefficients *B* | Unstandardized coefficients Std. error | Standardized coefficients Beta | *t* | Sig. | Collinearity statistics Tolerance | Collinearity statistics VIF |
|---|---|---|---|---|---|---|---|
| (Constant) | −4.074 | 1.323 | | −3.079 | 0.002 | | |
| VAHU | −0.062 | 0.096 | −0.103 | −0.640 | 0.523 | 0.247 | 4.052 |
| STVA | 0.144 | 0.952 | 0.025 | 0.151 | 0.880 | 0.236 | 4.231 |
| VACA | 0.958 | 0.891 | 0.117 | 1.076 | 0.284 | 0.538 | 1.860 |
| SIZE | 0.123 | 0.043 | 0.248 | 2.857 | 0.005 | 0.847 | 1.181 |
| ROE | −0.271 | 1.481 | −0.021 | −0.183 | 0.855 | 0.475 | 2.104 |

**Note(s)**: Dependent variable (NCSKEW)

**Table 2.** Multicollinearity test results

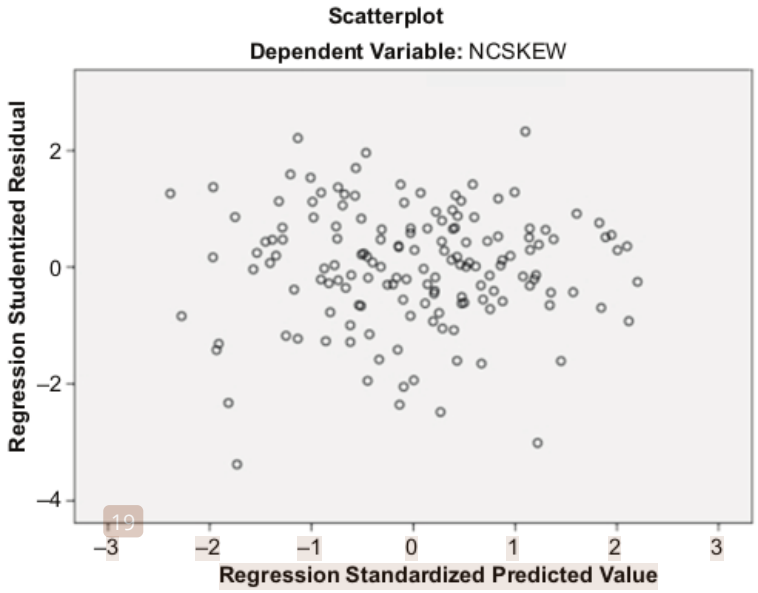


**Figure 1.** Heteroskedasticity test result

| | Dependent variable: ROE | | Dependent variable: NCSKEW | |
|---|---|---|---|---|
| | Predicted sign | Model 1 | Predicted sign | Model 2 |
| VAHU | + | 0.001 (0.005) | − | −0.062 (0.096) |
| STVA | + | 0.128** (0.052) | − | 0.144 (0.952) |
| VACA | + | 0.404* (0.037) | − | 0.958 (0.891) |
| SIZE (Control) | + | 0.010* (0.002) | − | 0.123 (0.043) |
| ROE (Intervening) | | | − | −0.271 (1.481) |
| Constant | | −0.340 (0.068) | | −4.074 (1.323) |
| *R*-square ($R^2$) | | 0.525 | | 0.066 |
| Sig. *F*-stat | | 0.000* | | 0.074*** |
| *N* | | 152 | | 152 |

**Note(s)**: This table presents the correlation coefficient number ($\beta$), while the number within parentheses is the standard error. *, ** and *** indicate significance at the levels 1%, 5% and 10%, respectively

**Table 3.**
Results of the regression model

ROE. This result is a strong indicator that there is a relationship between IC and firm performance, thus supporting H1(b) and H1(c). That is, if a firm can use its IC more efficiently in one year, this can lead to a performance increase in the same year.

In Table 3, Model 2 shows that all of the components of IC do not have any significant relationship with stock price crash risk at the 1% significance level. From Table 2, we also know that ROE does not have any significant influence on stock price crash risk. Furthermore, we use Model 1 and Model 2 for path analysis. After acquiring the numbers from Table 2, we calculated the indirect effect by multiplying the effect of the IC component with ROE and then ROE with stock price crash risk. Based on Table 2 and the path analysis calculation, VAHU has a direct effect on stock price crash risk of 0.103 while the indirect effect of VAHU on stock price crash risk through ROE is 0.000399. STVA has a direct effect on the risk of a stock price crash of 0.025 while STVA has an indirect effect on the risk of a stock price crash of 0.005922. Furthermore, the VACA component has a direct effect of 0.117 and an indirect effect of 0.01264 on the risk of stock price crashes. According to the principle of path analysis, if the indirect effect is greater than the direct effect, then it means there is a significant relationship in the indirect relationship between variables. We can conclude from the data that VAHU, STVA and VACA do not have any significant relationship with stock price crash risk either directly or indirectly through firm performance.

## 5. Discussion

Several studies show that IC plays an important role in improving sustainable company performance and business progress (see, e.g. Castillo *et al.*, 2019; Lee and Lin, 2019; Oppong and Pattanayak, 2019; Secundo *et al.*, 2020). However, the test results in this study prove that IC has no effect on stock crash risk on the IDX. In addition, other results show that the company's performance, as represented by ROE, also has no effect on stock price crash risk. We find that information inefficiency results in general distrust of stock markets in developing countries (Yang *et al.*, 2019). Information inefficiency is a global problem that always exists in the stock market, although more prevalent in developing countries than developed countries (Boya, 2019; Bartram and Grinblatt, 2021). Meanwhile, Al-Yahyaee *et al.* (2020) explain that high liquidity that is not balanced with low volatility will weaken information efficiency in the stock market. This indicates that a company's financial performance appears to be no longer considered in the share purchase decision.

Investors' optimistic (pessimistic) sentiment toward stock prices seems to dominate influence on the operation of the stock market. The sentiment index built on social media has

been shown to greatly influence the volatility of stock prices (Liang *et al.*, 2020). The optimistic (pessimistic) sentiment of Internet search-based investors can also influence premium value in the United States stock market (Teti *et al.*, 2019; Klemola, 2020). Meanwhile, Ni *et al.* (2019) reveal that the fluctuation of stock prices is more sensitive to the intraday sentiment of individuals. Chau *et al.* (2016) explain that sentiment-induced buying and selling is an important determinant of stock price variation. Based on explanations from various studies, we believe that investors' optimistic (pessimistic) sentiment toward stock price volatility dominates influence on buying or selling decisions, so that the financial performance aspects of listed companies are obscured in the stock market.

## 6. Conclusions and implications

### *6.1 Conclusions*

This study examines the effect of IC components on stock price crash risk by using firm performance as an intervening variable. This research is a quantitative study using secondary data on annual reports published by the IDX and stock price data published by Yahoo Finance. IC variables are measured by the VAIC method written by Pulic (1998), and stock price crash risk variables are measured by NCSKEW developed by Chen *et al.* (2017). Data were processed using the path analysis method to determine the direct effect and indirect effect from each of the interrelated variables.

Simultaneously, the VAHU, STVA and VACA variables have a significant relationship to firm performance; however, partially, VAHU does not have a significant effect like STVA and VACA. Capital employed has the biggest influence on firm performance. The results state that the three IC variables do not have a significant direct or indirect relationship with stock price crash risk. This result is in line with several previous studies. So far, the optimistic (pessimistic) sentiment of investors regarding the volatility of share prices has obscured aspects of the financial performance of listed companies. We conclude that investor sentiment has dominated influence on stock price crash risk so that the IC aspect has become obscured.

### *6.2 Implications*

So far, research on IC has been discussed in 700 articles written by leading authors at various universities (Dubic *et al.*, 2020). However, there is no research that discusses IC disclosure on the stock market. This research provides an understanding that the stock market is driven by the optimistic (pessimistic) sentiment of investors. This fact implies that IC disclosure, which is proxied by the company's financial performance, becomes obscured, while investors prefer to analyze the volatility of stock prices as a parameter in buying or selling decisions. In future research, it is necessary to modify the measurement of the intellectual property associated with knowledge of stock price volatility.

Basically, the ability and knowledge for compiling a stock portfolio that reveals specific information about the company is needed to increase shareholders' confidence (Chance and Yang, 2007). Meanwhile, specific information about the company will produce idiosyncratic volatility, which is the best predictor of stock returns and is proven to have a positive impact on investors' heterogeneous beliefs (Kongsilp and Mateus, 2017; He *et al.*, 2020). Zhan (2019) argues that there was a positive relationship between synchronization of stock price movements and stronger stock market volatility for emerging markets during the financial crisis from June 2007 to December 2008. As regards practical application, IC represents the knowledge and ability for preparing a stock portfolio that contains company-specific information, which is needed to minimize stock price crash risk.

# Does intellectual capital have any influence on stock price crash risk?

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