Leverage and Firms' Vulnerability: Do Crises and Industry Matter?

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ABSTRACT

This study aims to test whether a firm with a higher degree of leverage is more likely to be vulnerable during the financial crisis. The research sample comprises non-financial firms in Indonesia, Malaysia, and Korea during the period 2007-2019. Besides considering the duration and type of industry in comparing the effect of leverage, this study utilizes the pre-crisis period to determine the vulnerability. Using logistic regression, the result indicates that a higher degree of leverage is more likely to reduce a firms' financial health as expected, but surprisingly the effect is higher during the industry crisis than the global financial crisis. Furthermore, the nature of the industry provides different effects of leverage on firms' vulnerability. A further concern of the industry characteristic is needed, especially the new and emerging industries, particularly in evaluating and crafting regulation relates to leverage. Additional tests explore channels through which leverage generates these effects.

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Keywords: Crises; industry characteristic; leverage; vulnerability

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INTRODUCTION

The composition of debt and equity has become an issue of fiscal policy due to deductible expenses allowed. Instead of mitigating tax avoidance, the purpose is to strengthen the economic buffer to face financial crises. Hill and Shiraishi (2007) stating that Indonesia was more severely affected by the crisis than any other country in Asia. The Asian financial crisis in 1997-1998 showed that Indonesia, Korea, Malaysia were the country in Asia that had the highest number of companies experiencing financial distress (Pomerleano, 1998). It raised a fundamental issue that leverage is predicted as the main factors in dealing with the cause of firms' distress.

The effort to determine the factors that cause companies to experience decreasing financial health or being vulnerable is crucial. Leverage is an important factor, especially during a crisis Claessens et al. (2000). The weak financial structure before the crisis left companies vulnerable to economic conditions. This is supported by Hossain and Nguyen (2016) and Matsumoto (2007). By looking at the impact of the global financial crisis, it is very important to further study the leverage and its effect on the vulnerability of companies in Indonesia, Korea, and Malysia. Research related to is said to still receive little attention (Haron and Haron, 2016; Moosa and Li, 2012). This poor condition is supported by poor performance and industry conditions (Andrade and Kaplan, 1998).

The firms need to adjust the capital structure in a financial crisis (Indonesia, 2009). Alfaro et al. (2019) examined the relationship of leverage and fragility of non-financial firms in developing countries during the global crisis. The results of the study prove that leverage plays an important role in influencing performance in times of crisis. This supports the research of Opler and Titman (1994) and Fosu et al. (2016).

The choice between debt and equity, called governance structures, takes into account transaction costs. Equity is a form of funding suitable for projects that are high-specificity or high transaction costs. Transaction economic theory (TCE) underlines the importance of leverage as a governance structure instead of as a financial instrument. Under this theory, the structures which are governed by the nature of transactions will give a lower cost. If a highly specific asset is financed by debt, it will lead to low performance (Williamson, 1979). On the other side, agency theory (AT) states that high debt will lead the company to have a better performance.

This study aims to test whether leverage is a determinant of firms' vulnerability during the financial crisis, the effect of leverage during the first until the third years of the crisis, and those effects for mining and non-mining industries. The difference from the previous research is the determination of vulnerability. The previous research uses a particular score to determine the healthy or vulnerable firms. In this study, the pre-crisis financial condition is considered as an addition to the financial score. When the pre-crisis and during a crisis the score is low, it cannot be categorized as vulnerable. Therefore, it directly differentiates the vulnerable firm from those who are inefficient in the long term period. This study covered financial crisis that includes both global and industry crises together with its duration. The industry crisis occurred in different periods between industries during 2007-2019.

LITERATURE REVIEW

In general, research on leverage and financial vulnerability is rooted in research on leverage and performance that usually explained by two perspective i.e. Agency theory (AT) and TCE. The agency theory perspective on capital structure states that debt is an investment or management plan to reduce agency conflicts. It explains that leverage is positively related to company performance or value (Margaritis and Psillaki, 2007; Vithessonthi and Tongurai, 2015b).

TCE is related to governance of contractual relations in two-party transactions (Williamson, 1979; Coase, 1937; Williamson, 1975). It can explain that leverage has a negative effect on company performance when examined during a crisis period (Olaniyi et al., 2015; Molina, 2005). Singhal and Zhu (2013) states there are two ways to manage them, namely debt and equity. TCE is used in supporting the hypothesis that leverage has a negative effect on firm performance for companies that are expanding in new markets (O'Brien et al., 2014). TCE is said to be a perspective that provides a more complete picture because it includes several factors such as lenders' expectations of the risk of investments (Kochhar, 1996; Balakrishnan and Fox, 1993). In the crisis

period, the firms emphasize managing transaction costs more than mitigating agency conflict. The strategy to manage the cost relates to the industry characteristic has to be considered. Based on the context of developing countries as expressed by Le and Phan (2017), industry characteristics and the effort to govern financing structure in facing the crisis period will minimize transaction cost. Thus, TCE theory will be used in this study.

Leverage and firms' vulnerability in global financial crisis

The financial crisis is associated with phenomena such as substantial changes in credit volumes and asset prices, disruption of the intermediary function, and supply of external funding, as well as problems with the balance of the company, household, government, and financial institutions (Claessens and Kose, 2013). Vithessonthi and Tongurai (2015a) state that the leverage effect on performance is positive for large firms, and those firms have managed to survive the global financial crisis of 2007-2009. The firms' vulnerability must be emphasized in this study due to the different form from the long-term inefficient firms. When using only the financial score, these firms can be treated similarly. Thus, in this study, the pre-crisis period will be considered.

The financial crisis raises the fundamental issue of the role of leverage in the business continuity (Berger and Bouwman, 2013; Salim and Yadav, 2012; Dodd et al., 2021). Capital is said to be the main line of corporate defense in the face of a crisis. Crisis conditions are considered to have an influence on firms' performance (Zeitun and Saleh, 2015). In unfavorable environmental conditions, the risk faced is certainly greater if the company has a higher level of debt. In unfavorable conditions, high leverage tends to reduce the percentage of market share and has a lower operating profit than competitors.

> *H1: Firms with higher leverage who experience a period of global financial crisis tend to be vulnerable.*

Leverage and firms' vulnerability in industry crisis

Industry crisis is a narrower scope of financial crisis but affects the condition of the company. This industry crisis is a decline in industry performance due to certain events outside the control of the organization (Calandro Jr, 2007). Industry is said to be distressed when the median sales growth is negative and when the median stock return is below 30 percent (Opler and Titman, 1994, p.1372, Gopalan and Xie, 2011).

In relation to leverage, assessing differences between industries is important. The degree of leverage is acceptable for one industry, but may not be suitable for another industry. Industry characteristics are key in explaining capital (Campello, 2006; Muradoğlu and Sivaprasad, 2012). Each company is defined by its context, namely the industry (Arend, 2009). Chen and Wei (1993) and Islam and Khandaker (2015) state that mining industry are more risky than other industries in this regard.

Ofek (1993) provides empirical evidence that there is a positive relationship between leverage and the possibility of operational activities experiencing distress. The higher the debt funding, the lower the condition of the company during the crisis (Alfaro et al., 2019; Männasoo et al., 2017). Capital affects performance in times of crisis but the magnitude of influence varies between types of crises that occurred (Berger and Bouwman, 2013; Ashraf et al., 2020). High leverage is the main source of corporate financial difficulties, especially in bad industrial conditions (Andrade and Kaplan, 1998; Opler and Titman, 1994). In addition to analyzing crises as a whole, an analysis of individual crises was also carried out. Based on the theory and previous research, the formulation of the research hypothesis of the influence of leverage on potential vulnerability in the context of the occurrence of financial crises is as follows:

> *H2: Firms with higher leverage who experience a period of industry crisis tend to be vulnerable.*

METHODOLOGY

This study surveyed companies listed on the Indonesia, Korea, and Malaysia Stock Exchange, except in the financial sector. Those countries are the three highest percentage of the firm in distress in Asian financial crisis (Pomerleano, 1998). The exclusion of financial sector is related to the different characteristics compared to other

sectors. Financial obligations required by banking and insurance companies cannot be compared to non-financial companies (Rajan and Zingales, 1995).

This study focuses on the crises that occurred between 2007 and 2019. The year 2007 is the global financial crisis period, while 2019 is the pre-COVID-19 pandemic. They include global financial crisis, industry crisis, and when both crises occurred simultaneously. Because the pre-crisis is considered to determined vulnerability in the crisis period, the data in 2006 is used as well. Companies in the different sectors experienced a different period of industry crisis. Data were analyzed using STATA.

The industry or sector classification in this study refers to The North American Industry Classification System (NAICS). NAICS classification was used because it provides classification of a new industries or industries that are starting to develop such as wireless telecommunications, and internet publishing that illustrates the current economic direction.

Research model

This study uses unbalanced panel data to test the effect of leverage to firms' vulnerability. Using logistic regression the research model is:

$$
\begin{aligned}
log\left(\frac{Prob(VULN_{i,t})}{1-Prob(VULN_{i,t})}\right) \\
= \alpha + b_1 DER_{i,t-1} + b_2 SIZE_{i,t-1} + b_3 TANG_{i,t-1} + b_4 AGE_{i,t-1} + b_5 DIVERS_{i,t-1} \\
+ b_6 INTER_{i,t-1} + b_7 BGROUP_{i,t-1} + e
\end{aligned}
\tag{1}
$$

Where *VULN* measures the probability of the firm being in a vulnerable condition. *VULN* is a dummy that equals one if the firm is vulnerable, and zero otherwise. *DER* is leverage, proxied by debt to equity ratio. Control variable *SIZE* is a firm size that is measured by Ln total asset; *TANG* is calculated as fixed asset divided by total asset. *AGE* is natural logarithm number of year since the firm established to observation year, and *INTER* is a dummy one for export oriented firm, zero otherwise. *BGROUP* is dummy one for the firm as a member of conglomeration or business group, zero otherwise. Lagged leverage and control variable are used as Berger and Bouwman (2013).

Variable definition

Leverage shows the degree of indebtness, i.e. the amount of debt to other accounts that is significant in the statement of financial position (Gitman and Zutter, 2012). The debt to equity ratio is one ratio that is the center of attention of creditors related to the high ratio that puts their loans at the risk of not being paid. This ratio shows the amount of debt used to finance assets relative to equity. The measurement of this ratio is Debt to Equity.

Vulnerability is measured by dummy variable, one for vulnerable, zero for other. A firm is vulnerable if the Altman Emerging Market Score (EMS) is in the safe area in the pre-crisis period, then decreasing in the crisis period. Altman EMS is a choice among several other measurements such as financial ratios, Altman Z-Score (Altman, 1968), and credit rating. This score is said to have conformity with a trusted rating agency (Alfaro et al., 2019; Altman, 2005). The Altman Z-score has a very good performance over the market model (Chen et al., 2018). This is supported by research related to the use of this Z-score (Alfaro et al., 2019; Altman et al., 2017; Citron and Taffler, 2004).

The crises in this study include the global financial crisis and industry crisis. Instead of using the whole year, the duration of crises from the first year, second, and third year is used. Furthermore, additional analysis will be provided by analyzing the effect of leverage on vulnerability in the industry crisis that is preceded by the global crisis. Industry is said to be distressed when the median sales growth is negative. In the research of Opler and Titman (1994) and Gopalan and Xie (2011), industries experience distress if the median sales growth is negative and when the median stock return is below 30 percent. To adjust to the character of developing markets, the criteria related to capital markets are ignored in this study (Eldomiaty, 2008; Ramjee and Gwatidzo, 2012). Previous research uses 2007-2009 as the context or year of the financial crisis (Burzala, 2016; Görg and Spaliara, 2018; Kacperczyk and Schnabl, 2010). The crisis that year was different from the previous crisis, namely the 1997-1998 Asian financial crisis. The 2007-2009 crisis originated from the largest and most

influential economy, namely the United States, and brought the influence of this crisis to other countries in the global market (Wang, 2014).

EMPIRICAL RESULTS

Descriptive statistics

Table 1 presents the summary statistics of the variables for total samples and the groups of mining and non-mining. Chen and Wei (1993) state that mining industry are more risky than other industries in this regard. This statement is supported by Islam and Khandaker (2015) that there are fundamental differences related to leverage between mining and non-mining companies. This table explains the variables used to test the hypothesis of firms' vulnerability (*VULN*), leverage (*DER*), size (*SIZE*), tangibility (*TANG*), age (*AGE*), international oriented firms (*INTER*), and membership in a business group (*BGROUP*). It explains the variables only in the year of the crisis namely the industrial crisis or global crisis. Table 1 part A, is a description of variables using dummy 1 and 0. It explains the magnitude of the proportions for each of the dichotomous variables. Table 1 part B, explains the descriptive statistics for continuous variables.

Table 1 Descriptive statistics of variables

		(1) Obs	(2) Min	(3) Max	(4) Mean/proportion	(5) Std. dev
A:	**Dichotomous variables**					
VULN	*Total*	3446			.358	
	Non-mining	3250			.318	
	Mining	196			.361	
INTER	*Total*	3446			.404	
	Non-mining	3250			.406	
	Mining	196			.326	
BGROUP	*Total*	3446			.169	
	Non-mining	3250			.166	
	Mining	196			.180	
B:	**Continuous variables**					
DER	*Total*	3446	0.0002	6.731	0.967	0.898
	Non-mining	3250	0.0002	6.731	0.962	0.898
	Mining	196	0.0002	5.954	1.058	0.891
SIZE	*Total*	3446	0.500	24.550	14.297	3.607
	Non-Mining	3250	0.500	24.550	14.169	3.538
	Mining	196	9.942	22.829	16.418	4.072
TANG	*Total*	3446	0.000	2.500	0.500	0.214
	Non-mining	3250	0.000	2.500	0.500	0.214
	Mining	196	0.029	0.979	0.505	0.206
LNAGE	*Total*	3446	0.693	7.610	3.193	0.739
	Non-Mining	3250	0.693	7.610	3.221	0.728
	Mining	196	0.693	3.970	2.732	0.769

The summary of the overall picture of the two groups, namely vulnerable and healthy firms from each of the independent variables and control variables is depicted in Table 2. The correlation matrix of the variables are presented Table 3.

Table 2 Descriptive Statistics of healthy and vulnerable firms

Variables	Healthy N=2157	Vulnerable N=1289	Sig.
A: Continuous variables			
SIZE	14.484	13.984	0.000
TANG	0.461	0.566	0.000
AGE	3.229	3.132	0.000
B: Dichotomous variables			
INTER	0.425	0.414	0.515
BGROUP	0.186	0.175	0.397

Table 3 Variable Correlation

	FRAG	DER	SIZE	TANG	AGE	INTER	BGROUP
FRAG	1.0000						
DER	0.3647	1.0000					
SIZE	-0.0670	0.1600	1.0000				
TANG	0.2380	-0.1162	0.0558	1.0000			
AGE	-0.0634	-0.0259	0.1367	0.1269	1.0000		
INTER	-0.0111	-0.0997	-0.1410	-0.0579	0.0766	1.0000	
BGROUP	-0.0144	0.0788	0.3056	0.0953	0.0439	0.0791	1.0000

Table 2 illustrates the number of companies that in a period of crisis remained in good condition (2157 firm-year data), and 1289 firm-year data for companies in crisis experienced vulnerability. Part A is the average description of each continuous variable and B is the description of the proportions for the dichotomous variable. This proportion is the number of internationally oriented companies (*INTER*) to the total companies in each healthy or vulnerable group. Likewise, the proportion of companies included in the business group (*BGROUP*) to the total number of each healthy and vulnerable group. Part A shows that the average *DER* for the healthy companies group is 0.714 while vulnerable firms are higher with an average of 1.391. The *DER* or leverage test shows a significant difference between the two groups. The correlation of variables is presented in Table 3. In general, the result shows a low correlation. The VIF has a low score at the value of 1.09 on average.

Leverage effects on firms' vulnerability during financial crisis

In this section, the main results are divided into the group of financial crises, i.e., industry crises, global financial crisis, and when those crises occurred simultaneously.

Table 4 Logistic regression base on crises

	(1) Global crisis	(2) Industry crisis	(3) Global and Industry crises
DER	1.239***	1.683***	1.443***
	(12.94)	(15.11)	(7.99)
SIZE	-0.101***	-0.132***	-0.098**
	(-4.85)	(-6.82)	(-2.47)
TANG	3.609***	4.770***	3.831***
	(10.33)	(14.27)	(5.79)
AGE	-0.207**	-0.327***	-0.276*
	(-2.36)	(-3.70)	(-1.68)
INTER	0.356**	0.291**	-0.053
	(2.55)	(2.37)	(-0.21)
BGROUP	-0.113	-0.265	-0.515
	(-0.64)	(-1.56)	(-1.48)
_cons	-1.637***	-1.716***	-1.598**
	(-4.21)	(-4.41)	(-2.14)
N total	1248	1785	413
N (vulnerable)	479	645	165
N (healthy)	769	1140	248
Pseudo R^2	0.200	0.228	0.225

Note: *t* statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4 shows the effect of the main variables leverage (*DER*) and control variables to the dependent variable probability the firms become vulnerable. It illustrates that DER has a significant effect on the 0.01 level in all types of crises, namely the industrial crisis, global crisis, or when both crises happen simultaneously. With exponentiated coefficients $e^{1.239}$, $e^{1.683}$, $e^{1.443}$, or 3.452, 5.381, and 4.233, indicates a magnitude greater than 1, then the direction has a positive effect. With this description, the results of the logistic regression test in this study indicate that the leverage effect is highest when the industry crisis strikes, even exceeded the period of the global and the industry crisis occur together. This illustrates that the higher leverage provides the possibility that companies will experience vulnerability during an industry crisis more than the other crises.

A robustness check was performed using different measurements of leverage, that is, long-term debt to total asset and total debt to total asset. Besides, lag two years of the leverage is used to minimize endogeneity problem (Berger and Bouwman, 2013; Opler and Titman, 1994). Second, using quartile for degree of leverage, the highest and the lowest quartile were tested and thirdly, using alternative cut off to categorize firm size into small, medium, and large firm. The results of this test are generally similar to the main results (Appendix 3).

Leverage effect on firms' vulnerability base on industry

In Table 5, logistic regression for the mining industry and non-mining industries is presented. It describes the effect of leverage on a company's probability to be vulnerable in the context of a crisis period. This crisis covers both the industry crisis and the global financial crisis. Column (1) is logistic regression for all samples by including industry effects, while column (2) and column (3) are logistic regression of mining and non-mining industries.

In Column (1) Table 5, the results show that exponentiated coefficient of *DER* is $e^{1.433}$ or 4.233 or has a positive effect with significance <0.01. The results of the whole column (1) and the following description of each industry and the code used can be seen in Appendix 1 and 2. It appears that several industries with ID codes 4, 7, 8, 10, 12, 13, 14, and 15 are significant with a positive coefficient, respectively, which means the vulnerable probability of those industry is higher than the mining industry as industry base. While in Indonesia, the only industry that is healthier is the industry with ID 3 (utility industry) with a negative coefficient. This study does not compare the mining and non-mining industry in Korea due to the limited samples of mining industries in this country.

In Column (2 and 3) Table 5, *DER* has positive effect on the vulnerable probability for the mining industry. The logistic regression test results are shown with coefficient value of 0.577 for the mining industry and 1.525 for the non-mining industry. With this description, the results of the logistic regression test in this study indicate that the leverage effect is higher in the non-mining industry. Column (4), (5), and (6) shows that the effect of leverage on firm vulnerability among countries and the highest is in Korea.

Table 5 Logistic regression base on industry and country

	(1)	(2)	(3)	(4)	(5)	(6)
	All samples	Mining	Non-mining	Indonesia	Malaysia	Korea
DER	1.433***	0.577***	1.525***	1.226***	1.490***	2.076***
	(20.87)	(2.85)	(21.14)	(10.81)	(13.88)	(10.34)
SIZE	-0.115***	-0.188***	-0.111***	-0.164***	-0.311***	0.065
	(-8.16)	(-2.86)	(-7.89)	(-3.12)	(-6.91)	(1.40)
TANG	4.700***	3.681***	4.256***	3.583***	5.708***	7.725***
	(18.87)	(3.61)	(18.24)	(7.68)	(15.20)	(8.80)
AGE	-0.246***	0.548*	-0.313***	0.065	-0.199***	-1.001***
	(-4.09)	(1.72)	(-5.19)	(0.40)	(-2.60)	(-4.59)
INTER	0.256***	-0.411	0.315***	-0.011	0.289**	0.656
	(2.73)	(-1.08)	(3.54)	(-0.01)	(2.34)	(1.58)
BGROUP	-0.381***	-0.906	-0.209*	-0.196	-0.343*	-0.183
	(-3.19)	(-1.61)	(-1.77)	(-0.91)	(-1.66)	(-0.57)
_cons	-2.341***	-1.498*	-1.696***	-1.112	-0.606	-4.897***
	(-7.15)	(-1.76)	(-6.26)	(-1.59)	(-1.13)	(-3.85)
N total	3446	196	3250	903	1932	611
N-vulnerable	1289	62	1227	268	770	251
N-health	2157	134	2023	635	1162	360
Pseudo R²	0.230	0.175	0.225	0.214	0.241	0.393
Industry effect	Yes			Yes	Yes	Yes

Duration of crisis

To provide a detailed picture of the leverage effect on firms' vulnerability base on the duration of crises, that is, in the first year of crisis, second year, and the third year. In this research, the crises duration includes the years 2007-2009, which are the years of the global financial crisis in Asia. The duration of industry crisis is different among sectors. Sometimes one industry or sector only experienced one year of crisis, while others have experienced two, or three years of crisis. Table 6 provides the logistic regression result with context of crisis duration.

Table 6 Test of leverage on firm vulnerability base on crises duration

Crises duration	Global crisis	Industry crisis	Industry crisis preceded by the global crisis
First year	1.092***	1.433***	6.771***
Second year	1.130***	1.867***	
Third year	1.707***	1.626***	

Note: *t* statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6 contains the result of leverage effect on firm's financial considering the duration of crises. For the first year the coefficient show 1.433 and 1.092 significance in the level of 1% for industry crisis and global crisis, respectively, indicating that the global crisis has a lower leverage effect compared to industry crises. For the second year and the third year, the effect is stronger for the global crisis but not for the industry crisis. Thus, when the industry crisis is preceded by a global crisis the effect is the strongest.

The result of using the context of crisis duration can be summarized. First, the longer the global crises, the higher the leverage effect on the firm probability has experienced vulnerability. Second, the longer the industry crisis, the leverage effect is higher until the second year. Even so, the leverage effect is higher compare to the global crisis.

Leverage and vulnerability in industry crisis

Different types of crisis cause different effects. Atkeson et al. (2017) stated that three crises which occurred during 1926 to 2012 resulted in irregularities in company performance, but the other crises did not. Likewise, Görg and Spaliara (2018) which examined the effect of debt on potential export market exits, found that for the crisis period of the European currency exchange rate (ERM), debt has no significant effect. Conversely, the global financial crisis has a significant debt effect. Berger and Bouwman (2013) who examined the effect of capital on the potential survival of banking companies, stated that capital influences the potential for survival both in bank crises and market crises. Furthermore it is said that the two crises gave the same results but the magnitude of the effect was different.

The results of this study support the research hypothesis that companies with higher leverage tend to be potentially vulnerable in times of industry crisis. In a broader context of performance, the results of this study support Opler and Titman (1994) who showed that in an industry crisis, companies with high leverage have low performance. Andrade and Kaplan (1998) stated that leverage is the main cause of distress. In addition, poor company performance and poor industry performance also have a role in this regard.

Acharya et al. (2007) found that when industries have specific asset characteristics, non-deployable, and its debt guaranteed by special assets, then they experience industry distress. The specific assets are difficult to use or sell in this condition. It described that distress industry was not only experienced by individual companies, but also by creditors and healthy companies. By comparing the industry, this study shows that the nature of the industry is crucial to governing the structure through debt or equity. When the industry has character for a high-specificity project, higher leverage is not the more suitable financing form and the contrary. This study support transaction cost theory that is when the specificity of an asset is high the transaction cost of governance through debt will extremely high. The higher the leverage does not merely mean the higher probability to be vulnerable. The results of this study differ from those of Opler and Titman (1994) who stated that the effect on performance is smaller during an industry crisis. It also said that during the industry crisis is characterized by asset sales activity. This is of course contrary to the results of research by Acharya et al. (2007) which demonstrated that in an industry crisis asset sales will be difficult. This difference is caused by the different character of the industry and assets, resulting in different valuation results.

Leverage and vulnerability in the global financial crisis

Vithessonthi and Tongurai (2015a) who conducted research in the global crisis 2007-2009 stated that the crisis context provides a natural setting to determine the effect of leverage and performance. A global financial crisis will prevent companies from obtaining new sources of funds due to credit contractions. Görg and Spaliara (2018) stated that companies with high leverage experience greater difficulty in obtaining funding during extreme economic conditions. The influence of the condition of the global financial crisis was also shown by Cerutti et al. (2015) who proposed that just before the crisis, there were drawdowns or withdrawals of credit large enough to increase the number of risky loans between countries when the crisis occurred. This is in line with Shahzad et al. (2015) who stated that leverage affects company performance in times of global crisis.

The leverage effect in the period of the global crisis is the lowest. On the contrary, industry crisis is the highest even compared to the period of when both crises occur at the same time. In the Asian crisis in 1997-1998, Indonesia following by Korea and Malaysia are the most affected Asian countries (Pomerleano, 1998).

Learning from this experience, several developing countries began to prepare themselves to face the crisis including international portfolio reserves to anticipate the cessation of foreign funding (Forbes et al., 2012).

During the global crisis, the Indonesian economy was affected by the global economic turmoil, but overall it was still able to show performance that was nearly equal to the previous year (Indonesia, 2008). Indonesia's economy spatially began to diversify in 2009. The manufacturing sector in Java grew quite high, thereby reducing the impact of the recession on the weakening of the economic sector outside Java (Indonesia, 2009). Basri and Rahardja (2010) stated that the impact of the global crisis was relatively smaller compared to Malaysia and Thailand. In this study, the effect of leverage on vulnerability is Indonesia is the lowest among Malaysia and Korea. After falling into a recession in 1997/1998 and a country with the highest number of companies experiencing financial difficulties among other Asian countries, Indonesia was prepared for this global crisis, especially in the financial sector include regulation of leverage through fiscal policy. It regulates deductible interest expense related to the composition of debt to equity. The regulation has already considered the nature of the industry. Unfortunately, the rapid changing of technology and consumption pattern, have to consider the new and emerging industries is needed. This study shows that most of those industries relatively vulnerable compare to the mining industry.

Leverage and vulnerability in the non-mining industry

Generally, a higher average level of leverage in the non-mining sector has a higher chance of experiencing vulnerability than the mining industry. In the case of Indonesia, the utility industry tends to have lower vulnerability than the mining industry, even though the average leverage in this industry is higher. Roberts and Zurawski (2016) state that leverage in this industry tends to be higher than in other industries. The characteristics of products in this industry tend to be important community needs. This condition allows consumers not to reduce consumption or change consumption patterns in times of crisis. This industry is also said to have a stable income level (Alves Amaral-Baptista et al., 2011), while the research of Acharya et al. (2007) stated that the utilities industry has a high recovery rate after facing a crisis.

Some industries show a higher potential for vulnerability than the industry used as a basis for testing, namely the mining industry. The retail industry both stores and non-stores as well as the information industry, the potential for corporate vulnerability is higher than the mining industry. For the retail industry, the average degree of leverage is also higher than the mining industry. Such conditions certainly encourage the potential for vulnerability in this industry to be even higher. The retail industry is greatly affected by the shift in consumption patterns. In this sector there is migration from physical to online or possibly in the future switching to superstores or supercenter (Hortaçsu and Syverson, 2015).

For the information industry, which is dominated by companies engaged in communication, media and TV, it is also said to be sensitive to change. Doyle (2016) stated that this industry is highly influenced by technological change. Internet-based technology not only causes evolution but also becomes a confounding factor in existing conditions. When viewed from the crisis that occurred, in fact the three industries did not go through the number of industrial crises more than the mining industry. Empirical evidence of this study states that the character of the industry allows for higher potential vulnerabilities than the mining industry.

The construction and professional industries also have the potential to be more vulnerable than the mining industry. The construction industry is said to be quite difficult to achieve efficiency in times of crisis. The industry also has problems in choosing input compositions that are able to minimize long-term costs (Kapelko et al., 2014; You and Zi, 2007). In non-tradable sectors such as the construction industry, increasing leverage is very important (Alfaro et al., 2019).

Professional industries have a similar character to the information industry that is innovative and technology-based. This makes it possible to have a fairly high cost of research and provide the same possibilities when facing a crisis. Dekoulou and Trivellas (2014) stated that industries engaged in advertising and media such as professional industries, face high competition, financial instability combined with rapid technological evolution, and endless diversification of consumers. Such conditions certainly require investment in human resources and new technologies on an ongoing basis. Miao (2005) claimed that companies tend to have a lower level of leverage if the industry is associated with high technology. These industry characteristics are more exposed to high transaction costs, which of course will have lower risk if funded with a larger share of equity.

CONCLUSION

This research empirically addresses the following results. First, the companies with higher leverage who experience both global and industry crises tend to experience financial vulnerability. Second, in the industry crisis, the effect of leverage on vulnerability is higher. A further concern of the industry characteristic is needed particularly when it is highly dominated by changes in consumption patterns, innovation, and technology such as retail, information, and professional industries. On the contrary, a specific industry with higher leverage needed by the wider community does not experience changes in consumption, innovation, or technology, less vulnerable in times of crises. The results of this study support the theory of Transaction Cost Economics. When the specificity of assets of the industry is high, the transaction cost of governance through debt will be extremely high.

Arising from the measurement of vulnerability, which considers pre-crisis financial conditions, it is possible to differentiate the vulnerable firms from those of the long-term inefficient firms. This study may assist regulators in crafting or evaluating the fiscal policy relate to leverage or other treatment for these different types of firms and industries. Further research needs to pay attention to differentiate vulnerable firms with long-term inefficient firms that might need distinct determinants.

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APPENDIX

Appendix 1 Logistic regression – industry effect

Id	All sample	Indonesia	Malaysia
2	-.094	-0.023	-.383
3	-.209	-1.710**	-.842
4	0.713***	0.870*	.330
5	0.160	0.264	-.479
6	0.212	0.279	-.027
7	0.815***	.466	1.243***
8	0.670**	.439	.497
9	0.548	1.104*	-.519
10	0.708***	2.086***	-
11	0.277	.161	.301
12	0.733**	.902*	.831**
13	0.554**	.260	.612
14	0.862***	1.127	.745**
15	0.681**	.295	.489
16	-0.847	-1.112	-.052

Note: t statistics in parentheses $^{*} p < 0.1$, $^{**} p < 0.05$, $^{***} p < 0.01$

Appendix 2 Industry ID and NAICS Code

ID	Industry and NAICS Code
1	*Mining, Quarrying, Oil & Gas (21)*
2	*Agriculture, forestry, fishing, and hunting (11)*
3	*Utilities (22)*
4	*Construction (23)*
5	*Manufacturing (31)*
6	*Manufacturing (32)*
7	*Manufacturing (33)*
8	*Wholesale trade (42)*
9	*Retail trade (44)*
10	*Retail trade (45)*
11	*Transportation and warehousing (48-49)*
12	*Information (51)*
13	*Real estate, rental and leasing (53)*
14	*Professional, scientific, and technical services (54)*
15	*Administrative and remediation services (56)*
16	*Accommodation (72)*

Appendix 3 Logistic regression-different measure and lag2 of leverage

	Lev 1	Lev2	Lag2 lev
DER	3.343***	6.626***	7.492***
	(10.12)	(23.94)	(12.23)
SIZE	-0.070***	-.121**	-0.252***
	(-6.02)	(-9.02)	(-4.45)
TANG	2.013***	4.374***	3.682***
	(10.24)	(18.87)	(8.11)
AGE	-0.255***	-0.261	-0.014
	(-4.96)	(-4.52)	(-0.09)
INTER	.069	0.288	0.034
	(0.90)	(3.31)	(0.19)
BGROUP	-0.198*	-0.292	-0.183
	(-1.90)	(-2.54)	(-0.89)
_cons	-0.192	-3.178	-2.064**
	(-0.85)	(-11.46)	(-2.04)
N	3466	3466	3466
Pseudo R²	0.08	0.236	0.249

Appendix 4 Descriptive statistics of leverage and vulnerability base on country

		(1) Obs	(2) Min	(3) Max	(4) Mean/proportion	(5) Std. dev
A:	**Dichotomous variables**					
VULN	*Indonesia*	903			.296	
	Malaysia	1932			.398	
	Korea	611			.410	
B:	**Continuous variables**					
DER	*Indonesia*	903	0.0002	5.954	1.056	0.964
	Malaysia	1932	0.007	6.731	0.859	0.825
	Korea	611	0.101	5.974	1.177	0.965