“On the causality analysis of the correlation between financial leverage and systematic risk: evidence from Indonesian Stock Exchange”

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ON THE CAUSALITY ANALYSIS OF THE CORRELATION BETWEEN FINANCIAL LEVERAGE AND SYSTEMATIC RISK: EVIDENCE FROM INDONESIAN STOCK EXCHANGE

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Abstract

This research is aimed at analyzing the causality puzzle on the correlation between financial leverage and systematic risk (beta). Financial leverage and beta are usually considered as two proxies of risk derived from different domains: one ends at financial decision outcome, and the other points to market. Cross-sectionally, this result does not support the moderating-variable impact of size on the relation between financial leverage and systematic risk. On the other hand, however, the moderating-variable impact of industry and operating leverage (to some extent) on the relation between financial leverage and systematic risk were well documented. Inter-temporally, financial leverage is significantly and symmetrically related to beta, not moderated by size and operating leverage. This means that the two variables show bidirectional causality. This study contributes to the new insight that financial leverage and beta are the two variables with bidirectional causality, showing that in the long run, risks from fundamental (financial/micro-economy) and from market (macro-economy) are tightly linked to each other inter-temporally.

Keywords beta, systematic risk, bidirectional, cross-sectional, financial leverage, operating leverage, size, inter-temporal

JEL Classification G1, G3, M4

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INTRODUCTION

Understanding systematic risks and systematic (risk) theories is a crucial thing for investors, creditors, shareholders, corporate managers, and also scholars. To make sound and precise investment decisions, to control systematic risk related to capital structure decisions, as well as to optimize profitability and firm's value, they require systematic risk analysis. In addition, they also need to expand their knowledge on the various variables that affect the relationship between financial leverage and systematic risk.

Sarmiento-Sabogal and Fallon (2005) made inference (as cited in Yagill, 1982) that the further development of the Modigliani-Miller (MM) theory of the firm's capital structure carried both theoretical and practical implications posed by Hamada (1969); it was Hamada (1969) who developed the relationship between the proposition of MM and the CAPM portfolio theory (Sharpe, 1964; Lintner, 1963), which was basically derived from the previous portfolio theory initiated by Markowitz (1952); and Hamada (1969) had also shown how the role and implications of systematic risk in relation to leverage should be well noted.

In line with Kothari (2001, pp. 114-115) describing how firm-specific component can be used to jack up the power of the test, Hong and Sarkar (2007) state that systematic risk (beta) plays a vital role, especially in capital market literature. In event studies inspired by CAPM and efficient market hypothesis theories, systematic risk (beta) is the key component used to split between firm-specific effects and market-wide effects. The same thing is also true in the study of price-earnings relationships and earnings-response coefficients and also in accounting valuation models as proposed by Feltham and Ohlson (1995) and Ohlson (1995). Overall, the accuracy of beta will determine the relevance level of values evolving from the model.

Conclusively, we are now anxiously led to follow the way how the two domains of research areas covering systematic risks and leverage relate to each other. Many studies concerning capital structure (financial leverage) have tried to explore proxies for total business risk to explain financing decisions, on the one hand, while numerous examinations have also shown how a larger role of systematic risk have been played in theories either in asset pricing or in corporate financial decision making, on the other hand. Hence, the importance of distinct idiosyncratic and systematic risks in capital structure decisions is worth empirically examining in order to better understand the relationship between macro-economic frictions (systematic risk) and firm financing outcomes (leverage) (Schwert & Strebulaev, 2014).

The first research domain is the analysis of financial leverage determinants, among others, carried out by Gupta (1969), Ferri and Jones (1979), Kale, Noe, and Ramirez (1991) and others. In their findings, financial leverage is defined as dependent variables which are affected by various independent variables, such as size, growth, industry, business risks, and others. To date, this evidence is still consistent with the recent findings of, among others, Prime and Qi (2013), Cheng and Tzeng (2014), Öztekin (2015) who concluded that the reliable determinants for leverage are firm size, tangibility, industry leverage, average leverage ratio, profits, liquidity, age, and inflation. Even more surprisingly, Qiu and La (2010) and also Schwert and Strebulaev (2014) find that systematic risk is a crucial determinant of corporate capital structure, supported by their findings that the dynamic capital structure models relate financing decisions to macro-economic factors. This will bring a further urge for more investigating the impact of systematic risk on corporate decisions. Overall, this results lead to the inference that systematic risk is one of the determinants of leverage.

Meanwhile, the researchers, on the other hand, who consider the systematic risk determinants as the second domain, and who examine a relation between two domains can be viewed on the findings of Hamada (1972), Ben-Zion and Shalit (1975), Mandelker and Rhee (1984), Bowman (1979, p. 1981), Robichek and Cohn (1974), Melicher and Rush (1974), and Foster (1986). Although some researchers find that intrinsic business risk (i.e., the demand volatility of a firm's output due to macroeconomic conditions) is the main component of market beta (e.g., Griffin & Dugan, 2003; Mensah, 1992; Chung, 1989), most literatures acknowledge the impact of financial-and-operating leverage on market beta (e.g., Mandelker & Rhee, 1984; Gahlon & Gentry, 1982; Hill & Stone, 1980; John & Reisman, 1994; Schlueter & Sievers, 2013, etc.). To summarize, systematic risks (beta) are influenced by operating leverage, size, dividends, unexpected earning co-variability, business lines, and specifically financial leverage; and this comes to the opposite insight that financial leverage is one of the determinants of systematic risk (beta). Hence, this leads to the causality puzzle of the correlation between financial leverage and systematic risk that needs to be re-examined in this research.

Despite a variety of those research findings of determinants on either financial leverage or systematic risk, some other inconclusive arguments still exist, especially on the resulted signs (positively or negatively) of the relation, on its inter-relationship among several variables related to beta, and on some variables linked to it. In addition, the results of the prior studies (related to both the first and second domain) conclude that there are two independent variables that consistently affect financial leverage (see Gupta, 1969; Ferri & Jones, 1979) and beta (see Ben-Zion & Shalit, 1975; Lev, 1974; Mandelker & Rhee, 1984), i.e., size and operating leverage. While the other conclusions are that industries also affect the correlation between financial leverage and systematic risk or beta (Martikainen, 1993; Melicher, 1974), except for the findings of Martikainen (1993) in the pure manufacture industry, most researchers show consistency of the positive correlation between financial leverage (as independent variables) and beta (as the dependent variable).

In addition to the reasons above, the writer knows that in Indonesia, some researchers investigating this issue show that first, the results are inconsistent[1] (see, among others, Budiarti, 1996; Muljono, 2002; Oktiyatun, 2012; Retnaningdiah, 2003; Soviani, 2015; Sufiyati, 1997) and second, the analysis are still focused on the main-effect variables which influence beta, including financial leverage. In addition, the interaction among independent variables that affect systematic risk cannot be well hypothesized.

Given the above explanation, the aim of this research is to analyze the causality puzzle on the correlation between financial leverage and systematic risk or beta. Financial leverage is usually considered as a proxy of risk derived from company's financial data, representing the financial decision outcome, and as a domain that has distinctive determinants; while, on the other hand, beta is perceived as a proxy of risk coming from the market, representing macro-economic frictions that has some other determinants. Unfortunately, most researchers, however, have not yet sought to intensively explore the variables that affect the beta-and-financial leverage relationship both cross-sectionally and inter-temporally in a synergetic way. Furthermore, the aim of this research is also intended to empirically examine the relation's sensitivity cross-sectionally and temporally between financial leverage and systematic risk (beta) originating from the three variables: size (large and small), operating leverage (high and low), and industry (homogeneous and heterogeneous), and to test whether the relation between financial leverage and systematic risk is inter-temporally unidirectional or bidirectional.

The remainder of this paper is organized as follows: section 1 reviews prior literature and develops the hypothesis, while section 2 outlines the research methods. The results and discussion are presented in section 3, while conclusion is provided in the last section.

1. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Literature reviews are divided into two categories: first, theory or research literature that attempts to test what factors affect the financial leverage, and second, what factors impact on the systematic risk. The first category of the previous studies can be seen in the example of Ferri and Jones' studies (1979). It is found that the characteristics of the particular companies: i.e., industrial class, size and operating leverage significantly affect the high (low) financial leverage. That finding is also documented by Gupta (1969), Öztekin (2015), and also Prime and Qi (2013) who well prove that the pecking-order theory well explains private firm financing where the amount of leverage is negatively related to profits, liquidity, and age, and positively related to firm size and average leverage ratio.

The second is to re-examine the studies related to the determinants of systematic risk, which have clearly been stated by Foster (1986). He states that inter-relations among the company's underlying characteristics have been documented in various papers, such as the financing decisions, operation and investment, and beta or security return variance. It is said that the variables hypothesized as the economic determinants of beta and variance, among others, are financial leverage, operating leverage, unexpected earnings variability or co-variability, and business lines.

1 Even if, in Indonesia, the findings of Oktiyatun (2012) and Masrendrea, Dananti, and Nany (2010) prove that financial leverage positively influences systematic risk (beta), which is contrary to Soviani (2015) concluding that financial leverage negatively affects the systematic risk (beta), the results of Muljono (2002), Retnaningdiah (2003), Sadalia (2003), Dwiarti (2009) and Rochani (2010) show that financial leverage does not affect systematic risk (beta).

Some studies indicate that there is significant correlation between: 1) financial leverage and beta; 2) financial leverage and variance. The higher the financial leverage is, the higher both beta and variance will be, as the theory predicts. Hamada (1972) finds that there is a significantly positive correlation between financial leverage and beta. Financial leverage accounts for approximately 21-24% of average beta variability (see also Mandelker & Rhee, 1984; Christie, 1982; Bowman, 1980; Beaver, Kettler, & Scholes, 1970).

While the positive and significant influence of operating leverage on beta can also be found in the study of Lev (1974) and Mandelker and Rhee (1984), some other models have also found that the firm-specific business risks are the determinatnts of beta (Conine, 1982; Gahlon & Gentry, 1982; Pettit & Westerfield, 1972; Rubinstein, 1973; Foster, 1986; Ben-Zion & Shalit, 1975; Robichek & Cohn, 1974). Overall, beta is affected by financial characteristics, such as EPS growth trend, the riskier financial leverage, asset finance policies, business lines, and the changes of flow-through method.

Therefore, given the previous studies, there are at least three variables, i.e., size, operating leverage, industry (Melicher, 1974) which consistently indicate an influence on the correlation between financial leverage and systematic risk. Thus, this confirms the assumption that these three variables can affect the sensitivity of the relationship between financial leverage and systematic risk (beta). These three variables are also suspected to have contingent effects or may moderate the correlation variables between financial leverage and systematic risk.

In terms of size with respect to leverage, most literature supports the positive relationship, as stated by Elton and Gruber (1995, p. 149) and Francis (1986), Titman and Wessels (1988), Rajan and Zingales (1995). Larger firms, because of more diversified and less probability of bankruptcy, will be less risky than smaller ones; larger firms can more easily gain access to the stock market than smaller ones. Whereas, when linking size to beta, Lee and Hooy (2012) – particularly for Asian airline industry data – and Di Biase and D'Apolito (2012) also find the positive relationship; however, some results indicate ambiguity. Thus, as a moderating variable, different size of firms may affect the sensitivity of the relationship between financial leverage and beta. Thus the hypothesis to be tested is as follows:

H1: The strength of the correlation between financial leverage and systematic risk will be higher for the smaller firms than for the bigger ones, and vice versa.

In addition, industries are also suspected to affect the relation's sensitivity between financial leverage and beta (Melicher, 1974; Martikainen, 1993; Wolfgang, Menzel, & Schröder, 2016). In the sample that comprises a mixture of three industries, such as manufacturing, transport and trade, the results denote that operating and financial leverage positively and significantly affect systematic risk, but if the sample only consists of pure-manufacture industry (higher homogeneity), the results show that financial leverage negatively affects the systematic risk. As a result, the hypothesis below can be stated as follows:

H2: The strength of the correlation between financial leverage and systematic risk will be negatively higher for a group of relatively more homogeneous industries than of relatively more heterogenous ones, and vice versa.

To build a hypothesis related to the effect of operating leverage in relation to financial leverage, the previous findings in the relation between operating leverage and financial leverage or between operating leverage and systematic risk have to be considered, because both correlations show the opposite. The high operating leverage will decrease financial leverage (Ferri & Jones, 1979), but increase systematic risk (Lev, 1974; Mandelker & Rhee, 1984); furthermore, the low operating leverage will increase financial leverage, but decrease systematic risk. Thus, the following two competing hypotheses can be explained as follows:

H3a: The strength of the correlation between financial leverage and systematic risk will be higher for the increased operating leverage than otherwise.

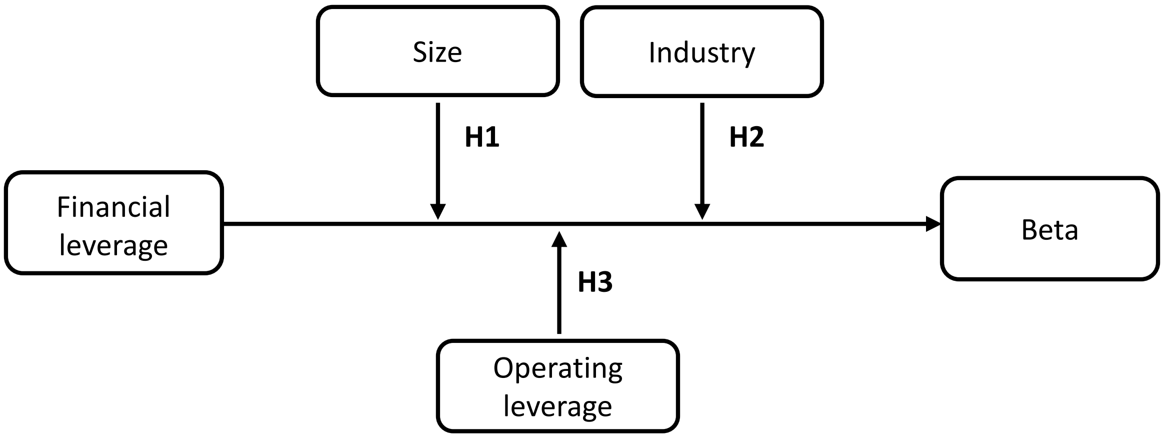

Figure 1. The conceptual framework for hypotheses 1, 2, and 3

H3b: The strength of the correlation between financial leverage and systematic risk will be higher for the decreased operating leverage than otherwise.

Thus, the conceptual framework for hypotheses 1, 2, and 3 to be cross-sectionally analyzed in this research can be portrayed in Figure 1.

Meanwhile, in terms of inter-temporal relationship between financial leverage and beta, causality analysis between beta and financial leverage should be examined. The reasons can be highlighted as follows: first, beta that is the measure of the volatility of the stock market price is a systematic risk. This means that the movement of stock prices is influenced by market price movements. Meanwhile, the sales and purchase mechanisms follow the law of supply and demand in the stock market. If demand increases, prices tend to increase; conversely, if supply increases or demand decreases, prices will fall.

Demand, according to the micro-economic theory, is a function of preference, number of customers, consumer's income, the price of related or substituted goods and expectation. In this context, demand for stocks, for example, can be affected by many factors, among others, the preference and expectations of the buyer (investor). In relation to the preference and the expectation, as buyers, the investors have to take into account the performance and the durability of companies which form the expectations to decide their own reasonable price (Wijaya, 1999, pp. 106-111).

To make an expectation of the company's value, all risks attached have to be calculated, including the level of debt that must be paid and the ability to pay for. Those are reflected on the level of financial leverage. With this expectation, the stock market will be aggregatively driven up and down. Because the individual stocks are shared as inputs in the market, it is sure that the individual stock prices will be also affected by market prices, a part of which is indicated by the strength of beta.

Second, financial leverage will be expected by investors as a sign of risk influencing the assessment of the price which eventually and aggregatively forms market prices through bid and ask market mechanisms (auction market). The shares reflecting the high financial leverage will be considered as highly risky, aggregatively affect the market price, and then influence the stock's systematic risk. Another plausible explanation comes from Gahlon and Gentry (1982) who suggest that systematic risk should be estimated through models of real-asset risk measures. They consider *DOL* (degree of operating leverage) and *DFL* (degree of financial leverage) as the determinants of systematic risk originating from real-asset risk measures as a critique for current approach in estimating beta (systematic risk). This is the reasons why causal correlation between financial leverage and beta should be empirically scrutinized. Thus, the above explanations lead to hypothesis 4 and the following conceptual framework (Figure 2).

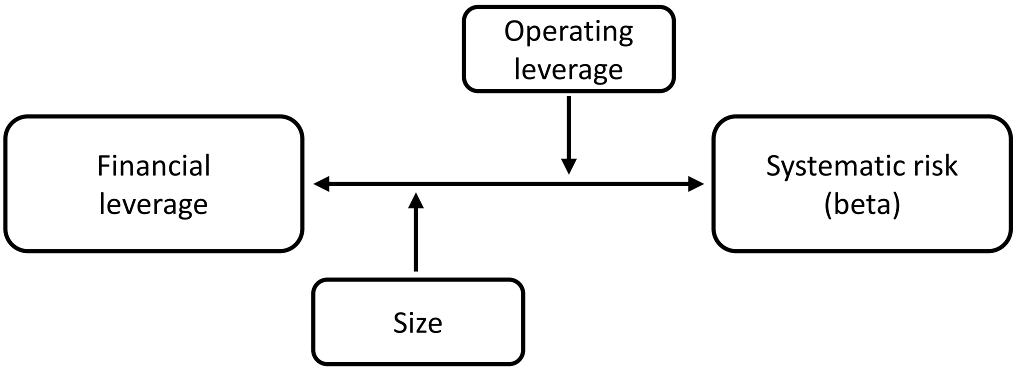

Figure 2. The conceptual framework for hypothesis 4

H4a: *The relation between systematic risk and financial leverage is symmetrical or bidirectional (two-way).*

H4b: *The strength of the relation between systematic risk and financial leverage will be higher when moderated by the operating leverage and the size of the company, and vice versa.*

Upon identifying the sensitivity toward the relationship between financial leverage and systematic risk, it is easy for the decision makers, i.e., both the principals (investors and share-holders) and the agents (managers) to make a decision. As Gahlon and Gentry (1982, p. 15) points out in their criticism of current beta estimation: "it masks the important fact that firms make decisions about how to operate in the factor and product markets of the real economic sector", real-asset risk measures such as operating leverage, financial leverage, including size (Lee & Hooy, 2012) will be the important determinants of systematic risk instead.

2. RESEARCH METHODS

Cross-sectional data collected from the Indonesian Stock Exchange during the two years have to meet several criteria of purposive sampling as follows: 1) the sample data are taken from the three industry categories; they are: basic chemicals industry, service industry, trade and real estate and consumer goods industry and various industries, and 2) financial statements have been prepared per December 31, for two years (2012–2013). The financial statement data has a report date at the end of December every year. Meanwhile, the data have been inter-temporally collected from the Indonesian Stock Exchange for nine years starting from 2006 to 2014, and must meet several criteria as follows: 1) market data (beta) are taken from the end of the quarter, and 2) the data have the quarterly financial statements.

To test the hypotheses 1, 2, and 3, the samples that meet the criteria will be analyzed using regression models:

2.1. Cross-sectional models with interaction

$$\beta_{it} = a + bDER_{it} + \gamma_1 DSIZE + \gamma_2 DSIZE \cdot DER_{it} + \varepsilon_{it} \quad (H1)\ (1)$$

$$\beta_{it} = a + bDER_{it} + \gamma_1 DDOL + \gamma_2 DDOL \cdot DER_{it} + \varepsilon_{it} \quad (H2)\ (2)$$

$$\beta_{it} = a + bDER_{it} + \gamma_1 IND1 + \gamma_2 IND2 + \gamma_3 IND1 \cdot DER_{it} + \gamma_4 IND2 \cdot DER_{it} + \varepsilon_{it} \quad (H3)\ (3)$$

$$\beta_{it} = a + bDER_{it} + \gamma_1 SIZE + \gamma_2 DDOL + \gamma_3 IND1 + \gamma_4 IND2 + \gamma_5 DSIZE \cdot DER_{it} + \gamma_6 DDOL \cdot DER_{it} + \gamma_7 IND1 \cdot DER_{it} + \gamma_8 IND2 \cdot DER_{it} + \varepsilon_{it} \quad (H1, H2, H3)\ (4)$$

where β_{it} – beta taken from PDBE UGM Yogyakarta; *DDOL* – dummy variables for operating leverage equal to 1 for the high score, 0 for the low one; DER – financial leverage measured by debt to equity ratio; $DSIZE$ – dummy variable for size equal to 1 for the high score, 0 for the low one; $IND1$, $IND2$, – dummy variable to classify the three categories of the industry: 00 (basic chemical industries), 10 (services industry, trade and real estate), and 01 (consumer goods industry and various industries).

Upon that procedures, the sensitivity of the correlation between financial leverage or the other variables and beta because of the identified moderating variables can be seen through the significant coefficient of each moderating variables.

2.2. Temporal model / time-series (referring to Bek Model (2003), originating from Granger-Sims (1972) to test hypotheses 4a and 4b:

$$BETA2_t = \alpha + \beta_1 DOLTOT + \beta_2 \Delta ASETTOTAL_T + \sum_{i=0}^{k} b_i jUMTOTAL_{t-i} + \varepsilon_t, \quad (5)$$

$$BETA2_t = \alpha + \beta_1 DOLTOT_T + \beta_2 \Delta ASETTOTAL_T + \sum_{i=0}^{k} b_i jUMTOTAL_{t-i} + \sum_{j=1}^{1} c_j UMTOTAL_{t+j} + \varepsilon_t, \quad (6)$$

and

$$UMTOTAL_t = \alpha' + \beta' DOLTOTAL_T + \beta' \Delta ASETTOTAL_T + \sum_{i=0}^{k} b_i' jBETA2_{t-i} + v_t', \quad (7)$$

$$UMTOTAL_t = \alpha' + \beta' DOLTOTAL_T + \beta' \Delta ASETTOTAL_T + \sum_{i=0}^{k} b_{ij}' BETA2_{t-i} + \sum_{j=1}^{1} c_j' BETA2_{t+j} + v_t', \quad (8)$$

where ε_t, ε_t', v_t, v_t' – the random terms that do not serially correlate to each other; $DOLTOTAL$, $ASETTOTAL$ – conditional variables that are considered exogenous, each becomes proxy of operating leverage and size; $BETA2_t$ – systematic risk (beta) for the beta (adjusted); $UMTOTAL_t$ – leverage (financial leverage); $BETA2_{t-i}$, $UMTOTAL_{t-i}$ dan $BETA2_{t+j}$, $UMTOTAL_{t+j}$ – lag and lead of the systematic risk (beta) and leverage (financial leverage), t – time.

With lag and lead variations, the hypothetical test for the causality can be described as follows:

1) financial leverage causes beta (unidimensional causality) if H_0: $c_j = 0$, for $j = 1, 2, ..., 1$, cannot be rejected and H_0: $c_j' = 0$, for $j = 1, 2, ..., n$, can be rejected;

2) beta causes financial leverage (unidimensional causality) if H_0: $c_j' = 0$, for $j = 1, 2, ..., 1$, cannot be rejected and H_0: $c_j = 0$ for $j = 1, 2, ..., n$, can be rejected; and 3) bidirectional causality occurs if both H_0: $c_j = 0$ for $j = 1, 2, ..., 1$, and H_0: $c_j' = 0$ for $j = 1, 2, ..., n$, can be rejected.

3. RESEARCH RESULTS AND DISCUSSION

3.1. Descriptive statistics

Table 1a and 1b show that the adjusted-beta standard deviation for three industry categories is very small. Thus, the adjusted-beta variations are smaller than non-adjusted beta. Similarly to financial leverage, the variations among industries do not describe the significant variations. There is a significant distinction appearing in assets and operating leverage in the cross-sectional data, and in assets on the temporal data.

3.2. The results and discussion

Testing *H1*, *H2*, and *H3*: Table 2 refers to the three splitted models (model 1, 2, and 3) and Table 3 relates to the unified model (model 4) used for testing hypotheses 1, 2 and 3. From Table 2, panel A shows the results of testing hypothesis 1: the size

Table 1a. Descriptive statistics for cross-sectional data (average period 2012–2013)

Panel A. Dependent variable

Industry	Variable	N	Average	Standard dev.	Min	Max
00	Adj-beta	127	2.64059	0.31072	2.078	3.746
10	Adj-beta	125	2.65064	0.22108	2.225	3.27
01	Adj-beta	140	2.65095	0.33887	1.859	3.994

Note: 00: (basic industrial chemistry); 10: (services industry, trade and real estate); 01: (consumer good industry and various industry).

Panel B. Independent variable

Industry	Variable	N	Average	Standard dev.	Min	Max
00	Fin. Leverage (DER)	127	3.71516	2.98542	0.6016	13.72597
	Fin. Leverage (DTA)	127	0.72557	0.12397	0.37562	0.93209
	Degrees of Op. Lev. (DOL)	127	8.81077	30.2991	–12.12655	158.0334
	Size	127	267.457.482	459.556.522	496932.5	1.931.217.076
10	Fin. Leverage (DER)	125	3.58436	4.00903	–6.90265	13.81719
	Fin. Leverage (DTA)	125	0.73999	0.16558	0.43746	1.169415
	Degrees of Op. Lev. (DOL)	125	–0.45448	17.61114	–53.54213	58.06131
	Size	125	169.037.567	296.412.006	105.318	1.523.728.601
01	Fin. Leverage (DER)	140	2.36782	2.79665	–9.555773	8.98823
	Fin. Leverage (DTA)	140	0.65195	0.18982	0.20604	1.01057
	Degrees of Op. Lev. (DOL)	140	2.573259	7.01727	–11.81648	37.906446
	Size	140	187215524	371.504.194	58098	1.778.729.930

Note: 00: (basic industrial chemistry); 10: (services industry, trade and real estate); 01: (consumer good industry and various industries).

Tabel 1b. Descriptive statistics for temporal data (2006–2014)

Variable	N (quarterly data)	Average	Standard dev.	Min	Max
Non-Adj Beta $(BETA1)$	36 x 119	0.65	1.62E+11	0.00	1.08
Adj-Beta $(BETA2)$	36 x 119	2.58980	0,26873	1.35	2.830
Fin. Leverage $(UMTOTAL)$	36 x 119	1.42083	2.365981	–6.02	7.530
Op. Leverage $(DOLTOT)$	36 x 119	0.338056	0.899336	–0.290	5.410
Size $(ASETTOTAL)$	36 x 119	3.05E+10	1.62E+11	1.10E+09	9.77E+11

Table 2. Regression results of the relation between financial leverage and beta (panel A moderated by size; panel B moderated by operating leverage; and panel C moderated by industry)

Variable	Coefficient	Standard error	t-ratio	Sig. level	Prediction
Panel A. The correlation between financial leverage and beta moderated by size					
Intercept	0.976	0.031	31.507	0.000**	?
$lnDER$	–0.00265	0.024	–0.109	0.913	+
$DSIZE$	–0.02918	0.037	–0.432	0.432	–
$lnDER \cdot DSIZE$ $(DERDSIZE)$	0.00550	0.008	0.714	0.477	+
Adj-R^2	–0.020	–	–	–	–
F-test	0.428	–	–	–	–
P-value	0.733	–	–	–	–
Panel B. The relation between financial leverage and beta moderated by operating leverage					
Intercept	0.964	0.019	51.311	0.000**	?
$lnDER$	0.00737	0.016	0.473	0.637	+
$DDOL$	–0.04834	0.047	–1.034	0.304	–/+
$lnDER \cdot DDOL$ $(DERDDOL)$	0.00747	0.011	0.702	0.484	–/+
Adj-R^2	–0.015	–	–	–	–
F-test	0.573	–	–	–	–
P-value	0.635	–	–	–	–
Panel C. The correlation between financial leverage and beta moderated by industry					
Intercept	0.99647	0.032	30.852	0.000**	?
$lnDER$	–0.02957	0.024	–1.253	0.214	+
$IND1$	0.00564	0.044	0.129	0.898	?
$IND2$	–0.11029	0.048	–2.299	0.024**	?
$lnDER \cdot IND1$	0.00070	0.008	0.086	0.932	+
$lnDER \cdot IND2$	0.03627	0.012	2.965	0.004**	+
Adj-R^2	0.069	–	–	–	–
F-test	2.317	–	–	–	–
P-value	0.051	–	–	–	–

Notes: the variables identified are as follows: 1) size, proxied by total sales and assets during the last four years (its average and categorized as large and small), as previously applied by Ferri and Jones (1979); 2) industry homogeneity (homogeneous or not), viewed according to the available lists of the companies' groups as published in the Indonesian Stock Exchange (BEI); 3) operating leverage, proxied by the ratio indicating the percentage change of profits to that of sales (degree of operating leverage as high and low), i.e., $(E_t - E_{t-1}) / E_{t-1} / \left[(TS_t - TS_{t-1}) / TS_{t-1}\right]$. E_t and E_{t-1} is earning before interest and taxes in period t and the previous period, while the TS_t and TS_{t-1} is the total sales in period t and the previous period; 4) financial leverage, indicating how far the firm's asset is financed by debt (liabilities), and usually based on the ratio between total debt and total equity (debt-to-equity ratio) or using degree of financial leverage (DFL), that is, the percentage change of quarterly earning after tax (EAT) divided by quarterly $EBIT$ percentage change (Brigham & Weston, 1990); beta or systematic risk, measured by its sensitivity of a stock to market movements (Elton & Gruber, 1995) or the systematic-risk measure of relative security or portfolio to market risk (Hartono, 1998), using the 60-month returns as suggested by Gonedes (1973). However, because the data are already available in $PDBE\ UGM$ Yogyakarta, the beta sources were taken from $PDBE\ UGM$. The data are categorized into two: adjusted beta and unadjusted beta. ** Significant at 5% level. * Significant at 10% level.

of the company negatively affects the correlation between the financial leverage and beta. The result indicates that the independent variable does not account for a significant amount of beta $(p\text{-value}=0.733)$. This also means that this model does not successfully support hypothesis 1, as documented by Francis (1986) and Elton and Gruber (1995, p. 149), that the large-scale companies indicate less risk than the small-scale companies. Larger-scale companies are easier to get access to the capital markets than otherwise.

Panel B shows the regression results of the correlation between financial leverage and beta when moderated by the operating leverage. The results show that the model test does not successfully support hypothesis 3 because of p-value indicating 0.635. Some empirical literatures show that the correlation between financial leverage and operating leverage is negative while operating leverage and systematic risk show positive correlation. A high operating leverage causes the decreased financial leverage (Ferri & Jones, 1979), but the increased systematic risk (Lev, 1974; Mandelker & Rhee, 1984), while the low of operating leverage will increase financial leverage, but decrease systematic risk.

Meanwhile, panel C illustrates how the industrial factors moderate the correlation between financial leverage and beta. The results also show that the model is successful to marginally support hypothesis 2 on the level of 0.05 or significant at the level of 0.1 $(p\text{-value}=0.051)$. This means that the moderating effect of industry (high or low levels of homogenity) significantly exists on the correlation between financial leverage and beta at the level of 0.05 (i.e., 0.004). When the industry is, however, splitted from industrial services, trade, as well as real estate and others, the result is not significant. Hence, this result is consistent with the findings of Martikainen (1993).

Given Table 3, it is indicated that hypotheses 1, 2, and 3 are examined simultaneously in one model, which includes all independent variables (i.e., size, operating leverage and industrial factors), and its interaction with financial leverage. The results report the evidence that the model is significant at the significant level of 0.05 $(p\text{-value}=0.031)$. Both interaction variables, i.e., the interaction between operating leverage and financial leverage, and also the industry, which are splitted from consumer good industry and the various industries and others, and the financial leverage can signifi-

Table 3. The regression results of the relation between financial leverage and beta (moderated by size, operating leverage, and industry)

Variables	Coefficient	Stand. Error	t-ratio	Sig. level	Prediction
Intercept	2.914	0.119	24.493	0.000**	?
$lnDER$	–0.207	0.086	–2.402	0.019**	+
$DSIZE$	–0.142	0.102	–1.386	0.170	–
$DDOL$	–0.266	0.132	–2.016	0.047**	–/+
$IND1$	–0.01505	0.131	–0.115	0.909	?
$IND2$	–0.407	0.138	–2.961	0.004**	?
$lnDER \cdot DSIZE$	0.02969	0.021	1.395	0.167	+
$lnDER \cdot DDOL$	0.04893	0.029	1.699	0.093*	+
$lnDER \cdot IND1$	0.00043	0.023	0.019	0.985	+
$lnDER \cdot IND2$	0.125	0.034	3.660	0.000**	+
Adj-R^2	0.107	–	–	–	–
F-test	2.189	–	–	–	–
P-value	0.031	–	–	–	–

Notes: ** Significant at 5% level. * Significant at 10% level.

cantly explain the variations of beta or systematic risk consecutively at 0.093 and 0.000 levels. This means that the results support hypotheses 2 and 3, while hypothesis 1 is not supported.

In summary, the test results cross-sectionally support hypotheses 2 and 3 which are successfully demonstrated using a unified-interaction model (model 4). This model indicates that, first, the effect of operating leverage and the industrial factors significantly affect the correlation between systematic risk and financial leverage; second, the influence of industrial factors is very strong when the industry is differentiated between consumer goods industry as well as various industries and other industries.

These results confirms the findings of Mandelker and Rhee (1984), providing evidence that operating and financial leverage are negatively correlated, and the correlation between the two variables is more negative for riskier firms. Alternatively, this also illuminates the findings of empirical results of risk summarized by Ryan (1997) addressing the distinction between sources of operating risk as factors affecting the contribution margin and risk multipliers as factors affecting the magnitude of fixed costs. In this context, the industry effect may be a surrogate for one factor affecting the contribution margin. The industry effect can be influential in the variability of quantities and prices of either outputs or inputs, resulting in a level of contribution margin variance.

In addition, these results also empirically support Bowman's (1979) findings that systematic risk is directly linked to financial leverage and accounting beta. Although Bowman (1979) demonstrates that there is no direct relationship between systematic risk and other variables, such as earnings variability, dividends, size and growth, he does not ignore the empirical results showing that systematic risk has not only linked to leverage, but also those variables, such as earnings variability, dividends, size and growth (Beaver et al., 1970). The significant empirical results of the relationship between systematic risk and the other accounting variables except for leverage may occur as the variables being tested is most likely a surrogate for another variable, e.g., dividend payout being a surrogate for accounting beta, or that causality may be operating in the opposite direction from that being hypothesized.

Additionally, Bowman (1980) also demonstrates that systematic risk is a function of business risk and financial risk. Because of some measurement problem in capturing business risk, empirical findings has shown that systematic risk is linked to many measures of accounting based risks as surrogates for business risk, including industry effects as empirically evidenced in this study.

Testing H4: To test the estimation of causality inter-temporally in hypothesis 4, the steps are based on the standard estimation procedures, which includes two-step evaluations. The first one is to test the stationary and the degree of integration for the variables: $BETA2\ (ADJUSTED\ BETA)$, $TOTALASSET$ and $UMTOTAL$ (financial leverage). The stationary test is conducted to examine whether or not the series or the row of variables in model (beta, total assets (size), financial leverage, and operating leverage) are stationary. The stationary condition is the requirement before further

Table 4. DF and ADF test

Variable	DF	ADF
$BETA2$	–4.130***	–4.37***
$TOTALASSET$	–2.006	–1.746
$D(TOTALASSET)$	–4.749***	–4.756***
$DOLTOT$	–3.699***	–3.640**
$D(DOLTOT)$	–5.93***	–5.84***
$UMTOTAL$	–4.35***	–4.257***

Notes: *** Significant at 1%. ** Significant at 5%. * Significant at 10%.

Table 5. The estimation results for models 5, 6, 7, and 8 (beta is adjusted)[2]

	Dependent variable							
	BETA2				*UMTOTAL*			
Model	**Model 5**		**Model 6**		**Model 7**		**Model 8**	
Ind Var \ LAG/LEAD[a]	**t–1**	**t–1; t–2**	**t–1; t+1**	**t–1; t–2 t+1; t+2**	**t–1**	**t–1; t–2**	**t–1; t+1**	**t–1; t–2 t+1; t+2**
C	2.55***	2.54***	2.41***	2.41***	–9.12***	–5.48	–14.61***	–10.45**
$DOLTOT$	–0.02	–0.02	–0.01	–0.09	–0.38	–0.558	–0.35	–0.47
$DTOTALASSET$	–0.007	0.03	–0.01	–0.48	0.02	–1.84	0.03	–1.60
$UMTOTAL(-1)$	0.034	0.03	0.06***	0.05**			4.14***	5.37***
$UMTOTAL(-2)$		0.01		0.05*				–2.78**
$UMTOTAL(+1)$			0.08***	0.10***			2.05*	1.6*
$UMTOTAL(+2)$				–0.01				0.2
$BETA2(-1)$					4.11***	5.55***		
$BETA2(-2)$						–2.79**		
$BETA2(+1)$								
$BETA2(+2)$								
R^2	0.06	0.07	0.45	0.59	0.31	0.43	0.39	0.6
Adj-R^2	–0.02	–0.05	0.37	0.49	0.25	0.36	0.31	0.51
F-Stat	0.74	0.55	5.97	6.006	4.85	5.69	4.73	6.47
Prob	0.53	0.69	0.001	0.000	0.006	0.001	0.004	0.000
D-W Stat	1.34	1.33	1.87	2.38	1.26	1.7	1.49	2.3
AIC	0.65	0.74	0.22	0.129	4.4	4.30	4.33	3.86
$SCHWARZ$	0.83	0.97	0.44	0.450	4.58	4.5	4.55	4.18
WALD-TEST:								
$C(2)$	0.91	0.89	0.86	0.43	0.61	0.50	0.62	0.47
$C(3)$	0.91	0.89	0.86	0.42	0.61	0.50	0.62	0.46

Notes: [a] Lag/Lead only as a comparison, not optimal point. *** Significant at 1% level. ** Significant at 5% level. * Significant at 10% level.

2 These findings for this corrected beta (not reported for the uncorrected beta which provides approximately the same results) shows that the measurement of beta is still debatable, especially adjusted-beta. Hartono and Surianto (1999) state that four lag and four leads are characterizing the beta phenomena at IDX. The adjustment of beta is very conditional depending on how active the market is at that time: the more active the market is, the less needed the adjustment will be, and the less active it is, the more needed the adjustment according to the average of inactivity will be.

analyzing time-series data in order that the use of OLS to estimate variables is not spurious (false).

The results of the stationary test can be viewed in Table 4.

Table 4 indicates that except for $TOTALASSET$, both DF and ADF values of all the variables are significant either at level 95% (the stated values are less than its critical value at –3.0314) or at level 99% (the stated values are less than its critical value at –3.7169). It means that all the variables, except for $TOTALASSET$ are stationary. Furthermore, after running first-order differencing, $TOTALASSET$ has been stationary, titled $D(TOTALASSET)$; thus, this has met the required condition to go further analysis.

Using adjusted beta $(BETA2)$, the results of this model can be observed as follows (see Table 5).

Table 5 indicates that both H_o: $c_j = 0$ for $j = 1, 2, 3, ..., 1$ and H_o: $c'_j = 0$ for $j = 1, 2, 3, ..., n$ are successfully rejected. This can be seen from the coefficient values of the lag and lead variables for both model 6 and model 8 which are significant. This means that causality in accordance with the third criteria, i.e., the causality correlation between and systematic risk (beta) and financial leverage, is bidirectional, supporting hypothesis *4a*.

Meanwhile, for hypothesis *4b*, the test results of Wald test show that two conditional variables (operating leverage and size) do not significantly affect the causal correlation between the two variables, i.e., financial leverage and beta. For all models in the Table 2, the p-value of Wald test is not significant. This means that the two conditional variables (operating leverage and size) can be actually removed because they are not structurally influential in the model. This finding is not consistent with the conceptual clarification of Gahlon and Gentry (1982), stating that financial leverage and operating leverage are the determinants of the systematic risk.

These results means that the bidirectional causality should be used as a basis to estimate and to make a policy that the correlation between beta and financial leverage is complementary. In the expectation to the value of the company, all risks attached to it have to be calculated, including the level of debt that must be paid and the ability to pay for them, that is, reflected from the amount of the financial leverage. Given the expectation, the stock market price will be aggregatively driven up and down. Because the individual stocks are the inputs of shares in the market, the price of individual stock prices will also be affected by the market price. Hence, the findings of the bidirectional causality correlation between systematic risk (beta) and financial leverage are a reflection of actual correlation form of the demand and the supply in the market that can form the equilibrium price.

Referring to these findings, however, the conditional variables expected to take effect the causality correlation between beta and financial leverage are not supported. This is most likely caused by the weaknesses of the emerging capital market, where there are still non-synchronous trading and insider trading rules which are not clear. For instance, to compare with Lee and Hooy (2012) who find the positive correlation between size and beta for non-Asian data, large-scale companies that should have negatively linked to beta do not occur in Indonesia. The large-scale companies are usually subject to a political action; thus, their market price fluctuation is in line with its still sensitivity to political issues.

CONCLUSION

Cross-sectionally, this result does not support the moderating effect of size on the correlation between financial leverage and systematic risk. This result, however, is consistent with the results of Sufiyati (1997), Qiu and La (2010), and Soviani (2015) where some of her results show that financial leverage is negatively related to beta. The negative correlation between financial leverage and systematic risk is confirmed, and strongly moderated by the industry and operating leverage (to some extent), supported by Bowman (1979), Mandelker and Rhee (1984), and also Ryan (1997). In spite of the significant results, however, the coefficients of financial leverage, operating leverage, and industry on the main effects show inconsistent signs.

Inter-temporally, the financial leverage is symmetrically (bidirectionally) related to beta (systematic risk). This means that both variables have two-way causality correlation. The high (or low) level of beta can affect and cause the high (or low) level of financial leverage, and on the contrary, the high (or low) level of financial leverage can affect and cause the high (or low) level of beta. However, in contrast to the prior studies from Gahlon and Gentry (1982) and Lee and Hooy (2012), the two conditional variables (operating leverage and size) do not significantly affect the causality relation between beta and financial leverage when using inter-temporal data. This study contributes to the new insight that financial leverage and beta are the two variables with bidirectional causality, showing that risks from both fundamental (financial/micro-economy) and market (macro-economy) are tightly linked to each other inter-temporally (in the long run). In addition, practitioners, academicians, and also policy makers need to always consider the two strands of risks as one unit when making business and economic policies or when examining other empirical test of business or economic risk.

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