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Article

Modeling the selection of comparable firms: A novel approach for business valuation in ASEAN nations

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Modeling the selection of comparable firms: A novel approach for business valuation in ASEAN nations

Nguyen Kim-Duc^{1*}, Hay Sinh¹ and Tran Bich-Van¹

Abstract: This study aims to develop systematic models for the selection of comparable firms for firm valuation. The conventional approach argues that indicators such as firm size, growth rate, and industry should be considered for the selection of peer firms. However, this is sometimes very difficult for appraisers because it is almost impossible to find firms that capture all these criteria, especially in developing countries. Guided by business valuation theory, three indicators—profitability, earnings growth rate, and systematic risk—are applied by this study to build systematic models that simultaneously consider the many criteria affecting firm value. Using firm-level data from non-financial enterprises with 18,418 firm-year observations collected from the six ASEAN nations' stock exchange markets from 2010 to 2020, this study contributes to business valuation literature by developing systematic models for the selection of comparable firms. The results of this study are also practically significant for valuers because our models can be applied to peer group selection as well. Additional analysis shows that our models are more appropriate or suitable than models from previous conventional approaches that use the same industry or same firm financial characteristics.



Nguyen Kim-Duc

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PUBLIC INTEREST STATEMENT

Comparable firms play a vital role in the application of market- and income-based valuation approaches. Our research is motivated by valuation practitioners who commonly use the financial information of peer firms to support their valuation procedures. Although academic literature provides several valuation indicators that could be used by valuers, the process of selection of close peers for the target firms is sometimes a difficult process. Our study develops systematic models that consider many factors simultaneously, so that the process of peer selection is rendered consistent and logical. Significantly, these factors are based on valuation theory, and all the proxy measurements ensure that it is possible for valuers to practically apply the models, especially for situations in which the target firm is a non-listed company. Finally, we demonstrate that our models are more appropriate than those based on the conventional approach. This is also empirical evidence that practitioners can use to convince their clients, when they employ the models.

Subjects: Property Valuation; Corporate Finance; Financial Accounting

Keywords: Comparable firms; Business valuation; Income-based approach; Market-based approach

1. Introduction

Previous theoretical and empirical studies suggest that criteria like the same industry, firm size, earnings growth, and leverage should be considered appropriate criteria for the selection of comparable firms (e.g., Alford, 1992; Boatsman & Baskin, 1981; Zarowin, 1990). The proposals made by these studies are however difficult to implement in practice because it is unclear which specific criteria should be followed for peer firm selection (Asche et al., 2016). There are also some additional questions raised by practitioners such as: (i) how many criteria should be used; (ii) is it more suitable to use only one criterion, some, or all the criteria that the appraisers know of; (iii) what is the basis of choosing some factors and ignoring others; and (iv) which criteria are relevant among the selected factors. These debates have considerable practical importance because there are often differences in firm value among appraisers, even though they may be estimating value for the same target enterprise. This leads to the appraisers' inability to explain the comparative results when clients use the services of multiple valuation companies.

The selection of comparable firms not only plays a key role but is also an essential step in the whole business valuation procedure (How et al., 2007; Vismara et al., 2015). These firms are required to contain the most similar information as the firm being valued (Cooper & Cordeiro, 2008). Although many factors can be used to select comparable firms, scholars and practitioners have long recognized that developing systematic models of peer selection can play a particularly powerful role in the business valuation process.

Damodaran (2012) suggests that selecting the most suitable peers for the target firm depends on the valuers' professional judgment for each specific case. Specifically, appraisers can use more criteria for peer selection when there are many comparable companies to choose from; otherwise, fewer criteria can be used with a lower number of peer firms. Similarly, Cooper and Cordeiro (2008) also argue that the most important information is obtained from appropriate or efficient peer selection rather than from the size of the sample.

Bhojraj and Lee (2002) introduced a new approach to select peer firms—the Warranted Multiple (WM)—which is a regression of many criteria. This model makes a significant contribution from a practical perspective because it resolves the disadvantages of the conventional approach. However, practitioners remain concerned about how valuation theory is incorporated into the systematic models and how the multiples are applied (Sloan, 2002). On the other hand, Asche et al. (2016) argue that previous studies related to the modeling of peer selection (e.g., Bhojraj & Lee, 2002) focus only on valuation accuracy without emphasizing the valuation process, which is also of interest to investors and equity analysts. Other studies however, focus mostly on the role of peers in valuing IPOs (e.g., How et al., 2007; Vismara et al., 2015) instead of developing models to select peer firms.

Valuations in ASEAN provide a unique research setting to develop systematic models of peer firm selection. First, valuations have been conducted in ASEAN for approximately three decades only, with the establishment of the ASEAN Valuers Association (AVA), despite the techniques having been developed globally since the 1940s. This leads to a lack of valuation-related documents and empirical studies to support practitioners. Second, the number of listed companies in Southeast Asian countries are relatively few (see Table 1). This indicates that ASEAN business valuation activities focus only on non-listed or newly listed firms; applying comparable firms is therefore important and popular, especially the listed-comparable firms. Finally, in recent years, some ASEAN stock exchanges have officially followed the Global Industry Classification Standards GICS®, developed by MSCI and S&P Dow Jones Indexes, to classify the industries for listed

companies. This is valuable information for valuers who typically use the same industry to select comparable firms. However, the empirical results of Kim-Duc et al. (2018) show that even when employing the new international mechanism of industry classification, peers may be less appropriate when representing risk classification in Vietnam. Kim-Duc et al. (2018) also argue that further research should be an empirical study on how to select comparable enterprises.

In the absence of empirical evidence on the effectiveness of selecting peers from international market settings, we question how useful the systematic models are in selecting comparable firms for valuation activity in ASEAN countries. Despite the difficulty of finding peers in a less populated market, we provide models that support the consideration of peer firms. This study applies a panel dataset from non-financial enterprises listed on six ASEAN nations' stock exchanges from 2010 to 2020, including Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. To select comparable firms, we develop a systematic model that simultaneously considers many criteria that impact firm value. Subsequently, we tested the appropriateness of the models to ensure that they were superior and more suitable than the previous conventional models.

Bhojraj and Lee (2002) also developed a model for peer selection. However, there are noticeable differences between their study and ours. Compared with previous studies, our research makes the following academic contributions. First, we focus on ASEAN countries, which lends uniqueness to the research. In recent years, ASEAN has attracted a lot of direct and indirect foreign investments leading to a rise in demand for business valuation in the member nations. In addition, ASEAN countries' business valuation standards have been significantly changed to integrate with international valuation standards. Furthermore, it is incumbent upon valuers to follow the set valuation standards and corroborate the empirical findings by applying professional judgment to support their valuation procedures.

Second, with our model, we help resolve the concern of how practitioners should use the models for peer firm selection. As mentioned previously, many of the target firms in these countries are non-listed companies rendering it very difficult for valuers to estimate the market value of multiples or WM. To deal with this issue, we added a new dependent variable, the book value of WM, which is a novel feature of our model when compared with that developed by Bhojraj and Lee (2002). This feature will facilitate practitioners in the application of our models in the ASEAN context.

Finally, and most importantly, unlike prior studies, our models employ valuation theory to identify the factors impacting firm value; we also follow these valuation method ideas to estimate proxy measurements for our study's concepts. Many prior empirical studies base themselves on financial literature to determine the factors that contribute to firm value. However, when the objective of peer enterprise selection is to estimate firm or equity value, it is more effective when the models are developed on the basis of business valuation theory (Bhojraj & Lee, 2002). Despite applying valuation theory to determine the components, the variable measures suggested by Bhojraj and Lee (2002) are still based on a finance perspective. It is also noted that although valuations follow both accounting and finance aspects, the indicators in various valuation models continue to have their own estimation views.

Apart from the academic aspect, there are two practical contributions related to business valuation. The first is that the findings of this study provide important backgrounds for practitioners to consistently and logically select comparable firms, which can resolve the drawbacks of conventional models. Second, we demonstrate that the selection of comparable firms through our models is more appropriate than the selection through a conventional approach (i.e., same industry or firm size), and this creates the empirical evidence for valuers to convince their clients with.

The remainder of this paper is organized as follows. In Section 2, we first review prior empirical studies and the literature on comparable firms. Thereafter we apply valuation theory related to market—and income-based approaches to determine the factors contributing to firm value.

Table 1. Number of companies listed on the stock exchanges of six ASEAN countries

Countries	The period provided by The World Bank				The period 2010–2020		
	Time Coverage	Minimum	Maximum	Average	Minimum	Maximum	2020
Indonesia	1980–2020	06(1980)	713(2020)	287	420(2010)	713(2020)	713
Malaysia	1980–2020	181(1980)	1,021(2006)	648	892(2015)	948(2010)	927
Philippines	1987–2020	140(1987)	268(2020)	223	251(2010–2011)	268(2020)	268
Singapore	1979–2020	95(1979)	564(2005)	315	459(2020)	484(2014)	459
Thailand	1980–2020	72(1980)	743(2020)	395	541(2010)	743(2020)	743
Vietnam	2008–2020	330(2008)	749(2018)	653	634(2010)	749(2018)	745

Source: The World Bank Database (Accessed on 28 July 2021).

Section 3 discusses the data, sample selection, and descriptive statistics. In Section 4, we present the general model for peer selection and conduct robustness checks of the main results. Section 5 concludes the paper.

2. Literature review and the application of valuation theory

Despite their widespread usage, only a few theories are available to guide the selection of comparable firms (see Asche et al., 2016). More importantly, as How et al. (2007) argue, it is difficult to find peers in a less populated market. Literature related to peer group selection can be divided into two groups. The first emphasizes the role of the same industry (e.g., Alford, 1992; Boatsman & Baskin, 1981; Tasker, 1998), while the other promotes a systematic model (e.g., Bhojraj & Lee, 2002; Bhojraj et al., 2003). Specifically, Boatsman and Baskin (1981) and Alford (1992) highlight the importance of the same industry and earnings growth rate for the selection of peers. In addition, firm size and financial leverage are also effective criteria in peer group selection (Alford, 1992).

In fact, it is difficult for practitioners to apply these criteria to their valuation processes because each valuer chooses a different indicator (see Damodaran, 2018). This sometimes leads to the same target firm, valuation date, and valuation purpose, but different peers among valuers or valuation companies. Vismara et al. (2015) find that three out of seven comparable firms, on average, are changed when the authors compare the peer selection results made by investment banks as underwriters and analysts at IPOs. To solve this problem, Bhojraj and Lee (2002) developed a systematic model with the significant feature, of considering many factors simultaneously, to select comparable firms. Although the study of Bhojraj and Lee (2002) is based on valuation literature, the measurements of variables do not completely follow business valuation theory.

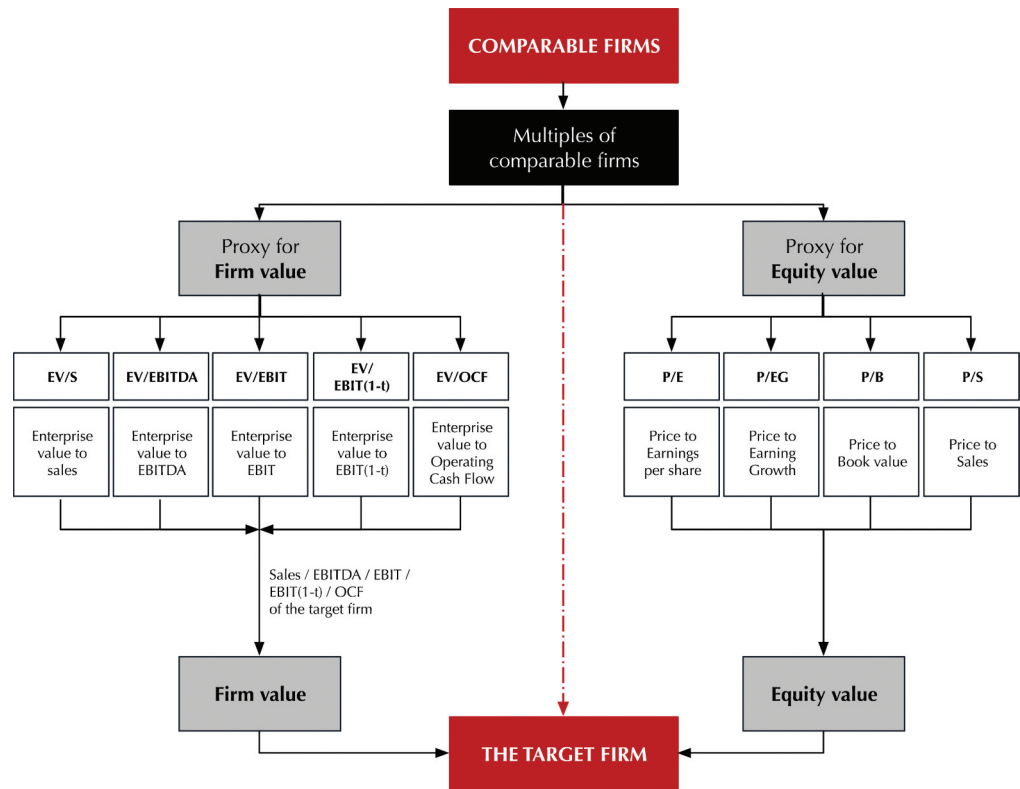
Most recently, Asche et al. (2016) applied a Chow test to investigate whether there is indeed a difference between two different valuations procedures in peer group selection. This is a novel approach that contrasts with the approach of Bhojraj and Lee (2002), Bhojraj et al. (2003), Liu et al. (2007), and Asche et al. (2016) argue that these previous studies focus only on valuation accuracy without the valuation process, which is of interest to investors and equity analysts. In this study however, we put ourselves in the role of valuers and the valuation profession, which demands consistency, rationality and legal responsibility. Thus, our research essentially follows the study of Bhojraj and Lee (2002), with some adjustments to accommodate valuation theory.

There are two approaches, market-and income-based valuation,¹ which require appraisers to select peer firms (Bhojraj & Lee, 2002; Damodaran, 2012; Pinto et al., 2015; Pratt & Niculita, 2008). More specifically, for the market-based approach, comparable firms are used in the guideline publicly traded company method, while the peers are applied to the discounted cash flow (DCF) technique of the income-based approach. Figures 1 and 2 show the position and the role of comparable firms in the valuation procedure of these two methods. It is also noted that the selection of peers and the estimation of their multiples is the first step in the market-based approach (Figure 1). For the income-based approach, comparable firms, by contrast, only play an indirect role, which is the basis for comparing some criteria of the target company (Figure 2). However, in several cases (e.g., the target firm is a firm with leverage restructure, a newly listed firm, an unlisted firm, or individual business unit), peer firms play a direct role in the income-based approach (Beneda, 2003; Damodaran, 2012; Renzi et al., 2013; Sarmiento-Sabogal & Sadeghi, 2014).

2.1. Comparable firms and the market-based approach

Despite the difficulty of finding peers in a less populated market, a market-based approach (or a comparable firm approach) is still useful in valuing IPO firms because it is intuitive and simple to justify with fewer assumptions about the firms' future cash flows (How et al., 2007; Vismara et al., 2015). In addition, Ritter and Welch (2002) argue that the approach that incorporates taking multiples of comparable peer firms is the most common approach used by underwriters to value IPOs.

Figure 1. Role of comparable firms in the market-based approach.



The multiples presented in Figure 1 can be classified into two groups: firm value and equity value proxy measures. Following an idea like Bhojraj and Lee (2002), we use enterprise-value-to-sales (EVS) and price-to-book-value (PB) ratios as multiple proxy measurements for firm and equity values, respectively.

Figure 1 also shows that comparable firms play a direct role, and selecting peers is the first step in the whole valuation procedure. Hence, appraisers must connect the multiples of peer enterprises to the corresponding fundamentals (e.g., sales; earnings before interest, taxes, depreciation and amortization, EBITDA; earnings before interest and taxes, EBIT) of the target company to estimate firm or equity values.

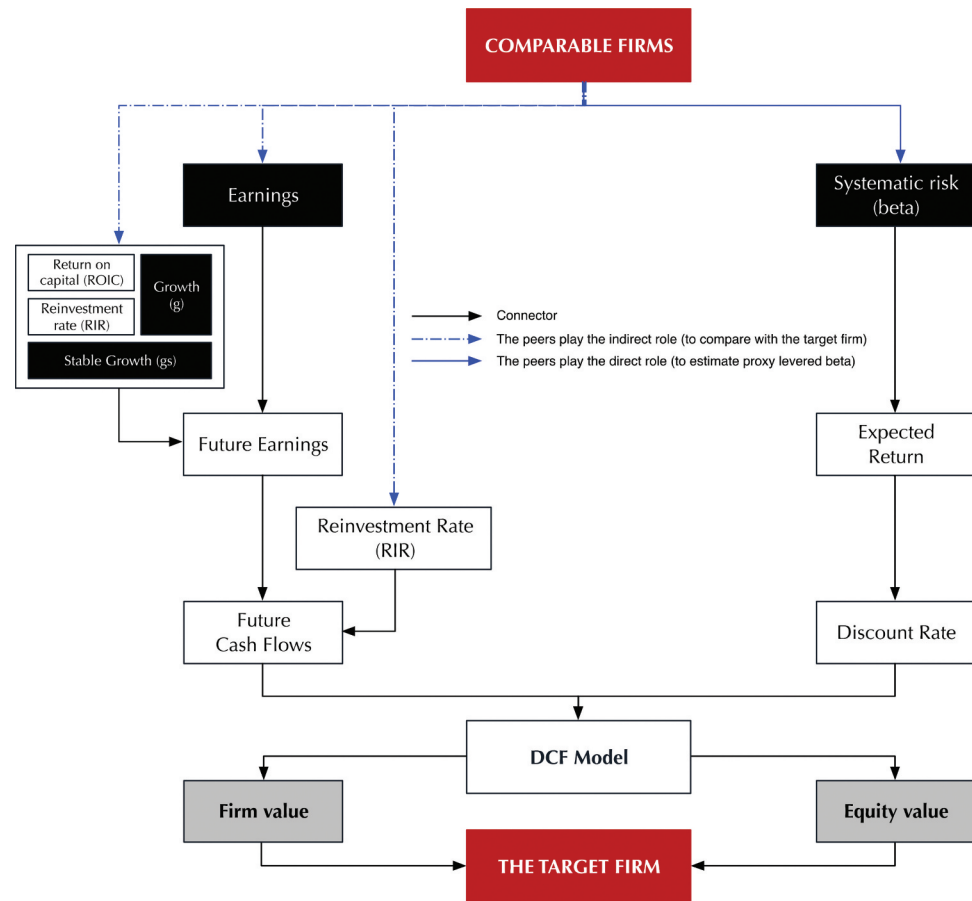
Connecting between dividend discount models and the residual income formula, the PB ratio can be expressed as Eq. (1) (Feltham & Ohlson, 1995; Lee, 1999). Similarly, in the case of stable growth, the EVS ratio can be expressed as Eq. (2) (Damodaran, 1994):

$$\frac{P_t^*}{B_t} = 1 + \sum_{k=1}^{\infty} \frac{E_t[(ROE_{t+k} - k_e)B_{t+k-1}]}{(1 + k_e)^k B_t} \quad (1)$$

$$\frac{EV_t^*}{S_t} = \frac{E_t[PM * b * (1 + g)]}{WACC - g} \quad (2)$$

The sub-index t indicates time; sub-index " $t + k$ " indicates the period; P^* and EV^* are the present value of expected dividends and total enterprise value, respectively; B and S are the book values of equity and total sales, respectively; $E[.]$ is the expectation based on available information; ROE is return on book equity; k_e is the cost of equity; PM is the operating profit margin (before interest);

Figure 2. Role of comparable firms in the income-based approach.



b is the constant payout ratio; WACC is the weighted average cost of capital; and g is the constant earnings growth rate.

Eqs. (1) and (2) show that there are four indicators that impact firm or equity value (EVS or PB), including profitability (PM or ROE), expected growth rates (g), cost of capital (WACC or k_e), and payout ratio. However, the lower the payout ratio,² the higher the expected growth rate in the future (Damodaran, 2012); thus, we only consider three indicators to develop an empirical model without the payout ratio.

2.2. Comparable firms and the income-based approach

For the income-based approach, the DCF technique (e.g., cost of capital or WACC method) is more commonly used to estimate firm and equity value (How et al., 2007). Based on Figure 2, there are two main factors for this technique including projected cash flow and discount rate.

For future cash flows (i.e., the numerator of the DCF technique), three components must be estimated: (i) profits, (ii) reinvestment rate (RIR), and (iii) earning-growth rate (g). For this, valuers only have current and past financial statements therefore, earnings growth rate is employed to estimate future earnings; subsequently, the connecting reinvestment rate helps valuers forecast cash flows in the future. In addition, earnings growth rate depends on two determinants, return on invested capital (ROIC) and reinvestment rate (RIR), and thus, “profitability” and “growth” are two variables that are considered to select comparable firms.

For the discount rate (i.e., the denominator of the DCF technique), the expected (or required) return can be used as a discount rate in business and equity valuation (Damodaran, 2012; Pinto et al., 2015). Hitchner (2011) argues that the cost of capital is also referred to as the discount rate, which equals the total expected rate of return. In fact, CAPM is still the most popular model used for valuation because of the relative objectivity of the procedure for estimating the cost of capital (Brigham et al., 2010; Pinto et al., 2015). Based on portfolio theory (Markowitz, 1952), the CAPM follows the significant relationship between systematic risk and expected return shown by the security market line (SML). Therefore, “risk” is the third variable considered in this approach.

In summary, from the market-and income-based approaches in business valuation, we identify three indicators that impact firm or equity value, including profitability, earnings growth, and risk.

3. Measurements

3.1. Data

To develop systematic models to select comparable firms for business valuation, we use several data sources. First, financial and stock data are collected from the Thomson Reuters database. Second, industry information is extracted from the stock exchange database of each country. Finally, we use annual reports to select an appropriate proxy for earnings for the companies in our sample.

We use a sample of listed firms from six ASEAN countries, including Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam from 2010 to 2020. We exclude financial institutions

Table 2. Sample details

Panel A: Distribution by countries				N	Percentage (%)
Indonesia				1,715	9.31
Malaysia				5,883	31.94
Philippines				489	2.66
Singapore				2,196	11.92
Thailand				4,121	22.37
Vietnam				4,014	21.79
Panel B: Industry concentration	N	Percentage (%)	Panel C: Distribution by year	N	Percentage (%)
Consumer Staples	2,332	12.66	2010	958	5.20
Communication Services	639	3.47	2011	1,525	8.28
Consumer Discretionary	2,962	16.08	2012	1,737	9.43
Energy	551	2.99	2013	1,697	9.21
Health Care	737	4.00	2014	1,752	9.51
Industrials	5,749	31.21	2015	1,781	9.67
Information Technology	1,416	7.69	2016	1,653	8.97
Materials	2,706	14.69	2017	1,838	9.98
Real Estate	790	4.29	2018	1,928	10.47
Others	536	2.91	2019	1,823	9.90
			2020	1,726	9.37

(insurance firms, diversified financial firms, banks) and utility firms from the sample because of the differences in their capital structures (Fama & French, 1992) ownership structures (Lozano et al., 2016) and the presentation of financial statements (Basil & Khaled, 2011). We also continuously eliminate the following firms from the sample: (i) firms in which the number of firms in the same industry (based on 2-digit GICS) is less than five (Bhojraj & Lee, 2002); (ii) missing information for the calculation of empirical variables; and (iii) those with a negative book value of equity. Hence, our final sample covers an unbalanced panel of firms listed in the stock exchanges of the six ASEAN nations over the period 2010–2020 and comprises 18,418 firm-year observations.

Panels A, B, and C of Table 2 summarize distributions of our sample by country, industry, and year, respectively.

3.2. Variable measurements

The dependent variable in our regression is a set of “warranted multiples” (WMs), which considers both the WM of firm and equity value. The proxies for WM of firm and equity value are EVS (Damodaran, 1994), and PB (Feltham & Ohlson, 1995), respectively. However, this study’s purpose is to build a model to select comparable firms based on valuation theory. Accordingly, companies that have the closest WM to the target firm (the firm being valued) are selected as comparable firms. Hence, in addition to EVS and PB, we add the third WM proxy, EVS-BV. The difference between EVS-BV and EVS is the capitalization of equity of EVS-BV, which is replaced by the book value of equity. Due to this efficiency, EVS-BV was also the main dependent variable in this study.

In our study, we expect to build a systematic model to select comparable firms for business valuation activities. Thus, we rely on business valuation theory to determine the indicators that impact firm or equity value. As analyzed above, the independent variables in this study are profitability, earnings growth rate, and risk.

PROFITABILITY: For business valuation models, profitability is expressed in formulas to estimate free cash flow to the firm or equity (FCFF or FCFE) and earnings growth rate. Bhojraj and Lee (2002) apply the industry-adjusted profit margin (AdjPM) as a proxy for profitability. However, following valuation theory, we add the return on capital (ROC) as the second proxy for profitability. WM is measured for both firm and equity value, and this leads to the ROCs, including return on adjusted assets (AdjROA) and return on equity (ROE).

GROWTH: Following the study of Bhojraj and Lee (2002), industry-adjusted profit growth forecasts (AdjGRO) are considered as proxies for earnings growth rate. In addition to AdjGRO, we also add the reinvestment rate (RIR) as a proxy measurement because it is a component of growth rate. RIRs also include the reinvestment rate to the firm, RIRF, and reinvestment rate to equity, RIRE.

RISK: According to corporate finance theory, risks can be divided into systematic and unsystematic risks, and unsystematic risk could be ignored by diversification (see Jordan et al., 2015). The empirical models of Hamada (1972, 1969) show the impact of financial leverage on systematic risk. However, besides financial risk, systematic risk is also affected by operating leverage (Rubinstein, 1973). In this study, we employ both financial and operating leverage as proxies for systematic risk (i.e., FL and OL).

Similar to Bhojraj and Lee (2002) study, we control for industry-wide factors impacting WM, including (i) the industry-average EVS-BV (IndEVS-BV), (ii) the industry-average EVS (IndEVS), and (iii) the industry-average PB (IndPB). We note that based on the idea of Sarmiento-Sabogal and Sadeghi (2014), the harmonic mean of variables (i.e., IndEVS-BV, IndEVS, and IndPB) takes the exogenous yearly mean for each industry in order to avoid the endogenous problems in the sample (this is synonymous with excluding the target firm in the average).

Table 3. Description of variables

Variables	Proxy	Name	Description
Panel A:			
Building the model to select comparable firms			
Warranted multiples (WMs)	EVS-BV	Book enterprise value to sale	Book enterprise value/net sales; where book enterprise value is defined as the sum of book value of equity and book value of long-term debt
	EVS	Enterprise value to sale	Enterprise value/net sales; where enterprise value is defined as the sum of market capitalization of equity and book value of long-term debt
	PB	Price-to-book-value ratio	Market capitalization of equity/total common equity
Profitability	AdjPM	Industry-adjusted profit margin	The firm's profit margin less the median industry profit margin
	AdjROA	Return on adjusted assets	Operating profit/adjusted asset
	AdjROE	Return on equity	Earnings after tax/total common equity
Growth	AdjGRO	Industry-adjusted profit growth	The firm's profit growth less the median industry profit growth
	RIRF	Reinvestment rate of firm	(Capital expenditure—depreciation + Δ non-cash net working capital)/EBIT (1-t)
	RIRE	Reinvestment rate of equity	(Capital expenditure—depreciation + Δ non-cash net working capital—net liabilities)/EAT
Risk	FL	Financial leverage	Book value of long-term debt/total common equity
	OL	Operating leverage	$\% \Delta \text{EBIT} / \% \Delta S$
Controls	IndEVS-BV	Industry-average EVS-BV	The harmonic mean of the EVS-BV for all the firms with the same two-digit GICS code
	IndEVS	Industry-average EVS	The harmonic mean of the EVS for all the firms with the same two-digit GICS code
	IndPB	Industry-average PB	The harmonic mean of the PB for all the firms with the same two-digit GICS code

(Continued)

Variables	Proxy	Name	Description
Panel B:	Testing the suitability of the developed models with previous conventional models		
	IWMs	Industry-average WM	The harmonic mean of the industry WM but excluding the target firm (IWMs include IEVS-BV, IEVS, and IPB)
	FWMs	WM forecasted from our models (i.e., Table 6)	The estimated results by using the coefficients derived from last year's estimation regressions (the first stage results) and current year accounting and market-based variables
	COMPWMs	Average actual WM for the closest comparable firms	The harmonic mean of the actual WMs of the four or ten closest firms based on their FWMs (COMPWMs include COMP-EVS-BV, COMP-EVS, and COMP-PB)

[Table 3](#) summarizes the variables used in our model and their measurements.

4. Analysis of the results

4.1. Descriptive statistics and correlation check

[Table 4](#) provides a summary of the descriptive statistics of the variables to understand the characteristics of our data. Multicollinearity among independent variables must be continuously examined before analyzing the regressions. The Pearson correlation results are shown in [Table 5](#). Some correlation coefficients exceed 0.5 such as EVS-BV and EVS, IndEVS-BV and IndEVS, but these variables do not simultaneously exist in the same model. The low correlations among the explanatory variables reported in [Table 5](#) suggest that multicollinearity is not a concern in our dataset.

4.2. Empirical results

In this section, we discuss the results using a multivariate framework. Panels A, B, and C in [Table 6](#) respectively present the coefficient estimates of the regression of EVS-BV, EVS, and PB warranted multiples, for the full sample. For each panel, the independent variables, profitability, growth, and risk are analyzed with different proxy measurements, including finance (FIN), valuation (VAL), and both finance and valuation aspects (BOTH).

For the proxy measurements of profitability, there are significant and negative impacts for all measurements of profitability (AdjPM and AdjROA) for EVS-BV and EVS. By contrast, for the PB proxy measure, only the coefficient of AdjROE is significantly negative at the 1% level, while there is no relationship between AdjPM and PB. The results for AdjROA are similar to the results from Bhojraj and Lee (2002) study.

For the proxy measurements of growth, the coefficient of the industry-adjusted profit growth (AdjGROWTH) is inconsistent for all models. For firm value, the relation between AdjGROWTH and EVS-BV is negative and significant at the 10% level; there is no statistically significant relationship between AdjGROWTH and EVS as well as PB. We further find that the coefficient of the firm's reinvestment rate (RIRF)—the alternative approach from the valuation aspect, is significantly positive at the 1% level for models with proxy measures for firm value (i.e., EVS-BV and EVS).

Table 4. Descriptive statistics

Variable	N	Mean	Std. Dev.	Minimum	Maximum
EVS-BV	18,418	1.368	1.465	0.013	9.950
EVS	18,418	1.770	1.754	0.005	9.975
PB	18,418	1.430	1.393	0.010	11.080
AdjPM	18,418	0.007	0.029	-0.347	0.385
AdjROA	18,418	0.047	0.078	-0.494	0.576
AdjROE	18,418	0.000	0.005	-0.266	0.516
AdjGROWTH	18,418	0.000	0.087	-0.593	0.476
RIRF	18,418	0.015	0.161	-2.873	3.919
RIRE	18,418	0.019	0.201	-2.299	3.898
FL	18,418	0.258	0.804	0.000	47.065
OL	18,418	0.904	2.694	0.025	39.814
IndEVSbv	18,418	2.237	1.810	0.219	9.666
IndEVS	18,418	2.504	1.901	0.141	9.557
IndPB	18,418	1.638	1.146	0.018	9.588
Size	18,418	22.599	3.717	13.940	33.494
Age	18,418	3.027	0.831	0.000	7.611

This is consistent with valuation theory because the higher the present reinvestment rate, the higher the future growth rate. For equity value, there is no statistically significant relationship between PB and all proxy measurements of growth (i.e., AdjGROWTH and RIRE). In fact, the earnings growth rate is one of the decisive factors guiding investor decisions, as reflected in stock prices. By contrast, the firm's reinvestment rate (or equity) contributes significantly to its intrinsic value and not its market value. This factor may be ignored or contribute less to PB due to the stock's market price, but positively impacts EVS due to debt's book value, and EVS-BV due to the book value of debt and equity.

For proxy measurement of risk, we find that the estimated coefficient of FL is positive and economically significant, as expected for all models, and these results are significant at the 1% level. Previous literature provides many reasons (e.g., bankruptcy costs and personal income tax) to explain why companies are unable to adopt a 100% debt financing policy. We examine the non-linearity of FL by including the square value of FL in the regression. As expected, the coefficients of FL and FL² are significantly positive and negative, respectively, for all the models. These results are like the coefficients of OL and OL² for models with EVS-BV and EVS as dependent variables, except for models of the PB dependent variable.

4.3. Additional analysis

We continuously compare the peer selection based on these systematic models with previous conventional approaches to ensure the suitability or aptness of this alternative approach. To do this, we use the regression equation, in which the dependent variables are "actual WMs of the target firm" and the independent variables are "average actual WMs of comparable firms." We have four versions of explanatory variables. We note that all versions are the average actual WMs, not average forecast WMs. The difference between them is the approach utilized for the selection of comparable firms. The approaches are broadly categorized into two groups. The first is the conventional approach (one version) that selects peers based on the same industry. The other is the approach developed in this study (three versions) that select comparable firms using the closest forecast WMs.

Table 5. Correlation matrix

	1.	2.	3.	4.	5.	6.	7.	8.
1. EVS-BV	1.000							
2. EVS	0.694	1.000						
3. PB	-0.144	0.408	1.000					
4. AdjPM	-0.009	0.040	0.062	1.000				
5. AdjROA	-0.195	-0.015	0.261	0.346	1.000			
6. AdjROE	-0.039	-0.013	0.005	0.097	0.302	1.000		
7. AdjGROWTH	-0.000	0.017	0.022	0.035	0.043	0.009	1.000	
8. RIRF	0.029	0.015	-0.012	-0.018	-0.029	-0.015	0.000	1.000
9. RIRE	-0.006	-0.025	-0.019	-0.013	0.008	-0.015	-0.024	0.484
10. FL	0.103	0.136	0.087	-0.008	-0.069	-0.165	0.010	0.011
11. OL	0.102	0.074	-0.018	-0.014	-0.084	-0.018	-0.002	0.004
12. IndEVSbv	0.261	0.189	-0.058	0.238	-0.086	-0.012	-0.010	-0.002
13. IndEVS	0.203	0.238	0.097	0.258	-0.069	-0.009	0.005	-0.000
14. IndPB	0.000	0.161	0.267	0.038	-0.015	-0.022	-0.033	0.007
15. Size	-0.064	-0.009	0.049	-0.053	0.178	0.061	0.028	0.014
16. Age	0.039	0.044	0.056	-0.021	-0.059	-0.017	0.011	-0.007
9. RIRE	9.	10.	11.	12.	13.	14.	15.	16.
10. FL	1.000							
11. OL	0.018	1.000						
12. IndEVSbv	-0.002	0.015	1.000					
13. IndEVS	-0.019	0.036	0.045	1.000				
14. IndPB	-0.026	0.051	0.033	0.691	1.000			
15. Size	-0.013	0.010	0.016	-0.015	0.287	1.000		
16. Age	-0.016	0.124	-0.067	-0.086	-0.075	-0.075	1.000	
	-0.018	0.010	0.009	0.028	0.103	0.159	0.048	1.000

The correlations in bold are statistically significant at the 5% level.

Variables	Panel A: EVS-BV			Panel B: EVS			Panel C: PB		
	FIN	VAL	BOTH	FIN	VAL	BOTH	FIN	VAL	BOTH
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
AdjPM	-4.814*** [0.247]		-2.840 *** [0.262]	-4.026*** [0.324]		-3.148*** [0.347]	0.393 [0.271]		0.482* [0.271]
AdjROA		-2.731*** [0.104]	-2.275*** [0.112]		-1.526*** [0.139]	-1.036*** [0.148]			
AdjROE								-6.640*** [1.472]	-6.833*** [1.476]
AdjGROWTH	-0.127** [0.065]		-0.111* [0.064]	-0.073 [0.085]		-0.066 [0.085]	0.098 [0.075]		0.095 [0.075]
RIRF		0.169*** [0.036]	0.167*** [0.036]		0.126*** [0.048]	0.122** [0.048]			
RIRE								-0.049 [0.033]	-0.048 [0.033]
FL	0.245*** [0.018]	0.208*** [0.018]	0.210*** [0.018]	0.244*** [0.024]	0.226*** [0.024]	0.228*** [0.024]	0.191*** [0.021]	0.175*** [0.022]	0.175*** [0.022]
FL ²	-0.006*** [0.000]	-0.005*** [0.000]	-0.005*** [0.000]	-0.005*** [0.000]	-0.005*** [0.000]	-0.005*** [0.000]	-0.002*** [0.000]	-0.002*** [0.000]	-0.002*** [0.000]
OL	0.021*** [0.005]	0.015*** [0.004]	0.015*** [0.004]	0.018*** [0.006]	0.016** [0.006]	0.015** [0.006]	-0.011* [0.005]	-0.011** [0.005]	-0.011* [0.005]
OL ²	-0.000*** [0.000]	-0.000*** [0.000]	-0.000** [0.000]	-0.000** [0.000]	-0.000* [0.000]	-0.000* [0.000]	0.000* [0.000]	0.000* [0.000]	0.000* [0.000]
IndEVSbv	0.069*** [0.005]	0.027*** [0.005]	0.049*** [0.005]						
IndEVS				0.032*** [0.006]	0.005 [0.005]	0.025*** [0.006]			
IndPB							0.116*** [0.008]	0.114*** [0.008]	0.115*** [0.008]
Size	0.202*** [0.017]	0.204*** [0.016]	0.213*** [0.016]	0.364*** [0.022]	0.361*** [0.022]	0.370*** [0.042]	-0.002 [0.019]	0.001 [0.019]	-0.000 [0.019]

(Continued)

Table6. (Continued)

Variables	Panel A: EVS-BV			Panel B: EVS			Panel C: PB		
	FIN	VAL	BOTH	FIN	VAL	BOTH	FIN	VAL	BOTH
Age	0.292*** [0.031]	0.173*** [0.032]	0.172*** [0.032]	0.354*** [0.041]	0.291*** [0.042]	0.296*** [0.042]	0.190*** [0.035]	0.183*** [0.035]	0.179*** [0.035]
Constant	-4.287*** [0.354]	-3.770*** [0.350]	-4.022*** [0.350]	-7.676*** [0.467]	-7.286*** [0.467]	-7.548*** [0.466]	0.677* [0.411]	0.616 [0.410]	0.685* [0.411]
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,418	18,418	18,418	18,418	18,418	18,418	18,418	18,418	18,418
Adj-R ²	0.078	0.097	0.104	0.061	0.059	0.064	0.023	0.024	0.024

Standard errors of the corresponding coefficients are reflected in square brackets. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

There are three steps for estimating independent variables based on the second approach. First, we use the estimated coefficients from the developed models (the results from Table 6) to forecast WMs (called FWMs). Second, we determine four and ten³ peer companies that have the closest FWMs to the actual WMs of the target firm. Finally, we estimate the harmonic average of the actual WMs of the four/ten firms. We note that the role of FWMs is only to select peers. In addition, because of the three versions available when developing systematic models (i.e., finance, valuation, and both finance and valuation), this approach also discloses three models for peer selection (i.e., three versions of FWMs for each WM). Most importantly, to perform the second step, we create a new code, visual basic application (VBA), to estimate the average of the actual WMs of the four closest firms based on their forecasted WMs, instead of applying available functions.

The tested model is shown below as Eq. (3):

$$WM_{i,t} = \beta_0 + \beta_1 IWM_{i,t} + \beta_2 COMPWM_{i,t} + \mu_{i,t} \quad (3)$$

where the sub-index *i* identifies the firm; sub-index *t* indicates the period; $\mu_{i,t}$ represents the term for random disturbance; WM represents the actual warranted multiple proxy measurements (i.e., EVS-BV, EVS, and PB); IWM is the harmonic mean of the industry actual WM (proxied by IEVS-BV, IEVS, and IPB); FWM is the forecast WM⁴ (proxied by FEVS-BV, FEVS, and FPB); and COMPWM is the harmonic mean of actual WMs of the four closest firms based on their FWM (proxied by COMPEVS-BV, COMPEVS, and COMPPB).

Table 7 presents the regression model obtained by estimating Eq. (3) for the full sample, showing the relationship between actual WMs and average actual WMs, which are chosen in different ways. The dependent variables are actual EVS-BV, actual EVS, and actual PB, which are presented in Panels A, B, and C, respectively. The independent variables are average WMs with four average versions divided into two groups: the conventional approach (Column [1]) and the new systematic approach with four peers (Columns [2], [3], and [4]) and ten peers (Columns [5], [6], and [7]). As mentioned above, the systematic models consider three versions for each WM: finance (FIN), valuation (VAL), and both finance and valuation aspects (BOTH). Thus, for each WM (each panel), when applying a new systematic approach, we have three versions to estimate the independent variables (FIN, VAL, and BOTH), which are reported in Columns [2]/[5], [3]/[6], and [4]/[7], respectively.

As stated previously, most target firms (the firms in need of value estimation) in ASEAN countries are non-listed companies, which means that EVS-BV remains the main dependent variable in our study. The results in Table 7 show that the average of industry-based comparable firms explains only 12.36%, 10.15%, and 6.88% of the variation in EVS-BV, EVS, and PB, respectively.

However, selecting comparable firms based on our systematic models sharply increases the explained level of variation in EVS-BV, EVS, and PB, at 35.21% (COMP-EVS-BV-BOTH), 34.34% (COMP-EVS-BOTH), and 11.54% (COMP-PB-BOTH), respectively, for models considering both finance and valuation aspects (Column [2]). These results are like those from models that consider the finance perspective, at 25.20% (COMP-EVS-BV-FIN), 32.36% (COMP-EVS-FIN), and 11.67% (COMP-PB-FIN) in the explained level of variation in EVS-BV, EVS, and PB, respectively (Column [3]). Selecting peers based on our models with only the valuation aspect is also better than selection based on the same industry, at 34.09% (COMP-EVS-BV-FIN), 35.58% (COMP-EVS-FIN), and 9.05% (COMP-PB-FIN) (Column [4]). More important, the explained level of our new systematic approach with ten comparable firms is higher than that with four peer firms (see Columns [5], [6], and [7]).

The results in Table 7 also show that the conventional approach of using the same industry to select comparable firms is less appropriate. These findings are consistent with the arguments of Bhojraj and Lee (2002). Kim-Duc and To (2015) and Kim-Duc et al. (2018) employed the same risk classification to choose comparable firms to test the suitability of proxy-levered beta (PLB). The results of these two studies suggest that further research should be an empirical study on how to

Table 7. Prediction regressions for ASEAN countries

	Panel A. Conventional Approach	Panel B. New Approach (4 peer firms)				Panel C. New Approach (10 peer firms)		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	
Dependent variable: EVS-BV								
IEVSBV	0.470*** [0.027]							
COMP-EVS-BV-BOTH		0.254*** [0.008]			0.534*** [0.011]			
COMP-EVS-BV-FIN			0.202*** [0.008]			0.430*** [0.011]		
COMP-EVS-BV-VAL				0.270*** [0.008]			0.550*** [0.012]	
Constant	0.591*** [0.031]	0.822*** [0.010]	0.879*** [0.010]	0.811*** [0.010]	0.495*** [0.014]	0.604*** [0.014]	0.494*** [0.014]	
Observations	15,361	15,361	15,361	15,361	15,356	15,356	15,356	
Hausman test	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]	
Adj. R ²	0.1236	0.3521	0.2520	0.3409	0.4102	0.3075	0.4026	
Dependent variable: EVS								
IEVS	[1]	[2]	[3]	[4]	[5]	[6]	[7]	
	0.626*** [0.026]							
COMP-EVS-BOTH		0.313*** [0.009]			0.631*** [0.011]			
COMP-EVS-FIN			0.297*** [0.008]			0.677*** [0.011]		

(Continued)

Table 7. (Continued)

	Panel A. Conventional Approach	Panel B. New Approach (4 peer firms)			Panel C. New Approach (10 peer firms)		
COMP-EVS-VAL				0.329*** [0.009]			0.608*** [0.011]
Constant	0.535*** [0.038]	0.976*** [0.014]	0.998*** [0.013]	0.958*** [0.013]	0.511*** [0.017]	0.445*** [0.017]	0.545***[0.017]
Observations	15,361	15,361	15,361	15,361	15,356	15,356	15,356
Hausman test	Yes [RE]	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]
Adj. R ²	0.1015	0.3434	0.3236	0.3558	0.4029	0.4053	0.3931
Dependent variable: PB							
IPB	[1] 0.621*** [0.034]	[2]	[3]	[4]	[5]	[6]	[7]
COMP-PB-BOTH		0.118*** [0.008]			0.195*** [0.011]		
COMP-PB-FIN			0.131*** [0.009]			0.215*** [0.011]	
COMP-PB-VAL				0.098*** [0.008]			0.173*** [0.011]
Constant	0.488*** [0.044]	1.122*** [0.012]	1.107*** [0.013]	1.149*** [0.012]	1.011*** [0.016]	0.985*** [0.017]	1.037*** [0.017]
Observations	15,361	15,361	15,361	15,361	15,356	15,356	15,356
Hausman test	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]	Yes [FE]
Adj. R ²	0.0688	0.1154	0.1167	0.0905	0.1441	0.1441	0.1248

Standard errors of the corresponding coefficients are reflected in square brackets. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

select comparable companies for higher effectiveness of PLB in the replacement of market-based beta. Our empirical evidence supports this conclusion.

4.4. A guideline for valuers for using our models

The findings of this study contribute to the practice of making valuations. This section describes the procedure to be adopted by valuers for the application of our models in the selection of peer firms.

First, we analyze the target firm to identify and select the appropriate WMs (i.e., EVS-BV, EVS, PB, or all) and the appropriate version of each WM (i.e., financial (FIN), valuation (VAL), or both (BOTH)). This step is considered a qualitative analysis and depends entirely on the professional judgment of valuers. There are many subjective factors to support this step, such as financial information, corporate governance, capital structure, market share, brand name, and customer relations.

Second, we estimate the actual WMs selected in the first step for the target firm.

The third step is of making proxy measurements for profitability, growth, and risk for all the companies for which data is available to the valuers; then the coefficient represented in [Table 6](#) can be applied to estimate the predicted WMs. The proxy measures for all variables are listed in [Table 3](#).

Fourth, we select appropriate comparable firms. The peers are companies that have the closest predicted WMs (i.e., the results of the third step) with the actual WMs of the target firm (i.e., the results of the second step). The number of comparable firms depends on the level of difference in results between the third and second steps, and the professional judgment of valuers based on the first step.

The final step (if possible), would be in using the results shown in [Table 7](#) to explain and convince clients that the conventional practice of using same industry to select comparable firms contains limitations and that the selection of peers based on these systematic models is more appropriate.

5. Conclusion

This study develops systematic models for the selection of comparable firms for business valuation. The selection and designation of the peer firms is an important requirement for the application of market-based and income-based approaches of valuation. Many studies have focused on the usefulness or efficacy of the peer approach (e.g., How et al., 2007) and on comparing the peer firm selection methods of investment banks as underwriters pre-and post-IPO (e.g., Vismara et al., 2015). By contrast, Bhojraj and Lee (2002) applied a valuation-based approach to build models for the selection of comparable firms. However, their study continues to be based on financial aspects and indicators to measure the variables. Based on valuation theory and a dataset of 18,418 firm-year observations in six ASEAN countries from 2010 to 2020, we develop systematic models to select and identify target firms' peers. In addition to the financial aspect, our research also follows valuation theory to measure factors like profitability, growth, and risk that impact WMs. This study demonstrates that our models are more suitable than the models following the conventional approach which consider indicators like same industry and firm size.

The first contribution of this study is the creation of systematic models that consider both financial and valuation aspects to support valuers in selecting peer firms. Following the models of this study, the selected peers are companies that have the closest WMs (EVS-BV for all types of target firms; EVS, and/or PB if the target firm is a listed firm) with the target firm, instead of conforming to criteria such as same industry or firm size. The second significant contribution is the appropriateness of these systematic models compared with the conventional approach. Thus, when applying these models, valuers can cite the results of this study as empirical evidence in the valuation reports.

Our research has several limitations, which warrant further study. First, our data focuses on listed firms in the ASEAN countries. These companies must meet strict requirements to be listed on

stock exchanges, and thus, future research could examine privately owned firms. Second, our empirical setting is limited to six ASEAN countries because of the lack of data from other members such as Brunei Darussalam, Cambodia, Lao PDR, and Myanmar. Further studies should investigate systematic models for multinational context.

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Notes

1. There are three approaches used to estimate asset value, including the cost-, market-, and income-based approaches (IVSC, 2019). For business valuation, the cost-based approach is also referred to as the asset-based approach (Pratt & Niculita, 2008).
2. A lower payout ratio also means that the reinvestment rate will be higher.
3. The previous version only determined four peer firms. Cooper and Cordeiro (2008) find that the average accuracy of using ten close peer firms is as similar to using all comparable firms in the same industry. Hence, we enhance accuracy with ten peer companies.
4. These variables are computed using the estimated coefficients from the prior year’s regression, and accounting or market-based variables from the current year.

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