

THE SUITABILITY OF PROXY LEVERED BETA IN BUSINESS VALUATION: EVIDENCE FROM VIETNAM



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ABSTRACT

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This study aims to test the suitability of Proxy Levered Beta (PLB) in the context of corporate valuation in Vietnam. In particular, there are two main issues clarified in this paper: (i) whether there is a significant relationship between financial leverage, operating leverage, and systematic risk; and (ii) whether PLB can be an alternative of Market-Based Beta (MBB). By estimating with the panel data collected from non-financial firms listed on Ho Chi Minh Stock Exchange (HoSE) during the period 2010–2015, the empirical findings show that: (i) the operating leverage and financial leverage have a significant impact on systematic risk; (ii) PLB with adjusted financial leverage will be the most effective measure of MBB; and (iii) the new standard of industry classification on HoSE will not suitable to represent the systematic risk when measuring PLB in Vietnam.

Contribution/ Originality: This study contributes in the existing literature in two ways: (i) concurrently considering both financial and operating leverage when adjusted beta coefficient instead of just financial leverage as previous studies; and (ii) providing the empirical evidence so that appraisers may not only apply them in Vietnam but also explain the valuation result to consumer convincingly.

1. INTRODUCTION

In corporate valuation, expected rate of return used to estimate the cost of capital or the appropriate discount rate. Although there are many models which have been used to estimate the expected return, the Capital Asset Pricing Model (CAPM) is still the most widely used and easily understood. It is because of this, "beta" estimation, one of the three components of CAPM, is vital to understand for appraisers when they seek to estimate firm value. Beta estimation for listed companies is relatively straightforward, which is assessed directly from the market (known as Market-Based Beta, MBB or β_m) (Modigliani and Miller, 1963; Sharpe, 1964; Hamada, 1972; Rubinstein, 1973; Bowman, 1979; Miles and Ezzell, 1985; Bowman and Bush, 2006; Damodaran, 2009). On the other hand, there can be major challenges when estimating beta for unlisted or newly listed companies. Thus, the Bottom-up

beta or Proxy-Levered Beta (PLB) has been proposed as a replacement for MBB in for these companies (Damodaran, 2012). In addition, firms with leveraged restructuring are also suggested to use PLB as an alternative of MBB.

Since there have been a number of empirical research which studied on the relationship between Operating Leverage (OL), Financial Leverage (FL) and systematic risk, the idea of using PLB to replace MBB has been derived (Damodaran, 2012). Specifically, there are two main steps to calculate PLB (i) indicate MBB of listed companies in the same industry (comparable listed firms), which are relevant to firms to be evaluated (the subject firm); then (ii) proxy the leverage of comparable listed firms to the leverage of the subject firm. The proxy leverage might be (i) financial leverage or (ii) both financial leverage and operating leverage. Therefore, PLB of unlisted or newly listed firms is equal to MBB of comparable listed firms after adjusting the financial leverage (known as PLB^{FL}) or both the financial leverage and operating leverage (known as PLB^{TL}).

According to Sarmiento-Sabogal and Sadeghi (2014) PLB is expected to be equal MBB. Most of the previous studies, which tested whether the PLB was an efficient replacement of MBB, indicated that PLB used only the adjusted financial leverage (Bowman, 1980; Kemsley and Nissim, 2002; Bowman and Bush, 2006; Sarmiento-Sabogal and Sadeghi, 2014; Nguyen and To, 2015). There is still a lack of research which tests the relationship between PLB and MBB when considering both adjusted financial leverage and operating leverage.

Until December 2017, the number of registered companies in Vietnam was 558.449 with 126.859 newly registered firms in 2017 (The General Statistics Office of Vietnam, 2018). However, until January 2018, there were only 344 listed firms on Ho Chi Minh Stock Exchange (HoSE) and 384 listed companies on Hanoi Stock Exchange (HNX). The fact in Vietnam show that the demand in corporate valuation also focus on unlisted or newly listed firms and therefore, PLB is usually used as an alternative ratio to MBB.

The main purpose of this paper is answer the research question; whether PLB is a good proxy for MBB for firms in Vietnam where there are a lot of private firms, especially for companies with inadequate information to calculate the MBB or firms with leveraged restructuring. Moreover, there is a lack of previous studies which have tested PLB model under both financial leverage and operating leverage. Therefore, this study will investigate two main issues: (i) whether appraisers need to adjust only the financial leverage or both financial and operating leverage when estimating PLB; (ii) during adjusting financial leverage, whether appraisers should consider the effect of tax shield.

The following sections of this paper is structured as follows: section 2 presents the theoretical framework and reviews the relevant theoretical literature. Section 3 introduces the methodology, empirical models, and data for further empirical analysis. Section 4 presents and discusses empirical findings. Finally, Section 5 concludes and raises some implications in the context of Vietnam corporate valuation.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1. Theoretical Framework

2.1.1. CAPM and Systematic Risk Measurement in CAPM

According to Damodaran (2002) expected return can be used as a discount rate in business valuation. Thus, there is a high attention of both investors and appraisers in the estimation of expected return. Based on previous studies, there are several models to calculate the ratio of expected return such as Capital Asset Pricing Model, CAPM, (Sharpe, 1964; Lintner, 1965; Mossin, 1966) Multifactor Models: (i) The Arbitrage Pricing Theory (Ross, 1976) (ii) The Fama-French Three-Factor Model (Fama and French, 1993) (iii) The Fama-French Five-Factor Model (Fama and French, 2015) etc; and higher co-moment factors (Harvey and Siddique, 2000; Smith, 2007). However, CAPM is still the most popular model used by analysts, investors, appraisers and companies.

According to Markowitz (1952) and Sharpe (1964) CAPM was introduced based on the theories of systematic risk management and portfolio management; therefore, it shows the significant relationship between systematic risk

and expected return. In the expected return of an asset, there are three main determinants (Jordan and Miller, 2009) (i) the pure time value of money measured by the risk-free rate (R_f); (ii) the reward for bearing systematic risk measured by the market premium ($E(R_m) - R_f$); and (iii) the amount of systematic risk measured by β_i .

$$E(R_i) = R_f + \beta_i * [E(R_m) - R_f] \quad (1)$$

The beta in CAPM is a ratio which compares the systematic risk of an asset with the systematic risk of the market. In addition, this ratio can also describe the responsiveness of expected return on the asset to the expected market return. Therefore, the beta of an asset or a security (β_i) is also called Market-based beta (MBB or β_m or β_{equity}).

According to Gahlon and Gentry (1982) and Mandelker and Rhee (1984) leverages have put a significant impact on the systematic risk. Furthermore, the beta is also reflected by these leverages (Damodaran, 2002). Thus beta β_i is called as leveraged beta ($\beta_{leverage}$ or β_l), which can be calculated as:

$$\beta_i = \beta_{equity} = \beta_m = \beta_l = MBB = \text{Corr}(R_i, R_m) * \frac{\sigma_i}{\sigma_m} = \frac{\text{Cov}(R_i, R_m)}{\sigma_m^2} \quad (2)$$

$\text{Cov}(R_i, R_m)$: covariance between expected return of an asset (R_i) and expected market return (R_m); σ_m^2 : market variance.

In the equation (2), the beta of an asset or a security is estimated in two cases. Firstly, the beta is calculated for listed companies during a specific period of at least five years in order to get a minimum of 60 month-observations of R_i (Dondeti *et al.*, 2014; Sarmiento-Sabogal and Sadeghi, 2014). Secondly, the beta equation (2) is applied for unlisted companies or individual business units. R_i cannot be calculated by stock price due to the shortage of data, thus the book value should be used instead (Damodaran, 2002). However, the book value of a firm is not usually published monthly, but quarterly. Therefore, to get the sufficient research data of at least 60 observations, the company has to obtain data during at least 15 years. However, the requirement of obtaining at least 15-year data would be impossible for these unlisted firms. According to Sarmiento-Sabogal and Sadeghi (2014) beta might not be calculated for the unlisted or short-term listed companies, so it could be challenges for investors and appraisers in the valuation process.

2.1.2. Financial Leverage and Operating Leverage

Since the financial leverage and operating leverage affect the systematic risk significantly (Rubinstein, 1973; Lev, 1974; Percival, 1974; Gahlon and Gentry, 1982; Mandelker and Rhee, 1984; Lord, 1996; Guthrie, 2011) companies usually use leverage to increase the expected return for their stockholders.

The financial leverage was first introduced in the modern capital structure theory of Modigliani and Miller (1958;1963). Following this strand of theory, a firm's value would be increased with the financial leverage under the effect of tax (Modigliani and Miller, 1963). However, the more debts a firm obtains, the higher bankruptcy cost it may face up with. Thus, an updated version of MM theory, the trade-off theory of Myers (1977) which indicates the availability of cost of bankruptcy and other relevant costs. According to (Hamada, 1969; Hamada, 1972) the model showed the impact of the financial leverage on the systematic risk. Thus, this model has been used and developed by a number of studies (Rubinstein, 1973; Bowman, 1979; Fernandez, 2006).

On the other hand, Rubinstein (1973) found that the systematic risk was also affected by operating leverage. While the financial leverage could create financial risk, the operating leverage would make more operating risks. As both operating and financial risks obtain several factors of both systematic and unsystematic risks, the unsystematic risk could be ignored by diversification (Jordan and Miller, 2009). Therefore, operating and financial risks have been a high consideration of the systematics risk in previous empirical research (Lev, 1974; Gahlon and Gentry, 1982; Mandelker and Rhee, 1984).

2.1.3. Proxy Levered Beta

Since there is a relationship between financial leverage, operating leverage and systematic risk, the bottom-up approach is used to estimate the beta. This approach is based on two main theories: (i) theory of systematic risk and expected return, and (ii) the relationship between leverage and systematic risk. If the beta is estimated by using this approach, it is called proxy leverage beta (PLB, or bottom-up beta). The PLB should be used in several cases such as: (i) firms with leverage restructure; (ii) newly listed companies; (iii) unlisted firms; and (iv) individual business units. There are a number of empirical studies (Damodaran, 2002; Beneda, 2003; Renzi *et al.*, 2013; Dondeti *et al.*, 2014; Sarmiento-Sabogal and Sadeghi, 2014) in which the authors discussed the PLB calculation including several steps:

- Step 1: Estimate the beta of compatible firms

Firstly, the beta of compatible companies is calculated. These firms are chosen from the one which are in the same risk level with the tested company, and are usually in the same industry (Damodaran, 2002; Sarmiento-Sabogal and Sadeghi, 2014). This is called leveraged beta (β_l) or market beta of compatible firms (β_m).

- Step 2: Estimate unlevered beta

Although these firms are compatible, betas of these companies cannot be applied in the valuation process due to the different leverage. According to Hamada (1972) unlevered companies use the same beta, thus the beta is unlevered to become Proxy Unlevered Beta (PUB). However, there are financial leverage and operating leverage, the calculation of PUB is classified into two different ways: (i) only adjusting the financial leverage (unlevered beta, PUB^{FL}), and (ii) adjusting both financial and operating leverage (business beta or total unlevered beta, PUB^{TL}).

- Step 3: Estimate the beta of tested company

In this step, based on the chosen leverage in step 2, the beta would be identified by combining the levered beta into unlevered beta (result in step 2).

2.2. Literature Review

An early model applying CAPM by Blume (1975) used beta to get the systematic risk, and it has become the fundamental research about beta. However, the past research only focused on the relationship between beta and expected return in different market such as the United States (Jensen *et al.*, 1972; Blume and Friend, 1973; Kothari *et al.*, 1995; Jagannathan and Wang, 1996) the United Kingdom (Pettengill *et al.*, 1995; Clare *et al.*, 1998) and emerging markets (Wong and Tan, 1991; Cheung *et al.*, 1993; Aydogan and Gursoy, 2000).

The estimated beta mostly focused on listed firm due to the high suitability (Gooding and O'Malley, 1977; Faff, 2001). On the other hand, Renzi *et al.* (2013) raised an attention on the beta calculation of unlisted firms due to a small number of research. Although PLB has been introduced as an optimal ratio (Beneda, 2003; Renzi *et al.*, 2013; Dondeti *et al.*, 2014) these papers only presented the PLB equation, not for the application.

2.2.1. Financial Leverage, Operating Leverage, and Systematic Risk

Mandelker and Rhee (1984) presented PLB with the determinants of systematic risk, in which there are financial and operating leverage. Furthermore, Hamada (1972); Hamada (1969) proved that the relationship between financial leverage and systematic risk. According to Rubinstein (1973) the systematic risk was depended by operating leverage. Findings of Percival (1974) also supported this idea when getting the significance of this relationship through the ratio between profit and cost. The empirical study of Lev (1974) examined 122 firms during the period of 1949-1968 in three different industries: (i) solar energy; (ii) steel; and (iii) petro and gas. He found that there was a relationship between operating leverage and systematic risk, which indicates that the higher operating leverage would make of systematic risk more sensitive. The findings of previous studies in different countries (Bowman, 1979;1980; Hill and Stone, 1980; Gahlon and Gentry, 1982; Huffman, 1983; Mandelker and Rhee, 1984; Bhandari, 1988; Huffman, 1989; Butler *et al.*, 1991; Darrat and Mukherjee, 1995; Lord, 1996; Guthrie,

2011) also showed the same result. In the Vietnamese market, Nguyen and To (2015) tested 167 listed firms on HoSE during the period of 2006-2014, also found that there was a relationship between financial leverage and systematic risk. However, this study did not consider the operating leverage and potential endogeneity.

2.2.2. Proxy Levered Beta and Market-Based Beta

The finding of the relationship between leverage and systematic risk supported the use of PLB in the corporate valuation and financial investment, when PLB was closely equal to MBB (Sarmiento-Sabogal and Sadeghi, 2014). In addition, Butler *et al.* (1991) also supported this result when their research of US listed companies in the period of 1974-1988 showed the positive relationship between PLB and MBB. Furthermore, Bowman and Bush (2006); Kemsley and Nissim (2002) also found the statistical relationship between PLB and MBB in Australian and US markets. With the listed companies in the US market during 1970-2011, even the market value was replaced by the book value, there was a relationship between PLB and MBB (Sarmiento-Sabogal and Sadeghi, 2014). Recently, when examining listed companies in the U.S. in the period 1970-2011, Sarmiento-Sabogal and Sadeghi (2014) shows that PLB has a positive correlation with MBB even when the book value of the stock was used instead of its market value.

In Vietnam, there are a number of papers studying the beta in CAPM (Nguyen, 2010; Vo and Pham, 2012). However, most of the research has focused on the estimated beta of listed firms and the suitability of CAPM in Vietnam. According to Hay and Nguyen (2012) the paper also mentioned about the PLB calculation and analyzed the pro and cons of PLB. In addition, Nguyen and To (2015) has focused on the suitability of PLB in Vietnam with data from 167 listed companies during 2006-2014. All of the findings showed that PLB is significantly suitable in Vietnamese market. The results support Modigliani and Miller (1958;1963) rather than Miles and Ezzell (1980;1985) which means that the tax shield should be considered when using financial leverage in the beta. However, Nguyen and To (2015) did not show the evidence of considering the operating leverage in the model of PLB. Although the result of Nguyen and To (2015) showed that the risk classified by industries was suitable, but from the 25th of January 2016, the HoSE officially classified the industries for listed companies by Global Industry Classification Standards, GICS® which were developed by MSCI and S&P Dow Jones Indexes.

3. MODELS, METHODOLOGY, AND DATA

3.1. Market-Based Beta (MBB) Measurement

MBB represents for the systematic risk of a security. For each firm-year observation, the MBB is estimated by equation (2). After MBB is identified, the length of the estimation period and the return interval (daily, weekly, monthly, or yearly) are considered. According to Damodaran (2002) Value Line and Standard and Poor's use the estimation period of five years, while Bloomberg uses the period of two years. Furthermore, Damodaran (2002) also stated that the shorter length of estimation period such as daily and weekly was, the more observation was obtained, but the result may fail due to in-transaction.

It is widely agreed that the length of the estimation period and the return interval has used the period of 5 years (Damodaran, 2002; Dondeti *et al.*, 2014; Sarmiento-Sabogal and Sadeghi, 2014). Hence, this paper will obtain 60 observations of security return (R_i) and market return (R_m) for the estimation of the MBB (β_i) of a security at t years, the period 5 years and the return interval is monthly.

3.2. Proxy Levered Beta (PLB) Measurement

PLB_{it} is calculated with three following steps:

Step 1: Estimate the MBB of compatible firms

Compatible firms are listed companies which are in the same business field with the testing company. This study uses the method of GICS®, the latest method to differentiate industries by HoSE. In addition, MBBs of these companies are estimated by equation (2) with the period of five years and the monthly return interval.

Step 2: Estimate PUB

PUB including both PUB^{FL} (β_u^{FL}) and PUB^{TL} (β_u^{TL}) is estimated under two main theories. In a taxation context, an issue is whether the tax shield was applied (Modigliani and Miller, 1958;1963) or not (Miles and Ezzell, 1980;1985). This study would like to apply both methods to do the empirical test of PLB (Marston and Perry, 1996; Kemsley and Nissim, 2002). In addition, the previous studies also suggested that the market value of debt (D_{mv}) should be used in equation of D/E. However, it is a complex process to estimate market value of debt (D_{mv}). Hence, the book value of debt (D_{bv}) is used in this study. The idea is supported by Bowman (1980) who stated that replacing D_{mv} by D_{bv} would not impact on the research results (Sarmiento-Sabogal and Sadeghi, 2014).

Thus, the equations (3) and (4) show the calculations of PUB^{FL}

$$PUB_{MM}^{FL} = \beta_u^{FL,MM} = MBB / \left[1 + \frac{D_{bv}}{E_{mv}} (1 - \tau) \right] \quad (3)$$

$$PUB_{ME}^{FL} = \beta_u^{FL,ME} = MBB / \left[1 + \frac{D_{bv}}{E_{mv}} \right] \quad (4)$$

Where

PUB_{MM}^{FL} (or $\beta_u^{FL,MM}$) is the proxy for unlevered beta, based on MM theory;

PUB_{ME}^{FL} (or $\beta_u^{FL,ME}$) is the proxy for unlevered beta, based on ME theory;

τ is corporate taxation.

The upcoming step is to identify proxy unlevered beta PUB^{TL} (β_u^{TL}) by taking out the operating leverage from PUB^{FL} . This is the beta of unleveraged financial and operating leverage. Thus, PUB^{TL} is calculated as equations (5) and (6), with EBIT is earnings before interests and taxes; and S is sales (or revenues):

$$PUB_{MM}^{TL} = \beta_u^{TL,MM} = PUB_{MM}^{FL} / \left[1 + \frac{\% \Delta EBIT}{\% \Delta S} \right] \quad (5)$$

$$PUB_{ME}^{TL} = \beta_u^{TL,ME} = PUB_{ME}^{FL} / \left[1 + \frac{\% \Delta EBIT}{\% \Delta S} \right] \quad (6)$$

According to Damodaran (2002); Sarmiento-Sabogal and Sadeghi (2014) the average of PUB (\overline{PUB}) takes the exogenous yearly PUB mean for each industry in order to avoid the endogenous problems in the sample. With four methods to estimate PUB shown in equations (3) to (6), there are four models to calculate \overline{PUB} including

\overline{PUB}_{MM}^{FL} ; \overline{PUB}_{ME}^{FL} ; \overline{PUB}_{MM}^{TL} ; \overline{PUB}_{ME}^{TL} . When the tax shield is applied, the income taxes are selected followed the

annual government policy (Kemsley and Nissim, 2002).

Step 3: Estimate PLB

PLB is identified by attaching financial leverage or both financial and operating leverage of testing company with $\overline{\text{PUB}}$ (in step 2). In this study, E_{bv} is used in the estimation of PLB to test the suitability of PLB in the market with lack of information. As a result, there are four versions to calculate PLB^{FL} and four versions to estimate PLB^{TL} , which are shown in the following equations:

$$\text{PLB}_{\text{MM_MV}}^{\text{FL}} = \overline{\text{PUB}}_{\text{MM}}^{\text{FL}} * \left[1 + \frac{D_{bv}}{E_{mv}} (1 - \tau) \right] \quad (7)$$

$$\text{PLB}_{\text{ME_MV}}^{\text{FL}} = \overline{\text{PUB}}_{\text{ME}}^{\text{FL}} * \left[1 + \frac{D_{bv}}{E_{mv}} \right] \quad (8)$$

$$\text{PLB}_{\text{MM_BV}}^{\text{FL}} = \overline{\text{PUB}}_{\text{MM}}^{\text{FL}} * \left[1 + \frac{D_{bv}}{E_{bv}} (1 - \tau) \right] \quad (9)$$

$$\text{PLB}_{\text{ME_BV}}^{\text{FL}} = \overline{\text{PUB}}_{\text{ME}}^{\text{FL}} * \left[1 + \frac{D_{bv}}{E_{bv}} \right] \quad (10)$$

$$\text{PLB}_{\text{MM_MV}}^{\text{TL}} = \overline{\text{PUB}}_{\text{MM}}^{\text{TL}} * \left[1 + \frac{D_{bv}}{E_{mv}} (1 - \tau) \right] * \left[1 + \frac{\% \Delta \text{OP}}{\% \Delta \text{S}} \right] \quad (11)$$

$$\text{PLB}_{\text{ME_MV}}^{\text{TL}} = \overline{\text{PUB}}_{\text{ME}}^{\text{TL}} * \left[1 + \frac{D_{bv}}{E_{mv}} \right] * \left[1 + \frac{\% \Delta \text{OP}}{\% \Delta \text{S}} \right] \quad (12)$$

$$\text{PLB}_{\text{MM_BV}}^{\text{TL}} = \overline{\text{PUB}}_{\text{MM}}^{\text{TL}} * \left[1 + \frac{D_{bv}}{E_{bv}} (1 - \tau) \right] * \left[1 + \frac{\% \Delta \text{OP}}{\% \Delta \text{S}} \right] \quad (13)$$

$$\text{PLB}_{\text{ME_BV}}^{\text{TL}} = \overline{\text{PUB}}_{\text{ME}}^{\text{TL}} * \left[1 + \frac{D_{bv}}{E_{bv}} \right] * \left[1 + \frac{\% \Delta \text{OP}}{\% \Delta \text{S}} \right] \quad (14)$$

3.3. Empirical Models

To test the suitability of PLB in corporate valuation context in Vietnam, the model is divided in two stages: (i) testing the association between operating leverage, financial leverage and systematic risk; (ii) testing the suitability of PLB in Vietnamese market.

3.3.1. Stage-1. Empirical Models of the Relationship between Financial and Operating Leverage and Systematic Risk

If there is a significant association between financial leverage, operating leverage and systematic risk, PLB can be applied in Vietnam. However, it cannot be said that PLB can reflect effectively the MBB, stage 2 will give an answer for this issue.

Findings from previous studies also indicate that financial leverage and operating leverage are the main determinants of systematic risk (Hamada, 1972; Rubinstein, 1973; Lev, 1974; Percival, 1974; Gahlon and Gentry, 1982; Huffman, 1983; Mandelker and Rhee, 1984; Bhandari, 1988; Lord, 1996; Guthrie, 2011).

Furthermore, systematic risk is also affected by other determinants related to the company characteristics. Several past studies report that firm size and revenue growth rate has a significant effect on systematic risk (Lev, 1974; Bhandari, 1988; Butler *et al.*, 1991; Bowman and Bush, 2006; Al-Qaisi, 2011; Asl *et al.*, 2012).

Firm size (SIZE): the smaller the firm size is, the higher risk sensitivity of investor will be in making business decision. As a result, the stock price might be influenced; then it indirectly affects the beta. Therefore, SIZE is the variable used to show the effect of firm size on the systematic risk (Bowman and Bush, 2006; Franzoni and Marin, 2006; Damodaran, 2009; Al-Qaisi, 2011; Asl *et al.*, 2012).

Sale growth rate (SGROWTH): there is a consensus that the sale growth rate is one of the important factors of systematic risk (Bowman and Bush, 2006; Franzoni and Marin, 2006; Al-Qaisi, 2011). Thus, SGROWTH is selected as a second variable of this model.

The regression model of MBB is formulated as follows:

$$MBB_{it} = \alpha_0 + \alpha_1 FL_{it} + \alpha_2 OL_{it} + \alpha_3 SIZE_{it} + \alpha_4 SGROWTH_{it} + \mu_{it} \quad (15)$$

Where

i represents for the ratio of firm/stock (cross unit)

t represents for the 5-year period (time unit)

MBB_{it} is the dependent variable showing the market-based beta of stock i at the end of year t , and representing for the systematic risk.

FL_{it} and OL_{it} are two independent variables, which are the means of financial leverage and operating leverage, respectively in five years at the end of year t .

There are a number of papers which calculate financial leverage such as a ratio of total debts/total assets, or total short-term debts/total assets, or total long-term debt/total assets (Thompson, 1976; Frank and Goyal, 2009; Pandey, 2011) or total debts/market values of equities (Hamada, 1972). In this study, financial leverage is measured by debt/equity (D/E) which is appropriate with the beta equation in stage 2. With the market price of equity, there are two different points of view in this study, which are including market value and book value of equity, E_{mv} and E_{bv} respectively. In operating leverage, the ratio of fixed cost and variable cost is usually used. However, both variables are not shown directly in the annual report and financial statement, it is difficult to identify this ratio in academic research. Therefore, operating leverage will be measured by the ratio of EBIT growth rate (%) and the percentage of sale, which is identified as $\% \Delta EBIT / \Delta S$. This ratio was also used in previous studies during the process to calculate PLB (Percival, 1974; Mandelker and Rhee, 1984; Lord, 1996; Damodaran, 2002; Bowman and Bush, 2006; Al-Qaisi, 2011; Renzi *et al.*, 2013).

$SIZE_{it}$ and $SGROWTH_{it}$ are two control variables, which are firm size and sale growth rate, respectively, of stock i at the end of year t . The variable of SIZE is measured by $\ln(\text{total assets})$, and SGROWTH is calculated by $(S_t - S_{t-1}) / S_{t-1}$.

3.3.2. Stage 2: Testing the Suitability of PLB

In this study, there is a hypothesis that the testing company does not have sufficient data to identify MBB. Thus, the beta will be measured as PLB. Then, the hypothesis will be withdrawn in order to identify the beta directly from MBB.

Furthermore, in the perfect market, the PUB in the same risk level is equal (Hamada, 1972). Thus, \overline{PUB} of firms in the same business industry is equal to every PUB. However, the result is different in the real business; LAMDA (λ) represents for the market fluctuation and other determinants which have an impact on risk, and it is

calculated as $\lambda_i = \frac{\overline{PUB}}{PUB_i}$.

The model of testing the suitability of PLB is formulated by theory of expected return and systematic risk, the relationship between systematic risk and leverage, and other previous studies, so it can be described as follows:

$$PLB_{it} = \alpha_0 + \alpha_1 MBB_{it} + \alpha_2 LAMDA_{it} + \mu_{it} \quad (16)$$

Where

i represents for the ratio of firm/stock (cross unit)

t represents for the 5-year period (time unit)

PLB_{it} is proxy levered beta of stock i at the end of year t

$LAMDA_{it}$ is standard deviation of stock i at the end of year t .

The main purpose of this model is to show that the coefficient regression between PLB and MBB is close to 1, which means that PLB is suitable even in the market with the lack of information (Sarmiento-Sabogal and Sadeghi, 2014).

Since \overline{PUB} and PUB_i have four different arguments in their measurement, the LAMDA will be tested under four

conditions $(\lambda_{MM}^{FL}; \lambda_{ME}^{FL}; \lambda_{MM}^{TL}; \lambda_{ME}^{TL})$.

$$LAMDA_{MM}^{FL} = \lambda_{MM}^{FL} = \frac{\overline{PUB_{MM}^{FL}}}{PUB_{MM}^{FL}} \quad (17)$$

$$LAMDA_{ME}^{FL} = \lambda_{ME}^{FL} = \frac{\overline{PUB_{ME}^{FL}}}{PUB_{ME}^{FL}} \quad (18)$$

$$LAMDA_{MM}^{TL} = \lambda_{MM}^{TL} = \frac{\overline{PUB_{MM}^{TL}}}{PUB_{MM}^{TL}} \quad (19)$$

$$LAMDA_{ME}^{TL} = \lambda_{ME}^{TL} = \frac{\overline{PUB_{ME}^{TL}}}{PUB_{ME}^{TL}} \quad (20)$$

With eight different equations of PLB and four versions of LAMDA, the models are identified as:

$$\text{Model (2.1): } PLB_{MM_MV_{it}}^{FL} = \alpha_0 + \alpha_1 MBB_{it} + \alpha_2 LAMDA_{MM_{it}}^{FL} + \mu_{it} \quad (21)$$

$$\text{Model (2.2): } PLB_{ME_MV_{it}}^{FL} = \alpha_0 + \alpha_1 MBB_{it} + \alpha_2 LAMDA_{ME_{it}}^{FL} + \mu_{it} \quad (22)$$

$$\text{Model (2.3): } PLB_{MM_BV_{it}}^{FL} = \alpha_0 + \alpha_1 MBB_{it} + \alpha_2 LAMDA_{MM_{it}}^{FL} + \mu_{it} \quad (23)$$

$$\text{Model (2.4): } PLB_{ME_BV_{it}}^{FL} = \alpha_0 + \alpha_1 MBB_{it} + \alpha_2 LAMDA_{ME_{it}}^{FL} + \mu_{it} \quad (24)$$

$$\text{Model (2.5): } PLB_{MM_MV_{it}}^{TL} = \alpha_0 + \alpha_1 MBB_{it} + \alpha_2 LAMDA_{MM_{it}}^{TL} + \mu_{it} \quad (25)$$

$$\text{Model (2.6): } PLB_{ME_MV_{it}}^{TL} = \alpha_0 + \alpha_1 MBB_{it} + \alpha_2 LAMDA_{ME_{it}}^{TL} + \mu_{it} \quad (26)$$

$$\text{Model (2.7): } PLB_{MM_BV_it}^{TL} = \alpha_0 + \alpha_1 MBB_{it} + \alpha_2 LAMDA_{MM_it}^{TL} + \mu_{it} \quad (27)$$

$$\text{Model (2.8): } PLB_{ME_BV_it}^{TL} = \alpha_0 + \alpha_1 MBB_{it} + \alpha_2 LAMDA_{ME_it}^{TL} + \mu_{it} \quad (28)$$

Table-1. A Summary of variables

CODES	VARIABLES	EQUATIONS
MBB _i	Market Based Beta of security i	$MBB_i = \beta_i = \frac{Cov(R_i, R_m)}{\sigma_m^2}$
FL_MV	Financial leverage with market value of equity	$FL_MV = \frac{D_{bv}}{E_{mv}}$
FL_BV	Financial leverage with book value of equity	$FL_BV = \frac{D_{bv}}{E_{bv}}$
OL	Operating leverage	$OL = \frac{\% \Delta EBIT}{\% \Delta S}$
SIZE	Firm's size	SIZE = ln(total assets)
SGROWTH	Revenue growth	$SGROWTH = \frac{S_t - S_{t-1}}{S_{t-1}}$
PLB ^{FL} _{MM_MV}	Proxy Leveraged Beta (adjusted financial leverage) Based on MM with market value of equity	$PLB_{MM_MV}^{FL} = \overline{PUB_{MM}^{FL}} * \left[1 + \frac{D_{bv}}{E_{mv}} (1 - \tau) \right]$
PLB ^{FL} _{ME_MV}	Proxy Leveraged Beta (adjusted financial leverage) Based on ME with market value of equity	$PLB_{ME_MV}^{FL} = \overline{PUB_{ME}^{FL}} * \left[1 + \frac{D_{bv}}{E_{mv}} \right]$
PLB ^{FL} _{MM_BV}	Proxy Leveraged Beta (adjusted financial leverage) Based on MM with book value of equity	$PLB_{MM_BV}^{FL} = \overline{PUB_{MM}^{FL}} * \left[1 + \frac{D_{bv}}{E_{bv}} (1 - \tau) \right]$
PLB ^{FL} _{ME_BV}	Proxy Leveraged Beta (adjusted financial leverage) Based on ME with market book of equity	$PLB_{ME_BV}^{FL} = \overline{PUB_{ME}^{FL}} * \left[1 + \frac{D_{bv}}{E_{bv}} \right]$
PLB ^{TL} _{MM_MV}	Proxy Leveraged Beta (adjusted both financial leverage and operating leverage) Based on MM with market value of equity	$PLB_{MM_MV}^{TL} = \overline{PUB_{MM}^{TL}} * \left[1 + \frac{D_{bv}}{E_{mv}} (1 - \tau) \right] * \left[1 + \frac{\%EBIT}{\% \Delta S} \right]$
PLB ^{TL} _{ME_MV}	Proxy Leveraged Beta (adjusted both financial leverage and operating leverage) Based on ME with market value of equity	$PLB_{ME_MV}^{TL} = \overline{PUB_{ME}^{TL}} * \left[1 + \frac{D_{bv}}{E_{mv}} \right] * \left[1 + \frac{\%EBIT}{\% \Delta S} \right]$
PLB ^{TL} _{MM_BV}	Proxy Leveraged Beta (adjusted both financial leverage and operating leverage) Based on MM with book value of equity	$PLB_{MM_BV}^{TL} = \overline{PUB_{MM}^{TL}} * \left[1 + \frac{D_{bv}}{E_{bv}} (1 - \tau) \right] * \left[1 + \frac{\%EBIT}{\% \Delta S} \right]$
PLB ^{TL} _{ME_BV}	Proxy Leveraged Beta (adjusted both financial leverage and operating leverage) Based on ME with book value of earning	$PLB_{ME_BV}^{TL} = \overline{PUB_{ME}^{TL}} * \left[1 + \frac{D_{bv}}{E_{bv}} \right] * \left[1 + \frac{\%EBIT}{\% \Delta S} \right]$
LAMDA ^{FL} _{MM}	Lamda of adjusted financial leverage Based on MM	$LAMDA_{MM}^{FL} = \lambda_{MM}^{FL} = \frac{\overline{PUB_{MM}^{FL}}}{\overline{PUB_{MM}^{FL}}}$
LAMDA ^{FL} _{ME}	Lamda of adjusted financial leverage Based on ME	$LAMDA_{ME}^{FL} = \lambda_{ME}^{FL} = \frac{\overline{PUB_{ME}^{FL}}}{\overline{PUB_{ME}^{FL}}}$
LAMDA ^{TL} _{MM}	Lamda of adjusted both financial leverage and operating leverage Based on MM	$LAMDA_{MM}^{TL} = \lambda_{MM}^{TL} = \frac{\overline{PUB_{MM}^{TL}}}{\overline{PUB_{MM}^{TL}}}$
LAMDA ^{TL} _{ME}	Lamda of adjusted both financial leverage and operating leverage Based on ME	$LAMDA_{ME}^{TL} = \lambda_{ME}^{TL} = \frac{\overline{PUB_{ME}^{TL}}}{\overline{PUB_{ME}^{TL}}}$

Note: (PUB_MM^FL); (PUB_ME^FL); (PUB_MM^TL); (PUB_ME^TL) are the means of PUB_MM^FL; PUB_ME^FL; PUB_MM^TL; PUB_ME^TL, respectively

3.4. Sample Construction and Research Data

This study uses the data of 307 listed firms in HoSE during the period of 2010–2015 (the 31st of December 2015) under several conditions. Firstly, all firms in financial sector are omitted due to the different capital structure (Fama and French, 1992). In addition, Basil and Khaled (2011) stated that the financial statements of financial companies are created and designed differently with those in other sectors. Secondly, the selected companies have positive market equity and obtain at least 60 monthly observations of R_i during 5 years. In order to estimate MBB, each company must have at least one observation of MBB. Thus, to get the MBB during the research period of 2010–2015, it is calculated from 28,680 observations of R_i (firm-month observations) of those listed companies on HoSE from 2006 to 2015. Furthermore, firms listed after January 1st, 2011 are omitted from the sample because it could not obtain at least one observation of MBB. Finally, all MBB in this sample may have the statistical significance. As a result, 153 companies are selected to test in this study. In addition, the firms which were listed after January 1st, 2006 and before January 1st, 2011 are still in the data sample, thus these companies might not have all six observations of MBB during the research period. Hence, an unbalanced panel are created with 478 firm-year observations. All data is collected from database of Thomson Reuters, BIDV Securities Company (BSC), HoSE, and from financial statements of these companies.

3.5. Methodology

There are three different estimation methods using in the regression model: (1) Pooled OLS; (2) Fixed Effect Model (FEM); and (3) Random Effect Model (REM). Then F-test, LM-test (Breusch-Pagan Lagrange Multiplier), Hausman test is used to decide the appropriate estimation method. According to Frank and Goyal (2009) it might not evaluate the endogenous variables in the test of relationship between leverage and systematic risk. In Vietnamese market, Phan *et al.* (2009) found that there are several determinants of systematic risk such as GDP growth rate, inflation, interest, and security market trend of corporates effect the firm's capital structure. In addition, Getzmann *et al.* (2010) stated that one of the limitations of Pooled OLS, FEM, REM is that they do not solve the endogenous problem. Therefore, 2SLS is applied in stage 1, empirical models of the relationship between leverage and systematic risk.

4. RESEARCH RESULTS AND DISCUSSION

4.1. Summary Statistics

The descriptive statistics of all variables are reported in table 2. Stage 1 and stage 2 of the research model are described in Panel A, and Panel B, respectively.

In Panel A, the mean of FL_MV and FL_BV are 2.09 and 1.32, respectively, with the standard deviation of FL_MV and FL_BV are 2.29 and 1.11, respectively. As the standard deviation of FL_MV is higher than that of FL_BV, the data dispersion of FL_MV is larger than that of FL_BV. This means that stock price will react with news, but it depends on the lag of its reaction. In addition, the variable of OL has the mean of 7.55 and its standard deviation of 16.76. This result shows that companies use considerable operating leverage in Vietnam; moreover, there is an increase in using operating leverage rather than using financial leverage. This is an appropriate finding in the real business because companies can choose an optimal capital structure but the operating leverage depended significantly on the business field.

In Panel B, the mean of MBB is 0.97, which is lower than 1, the expectation of theory. The reason of this difference is that there is no investment portfolio used in this study. Furthermore, the result shows that the value of PLB_BV is lower than that of PLB_MV in all cases. This finding can support those in Panel A. Moreover, PLB^{TL} is significantly higher than PLB^{FL} as well as the expected value in all cases. Therefore, companies should use financial leverage to measure PLB; this issue will be explained further in section 4.2. According to Hamada (1972) the mean of PLB is equal to the mean of MBB when LAMDA is 1. However, in four different calculations of LAMDA, the

values are bigger than 1. It is explained that \overline{PUB} might be affected more when firms have high leverage (Marston and Perry, 1996; Sarmiento-Sabogal and Sadeghi, 2014). As a result, it explains the reasons why LAMDA_ME is higher than LAMDA_MM, and LAMDA_TL is higher than LAMDA_FL. Finally, the result shows that there is no correlation between variables over 0.8; it means that the problem of multicollinearity is not significant in this model.

Table-2. Summary statistics for all variables

Variables	Obs.	Mean	Std. Dev.	Min	Max
Panel A: Stage 1					
FL_MV	478	2.0913	2.2969	0.0374	16.0528
FL_BV	478	1.3275	1.1151	0.043	6.3344
OL	478	7.5543	16.7661	0.591	161.4555
SIZE	478	27.9850	1.1614	25.6337	30.9444
SGROWTH	478	0.2356	1.5971	-0.9497	31.5481
Panel B: Stage 2					
MBB	478	0.9773	0.3944	0.1270	2.2413
$PLB_{MM_MV}^{FL}$	478	1.2286	1.0569	0.2828	10.8102
$PLB_{ME_MV}^{FL}$	478	1.3095	1.2353	0.2742	12.4656
$PLB_{MM_BV}^{FL}$	478	0.9463	0.4734	0.2962	3.5622
$PLB_{ME_BV}^{FL}$	478	0.9773	0.5480	0.2903	4.1734
$PLB_{MM_MV}^{TL}$	478	2.0295	4.3350	0.0960	48.2576
$PLB_{ME_MV}^{TL}$	478	2.1591	4.7400	0.0913	52.9789
$PLB_{MM_BV}^{TL}$	478	1.5244	2.7449	0.1085	25.2393
$PLB_{ME_BV}^{TL}$	478	1.5707	2.8560	0.1060	24.6146
$LAMDA_{MM}^{FL}$	478	1.4089	1.3835	0.2127	17.6695
$LAMDA_{ME}^{FL}$	478	1.4901	1.5704	0.1958	19.2866
$LAMDA_{MM}^{TL}$	478	2.3339	5.6839	0.064	70.8191
$LAMDA_{ME}^{TL}$	478	2.4640	6.0563	0.0605	77.7477

4.2. Empirical Results

In stage 1, the two variables of financial leverage (FL) and operating leverage (OL) are mainly considered. The results might be affected by endogenous variables (Frank and Goyal, 2009). However, using the methods of Pooled PLS, FEM and REM may not obtain an appropriate result (Getzmann *et al.*, 2010). Therefore, after solving the problem of endogenous variables, the result of 2SLS is used as the final one in this step.

Table-3. The correlation between financial leverage, operating leverage and systematic risk

	Model (1.1)	Model (1.2)
FL_MV	0.0290*** (0.0076) [3.83]	-
FL_BV	-	0.0498*** (0.0159) [3.14]
OL	0.0017* (0.0010) [1.68]	0.0017* (0.0010) [1.70]
SIZE	0.0846*** (0.0147) [5.76]	0.0801*** (0.0149) [5.37]
SGROWTH	0.0319*** (0.0106) [3.00]	0.0318*** (0.0107) [2.97]
Observations	478	478
Wald (χ^2)	67.44***	62.16***

Table 3 shows the regression result with dependent variables of MBB. The data sample is collected from companies (not including those in financial sector) listed on HoSE, during 2010-2015. This result is used for the model (1.1) and (1.2). The method of 2SLS is used in order to avoid the endogenous variables. Standard deviations are shown in (.), statistical t is in [·]. The symbols of ***, **, * are represented for the significant level of 1%, 5%, 10%, respectively.

From 2SLS result, the coefficients of FL in both FL_MV and FL_BV are positive and significant at 1%. Similarly, there is a statistically significance of the relationship between OL and systematic risk at 10%. In addition, SIZE and SGROWTH also have a statistical significance on systematic risk at 1%. The finding is similar to several previous studies (Bowman, 1979;1980; Gahlon and Gentry, 1982; Huffman, 1983; Mandelker and Rhee, 1984; Bhandari, 1988; Huffman, 1989; Butler *et al.*, 1991; Darrat and Mukherjee, 1995; Lord, 1996; Guthrie, 2011).

Due to the significant relationship between FL, OL, and systematic risk, this finding is an important condition to use PLB in Vietnam. However, according to Sarmiento-Sabogal and Sadeghi (2014) it is necessary to test whether PLB was closely equal to MBB in order to use PLB as a replacement of MBB.

From the results of F-test, LM test, and Hausman test in three methods, REM is selected to use in model 2.6 and FEM is applied in the seven remaining models in the stage 2. In this stage, Damodaran (2002) and Sarmiento-Sabogal and Sadeghi (2014) suggested that \overline{PUB} should be calculated as arithmetic mean in order to avoid the endogenous variables in the data sample. As a result, the final outcomes are selected from the methods of FEM and REM in this stage. Furthermore, using Robust Option can avoid the problem of heteroskedasticity.

In table 4, there is a significant correlation between PLB and MBB at the significant level of 1% in eight models. Specifically, even it is either PLB^{FL} or PLB^{TL} , the coefficients of MBB (α_1) calculated by E_{bv} is lower than the estimated value based on E_{mv} (α_1 , $PLB^{FL}_{MM_MV} = 0.97$; α_1 , $PLB^{FL}_{MM_BV} = 0.48$; α_1 , $PLB^{FL}_{ME_MV} = 1.11$; α_1 , $PLB^{FL}_{ME_BV} = 0.54$; α_1 , $PLB^{TL}_{MM_MV} = 2.11$; α_1 , $PLB^{TL}_{MM_BV} = 1.62$; α_1 , $PLB^{TL}_{ME_MV} = 1.97$; α_1 , $PLB^{TL}_{ME_BV} = 1.66$). The result shows that PLBs are evaluated lower when it applies E_{bv} in the model.

Table-4. The correlation between PLB and MBB

Method □	Variables	Model (2.1)	Model (2.2)	Model (2.3)	Model (2.4)	Model (2.5)	Model (2.6)	Model (2.7)	Model (2.8)
		PLB ^{FL} _{MM_MV}	PLB ^{FL} _{ME_MV}	PLB ^{FL} _{MM_BV}	PLB ^{FL} _{ME_BV}	PLB ^{TL} _{MM_MV}	PLB ^{TL} _{ME_MV}	PLB ^{TL} _{MM_BV}	PLB ^{TL} _{ME_BV}
Pooled OLS	MBB	1.0660*** (0.0797) [13.37]	1.1535*** (0.0890) [12.95]	0.4725*** (0.0426) [11.09]	0.5074*** (0.0479) [10.60]	1.7376*** (0.1989) [8.74]	1.8462*** (0.2139) [8.63]	1.0887*** (0.1479) [7.36]	1.1084*** (0.1563) [7.09]
	LAMDA	0.6034*** (0.0227) [26.55]	0.6305*** (0.0224) [28.19]	0.2250*** (0.0121) [18.52]	0.2343*** (0.0120) [19.49]	0.7049*** (0.0138) [52.08]	0.7246*** (0.0139) [52.01]	0.4306*** (0.0103) [41.95]	0.4181*** (0.0102) [41.06]
FEM	MBB	0.9765*** (0.1424) [6.86]	1.1120*** (0.1602) [6.99]	0.4892*** (0.0560) [8.16]	0.5439*** (0.0666) [8.17]	2.1151*** (0.3919) [5.40]	2.3052*** (0.4195) [5.49]	1.6219*** (0.2692) [6.03]	1.6650*** (0.2786) [5.98]
	LAMDA	0.4437*** (0.0297) [14.93]	0.4836*** (0.0297) [16.31]	0.1435*** (0.0125) [11.47]	0.1543*** (0.0123) [12.52]	0.6776*** (0.0194) [35.01]	0.7075*** (0.0200) [35.39]	0.4995*** (0.0133) [37.57]	0.4927*** (0.0133) [37.10]
REM	MBB	1.1031*** (0.0995) [11.09]	1.2180*** (0.1109) [10.98]	0.4816*** (0.0469) [10.26]	0.5274*** (0.0523) [10.08]	1.8457*** (0.2256) [8.18]	1.9760*** (0.2446) [8.08]	1.1945*** (0.1813) [6.59]	1.2226*** (0.1931) [6.33]
	LAMDA	0.5270*** (0.0238) [22.12]	0.5606*** (0.0236) [23.77]	0.1677*** (0.0108) [15.50]	0.1774*** (0.0107) [16.61]	0.7026*** (0.0138) [50.76]	0.7226*** (0.0140) [51.62]	0.4436*** (0.0104) [42.70]	0.4333*** (0.0103) [41.94]
Observations		478	478	478	478	478	478	478	478
F. Stat		111.57***	133.29***	69.85***	81.67***	613.59***	626.97***	706.35***	689.00***
Wald (χ^2)		500.22***	575.75***	260.39***	293.97***	2580.18***	2668.91***	1824.33***	1759.37***
F Test		3.36***	□.23***	6.71***	6.82***	1.65***	1.69***	2.30***	2.50***
LM Test		22.17***	20.76***	215.78***	224.97***	8.95***	10.44***	7.73***	10.05***
Hausman Test		28.88***	25.24***	33.16***	32.90***	5.20*	2.73	45.44***	50.81***
Robustness	MBB	0.9765*** (0.2309) [4.23]	1.1120*** (0.2422) [4.62]	0.4892*** (0.1095) [4.47]	0.5439*** (0.1162) [4.68]	2.1151*** (0.5229) [4.05]	1.9760*** (0.3210) [6.16]	1.6219*** (0.3353) [4.84]	1.6650*** (0.3511) [4.74]
	LAMDA	0.4437*** (0.1719) [2.58]	0.4836*** (0.1713) [2.82]	0.1435*** (0.0587) [2.44]	0.1543*** (0.0583) [2.65]	0.6776*** (0.1217) [5.57]	0.7226*** (0.0828) [8.73]	0.4995*** (0.0533) [9.38]	0.4927*** (0.0498) [9.90]
R ²		0.4086	0.4522	0.3019	0.3358	0.7916	0.7947	0.8139	0.8101
Adjusted R ²		0.4061	0.4499	0.2990	0.3330	0.7908		0.8131	0.8093

Table 4 describes the regression model of PLB and its determinants in all eight models from 2.1 to 2.8. The data sample is collected from companies (not including those in financial sector) listed on HoSE, during 2010-2015. Each model is tested in three methods of Pooled PLS, FEM, and REM. In addition, the F-test, LM test (Breusch-Pagan Lagrange Multiplier), and Hausman test are used in order to select the most appropriate method. Standard deviations are shown in (), statistical t is in []. The symbols of ***, **, * are represented for the significant level of 1%, 5%, 10%, respectively

For PLB^{FL}_{MV} , when it is estimated by E_{mv} , the coefficient of MBB is equal 1 at 1% significant level (α_1 , $PLB^{FL}_{MM_{MV}} = 0.97$; α_1 , $PLB^{FL}_{ME_{MV}} = 1.11$). This result indicates that PLB^{FL}_{MV} is a good proxy for MBB, in both theories of MM and ME. On the other hand, even the coefficient of MBB is significant at 1% when PLB^{FL} is calculated by E_{bv} , it does not reach the expectation. It can be concluded that PLB^{FL}_{MV} (under MM or ME theory) is an effective measure of beta for newly listed firm and firms with leverage restructure in Vietnam. In addition, with the unlisted companies, even MBB is statistically significant to PLB^{FL}_{BV} , PLB^{FL}_{BV} is underestimated because the book value of financial leverage (D_{bv}/E_{bv}) cannot reflect considerably the market value of financial leverage (D_{bv}/E_{mv}). With PLB^{TL} , even it has a statistical significance at 1%, the coefficient is not as the predications in four models. Similar to financial leverage, PLB is highly evaluated when having a high operating leverage. It can be explained that the coefficients of MBB to PLB^{TL} are higher than that to PLB^{FL} . Furthermore, PLB^{TL} is less suitable than PLB^{FL} when replacing to MBB. This result is contrary to the author's expectation, which might be due to the errors during estimating operating leverage.

In table 4, it also shows that PLB^{TL}_{BV} is more appropriate than PLB^{TL}_{MV} (α_1 , $PLB^{TL}_{MM_{MV}} = 2.11$; α_1 , $PLB^{TL}_{MM_{BV}} = 1.62$; α_1 , $PLB^{TL}_{ME_{MV}} = 1.97$; α_1 , $PLB^{TL}_{ME_{BV}} = 1.66$), but this result is opposite to PLB^{FL} . As mentioned in previous sections, PLB^{FL}_{MV} can replace MBB when its coefficient is equal 1. While PLB^{FL}_{BV} is underestimated compared to PLB^{FL}_{MV} because D_{bv}/E_{bv} does not reflect effectively D_{bv}/E_{mv} , and it is lower than expected value of 1. In addition, when adjusting the operating leverage, PLB will be highly estimated with higher operating leverage. Therefore, even PLB^{TL}_{BV} is higher than the expected value, it is underestimated when compared to PLB^{TL}_{MV} . The variable of LAMDA representing for the lag of market in eight models has a considerable correlation with PLB at 1% significant level. However, its coefficients are lower than 1, and it means in four estimation models of LAMDA is over than 1. The result shows that the new mechanism of industry classification which HoSE has applied is not appropriate to the PLB in Viet Nam.

Table-5. Testing result of the difference of means between MBB and PLB, MM and ME

Panel A: H ₀ : MBB = PLB			
MBB = $PLB^{FL}_{MM_{MV}}$	-3.3080***	MBB = $PLB^{TL}_{MM_{MV}}$	-1.1750
MBB = $PLB^{FL}_{ME_{MV}}$	-3.8650***	MBB = $PLB^{TL}_{ME_{MV}}$	-1.7870*
MBB = $PLB^{FL}_{MM_{BV}}$	1.6740*	MBB = $PLB^{TL}_{MM_{BV}}$	1.4990
MBB = $PLB^{FL}_{ME_{BV}}$	0.8750	MBB = $PLB^{TL}_{ME_{BV}}$	1.1320
Panel B: H ₀ : MM = ME			
$PUB^{FL}_{MM} = PUB^{FL}_{ME}$	18.944***	$PLB^{FL}_{MM_{BV}} = PLB^{FL}_{ME_{BV}}$	-5.7090***
$PUB^{TL}_{MM} = PUB^{TL}_{ME}$	18.944***	$PLB^{TL}_{MM_{MV}} = PLB^{TL}_{ME_{MV}}$	-7.634***
$PLB^{FL}_{MM_{MV}} = PLB^{FL}_{ME_{MV}}$	-7.9960***	$PLB^{TL}_{MM_{BV}} = PLB^{TL}_{ME_{BV}}$	-5.1090***

In the last step, there is a test for the difference of means between two samples with two questions: (i) whether there is a significant difference between \overline{PLB} and \overline{MBB} ; (ii) whether there is a considerable difference between the

means of PLB under MM and ME theories. The Wilcoxon signed-rank is used as a method to test these hypotheses. Table 5 will show the testing result.

Table 5 shows the result of the difference of means between MBB and PLB, under MM and ME theories. Panel A describes the testing outcome of the hypothesis of whether the mean of PLB is different that of MBB. Panel B illustrates the hypothesis of whether there is a difference between the means of PLB under MM and ME theories. The symbols of ***, **, * are represented for the significant level of 1%, 5%, 10%, respectively.

Firstly, panel A shows that there is a significant difference of means between PLB^{FL}_{MV} and MBB at 1% significant level, even it is considered the tax shield or not. In addition, the results also show that $PLB^{FL}_{MM,MV}$ is lower evaluated than $PLB^{FL}_{ME,MV}$. This supports to the result in table 4.

In addition, in panel A, the difference between MBB and $PLB^{FL}_{MM,BV}$, and between MBB and $PLB^{TL}_{ME,MV}$ are significant at the level of 10%. The means of $PLB^{FL}_{MM,BV}$ is underestimated which the means of $PLB^{FL}_{ME,MV}$ is overestimated. This result is appropriate with that in table 4. For the remaining cases of PLB, there is no evidence to reject the hypothesis of whether PLB is equal to MBB or the means of MBB is equal to PLB.

With the hypothesis of whether MM is equal to ME, the result shows that there is a significant difference between MM and ME at 1% level of significance in all cases (panel B). According to Miles and Ezzell (1980) the PUB calculation followed MM would be higher than that of ME. The empirical finding in this study also shows the same with that of Miles and Ezzell (1980) as well as Sarmiento-Sabogal and Sadeghi (2014) in the US market. Since Sarmiento-Sabogal and Sadeghi (2014) stated that there was no theory to explain this finding, thus they did not give any comments to this finding. In addition, there is a significant difference between PLB_{MM} và PLB_{ME} in any cases. Therefore, panel B can imply that the mean of PLB calculated under ME is going to estimate systematic risk higher than PLB calculation under MM. The result is also supported by the finding of previous studies (Sarmiento-Sabogal and Sadeghi, 2014; Nguyen and To, 2015).

5. CONCLUSION AND IMPLICATIONS FOR VIETNAM

5.1. Conclusion

Estimating the market beta (MBB) usually incurs difficulty during the calculation, especially in several specific cases such as (i) firms with leverage restructure, (ii) new listed companies, (iii) unlisted firms, (iv) individual business unit due to the lack of data. Therefore, PLB is created as a solution of this problem in these cases. The main purpose of this study is to test whether PLB can be an effective replacement of MBB and whether PLB is significantly suitable to use in Vietnam. From the quantitative method, several findings are as following:

Firstly, there is a significant relationship between operating leverage, financial leverage and systematic risk in Vietnam. This is the background for using PLB in this market. In addition, the systematic risk is affected by firms' size and sale growth rate. This result is consistent with previous studies (Bowman, 1979;1980; Gahlon and Gentry, 1982; Huffman, 1983; Mandelker and Rhee, 1984; Bhandari, 1988; Huffman, 1989; Butler *et al.*, 1991; Darrat and Mukherjee, 1995; Lord, 1996; Guthrie, 2011).

Secondly, PLB has a considerable correlation to MBB at 1% level of confidence in all cases in this study, namely (i) adjusted financial leverage (FL) or both financial leverage and operating leverage (TL), (ii) financial leverage with equity in book value (D_{bv}/E_{bv}) or that in market value (D_{bv}/E_{mv}), (iii) considering tax shield (MM theory) or not (ME theory). This supports the previous empirical studies stating that PLB was correlated to MBB (Bowman, 1980; Kemsley and Nissim, 2002; Bowman and Bush, 2006; Sarmiento-Sabogal and Sadeghi, 2014; Nguyen and To, 2015).

In addition, the study also finds that PLB with proxy financial leverage being the most efficient measure of MBB. Thus, PLB is recommended to use with unlisted or newly listed companies. Since the stock cannot be traded in unlisted firms, E_{mv} cannot be identified. This is the reason why E_{bv} is used to calculate financial leverage. While this problem is not a big issue with new listed firms, its E_{mv} and E_{bv} are easily measured. As using E_{mv} gives a more

appropriate PLB rather than E_{bv} , PLB is a considerable measurement of MBB in newly listed companies. However, one of the findings shows that MBB is underestimated when using $PLB^{FL_{BV}}$ in unlisted companies.

Another finding of this study is that there is a difference of PLB between MM and ME theories. Hence, PLB is higher when calculating under ME theory. However, when testing each pair of MBB and PLB in both MM and ME theories, there is a slight difference between MBB and PLB. In specifically, with $PLB^{FL_{BV}}$ and $PLB^{TL_{MV}}$, the result with ME is more appropriate than that of MM. On the other hand, PLB under MM theory is more suitable when using $PLB^{FL_{MV}}$ and $PLB^{TL_{BV}}$. In corporate valuation of unlisted firms in Vietnam, appraisers use financial leverage based on E_{bv} under MM theory. However, there is no any arguments on this result, this study might become an empirical evidence to support appraisers to the contribution of PLB calculation in Vietnam.

Finally, the mean and coefficient of LAMDA (lag of market) shows that even HoSE has applied the new international mechanism into the industry classification, it is not appropriate when representing to the risk classification in PLB calculation in Vietnam.

From the above findings, it can be concluded that MBB of compatible firms can be a significant measurement of PLB. Specifically, the more consistency between compatible companies and the valuating firm, the more possibility it can represent the same risk classification and LAMDA is close to 1. Therefore, the further research should be an empirical study on how to select the compatible companies for the more effectiveness of PLB in the replacement of MBB.

5.2. Implications in Vietnam

For Investors and Appraisers

Since the PLB are significantly correlated to MBB in Vietnam, it can be said that PLB is one of the most effective measurements of MBB when PLB uses the proxy financial leverage and market value of equity, which is noted as $PLB^{FL_{MV}}$. While systematic risk is underestimated by $PLB^{FL_{BV}}$, PLB^{TL} always over evaluates the systematic risk under any conditions. The result implies that appraisers should use $PLB^{FL_{MV}}$ to be an alternative of MBB. Thus, it is totally supported that PLB can be used in newly listed companies in Vietnam. For the unlisted firms, since systematic risk is underestimated by $PLB^{FL_{BV}}$ and overestimated by PLB^{TL} , investors and appraisers should make a decision based on the characteristics of asset/security. This finding can be applied as the evidence to explain in the valuation process when appraisers need to defense the result to their customers. In addition, if the leverage in MBB is assumed not to be changed during the length of estimation period, investors and appraisers can use PLB when evaluating the firms with leverage restructure. Therefore, the result of this study also supports the use of $PLB^{FL_{MV}}$ to estimate the beta of listed firms with a new leverage restructure or firms with high leverage. Finally, the risk classification of industry also has an impact on the PLB estimation. Thus, to select the compatible firms to testing company, investors and appraisers must identify carefully an appropriate industry. According to specific cases, analysts make decisions on more criteria (for example, when there are a large number of compatible companies), or less criteria (for instance, when there are a small number of compatible firms) to select the most suitable companies in their valuation (Damodaran, 2002). In conclusion, appraisers should pay attention to using the industry classification of HoSE.

For State Management Agencies

In Vietnam, there are two legal documents impacting business valuation process including (i) the Vietnamese valuation standard 12 - Business Valuation; and (ii) the 126/2017/ND-CP Degree and both of them are effective from the 1st of January 2018. However, the main purpose of corporate valuation methods in the 126/2017/ND-CP Degree focuses on changing from State-owned Enterprises (SOE) to Joint Stock Company. For the Vietnamese Valuation Standard 12, the highlights are the mention of the levered beta and only for adjusting the financial leverage. Therefore, the results in this study not only suggest applying the method of Bottom-up as a measurement

of the beta in the process of corporate valuation in Vietnam but also strongly support the rules in this standard. Finally, the study can contribute to appraisers training courses in Vietnam, especially for professional program of Vietnamese Valuation Association, in term of providing the method of Bottom-up in order to give an appropriate solution to estimate beta in case of lack of data and information.

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