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Investigating the Role of Growth in Determining Capital Structure in Thai Stock Market (SET) through Signaling Game

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Abstract

In this paper, I propose a static signaling game to explain how a firm's growth prospect can determine its leverage ratio through an assumption of asymmetric information between a firm's manager and an investor. Applying the solution concept of perfect Bayesian equilibrium, there exists a separating equilibrium where a firm with better growth prospects chooses the financing option that increases leverage ratio as a signaling device. I collected financial data from listed firms in SET, excluding banks, financial services, insurances and utilities from 2004 to 2018, and considered only firms with no missing values to construct a balanced panel. After data pre-processing step, I constructed fixed effects model on the balanced panel of the remaining 151 firms. I found that market-to-book values of assets (proxy for growth) can explain debt-to-asset (proxy for leverage ratio) positively and significantly. The empirical result supports the game model result, and this is consistent with pecking-order theory (POT) prediction, rather than trade-off theory (TOT).

Keywords: Capital structure, Growth signaling, Pecking order
JEL Classifications: C72, G32

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1. Introduction

Are there any relationships between capital structure and firm's performance? Under Modigliani and Miller (1958) assumptions, we should expect that a leveraged firm has the same value as an unleveraged firm, given that prospects are exactly the same. In this paper, I relax the assumptions of symmetric information. One of the earliest papers that focus on relaxing this assumption is Majluf and Myers (1984). In their model, managers act in the best interest of current shareholders, and would decide issuing securities when stocks are overpriced. As investors are aware of these managers' decisions, managers will rely on the source of fund least sensitive to information problems first, which is retained earnings. After that, they will prefer debt to equity because equity is more sensitive to information problems. The theory explaining the sequence of fund raising is called pecking order theory (POT). In contrast, in trade-off theory (TOT) framework, firms choose the level of debt and equity by balancing costs and benefits of using debt to determine the optimal leverage ratio where the total cost of funds is minimized. There is a trade-off among different leverage ratios because there are both costs and benefits of using more debt; for example, firms will gain the tax savings, will not face with dilution of control, but will have to face higher bankruptcy cost.

The main question of this study concerns the role of growth prospects in determining leverage ratios as to whether capital structures of the firms in Thai stock market (SET) should fit with POT or TOT framework. According to González and González (2011), in POT framework, higher growth prospects generate the needs for more investments, and firms will rely on debt rather than equity due to the sequence of POT, resulting in higher leverage. However, in TOT framework, higher growth prospects result in lower leverage due to higher cost of financial distress, less free cash flow conflict between managers and shareholders, and higher conflict on firm investments between debtholders and shareholders. Since these two frameworks lead to different predictions on the role of growth toward capital structure, investors need to understand this relationship when they conduct firm valuation as they need to forecast leverage ratio accurately in order to calculate the weighted average cost of capital (WACC), an essential component in firm valuation.

This paper presents a static signaling game to illustrate how growth affects leverage ratio when information about growth prospect is asymmetric. I assume that the growth prospect of a firm is private information to the firm manager while an investor observes only manager's financing decision, not the firm prospect itself. Using perfect Bayesian equilibrium solution concept, I have found that separating equilibrium exists when the manager of a firm with better prospects chooses taking more debt. This implies that financing decisions can be used as a signal of firm's growth prospect. The intuition of signaling device is consistent with Morellec and Schürhoff (2011), where firms can signal their types using financing option as well as timing of investments. However, since dynamic model is used, the result from that paper is qualitatively different from mine: investment timings vary based on firm types, but financing hierarchy does not follow POT.

Using panel data from SET listed firms (2004-2018), I used four explanatory variables as possible determinants of capital structure: growth, size, earnings and tangibles. Then, following the estimation guideline from Serrasqueiro, Matias and Salsa (2016), fixed-effect (FE) model is applied. My main result is that market prospects of growth (proxy by market-to-book value of assets) is the main determinant of capital structure (proxy by debt to asset), and the relationship fits with POT, rather than TOT. The result suggests that investors should take market prospect of firms into account as

the main factor in determining WACC of these firms, as indicated in POT framework. My result is consistent with Pongsupatt and Pongsupatt (2019). However, my result is different from Thippayana (2014) and Pongsupatt and Pongsupatt (2019) in that I have not found significant relationship between leverage ratio and these explanatory variables: size, earnings and tangibles. The difference in results is due to different model specifications.

2. Model

2.1 Model Setup

I assume two players in my model setting: a firm manager and a representative investor. The firm has its own type θ, which can be either H or L, chosen by nature with probability p and $1-p$ respectively. Starting with the firm value of zero, a firm has found an investment project with required investment of K. I assumed the starting firm value to be zero because I would like to explain the effect of growth prospects onto capital structure, so it is best to keep other factors constant, including the initial firm value. That is why I did not include analysis of retained earnings in this model.

The difference between firm H and firm L is the different return profiles. For type H, project has the constant return of r^H, implying that the firm value is equal to $(1+r^H)K$ after the investment. For type L, project is successful with probability of 0.5 where firm value is equal to $(1+r^L)K$ after the investment. Otherwise, the firm value is equal to zero. In other words, type H firm has the project with stable return of r^H while type L firm has the project with volatile return (either r^L or -1).

The firm manager has two financing options, regardless of the type of firm. The first option (safe choice) is to fund project that requires investment K from only outside equity holders. The second option (participating choice) is that manager borrows debt D to participate in the project and fund the remaining $K-D$ from outside equity holders. I assume that the firm has to find external financing from the equity holder in every case (one possible reason is limited borrowing capacity), so $K > D$. The main reason is I would like to study capital structure used in forecasting WACC, so if the manager does not need to find external financing, WACC does not need to be estimated anyway.

The sequence of this game is as following. First, nature draws firm type θ, either H or L, with probability $p, 1-p$, respectively. The type of a firm is private information to the firm manager. Then, the firm manager chooses one of the two financing options, described above. After a representative investor observes the firm manager's action, the investor decides to accept or reject the firm offer without knowing the firm's type.

2.2 Assumptions

By my model setup, several assumptions are outlined as following:

A1: To simplify the calculation, I assumed that a representative investor is risk-neutral. The investor compares only the expectations of returns and ignores the variance in decision making.

A2: $1 > 2r^H > r^L > r^H$. In case of success, firm L has higher return than high-type firm H, since the investment in low-type firm L is riskier than investment in firm H ($r^L > r^H$). However, the expected return for investment in high-type firm is greater than the expected return in low-type firm ($r^H > 2r^L$). Since the investor is risk-neutral, only

differences in mean returns are enough to show that the investor prefers the project in firm H to the project in firm L.

A3: Manager has to borrow at the borrowing rate of r^D in case the manager chooses participating choice. Also, r^D is the cost of equity from the perspective of the investor. In case of firm type L, if the firm value is zero after the investments, the firm manager has to liquidate private assets to pay back the principal and interest rate in full amount. To simplify the calculation, I would not consider an option to default and complications related to default in this model.

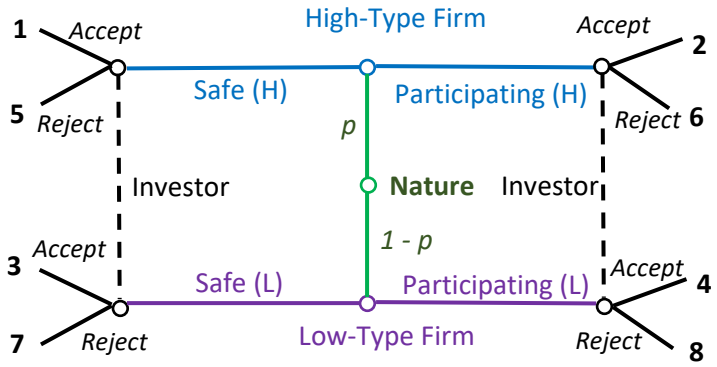
A4: $r^H - \alpha > r^D$, where αK is defined as total managerial compensation given to the manager only if the investment occurs and the project is successful, where $\alpha > 0$. The net return from investment in high-type firm must be greater than investing somewhere else, from the investor's standpoint.

A5: The project is all-or-nothing investment. If investor rejects the offer, the investment cannot occur.

2.3 Payoff Calculation

From the model setup, the game model is constructed as in figure 1.

Figure 1: Signaling game between the firm manager and the investor, where the firm type is private information to the firm manager.



Source: Author's explanations.

In order to calculate payoff for each labeled outcome, I need to keep track of starting outcome and ending outcome for each player. By calculating payoff, I would get the result as following:

Node 1: High firm type; Choice Safe(H); Investor accepts

Manager: He started with 0, and ended with αK

Investor: She started with K, and ended with $(1 + r^H - \alpha)K$

Node 2: High firm type; Choice Participating(H); Investor accepts

Manager: He started with 0, borrowed debt D, and ended with

$$\alpha K + D(1 + r^H - \alpha) - (1 + r^D)D = \alpha K + (r^H - \alpha - r^D)D$$

Investor: She started with $K - D$, and ended with $(1 + r^H - \alpha)(K - D)$

Node 3: Low firm type; Choice Safe(L); Investor accepts

Manager: He started with 0, and is expected to get $\frac{\alpha}{2}K$ at the end.

Investor: She started with K, and is expected to get $\frac{1+r^L-\alpha}{2}K$ at the end.

Node 4: Low firm type; Choice Participating(L); Investor accepts

Manager: He started with 0, and is expected to get $\frac{1}{2}(\alpha K + (r^L - \alpha - 1 - 2r^D)D)$

Investor: She started with $K - D$, and is expected to get $\frac{1+r^L-\alpha}{2}(K - D)$ at the end.

Node 5-8: Any type firm; Any choice chosen by manager; Investor rejects

Manager: He started with 0, and ended with 0

Investor: She started with S, and ended with $S(1 + r^D)$, where $S \in \{K, K - D\}$

Note that the variable S is defined to make sure that I compared payoffs from different situations with the same starting point.

2.4 Result

Proposition: Perfect Bayesian equilibrium has the following properties:

a) When $\alpha K + (r^L - \alpha - 1 - 2r^D)D \leq 0$, there is a unique separating equilibrium where high-type firm chooses participating option while low-type firm chooses safe option. (i.e. this separating equilibrium occurs as long as it is not profitable for low-type firm to mimic high-type firm)

b) If a pooling equilibrium with firm investment exists, then $p(1 + 2r^H - r^L - \alpha) + r^L - \alpha \geq 1 + 2r^D$. (i.e. if pooling equilibrium occurs, expected payoff in firm investment is greater than opportunity cost of funds)

Proof:

a) Consider the outcome where high-type firm chooses participating option while low-type firm chooses safe option. Then, the investor will choose 'accept' after observing participating option while she chooses 'reject' after observing safe option. By sequential rationality and consistent belief, low-firm type would not deviate as long as $\alpha K + (r^L - \alpha - 1 - 2r^D)D \leq 0$. Also, consider another outcome where high-type firm chooses safe option while low-type firm chooses participating option. Then, the investor will choose 'accept' after observing safe option; however, low-firm type has an incentive to deviate as the manager will get αK in case of success, so this outcome could not be the equilibrium. Hence, there is only one separating equilibrium where high-type firm chooses participating option while low-type firm chooses safe option, as $\alpha K + (r^L - \alpha - 1 - 2r^D)D \leq 0$.

b) Consider every possible pooling equilibrium. First, both firms choose safe options. If firm investments occur, the investor will choose 'accept' after observing safe option and 'reject' otherwise. By sequential rationality and consistent belief, this equilibrium occurs when $p(1 + 2r^H - r^L - \alpha) + r^L - \alpha \geq 1 + 2r^D$ and $q(1 + 2r^H -$

$r^L - \alpha) + r^L - \alpha \leq 1 + 2r^D$, where q is off-equilibrium path belief that firm is high-type. Second, both firm types choose participating options. If firm investments occur, the investor will choose 'accept' by observing participating option and choose 'reject' otherwise. By sequential rationality and consistent belief, this equilibrium occurs when $p(1 + 2r^H - r^L - \alpha) + r^L - \alpha \geq 1 + 2r^D$ and $s(1 + 2r^H - r^L - \alpha) + r^L - \alpha \leq 1 + 2r^D$ and $\frac{1}{2}(\alpha K + (r^L - \alpha - 1 - 2r^D)D) \geq 0$, where s is off-equilibrium path belief that firm is high-type. Hence, from these two outcomes, the necessary condition for pooling equilibrium with firm investments to occur is $p(1 + 2r^H - r^L - \alpha) + r^L - \alpha \geq 1 + 2r^D$.

2.5 Summary

From the proposition, I would get two main results. First, in separating equilibrium in the context of signaling game, firms with better growth prospect (high-type firms) selects participating option as the signaling device. The signaling device must be sufficiently costly to prevent other firms (low-type firms) from mimicry, captured by $\alpha K + (r^L - \alpha - 1 - 2r^f) \leq 0$. High-type firm will choose $D \in [\underline{D}, \overline{D}]$, where $\overline{D}$ is the maximum borrowing capacity, and $\alpha K + (r^L - \alpha - 1 - 2r^f)\underline{D} = 0$. In this game setting, however, high-type firm will choose $\overline{D}$ because the project is not risky, and as the manager invests more, the higher payoff he will get. Second, in order for pooling equilibrium to exist within the context of the risk-neutral investor, the expected return from investing in a firm must be greater than opportunity cost of fund, r^D. If an investor is risk-averse, pooling equilibrium occurs when the expected return from investing in a pool of risky assets is high enough to compensate the opportunity cost of fund and market risk. Also, notice that the expected return from investing in both types does not play the role in determining separating equilibrium since $r^H - \alpha > r^D$.

2.6 Role of Growth in Determining Capital Structure

In the game model, I illustrated the role of growth prospect in determining firm's capital structure through the channel of asymmetric information about firm's type. In the separating equilibrium, the firm with better prospects chooses participating option as the signaling device. In the pooling equilibrium, the rate of return in investing in this pool of firms must be high enough to compensate for opportunity cost of fund and market risk, while there are no restrictions on expected rate of return in the separating equilibrium, aside from assumptions. This implies that the high-type firm chooses using debt not because of the financing sequence as outlined by Majluf and Myers (1984). Rather, it is more profitable for the firm manager in choosing this financing option. Otherwise, the project could be rejected by an investor, by the result of separating equilibrium. The low-type firm chooses using equity because it is not profitable for the firm manager to deviate even though the project could be accepted if the firm manager switched to using debt. Since my model was constructed based on the asymmetric information problem, I would put my model in the class of POT framework.

In the next section, I would like to assess the relationship between growth and capital structure of firms in Thai stock market. Investors who would conduct financial modeling need to understand this relationship to forecast WACC accurately which is an essential ingredient of firm value estimations. Different relationship implied different forecasts of capital structure leading to different forecasts of WACC. According to González and González (2011), TOT and POT frameworks predict opposite relationship between growth prospect and leverage ratio. From Table 1, TOT predicts negative relationship because growth opportunities imply less need for disciplinary role of debt,

more conflicts between debtholders and shareholders in risk-shifting substitution, and higher cost of financial distress. POT predicts a positive relationship because firms with investment opportunities need more funds. Therefore, these firms should be more leveraged due to the sequence of financing in POT and information problems. Unlike assets in place, investment opportunities encouraged the use of debt, rather than equity.

Table 1: The role of growth in determining capital structure in Trade-Off Theory (TOT) and Pecking Order Theory (POT) framework

Framework	**Explanation and Prediction**
Trade-Off Theory (TOT)	The firm with better growth prospect would imply 1) less need for disciplinary role of debt 2) more conflicts between creditors and shareholders in risk-shifting substitution (e.g. tail risk) 3) greater cost of financial distress (when firm value mostly comes from growth prospect, compared to asset in place) *Prediction*: There is a negative relationship between growth prospect and leverage ratio, as benefit of debt decreases and cost of debt increases.
Pecking Order Theory (POT)	The firm with better growth prospect would imply 1) more need for funding 2) more information problem on investment opportunities (compared to asset in place) 3) choosing higher leverage ratio as the signaling device (e.g. lower bankruptcy cost and greater tax deduction benefit for the firm)* *Prediction*: There is a positive relationship between growth prospect and leverage ratio, as firms prefer using debt to issuing shares due to asymmetric information problem.

Note:* Results of our game model explained in listed firms setting.
Source: Author's explanations.

My result also implies positive relationship between growth prospect and leverage ratio as high-type firm chooses the financing option which incurs more debt in separating equilibrium. Unlike previous explanations, I assumed initially that both types of firms have equal required investments (K), but the difference is the project profile in each type of firm. Thus, the firm can use financing choice as a channel to signal its type, which is consistent with the result from Morellec and Schürhoff (2011). Unlike their models, my model is a static model, so firms cannot choose investment timing, and that explains why firms must choose financing option as the only signaling device.

3. Methodology

3.1 Data Collection and Pre-processing

I collected financial information of firms in Thai stock market (SET) by each sector based on Thomson Reuters Datastream classifications. However, I excluded sectors where businesses are highly regulated: banks, financial services, insurances and utilities. The variables that I collected include total debt, total assets, market capitalization, book value of equity, EBITDA and tangible assets. These variables are

collected as annual data. The period of study is from 2004 to 2018, 15 years in total. Since I need to generate a balanced panel, the longer period of the study is, the fewer number of firms I could get after pre-processing. When either longer or shorter period of study are also acceptable, 15 years is one possible choice.

Then, I need to preprocess data in order to get a balanced panel. First, I excluded the firm with missing data in any of these variables. These firms could be incoming firms or exiting firms. Then, I excluded the firm if any of its observations do not pass non-negativity criteria. In other words, I did not exclude the firm observations if its assets, debts, total tangible assets, book values and market values were all non-negative from 2004 to 2018. Theoretically, these variables could not be negative. Many firms are unfortunately excluded because parts of the data are considered problematic. After excluding firms based on these criteria, I had 151 firms left in total.

The final step for pre-processing is to adjust for inflation. I deflated all of these variables using core inflation collected from Tide (PIER) database. After pre-processing was done, I did some exploratory data analysis to find an appropriate empirical model.

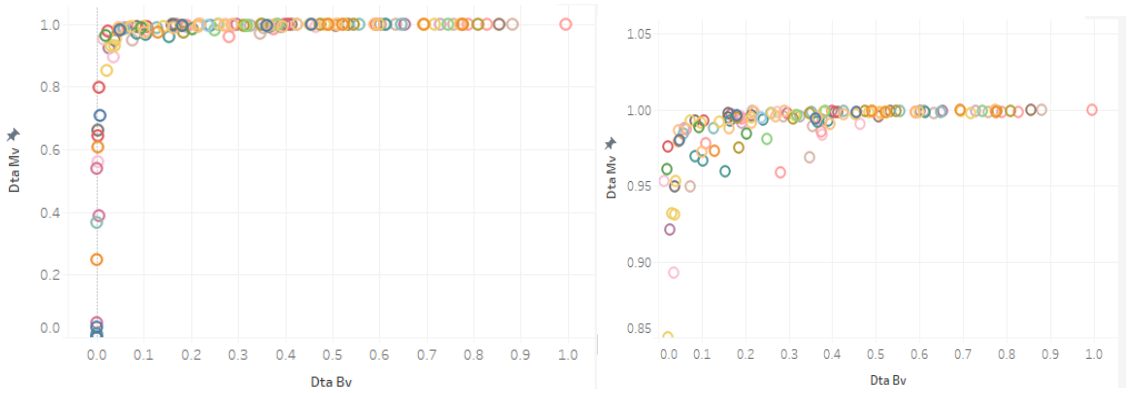
3.2 Variable Selection and Exploratory Data Analysis

If I would like to study determinants of capital structure, the first question is how I measured the capital structure. Many authors used either debt-to-asset in book value (DTA BV) or debt-to-asset in market value (DTA MV). DTA BV is calculated by using debt divided by debt and market capitalization of equity. DTA MV is calculated by using debt divided by debt and book value of equity. Based on POT, retained earnings is an essential source of funding before a company seeks external funding; however, I did not explicitly include retained earnings in this analysis. That is because retained earnings have already been included in the denominator of DTA (asset includes liabilities and equity; retained earnings is included in equity). Note that the analysis of retained earnings will be mentioned again in section 4. Intuitively, as DTA increases, it could refer to either the company takes more debt, or the company takes out its retained earnings. The only financing option that causes DTA to decrease is to increase the equity portion; for example, raising more funds.

In figure 2, I plotted the scatter plot between DTA BV and DTA MV of each firm in 2018. In figure 2 (a), there are many firms with very high DTA MV, but I could not see the relationship between these two variables clearly due to a few firms that have extremely low DTA BV. In figure 2 (b), this figure shows the same data filtered by DTA MV being greater than 0.8. Now, I could see a slightly positive relationship between these two variables. However, the positive relationship is not distinct due to firms with very low DTA BV. Therefore, I will consider both of these variables in the next sections.

Then, I need to define the growth prospects of the firm empirically. I used market-to-book value of asset (MTBV) calculated by using debt and market capitalization divided by debt and book value of equity. This is the main channel where asymmetric information is transmitted through firm growth prospect that I would like to study. If asymmetric information about the firm is signalled through growth prospect, I would see positive relationship between the growth prospect and capital structure. Intuitively, if MTBV of a firm is high, that means investors are willing to buy the company at a high price because they expect the growth prospect of that particular firm. Since I could not measure growth prospects directly because no one knows the future information, MTBV is one possible choice used in estimating the growth prospects. According to Gaud et al. (2005), MTBV is a common proxy in estimating prospects even though there are other possible reasons explaining why MTBV could be high.

Figure 2: Scatter plot between debt-to-asset book value (DTA BV) and debt-to-asset market value (DTA MV) in 2018 (a) all firms that pass pre-processing steps (b) all firms that pass pre-processing steps and DTA MV exceeds 0.8

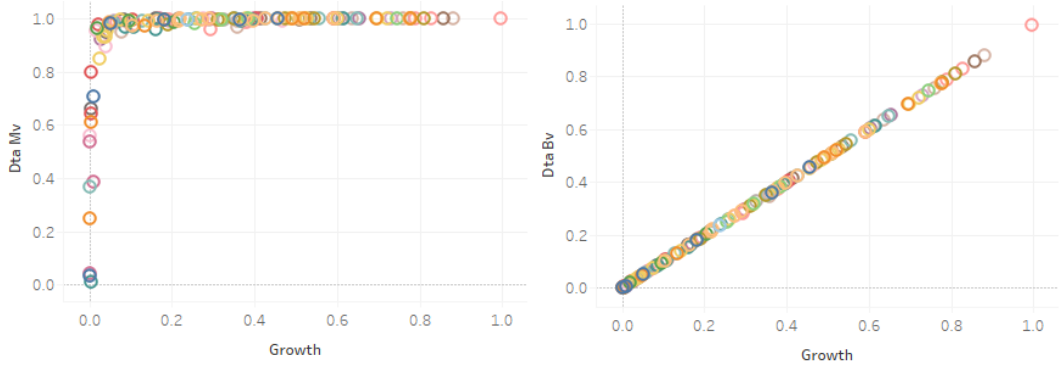


(a) (b)

Source: Author's calculations.

In figure 3, I plotted the scatter plot between DTA and MTBV. In figure 3 (a), I plotted DTA (MV) against MTBV. There is a weak positive relationship between these two; however, this simple linear regression between these two seems inadequate, so we need to include more variables in this model. In figure 3 (b), I plotted DTA (BV) against MTBV. I could see strong linear relationship between these two variables clearly. Due to my definition and data inspection, the strong linear relationship is mainly because many companies have high proportions of debt and low proportions of equity. Looking at it closely, I could see some degree of variations in DTA BV within some particular growth ranges. Therefore, MTBV alone may not be enough in explaining DTA.

Figure 3: Scatter plot between debt-to-asset and MTBV in 2018 (a) using debt-to-asset market value (DTA MV) (b) using debt-to-asset book value (DTA BV)

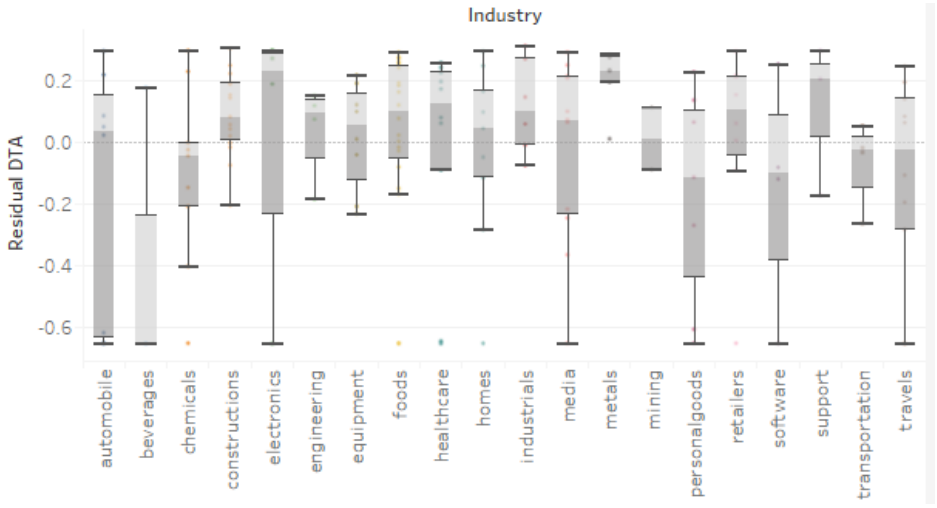


Source: Author's calculations.

There exists a distinct pattern when I look at both figure 2 and 3. I color coded each dot based on the industry the firm belongs to. It seems like firms in the same industry cluster together, so I may wonder whether there are variations among these firms. In other words, are they any firm-specific effects? In this initial analysis, I defined residual DTA MV as the residual from the simple regression of DTA MV on MTBV. Then, I constructed box-and-whisker plot on these residuals classified by each sector to see

whether there are variations among firms. Note that for the purpose of visualization, rather than showing box-and-whisker plot on each firm, making the diagram cluttered, I classified the residuals based on the industry each firm belongs to instead. In figure 4, I could see that there are variations of residuals among industries. In addition, I could see huge variations within the same industry.

Figure 4: Box-and-whisker plot of the residuals (regression of DTA MV on MTBV) of each firm in 2018 classified in each industry



Source: Author's calculations.

To summarize, I have learned the following:

a) There is a weak positive relationship between DTA BV and DTA MV. Hence, I will use both explanatory variables in the analysis.

b) Simple linear regression of DTA on MTBV may not be enough to explain capital structure.

c) There are variations of capital structures that are not explained by MTBV among firms.

3.3 Model

In this section, I will construct an empirical model that explains determinants of capital structure using regression analysis. I will explain capital structure (DTA BV and DTA MV) using growth prospects as the main determinant, firm-specific factor and some control variables (size, earnings and tangibles) as following: DTA = f(growth, firm-specific factor, size, earnings, tangibles, u).

I used MTBV as a proxy of growth, as explained in the previous section. I included firm-specific factor in the model, also explained in the previous section. I also included size, earnings and tangibles as control variables because these are common variables that have been used for studying capital structure. Note that there are no set of control variables agreed upon by researchers; however, we used this set of variables because they are common in many papers, implying that these could potentially be essential components used in explaining capital structure. I used natural log of total assets as a proxy of size, EBITDA divided by total asset as a proxy of earnings, and tangible assets, including inventories, divided by total asset as a proxy of tangibles. In order to interpret signs of these factors, I used trade-off theory (TOT) and pecking order theory

(POT) explanations from González and González (2011), which will be explained in section 4.

I developed our model by applying estimation guidelines from Serrasqueiro, Matias and Salsa (2016) as following. First, I used F-test to see whether there are significant differences among individual-specific characteristic. The result from F-test suggested using panel data method, rather than pooled OLS. This test supports our previous result from EDA to include firm-specific characteristic in the model. Second, I used Hausman test to check whether unobserved variables are correlated with explanatory variables for choosing between fixed effect and random effect model. The result from Hausman test suggested using fixed effect model, rather than random effect. In addition, I used Durbin-Watson test to detect the first-order autocorrelation. First-order autocorrelation exists in fixed-effect model with DTA book value, but not in fixed-effect model with DTA market value. I estimated fixed effect model with DTA book value again, using Cochrane-Orcutt procedure so that I could interpret value of t-tests. I also used Variance Inflation Factor (VIF) to detect multicollinearity, especially in case I found insignificant t-stats.

4. Result

4.1 Empirical Result and Analysis

According to F-test and Hausman test, I apply fixed-effect model. Table 2 presents the fixed effect models, using DTA book value and market value as dependent variables. Due to Durbin-Watson statistics, FE (BV) is re-estimated using Cochrane-Orcutt procedure. In addition, VIF does not show multicollinearity problem, so I could interpret t-stats from the models shown in Table 2.

First, growth, measured by MTBV, could explain leverage ratio in a positive relationship significantly in both models using DTA (BV) and DTA (MV). This implies that the relationship between growth prospect and capital structure fits more suitably with POT, rather than TOT. One explanation from González and González (2011) is that firms with growth prospects need more funds to invest, and they choose using debt before equity, causing leverage ratio to increase. Another possible explanation from my model is that firms use more debt to signal their types as the signaling device that should be difficult for the other type to mimic. In my settings, the other type would not mimic because in case of failure, the manager has to take the full responsibility. However, in empirical settings, the explanations should be different under the same reasoning. One possible explanation is due to my variable definition. Since retained earnings is included in the denominator of DTA, the higher growth prospect leads to the investment which could start with retained earnings, and then taking out the debt. Both actions lead to an increase in DTA, either by reducing retained earnings in denominator, or increasing debt in numerator. The fundamental reason in taking out debt is that when firms take more debt, there are bankruptcy costs associated with higher leverage. The firm with good prospect is very likely to stay solvent if debt to asset increases. Firms with not good prospects will possibly be insolvent if they are as highly leveraged as firms with good prospects, so the bankruptcy cost is a lot higher for the firms with not good prospect. This reason could also be supported by debt tax shield. For firms with stable prospects, they certainly use debt expenses to deduct tax expenses, as the benefits occur only when firms got positive earnings before tax (EBT). For the firms with not good prospects, there is some possibility that they will not use this benefit due to possibility of getting negative EBT, so the net cost of debt is higher for this type of firms. Hence, the information

asymmetry is signaled through growth prospects, captured by MTBV, showing the positive relationship between DTA and MTBV.

Second, the other three factors (size, earnings and tangibles) do not explain leverage ratios significantly, except for size in FE(BV) and earnings in FE(MV). However, signs of size effects are the same across three equations while signs of earnings and tangibles are not. I used TOT and POT explanations from González and González (2011) to interpret signs of these factors. The signs of size effects are all negative across models, which can be explained using POT framework. Small firms have more information problems than large firms, so they need to follow POT financing sequence, resulting in the reduction of retained earnings and the increase in debt. These actions lead to higher leverage ratios. Signs of earnings and tangibles are not the same across three equations. With or without Cochrane-Orcutt estimation, these models should provide unbiased estimates. It is possible that either both effects from POT and TOT counteract each other, or there is none of these effects from the beginning. TOT framework predicts that firms with higher earnings will have higher tax benefits from using debt, leading to positive relationships; firms with more tangibles will have lower costs of financial distress, leading to positive relationships. POT framework predicts that firms with higher earnings use internal funds first, which reduces the need of using debt. These two actions lead to the decrease in both numerator and denominator of DTA. For example, an equal reduction in both retained earnings and debt causes DTA to decrease. (By simple algebra, it could be shown that $\frac{a-x}{b-x} < \frac{a}{b}$) By POT, firms with less tangibles have more information problems, so if they would like to find external financing, they have to utilize debt strictly before equity, leading to negative relationship.

Table 2: Final Model of Explaining Capital Structure of Firms in SET

Variables	FE(BV)	FE(MV)	FE-CC(BV)
Growth	1.0016 (5225)***	0.5584 (15.118)***	0.9542 (61.311)***
Size	-0.0003 (-5.261)***	-0.0003 (-0.022)	-0.008 (-1.387)
Earnings	-0.0003 (-1.059)	-0.1083 (-1.815)*	0.0167 (0.896)
Tangibles	0.0001 (0.399)	0.0118 (0.186)	-0.017 (-0.784)
F-test for individual effect	7.8468	10.643	
p-value	0.0000	0.0000	
Hausman Test Chi-square	100.96	12.73	
p-value	0.0000	0.0127	
Durbin-Watson Statistic	1.7352	2.0759	1.985
p-value	0.0000	0.9645	0.375
Number of obs	151 firms 15 years	151 firms 15 years	151 firms 15 years

Note: This table presents the final model used in explaining capital structure of firms in Thai stock market. The first two columns show fixed effect models, using debt-to-asset (book value and market value). The last column shows fixed effect model (BV), together with Cochrane-Orcutt procedure to correct for first-order autocorrelation. The t-statistics are reported in parentheses. (* 0.1, ** 0.05, *** 0.01)
Source: Author's calculations.

4.2 Study Result

The game result in section 2.5 shows that firms with better growth prospect decide to signal this message through choosing financing option with debt included. This has the property of perfect Bayesian equilibrium because the signal is beneficial for firms with good investments but costly for firms with risky investments. The empirical result in section 4.1 shows that firms with higher MTBV (a chosen proxy for growth prospect) tend to have higher DTA. This could be the result of either taking out more retained earnings to invest or borrowing more or both. All of these cause DTA to increase. The pattern I have found so far is consistent with POT. Firms with better prospect need to find the funding first from retained earnings, then borrowing debt, and finally raising more shares. The positive relationship between DTA and MTBV implies that firms fund their projects relatively heavily from retained earnings and borrowing, compared with raising more capital from shareholders. This could be attributed to the perfect Bayesian equilibrium where the firm would like to signal its growth prospect to outsiders that I have found earlier.

I would conclude that growth is the main determinant in explaining the capital structure of firms in SET that fits appropriately in POT framework. The main result provides the insights to investors who needed to conduct firm valuation. First, investors would estimate capital structure as a function of a growth prospect proxy, such as MTBV, in the framework of POT. Then, forecasts of capital structures could be used to estimate WACC, which would be used to estimate firm value accurately. Unlike usual ways to estimate firm values, the firm growth forecasts are becoming more essential components in the valuation.

5. Conclusion

Investors need an accurate understanding of what determines capital structure, and how that factor can explain capital structure, so they could conduct firm valuation precisely. By using the concept of perfect Bayesian equilibrium, I showed that firms with stable return projects will choose financing option with debt included. Then, I conducted empirical analysis using financial information from firms in SET. First, I performed data pre-processing to create a balanced panel. Then, I conducted exploratory data analysis by capturing relationships among variables of interest. After initial analysis, I constructed the model by incorporating growth proxy, firm-specific effect and other control variables. The main result of the study is that growth is the main determinant in explaining capital structure of firms in SET, and the relationship fits in the class of POT, rather than TOT. I illustrated how growth prospects could determine capital structure through the channel of asymmetric information of firm types between the manager and the investor, using the concept of perfect Bayesian equilibrium. Firms with better growth prospects used the financial decisions that increased leverage ratios as signaling devices because it is quite costly for firms of the other type to do so.

Accurately explaining the firm capital structure is essential for both investors and policymakers. For investors, higher leverage does not merely imply that the firm is riskier and will have a hard time paying more interest expense. Understanding the firm fundamental (such as growth prospect) is the key to understand the firm capital structure. For policymakers, highly leveraged firms do not necessarily imply the need to apply higher degree of supervision or more stringent financial regulations to these firms. What actually determines the riskiness is the firm fundamental which will affect the firm capital structure.

My model has some limitations in explaining the determinants of capital structures in listed firms. These limitations could be partially overcome if the role of asset in place and bankruptcy cost were included and analyzed explicitly in the model. Regarding empirical results, MTBV is not a perfect proxy of the market prospect of firms. To capture firm prospects, the proxy variables that were derived from accounting variables would be better choices than the proxy that was derived from market prices.

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References

Gaud, P., Jani, E., Hoesli, M., & Bender, A. (2005). The capital structure of Swiss companies: an empirical analysis using dynamic panel data. *European Financial Management*, 11(1), 51-69.

González, V. M., & González, F. (2011). Firm size and capital structure: evidence using dynamic panel data. *Applied Economics*, 44(36), 4745-4754.

Maljuf, N.S., & Myers, S.C. (1984). Corporate financing and investment decisions when firms have information the investors do not have. *Journal of Financial Economics*, 13(2), 187-221.

Modigliani, F., & Miller, M. (1958). The cost of capital, corporation finance and the theory of finance. *American Economic Review*, 48(3), 291-297.

Morellec, E., & Schürhoff, N. (2011). Corporate investment and financing under asymmetric information. *Journal of financial Economics*, 99(2), 262-288.

Pongsupatt, A., & Pongsupatt, T. (2019). Determinants of capital structure: An empirical analysis of listed companies in Thailand Stock Exchange SET 100 Index. Retrieved from https://econpapers.repec.org/paper/sekiacpro/9811664.htm.

Serrasqueiro, Z., Matias, F., & Salsa, L. (2016). Determinants of capital structure: New evidence from Portuguese small firms. *Dos Algarves: A multidisciplinary e-journal*, 28(2016), 13-28.

Thippayana, P. (2014). Determinants of capital structure in Thailand. *Procedia-Social and Behavioral Sciences*, 143(2014), 1074-1077.