

CAPITAL STRUCTURE AND MARKET POWER

Prajya Ngamjan

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Prajya Ngamjan

School of Business Administration

Associate Professor *Aekkachai Nittayagasetwat* Major Advisor
(Aekkachai Nittayagasetwat, Ph.D.)

Associate Professor *P. Jiraporn* Co-Advisor
(Pornsit Jiraporn, Ph.D.)

The Examining Committee Approved This Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy (Finance)

Assistant Professor *Viput Ongsakul* Committee Chairperson
(Viput Ongsakul, Ph.D.)

Associate Professor *Aekkachai Nittayagasetwat* Committee
(Aekkachai Nittayagasetwat, Ph.D.)

Assistant Professor *Surang Hensawang* Committee
(Surang Hensawang, D.B.A.)

Assistant Professor *Viput Ongsakul* Dean
(Viput Ongsakul, Ph.D.)

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ABSTRACT

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Employing a sample set of 289 Thai listed firms during 2005-2014, the research found that leverage leads to increasing market power as measured by Tobin's Q and sales growth. The explanation is given by the limited liability theory; that is, a firm employs debt as a commitment tool to compete aggressively in product markets. The main finding remained robust through different leveraged firms/groups, different market concentration groups, different time periods, and in different industrial sectors. Additionally, leverage had stronger effects on market power: if the period was during economic expansion, if the firm was low leveraged, if the firm was in a low-leveraged sector, and if the firm was in an unconcentrated industrial sector. Furthermore, when using total debt instead of long-term debt as the independent variable, the explanatory powers captured by the adjusted R^2 s substantially increased. This suggests that the portion of short-term debt is an important source of finance and plays an important role in managing financial strategies, supporting the findings of previous research, that compared to developed countries, developing countries rely more on short-term finance.

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ABBREVIATIONS

Abbreviations

HI
LTD
QMV
ROA
SET
SG
SIZE2
TANG2
TD

Equivalence

Hirfindahl Index
Long Term Debt
Tobin's Q
Return on Asset
The Stock Exchange of Thailand
Sales Growth
Firm's size
asset tangibility
Total Debt

Symbols

D^i
 $R^i(q^i, q^j, z)$
 $R_z^i \equiv \partial R^i / \partial z$
 q^i
 z^i

Equivalence

Debt levered by firm i
The operating profit of firm i
The marginal profit of firm i given z
Market product output of firm i
The uncertainty of R^i , where $z \in [\underline{z}, \bar{z}]$

CHAPTER 1

INTRODUCTION

Conventionally, financial markets and product markets are studied and analyzed separately. On the one hand, the main assumption in the industrial organization literature is that the firm's objective is to maximize total profits and that firms are all equity financed. On the other hand, the main assumption of the finance literature is that firms, without taking product market strategy into consideration, are maximizing equity value, and earnings are exogenously specified by a given distribution (Harris & Raviv, 1991; Spigel, 2015).

In the finance literature, the theories of capital structure could date back to the work of Franco Modigliani and Merton Miller in 1958, which has paved way for the modern theory of capital structure. Capital structure theories have attempted to explain the financial choices of firms from different perspectives. Examples of well-established capital structure theories are the static trade-off theory (Jensen, 1986), the agency costs based theory (Jensen & Meckling 1976), and the pecking-order theory (Donaldson, 1961; Myers & Majluf, 1984). The static trade-off theory posits that firms set a target debt-equity ratio by balancing costs and benefits. Pecking order theory postulates that, due to asymmetric information, a firm prefers internal sources of funds to external sources for financing investments. Agency costs theory hypothesizes that the agency costs of equity and debt determine firm capital structure choices. These theories, however, do not take a firm's product market strategy into consideration. Furthermore, it is arguable that financial structure can influence and be influenced by product markets (Istaitieh & Rodriguez, 2003a). First, since firms are financially constrained (implying that they must raise their capital in some way for their investment), their behaviors in the product markets must depend on the characteristics (e.g. maturity, cost) and amount of funds that they have acquired. Second, financing strategy is a part of corporate strategy that affects a firm's real

investments and outputs (Grinblatt & Titman, 2002). Third, firms could project output market consequences based on their financial decisions (Istaitieh & Rodriguez, 2003b). Therefore, studying the interaction of corporate financing decisions and physical product market strategies would provide further understanding of firms' behavior. Additionally, studying a firm's behaviors in the physical product markets helps to compliment traditional finance paradigms and extend the insight into a firm's capital structure strategies (La Rocca, La Rocca, & Gerace, 2008).

Two theories that provide links between capital structure and product markets are limited liability theory and predation-based theory. On the one hand, the limited liability theory predicts that firms use risky debt to commit to aggressive product market strategy (Brander & Lewis, 1986). On the other hand, predation-based theory suggests the contrary, that is, leverage leads a firm to behave "softer" regarding product market competition (Bolton & Scharfstein, 1990).

Empirical research in this field has shown mixed results, i.e. leverage could lead to either tougher or softer product market competition. For example, Chevalier (1995a) employed event study in order to examine the effect of the announcement of leverage buyout LBOs in the American supermarket industry during the 80s. The research found that supermarket LBO announcements lead to the increasing market values of rival firms, and that LBOs encourage entry and expansion of rival supermarket chain firms. This suggests that leverage increases lead to softer product-market competition. Phillips (1995) employed a two-stage simultaneous equation method and reduced form equations with monthly individual firm data of four industries during the 90s. He found mixed results, i.e. output was found to be both negatively and positively associated with average industry debt ratio depending on the industry. Kovenock and Phillips (1995) used logistic regression on 40 firms from 1979 to 1990 and found that firms with unproductive plants in highly-concentrated industries are more likely to recapitalize and increase debt financing. After recapitalization, the investment behavior of recapitalizing firms was found to be more passive, while their rivals became more aggressive. Zingales (1998) used OLS least squares and probit regression to study the survival of trucking companies during deregulation, and found that highly-leveraged firms were less likely to survive deregulation, and high leverage appeared to affect survival by reducing investments

and prices. Campello (2006) also found mixed results, i.e. moderate leverage was associated with relative-to-rival sales increases, and high leverage leads to product market underperformance.

The above research, however, was carried out using data mainly from developed countries. The research in this area using data from developing countries such as Thailand is scarce. To the best of the author's knowledge, the only study that has investigated the association between capital structure and market power was that of Lovisuth, Fairchild, Rathinasamy (2007), who tested the relationship between capital structure and market power (product differentiation) using ordinary least squares (OLS) and a two-way fixed effects model for the sample containing 223 non-financial firms in Thailand from 1997 to 2004. On the one hand, the relationship between market power and either total debt or short-term debt is U-shaped. On the other hand, the relationship between market power and long-term debt was found to be inverted U-shaped. The paper concludes that two opposing limited liability and predation effects lead to these non-linear relationships.

Therefore, it is interesting to investigate in the context of a developing country such as Thailand. The current research fills the gap in the field of capital structure and market power, and adds further insight into firm behavior in the Thai market.

This research attempts to investigate the relationships between firms' capital structure and their product market outcome as postulated by the limited liability theory, which asserts that firms use risky debt to commit to aggressive product market strategy. The empirical analyses were carried out in two tiers; namely, firm-level analysis and sectoral analysis. On the one hand, firm-level analysis investigates the behaviors of the sample firms based on their aggregate behaviors. On the other hand, sectoral analysis investigates firms' product market power within the industrial sector in which the firms compete.

The remainder of the study is structured as follows: Chapter 2 reviews the literature pertinent to the research. Chapter 3 presents the model, data, and methodology used. Chapter 4 offers the findings and results, and Chapter 5 draws conclusions, and offers a discussion and recommendations.

CHAPTER 2

LITERATURE REVIEW

This chapter gives an overview of selected theories related to capital structure decisions, and the association between capital structure choices and product market outcomes. First, capital structure theories are discussed. This set of theories explains what determines a firm's financial structure choices, i.e. how firms decide to raise debt *vis-à-vis* equity capitals, and how capital structure choices affect the firm's value and performance. Second, capital structure theories that establish a link between capital structure and a firm's market output is discussed. Third, empirical research on the association between capital structure choices and product market outcomes is reviewed. Last, some issues of the research, *viz.* simultaneity and the non-monotonic association between competitive strategy and capital structure, are discussed.

Theories explaining the capital structure determinants and relationships between capital structure choices and a firm's product market outputs/market power are discussed in Sections 2.1 and 2.2, which are sketchily illustrated Figure 2.1 below.

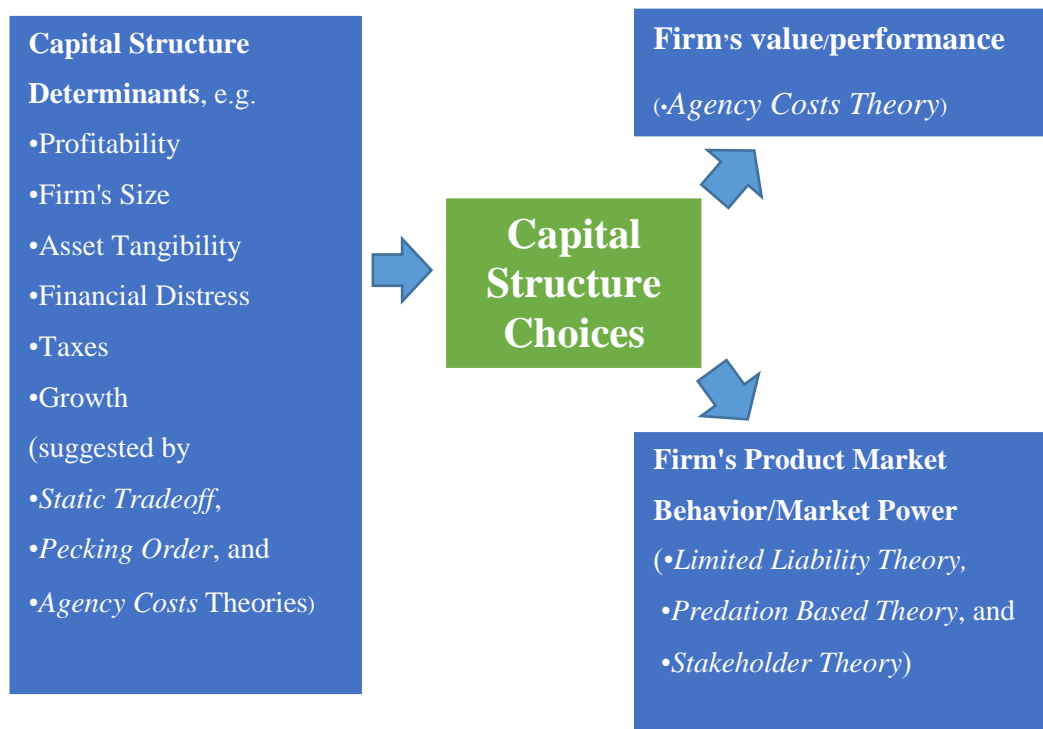


Figure 2.1 Relationship between Capital Structure Choices and a Firm's Product Market Outputs/Market Power

2.1 Capital Structure Theories

Capital structure refers to the relative mix of debt and equity financing structure of a company. The study of capital structure attempts to explain this security mix employed by firms to finance real investment (Myers, 2001). Capital structure has been an important subject in the finance discipline notably since the salient work of Franco Modigliani and Merton Howard Miller in 1958. The irrelevance proposition proposed by Modigliani and Miller (MM, henceforth) helped to establish the foundation of modern capital structure theory. The proposition states that, under perfect and frictionless capital markets as prescribed by MM, the firm choice of financing mix (debt *vis-à-vis* equity) does not affect the cost of capital or the value of the firm as long as it does not affect the probability distribution of the total cash flows to the firm (Jensen & Smith, 1984). Therefore, this is called the

“*irrelevancy theory*,” i.e. financing choice is not relevant to the firm’s value or, in other words, financing does not matter. This result marks the starting point to investigate why capital structure is relevant in the real world. The reasons are the imperfections of the real world, for example, the existences of taxes, bankruptcy costs, agency costs, and information asymmetry (Chaturvedi, 2009).

After MM, there has been a growing number of theories attempting to explain how firms choose their capital structure. Three well-established capital structure theories are discussed here, namely, static trade-off theory (Jensen, 1986), agency costs based theory (Jensen & Meckling, 1976), and pecking-order theory (Donaldson, 1961; Myers & Majluf, 1984).

2.1.1 Static Trade-Off Theory (STO)

Firms set a target debt-equity ratio by balancing costs and benefits, i.e. taking into account certain relevant factors, such as interest tax shields, financial distress costs, and agency costs. For example, firms with high profits to shield tend to have higher debt financing. On the one hand, too much debt may lead to higher financial distress, which in turn encourages equity financing. On the other hand, too much equity financing may also lead to conflicts of interest between managers and shareholders (Jensen, 1986). Under this circumstance, the managers of the firm will set a target leverage ratio by trading off between interest tax shields and the cost of financial distress. The target leverage ratio will vary from firm to firm according to the firm-specific characteristics.

2.1.2 Pecking Order Theory (POT)

Under the pecking order theory introduced by Donaldson (1961) and Myers and Majluf (1984), a firm prefers internal sources of funds (retained earnings) as a primary source to finance its investment. If the internal source is not available or is insufficient to fund its project, the firm will raise funds from external sources, in which debt is preferred over equity. The reason why equity is a less preferred source of funds is that investors may perceive the new shares issuing as if the firm were overvalued, and the managers of the firm are taking advantage of the information asymmetries.

The capital structure of each firm also depends on its profitability and its investment opportunities. On the one hand, the firms with high profitability and slow growth are likely to have sufficient retained earnings to internally finance their investments. On the other hand, a low profitable firm with relatively low growth tends to have a higher debt ratio.

2.1.3 Agency Costs Theory (ACT)

Both static trade-off and pecking order theories assume that the interests of managers and shareholders are in line, i.e. the manager maximizes shareholders' wealth. However, in the circumstance where the two parties are different persons such as the environment of a corporate firm, their interests might no longer align. Furthermore, as there are various stakeholders within a firm, e.g. shareholders, debtholders, managers, etc., these stakeholders' self-interests may also no longer align, giving rise to conflicts of interests and agency costs. Agency costs refer to the costs borne by a principal should he have an agent acting on his behalf, which are the sum of the monitoring expenses of shareholders, the bonding expenses of the managers, and the residual loss which is the divergence between the agent's own decision and those decisions to maximize the welfare of the principal (Jensen & Meckling, 1976).

Research on agency costs is largely credited for a seminal paper by Jensen and Meckling (1976), who posit that the separation of ownership and control inevitably gives rise to the agency cost of an outside equity (agency cost of equity), since managers may deviate from maximizing shareholder wealth and thereby transfer firm resources for private benefit.

Jensen and Meckling (1976) identified two types of conflicts, *viz.*, conflicts between shareholders and managers, and debtholders and equityholders, discussed below.

2.1.3.1 Conflicts of Interests between Shareholders and Managers (Agency Cost of Equity)

If the manager (the agent) and owner (the principal) are not the same person, and they are both utility maximizers, it is highly likely that the agent will not always act in the best interest of the principal (Jensen & Meckling, 1976). This is a

“*moral hazard*” problem. Instead of maximizing the owner’s wealth, the manager may be tempted to take a suboptimal decision to thereby maximize her own wealth at the expense of the owner. For instance, the manager might attempt to transfer wealth from the owner through empire-building, over-compensating, and perquisite consuming.

One way to alleviate the problem of the agency cost of equity is through the use of capital structure as a corporate governance tool, i.e. debt can be employed to reduce the manager-shareholder conflict and the agency cost of equity by the following channels:

1) increasing debt may in turn increase the manager’s share of ownership, thus making the manager’s objective more in line with the shareholders (Jensen & Meckling, 1976);

2) using debt compels a firm to pay out fixed interest, thereby reducing the amount of free-cash-flows in the hand of the manager (Jensen, 1986) and increasing the threat of liquidation (Grossman & Hart, 1982).

However, introducing debt into capital structure may raise conflicts between shareholders and debtholders, as discussed next.

2.1.3.2 Conflicts of Interest between Shareholders and Debtholders (Agency Cost of Debt)

The main difference between shareholders and debtholders is that shareholders receive a residual claim, while debtholders receive a fixed income. Thus, if there is no uncertainty attached to the fixed income received by debtholders, there should be no conflict between the two parties. However, as debt is not totally free of default risk, conflicts between debt and equity investors are inevitable. Furthermore, debtholders do not gain from higher profit generated from a riskier investment, since their stream of income is fixed. This suggests that bondholders would prefer less risky projects.

Shareholders can gain by reducing the value of the existing debt. Suppose that the firm manager is in favor of stockholders. It follows that the manager can transfer wealth from bondholders to shareholders, and shareholders can transfer value from debtholders *via* the following channels:

First, equityholders can capture the gain from investing sub-optimally. Being residual claimers, shareholders have an incentive to motivate the manager to invest in high-risk projects. If the project succeeds, shareholders will gain the upside, while debtholders will receive the same amount of fixed interest. However, if the project fails, both shareholders and debtholders share the loss. This is called the “*asset substitution effect*,” which calls for debtholders to monitor the firm and impose debt covenants (Jensen & Meckling, 1976).

Second, the manager can initiate a “*dividend recapitalization*,” i.e. issue new bonds to finance the dividends for the shareholders. This will reduce the value of the current debt, and hence transfer wealth from debtholders to stockholders.

Third, managers may refuse to invest in positive NPV (Net Present Value) projects, if all of the benefits will be distributed to the debtholders. This is called the “*underinvestment*” or “*debt overhang*” problem (Myers, 1977).

2.1.4 Capital Structure Determinants

This section discusses the capital structure determinants deduced from the above three capital structure theories.

2.1.4.1 Profitability

According to the pecking order theory, profitable firms are expected to issue less debt as they can finance their investment by internal sources of funds. However, under the static trade-off theory and the agency costs based theory, the prediction of capital structure can be determined based on the free cash flow theory (Jensen, 1986) which defines debt as a device to force managers to pay out firms’ profits in a disciplined manner. As a result, a positive correlation between profitability and leverage is expected.

2.1.4.2 Firm’s Size

Fama and Jensen (1983) have shown that large firms are expected to have a lower degree of information asymmetry because larger firms tend to provide more information to investors. This suggests the attractiveness of equity financing, and thus implies lower debts, as well as a negative correlation between size and leverage ratio. On the other hand, larger firms usually have more stable cash flows which reduce the probability of bankruptcy. Therefore, larger firms bear lower costs

in issuing debt compared with smaller firms and the debt issuing is expected under the static trade-off theory. This suggests a positive correlation between size and leverage ratio.

2.1.4.3 Asset Tangibility

Tangible assets can be used as collateral for debt financing. Firms can borrow at lower interest rates when they issue debts with collateral since debts are secured by the collateralization of tangible assets. In addition, secured debts help to reduce the agency cost of debt, and to reduce the probability of firms engaging in asset substitution. Therefore, the asset tangibility is expected to have a positive correlation with firms' leverage.

2.1.4.4 Financial Distress

An increase in earnings volatility may cause firms to be unable to fulfil their debt commitment, and thus increase the probability of financial distress. Therefore, since interest payment is a commitment but dividend payment is not, the increase in financial distress can discourage a firm from issuing debts. The negative correlation between earnings volatility and leverage is expected under the static trade-off theory. On the other hand, one may argue that firms with high earnings volatility usually suffer from information asymmetries, which implies the preference of debt financing, and thus suggests the prediction of positive correlation.

2.1.4.5 Effective Tax Rate

As a higher effective tax rate reduces firms' internal funds, under the pecking order theory, this suggests that firms are likely to raise external funds by issuing debts in order to finance their investments. In addition, the static trade-off theory suggests that firms with higher taxable income usually issue more debts to benefit from tax shields. As a result, a positive correlation between the effective tax rate and leverage ratio is expected.

2.1.4.6 Growth Opportunity

Firms with higher growth opportunities are likely to have a higher degree of information asymmetry. Therefore, under the pecking order theory, such firms are expected to have a higher leverage ratio. However, firms with substantial growth opportunities have the most to lose if they have debt overhanging, as it prevents firms from raising new capital. This also suggests a higher cost of financial

distress, and thereby a negative correlation between growth opportunities and leverage ratio.

2.2 Capital Structure and Product Market

Two fundamental questions regarding capital structure are the following: 1) whether capital structure matters (can change in capital structure lead to a change in the total market value of a firm?); and 2) if capital structure does matter, what factors determine the optimal capital structure? (Megginson, 1997). Both questions are partly addressed by the theories discussed above, which only deal with the financial side of a firm. Nonetheless, firms engage in both financial and real activities. On the one hand, a firm requires funds to invest its assets. On the other hand, the firm can also be a contributor in the real physical product markets. Therefore, a more complete picture would be adding, into the equation, the interaction of the physical product markets that firms operate in. Another *raison d'être* is that corporate financial decisions are a part of the overall corporate strategies affecting firms' real investment and outputs (Grinblatt & Titman, 2002). Furthermore, since firms are not financially unconstrained, their actions (in the product markets) must be based on the amount and characteristics of the funds they have obtained. Hence, combining the studies of a firm's behaviors in the physical product markets with its capital structure choices will help to compliment the traditional finance paradigms and extend the insight into a firm's capital structure strategies (La Rocca et al., 2008).

The literature that links capital structure and product markets can be classified into two broad strands.

First, the firm's product outputs and capital structure: this tread of the literature suggests that capital structure is employed as a commitment tool to a product market strategy, i.e. debt could make firms compete more or less aggressively. These are, namely, *limited liability* and *predation-based* theories (Brander & Lewis, 1986; Maksimovic, 1988; Showalter, 1995; Bolton & Scharfstein, 1990, *inter alia*).

Capital structure and a firm's product market outputs can also be affected through the firm's non-financial stakeholders (e.g. customers, suppliers, employees).

This is the so-called *stakeholder theory of capital structure* (e.g. Titman, 1984; Cornell & Shapiro, 1987).

Second, market structure and capital structure: market structure could affect and be affected by a firm's leverage decisions. Debt levels can be associated with high or low industry concentration levels (eg. Opler & Titman, 1994; Chevalier, 1995a, b).

This research reviews the limited liability theory, predation-based theories, and the stakeholder theory of capital structure. The first two theories provide linkages between capital structure and competitive strategies in product markets, and the last links financial structure and product market competition *via* the agency problems arising between the firm and its stakeholders.

2.2.1 Limited Liability Theory

Brander and Lewis (1986, BL86 henceforth) are among the first to formally analyze the linkage between product markets and capital markets. BL86 theoretically show that issuing risky debt leads firms to becoming more aggressive in product markets, because a higher leverage level increases the firm's bankruptcy probability. Therefore, a firm will be more aggressive and raise its production and output in response to debt finance. Thereby, capital structure is employed as a commitment device to conduct a product market strategy (Isataitieh & Rodriguez-Fernandez, 2006). The model proposed by BL86 is called the "*limited liability model*," which is based on Cournot competition (i.e. competing on quantity).

Maksimovic (1988) then extend BL86's theory to a repeated oligopoly environment; in order to prevent price wars, firms have an incentive to tacitly collude with their rivals. However, since equityholders receive residual cash flow after debt payment, they have an incentive to deviate from the implicit agreement to earn a higher cash flow from monopoly profit. Hence, capital structures can induce equityholders to select strategic moves that do not maximize the firm's value.

Short-term and long-term debts can also affect a firm's product market behaviors differently. Glazer (1994) showed that with limited liability, a firm's behavior in product market competition can be strongly affected by its accumulated profits. That is, the higher the profit, the less aggressively the firm will behave in the

following periods. Furthermore, the maturity of debt has an impact on the production behavior of the firm. Issuing long-term debts will not induce a firm to be as aggressive as issuing short-term debts. That is, the shorter the maturity date, the more aggressive the firm becomes. In short, the limited liability theory predicts that in increasing leverage levels, the firm will compete more aggressively in product markets. Furthermore, the shorter the maturity date of debts, the more aggressively the firm will behave.

2.2.2 Predation Based on Agency Problems in Financial Contracting

A firm's leverage behavior can also affect the product market strategies of its competitors (Grinblatt & Titman, 2002). Bolton and Scharfstein (1990) pointed out that agency problems in financial contracting can induce rational predation. Investors want to reduce managerial slack by issuing financial contracts to terminate funding if a firm's performance is poor. However, imposing this financial constraint will in turn induce predation. In order to be certain that the firm's performance is poor, rational deep-pocket rivals will compete aggressively in the product market. Therefore, the agency problems between investors and manager imply that in order to avoid predation, firms will rely more on internal sources of capital. In contrast to the prediction of limited liability, the predation theory suggests a negative association between leverage and market power.

2.2.3 Stakeholder Theory of Capital Structure

Agency problems can affect financial structure and product market competition. Titman (1984) showed that, through the liquidation decision of the firm, there exists an agency relationship between the firm (as the agent) and its stakeholders (as the principals). In order to reduce the agency problem, the firm will align its capital structure as a pre-positioning or bonding mechanism. This can be explained as follows. The nonfinancial stakeholders of a firm, e.g. customers, suppliers, employees, and communities, can influence the firm's financing decisions because a firm's liquidation costs can affect its stakeholders. For example, the firm's customers might find it difficult to obtain products, spare parts, or other services, suppliers might lose the income generated from doing business with the firm, and employees might

lose their jobs and income. Consequently, these rational stakeholders will demand compensation from the firm in distress, e.g. stakeholders will avoid doing business with such a firm, customers will pay less or avoid buying from the firm, and potential employees will demand higher wages. As a result, in order to reduce the probability of financial distress, firms may prefer equity over debt in the capital structure. Furthermore, the costs imposed will be more prominent should the products of the firm be unique or durable (e.g. automobile firm), and thus these firms will choose a low-leveraged financial structure.

2.3 Empirical Research on Competitive Strategy and Capital Structure

The previous empirical results of studies on the interaction between a firm's financing decisions and its product market performance are mixed, i.e. leverage is found to be either beneficial or detrimental to competitive performance (Campello, 2006).

Chevalier (1995a) was among the first to employ event study to examine the effect of the announcement of leverage buyout LBOs in the American supermarket industry during the 1980s. First, the research examined the effects of four supermarket LBO announcements during the period 1986-1988, and found that, corresponding to the announcements, the market values of the rival firms increased. Second, the paper investigated entry and expansion during the period 1985-1995, and found that LBOs encouraged the entry and expansion of rival supermarket chain firms. Both results suggested that leverage increases during an investigation period, leading to softer product-market competition. Chevalier (1995b) further examined the changes in supermarket prices in local markets following supermarket LBOs during 1981-1990 and found that supermarket prices could either rise or fall: a) price rises: rivals are highly leveraged and LBO firms have higher prices than their less leveraged rivals, suggesting that LBOs create incentives to raise prices; and b) price falls: rivals are low leveraged and concentrated, suggesting that rivals attempt to "prey" on LBO chains.

Phillips (1995) showed that industry product market decisions are associated with capital structure by employing a two-stage simultaneous equations method and

reduced-form equations with the monthly individual firm data of four industries during 1980-1990. He found mixed results: a) for three industries (fiberglass, tractor trailers, and polyethylene) output is negatively associated with the average industry debt ratio, suggesting that debt causes leveraged firms to behave less aggressively; and b) in the other industry (gypsum), output was positively associated with the average industry debt ratio, suggesting that debt causes leveraged firms to behave more aggressively. Kovenock and Phillips (1995) used logistic regression on 40 firms during 1979-1990 to investigate the interaction of capital structure decisions and product-market behavior. They found that firms with unproductive plants in highly-concentrated industries were more likely to recapitalize and increase their debt financing. This suggests that in highly-concentrated industries agency costs cannot be driven out by low competition. After recapitalization, the investment behavior of recapitalizing firms was found to be more passive, while their rivals become more aggressive. Kovenock and Phillips concluded that the evidence is inconsistent with the limited-liability effect of debt.

Zingales (1998) used ordinary least squares and probit regression to investigate the relationship between debt and product-market competition. He studied the survival of trucking companies during the eight years following the beginning of deregulation as a function of their economic efficiency (fitness) and their financial resources (fatness). He found that deregulation survival chances depend on firms' efficiency and leverage levels at the beginning of the regulation. Therefore, both fitness and fatness play an important role in surviving deregulation. Highly-leveraged firms are less likely to survive deregulation. High leverage appears to affect survival by reducing investments and prices. Furthermore, Zingales criticized the results of some previous research, such as that of Phillips (1995), Chevalier (1995a; 1995b), and Kovenock and Phillips (1997) as being subjected to endogeneity. Recall that the limited liability model assumes that decision to leverage commits firms to competing more aggressively (Brander and Lewis, 1986). The leverage decision (LBO) may not be exogenous of the competitive environment, i.e. the leverage decision might come from the anticipation of the outcome of a competitive position. Therefore, the causality could run in both directions—between the competitive environment and the firm's financing decisions. In Zingales (1998), however, the deregulation is an

exogenous shock that unexpectedly changed both the competitive environment and the leverage of firms. Therefore, in the next section, endogeneity will be discussed. Campello (2006) found mixed results, i.e. moderate leverage was associated with relative-to-rival sales increases, and high leverage leads to product market underperformance.

2.4 Simultaneity of Leverage and Market Power

As stated earlier, causality could run in both directions, between a competitive environment and a firm's financing decision (Zingales, 1998). More attention has been placed on causality, which can be seen in some recent research papers as follows.

Istaitieh and Rodriguez (2003a) explore the possibility of simultaneous bias between firm's financing decision and firm's strategic behavior. Following limited liability theory, firm's debt is assumed to affect firms' strategic behavior. However, firms could also anticipate the output market consequences of financial decisions. Therefore, the causal direction could be in two ways. The authors estimated a simultaneous equations model (a system of two equations) with a sample of 2,112 Spanish manufacturing firms during 1993 and 1999. The first equation was a financial leverage equation following stakeholder theory and the firm's strategic behavior. The second equation followed the limited liability model, i.e. the firm's strategic behavior is affected by financial leverage. The research revealed that leverage level both affects and is affected by a firm's strategic behavior.

In order to tackle endogeneity, Campello (2006) employed asset tangibility as an instrumental variable for debt financing in sales performance equations. This is due to the fact that creditors normally request collateral in exchange for financing. Thus, on the one hand, asset tangibility is likely to correlate with a firm's financing. On the other hand, tangibility assets should not determine the firm's relative sales performance.

Smith, Chen, and Anderson (2008) employed the seemingly unrelated regression method (SUR) to examine the relationship between the capital structure of New Zealand manufacturing firms and their product market strategies during 1997-

2007. The research revealed that long-term debt both influences and is influenced by product market competition. The use of long-term debts increases with a firm's relative-to-industry sales.

2.5 Non-monotonic Association between Competitive Strategy and Capital Structure

The association between financial structure and market competition can also be non-linear. Campello (2006) suggested that, as empirically shown in previous studies, a firm's financing decisions can both hurt and boost its product market performance. He proposed a model of a non-monotonic association between external financing and product market outcomes, and found that moderate debt level could relatively raise the market share. Nonetheless, after some point, additional leverage leads to significant sales underperformance. On the one hand, high-leveraged leader firms in concentrated industries cannot expand their sales through leveraging. On the other hand, lower-leveraged leader firms in the same industries may have a significantly positive sales growth rate.

Lovisuth et al. (2007) tested the relationship between capital structure and market power (product differentiation) using ordinary least squares and the two-way fixed effects model. The sample contains 223 non-financial firms in Thailand during 1997-2004. The results revealed a non-linear relationship between capital structure and market power. On the one hand, the relationship between market power and either total debt or short-term debt was U-shaped. On the other hand, the relationship between market power and long-term debt was found to be inverted U-shaped. The paper concluded that the two opposing limited liability and predation effects led to these non-linear relationships. Consequently, Rathinasamy, Fairchild, Lovisuth, and Krishnaswamy (2013) explored the relationship between market power (product differentiation) and capital structure choice using the two-way fixed-effects time series cross sectional regression method. The sample comprised 585 U.S. firms over the period of 1994-2011. The results revealed a "cubic relationship" between market power and capital structure (measured by long-term debt to total assets and total debt to total assets). Furthermore, at different levels of profit, the relationship of profit and

capital structure is reversed, i.e. at a high level of profit, the relation of profit and level of debt is positive; and at a low level of profit, the relation is negative.

In sum, it was empirically found that the association between leverage and market competition is not necessarily linear or monotonic.

CHAPTER 3

MODEL, DATA, AND METHODOLOGY

This chapter discusses the theoretical model pertinent to the study. This research adopted a model that explains the interrelationships among market power and capital structure based on the limited liability theory (Brander & Lewis, 1986).

3.1 Model of Capital Structure and Market Power

Brander and Lewis (1986) introduced a theory indicating that the choice of capital structure can affect product markets, called the “*limited liability model*.” The model theorizes that firms intend to transfer wealth from debtholders to stockholders by using a high leverage level to compete more aggressively, implying a positive relationship between leverage level and market power.

This section adopts the limited liability model as expounded by Brander and Lewis (1986) and Spiegel (2015). The model possesses the following assumptions: there are two rival firms, i and j , producing two competing products q^i and q^j , respectively (the model is based on Cournot competition, i.e. competing on quantity).

1) The operating profit of firm i , $R^i(q^i, q^j, z)$, is defined as the revenue after variable costs, and satisfying the following properties: $R_z^i \equiv \partial R^i / \partial z > 0$, $R_{ii}^i \equiv \partial R^i / \partial q^i < 0$, $R_j^i \equiv \partial R^i / \partial q^j < 0$, and $R_{ij}^i \equiv \partial R^i / \partial q^j = \partial R_j^i / \partial q^i < 0$.

2) The random variable z^i reflects the uncertainty of R^i , where $z \in [\underline{z}, \bar{z}]$ following the density function $f(z^i)$, and z^i and z^j are independent and identically distributed.

3) High value of z^i lead to higher marginal profits, $R_z^i > 0$, where $R_z^i \equiv \partial R^i / \partial z$. There are two possible effects of z_i on marginal profit:

4) In the normal case, $R_{iz}^i > 0$, marginal profits are higher in better states of the world; and

5) In the unlikely case, $R_{iz}^i < 0$, marginal profits are lower in better states of the world.

6) The financial structure of firm i is given by debt obligation, D^i .

7) Shareholders are risk neutral on a firm's profit, such that they are concerned only with the maximization of expected equity value.

The model is constructed as a two-stage sequential duopoly game of two firms i and j , where the following applies:

In stage 1 (period 1), the two firms choose financial structure (leverage level which is due at the end of period 2) D^i and D^j , for firm i and firm j , respectively, and at stage 2 (period 2), both firms select output levels according to the financial structures chosen in stage 1.

The operating profits (revenues after costs) of firm i , $R^i(q^i, q^j, z)$ depend on its level of output chosen in period 2, q^i ; the competitor's level of output q^j ; and random shock z^i . The explanation will begin with the leverage free case where both firms are equity funded; then debt will be introduced to the capital structure of both firms in the second case.

3.1.1 Case I: Leverage Free

Both firms are leverage free, i.e. 100 per cent equity funded. In period 2, firm i chooses an output level q^i (strategy in the product market) to maximize its expected value to the shareholders; namely, the equity value V^i .

$$V^i = \int_{\hat{z}^i}^{\bar{z}} R^i(q^i, q^j, z) f(z^i) dz^i. \quad \text{Equation 1}$$

The state of nature z is further defined as follows:

† The critical state of nature \hat{z}^i is defined such that $\hat{z}^i \in (\underline{z}, \bar{z})$, or $\underline{z} < \hat{z}^i < \bar{z}$. The critical state of nature \hat{z}^i is explicitly defined by

$$R^i(q^i, q^j, \hat{z}^i) - D^i = 0 \quad \text{Equation 2}$$

That is, when the state is \hat{z}^i , the firm has just enough to pay off its debt obligation.

† Good states are defined by $z^i \geq \hat{z}^i$, implying $R^i(q^i, q^j, \hat{z}^i) > D^i$, i.e. the firm remains solvent, and

† Bad states happen when $z^i < \hat{z}^i$, implying $R^i(q^i, q^j, \hat{z}^i) < D^i$, i.e. all profits are paid to debt-holders and the firm goes bankrupt.

Accordingly, the best response function (the first order condition) for firm i is

$$\frac{\partial V^i}{\partial q^i} = V_i^i = \int_{\hat{z}^i}^{\bar{z}} R^i(q^i, q^j, z) dF(z) = 0 \quad \text{Equation 3}$$

As in the traditional Cournot oligopoly model, solving the system of the two best response functions ($V^i = 0$ and $V^j = 0$) will result in Nash equilibrium (q^{i*}, q^{j*}) . If R^i is nicely behaved (concave), the firm will produce until the marginal operating profit is nil.

3.1.2 Case II: Leverage

Both firms issue debt in the first period, D^i and D^j , respectively. The firms then select output levels, q^i and q^j , to maximize the expected value of the firms to shareholders, V^i and V^j , consecutively.

The firm's objective is to maximize the value to shareholders. The expected equity market value is then given by the expected operating profits after debt payment.

$$V^i = \int_{\hat{z}^i}^1 [R^i(q^i, q^j, z) - D^i] f(z) dz \quad \text{Equation 4}$$

Without loss of generality, \hat{z}^i is restricted to be in the range of 0 and 1, such that $\hat{z}^i \in (0, 1)$. The best response function (the first order condition) of firm i is thus

$$\frac{\partial V^i}{\partial q^i} \equiv V_i^i = \int_{\hat{z}^i}^1 R_i^i(q^i, q^j, z) f(z) dz = 0 \quad \text{Equation 5}^1$$

With the introduction of debt into the capital structure, firm production strategy changes. This can be shown by total differentiate Equation 5 which expresses q^i as an implicit function of D^i .

$$dV_i^i = \frac{\partial V_i^i}{\partial q^i} dq^i + \frac{\partial V_i^i}{\partial D^i} dD^i = 0. \quad \text{Equation 6}^2$$

Note that V_i^i is the first derivative of V^i with respect to q^i , and $\partial V_i^i / \partial q^i$ is the second derivative of V^i w.r.t. q^i , which can compactly be denoted by V_{ii}^i . Likewise, $\partial V_i^i / \partial D^i$ is the cross derivative of q^i and D^i , denoted by V_{iD}^i . Rearranging Equation 6, we have the comparative static

¹ Recall Leibniz rule of differencing under integral sign stating that $\frac{d}{dt} \left(\int_{g(t)}^{h(t)} F(x, t) dx \right) = (F(h(t), t)h'(t) - F(g(t), t)g'(t)) + \int_{g(t)}^{h(t)} \frac{\partial F(x, t)}{\partial t} dx$ (see Flanders, 1973). Applying this rule to Equation 4, we have

$$\begin{aligned} V_i^i &= [R^i(q^i, q^j, 1) - D^i] f(z) \frac{\partial 1}{\partial q^i} - [R^i(q^i, q^j, \hat{z}^i) - D^i] f(z) \frac{\partial \hat{z}^i}{\partial q^i} \\ &\quad + \int_{\hat{z}^i}^1 \frac{\partial [R^i(q^i, q^j, \hat{z}^i) - D^i]}{\partial q^i} f(z) dz = 0 \end{aligned}$$

The first and the second terms on the right hand side equal zero, since the differentiation of a constant is nil and $R^i(q^i, q^j, \hat{z}^i) - D^i = 0$ from the condition Equation 2, and the third term by using the sum-rule of differentiation $\frac{\partial [R^i(q^i, q^j, \hat{z}^i) - D^i]}{\partial q^i} = \frac{\partial R^i(q^i, q^j, \hat{z}^i)}{\partial q^i} - \frac{\partial D^i}{\partial q^i} = R_i^i(q^i, q^j, \hat{z}^i) - 0$.

² Recall total differentiation $dU(x_1, x_2, \dots, x_n) = \frac{\partial U}{\partial x_1} dx_1 + \frac{\partial U}{\partial x_2} dx_2 + \dots + \frac{\partial U}{\partial x_n} dx_n$.

$$\frac{dq^i}{dD^i} = -\frac{\partial V_i^i / \partial D^i}{\partial V_i^i / \partial q^i} \quad \text{Equation 7}$$

Due to the second order condition for maximization, $\partial V_i^i / \partial q^i < 0$. Thus, the sign of Equation 7 depends on the term $\partial V_i^i / \partial D^i$, the cross derivative of V^i w.r.t. q^i and D^i . There are two possibilities: (i) $\partial V_i^i / \partial D^i > 0$, the firm increases its production as D^i increases; and (ii) $\partial V_i^i / \partial D^i < 0$, the firm reduces its production as D^i increases.

To clarify the sign of $\partial V_i^i / \partial D^i$, we go back to Equation 5 and differentiate V_i^i w.r.t. D^i , and we have

$$\frac{\partial V_i^i}{\partial D^i} = -R_i^i(q^i, q^j, \hat{z}^i) f(\hat{z}^i) \frac{\partial \hat{z}^i}{\partial D^i} \quad \text{Equation 8}^3$$

The last term $\partial \hat{z}^i / \partial D^i > 0$,⁴ i.e. a higher leverage leads to higher a critical state of nature implying a higher chance that the firm will go bankrupt. Using this condition, $1/R_{\hat{z}^i}^i(q^i, q^j, \hat{z}^i) = \partial \hat{z}^i / \partial D^i > 0$, with Equation 8, we have

$$\frac{\partial V_i^i}{\partial D^i} = -\frac{R_i^i(q^i, q^j, \hat{z}^i)}{R_{\hat{z}^i}^i(q^i, q^j, \hat{z}^i)} f(\hat{z}^i). \quad \text{Equation 9}$$

The denominator is positive from the aforementioned condition, and the probability density function $f(\hat{z}^i)$ is strictly positive by definition. Thus, we need to determine the sign of the numerator $R_i^i(q^i, q^j, \hat{z}^i)$, the marginal profit evaluated at the worst state of nature relevant to equity holders. If this is negative, it implies that

³ Differentiate Equation 5 w.r.t. D^i , using the Leibniz rule again, we have

$$\begin{aligned} \frac{\partial V_i^i}{\partial D^i} &= [R_i^i(q^i, q^j, 1)]f(1) \frac{\partial 1}{\partial D^i} - [R_i^i(q^i, q^j, \hat{z}^i)]f(\hat{z}^i) \frac{\partial \hat{z}^i}{\partial D^i} \\ &\quad + \int_{\hat{z}^i}^1 \frac{\partial R_i^i(q^i, q^j, z)}{\partial D^i} f(z) dz \end{aligned}$$

The first term and the last term on the right hand side are gone.

⁴ From the condition Equation 2, $R^i(q^i, q^j, \hat{z}^i) = D^i$, we have $\partial R^i(q^i, q^j, \hat{z}^i) / \partial \hat{z}^i = \partial D^i / \partial \hat{z}^i$, and then $1/R_{\hat{z}^i}^i(q^i, q^j, \hat{z}^i) = \partial \hat{z}^i / \partial D^i > 0$.

Equation 7, $\partial q^i / \partial D^i$, is positive, i.e. the firm is more aggressive as it levers more, and *vice versa*.

3.1.3 Case 1 (Normal Case):

$$\partial R_i^i(q^i, q^j, \hat{z}^i) / \partial \hat{z}^i > 0 \text{ implying } R_i^i(q^i, q^j, \hat{z}^i) < 0 \text{ and } \partial q^i / \partial D^i > 0:$$

In good states of nature, i.e. when $\hat{z}_i \leq z \leq 1$, the first order condition states that the expectation of $R^i(q^i, q^j, z)$ equals zero. If $\partial R_i^i / \partial z > 0$, R_i^i will be negative for low z , and positive for high z . Therefore, $R_i^i(q^i, q^j, \hat{z}^i) < 0$, because \hat{z}^i is the lowest possible value that the firm will consider, suggesting $\partial q^i / \partial D^i > 0$, i.e. the firm will be more aggressive (producing more as leverage increases). (See Figure 3.1a).

3.1.4 Case 2 (Unlikely Case):

$$\partial R_i^i(q^i, q^j, \hat{z}^i) / \partial \hat{z}^i < 0 \text{ implying } R_i^i(q^i, q^j, \hat{z}^i) > 0 \text{ and } \partial q^i / \partial D^i < 0:$$

If $\partial R_i^i / \partial z < 0$, R_i^i will be positive for low z , and negative for high z . Therefore, $R_i^i(q^i, q^j, \hat{z}^i) > 0$, because \hat{z}^i is the lowest possible value that firm will consider, suggesting $\partial q^i / \partial D^i < 0$, i.e. the firm will be softer (producing less as leverage increases) (See Figure 3.1b).

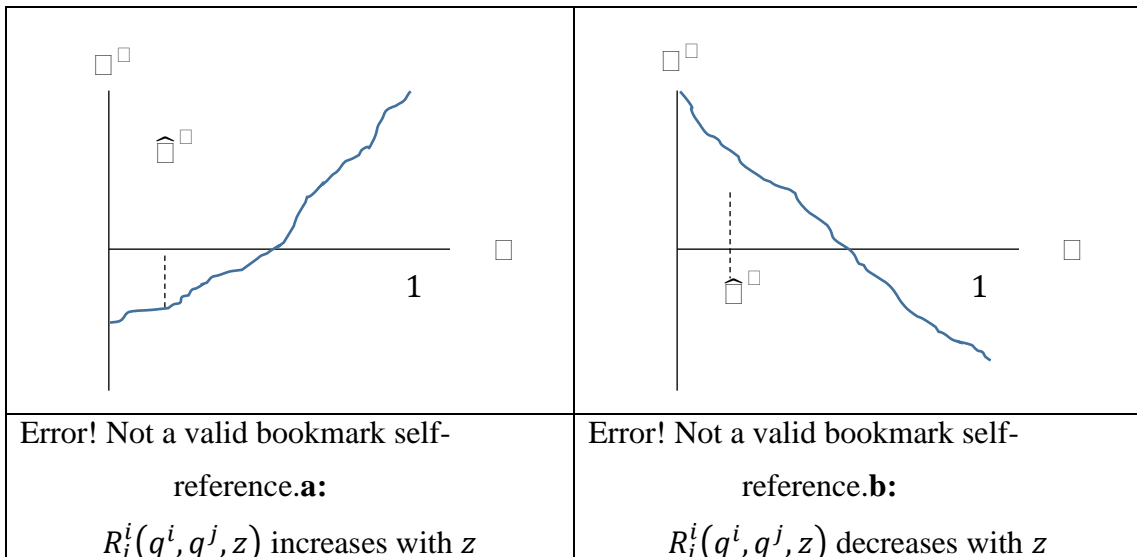


Figure 3.1 The Sign of $R_i^i(q^i, q^j, z)$

Source: adapted from Spiegel, 2015.

For the normal case, the intuition of the limited liability model is that in good states equityholders are residual claimants. However, should bad states occur, debtholders would take over and become residual claimants. Higher debt level increases the chances that the firm could become bankrupt, and hence shifts the critical state \hat{z}^i up. Therefore, in response to an increase in debt finance, the firm will be more aggressive and raise its production and output. The higher the debt level, the more aggressive the firm becomes. This is illustrated in the below.

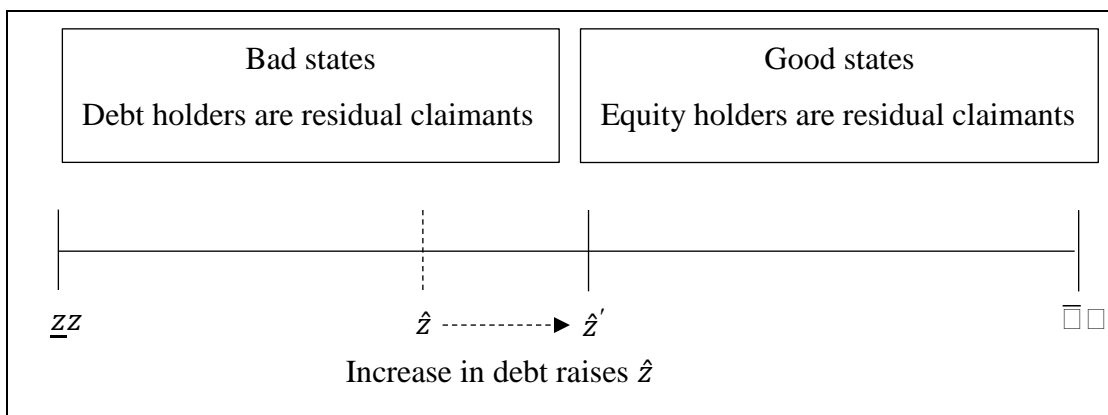


Figure 3.2 States Space of Residual Claimant Regions

Source: adapted from Blander and Lewis, 1986, p.961.

3.2 Hypotheses

The hypotheses developed from the above theory of limited liability are presented herewith.

H_0 : Increasing leverage level has **no** effect on a firm's market product behavior.

H_a : Increasing leverage level has a **positive** effect on a firm's market product behavior.

In the next section, the measures of leverage and product market competition will be discussed.

3.3 Proxies for Product Market Competition and Capital Structure

This section discusses the dependent variables and independent variables employed in the analysis. Limited liability theory posits that a firm uses debt as a commitment tool to behave aggressively in the product market. It follows that leverage will be used as the independent variable and the firm's product market behavior as the dependent variable. The long-term debt ratio (LTD) and total debt ratio (TD) will be employed.

The measures for market competition can be separated into two broad groups, i.e. measures at the firm level and at the industrial level. First, at the firm level, sales growth (SG), relative sales growth (RSG), and market share can be employed to gauge the firm's behavior in the product market. SG measures the firm's own sales growth, RSG the firm's sales growth relative to its industry, and market share measures the firm's market share relative to its industry. Furthermore, price-cost margin (PCM) and Tobin's Q (QMV) can be used to measure the market power of the firm. Second, at the industrial level, the Herfindahl index (HI) is used to measure the degree of competitiveness in the industry. These variables are discussed in the next section.

3.3.1 Product Market Competition Measure

Three closely-related terminologies, market structure, market concentration, and market power, will be discussed below.

Market structure describes the characteristics of a market, including the number of firms, the degree of product differentiation, and the ease of entry into and exit from the market (Tucker, 2003). Market concentration indicates the market structure, i.e. the number of firms and level of production contributed by firms to the market. The degree of market competitiveness depends on the extent each firm has power to influence the market price (Nguyen & Kira, 2000). On the one hand, in a perfect competitive market, all firms are price-takers, i.e. they have no market power. On the other hand, in monopolistic competition, the firm is a price-maker, i.e. it has full market power. Consequently, market power can be explained as the ability of a firm to control the price or volume of production which in turn implies a firm's monopoly, or oligopoly or competitive power (Pandey, 2002).

In sum, market concentration indicates the type of market structure that firms are operating in. Market power identifies the degree of the ability of a firm to influence price and production.

There are a number of proxies for product market competition. Schmalensee (1988) stated that the common measures of market concentration increase as the number of firms declines and as their shares become less equal, indicating a location on some point between perfect competitive and monopoly structures. These measures are, namely, the Herfindahl index, the firm concentration ratio, the price-cost margin, sales growth and relative-to-industry sales growth, and Tobin's Q (see e.g. Campello, 2006; Smith et al., 2008; and Chou, Ng Sibilkov, and Wang, 2011).

3.3.1.1 Product Market Competition Measures—Firm Level

1) Relative-to-Industry Sales Growth (RSG)

Campello (2003, 2006) proposed using relative-to-industry sales growth to measure firm performance in the product market. He suggested that the measure is different from other performance proxies in that it can consistently be estimated across industries and times, and it summarizes information from the combined effects of all competitive strategies.

$$\text{Relative to Industry Sales Growth}_{it} = \frac{\text{Sales}_{it} - \text{Sales}_{it-1}}{\text{Total Industry } j\text{'s Sales}_{jt}} \quad \text{Equation 10}$$

2) Sales Growth (SG)

Alternatively, a firm's product output can simply be compared to its own past output. Similar to RSG, SG can also be consistently estimated across industries and times. SG can also reflect the effects of product market competitive strategies. SG is given by

$$\text{Sales Growth}_{it} = \frac{\text{Sales}_{it} - \text{Sales}_{it-1}}{\text{Sales}_{it-1}}. \quad \text{Equation 11}$$

3) Market Share

The market share s_{ij} is given by

$$s_{ij} = \frac{Net\ Sales_i}{Total\ Sales_j}, \quad \text{Equation 12}$$

The market share can also be used to gauge product market competition relative to the industry (Smith et al., 2008).

4) Price-Cost Margin (PCM)

PCM of firm i for the time t is calculated by

$$PCM_i = \frac{Profit_{it}}{Sales_{it}}, \quad \text{Equation 13}$$

The idea was developed from the Lerner index to capture market power, where the firm with high profit margin implies high pricing power and hence low market competition. On the other hand, the lower PCM_{it} implies low profit margin, low pricing power, and hence high competition. PCM can also be industrial adjusted by subtracting the industry average PCM from the firm's PCM (Chou et al., 2011).

5) Tobin's Q

It was pointed out by Lindenberg and Ross (1981) that the value of Tobin's Q is significantly and positively related to the firm's monopoly power (Schwinn, 1983). The idea is to use the difference between the market value of the firm and its replacement cost as a measure of or bound for monopoly rents. For a competitive firm, the Q should be close to or less than unity. However, with the ability to earn above a competitive return (monopoly rent), the Q could be greater than one (Lindenberg & Ross, 1981). Common measures of Tobin's Q ratio are the following:

$$QMV_{it} = \frac{Market\ Value\ of\ Equity_{it} + Book\ Value\ of\ Liability_{it}}{Book\ Value\ of\ Total\ Assets_{it}}, \text{ and} \quad \text{Equation 14}$$

$$QMV1_{it} = \frac{\text{Market Value of Equity}_{it} + \text{Book Value of Liability}_{it}}{\text{Book Value of Common Stock} + \text{Book Value of Liability}_{it}}. \quad \text{Equation 15}$$

3.3.1.2 Product Market Competition Measures - Industrial Level

1) Herfindahl index (HI)

Herfindahl index (or Herfindahl–Hirschman Index) for industry

i is given by

$$HI_i = \sum_{j=1}^K s_{ij}^2, \quad \text{Equation 16}$$

where s_{ij} is the market share of firm i in industrial j , which is calculated by the net sales of the firm i divided by the total sales of the industry j . HI measures the degree of product market concentration at an industry level. The index lies in the interval of 0 to 1.

The smaller is the index, the higher is number of firms in the industry, and the greater product market competition (low concentration) (Smith et al., 2008; Chou et al., 2011).

3.3.2 Capital Structure Measures

Rajan and Zingales (1995) have stated that capital structure can be defined differently depending on the purpose of the analysis. For example, the relevant capital structure measure for a study of agency cost of debt is probably the stock of debt relative to firm value (total debt ratio).

Two common measures of capital structure are long-term debt and total-debt, as discussed in the following. Campello (2006) suggested that using long-term book leverage mitigates the likelihood of reverse causality between performance and capital structure when a) the long-term book value is not as sensitive to the market's evaluation of the firm's performance as the market value is; and when b) the leverage level reflects the past financing decision. Long-term book debt is calculated as the ratio of long-term debt to total assets.

However, despite the fact that long-term debt is widely used in developed countries as a financing source, short-term debt is used more extensively in countries where the financial infrastructure is less developed (Ağca, De Nicolò, & Detragiache, 2007). Pandey (2002) has suggested that, in emerging markets, firms employ not only long-term debt but also short-term debt to finance their assets. Furthermore, short-term debt can also be rolled over and used as a substitute for long-term debt. Demircuc-Kunt and Maksimovic (1999) and Booth, Aivazian, Demircuc-Kunt, and Maksimovic (2001) found that developing countries have a substantially lower amount of long-term debt. They suggested that employing long-term debt as an independent variable might have lower explanatory power. Thus, in the environment of a developing country such as Thailand, employing total debt as a proxy for capital structure is a sensible choice. The relevance of short-term debt is further discussed in Chapter 5.

In this study, both long-term debt and total debt ratios are used. Long-term debt ratio (LTD) is defined as long-term debt to total assets, and, likewise, total debt ratio (TD) as total debt to total assets.

$$\text{Long-Term Debt (LTD)}_{it} = \frac{\text{Long - Term debt}_{it}}{\text{Total Assets}_{it}}, \text{ and} \quad \text{Equation 17}$$

$$\text{Total Debt (TD)}_{it} = \frac{\text{Total Debt}_{it}}{\text{Total Assets}_{it}}. \quad \text{Equation 18}$$

3.3.3 Control Variables

This section discusses the variables that might affect the dependent variable of market power.

Larger firms with more profitability and greater investments in fixed assets are expected to perform better than their competitors and to compete more aggressively (Smith et al., 2008). Furthermore, high market power firms have more ability to manipulate prices and hence enjoy higher profit; profitability is thus likely to correlate with market power. Large companies compete aggressively (e.g. through price cutting policy) to drive competition out of business. Cutting price policy could stem from either a predatory pricing policy or a genuine pricing strategy based on low margins, i.e. the greater economy of scale of larger firms (Yannopoulos, 2011).

Therefore, in this study, the set of control variables includes firm performance (Profitability), firm size (SIZE2), and asset tangibility (TANG2), defined as follows:

$$\text{Profitability } (ROA_{it}) = \frac{\text{Net Income}_{it}}{\text{Total Assets}_{it}}, \quad \text{Equation 19}$$

$$\text{Size } (SIZE2_{it}) = \frac{\ln(\text{Total Assets}_{it})}{100}, \quad \text{and} \quad \text{Equation 20}$$

$$\text{Asset Tangibility } (TANG2_{it}) = \frac{\text{Property, Plant, and Equipments}_{it}}{\text{Total Assets}_{it}}. \quad \text{Equation 21}$$

3.4 Data

The original firm-level sample set was retrieved from the DATASTREAM database, including firms listed on the Stock Exchange of Thailand (SET) (578 firms in total as of 9 November, 2015). Regulated financial sectors were left out of the sample set. In order to ensure a reliable measure of centrality, the sectors with less than four firms were excluded as, suggested by Opler and Titman (1994). Firms with incomplete and missing data were discarded. The leverage variables total debt ratio (TD) and long-term debt ratio (LTD) were restricted to be in the [0,1] range. Consequently, there were 2,890 observations of 289 firms in 21 sectors (out of the total 28 sectors) left in the panel sample for the period 2005-2014 (for a list of sample firms, see the Appendix).

3.4.1 Variable Characteristics

Table 3.1 reports the descriptive statistics for the data. The means of the total debt and long term debt ratios were 0.24 and 0.13, respectively. The two measures of market power, QMV (Tobin's Q) and SG (Sales Growth), had averages of 0.42 and 0.11, respectively. ROA (return on assets) was employed to capture the profitability.

SIZE2 is a proxy of the size of a firm, calculated as the natural logarithm of total assets scaled by 100. TANG2 is a measure for asset tangibility and has been defined as net property, plant, and equipment divided by total assets. The means of ROA, SIZE2, and TANG2 were 0.06, 0.15, and 0.39, respectively.

Table 3.1 Descriptive Statistics

Variable	Obs.	Mean	Median	Std.Dev	min	MAX
<i>TD</i>	2890	0.24	0.22	0.2	0	0.89
<i>LTD</i>	2890	0.13	0.07	0.14	0	0.91
<i>QMV</i>	2832	0.42	0.43	0.21	0	1.15
<i>SG</i>	2888	0.11	0.06	0.47	-1	15.28
<i>ROA</i>	2890	0.06	0.05	0.39	-1.4	20.2
<i>SIZE2</i>	2890	0.15	0.15	0.02	0.11	0.21
<i>TANG2</i>	2889	0.39	0.38	0.23	0	0.98

Note: The sample includes 289 SET firms for the period 2005-2014. TD (total debt ratio) is defined as the ratio of total debt to total assets; LTD (long term debt ratio) is defined as the ratio of long-term debt to total assets; QMV (Tobin's Q) is defined as (market value of equity + book value of equity)/total assets; SG is sales growth; ROA (profitability) is the ratio of net income to total assets; SIZE2 (size) is the natural logarithm of total asset scaled by 100; and TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets.

Figure 3.3 below illustrates the average leverage levels of the SET non-financial sectors for the period 2005-2014. The highest leveraged sector is transportation and logistics, with an average total debt of 38.31 percent, where the lowest was Fashion at 11.20 percent. The average total debt level ratio was 24.02 percent.

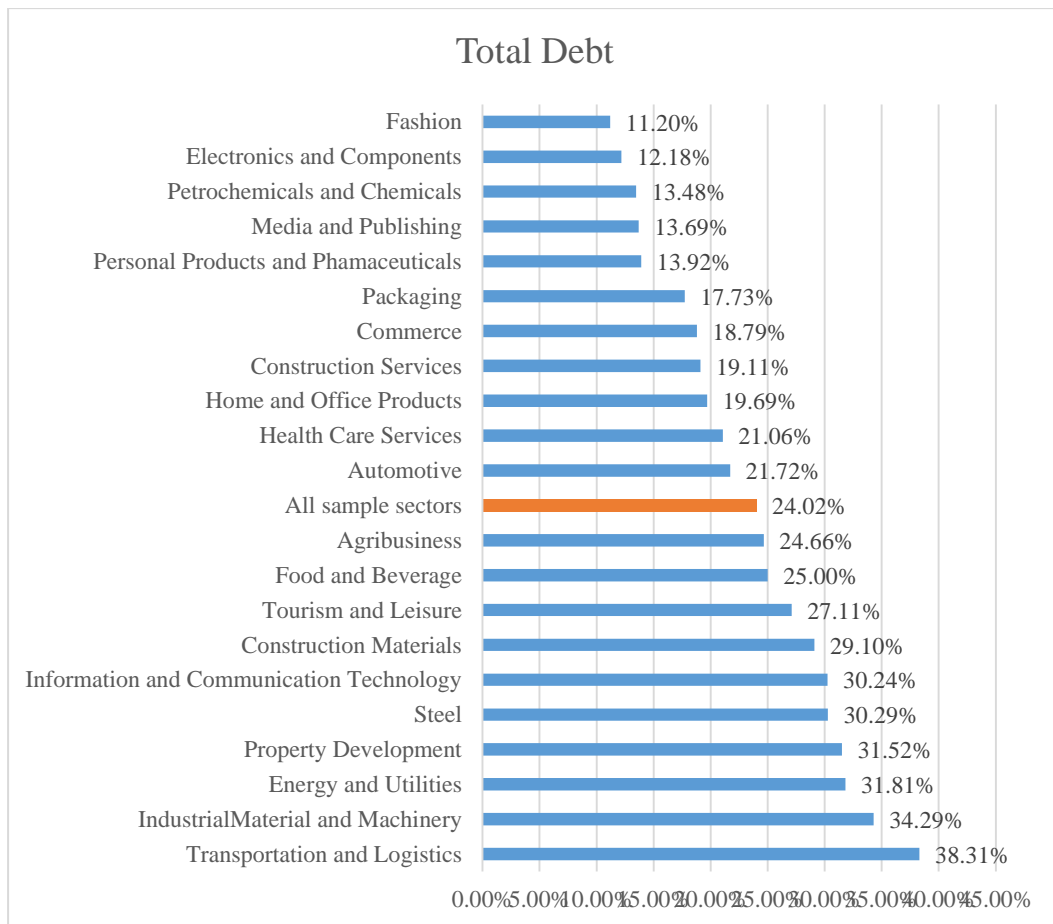
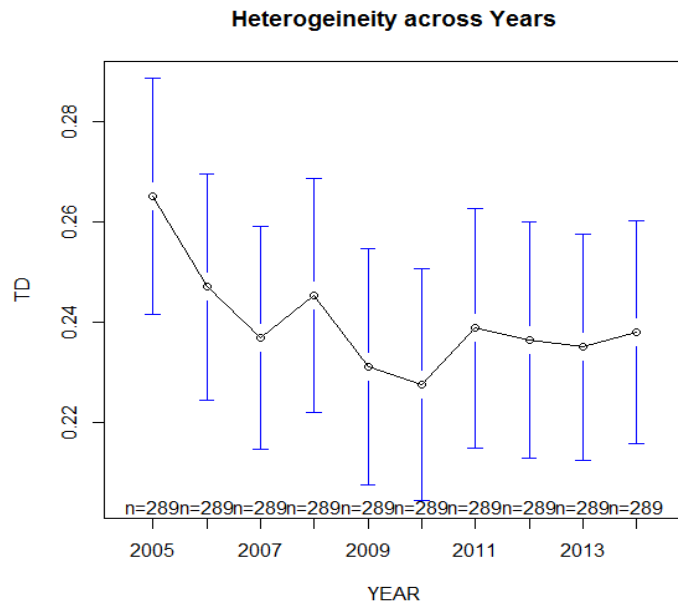


Figure 3.3 Ranked Average Total Debts of Selected SET Non-Financial Sectors for the Period 2005-2014.

Note: The sample includes 289 SET firms for the period 2005-2014. TD (total debt ratio) is defined as the ratio of total debt to total assets.

Figure 3.4 plots the dynamics of annual means of TD and LTD of the sample firms over 2005-2014. Both series have similar dynamics, although the LTD seems to be more stable than the TD. This was confirmed by the fact that the standard deviation of LTD was 0.14 compared to 0.2 of TD (see Table 3.1 above). It is also interesting to see that the total debt ratio was considerably higher (almost 0.25) in 2008 than the long-term debt ratio (about 0.11) of the same year. This makes sense, since 2008 fell within the subprime crisis, where many firms experienced hardship and credit was more difficult to obtain. Hence, firms might have resorted to short-term finance, which is the difference between the total debt and long-term debt ratios.

Panel A: TD



Panel B: LTD

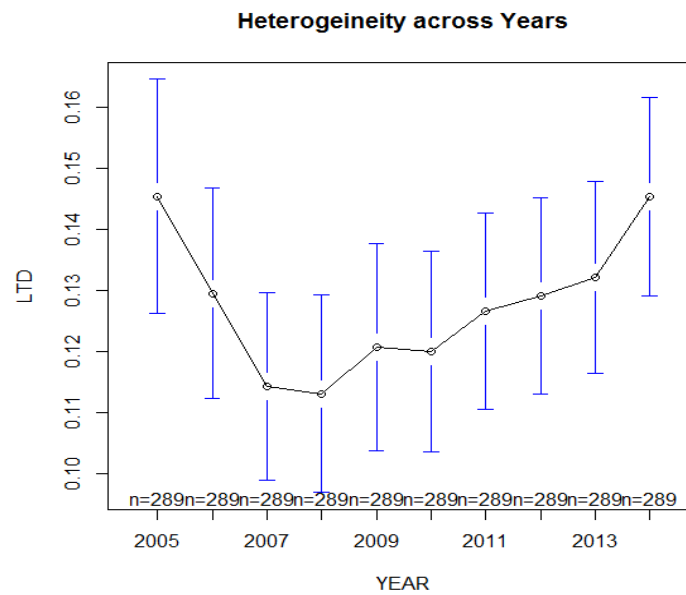
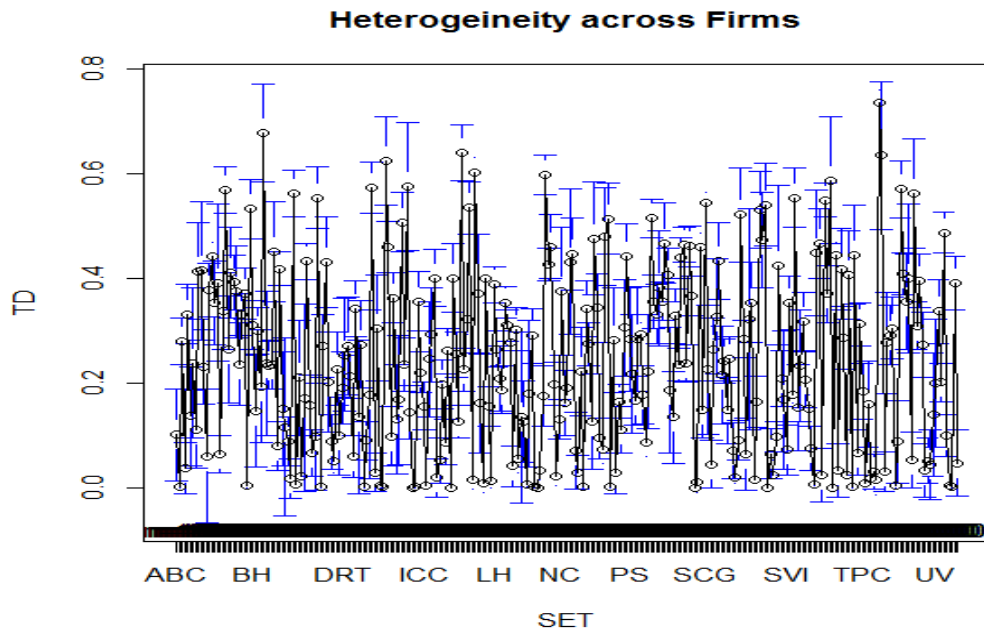


Figure 3.4 Heterogeneity of TD and LTD across Years

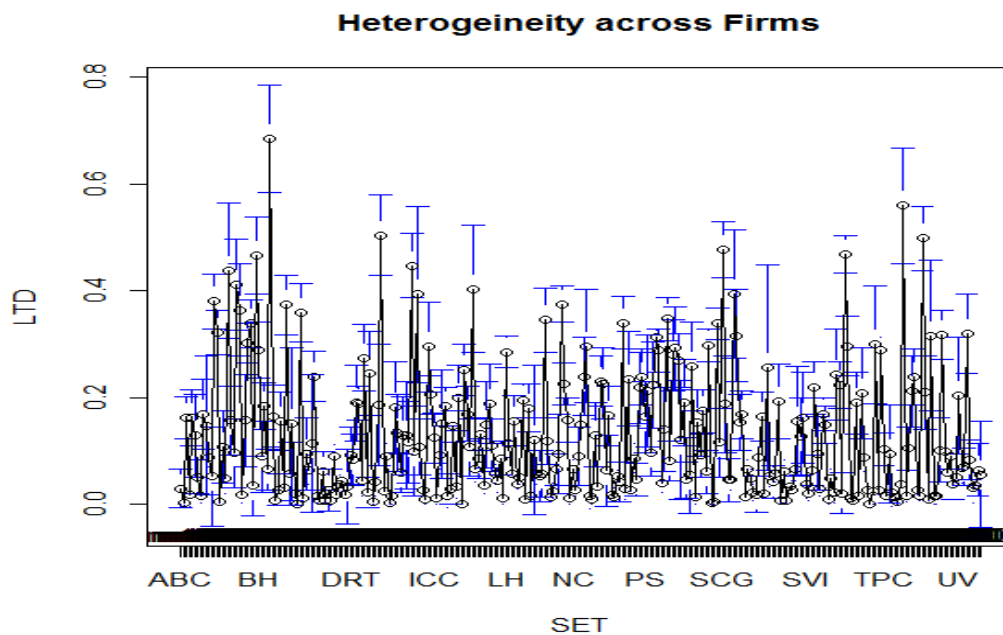
Note: The sample includes 289 SET firms for the period 2005-2014. TD (total debt ratio) is defined as the ratio of total debt to total assets; and LTD (long-term debt ratio) is defined as the ratio of long-term debt to total assets.

Figure 3.5 portrays the heterogeneities of the means of TD and LTD for each individual firm over the period 2005-2014. At first glance, the figures might look somewhat confounding, but they sketchily illustrate that leverage levels are rather varying from firm to firm. Among the sample firms, the magnitude of variation of LTD seems to be less than that of TD. As the difference between TD and LTD is short-term debt, this explains why the volatilities of TD are wider than those of LTD. The bigger the difference between TD and LTD implies the higher use of short-term debt.

Panel A: TD



Panel B: LTD

**Figure 3.5** Heterogeneity of TD and LTD across Firms

Note: The sample includes 289 SET firms for the period 2005-2014. TD (total debt ratio) is defined as the ratio of total debt to total assets; and LTD (long-term debt ratio) is defined as the ratio of long-term debt to total assets.

3.5 Methodology

This section discusses the empirical model and the analytical framework employed in this research.

3.5.1 Empirical Model

A general form of the cross-sectional-time series regression model, as suggested by the limited liability model discussed above (Section 3.1), and by previous literature, e.g. Opler and Titman (1994), Campello (2006), and Smith et al. (2008), was constructed as follows.

$$\begin{aligned} \text{Market Power}_{it} = & \alpha_i + \beta_1 \text{Leverage}_{it} + \beta_2 \text{Profitability}_{it} \\ & + \beta_3 \text{Size}_{it} + \beta_4 \text{Tangibility}_{it} + \eta_{it}, \end{aligned} \quad \text{Equation 22}$$

Market Power_{it} is a measure of the market power of firm i at time t , leverage_{it} is a measure of debt level, and profitability, size, and tangibility are used as the control variables (control variables are discussed in Section 3.3.3).

3.5.2 Empirical Methodology Framework

The main investigation focusses on the effects of a firm's leverage choices regarding product market outputs (market power) as postulated by the limited liability theory. It follows that the empirical analyses can be carried out at both firm level and sectoral level. On the one hand, it is sensible to see the behaviors of these individual firms purely based on their aggregate leverage behaviors. On the other hand, as mentioned in Section 3.3.1, market power refers to the degree of the ability of a firm to influence price and production vis-à-vis other similar firms that sell homogenous products (White, 2012). Thus, power must come from changes in market share resulting from the competition between firms within an industrial cluster. Hence, firms' product market power can also be investigated within the cluster that firms compete in. Therefore, the analyses were divided into two tiers; namely, firm-level analysis and sectoral analysis, which are discussed next.

Firm-level analysis: The analyses were carried out on every firm in the sample set (pooled data). Under the pooled data analysis the collective leverage behaviors of all sample firms were examined altogether. Then, in order to investigate whether the firms with different debt levels behaved differently in the physical product markets, individual firms were further grouped according to their indebtedness levels, *viz.*, high-, medium-, and low-leverage. This will shed light on how firms with different leverage levels behave in the markets. Additionally, as it is evident that sales growth is related to capital structure (see e.g. Campello, 2003; Huang & Song, 2005; Smith et al., 2008), the sample firms were also grouped according to their sales growth levels. This will illuminate the question of how leverage might influence firms with different growth levels to behave in the product markets.

Sectoral analysis: It has been reported that firms in the same industrial sector share similar proportions of assets and liabilities (see e.g. Harris & Raviv, 1991). Furthermore, product market characteristics have been found to be linked to capital structure decisions (interaction of capital structure with real business decisions). For example, Phillips (1995) found that product market output was associated with the average industry debt ratio. Further, Smith et al. (2008) found that leverage both influences and is influenced by product-market competition. Guney, Li, and Fairchild (2011) found that the relationship between leverage and product market competition depends on, *inter alia*, industry types. Thus, in this section, firms are grouped according to industrial sectors. Each sector was then being analyzed for all 21 sample sectors. In addition, the industrial sectors were grouped and investigated according to their average sectoral debt levels and market concentration levels (as measured by the Hirfindahl index).

The analytical framework is summarized in Figure 3.6 immediately below.

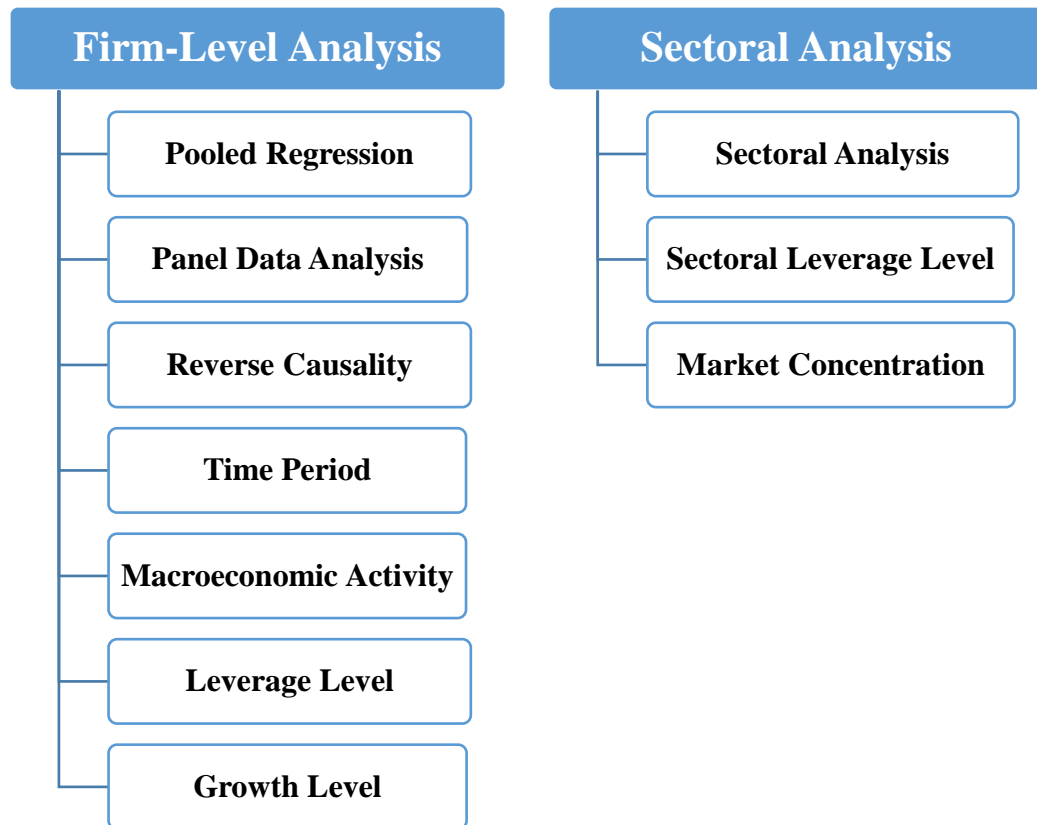


Figure 3.6 Analytical Framework

3.5.2.1 Firm-Level Analysis

This section outlines the series of firm-level analyses, which will be further discussed in detail in Chapter 4.

1) Pooled Regression

Pooled regression analysis was carried out for the entire sample set in order to investigate the aggregate behavior of all the sample firms.

2) Panel Data Analysis

Pooled regression ignores the panel structure of the data, i.e. it does not consider heterogeneity across firms and time. Thus, panel data analysis was also performed.

3) Reverse Causality

The limited liability theory implies that capital structure choices commit firms to behaving more aggressively in the product markets. There is

a possibility that the causality can be reversed. Thus, the lagged values of the leverage variables were employed in order to mitigate this problem.

4) Time Period

The time period of the data set was 2005-2014, which might have been affected by a structural break generated by the US. sub-prime mortgage crisis in 2008. Therefore, investigations were carried out in order to explore how the sample firms behaved during the economic downturn and expansion.

5) Macroeconomic Activity

The relationship between competitive product market outcome and capital structure may be spurious if a firm's output and capital structure are influenced by trends in the industry, excess capacity, and growth (Campello, 2003). Therefore, GDP growth and linear and quadratic time trends were added to the original models.

6) Leverage Level

Firms were grouped according to their indebtedness levels, namely, high, medium, and low leverage. Then each group was analyzed separately. This will shed light on whether firms with different leverage levels perform differently in the product markets.

7) Growth Level

The firms were categorized according to their sales growth rates in order to investigate whether different levels of debt affect market power differently for firms with different growth rates.

3.5.2.2 Sectoral Analysis:

The firms were grouped according to their industrial sectors (as categorized by SET) and analyzed as follows.

1) Sectoral Analysis

To investigate the behavior of each individual sector, regression analyses were carried out separately for all 21 sample sectors.

2) Sectoral Leverage Level

In order to investigate whether firms behave differently in the product markets in the different debt groups, regressions were performed in different leverage groups separately.

3) Market Concentration

Likewise, firms that operate in different market concentration groups may behave differently in the product markets. The level of market concentration was measured using the Hirfindahl index ($HI \in [0, 1]$), and the sample groups were categorized according to different market concentration levels.

CHAPTER 4

FINDINGS AND RESULTS

This chapter presents a series of analyses at the firm level and sectoral level. The original sample set consisted of 289 Thai listed firms for 21 industrial sectors for the period 2005-2014. The analyses are presented in Sections 4.1 and 4.2, respectively.

4.1 Firm-Level Analysis

This section investigates the aggregate behaviors of firms in the product markets regarding their respective capital structure choices. The analysis begins with pooled regression analysis in Section 4.1.1. Then, a series of additional tests and investigations are carried out. In Section 4.1.2, panel data analysis is carried out in order to mitigate the issue of omitted variables. In Section 4.1.3, plausible reverse causality is addressed by employing lags of leverage variables in order to ensure that the financing decision is established before the product market decision is made. In Section 4.1.4, there is a possibility of a structural break generated by the U.S. sub-prime mortgage crisis in 2008. Therefore, it is prudent to investigate the behaviors of the sample firms before and after the crisis. In Section 4.1.5, the macroeconomic activity variables are included in order to capture the effects of the state and the trend of the economy in relation to market power. Section 4.1.6 investigates whether firms in different debt groups behave differently in the product market. Lastly, Section 4.1.7 explores whether firms with different sales growth behave differently, regarding their leverage levels, in the physical product markets.

4.1.1 Pooled Regression Analysis

The main hypothesis tests whether leverage has a positive effect on product market competition. The main independent variable is leverage level measured by the

total debt ratio (TD) and the long-term debt ratio (LTD). Market power is defined as the degree of ability of a firm to influence price and production. Therefore, in order to gauge a firm's product market outcomes, this research employs two proxies, namely, sales growth (SG) and Tobin's Q (QMV). On the one hand, SG directly measures the firm's output. On the other hand, QMV gauges the market power of the firm, as mentioned before that Tobin's Q is related to the firm's monopoly power. As discussed in Section 3.3.3 above, control variables employed profitability (ROA), firm size (SIZE2), and asset tangibility (TANG2). MM-type regression estimators as proposed by Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were employed (under the `robustbase` package in the R programming environment).

Four empirical models were carried out varying in the dependent and independent variables, as illustrated below.

Table 4.1 Empirical Models

$QMV_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_2 SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 TD_{it} + \eta_{it}$	Model 1
$SG_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_2 SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 TD_{it} + \eta_{it}$	Model 2
$QMV_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_3 SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 LTD_{it} + \eta_{it}$	Model 3
$SG_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_2 SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 LTD_{it} + \eta_{it}$	Model 4

where

$$i = 1 \dots n \text{ firm,}$$

$$t = 1 \dots T \text{ time period,}$$

$$QMV_{it} = \text{Tobin's Q,}$$

$$ROA_{it} = \text{(profitability) ratio of net income to total assets,}$$

$$SIZE_{it} = \text{(size) the natural logarithm of total asset scaled by 100,}$$

$$TANG2_{it} = \text{(asset tangibility) net property, plant and equipments divided by total assets, and}$$

$$\eta_{it} = \text{the error term.}$$

Model 1 was employed as the benchmark model, where Tobin's Q (QMV) was used as a measure for market power and total debt ratio (TD) as leverage-level proxy.

Then, for further analyses and robustness tests, the dependent variable QMV was substituted by another measure for market power, sales growth (SG), and the independent variable TD was replaced by long-term debt (LTD), and labeled Models 2, 3, and 4, respectively. The robustness tests and further analyses are explored in the following sections.

Table 4.2 reports on the regression results for Model 1, where the estimate of the total debt ratio was positive and statistically significant at the 1 percent level, supporting the limited liability hypothesis, that capital structure has a positive effect on a firm's market product behavior. ROA (a proxy for profitability) and SIZE2 (a proxy for firm size) were both positive and statistically significant at the 1 percent level, indicating that as firms become more profitable and larger, they compete more aggressively in the product markets. The estimate of TANG2 (a proxy for asset tangibility) was negative and statistically significant at the 1 percent level, implying that as fixed assets increase, firms become less aggressive in the product markets. The adjusted R^2 value of the estimation of the Model 1 was 0.7824.

Table 4.2 Regression Result

Independent Variable	Model (1)	Model (2)	Model (3)	Model (4)
	Dependent Variable			
	QMV	SG	QMV	SG
<i>ROA</i>	0.0079*** (8.65e-13)	0.7198*** (<2.2e-16)	-0.5547*** (<2e-16)	0.6074*** (<2e-16)
<i>SIZE2</i>	0.6745*** (2.88e-07)	0.7030*** (0.002686)	1.9399*** (3.09e-16)	0.7989*** (0.00160)
<i>TANG2</i>	-0.0630*** (1.94e-12)	-2.549e-05 (0.998748)	-0.1007*** (8.63e-13)	-0.0012 (0.94195)
<i>TD</i>	0.9084*** (<2e-16)	0.1662*** (2.05e-11)	-	-
<i>LTD</i>	-	-	0.6848*** (<2e-16)	0.1391*** (5.4e-06)
Robust Residual S.E.	0.0918	0.1654	0.1705	0.1659
Adjusted R^2	0.7824	0.1159	0.3451	0.09852

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the robustbase package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) was defined as the ratio of total debt to total assets; QMV (Tobin's Q) is the market value of equity plus the book value of liability divided by total assets; SG is sales growth; ROA (profitability) is the ratio of net income to total assets; SIZE2 (size) is the natural logarithm of total asset scaled by 100; and TANG2 (asset tangibility) is net property, plant and equipment divided by total assets.

Another measure of firm behavior in the product markets, *viz.*, sales growth (SG), was employed in Model 2. The regression result for Model 2 confirmed that as leverage increases, firms' sales growth expands, implying that they become more aggressive in the product markets. Additionally, *relative-to-industry sales growth* (RSG), as suggested by Campello (2006), has also been employed as a measure for market power. However, none of the estimates of leverage proxies (TD and LTD) was statistically significant (the results are not shown).

Next, the independent variable TD was replaced with another leverage proxy, LTD, defined as the ratio of long-term debt to total assets. They were, respectively, named Model 3 and Model 4. The LTD results confirmed the results of the TD, *i.e.* increasing debt leads to more aggressive behavior in the product markets.

An interesting point is that the explanatory powers (captured by adjusted R^2 s) of Models 1 and 2 were obviously greater than those of Models 3 and 4 (0.7824 and 0.1159 to 0.3451 and 0.09852, respectively). Since the difference between total debt and long-term debt was short-term debt, this implies that improvements in explanatory powers must come from the inclusion of short-term debt. In other words, short-term debt is an important ingredient in managing financial strategies. This will be discussed further in Section 5.2, Discussion and Recommendations.

Hitherto, the findings were consistently in favor of the limited liability theory. However, it can be argued that the relationship between leverage and a firm's product market output can be generated from other factors omitted from the models. As a consequence, these omitted variables can render the relationship between the independent and dependent variables spurious. Some technique such as the fixed-effects regression of the panel data analysis can be employed to mitigate the problem (Gormley and Matsa, 2014). Additionally, the limited liability theory postulates that the leverage decision commits the firm to acting aggressively. Nonetheless, the direction of causality could be the other way round, resulting in a problem of endogeneity. Furthermore, the relationship might not be consistent through, *e.g.* time periods, industrial sectors, different market concentration groups, and different leverage level groups. Therefore, further investigation and robustness tests were carried out and are presented in the following sections.

4.1.2 Panel Data Analysis

The relationship between leverage and a firm's product market outcomes could be generated from other factors as stated above. For example, the increasing firm sales growth and market power might be a result of an increase in aggregate demand, managerial talent, and any other plausible factors. It follows that these unobserved omitted variables can render the relationship between the independent and dependent variables spurious. Furthermore, a common pooled regression analysis does not take into account heterogeneities across firms and time, which can be accommodated by a panel data model.

Two main models in panel data analysis are the *fixed effects* and *random effects* models. For the fixed effects model, the constant term, α_i , is assumed to be correlated with X_{it}^k . For the random effects model, α_i is assumed to be orthogonal to X_{it}^k . However, both fixed effects and random effects models only control for heterogeneity across entities, but not the time variant. In order to capture time heterogeneity, time-dummy variables can be introduced to both models.

Equation 22 can be written compactly to illustrate the fixed and random effects model as below:

$$y_{it} = \sum_{k=1}^K \beta_k X_{it}^k + \alpha_i + \eta_{it}, \quad \text{Equation 23}$$

where

$i = 1 \dots n$ firm,

$t = 1 \dots T$ time period,

y_{it} = the dependent variable,

X_{it}^k = independent variables,

β_k = the coefficient for each corresponding independent variable,

α_i = the time-invariant (intercept) specific for each firms, and

η_{it} = the error term.

The analysis begins with the following models:

1) the fixed effects model is carried out to accommodate the (time-invariant) heterogeneity across units: (the time-invariant α_i is assumed to correlate with X_{it}^k);

2) the random effects model, (the time-invariant α_i is assumed to be uncorrelated with X_{it}^k); and

3) time dummies are incorporated into fixed effects and random effects models to control for heterogeneity across time.

The model selection process consists of performing various statistical tests, *viz.*, *F*-test for individual/time effects; the Breusch-Pagan Lagrange Multiplier-test of individual and/or time effects for panel models; and the Hausman (Durbin-Wu-Hausman) test.

The model selection test results supported the fixed-time effects model. This indicates that heterogeneities across firms and time are presented, which is in line with the previous Figure 3.4 and Figure 3.5 where the dynamics of TD and LTD are varying through time and are different from firm to firm. Hence, the results of the fixed-time effects models are presented in Table 4.3, which support the main hypothesis—that as leverage increases, firms commit themselves to aggressive product market strategies.

In conclusion, after the firm-time heterogeneities and omitted variables have been addressed by the panel data models, the results remain intact.

Table 4.3 Panel Data Analysis Estimation Results

Independent Variable	Model (1)	Model (2)	Model (3)	Model (4)
	Dependent Variable			
	QMV	SG	QMV	SG
<i>ROA</i>	0.0052979* (0.0695828)	-0.033946 (0.1459768)	-0.01480916*** (0.0008002)	-0.039695* (0.087528)
<i>SIZE2</i>	-0.9633273*** (0.0008199)	10.008876*** (8.466e-06)	2.47425745*** (8.397e-09)	10.531048*** (1.587e-06)
<i>TANG2</i>	-0.0198473*** ($< 2.2e-16$)	-0.237126** (0.0148724)	0.03752280** (0.0468247)	-0.239534* (0.013918)
<i>TD</i>	0.8776030*** ($< 2.2e-16$)	0.258391*** (0.0077761)	-	-
<i>LTD</i>	-	-	0.64432489*** ($< 2.2e-16$)	0.340302*** (0.005598)
Sample size	2529	2585	2529	2585
<i>F</i> -statistic	426.145	8.82265	74.3043	8.87015
(<i>p</i> -value)	$< 2.22e-16$	$< 2.22e-16$	$< 2.22e-16$	$< 2.22e-16$
Adjusted R^2	0.61333	0.03804	0.2469	0.038236

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. The estimation results for Models 1, 2, 3, and 4 are the results of the fixed-time effects models (the estimations of the time dummies were omitted; the procedures were carried out under the *plm* package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) was defined as the ratio of total debt to total assets; QMV (Tobin's Q) is the market value of equity plus the book value of liability divided by total assets; SG is sales growth; ROA (profitability) is the ratio of net income to total assets, SIZE2 (size) is the natural logarithm of total assets scaled by 100; and TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets.

4.1.3 Reverse Causality

The limited liability model implies that the causality runs from the leverage decision to the product market strategies. However, it can be argued that the direction can be counter-causal. One plausible explanation is given by Zingales (1998) and Istaatieh and Rodrigues-Fernandez (2006), that if firms anticipate the consequence of the financial decision on the product market (that firms become more aggressive or passive), then the product market could also influence the capital structure decision.

In order to alleviate the threat of endogeneity, the current period of leverage proxies (TD_t and LTD_t) were replaced by their respective lagged values (up to four periods). This implies that the leverage decision has been established well before the product market decision was made. Therefore, the current leverage proxies were replaced by their respective lagged values; namely TD_{t-k} and LTD_{t-k} (where $k = 1, 2, 3,$ or 4). The models were varied according to the different leverage measures and market power proxies and labeled Models 5, 6, 7, and 8, as illustrated below.

$$QMV_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_k SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 TD_{it-k} + \eta_{it} \quad \text{Model 5}$$

$$SG_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_k SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 TD_{it-k} + \eta_{it} \quad \text{Model 6}$$

$$QMV_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_k SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 LTD_{it-k} + \eta_{it} \quad \text{Model 7}$$

$$SG_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_k SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 LTD_{it-k} + \eta_{it} \quad \text{Model 8}$$

for $k = 1, 2, 3,$ or 4 .

Table 4.4 reports the regression results for the four models with the variables TD_{t-1} and LTD_{t-1} (the regressions models including lagged variables of TD and LTD for period 2, 3, and 4 yield the same result), that leverage leads to increasing sales growth and product market power.

Therefore, although endogeneity has been accounted for, the same conclusion still remains robust.

Table 4.4 Regression Results

Independent Variable	Model (5)	Model (6)	Model (7)	Model (8)
	Dependent Variable			
	QMV	SG	QMV	SG
<i>ROA</i>	-0.3018462*** (6.04e-07)	0.643410*** (<2e-16)	-0.630346*** (<2e-16)	0.6061666*** (<2e-16)
<i>SIZE2</i>	1.8393934*** (<2e-16)	0.973740*** (2.19e-05)	2.746089*** (<2e-16)	0.8597904*** (0.000501)
<i>TANG2</i>	-0.0689426*** (1.98e-09)	0.008138 (0.612)	-0.083250*** (2.16e-08)	-0.0008525 (0.961102)
<i>TD_{t-1}</i>	0.7394731*** (<2e-16)	0.108330*** (9.91e-07)	-	-
<i>LTD_{t-1}</i>	-	-	0.556875*** (<2e-16)	0.1367294*** (3.87e-06)
Adjusted <i>R</i> ²	0.6065	0.1033	0.3011	0.09977

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the *robustbase* package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) is defined as the ratio of total debt to total assets; QMV (Tobin's Q) is the market value of equity and the book value of liability over total assets; ROA (profitability) is the ratio of net income to total assets, SIZE2 (size) is the natural logarithm of total assets scaled by 100; TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets; and SG is sales growth.

4.1.4 Different Time Periods

Regarding the time period (2005-2014) of the data set, one should be well cautious about a structural break possibly generated by the US. sub-prime mortgage crisis in 2008. Therefore, it is prudent to investigate whether the sample firms behaved differently during the normal and crisis periods. The dummy variable *DT* was included in the Models 1, 2, 3, and 4, where *DT* equals unity for the post crisis period (2008-2014) and 0 otherwise (this is a dummy variable version of Chow's structural break test).

Table 4.5 Test for Structural Break

Independent Variable	Model (1)	Model (2)	Model (3)	Model (4)
	Dependent Variable			
	QMV	SG	QMV	SG
<i>Intercept</i>	0.091641*** (3.95e-06)	-0.111449*** (0.00180)	0.075100** (0.0369)	-0.096251** (0.015020)
<i>DT</i>	0.003407 (0.416)	-0.032958*** (1.31e-05)	-0.011730 (0.1044)	-0.036558*** (1.57e-06)
<i>ROA</i>	0.008068*** (2.24e-11)	0.715204*** (< 2e-16)	-0.562474*** (< 2e-16)	0.604648*** (< 2e-16)
<i>SIZE2</i>	0.758502*** (1.63e-08)	0.764190*** (0.00138)	2.187305*** (< 2e-16)	0.852739*** (0.000981)
<i>TANG2</i>	-0.062210*** (4.01e-12)	-0.005624 (0.72960)	-0.102634*** (3.63e-13)	-0.008533 (0.617246)
<i>TD</i>	0.905784*** (< 2e-16)	0.158206*** (6.80e-11)	-	-
<i>LTD</i>	-	-	0.672612*** (< 2e-16)	0.140417*** (5.58e-06)
Sample Size	2890	2890	2890	2890
Robust Residual S.E.	0.09175	0.1651	0.1701	0.1654
Adjusted R^2	0.7823	0.1218	0.3482	0.1061

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the *robustbase* package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) is defined as the ratio of total debt to total assets; QMV (Tobin's Q) is the market value of equity plus the book value of liability divided by total assets; SG is sales growth; ROA (profitability) is the ratio of net income to total assets, SIZE2 (size) is the natural logarithm of total assets scaled by 100; and TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets; and DT is a time-dummy variable taking value 1 for the post crisis period (2008-2014) and 0 otherwise.

The regression results presented in Table 4.5 above show that the structural break effect was not statistically significant when the firms' market power was measured by Tobin's Q (Models 1 and 3). However, when sales growth was used as a proxy for the firm's product market output, it was evident that the sub-prime crisis had a negative impact on sales growth. That is, after the crisis, sales growth shrank by approximately three percent for both leverage measures, total debt and long-term debt.

Next, in order to investigate whether leverage has different effect on the product market outcome on different time periods, the full sample period of 2005-2014 was separated into two sub-periods, namely, pre-crisis (2005-2007) and post-crisis (2008-2014). The regression results for each sub-period are presented in the Table 4.6 and Table 4.7 below.

Table 4.6 Regression Analysis for the Pre-Crisis Period 2005-2007

Independent Variable	Model (1)	Model (2)	Model (3)	Model (4)
	Dependent Variable			
	QMV	SG	QMV	SG
<i>ROA</i>	0.0089*** ($< 2e-16$)	0.8504*** ($9.32e-13$)	-0.5877*** ($3.91e-09$)	0.7077*** ($7.97e-12$)
<i>SIZE2</i>	0.5553** (0.02797)	0.9009** (0.0393)	1.7876*** ($1.33e-05$)	1.0167** (0.0244)
<i>TANG2</i>	-0.0689*** ($2.86e-05$)	0.00201 (0.9481)	-0.12737*** ($6.23e-06$)	-0.0051 (0.8779)
<i>TD</i>	0.9249*** ($<2e-16$)	0.2089*** ($1.60e-07$)	-	-
<i>LTD</i>	-	-	0.76437*** ($<2e-16$)	0.1897*** (0.0005)
Sample Size	867	867	867	867
Robust Residual Standard Error	0.0852	0.1601	0.1605	0.1608
Adjusted R^2	0.80	0.14	0.38	0.12

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the robustbase package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) is defined as the ratio of total debt to total assets; QMV (Tobin's Q) is the market value of equity plus the book value of liability divided by total assets; SG is sales growth; ROA (profitability) is the ratio of net income to total assets, SIZE2 (size) is the natural logarithm of total assets scaled by 100; and TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets.

Table 4.7 Regression Analysis for the Post-Crisis Period 2008-2014

Independent Variable	Model (1)	Model (2)	Model (3)	Model (4)
	Dependent Variable			
	QMV	SG	QMV	SG
<i>ROA</i>	-0.02503 (0.4467)	0.6471*** (3.78e-11)	-0.5568*** ($< 2e-16$)	0.5594*** (1.09e-12)
<i>SIZE2</i>	0.8895*** (9.89e-08)	0.7435** (0.0109)	2.3999*** (5.07e-16)	0.8453*** (0.0089)
<i>TANG2</i>	-0.05971*** (3.13e-08)	-0.0114 (0.5538)	-0.0946*** (1.06e-08)	-0.01201 (0.5508)
<i>TD</i>	0.8927*** ($< 2e-16$)	0.1324*** (2.38e-05)	-	-
<i>LTD</i>	-	-	0.6323*** ($< 2e-16$)	0.1125*** (0.0036)
Sample Size	2023	2023	2023	2023
Robust Residual Standard Error	0.0942	0.1668	0.1738	0.1671
Adjusted R^2	0.77	0.10	0.34	0.09

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the *robustbase* package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). *TD* (total debt ratio) is defined as the ratio of total debt to total assets; *QMV* (Tobin's Q) is the market value of the equity plus book the value of liability divided by total assets; *SG* is sales growth; *ROA* (profitability) is the ratio of net income to total assets, *SIZE2* (size) is the natural logarithm of total assets scaled by 100; and *TANG2* (asset tangibility) is net property, plant, and equipment divided by total assets.

The results from the Table 4.6 and Table 4.7 confirm that the positive relationship between leverage level and market power was robust through different time periods. However, it is evident that the effects of leverage on market power were stronger during the pre-crisis than in the post-crisis periods. This implies that leverage has greater effects on market power during economic expansion.

4.1.5 Macroeconomic Activity

Campello (2003) has pointed out that the relationship between competitive product market outcome and capital structure may be spurious, if a firm's output and capital structure are influenced by trends in industry, excess capacity, and growth. Therefore, *GDP growth* and *linear* and *quadratic time trends* were added to the original Models 1, 2, 3, and 4, and were labeled Models 1a, 2a, 3a, and 4a, as follows:

	Model
$QMV_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_2 SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 TD_{it} + \beta_5 \Delta GDP_t + \beta_6 TREND_t + \beta_7 TREND2_t + \eta_{it},$	1a
$SG_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_2 SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 TD_{it} + \beta_5 \Delta GDP_t + \beta_6 TREND_t + \beta_7 TREND2_t + \eta_{it},$	2a
$QMV_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_2 SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 LTD_{it} + \beta_5 \Delta GDP_t + \beta_6 TREND_t + \beta_7 TREND2_t + \eta_{it},$	3a
$SG_{it} = \alpha_i + \beta_1 ROA_{it} + \beta_2 SIZE2_{it} + \beta_3 TANG2_{it} + \beta_4 LTD_{it} + \beta_5 \Delta GDP_t + \beta_6 TREND_t + \beta_7 TREND2_t + \eta_{it},$	4a

where other variables were defined as usual and where *TREND* is a linear time trend, *TREND2* is a quadratic time trend, and ΔGDP_t is the percentage change of the GDP (chain volume measures).

Table 4.8 Regression Analysis with Macroeconomic Indicators

Independent Variable	Model (1)	Model (2)	Model (3)	Model (4)
	Dependent Variable			
	QMV	SG	QMV	SG
<i>ROA</i>	0.0082078*** (6.16e-11)	0.6711673*** ($< 2e-16$)	-0.5655407*** ($< 2e-16$)	0.5770622*** ($< 2e-16$)
<i>SIZE2</i>	0.7402175*** (3.63e-08)	0.7852302*** (0.000819)	2.2167341*** ($< 2e-16$)	0.8470384*** (0.000815)
<i>TANG2</i>	-0.0608071*** (1.60e-11)	-0.0065914 0.681044	-0.1040277*** (2.17e-13)	-0.0099716 (0.553542)
<i>D. GDP.CVM</i>	0.0011997 (0.117583)	0.0123176*** ($< 2e-16$)	0.0022227* (0.0854)	0.0125062*** ($< 2e-16$)
<i>TREND</i>	0.0033214 (0.275117)	-0.0151417*** (0.005243)	0.0036051 (0.4803)	-0.0163064*** (0.002708)
<i>TREND2</i>	-0.0001890 (0.482067)	0.0011097* * (0.018382)	-0.0005226 (0.2460)	0.0011664** (0.013215)
<i>TD</i>	0.9067676*** ($< 2e-16$)	0.1488042*** (3.43e-10)	-	-
<i>LTD</i>	-	-	0.6749785*** ($< 2e-16$)	0.1373227*** (4.62e-06)
Sample Size	2890	2890	2890	2890
Robust Residual S.E.	0.09159	0.1622	0.1703	0.1626
Adjusted R^2	0.783	0.1504	0.3491	0.1383

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the

robustbase package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) is defined as the ratio of total debt to total assets; QMV (Tobin's Q) is the market value of equity plus the book value of liability divided by total assets; SG is sales growth; ROA (profitability) is ratio of net income to total assets; SIZE2 (size) is the natural logarithm of total assets scaled by 100; TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets; TREND is a linear time trend and TREND2 is quadratic time trend; and *D.GDP.CVM* is the percentage change in the GDP (chain volume measures).

After controlling for the GDP change and time trends (linear and quadratic), the result remained robust, i.e. the positive association between leverage and market power was confirmed. The variable *D.GDP.CVM* was found to be positive in all models (but not significant only in the Model 1), indicating that as the economy expands, sales growth and Tobin's Q also increase. The trend variables, TREND and TREND2, were not significant when using Tobin's Q as the independent variable in Models 1 and 3, but significant when sales growth was employed in Models 2 and 4 (using SG as the dependent variable). The results for Models 2 and 4—that the estimates of TREND and TREND2 were respectively negative and positive, suggested that over time sales growth declined at a decelerating speed. This is consistent with the time period that the year 2008 was amidst the crisis where the aggregate output was falling.

4.1.6 Firm Leverage Level

This section discusses whether firms with different leverage levels behave differently in the product market. The distribution of average TD over the period 2005-2014 of the sample firms is shown in Figure 4.1 below. The lowest average TD is 0, where the highest is 0.7367. Firms were then categorized into three different total debt groups, as described in Table 4.9 below.



Figure 4.1 Leverage Distribution

Note: The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). The total debt ratio (TD) is the ratio of total debt to total assets. The firms were categorized according to their average TD for the period 2005-2014.

Table 4.9 Firms Grouped by Sales Growth Level

Total Debt Ratio (TD)	Firms
Low TD: $0 < TD \leq 0.25$	159
Medium TD: $0.25 < TD \leq 0.50$	104
High TD: $0.50 < TD \leq 0.75$	26
Total	289

Note: The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). The total debt ratio (TD) is the ratio of total debt to total assets.

The results of MM robust regressions of Models 1 and 2 are presented in Table 4.10 below. TD was found to be positively significant associated with both market power variables, QMV and SG. However, when firms were in the high TD group ($0.50 < TD \leq 0.75$), TD was not significantly associated with market power (SG). This implies that when a firm's leverage position is already high, increasing debt cannot improve the firm's output.

It is interesting to see that the degrees of association between TD and market power measures decreased with the leverage groups. For QMV, the low TD group had a degree of association of 0.99905, medium TD 0.90139, and low TD 0.8559. For SG, the low TD group 0.28, medium TD 0.2373, and high TD were not statistically significant. That is, the higher the leverage level of the firm, the smaller is the positive effect of leverage on market power, and when the leverage level is high, the effect disappears.

Table 4.10 Regression Results for Different Total Debt Groups

Independent Variable	Low TD: $0 < TD \leq 0.25$		Medium TD: $0.25 < TD \leq 0.50$		High TD: $0.50 < TD \leq 0.75$	
	Dependent Variable					
	QMV	SG	QMV	SG	QMV	SG
<i>ROA</i>	0.01126*** ($< 2e-16$)	0.59227*** ($3.83e-09$)	-0.09131** (0.044290)	0.97834*** ($< 2e-16$)	-0.343*** (0.000145)	1.0854*** (0.00494)
<i>SIZE2</i>	2.42676*** ($4.82e-16$)	0.578879* (0.0963)	-0.22376 (0.202876)	0.86946** (0.0180)	1.066*** (0.003599)	0.9075 (0.26669)
<i>TANG2</i>	-0.1385*** ($< 2e-16$)	0.008703 (0.7006)	-0.04222 (0.000636)	0.0003692 (0.9896)	0.0507*** ($2.97e-05$)	-0.0513 (0.26056)
<i>TD</i>	0.99905*** ($< 2e-16$)	0.28082*** ($1.54e-08$)	0.90139*** ($< 2e-16$)	0.2373*** ($9.1e-05$)	0.8559*** ($< 2e-16$)	0.2480 (0.12613)
Sample Size	1590	1590	1040	1040	260	260
Adjusted R^2	0.5514	0.1242	0.6469	0.1178	0.7686	0.0544

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the

robustbase package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) is defined as the ratio of total debt to total assets; QMV (Tobin's Q) is the market value of equity and the book value of liability over total assets; ROA (profitability) is the ratio of net income to total assets, SIZE2 (size) is the natural logarithm of total assets scaled by 100; TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets; and SG is sales growth.

4.1.7 Firm Sales Growth Levels

This section investigates whether firms with different sales growth behave differently, regarding their leverage levels, in the physical product markets. Firms with different growth rates might exhibit different behaviors in the physical product market. For instance, Du and Temouri (2015) reported that firms with high growth enjoy higher productivity levels. Additionally, sales growth has been reported to be associated with capital structure (see e.g. Campello, 2003; Huang & Song, 2005; Smith et al., 2008).

The average GDP growth during the period 2005-2014 was 3.46 percent. The corresponding average sales growth of the sample firms for the same period was 0.108009 percent, ranging from negative growth -0.1965 to 2.07986 percent. The distribution of the average sales growth is illustrated in Figure 4.2 below.

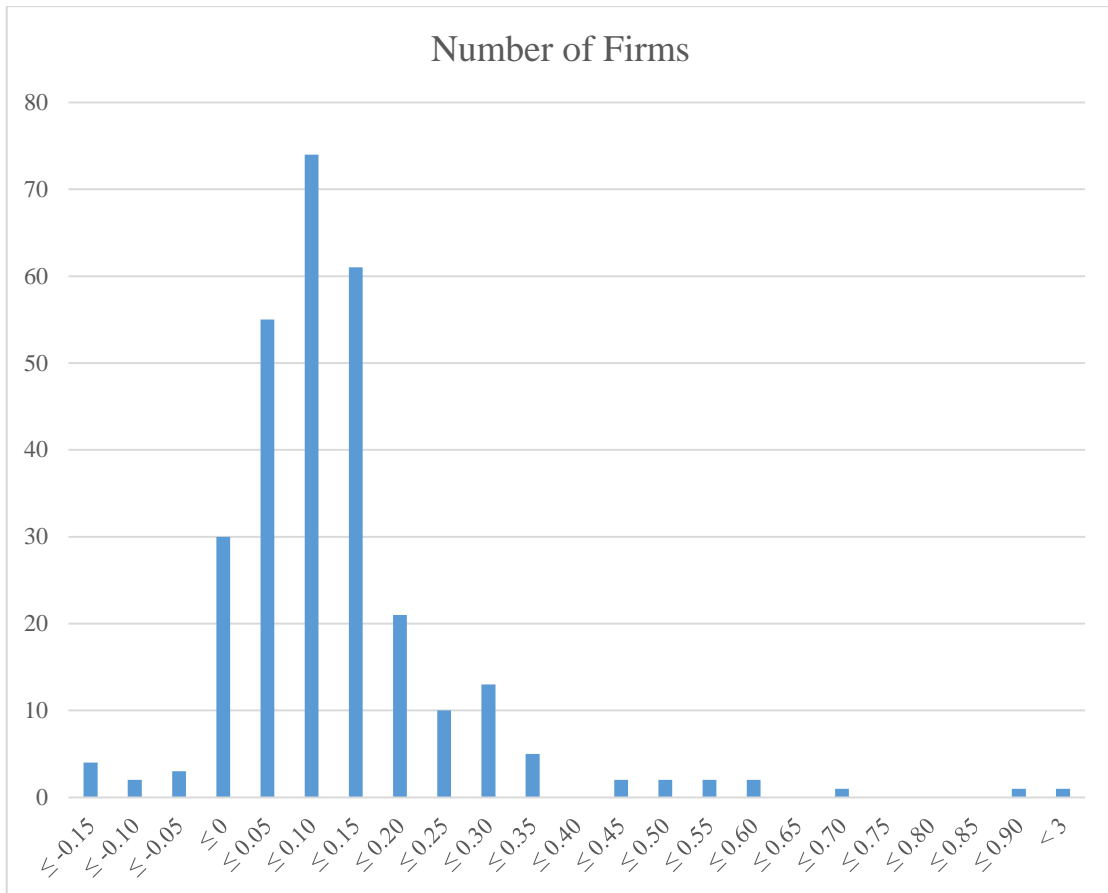


Figure 4.2 289 SET Firms Ranked by Average Percentage Sales Growth during the Period 2005-2014

Note: The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). Sales growth (SG) was calculated according to the first difference between sales growth divided by the sum of the squares of market share of firm i in industry j .

Firms were then grouped into three different sales growth levels, as described in Table 4.11 below. The majority of firms had positive sales growth rates between 0 to 0.20 percent, while about 13.5 percent experienced growth rates above 0.20 percent. The low growth corresponded to the periods of economic downturn and recovery.

Table 4.11 Firms Grouped by Sales Growth Level

Sales Growth	Firms	%
Negative Growth: $SG \leq 0$	39	13.495
1 st Positive Growth: $0 < SG \leq 0.20$	211	73.01
2 nd Positive Growth: $SG > 0.20$	39	13.495
Total	289	100

Note: The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). SG was calculated as the first difference of sales growth divided by the value of the previous-period sales growth of firm i .

The results for the MM robust regressions for Models 1 and 2 are provided in Table 4.12 below. For the dependent variable QMV, the leverage level as measured by TD was found to be positively significantly associated with the firm's market power in all three different sales growth groups. However, when SG was employed as the independent variable, the estimated signs of TD were positive in all three cases, but the sign was not statistically significant in the negative SG group. Furthermore, when the average sales growth was positive, the estimated TD's effects on SG notably increased from 0.1175 to 0.63345, and when the average SG was negative, TD had no effect on SG. This implies that, when the growth is positive, increasing leverage boosts firms' productivity and market power, but when firms experience negative growth, additional debt does not benefit firms' physical output or market power.

Table 4.12 Regression Results for Different Sales Growth Groups

Independent Variable	Negative SG ($SG \leq 0$)		1 st Positive SG ($0 < SG \leq 0.20$)		2 nd Positive SG ($SG \geq 0.20$)	
	Dependent Variable					
	QMV	SG	QMV	SG	QMV	SG
<i>ROA</i>	-0.08925*	0.4574**	-0.14833**	0.5649***	0.18357*	2.0792***
	(0.0936)	(0.0293)	(0.0161)	(< 2e-16)	(0.0907)	(2.99e-05)
<i>SIZE2</i>	0.22325	0.5877	0.79590***	0.315071	-0.48444	-1.598792
	(0.6599)	(0.5344)	(1.29e-05)	(0.245)	(0.2848)	(0.272)
<i>TANG2</i>	-0.04222**	-9.169e-05	-0.05335***	0.007407	-0.17463	-0.007734
	(0.0363)	(0.9989)	(<9.84e-06)	(0.692)	(2.29e-12)	(0.930)
<i>TD</i>	1.02271***	0.04220	0.85877***	0.1175***	0.881***	0.6335***
	(< 2e-16)	(0.5955)	(< 2e-16)	(3.2e-05)	(< 2e-16)	(5.88e-06)
Sample Size	390	390	2110	2110	390	390
Adjusted R^2	0.8621	0.05636	0.7605	0.072	0.767	0.1452

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the *robustbase* package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) is defined as the ratio of total debt to total assets; QMV (Tobin's Q) is the market value of equity and the book value of liability over total assets; ROA (profitability) is the ratio of net income to total assets, SIZE2 (size) is the natural logarithm of total assets scaled by 100; TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets; and SG is sales growth.

4.2 Sectoral Analysis

As discussed in Section 3.5.2.2 that product market output is related with average industry debt ratio (Phillips, 1995; Smith et al., 2008). Thus, under this section, all 289 sample firms were grouped according to their own industrial sectors (as categorized by SET), which were individually analyzed for all 21 sample sectors (out of a total of 28 sectors). Then, each industrial sector was further classified by average sectoral leverage levels and degree of market concentration.

4.2.1 Sectoral Analysis

Regression analyses of the four empirical models discussed in Section 4.1.1 were carried out for each individual sector. The regression results for all 21 sectors were combined into two tables: presents the results of Models 1 and 2 where total debt ratio (TD) was employed as a measure of leverage level, and in the results for Models 4 and 5 with a long-term debt ratio (LTD) can be seen.

Table 4.13 Models 1 and 2 (Total Debt)

Sector	Dep. Variable	Independent Variable				Firm	Adj. R ²
		ROA	SIZE2	TANG2	TD		
Agribusiness	QMV	0.42564*** (1.26e-08)	0.41051 (0.16825)	-0.08215*** (0.00746)	1.01207*** (<2e-16)	8	0.99
	SG	1.6179** (0.01337)	1.3529 (0.78434)	-0.2666 (0.25046)	0.4528*** (0.00666)	8	0.1615
Food and Beverage	QMV	-0.30571*** (0.00678)	4.69827*** (1.22e-06)	0.01959 (0.63711)	0.64676*** (5.85e-16)	21	0.6876
	SG	1.35365*** (1.11e-07)	2.96006*** (0.000456)	-0.11569 (0.093154)	0.27199** (0.001797)	21	0.2373
Fashion	QMV	-0.04593 (0.540)	0.30370 (0.322)	-0.29648*** (3.05e-10)	0.74557*** (2e-16)	21	0.8345
	SG	0.68980*** (1.53e-11)	0.02793 (0.964)	-0.06563 (0.254)	0.05269 (0.489)	21	0.1562

Table 4.13 (Continued)

Sector	Dep. Variable	Independent Variable				Firm	Adj. R ²
		ROA	SIZE2	TANG2	TD		
Home and Office Products	QMV	-0.31568** (0.008878)	3.58514*** (5.09e-06)	-0.59622*** (0.000825)	0.41814*** (1.10e-09)	6	0.8018
	SG	0.7650 (NA) ^a	5.0480 (NA) ^a	-1.0756 (NA) ^a	-0.4160 (NA) ^a	6	NA
Personal Products and Pharmaceuticals	QMV	-0.7150*** (0.000387)	3.8780*** (1.95e-05)	0.5846*** (0.006854)	0.3037 (0.286414)	4	0.6843
	SG	0.4999 (0.775)	6.0253 (0.330)	-1.2688 (0.213)	0.3606 (0.798)	4	-0.02349
Regression Analysis of Automotive Sector	QMV	0.084067 (0.6215)	1.569067** (0.0302)	-0.140195** (0.0333)	0.91174*** (<2e-16)	13	0.8165
	SG	0.6198** (0.02739)	-1.1364 (0.52713)	-0.2016 (0.22586)	0.4097*** (0.00217)	13	0.08509
Industrial Material and Machinery	QMV	-0.216098 (0.612)	0.003187 (0.995)	-0.028163 (0.846)	0.96021*** (0.960206)	6	0.04746
	SG	0.1282 (0.696)	0.2860 (0.803)	0.1801 (0.204)	0.1248 (0.553)	6	0.1069
Packaging	QMV	0.03427 (0.921186)	0.02644 (0.941391)	-0.01330 (0.874455)	0.65149*** (0.000431)	12	0.521
	SG	1.822668*** (0.000393)	-0.717853 (0.434578)	-0.171289 (0.368351)	0.786480** (0.012446)	12	0.1891
Petrochemicals and Chemicals	QMV	-0.20281 (0.137)	0.66594 (0.069)	-0.04098 (0.492)	0.91017*** (<2e-16)	8	0.9041
	SG	1.2263*** (0.000136)	-2.0363 (0.095485)	-0.1185 (0.407354)	0.3581** (0.014711)	8	0.3515
Steel	QMV	0.06618 (0.69232)	-1.40111*** (0.00232)	-0.05708 (0.15794)	1.11680*** (< 2e-16)	22	0.906
	SG	1.29969*** (0.000414)	0.37062 (0.588842)	0.07684 (0.191667)	0.21361*** (0.001927)	22	0.2537
Construction Materials	QMV	0.33470 (0.1322)	1.04654** (0.0154)	0.04557 (0.1693)	0.83210*** (<2e-16)	16	0.9005
	SG	0.61638*** (0.00219)	0.91132 (0.16793)	0.10382** (0.04230)	0.11251** (0.02976)	16	0.07491
Construction Services	QMV	-0.33470 (0.1322)	1.04654** (0.0154)	0.04557 (0.1693)	0.83210*** (<2e-16)	12	0.9005
	SG	0.61638*** (0.00219)	0.91132 (0.16793)	0.10382* (0.04230)	0.11251** (0.02976)	12	0.07491

Table 4.13 (Continued)

Sector	Dep. Variable	Independent Variable				Firm	Adj. R ²
		ROA	SIZE2	TANG2	TD		
Property Development	<i>QMV</i>	0.004821 (0.94770)	-1.53043*** (0.00843)	-0.22479*** (2.17e-09)	0.75483*** (< 2e-16)	24	0.6053
	<i>SG</i>	0.43550 (0.370)	-1.17349 (0.504)	-0.04052 (0.601)	0.02173 (0.910)	24	0.02973
Energy and Utilities	<i>QMV</i>	-0.23951** (0.01323)	4.17449*** (1.02e-07)	-0.17999*** (2.02e-05)	0.78306*** (< 2e-16)	24	0.8519
	<i>SG</i>	0.52421*** (0.000152)	1.21354* (0.071857)	-0.03071 (0.499373)	0.12280** (0.042401)	24	0.1455
Commerce	<i>QMV</i>	0.1705 (NA) ^a	3.1629 (NA) ^a	-0.1552 (NA) ^a	0.9530 (NA) ^a	10	NA ^a
	<i>SG</i>	0.38662 (0.456)	1.24632 (0.541)	0.07398 (0.719)	0.04569 (0.737)	10	0.05599
Healthcare Services	<i>QMV</i>	-0.01560 (NA) ^a	1.61940 (NA) ^a	-0.14360 (NA) ^a	1.18245 (NA) ^a	13	NA ^a
	<i>SG</i>	0.51872** (0.01662)	-0.52269 (0.70942)	0.06274 (0.42664)	0.42664*** (0.00173)	13	0.05117
Media and Publishing	<i>QMV</i>	0.05357 (0.86732)	-0.77904 (0.16936)	0.04178 (0.63246)	1.04559*** (< 2e-16)	20	0.8925
	<i>SG</i>	0.96247*** (0.000675)	1.80249 (0.469558)	0.03884 (0.748774)	0.07220 (0.685103)	20	0.2563
Tourism and Leisure	<i>QMV</i>	-0.05702 (NA) ^a	6.77891 (NA) ^a	0.11600 (NA) ^a	0.94172 (NA) ^a	10	NA ^a
	<i>SG</i>	1.0167 (0.267)	5.1102 (0.140)	-0.1080 (0.684)	0.1461 (0.535)	10	0.04719
Transportation and Logistics	<i>QMV</i>	-0.08909 (0.369885)	2.92373*** (0.000997)	-0.09758 (0.119368)	0.77840*** (< 2e-16)	12	0.887
	<i>SG</i>	0.40914*** (2.73e-08)	-1.17100 (0.6189)	-0.16303 (0.3360)	0.19078* (0.0995)	12	0.05575
Electronics and Components	<i>QMV</i>	0.001747 (0.9714)	2.426735** (0.0143)	0.010009 (0.8747)	0.99075*** (<2e-16)	9	0.9239
	<i>SG</i>	1.011688*** (0.00522)	5.688608*** (0.00717)	0.006708 (0.92038)	0.104620 (0.31660)	9	0.3145
Information and Communication Technology	<i>QMV</i>	-0.14789*** (0.005148)	1.00711*** (0.002695)	0.06288*** (0.000291)	0.96504*** (< 2e-16)	18	0.9265
	<i>SG</i>	0.57175** (0.003461)	-0.05224 (0.948542)	-0.04244 (0.381115)	0.27997*** (0.000105)	18	0.1492

Note: ^aAlgorithm did not converge. Significant at 1%(***), 5%(**), and 10%(*) levels.

MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the *robustbase* package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). *TD* (total debt ratio) is defined as the ratio of total debt to total assets; *QMV* (Tobin's Q) is the market value of equity plus the book value of liability divided by total assets; *SG* is sales growth; *ROA* (profitability) is the ratio of net income to total assets, *SIZE2* (size) is the natural logarithm of total assets scaled by 100; and *TANG2* (asset tangibility) is net property, plant, and equipment divided by total assets.

The results indicate that the estimate of *TD* is negative but not statistically significant for one sector, i.e. home and office products. Therefore, the regression results for each individual sector confirmed the main findings—that increasing leverage is associated with increasing market power.

Table 4.14 Models 3 and 4 (Long-term Debt)

Sector	Dep. Variable	Independent Variable				Firm	Adj. R ²
		ROA	SIZE2	TANG2	LTD		
Agribusiness	<i>QMV</i>	-0.31855*** (9.50e-08)	15.41076*** (2.06e-09)	-0.0367*** (0.597)	0.03703 (0.886)	80	0.5535
	<i>SG</i>	0.8597 (0.169)	8.2701 (0.281)	-0.1668 (0.423)	-0.4053 (0.311)	80	0.1117
Food and Beverage	<i>QMV</i>	-79428*** (7.15e-07)	4.58613*** (3.36e-10)	0.03100 (0.49246)	0.6653*** (1.90e-10)	210	0.4661
	<i>SG</i>	1.14513*** (8.57e-08)	2.53045* (0.01248)	-0.09535 (0.14724)	0.28932 (0.05441)	210	0.2109
Fashion	<i>QMV</i>	-0.41721*** (8.83e-08)	0.74725 (0.0979)	-0.33726*** (2e-16)	0.6629*** (2e-16)	210	0.5882
	<i>SG</i>	0.679171*** (9.06e-12)	0.007635 (0.990)	-0.059473 (0.275)	0.059158 (0.059158)	210	0.1574

Table 4.14 (Continued)

Sector	Dep. Variable	Independent Variable				Firm	Adj. R ²
		ROA	SIZE2	TANG2	LTD		
Home and Office Products	<i>QMV</i>	-0.4024** (0.006581)	3.6014*** (0.000197)	-0.3795* (0.023218)	0.5182*** (0.000215)	60	0.6988
	<i>SG</i>	1.1818* (0.021)	-1.3220 (0.689)	-0.7785 (0.197)	0.3756 (0.446)	60	0.09866
Personal Products and Pharmaceuticals	<i>QMV</i>	-0.8912*** (4.83e-08)	4.2431*** (2.59e-05)	0.6804*** (0.00014)	-0.2077 (0.52775)	40	0.5871
	<i>SG</i>	0.7525 (0.72829)	10.7968*** (0.00461)	-1.6698 (0.10172)	2.2633* (0.07767)	40	0.05538
Automotive	<i>QMV</i>	-0.1283 (0.8387)	3.5364 (0.1220)	0.1924 (0.4033)	0.5571** (0.0264)	130	0.5171
	<i>SG</i>	0.45537 (0.0645)	-0.68607 (0.7277)	-0.01868 (0.9032)	0.29876* (0.0625)	130	0.03657
Industrial Material and Machinery	<i>QMV</i>	-1.38226*** (0.001015)	-1.84802** (0.017882)	-0.01739 (0.843321)	0.562*** (5.05e-05)	60	0.5867
	<i>SG</i>	0.08307 (0.808)	0.04339 (0.968)	0.15326 (0.247)	0.17389 (0.350)	60	0.1163
Packaging	<i>QMV</i>	-0.09411 (NA) ^a	-0.01305 (NA) ^a	-0.05530 (NA) ^a	0.66357 (NA) ^a	120	NA ^a
	<i>SG</i>	1.021253** (0.00893)	-0.729891 (0.50304)	0.009276 (0.95981)	0.291513 (0.34892)	120	0.07457
Petrochemicals and Chemicals	<i>QMV</i>	0.04363 (0.864878)	0.46230 (0.670483)	0.28082 (0.192167)	0.574*** (0.000131)	80	0.4325
	<i>SG</i>	1.24430*** (0.000357)	-2.29103 (0.085696)	-0.04364 (0.746325)	0.29379 (0.226993)	80	0.2852
Steel	<i>QMV</i>	-0.24741 (0.10693)	-1.16223* (0.04074)	0.21062*** (3.37e-05)	1.9029*** (< 2e-16)	220	0.7278
	<i>SG</i>	1.06279*** (0.000352)	0.11896 (0.904634)	0.08567 (0.180495)	0.35785 (0.111112)	220	0.2069
Construction Materials	<i>QMV</i>	-1.18545*** (6.44e-05)	-2.15283 (0.22450)	-0.27314*** (0.00230)	0.8293*** (1.58e-11)	160	0.4939
	<i>SG</i>	0.478560*** (0.00761)	0.060196 (0.94195)	0.047604 (0.46433)	0.176674 (0.08307)	160	0.06492

Table 4.14 (Continued)

Sector	Dep. Variable	Independent Variable				Firm	Adj. R ²
		ROA	SIZE2	TANG2	LTD		
Construction Services	<i>QMV</i>	-1.18545*** (6.44e-05)	-2.15283 (0.22450)	-0.27314*** (0.00230)	0.8293*** (1.58e-11)	120	0.4939
	<i>SG</i>	0.478560*** (0.00761)	0.060196 (0.94195)	0.047604 (0.46433)	0.176674* (0.08307)	120	0.06492
Property Development	<i>QMV</i>	-0.38189 (0.15965)	-1.00509 (0.38214)	-0.14421*** (0.00604)	0.6924*** (9.72e-07)	240	0.149
	<i>SG</i>	0.41624 (0.186)	-1.16354 (0.363)	-0.04214 (0.542)	0.04133 (0.787)	240	0.02846
Energy and Utilities	<i>QMV</i>	-0.78955*** (2.74e-12)	6.54490*** (1.61e-11)	-0.29454*** (1.18e-05)	0.5140*** (2.18e-08)	240	0.5173
	<i>SG</i>	0.39713*** (0.000555)	1.88841*** (0.003902)	-0.04258 (0.415289)	0.03603 (0.684640)	240	0.1201
Commerce	<i>QMV</i>	-0.24558 (0.1463)	-2.24791 (0.1918)	0.45327*** (4.39e-08)	0.9878*** (6.00e-10)	100	0.7
	<i>SG</i>	0.44737 (0.393)	0.21749 (0.935)	0.10345 (0.558)	0.17703 (0.443)	100	0.07086
Healthcare Services	<i>QMV</i>	-0.25064 (0.298252)	4.05832*** (0.000341)	-0.38638*** (2.5e-07)	0.52064* (0.085004)	130	0.3499
	<i>SG</i>	0.372069* (0.0939)	1.802452 (0.2038)	0.003448 (0.9676)	-0.129382 (0.7194)	130	0.00477 9
Media and Publishing	<i>QMV</i>	-0.37837** (0.0051)	1.50516 (0.2426)	-0.10176 (0.2229)	0.9797*** (2.04e-12)	200	0.569
	<i>SG</i>	0.9667*** (6.1e-05)	1.4442 (0.514)	0.0433 (0.686)	0.1545 (0.447)	200	0.09866
Tourism and Leisure	<i>QMV</i>	-0.30513 (0.35004)	6.07018*** (6.11e-07)	-0.07385 (0.63128)	0.92599* (0.01811)	100	0.6057
	<i>SG</i>	0.9405 (0.262)	3.5051 (0.411)	-0.1033 (0.609)	0.4693 (0.253)	100	0.0601
Transportation and Logistics	<i>QMV</i>	-0.8348*** (0.000313)	5.1979*** (0.002688)	-0.4404*** (0.004875)	0.00488** (0.025146)	120	0.2907
	<i>SG</i>	0.38157*** (7.77e-06)	-0.50034 (0.836)	-0.16089 (0.427)	0.01722 (0.953)	120	0.03154

Table 4.14 (Continued)

Sector	Dep. Variable	Independent Variable				Firm	Adj. R ²
		ROA	SIZE2	TANG2	LTD		
Electronics and Components	QMV	-0.03442 (0.751841)	7.65627*** (3.94e-06)	-0.14193*** (0.000484)	0.8951*** (1.74e-12)	90	0.832
	SG	1.05772*** (0.002945)	6.98580*** (0.000299)	-0.01403 (0.822587)	-0.01647 (0.854236)	90	0.3134
Information and Communication Technology	QMV	-0.33388** (0.039755)	0.14440 (0.818232)	0.12344*** (0.000368)	0.929*** (< 2e-16)	180	0.7567
	SG	0.54421*** (0.000341)	-0.10716 (0.898089)	-0.01437 (0.739957)	0.2518*** (0.000539)	180	0.1334

Note: ^aAlgorithm did not converge. Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the robustbase package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). LTD (long term debt ratio) is defined as the ratio of long term debt to total assets; QMV (Tobin's Q) is the market value of equity plus the book value of liability divided by total assets; SG is sales growth; ROA (profitability) is the ratio of net income to total assets, SIZE2 (size) is the natural logarithm of total assets scaled by 100; and TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets.

Again the regression results for Models 3 and 4 confirm the main finding of a positive relationship between leverage level and market power. Although some sectors, namely, agribusiness, personal products and pharmaceuticals, healthcare services, electronics and components, showed a negative relationship between LTD and the product market outcome proxies (QMV and SG), but none of the estimates was statistically significant.

4.2.2 Sectoral Leverage level

This section investigates whether firms in different industrial sectors, classified by their leverage levels, behaved differently in the product markets. Table ranks the sample sectors from the highest average total debt to the lowest. The first five highest-leveraged sectors were transportation and logistics, industrial material and machinery, energy and utilities, property development, and steel. The five lowest leveraged sectors were personal products and pharmaceuticals, media and publishing, petrochemicals and chemicals, electronics and components, and fashion.

Table 4.15 Industrial Sectors Ranked by Average Leverage Levels of 289 SET Firms for the Period 2005-2014

	SECTOR	TD (%)	Number of Firms
1.	Transportation and Logistics	38.31	12
2.	Industrial Material and Machinery	34.29	6
3.	Energy and Utilities	31.81	24
4.	Property Development	31.52	24
5.	Steel	30.29	22
6.	Information and Communication Technology	30.24	18
7.	Construction Materials	29.10	16
8.	Tourism and Leisure	27.11	10
9.	Food and Beverage	25.00	21
10.	Agribusiness	24.66	8
11.	Automotive	21.72	13
12.	Health Care Services	21.06	13
13.	Home and Office Products	19.69	6
14.	Construction Services	19.11	12
15.	Commerce	18.79	10
16.	Packaging	17.73	12
17.	Personal Products and Pharmaceuticals	13.92	4
18.	Media and Publishing	13.69	20
19.	Petrochemicals and Chemicals	13.48	8
20.	Electronics and Components	12.18	9
21.	Fashion	11.20	21
	All sample sectors	24.02	289

Note: The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) is defined as the mean of total debt to the total assets ratio of each sector.

The highest leveraged sector (Transportation and Logistics) had the average total debt ratio of 38.31 percent, the lowest was Fashion at 11.2 percent. The sample sectors were then categorized, according to their leverage range, into three groups, namely, 2nd Decile (TD lie between 11% - 20%), 3rd Decile (21% - 30%), and 4th Decile (31% - 40%), respectively (see Table below).

Table 4.16 Sectoral Group by Leverage Level

Sectoral Leverage Level	Range of TD	Firms	Sector
2 nd Decile leverage group	$10\% < TD \leq 20\%$	102	9
3 rd Decile leverage group	$20\% < TD \leq 30\%$	81	6
4 th Decile leverage group	$30\% < TD \leq 40\%$	106	6
Total		289	21

Note: The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) is defined as the mean of total debt to the total assets ratio of each sector.

The results for the MM robust regression of Models 1 and 2 are offered in Table below. The leverage levels were found to be positively associated with firm market power in all three leverage groups. However, the degree of association appeared to decline with the levels of leverage. The estimates of TD, for the 2nd Decile TD was 1.0039, 3rd Decile was 0.9678, and for 4th Decile was 0.8374. This implies that the higher is the sectoral leverage level, the fewer are the benefits gained from the leverage on market power. For SG, the 4th Decile group had the highest association between TD and SG. The relationship seemed to be different for the SG case, where the 4th Decile group had the highest degree of association between TD and SG.

Table 4.17 Regression Results for Low-, Medium-, and High-Leveraged Sectors

Independent Variable	2 nd Decile (10% < TD ≤ 20%)		3 rd Decile (20% < TD ≤ 30%)		4 th Decile (30% < TD ≤ 40%)	
	Dependent Variable					
	QMV	SG	QMV	SG	QMV	SG
ROA	-0.0271 (0.6595)	0.7740*** (<2e-16)	0.1311*** (0.0037)	0.6895** (3.57e-12)	-0.0894 (0.1322)	0.6228*** (2.57e-05)
SIZE2	3.1605*** (1.53e-10)	1.3254*** (0.0005)	0.1866 (0.2769)	0.4873 (0.1789)	0.8571*** (3.92e-05)	0.2416 (0.5966)
TANG2	-0.1623*** (3.66e-13)	-0.0178 (0.528264)	0.0068 (0.6558)	0.0749*** (0.0092)	-0.0385*** (0.0009)	-0.0271 (0.3895)
TD	1.0039*** (<2e-16)	0.16341*** (1.30e-05)	0.9678*** (<2e-16)	0.1460*** (4.52e-05)	0.8374*** (<2e-16)	0.1713*** (0.00097)
Sample Size	1020	1020	810	810	1060	1060
Adjusted R ²	0.72	0.17	0.88	0.12	0.74	0.07

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the *robustbase* package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014. TD (total debt ratio) is defined as the ratio of total debt to total assets; QMV (Tobin's Q) is the market value of equity and the book value of liability over total assets; ROA (profitability) is the ratio of net income to total assets, SIZE2 (size) is the natural logarithm of total assets scaled by 100; TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets; and SG is sales growth.

4.2.3 Market Concentration

It is both conventional and empirical that higher concentration is related to lower competitiveness (Bikker & Haaf, 2002). Market concentration has also been found to be related to leverage decision. For example, Kovenock and Phillips (1997) reported that leverage leads to softer competition for firms in high-concentrated industries.

This section explores whether firms in different market concentration groups behave differently in the product markets. The level of market concentration was

measured using the Herfindahl index (Herfindahl-Hirschman index - HI), which takes the value between 0 and 1. The smaller (larger) index indicates lower (higher) concentration and greater (lower) product market competition. Figure 4.3 and Table rank sectors according to the Herfindahl index values. The five highest-concentrated sectors were construction materials, transportation and logistics, agribusiness, energy and utilities, and petrochemicals and chemicals. The five lowest-concentrated sectors were Automotive, Property Development, Media and Publishing, Fashion, and Steel.

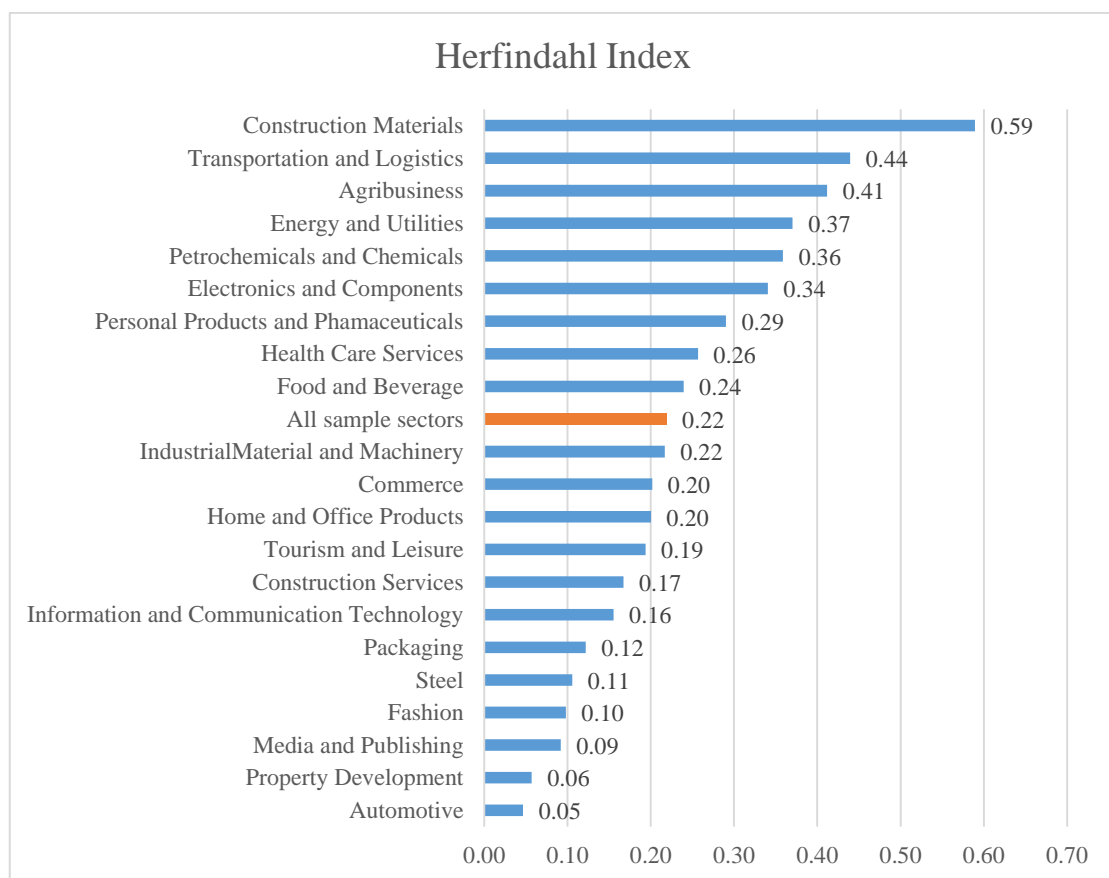


Figure 4.3 Market Concentration of 21 Sectors* of 289 SET Firms for the Period 2005-2014

Note: The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). The Herfindahl index was calculated according to the sum of the squares of the market share of firm i in industry j .

Table 4.18 Sectors Ranked by Herfindahl Index of 289 SET Firms for the Period 2005-2014 (with TD levels)

	SECTOR	HI	TD (%)	Number of firm
1.	Automotive	0.05	21.72	13
2.	Property Development	0.06	31.52	24
3.	Media and Publishing	0.09	13.69	20
4.	Fashion	0.10	11.20	21
5.	Steel	0.11	30.29	22
6.	Packaging	0.12	17.73	12
7.	Information and Communication Technology	0.16	30.24	18
8.	Construction Services	0.17	19.11	12
9.	Tourism and Leisure	0.19	27.11	10
10.	Home and Office Products	0.20	19.69	6
11.	Commerce	0.20	18.79	10
12.	Industrial Material and Machinery	0.22	34.29	6
13.	Food and Beverage	0.24	25.00	21
14.	Health Care Services	0.26	21.06	13
15.	Personal Products and Pharmaceuticals	0.29	13.92	4
16.	Electronics and Components	0.34	12.18	9
17.	Petrochemicals and Chemicals	0.36	13.48	8
18.	Energy and Utilities	0.37	31.81	24
19.	Agribusiness	0.41	24.66	8
20.	Transportation and Logistics	0.44	38.31	12
21.	Construction Materials	0.59	29.10	16
	All sample sectors	0.22	24.02	289

Note: The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). TD (total debt ratio) is the sectoral mean of the total debt to total assets ratio; and HI (Herfindahl index) was calculated with the sum of the squares of the market share of firm i in industry j . The smaller (larger) index indicates lower (higher) concentration and greater (lower) product market competition.

The sample industrial sectors were categorized into three different market concentration levels (classified by the U.S. Department of Justice and the Federal Trade Commission, 2010), as shown in Table below.

Table 4.19 Sectoral Group by Market Concentration Level

Market Concentration Level	Range of HI Value	Firms	Sector
Unconcentrated	$HI < 0.15$	112	6
Moderately Concentrated	$0.15 \leq HI \leq 0.25$	83	7
Highly Concentrated	$HI > 0.25$	94	8
Total		289	21

Note: The sample includes 289 SET firms for the period 2005-2014 (financial sectors and firms with incomplete and missing data were excluded). HI (Herfindahl index) was calculated using the sum of the squares for the market share of firm i in industry j .

The results of the MM robust regressions for Models 1 and 2 are shown in Table below. The leverage level was found to be significantly and positively associated with the firm's market power in all three different market concentration groups. That is, no matter whether the firms were in highly-, moderately-, or low-concentrated market environments, the higher leverage level consistently led to higher market power. An interesting fact is that the association between leverage and market power was the strongest when the firms were in unconcentrated groups. This suggests that if sectors are not concentrated, increasing leverage will have the highest effects on the firms' market power, i.e. firms will be able to compete more aggressively and increase their outputs. This is reasonable because competition can be conducted more freely in unconcentrated industries.

Table 4.20 Regression Results for Different Market Concentration Groups

Independent Variable	Unconcentrated ($HI < 0.15$)		Moderate concentration ($0.15 \leq HI \leq 0.25$)		High concentration ($HI > 0.25$)	
	Dependent Variable					
	QMV	SG	QMV	SG	QMV	SG
<i>ROA</i>	0.0087*** ($< 2e-16$)	0.8913*** ($1.08e-14$)	-0.2019* (0.0537)	0.72640*** ($5.69e-11$)	-0.0078 (0.8772)	0.5399*** ($9.45e-11$)
<i>SIZE2</i>	0.3760* (0.0887)	0.9874 (0.101)	2.2517*** ($3.5e-07$)	1.1406*** (0.0096)	0.6937*** ($3.38e-05$)	0.0974 (0.764)
<i>TANG2</i>	0.0346** (0.011)	-0.0071 (0.853)	-0.2042*** ($< 2e-16$)	-0.0145 (0.6096)	-0.062*** ($9.49e-06$)	0.0335 (0.152)
<i>TD</i>	0.946*** ($< 2e-16$)	0.1874*** ($1.00e-05$)	0.7057*** ($< 2e-16$)	0.1082*** (0.0022)	0.8795*** ($< 2e-16$)	0.1713*** ($7.34e-06$)
Sample Size	1120	1120	830	830	940	940
Adjusted R^2	0.85	0.14	0.58	0.12	0.84	0.08

Note: Significant at 1%(***), 5%(**), and 10%(*) levels. MM-type regression estimators as described in Yohai (1987) and Koller and Stahel (2011) with highly-robust and highly-efficient estimators were carried out (under the *robustbase* package in the *R environment*). The sample includes 289 SET firms for the period 2005-2014. TD (total debt ratio) is defined as the ratio of total debt to total assets; QMV (Tobin's Q) is the market value of equity and the book value of liability over total assets; ROA (profitability) is the ratio of net income to total assets, SIZE2 (size) is the natural logarithm of total assets scaled by 100; TANG2 (asset tangibility) is net property, plant, and equipment divided by total assets; and SG is sales growth.

CHAPTER 5

CONCLUSION, DISCUSSION, AND RECOMMENDATIONS

5.1 Conclusion

This study empirically investigated whether leverage has a positive effect on product market strategy as postulated by the limited liability theory introduced by Brander and Lewis (1986). As discussed in Section 3.5, the analytical framework was separated into firm-level and firm-sectoral analyses. Figure 5.1 sketchily outlines the said methodological framework. The analyses are concluded in the following sections 5.1.1 and 5.1.2. The main findings are then concisely and conveniently summarized in Table 5.1.

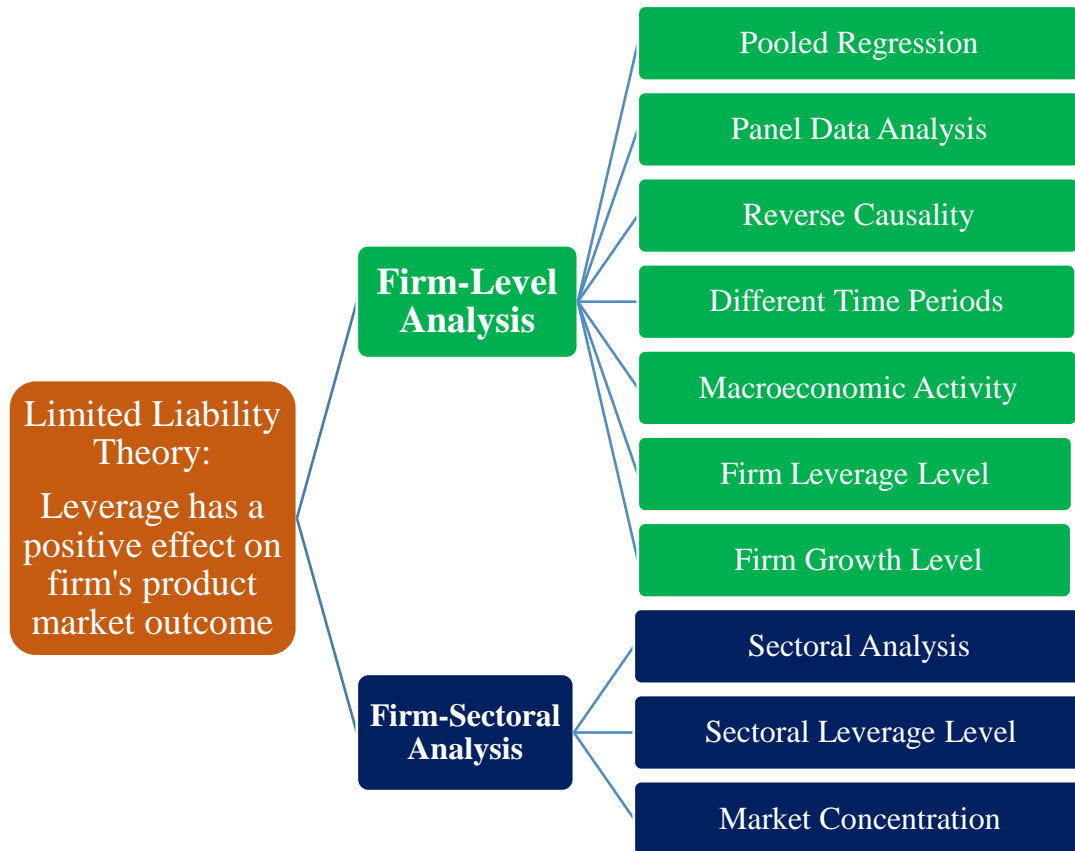


Figure 5.1 Analytical Framework

5.1.1 Firm-Level Analysis

This section reports on the summary of the empirical results for the firm-level analyses.

5.1.1.1 Regression Analysis

MM-type robust estimator regression analysis was carried out, where total debt ratio (TD) was found to have a strong significant positive effect on market power proxied by Tobin's Q (QMV). When QMV was substituted by another measure for market power, i.e. sales growth (SG), and the independent variable TD was replaced by long-term debt (LTD), and the same results were still confirmed.

5.1.1.2 Panel Data Analysis

Panel data analysis was carried out in order to address the problem of unobserved heterogeneities. The model selection tests supported the fixed-time

effects model, indicating that leverage levels (both total debt and long-term debt) were heterogeneous across firms and time. The estimation results for the fixed-time effects models supported the main hypothesis—that as leverage increases, firms engage in aggressive product market strategies.

5.1.1.3 Reverse Causality

The limited liability theory postulates that causality runs from the leverage decision to the product market outcome. However, as mentioned, the direction of causality can be counter-causal. The lagged values (up to four periods) of total debt and long-term debt were employed to ensure that the leverage decision had been established well before the product market decision was made. The regression results show that all the lagged values of TD and LTD yielded the same conclusion—that leverage induces market power.

5.1.1.4 Time Periods

Regarding the time period of the data set for 2005-2014, there is a possibility of a structural break due to the 2008 U.S. sub-prime mortgage crisis. The test results show that the structural break impact was not statistically significant when the firm's market power was measured by Tobin's Q, but was significant when measured by sales growth. After the crisis, the sales growth shrank by approximately three percent for both leverage measures, total debt, and long-term debt.

The full sample period of 2005-2014 was separated into pre-crisis (2005-2007) and post-crisis (2008-2014) periods. The regression results confirmed that the positive relationship between leverage level and market power was robust through both periods. However, leverage seemed to have a stronger positive effect on market power during the pre-crisis period.

5.1.1.5 Macroeconomic Activity

The macroeconomic variables, namely, GDP growth, and linear and quadratic time trends, were added to the original models. The results were still robust. ΔGDP_t was found to be positive in all models (only Model 1 was not statistically significant), implying that market power, captured by sales growth and Tobin's Q, increased with the state of the economy. The estimates for linear trend and quadratic trend were, respectively, negatively and positively significant when using sales growth as the independent variable, suggesting that sales growth decreased

over time at a decelerating rate. This is in line with the time period in which the economy plunged into recession in the year 2008.

5.1.1.6 Firm Leverage Level

In order to investigate whether firms with different leverage level groups perform differently in the product markets, the firms were grouped and analyzed separately according to their total debt levels, namely, high ($0.50 < TD \leq 0.75$), medium ($0.25 < TD \leq 0.50$), and low ($0 < TD \leq 0.25$) leverage.

The MM robust regression's results revealed that TD was significantly and positively associated with both market power variables, QMV and SG. For both SG and QMV, the lowest leveraged group had the highest degree of association between leverage and market power. This implies that leverage has the most positive effect of boosting market power when the indebtedness level is low. Moreover, in terms of SG, TD was not statistically significant when the firms were in the high TD group, suggesting that when the level of indebtedness is high, additional leverage cannot improve market power as measured by sales growth.

In sum, the lower the leverage is, the greater is the effect of TD on a firm's market output and power. In other words, when the firm's indebtedness level is already high, increasing debt has little or no effect on market power.

5.1.1.7 Firm Sales Growth Level

The firms were categorized according to their sales growth rates (negative growth $SG \leq 0$, 1st positive growth $0 < SG \leq 0.20$, and 2nd positive growth: $SG > 0.20$) in order to investigate whether different levels of debt affect market power differently for firms with different growth rates.

In terms of QMV, total debt was found to be positively and significantly associated with the firm's market power in all three different sales growth groups. However, when SG was employed as the independent variable, for positive sales growth, the TD effects on SG notably increased from 0.1175 to 0.6335, but when the average SG was negative, TD had no effect on SG. This implies that, when the growth is positive, increasing leverage boosts firms' productivity and market power, but when a firm experiences negative growth, additional debt does not benefit its physical output or market power.

5.1.2 Sectoral Analysis

In this section, the firms were grouped within their industrial sectors (as specified by SET) and analyzed sector by sector by means of their average sectoral leverage levels and by their sectoral concentration levels. Summaries of the analyses are given herewith.

5.1.2.1 Sectoral Analysis

In order to investigate the behavior of each individual sector, the regression analyses were carried out separately for all 21 sampled sectors. The results confirmed the main finding of a positive association between leverage and product market power. Although the coefficients of TD and LTD for some sectors were negative, none of them was statistically significant.

5.1.2.2 Sectoral Leverage Level

The sample sectors were categorized into three groups, namely, 2nd Decile (average total debt between 11% - 20%), 3rd Decile (21% - 30%), and 4th Decile (31%-40%). Thereafter, the regression estimations were separately performed in each of these leverage groups, where leverage level was consistently found to be positively associated with the firm's market power.

In sum, no matter whether the firms were in high-, medium-, or low-leveraged industries, leverage led to higher market power. In terms of Tobin's Q, the degrees of positive association declined with leverage groups, suggesting that the positive effect of debt on market power is highest when firms are in a low-leveraged sector. In terms of SG, the 4th Decile group had the highest degree of association between leverage and market power.

5.1.2.3 Market Concentration

The degree of market concentration was measured using the Hirfindahl index. The sample sectors were categorized into three different market concentration levels, namely, Unconcentrated ($HI < 0.15$), Moderate Concentration ($0.15 \leq HI \leq 0.25$), and High Concentration ($HI > 0.25$).

The leverage level was found to be positively associated with the firm's market power in all three different market concentration groups. That is, no matter whether the firms were in highly, moderately, or low-concentrated market environments, the higher leverage level consistently led to higher market power.

Furthermore, the positive association between leverage and market power was found to be strongest when firms were in unconcentrated groups. This is likely because competition is less restricted in low-concentrated industries allowing firms to compete more freely as a commitment from raising debt.

For convenience, all of the findings presented in Sections 5.1.1 and 5.1.2 are summarized in the following Table 5.1.

Table 5.1 Summary of Findings

• Firm-Level Analysis	Summarized Findings
Regression Analysis	<ul style="list-style-type: none"> • The results from MM-type robust estimator regression showed that total debt ratio (TD) and long-term debt ratio (LTD) had a significant positive association with market power proxied by Tobin's Q (QMV) and sales growth (SG).
Panel Data Analysis	<ul style="list-style-type: none"> • To accommodate for heterogeneities across firms and time, <i>fixed-time effects model</i> was employed. • The main hypothesis, that leverage induces market power, was confirmed.
Reverse Causality	<ul style="list-style-type: none"> • The lagged values (up to four periods) of TD and LTD were employed. • The regression results showed that, despite using lagged values of TD and LTD, the same conclusion remained robust.
Different Time Periods	<ul style="list-style-type: none"> • The sample set was separated into two periods, <i>pre-crisis</i> (2005-2007) and <i>post-crisis</i> (2008-2014). • The regression results confirmed the positive association between leverage level and market power in both time periods. The degree of association was stronger in the pre-crisis period. • The structural break test showed that the 2008 sub-prime crisis had a negative impact on SG (shrunk by about three percent) but not on QMV.
Macroeconomic Activity	<ul style="list-style-type: none"> • GDP growth, and linear and quadratic time trends, were added to the original models, and the regression results confirmed the hypothesis.

Table 5.1 (Continued)

• Firm-Level Analysis	Summarized Findings
Firm Leverage Levels	<ul style="list-style-type: none"> • ΔGDP_t was found to be positive in all models (not statistically significant only in Model 1), indicating that sales growth and Tobin's Q move in the same direction with states of the economy. • Firms were grouped by their debt levels: high ($0.50 < TD \leq 0.75$), medium ($0.25 < TD \leq 0.50$), and low ($0 < TD \leq 0.25$). • TD was significantly positively associated with both market power variables, QMV and SG. • For both SG and QMV, leverage had the most positive effect of boosting market power when the indebtedness level was low. • In terms of SG, TD was not significant when firms were in the high-leveraged group. • In sum, the lower the leverage, the greater is the effect of leverage on a firm's market output and power. In other words, when the firm's indebtedness level is already high, increasing debt has little or no effect on market power.
Firm Growth Levels	<ul style="list-style-type: none"> • Firms were categorized by their sales growth rates (Negative $SG \leq 0$; 1st Positive $0 < SG \leq 0.20$; and 2nd Positive $SG > 0.20$). • TD was positively and significantly associated with QMV in all three different sales growth groups. • When SG was positive, the TD effects on SG substantially increased.

Table 5.1 (Continued)

• Firm-Level Analysis	Summarized Findings
	<ul style="list-style-type: none"> • When SG was negative, TD had no effect on SG. • This implies that, when the growth is positive, increasing leverage boosts firms' productivity and market power, but when firms experience negative growth, additional debt does not benefit their market power.
• Sectoral Analysis	Summarized Findings
Sectoral Analysis	<ul style="list-style-type: none"> • In order to investigate the behavior of each sector, regression analyses were carried out separately for all 21 sampled sectors. • The main finding of a positive association between leverage and product market power was confirmed. • Some sectors showed a negative association, but none of them was statistically significant.
Sectoral Leverage Level	<ul style="list-style-type: none"> • Industrial sectors were categorized into three groups: 2nd Decile (average TD between 11% - 20%), 3rd Decile (21% - 30%), and 4th Decile (31%-40%). • The regression results for each of these leverage groups showed a significantly-positive association between leverage and the firm's market power. • In sum, no matter whether the firms were in high-, medium-, or low-leverage industries, leverage led to higher market power.

Table 5.1 (Continued)

• Sectoral Analysis	Summarized Findings
Market Concentration	<ul style="list-style-type: none"> • In terms of Tobin’s Q, the degree of positive association declined with different leverage groups, indicating that the positive effect of debt on market power is when firms are in the low-leveraged sector. • In terms of SG, the degree of association between leverage and market power was highest in the 4th Decile group. • The sample sectors were categorized into three different market concentration levels (measured by Hirfindahl index - HI), namely, Unconcentrated ($HI < 0.15$), Moderate Concentration ($0.15 \leq HI \leq 0.25$), and High Concentration ($HI > 0.25$). • The leverage level was found to be positively associated with firms’ market power in all three different market concentration groups. • However, the positive association between leverage and market power was found to be strongest when the firms were in unconcentrated groups. • In low-concentrated industries, increasing leverage had the highest positive effect on firms’ market power.

5.2 Discussion and Recommendations

Empirical evidence on the limited liability hypothesis was mixed. For instance, Chevalier (1995a, b), Phillips (1995), Kovenock and Phillips (1995), Zingales (1998), and Campello (2003) found the results to be in contradiction with the limited liability theory. The main finding of this dissertation is, however, in favor of the limited liability theory, i.e. leverage leads to stronger market competition as measured by Tobin's Q and sales growth. This is in line with, for example, Smith et al. (2008) and Mitani (2014). An explanation is given by the limited liability theory that a firm employs debt as a commitment tool to compete aggressively in the product market. The prediction of the limited liability theory remained robust against various circumstances.

Another interesting remark is that when using total debt instead of long-term debt as the independent variable, the explanatory powers captured by adjusted R^2 s substantially increased (0.3451 to 0.7824 and 0.0985 to 0.1159, for Tobin's Q and sales growth as independent variables, respectively). The difference between total debt and long-term debt is short-term debt. Therefore, the reason for the improvement in the explanatory power must have come from the inclusion of short-term debt into the leverage variable, suggesting that short-term debt is an important ingredient in managing financial strategies. This supports the findings that, compared to developed countries, developing countries have a substantially lower amount of long-term debt (as they rely more on short-term financing) and hence using long-term debt as an explanatory variable might lead to lower explanatory power (Booth et al., 2001; Demircuc-Kunt & Maksimovic 1999).

Although the use of short-term leverage is not uncommon in developing economies, relying on short-term borrowing is risky and can lead to self-fulfilling liquidity crises (Broner, Lorenzoni, & Schmukler, 2013). On a private level, large amounts of short-term liabilities make it difficult to renew debt, which in turn could cause an outright default (Broner et al., 2013.). On the larger public level, short-term debt for either the public sector or private sector could trigger crises. For instance, short-term debt accumulated by the respective governments led to crises in Mexico in 1995, Russia in 1998, and Brazil in 1999, and by the private sectors in Thailand,

South Korea, and Indonesia led to the South-East Asian crisis in 1997 (Rodrik & Valasco, 1999).

It would thus be interesting to further investigate the nature of short-term debt employed by Thai firms. Furthermore, on the policy making level, in order to mitigate maturity mismatches and the probability of crises, the importance of employing long-term leverage as opposed to the short-term should be promoted (Opazo, Raddatz, & Schmukler, 2009).

5.2.1 Implications for Corporate Strategy and Finance Strategy

This research empirically confirmed a link between financial decisions and corporate strategy—that leverage can be employed as a strategic tool for firms to compete aggressively in the physical product markets. This result was consistent for the majority of the 21 sample sectors (20 for TD and 18 for LTD). This implies that the decisions regarding financial choices and corporate strategy are related and should go hand-in-hand. In addition to the main finding, the following is the empirical evidence exhumed from the analyses that might be taken into consideration in forming financial and corporate strategies.

1) Competition Signal

An increase in leverage level can be comprehended as a signal that the firm will compete more aggressively in the product market.

2) State of Economy

Leverage is positively associated with market power through both an economic boom and recession. However, the effect of leverage on market power seems to be stronger during a boom.

3) Firm's Sales Growth

When a firm's sales growth is positive, the higher is the leverage, the greater is the effect on product market output. However, leverage has no effect on boosting output when the growth is negative.

4) Status Quo of Leverage Position of the Firm

No matter whether the level of indebtedness is high, medium, or low, leverage consistently has a positive effect on a firm's output. However, leverage can boost market power best when the current firm's leverage position is low.

5) Status Quo of Leverage Position of the Industrial Sector

No matter whether firms are in low-, medium-, or high-leveraged sectors, leverage continues to lead to higher market power. In terms of Tobin's Q, the benefit of leverage reduces with the level of leverage, i.e. the positive effect of debt on market power is highest when firms are in a sector of low debt.

6) Concentration Level of Industrial Sector

The leverage level was found to be positively associated with firm market power in three different market concentration groups (unconcentrated, moderately concentrated, and highly concentrated). The positive association between leverage and market power is strongest when firms are in unconcentrated groups.

In sum, leverage has greater effects on market power: if the period is during economic expansion, if firms are low leveraged, if firms are in an unconcentrated industrial sector, and if firms are in a low-leveraged sector.

5.2.2 Implication for Investors

Increasing leverage leads to increasing market power as measured by Tobin's Q and sales growth. Since the definition of Tobin's Q (from Equation 14, Section 3.3.1) is

$$QMV_{it} = \frac{\text{Market Value of Equity}_{it} + \text{Book Value of Liability}_{it}}{\text{Book Value of Total Assets}_{it}},$$

obviously, leverage must lead to an increase in the book value of the liability portion of Tobin's Q. Therefore, suppose for simplicity that the total assets remain constant, whether leverage leads to an increase in the market value of equity remains uncertain and demands further investigation.

From Equation 11 (Section 3.3), sales growth was defined as

$$\text{Sales Growth}_{it} = \frac{\text{Sales}_{it} - \text{Sales}_{it-1}}{\text{Sales}_{it-1}}$$

According to this definition of sales growth, the positivity of SG must come from increases in the sales of period t compared to the previous period $t - 1$. It is empirically evident from this research that as the level of leverage increases, sales growth also increases. Furthermore, increases in sales has been reported to be related to an increase in net income, and net income has been reported to positively associate with a rise in share prices (see e.g. Arkan, 2016; Shin & Thaker, 2017). Therefore, one might be able to deduce from the above premises that leverage leads to an increase in share prices.

Nonetheless, it has also been reported that the net effect on share prices is uncertain, and one reason is that increasing leverage also induces financial risks which, in turn, can have an adverse effect on stock prices (Ardalan, 2017). Moreover, the empirical results of the relationships between leverage and share prices were mixed, i.e. the associations could be either positive or negative (see e.g. Deesomsak, Paudyal, & Pescetto, 2004; Leary and Roberts, 2005; Menon, 2016; and Won Seo and Jin Chung, 2017). Therefore, further investigation and evidence are needed in order to draw sound conclusions.

Future Research

Future research in the area of capital structure should incorporate firms' behavior in physical product markets into capital structure choices. Since short-term debt is an important ingredient of the leverage of Thai firms, the nature and causes of employing the short-term debt of Thai firms should be investigated. The relationship between share prices and leverage decision is also an appealing topic.

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APPENDICES

APPENDIX A

The Sample Firms

No.	Symbol	Company
1. Agribusiness Sector		
1	CHOTI	KIANG HUAT SEA GULL TRADING FROZEN FOOD PUBLIC CO., LTD.
2	EE	ETERNAL ENERGY PUBLIC COMPANY LIMITED
3	GFPT	GFPT PUBLIC COMPANY LIMITED
4	LEE	LEE FEED MILL PUBLIC COMPANY LIMITED
5	STA	SRI TRANG AGRO-INDUSTRY PUBLIC COMPANY LIMITED
6	TRUBB	THAI RUBBER LATEX CORPORATION (THAILAND) PUBLIC CO.,LTD.
7	TWPC	THAI WAH PUBLIC COMPANY LIMITED
8	UPOIC	UNITED PALM OIL INDUSTRY PUBLIC COMPANY LIMITED
2. Automotive Sector		
9	AH	AAPICO HITECH PUBLIC COMPANY LIMITED
10	BAT-3K	THAI STORAGE BATTERY PUBLIC COMPANY LIMITED
11	CWT	CHAI WATANA TANNERY GROUP PUBLIC COMPANY LIMITED
12	EASON	EASON PAINT PUBLIC COMPANY LIMITED
13	GYT	GOODYEAR (THAILAND) PUBLIC COMPANY LIMITED
14	IHL	INTERHIDES PUBLIC COMPANY LIMITED
15	IRC	INOUE RUBBER (THAILAND) PUBLIC COMPANY LIMITED
16	SAT	SOMBOON ADVANCE TECHNOLOGY PUBLIC COMPANY LIMITED
17	STANLY	THAI STANLEY ELECTRIC PUBLIC COMPANY LIMITED
18	TKT	T.KRUNGTHAI INDUSTRIES PUBLIC COMPANY LIMITED
19	TNPC	THAI NAM PLASTIC PUBLIC COMPANY LIMITED
20	TRU	THAI RUNG UNION CAR PUBLIC COMPANY LIMITED
21	TSC	THAI STEEL CABLE PUBLIC COMPANY LIMITED
3. Commerce Sector		
22	BIGC	BIG C SUPERCENTER PUBLIC COMPANY LIMITED
23	BJC	BERLI JUCKER PUBLIC COMPANY LIMITED
24	CPALL	CP ALL PUBLIC COMPANY LIMITED
25	HMPRO	HOME PRODUCT CENTER PUBLIC COMPANY LIMITED
26	IT	IT CITY PUBLIC COMPANY LIMITED
27	KAMART	KARMARTS PUBLIC COMPANY LIMITED
28	LOXLEY	LOXLEY PUBLIC COMPANY LIMITED
29	MAKRO	SIAM MAKRO PUBLIC COMPANY LIMITED
30	SINGER	SINGER THAILAND PUBLIC COMPANY LIMITED
31	SPC	SAHA PATHANAPIBUL PUBLIC COMPANY LIMITED

No.	Symbol	Company (cont.)
4. Construction Materials Sector		
32	CCP	CHONBURI CONCRETE PRODUCT PUBLIC COMPANY LIMITED
33	DCC	DYNASTY CERAMIC PUBLIC COMPANY LIMITED
34	DCON	DCON PRODUCTS PUBLIC COMPANY LIMITED
35	DRT	DIAMOND BUILDING PRODUCTS PUBLIC COMPANY LIMITED
36	GEL	GENERAL ENGINEERING PUBLIC COMPANY LIMITED
37	Q-CON	QUALITY CONSTRUCTION PRODUCTS PUBLIC COMPANY LIMITED
38	RCI	THE ROYAL CERAMIC INDUSTRY PUBLIC COMPANY LIMITED
39	SCC	THE SIAM CEMENT PUBLIC COMPANY LIMITED
40	SCCC	SIAM CITY CEMENT PUBLIC COMPANY LIMITED
41	SCP	SOUTHERN CONCRETE PILE PUBLIC COMPANY LIMITED
42	TASCO	TIPCO ASPHALT PUBLIC COMPANY LIMITED
43	TCMC	THAILAND CARPET MANUFACTURING PUBLIC COMPANY LIMITED
44	TPIPL	TPI POLENE PUBLIC COMPANY LIMITED
45	UMI	THE UNION MOSAIC INDUSTRY PUBLIC COMPANY LIMITED
46	VNG	VANACHAI GROUP PUBLIC COMPANY LIMITED
47	WIJK	WIJK & HOEGLUND PUBLIC COMPANY LIMITED
5. Construction Services Sector		
48	CK	CH. KARNCHANG PUBLIC COMPANY LIMITED
49	CNT	CHRISTIANI & NIELSEN (THAI) PUBLIC COMPANY LIMITED
50	EMC	EMC PUBLIC COMPANY LIMITED
51	ITD	ITALIAN-THAI DEVELOPMENT PUBLIC COMPANY LIMITED
52	NWR	NAWARAT PATANAKARN PUBLIC COMPANY LIMITED
53	PREB	PRE-BUILT PUBLIC COMPANY LIMITED
54	PYLON	PYLON PUBLIC COMPANY LIMITED
55	SEAFCO	SEAFCO PUBLIC COMPANY LIMITED
56	STEC	SINO-THAI ENGINEERING AND CONSTRUCTION PUBLIC CO.,LTD.
57	STPI	STP&I PUBLIC COMPANY LIMITED
58	SYNTEC	SYNTEC CONSTRUCTION PUBLIC COMPANY LIMITED
59	UNIQ	UNIQUE ENGINEERING AND CONSTRUCTION PUBLIC COMPANY LIMITED
6. Electronic Components Sector		
60	CCET	CAL-COMP ELECTRONICS (THAILAND) PUBLIC CO., LTD.
61	DELTA	DELTA ELECTRONICS (THAILAND) PUBLIC COMPANY LIMITED
62	DRACO	DRACO PCB PUBLIC COMPANY LIMITED
63	EIC	ELECTRONICS INDUSTRY PUBLIC COMPANY LIMITED
64	HANA	HANA MICROELECTRONICS PUBLIC COMPANY LIMITED
65	KCE	KCE ELECTRONICS PUBLIC COMPANY LIMITED
66	METCO	MURAMOTO ELECTRON (THAILAND) PUBLIC COMPANY LIMITED
67	SVI	SVI PUBLIC COMPANY LIMITED
68	TEAM	TEAM PRECISION PUBLIC COMPANY LIMITED

No.	Symbol	Company (cont.)
7. Energy & Utilities Sector		
69	AI	ASIAN INSULATORS PUBLIC COMPANY LIMITED
70	AKR	EKARAT ENGINEERING PUBLIC COMPANY LIMITED
71	BAFS	BANGKOK AVIATION FUEL SERVICES PCL.
72	BANPU	BANPU PUBLIC COMPANY LIMITED
73	BCP	THE BANGCHAK PETROLEUM PUBLIC COMPANY LIMITED
74	DEMCO	DEMCO PUBLIC COMPANY LIMITED
75	EASTW	EASTERN WATER RESOURCES DEVELOPMENT AND MANAGEMENT PCL.
76	EGCO	ELECTRICITY GENERATING PUBLIC COMPANY LIMITED
77	GLOW	GLOW ENERGY PUBLIC COMPANY LIMITED
78	IFEC	INTER FAR EAST ENERGY CORPORATION PUBLIC COMPANY LIMITED
79	IRPC	IRPC PUBLIC COMPANY LIMITED
80	LANNA	THE LANNA RESOURCES PUBLIC COMPANY LIMITED
81	PTT	PTT PUBLIC COMPANY LIMITED
82	PTTEP	PTT EXPLORATION AND PRODUCTION PUBLIC COMPANY LIMITED
83	RATCH	RATCHABURI ELECTRICITY GENERATING HOLDING PUBLIC CO.,LTD.
84	RPC	RPCG PUBLIC COMPANY LIMITED
85	SCG	SAHACOGEN (CHONBURI) PUBLIC COMPANY LIMITED
86	SGP	SIAMGAS AND PETROCHEMICALS PUBLIC COMPANY LIMITED
87	SOLAR	SOLARTRON PUBLIC COMPANY LIMITED
88	SPCG	SPCG PUBLIC COMPANY LIMITED
89	SUPER	SUPERBLOCK PUBLIC COMPANY LIMITED
90	SUSCO	SUSCO PUBLIC COMPANY LIMITED
91	TOP	THAI OIL PUBLIC COMPANY LIMITED
92	TTW	TTW PUBLIC COMPANY LIMITED
8. Fashion Sector		
93	ABC	ASSET BRIGHT PUBLIC COMPANY LIMITED
94	AFC	ASIA FIBER PUBLIC COMPANY LIMITED
95	BTNC	BOUTIQUE NEWCITY PUBLIC COMPANY LIMITED
96	CPH	CASTLE PEAK HOLDINGS PUBLIC COMPANY LIMITED
97	CPL	C.P.L. GROUP PUBLIC COMPANY LIMITED
98	ICC	I.C.C. INTERNATIONAL PUBLIC COMPANY LIMITED
99	LTX	LUCKYTEX (THAILAND) PUBLIC COMPANY LIMITED
100	NC	NEWCITY (BANGKOK) PUBLIC COMPANY LIMITED
101	PAF	PAN ASIA FOOTWEAR PUBLIC COMPANY LIMITED
102	PG	PEOPLE'S GARMENT PUBLIC COMPANY LIMITED
103	PRANDA	PRANDA JEWELRY PUBLIC COMPANY LIMITED
104	SAWANG	SAWANG EXPORT PUBLIC COMPANY LIMITED
105	SUC	SAHA-UNION PUBLIC COMPANY LIMITED
106	TNL	THANULUX PUBLIC COMPANY LIMITED

No.	Symbol	Company (cont.)
107	TPCORP	TEXTILE PRESTIGE PUBLIC COMPANY LIMITED
108	TR	THAI RAYON PUBLIC COMPANY LIMITED
109	TTL	TTL INDUSTRIES PUBLIC COMPANY LIMITED
110	TTTM	THAI TORAY TEXTILE MILLS PUBLIC COMPANY LIMITED
111	UPF	UNION PIONEER PUBLIC COMPANY LIMITED
112	UT	UNION TEXTILE INDUSTRIES PUBLIC COMPANY LIMITED
113	WACOAL	THAI WACOAL PUBLIC COMPANY LIMITED
		9. Food & Beverage Sector
114	APURE	AGRIPURE HOLDINGS PUBLIC COMPANY LIMITED
115	ASIAN	ASIAN SEAFOODS COLDSTORAGE PUBLIC COMPANY LIMITED
116	CFRESH	SEAFRESH INDUSTRY PUBLIC COMPANY LIMITED
117	CM	CHIANGMAI FROZEN FOODS PUBLIC COMPANY LIMITED
118	CPF	CHAROEN POKPHAND FOODS PUBLIC COMPANY LIMITED
119	F&D	FOOD AND DRINKS PUBLIC COMPANY LIMITED
120	HTC	HAAD THIP PUBLIC COMPANY LIMITED
121	KSL	KHON KAEN SUGAR INDUSTRY PUBLIC COMPANY LIMITED
122	LST	LAM SOON (THAILAND) PUBLIC COMPANY LIMITED
123	MINT	MINOR INTERNATIONAL PUBLIC COMPANY LIMITED
124	OISHI	OISHI GROUP PUBLIC COMPANY LIMITED
125	PB	PRESIDENT BAKERY PUBLIC COMPANY LIMITED
126	SAUCE	THAITHEPAROS PUBLIC COMPANY LIMITED
127	SNP	S & P SYNDICATE PUBLIC COMPANY LIMITED
128	SORKON	S. KHONKAEN FOODS PUBLIC COMPANY LIMITED
129	SSC	SERMSUK PUBLIC COMPANY LIMITED
130	SSF	SURAPON FOODS PUBLIC COMPANY LIMITED
131	TF	THAI PRESIDENT FOODS PUBLIC COMPANY LIMITED
132	TIPCO	TIPCO FOODS PUBLIC COMPANY LIMITED
133	TU	THAI UNION GROUP PUBLIC COMPANY LIMITED
134	TVO	THAI VEGETABLE OIL PUBLIC COMPANY LIMITED
		10. Health Care Services Sector
135	AHC	AIKCHOL HOSPITAL PUBLIC COMPANY LIMITED
136	BCH	BANGKOK CHAIN HOSPITAL PUBLIC COMPANY LIMITED
137	BDMS	BANGKOK DUSIT MEDICAL SERVICES PUBLIC COMPANY LIMITED
138	BH	BUMRUNGRAD HOSPITAL PUBLIC COMPANY LIMITED
139	CMR	CHIANG MAI RAM MEDICAL BUSINESS PUBLIC COMPANY LIMITED
140	KDH	THONBURI MEDICAL CENTRE PUBLIC COMPANY LIMITED
141	M-CHAI	MAHACHAI HOSPITAL PUBLIC COMPANY LIMITED
142	NEW	WATTANA KARNPAET PUBLIC COMPANY LIMITED
143	NTV	NONTHAVEJ HOSPITAL PUBLIC COMPANY LIMITED
144	RAM	RAMKHAMHAENG HOSPITAL PUBLIC COMPANY LIMITED
145	SKR	SIKARIN PUBLIC COMPANY LIMITED
146	SVH	SAMITVEJ PUBLIC COMPANY LIMITED

No.	Symbol	Company (cont.)
147	VIBHA	VIBHAVADI MEDICAL CENTER PUBLIC COMPANY LIMITED
11. Home & Office Products Sector		
148	FANCY	FANCY WOOD INDUSTRIES PUBLIC COMPANY LIMITED
149	KYE	KANG YONG ELECTRIC PUBLIC COMPANY LIMITED
150	L&E	LIGHTING & EQUIPMENT PUBLIC COMPANY LIMITED
151	MODERN	MODERNFORM GROUP PUBLIC COMPANY LIMITED
152	OGC	OCEAN GLASS PUBLIC COMPANY LIMITED
153	ROCK	ROCKWORTH PUBLIC COMPANY LIMITED
12. Industrial Materials & Machinery Sector		
154	CTW	CHAROONG THAI WIRE & CABLE PUBLIC COMPANY LIMITED
155	FMT	FURUKAWA METAL (THAILAND) PUBLIC COMPANY LIMITED
156	KKC	KULTHORN KIRBY PUBLIC COMPANY LIMITED
157	SNC	SNC FORMER PUBLIC COMPANY LIMITED
158	TCJ	T.C.J. ASIA PUBLIC COMPANY LIMITED
159	VARO	VAROPAKORN PUBLIC COMPANY LIMITED
13. Information & Communication Technology Sector		
160	ADVANC	ADVANCED INFO SERVICE PUBLIC COMPANY LIMITED
161	AIT	ADVANCED INFORMATION TECHNOLOGY PUBLIC CO.,LTD.
162	DTAC	TOTAL ACCESS COMMUNICATION PUBLIC COMPANY LIMITED
163	FER	FERRUM PUBLIC COMPANY LIMITED
164	IEC	THE INTERNATIONAL ENGINEERING PUBLIC COMPANY LIMITED
165	ILINK	INTERLINK COMMUNICATION PUBLIC COMPANY LIMITED
166	INTUCH	INTOUCH HOLDINGS PUBLIC COMPANY LIMITED
167	JAS	JASMINE INTERNATIONAL PUBLIC COMPANY LIMITED
168	JTS	JASMINE TELECOM SYSTEMS PUBLIC COMPANY LIMITED
169	MFEC	MFEC PUBLIC COMPANY LIMITED
170	MSC	METRO SYSTEMS CORPORATION PUBLIC COMPANY LIMITED
171	PT	PREMIER TECHNOLOGY PUBLIC COMPANY LIMITED
172	SAMART	SAMART CORPORATION PUBLIC COMPANY LIMITED
173	SAMTEL	SAMART TELCOMS PUBLIC COMPANY LIMITED
174	SVOA	SVOA PUBLIC COMPANY LIMITED
175	THCOM	THAICOM PUBLIC COMPANY LIMITED
176	TWZ	TWZ CORPORATION PUBLIC COMPANY LIMITED
177	TRUE	TRUE CORPORATION PUBLIC COMPANY LIMITED
14. Media & Publishing Sector		
178	AMARIN	AMARIN PRINTING AND PUBLISHING PUBLIC COMPANY LIMITED
179	AQUA	AQUA CORPORATION PUBLIC COMPANY LIMITED
180	BEC	BEC WORLD PUBLIC COMPANY LIMITED
181	EPCO	EASTERN PRINTING PUBLIC COMPANY LIMITED
182	FE	FAR EAST DDB PUBLIC COMPANY LIMITED
183	GRAMMY	GMM GRAMMY PUBLIC COMPANY LIMITED
184	MACO	MASTER AD PUBLIC COMPANY LIMITED

No.	Symbol	Company (cont.)
185	MAJOR	MAJOR CINEPLEX GROUP PUBLIC COMPANY LIMITED
186	MATCH	MATCHING MAXIMIZE SOLUTION PUBLIC COMPANY LIMITED
187	MATI	MATICHON PUBLIC COMPANY LIMITED
188	MCOT	MCOT PUBLIC COMPANY LIMITED
189	NMG	NATION MULTIMEDIA GROUP PUBLIC COMPANY LIMITED
190	PRAKIT	PRAKIT HOLDINGS PUBLIC COMPANY LIMITED
191	RS	RS PUBLIC COMPANY LIMITED
192	SE-ED	SE-EDUCATION PUBLIC COMPANY LIMITED
193	SMM	SIAM INTER MULTIMEDIA PUBLIC COMPANY LIMITED
194	SPORT	SIAM SPORT SYNDICATE PUBLIC COMPANY LIMITED
195	TH	TONG HUA COMMUNICATIONS PUBLIC COMPANY LIMITED
196	TKS	T.K.S. TECHNOLOGIES PUBLIC COMPANY LIMITED
197	WORK	WORKPOINT ENTERTAINMENT PUBLIC COMPANY LIMITED
15. Packaging Sector		
198	AJ	A.J. PLAST PUBLIC COMPANY LIMITED
199	ALUCON	ALUCON PUBLIC COMPANY LIMITED
200	CSC	CROWN SEAL PUBLIC COMPANY LIMITED
201	NEP	NEP REALTY AND INDUSTRY PUBLIC COMPANY LIMITED
202	NPP	NIPPON PACK (THAILAND) PUBLIC COMPANY LIMITED
203	PTL	POLYPLEX (THAILAND) PUBLIC COMPANY LIMITED
204	SITHAI	SRITHAI SUPERWARE PUBLIC COMPANY LIMITED
205	TCOAT	THAI COATING INDUSTRIAL PUBLIC COMPANY LIMITED
206	TFI	THAI FILM INDUSTRIES PUBLIC COMPANY LIMITED
207	THIP	THANTAWAN INDUSTRY PUBLIC COMPANY LIMITED
208	TMD	THAI METAL DRUM MANUFACTURING PUBLIC COMPANY LIMITED
209	TPP	THAI PACKAGING & PRINTING PUBLIC COMPANY LIMITED
16. Personal Products & Pharmaceuticals Sector		
210	DSGT	DSG INTERNATIONAL (THAILAND) PUBLIC COMPANY LIMITED
211	OCC	O.C.C. PUBLIC COMPANY LIMITED
212	S&J	S & J INTERNATIONAL ENTERPRISES PUBLIC COMPANY LIMITED
213	TOG	THAI OPTICAL GROUP PUBLIC COMPANY LIMITED
17. Petrochemicals and Chemicals Sector		
214	PATO	PATO CHEMICAL INDUSTRY PUBLIC COMPANY LIMITED
215	PMTA	PM THORESEN ASIA HOLDINGS PUBLIC COMPANY LIMITED
216	TCB	THAI CARBON BLACK PUBLIC COMPANY LIMITED
217	TCCC	THAI CENTRAL CHEMICAL PUBLIC COMPANY LIMITED
218	TPC	THAI PLASTIC AND CHEMICALS PUBLIC COMPANY LIMITED
219	UP	UNION PLASTIC PUBLIC COMPANY LIMITED
220	VNT	VINYTHAI PUBLIC COMPANY LIMITED
221	WG	WHITE GROUP PUBLIC COMPANY LIMITED

No.	Symbol	Company (cont.)
18. Property Development Sector		
222	AP	AP (THAILAND) PUBLIC COMPANY LIMITED
223	AQ	AQ ESTATE PUBLIC COMPANY LIMITED
224	BLAND	BANGKOK LAND PUBLIC COMPANY LIMITED
225	CGD	COUNTRY GROUP DEVELOPMENT PUBLIC COMPANY LIMITED
226	ESTAR	EASTERN STAR REAL ESTATE PUBLIC COMPANY LIMITED
227	GLAND	GRAND CANAL LAND PUBLIC COMPANY LIMITED
228	HEMRAJ	HEMARAJ LAND AND DEVELOPMENT PUBLIC COMPANY LIMITED
229	KC	K.C. PROPERTY PUBLIC COMPANY LIMITED
230	LH	LAND AND HOUSES PUBLIC COMPANY LIMITED
231	LPN	L.P.N. DEVELOPMENT PUBLIC COMPANY LIMITED
232	MBK	MBK PUBLIC COMPANY LIMITED
233	MJD	MAJOR DEVELOPMENT PUBLIC COMPANY LIMITED
234	MK	M.K. REAL ESTATE DEVELOPMENT PUBLIC COMPANY LIMITED
235	NOBLE	NOBLE DEVELOPMENT PUBLIC COMPANY LIMITED
236	PF	PROPERTY PERFECT PUBLIC COMPANY LIMITED
237	PRECHA	PREECHA GROUP PUBLIC COMPANY LIMITED
238	PRIN	PRINSIRI PUBLIC COMPANY LIMITED
239	PS	PRUKSA REAL ESTATE PUBLIC COMPANY LIMITED
240	QH	QUALITY HOUSES PUBLIC COMPANY LIMITED
241	S	SINGHA ESTATE PUBLIC COMPANY LIMITED
242	SAMCO	SAMMAKORN PUBLIC COMPANY LIMITED
243	SPALI	SUPALAI PUBLIC COMPANY LIMITED
244	TFD	THAI FACTORY DEVELOPMENT PUBLIC COMPANY LIMITED
245	UV	UNIVENTURES PUBLIC COMPANY LIMITED
19. Steel Sector		
246	CEN	CAPITAL ENGINEERING NETWORK PUBLIC COMPANY LIMITED
247	CITY	CITY STEEL PUBLIC COMPANY LIMITED
248	CSP	CSP STEEL CENTER PUBLIC COMPANY LIMITED
249	GJS	G J STEEL PUBLIC COMPANY LIMITED
250	GSTEL	G STEEL PUBLIC COMPANY LIMITED
251	INOX	POSCO-THAINOX PUBLIC COMPANY LIMITED
252	MAX	MAX METAL CORPORATION PUBLIC COMPANY LIMITED
253	MCS	M.C.S. STEEL PUBLIC COMPANY LIMITED
254	MILL	MILLCON STEEL PUBLIC COMPANY LIMITED
255	PAP	PACIFIC PIPE PUBLIC COMPANY LIMITED
256	PERM	PERMSIN STEEL WORKS PUBLIC COMPANY LIMITED
257	RICH	RICH ASIA STEEL PUBLIC COMPANY LIMITED
258	SAM	SAMCHAI STEEL INDUSTRIES PUBLIC COMPANY LIMITED
259	SMIT	SAHAMIT MACHINERY PUBLIC COMPANY LIMITED
260	SSI	SAHAVIRIYA STEEL INDUSTRIES PUBLIC COMPANY LIMITED
261	SSSC	SIAM STEEL SERVICE CENTER PUBLIC COMPANY LIMITED

No.	Symbol	Company (cont.)
262	THE	THE STEEL PUBLIC COMPANY LIMITED
263	TIW	THAILAND IRON WORKS PUBLIC COMPANY LIMITED
264	TMT	THAI METAL TRADE PUBLIC COMPANY LIMITED
265	TSTH	TATA STEEL (THAILAND) PUBLIC COMPANY LIMITED
266	TWP	THAI WIRE PRODUCTS PUBLIC COMPANY LIMITED
267	TYCN	TYCOONS WORLDWIDE GROUP (THAILAND) PUBLIC CO.,LTD.
20. Tourism & Leisure Sector		
268	ACD	ASIA CORPORATE DEVELOPMENT PUBLIC COMPANY LIMITED
269	ASIA	ASIA HOTEL PUBLIC COMPANY LIMITED
270	CENTEL	CENTRAL PLAZA HOTEL PUBLIC COMPANY LIMITED
271	CSR	CITY SPORTS AND RECREATION PUBLIC COMPANY LIMITED
272	DTC	DUSIT THANI PUBLIC COMPANY LIMITED
273	ERW	THE ERAWAN GROUP PUBLIC COMPANY LIMITED
274	GRAND	GRANDE ASSET HOTELS AND PROPERTY PUBLIC COMPANY LIMITED
275	LRH	LAGUNA RESORTS & HOTELS PUBLIC COMPANY LIMITED
276	MANRIN	THE MANDARIN HOTEL PUBLIC COMPANY LIMITED
277	OHTL	OHTL PUBLIC COMPANY LIMITED
21. Transportation & Logistics Sector		
278	AOT	AIRPORTS OF THAILAND PUBLIC COMPANY LIMITED
279	ASIMAR	ASIAN MARINE SERVICES PUBLIC COMPANY LIMITED
280	BECL	BANGKOK EXPRESSWAY PUBLIC COMPANY LIMITED
281	BMCL	BANGKOK METRO PUBLIC COMPANY LIMITED
282	BTC	BANGPAKONG TERMINAL PUBLIC COMPANY LIMITED
283	JUTHA	JUTHA MARITIME PUBLIC COMPANY LIMITED
284	KWC	KRUNGDHEP SOPHON PUBLIC COMPANY LIMITED
285	PSL	PRECIOUS SHIPPING PUBLIC COMPANY LIMITED
286	RCL	REGIONAL CONTAINER LINES PUBLIC COMPANY LIMITED
287	THAI	THAI AIRWAYS INTERNATIONAL PUBLIC COMPANY LIMITED
288	TSTE	THAI SUGAR TERMINAL PUBLIC COMPANY LIMITED
289	TTA	THORESEN THAI AGENCIES PUBLIC COMPANY LIMITED

BIOGRAPHY

NAME

Mr. Prajya Ngamjan

ACADEMIC BACKGROUND

MSc. Banking and Finance

University of Stirling, U.K., 1996

PRESENT POSITION

Lecturer in Finance

Finance and Accounting Department,

Faculty of Liberal Arts and Management

Science,

Kasetsart University,

Chalermphrakiat Sakonnakhon Province

Campus

Sakon Nakhon, Thailand