JOINT DETERMINATION OF FIRM DEBT, OWNERSHIP STRUCTURE ON FIRM'S PERFORMANCE: A METHODOLOGICAL REVIEW

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ABSTRACT

Debt-equity choice is one important activity of financing policy. Previous studies use a straightforward regression in analyzing determinants of debt-equity choice by assuming an ownership structure is exogenous. Whereas, other related studies on ownership structure, instead assume that the level of debt is an exogenous variable. The same variable has been used interchangeably either as a dependent and an independent variable.

Although this assumption seems common, other studies have argued that ownership structure is a function of level of debt and other firm's variables. The same variables are used interchangeably. If the level of debt is a proxy for both debt-equity choice and ownership structure, it is highly likely that the level of debt and the ownership structure is jointly determined. Consequently, the ordinary least square will generate inconsistent parameter estimates, which can lead to misinterpretation of the regression results and incorrect management decision. Hence, it is necessary to look at these variables simultaneously.

This paper has two contributions. Firstly, it provides a methodological review of the usage of simultaneous equation to overcome endogeneity bias. Secondly, this study offers three simultaneous equation model that consist debt-equity choice, ownership structure, and firm performance equations. The simultaneous multiple equation can be used to re-examine the determinants of debt-equity choice, investigate its link to the ownership structure and the firm performance and *vice versa*, and also examine the agency problem that might take place.

This methodological reflection proves that one analysis is not sufficient for financial study. A series of test is necessary in order to find which result can be used to make valid conclusions.

Keywords: debt-equity choice, ownership structure, endogeneity bias, joint determined, firm performance and simultaneous multiple regression.

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I. INTRODUCTION

Previous studies have widely accepted that debt-equity choice and ownership structure are related to firms' performance and have invoked agency problems to explain it independently. At least since Jensen & Meckling (1976), previous works have assumed the ownership structure and other determinants as exogenous variables. The ownership structure and the other exogenous variables are hypothesized to have an effect on the firm debt and performance[1]. Rajan and Zingales (1995) state that firm debt may be explained by four exogenous variables such as tangibility of fixed assets, growth opportunities, firm size, and profitability[2]. Related studies on ownership structure, for instance, Kim and Sorensen (1986), Agrawal and Mandelker (1987), Friend and Lang (1988), McConnel and Servaes (1995), Moh'd, Perry and Rimeby (1998), Brailsford, Oliver and Pua, (1999) have assumed the ownership structure as an exogenous variable in their study to investigate the determinants of firm debt.

Although this assumption seems common, other studies have argued that the ownership structure is a function of level of debt and other firm's variables[3]. The same variables, namely the level of debt and the ownership structure were used interchangeably as a dependent and an independent variable. If the level of debt as well as the ownership structure is endogenous, the ordinary least square (OLS) will generate inconsistent parameter estimate, which can lead to misinterpretation of the regression results and incorrect management decisions (Cho, 1998: 104)[4]. Hence, there is a good reason to believe that *the level of firm debt, the ownership structure, as well as the firm performance have been jointly determined, thereby it is necessary to look at it simultaneously*[5].

There are a number of studies, which investigate the debt-equity choice and the ownership structure independently, but virtually very little work has been carried out on this endogeneity issue. There are

[1] *Generally previous studies use insider block ownership as a proxy of the ownership structure. For instance McConnel & Servaes (1995), Moh'd, Perry & Rimeby (1998), Brailsford, Oliver & Pua (1999) assume that the insider ownership is an exogenous variable.*

[2] *Rajan & Zingales (1995) use four key independent variables to analyze the determinants of capital structure across the G – 7 countries. Lee et al., (1999) use these four variables to examine the determining power of corporate debt in Korea in order to investigate the major differences in the capital structure choices between chaebol and non-chaebol firms. Bevan & Danbolt (2000) use the same variables to examine the determinants of capital structure in the U.K.*

[3] *Morck Shleifer & Vishny (1988), McConnel & Servaes (1990) in their study assume the level of debt as an exogenous variable and the insider ownership as an endogenous variable.*

[4] *In similar vein, Jensen, Solberg, & Zorn (1992: 248) argue if the insider ownership is itself endogenous, previous evidence that assume the insider ownership affects debt and dividend policy might be misleading.*

[5] *Pindyck and Rubinfeld (1991: 314-315) point out that the ordinary least squares estimation is inconsistent as well as biased. Thereby there is a serious specification error in one equation can affect the parameter estimate in the other equations. Also see Wonnacott & Wonnacott (1979: 256-260). The previous studies that have been reviewed in this study have a similar vein. See Table: 1 on the appendix of this paper.*

previous studies that have paid attention to this issue by using simultaneous equation method studies by Jensen, Solberg & Zorn (1992), Agrawal & Knoeber (1993), Bathala, Moon & Rao Cho (1998), Barnhart & Rosenstein (1998), and Chen & Steiner (1999). Although these studies slightly different focus the evidence indicate that firm debt, ownership structure on the firm performance are being jointly determined.

attention to this methodological issue the paper has two major tasks. First, the objective of paper is to make a methodological review whether there is a joint determination of firm debt, ownership structure, and firm performance. If this condition takes place, then it is necessary to see whether this joint determination impacts seriously on the findings of ordinary least square[6]. In addition, the second task, this paper would like to offer a simultaneous multiple equations model as a solution overcome this endogeneity bias and can be used re-examine the determinants of debt-equity choice. can also be used to investigate the agency problems that might occur, and the link between debt-equity choice, ownership structure, and firm performance.

rest of the paper is organized in the following manner. Section 2 presents a review of debt-equity choice theories and how it's jointly determined on the ownership structure and the firm performance. The three simultaneous equations that can be used to overcome the limitation of single equation are offered in section 3. This simultaneous model allows us to powerfully overcome the endogeneity problem in the study of the debt-equity choice, the ownership structure on the firm performance. Section 4 presents the conclusion and suggestion for the future study.

II. A REVIEW OF DEBT-EQUITY CHOICE THEORIES AND ITS JOINT DETERMINATION ON OWNERSHIP STRUCTURE AND FIRM PERFORMANCE

Modigliani & Miller (1958) posit that capital structure is irrelevant to the value of the firm. This argument is founded upon a number of restrictive assumptions[7]. There are two main streams in the literature following Modigliani & Miller (1958) namely *target leverage ratio or trade-off theory* that is defined as the mix of debt and equity, which maximizes the value of the firm. Myers (1984) reviews this framework

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There is only a few studies that have paid attention to this methodological issue. Since 1990, we only found 6 (six) papers in Journal of Financial Economic, Journal of Financial and Quantitative Analysis, Financial Review, Financial Management, which are related to this matter. The summary of this review can be seen in Table 1.

These assumptions include no transaction costs, no taxes or inflation, the equality of borrowing and lending rates, no bankruptcy cost and independence of financing and investment decisions.

and refers to it as the static tradeoff theory. He discusses two problems. First, cost of adjustment will lead to lags in adjustment to the optimal capital structure. Second, cross-sectional empirical tests are influenced by a divergence from target. These differences between the optimal debt ratio and the actual debt ratio may arise due to re-capitalization costs, or other reasons[8]. The second stream is known as *the fund cost hierarchy or pecking order theory*. This stream states that internal funds (retained earnings) are always cheaper than debt funds or funds raised on external equity market (Myers & Majluf, 1984).

The tradeoff theory says, firms' optimal debt-equity ratio is determined by trading off the benefits of debt with the costs. All of these costs such as taxation, bankruptcy, financial distress costs and agency costs influence the level of debt. Modigliani & Miller (1958, 1963) argue that tax deductibility of interest payments can make this ratio optimal for firms. Miller (1977) extends this work, deriving an expression for the gain from leverage when different tax rates are applied to corporate profit, personal earnings from stock and personal interest earnings. The implication of the influence of taxation on debt-equity choices is the optimal leverage may increase as corporate tax rates rise.

In reality, bankruptcy imposes both direct and indirect costs on the firm. The direct cost includes legal expenses, trustee fees and other payment that accrue to parties other that debtholders or shareholders. The indirect bankruptcy cost includes disruption of operations, loss of suppliers and market share and the imposition of financial constraints by creditors. Prior studies find that these bankruptcy and financial distress costs carry a number of implications for debt-equity choices. Optimal debt level may be inversely related to measures of financial risk such as cash flow volatility although the findings are not conclusive [Bradley, Jarrell & Kim (1984) and Banerjee, Hesmati & Wihlborg (1999)], while, Chen, Leinsink & Sterken (1998) find a positive relationship.

Optimal leverage ratio may also be positively related to the firm size (Shuetrim, Lowe & Morling, 1993). If bankruptcy costs include a fixed component, this costs constitutes a larger fraction of the value of a firm as the firm size decreases (Ang, Chua & McConnel, 1982). Homaifar (1994) find a positive relationship but Banerjee, Hesmati & Wihlborg (1999) find a negative relationship between these variables.

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[8]   *See de Jong (1999: 11)*

agency costs are borne by firm's owners as a result of potential conflicts between debtholders and *shareholders* and between managers and shareholders (Jensen & Meckling, 1976). Titman and Wessels *(1988)* suggest that a firm's growth opportunity is a good proxy for the agency costs of debt. Firms with *significant* growth opportunities are expected to use equity rather than debt as a source of finance. De *Jong (1999, 2000)*, Homaifar (1994), Chen, Leinsink & Sterken (1998). Wald (1999), Rajan and Zingales *(1995)* find a negative relationship between firm's growth opportunities and level of firm debt, while *Kester (1986)* does not find a significant relationship.

Pecking order theory assumes that firms do not have a target for a specific debt ratio, but the use of *internal* financing is undertaken only when internal funds are insufficient. According to this theory, *firms have* the order of preference when issuing financing preferring the use of retained earnings, followed *by borrowing* through debt instrument and lastly issuing new shares. Using retained earning and issuance *new shares* reflect the ownership by shareholders while borrowing through debt instrument represents *the ownership* by debtholders (Megginson, 1997).

Since the information between management and investors is asymmetric, external funds are less desirable. *If firms have* to resort to external funds, they prefer to use debt, convertible securities, and the last *option would* be using equity (Myers & Majluf, 1984; Myers, 1984). A variety of market imperfections *are also capable* of explaining variations in the relative costs of different funds types (Shuetrim, Lowe & *Morling, 1993)*. Costs and delays involved in raising funds on equity markets may lead to a preference *for internal* equity and debt over external equity. In addition, some firms may prefer to maintain privacy. *When debt* finance is used, information is provided to bankers, but there is no requirement for the *disclosure* of information to the capital market, competitors, or to shareholders (Shuetrim, Lowe & *Morling, 1993)*. The advantages of privacy and costs of releasing information may generate a fund cost *hierarchy*. When new equity is issued to new owners, it may dilute the claims of existing shareholders.

Pecking order theory implies a negative relationship between cash flow and the firm debt because, the *increasing* of firm's cash flow makes firms are able to rely more heavily on internal funds (Myers & *Majluf, 1984)*. The profitability will be a proxy for available internal funds. If a firm is successful and *has earning* profits, there should be a sufficient internal fund for investment. Hence, it is assumed to *have a* negative relationship between firm debts (Myers & Majluf, 1984).

Both theories (trade-off and pecking order theory) lead to an understanding that debt-equity choice has a close relationship with the ownership structure and assumed it with other variables, and to tread them as exogenous variables[9]. Previous studies that examine an optimal mix between inside and outside block ownership have assumed that the firm debt as an exogenous variable (Morck, Shleifer & Vishny, 1988; Mehran, 1995). Based on this theoretical review, it can be concluded that the joint determination between firm debt, ownership structure on firm performance has taken place[10].

Although there are only a few previous studies that have paid attention on this methodological issue, their findings can be used as guidance. A comparison between the result of OLS and 2SLS (two stage least squares) or 3SLS (three stage least squares) of these previous studies lead a conclusion that the results of OLS are not consistent. This view concerns with the econometrics viewpoint, when there is an endogeneity bias, the OLS will have an inconsistent parameter result (Pindyck & Rubinfeld (1991), Wonnacott & Wonnacott (1979), Gujarati (1995)).[11]

A review of debt-equity choice, ownership structure and firm performance as an endogenous variable

Debt-equity choice as a endogenous variable

Debt-equity choice has been become one of dominant research topics in financial economics. Generally, the level of firm debt is used as a proxy of debt-equity choice. Firm's debt is often measured by the total debt divided by total assets. The natural logarithm transformation of total debt / total asset is normally used to mitigate problems with the sample distribution of the ratio. Firm debt can be separated into short-term and long-term debt. They have a different speed and flexibility. A short-term debt can be obtained as much a faster rate than the long-term, and the former also has more flexibility than the latter. Long-term debt agreements always contain provisions, or covenants, which constrain the firm's future action. Short-term credit agreements are generally much less onerous in this regard (Brigham, 1992,

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[9]   *Harris and Raviv (1991) offer an excellent survey of capital structure theories.*

[10]   *For example, the model that introduced by Mehran (1992: 544) is* **leverage ratio** *= f (percentage of executive total compensation in options, percentage of equity owned by managers, percentage of outside board members, percentage of shares owned by individual investors, percentage of shares owned y institutional investors, percentage of share owned by corporations, growth opportunities, collateral value of assets, business risk). McConnell & Servaes (1995: 141) have a model Tobin's Q = f (Debt/RV, INOWN-squared, LB, INSTO, R&D/RV, ADV/RV, RV). The same variable, the level of debt and the firm performance were used interchangeably as a dependent and an independent variable (a jointly determined are in italics font style).*

[11]   *The summary of this methodological review can be seen in table 1.*

Even though the short-term debt often has more speed and flexibility as well as less expensive that the long-term one, it also has more risks than the long-term debt. This occurs for two reasons. First, if a firm borrows on a long-term basis, its interest costs will be relatively stable over time, but if it uses short-term debt, its interest expense will fluctuate widely, at time at quite high rates. Second, if a firm borrows heavily on a short-tem basis, it may find itself unable to repay the debt. This condition induces poorer financial position when the lender will not extend the loan period, and is an able to force the firm into bankruptcy (Brigham, 1992: 711).

Ownership structure as a joint determination

The ownership structure as a determinant of firm debt can be classified into external block ownership and managerial block ownership. There are two hypotheses related to the external block ownership namely active monitoring and passive voter hypothesis. The active monitoring hypothesis states that the external block-holders reduce the scope of managerial opportunism, resulting in lower direct agency conflicts between manager and shareholders (Sheifer & Vishny, 1986; Friend & Lang, 1988). Firms with higher level of external block ownership are likely to have higher debt ratio, *ceteris paribus* (Brailsford, Oliver & Pua, 1999). Opposite to the active monitoring hypothesis is known as passive voter hypothesis (McConnel & Servaes, 1990).

The hypothesis that is related to the managerial block ownership is convergence of interest hypothesis. It states that at low levels of managerial share ownership, the firm value increases due to the convergence of interest effects. Managerial block ownership and debt ratio are found to be curvilinear (McConnel & Servaes, 1995; Brailsford, Oliver & Pua, 1999). In this respect firm debt is arguably induces ownership structure, and likewise the ownership structure influences firm debt.

The other exogenous variables

The other determinants such as firm risk, agency cost, effects of taxes are also assumed to be exogenous. This study uses the four basic variables as introduced by Rajan & Zingales (1995: 1451), and extends it to allow better understanding of the debt-equity choice and its determinants.

The other variables to control firm risk are firm size (Himmelberg et al., 1999: 14; Brailsford, Oliver & Pua, 1999:12; Titman and Wessels, 1988; Homaifar, 1994; Banerjee, Hesmati & Wihlborg, 1999; de Jong, 1999), earnings volatility (De Angelo & Masulis, 1980; Chen & Steiner, 1998; Titman & Wessels, 1988), and industry classification.

The variables used to control agency costs are profitability and tangibility of assets. Titman and Wessel (1988); Brailsford, Oliver & Pua, (1999) use it as a proxy of agency cost.

The variables used to control the effect of taxes are dividend pay out ratio (Moh'd, Perry & Rimbey, 1998) and marginal taxes payment (Homaifar, 1994).

Ownership structure as endogenous variable

The ownership structure in previous studies has been classified into external block ownership and managerial block ownership. Managerial block ownership is defined as the percentage share own by body of men (people) who, in law, have formally assumed the duties of exercising domination over the corporate business and assets (Berle & Means, 1932: 196). External block ownership has traditionally been defined as the share ownership by large non-managerial investor. Friend & Lang (1988) argue that the external block ownership have incentive to monitor and influence management appropriately to protect their significant investment. Referring to Shleifer & Vishny, (1986), the external blockholders reduce the scope of managerial opportunism, resulting in lower direct agency conflicts between management and shareholders.

Related to the managerial share ownership, Jensen and Meckling (1976) have suggested that the structure of equity ownership have an important effect on managerial incentives and the firm value. Since risk averse managers bear an unavoidable burden of risk to the fortunes of the firms employing them, managerial self-interest advocates argue that once presented with opportunities, managers have incentives to lowers the non-diversifiable employment risks by ensuring the continued viability of the firm.

One technique for reducing non-diversifiable employment risk is by decreasing the firms' debt holdings (Friend & Lang, 1988). This is because debt increases the bankruptcy risks of a firm. Since the occurrence of bankruptcy or financial distress will result in lost of employment, potential impairment of future employment and potentially lower earning capacity of managers, it is argued that self-interested managers have incentives to reduce corporate debt to a level which is less than optimal. However, it is unlikely that management can reduce the debt level to zero due to the existence of corporate governance mechanisms to discipline and control their behavior. Such mechanisms include the managerial labor market, capital market and market for corporate control.

Firm performance as endogenous variable

....proxy of firm's performance is Tobin's Q which is measured by the market value of the firm over *...replacement* value of the assets. The denominator reflects the value of the assets in the hands of the *firm with a* specific management term (De Jong, 1999: 72). Basically the definition of Tobin's Q *....presents* two key concepts namely growth opportunities and firm performance. The first concept is *....defined as the* market's expectation of the value of future projects, over which the management has *....discretion.* The second concept is a performance measurement. Tobin's Q measures the value of the *specific firm,* relative to the costs of the assets. The relationship between Tobin's Q and the firm's debt *....two* opposite predictions. Managers choose leverage voluntarily because of the self-imposed *disciplining* through debt, a negative tradeoff with other governance devices (Jensen, 1986). On the *other hand,* managers will try to avoid the disciplining role of debt and hence, governance is required to *force managers* to increase firm's debt (Zwiebel, 1996).

Barnhart & Rosenstein (1998) and Cho (1998) propose a firm performance model in which assumed a *joint determination* between firm performance and ownership structure occurs. Bradley, Jarrell and *Kim (1984),* Banerjee, Hesmati & Wihlborg (1999) find an inverse relationship between corporate leverage *and business risk.* Logically, if firm' performance has a negative relationship to firm debt and the level *of debt is* negatively related to firm risk, firm performance has a negative relationship to firm risk.

The above discussion leads to a summary of the relationship among debt-equity choice, ownership *structure,* and firm performance as formally stated in the following equations:
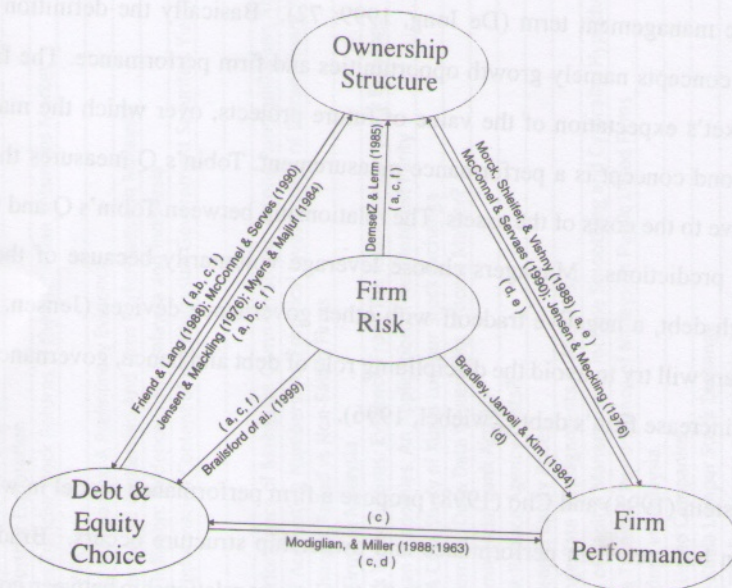
1) **Firm debt = f (ownership structure, firm performance,** agency cost, firm risk, the effect of taxes)
2) **Insider ownership = f (firm performance, firm debt,** earning volatility, dividend payment, external *block* ownership)
3) **Firm performance = f (ownership structure, firm debt,** firm risk, industrial characteristic)

Notice that since each of the variable ends up being a dependent and an independent variable *interchangeably* then, it is justified to claim those factors are being jointly determined.

Figure 1 provides a summary of selected empirical and theoretical studies that support each causal *relationship* as presented. The notation 'a' to 'f' refers to the previous studies, which have used *simultaneous* regression. The summary of their findings as shown in Table 1 of the appendix.

Figure: 1

Summary of the relationship between debt-equity choice, ownership structure, and firm performance and its joint determination

In sum, the direction of causality between firm debt and firm performance or firm debt and ownership structure is not clear. The main task of empirical studies on debt-equity is to explain how firm prefer debt or equity in financing their investment, however in doing it, some exogenous variables namely firm performance and ownership structure need to be understood critically within the endogeneity problem.

By analysis of the two functions say: *firm debt* = f(ownership structure, *firm performance*, other control variables) and *firm performance* = f(*firm debt*, ownership structure, other control variables), it can be proven that the OLS results are bias.

Formally, assume that the true model cal be written as:

Debt-equity equation

$$Z = \beta X + \varepsilon$$

Firm performance equation

$$X = \gamma Z + \eta$$

Where $E(\varepsilon) = E(\eta) = 0$ and $cov(\varepsilon, \eta) = \sigma_{\varepsilon\eta}$. Z denotes firm debt, and X firm performance.

First equation (firm debt) is estimated by OLS, this study obtain

$$\hat{\beta} = \frac{cov(X, Z)}{var(X)} = \frac{cov(X, \beta X + \varepsilon)}{var(X)} = \beta + \frac{cov(X, \varepsilon)}{var(X)}$$

The second term can be evaluated by replacing X with the right-hand side of firm performance equation, this study obtain

$$cov(X, \varepsilon) = cov(\gamma Z + \eta, \varepsilon) = cov[\gamma(\beta X + \varepsilon) + \eta, \varepsilon] = \gamma\sigma_\varepsilon^2 + \beta\gamma cov(X, \varepsilon) + \sigma_{\varepsilon\eta}$$

It follows that $cov(X,\varepsilon) = \dfrac{\gamma\sigma_\varepsilon^2 + \sigma_{\varepsilon\eta}}{1 - \beta\gamma}$. If $\gamma \neq 0$, or $\sigma_{\varepsilon\eta} \neq 0$, the estimated coefficient $\hat{\beta}$ will be biased and inconsistent, hence it is a serious problem in debt-equity studies[12].

II. SIMULTANEOUS MULTIPLE REGRESSIONS[13]

Based on the foregoing discussion, the firm debt, the ownership structure, and the firm performance are endogenous; a simple Ordinary Least Square would yield inconsistent estimates. Therefore, this study offers three simultaneous multiple regressions that consist of debt-equity choice equation (1), ownership structure equation (2), and firm performance equation (3) to overcome this endogeneity problem.

The two stage least squares analysis (2SLS) and three stage least squares (3SLS) are proposed to be used to analyse these simultaneous equations[14].

Firm debt = f (ownership structure, firm performance, agency cost, firm risk, the effect of taxes)

$Lntd_{at} = \alpha_1 + \beta_1 MBO_{at} + \beta_2(MBO)^2_{at} + \beta_3 Lntobin_{at} + \beta_4 Lntobin^2_{at} + \beta_5 Lntobin^3_{at} + \beta_6 Tangibil_{at} + \beta_7 Profbt_{at} + \beta_8 Profbt^2_{at} + \beta_9 Sizea_{at} + \beta_{10}Evolt_{at} + \beta_{11}Div_{at} + \beta_{12}ECi_{at} + \beta_{13}ECi^2_{at} + \varepsilon_{(1)at}$ (1)

Insider ownership = f (firm performance, firm debt, earning volatility, industry characteristic, dividend payment, external block ownership)

$MBO_{at} = \alpha_2 + \beta_{14}Lntobin_{at} + \beta_{15}Lntobin^2_{at} + \beta_{16}Lntobin^3_{at} + \beta_{17}Lntd_{at} + \beta_{18}Evolt_{at} + \beta_{19}Evolt^2_{at} + \beta_{20}Size_{at} + \beta_{21}Div_{at} + \beta_{22}ECi_{at} + \varepsilon_{(2)at}$ (2)

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[12] *The discussion of the inconsistency of OLS estimators is beyond the scope of this paper. The interested reader may refer to Gujarati (1995, p. 642)*

[13] *This paper extends the simultaneous multiple equations that were introduced by Augustinus and Taib (2002) by taking into account the market power interaction. See also Pandey (2002).*

[14] *Two stage least squares (2SLS) and three stage least squares (3SLS) provide a very useful estimation procedure for obtaining the values of structural parameters in over identified equations (Pindyck and Rubinfeld, 1991: 298). 2SLS and 3SLS is useful in the cases of exact identification & over identification. Gujaranti (1995, 1999). Table: 2 provides the measurement of both endogenous and exogenous variables.*

Firm performance = f (ownership structure, firm debt, firm risk)

$$Lntobin_{at} = \alpha_3 + \beta_{23}MBO_{at} + \beta_{24}lntd_{at} + \beta_{25}Evolt_{at} + \beta_{26}Evolt^2_{at} + \beta_{27}Profbt_{at} + \beta_{28}Div_{at} +$$

$$\beta_{29}ECi_{at} + \Sigma\gamma_k IC_{(k)at} + \varepsilon_{(3)at} \tag{3}$$

To determine the identifiability of this system of equation, the order condition (necessary) and the rank condition (sufficient) should be checked. There are 3 (three) endogenous variables (M) in this system / model and 32 predetermined variable (K) in this system equation.[15]

The order and rank condition [16]

Equation (1) has 3 m and 11 k. This equation has $(K - k) > (m - 1)$ is $32 - 11 = 3 - 1$ and the rank of matrix A is $= M - 1$ $(3 - 1 = 2)$. It can be concluded this equation is over identified.[17]

Equation (2) has 3 m and 7 k. This equation has $(K - k) > (m - 1)$ is $32 - 7 > 3 - 1$ and the rank of matrix A is $= M - 1$ $(3 - 1 = 2)$. It can be concluded this equation is over identified.

Equation (3) has 3 m and 25 k. This equation has $(K - k) > (m - 1)$ is $32 - 25 > 3 - 1$ and the rank of matrix A is $= M - 1$ $(3 - 1 = 2)$. It can be concluded this equation is over identified.

Since all of these equations are over identified, it is a sufficient and necessary condition to use 2SLS and 3SLS to analyse the data.

Debt-equity choice equation (1)

In equation (1), Lntd is the level of debt. It regress against other endogenous variable consists of *MBO* (is managerial block ownership), *lntobin* (is firm's performance - Tobin's Q), and also other exogenous variables. The endogenous variables consists the level of debt (*lntd*), managerial block ownership (*MBO*), and firm performance (*lntobin*). Both of these variables, managerial block ownership (*MBO*) and firm performance (*lntobin*) have a joint determination on firm debt (*lntd*).

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[15] *The number of predetermined variables is the number of exogenous variables plus the lagged endogenous variables.*

[16] *M = number of endogenous variables in the model, m = number of endogenous variables in a given equation, K = number of predetermined variables in the model, k = number of predetermined variables in a given equation. If K − k > m − 1 the overidentified is occur and if K − k = m − 1 is just (exactly) identified.*

[17] *see Wonnacott & Wonnacott (1979), Pindyck and Rubinfeld, (1991: 292, 315), Gujarati (1995).*

The exogenous variables in equation (1)

This study extend the equation by using the quadratic and cubic Tobin's Q ($lntobin^2$ and $lntobin^3$). These variables are useful to examine the relationship between debt-equity choice and market power interaction[18]. The other exogenous variables such as: *Agency costs*, the proxy of agency cost are tangibility of assets (*Tangibil*) and profitability (*Proftb*). Firm risk, this study uses firm size (*Sizea*), earning volatility (*Evolt*), the square of earning volatility ($Evolt^2$). Dividend payout (*Div*) ratio is used as the proxy of the effect of taxes.

The variables used to control for the effect of ownership are MBO^2 (is the square of managerial block ownership), *ECi* (is external block ownership) and ECi^2 (is the square of external block ownership).

The equation (1) should be used together with ownership structure equation (equation 2), and also firm performance equation (equation 3) as one system equation (structural equation). The one system equation is more powerful to reexamine the trade-off and pecking order theory, in addition to testing the link between debt-equity choice, ownership structure, and agency problem that might have taken place.

Trade-off theory vs. pecking order theory

Generally, the trade-off theory pays attention to variables that are related to agency cost, firm risk, and the effect of taxes. Whereas the pecking order theory will relate to variables such as growth opportunities, profitability and firm size. The debt-equity equation (1) can be used to test both theories.

The firm debt and the agency cost variable.

With regard to the tangibility of fixed assets, most studies hypothesized a positive relationship between tangibility of fixed assets and level of debt (Bevan & Danblot, 2000, Rajan and Zingales, 1995 and Titman and Wessel, 1998). However, results are different for short and long-term debt. Short-term debt in general has a negative relationship to the tangibility of fixed assets (Bevan and Danblot, 2000). Although long-term and short-term debt seems to be having the opposite relationship, pecking order theory argues that firms are expected have high future growth should use a greater amount of equity financing (Myers and Majluf, 1984 and Majluf, 1984). The findings that reported by other studies are also consistent with the theory. Firms that use a lot of debt tend to be having low growth opportunities. Pecking order theory also postulates have a negative relationship between profitability and level of

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[18] Pandey I. M. (2002) provides a new insight on the way in which debt-equity choice and market power are related. This quadratic and cubic model can help to explain the complex interaction of the market conditions, agency problems and bankruptcy costs.

debt. Profitable firms tend to use less debt as they have more internal funds to finance their investment activities. The findings by Rajan and Zingales (1995), Titman and Wessel, (198), Myers and Majluf (1984) are consistent with this, except Jensen (1986).

Similarly, the relationship between firm performance (Tobin's Q) and short-term and long-term debt are different. Myers (1977) finds a negative relationship between the long-term debt and the growth opportunities (Tobin's Q). This finding is similar to Myers & Majluf (1984), who also find the growth opportunity has a positive relationship to the short-term debt. Related to total debt, Bevan & Danblot (2000); Myers & Majluf (1984); Myers (1984) and Rajan and Zingales (1995) have a similar argument that there is a negative relationship between total debt and growth opportunities.

The firm debt and the firm risk

Bevan & Danblot (2000) find a positive relationship between the firm size and the long-term debt, and also a significant negative relationship between the firm size and the short-term debt. They argue that a small firm may have difficulty in obtaining long-term debt appears to compensate by using more short-term debt. Smith and Warner (1979) argue there is a negative relationship between the total debt and the firm size. This argument is opposite to Rajan & Zingales (1995) that predict a positive relationship. Myers (1984), and Myers & Majluf (1984) predict as a result of asymmetric information, firms will prefer internal to external sources. Thereby a pecking order is established whereby companies with high levels of profit tend to finance investment with retained earning rather than by the raising of debt finance.

The firm debt and the effect of taxes

The variables used as a proxy of the effect of taxes are dividend payout ratio and the marginal of taxes (Homaifar, 1994; Brailsford, Oliver & Pua, 1999:15). With the relaxation of irrelevance assumption, the firms with a high tax liability are expected to utilize greater amounts of debt to tak advantage of the deductibility of interest expenses. There are a positive relationship between the corporate tax rate and the amount of debt employed by the firm (DeAngelo & Masulis, 1980). Homaifar (1994) argues in the long run, the leverage ratio is indeed positively related to the corporate tax rates.

Managerial block ownership

The active monitoring hypothesis, posits that firms with a higher level of external block holdings are likely to have higher debt ratio (Sheifer & Vishny, 1986; Friend & Lang, 1988). Opposite to this, the passive voters' hypothesis argues firms with a higher level of external block holdings are likely to have

debt ratio (McConnel & Servaes, 1990).

Morck, Sheifer & Vishny (1988) and McConnel and Servaes (1990) find a non-linear relation between ownership structure and the corporate value. Since the debt-equity choice is being jointly determined by the ownership structure and the firm performance, it can be hypothesized there is a curvilinear relationship between firm's debt and ownership structure. This study extends this line of research by exploring how the ownership structure affects firm's debt[19]. This relationship can be hypothesized at low levels of managerial share ownership, managerial share ownership is positively related to a firm's debt ratio, ceteris paribus.

At high level of managerial share ownership, managerial share ownership is negatively related to a firm's debt ratio, ceteris paribus, such that the expected relationship between management ownership and the leverage ratio is curvilinear. In this case coefficient of $(MBO)^2$ has a significant relationship to the level of debt.

agency problem of manager vs. shareholder

The agency problems related to the debt-equity choice can be classified into two groups: manager and shareholder conflict, and shareholder and debt-holder conflict. Shareholders vs. managers have two problem, namely over investment problems: self-imposed debt (Jensen, 1986; de Jong 1999, 2000) and over investment problem: debt avoidance (Zweibel, 1996; de Jong, 1999, 2000).

In self imposed debt of over-investment problem of shareholder-manager conflict, the growth opportunities and the control structure have a negative relationship to the level of firm debt, but the free cash flow has a positive relationship to the level of firm debt. In this case the level of firm debt positively related to the moral hazard problem (Jensen, 1986; de Jong 1999, 2000). This relationship can be hypothesized a firms with a lack of growth opportunities, and if these growth opportunities negatively influence the level of debt, it can be concluded the over investment problem in forms self imposed debt occur.

In debt avoidance of over-investment problem of shareholder-manager conflict, the growth opportunities is non-negative and the control structure have a negative relationship to the level of debt but, the free

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[19] *This relationship can be investigated with the ownership structure equation (2) whether the firm debt determines the ownership structure vice versa.*

cash flow has a non-positive relationship to the level of firm debt. In this case the level of debt negatively related to the moral hazard problem (Zweibel, 1996; de Jong 1999, 2000).

An agency problem of debtholder vs. shareholder

Related to agency problem on shareholder vs. debtholder conflict, there are three agency problems. Direct wealth transfers (Smith & Warner, 1979; de Jong, 1999, 2000), assets substitution problems (Jensen & Meckling, 1976; de Jong, 1999,2000), and under investment problem (Myers, 1977; de Jong, 1999, 2000). This conflict between shareholders and debtholders mainly focus on the degree to which a firm can secure its debt and the firm's growth opportunities, both in relation to the relative amount of debt.

In the case of asset substitution problem, the firm substitutes current projects for project, which have higher risk (Jensen & Meckling, 1976). As the debtholders are compensated given the risk of current projects, wealth is transferred from debtholders to shareholders (de Jong, 1999). In this problem, the covenant and the secured debt have a negative relationship to the level of debt.

The contents of the bond contract can be adjusted by including restriction to control agency conflict. For example a covenant may contain restriction on the payment of dividend or on the disposition of assets (Myers, 1977; Smith & Warner, 1979; de Jong 1999). The collateralization by tangible assets in a debt contract may mitigate this agency problem, because debt becomes less risky (Titman & Wessel, 1988; de Jong 1999). In this case, the level of firm debt positively related to the moral hazard problem. This relationship can be hypothesized in the situation that asset substitution is taking place, the level of debt is positively related to this agency problem. The tangibility of asset as well as dividend is negatively related to this asset substitution problem.

In under investment agency problem, the growth opportunities has a positive relationship to this under investment (McConnel & Servaes, 1995). The covenants, the secured debt and the short-term debt negatively related to this agency problem (de Jong, 1999). The level of debt positively related to the under investment problem. This relationship can be hypothesized in the situation the under-investment is taking place, the level of debt and the growth opportunities are positively related to this agency problem. The tangibility of assets as well as the dividend is negatively related to this under investment problem.

Ownership structure equation (2)

Equation (2) shows that (*MBO*) managerial block ownership being determined by endogenous variables such as firm debt (*lntd*), and firm performance (*lntobin*). Some exogenous variables that are used in this equation are the square of Tobin's Q (*lntobin²*) and cubic (*lntobin³*). Firm size (*sizea*), earning volatility (*evolt*) and the square of earning volatility (*evolt2*) are used as the proxy of firm risk. Dividend payout ratio (*div*) used as the proxy the taxes effect. Whilst one largest shareholder (*Eci*) is used as the proxy of ownership concentration.

This model posits that managerial ownership to be a positive function of risk due to the value of managerial ownership in resolving the conflict between external shareholders and management. The relationship will be negative if management risk aversion becomes dominant at sufficiently high level of risk. As value management becomes more state-related and less subject to market discipline, thereby reducing firm value.

To examine the link between ownership structure and firm debt, this model extends Chen & Steiner (1999) model, and hypothesized risk is a nonlinear determinant of managerial ownership. However, at low levels of risk, a positive relationship is expected in support of reduction in the conflict between external shareholder and management. At higher levels of risk managerial risk aversion considerations are expected to limit managerial ownership.

Higher levels of debt and dividend payouts serve to reduce problems with free cash flow (Jensen, 1986; Chen & Steiner, 1999) and consequently, the value of managerial ownership is expected to decline over higher levels of debt and dividend payouts. The hypotheses to be pursued in this discussion is debt and dividends serve as substitute monitoring forces for managerial ownership leading to an inverse causal relation from both debt and dividends to managerial ownership.

Firm performance equation (3)

The Equation (3) shows that lntobin as the proxy of firm performance is determined by some exogenous variables such as: earning volatility (*Volt*) and the square of earning volatility (*Evolt2*), IC (is Industry Classification -dummy variable). Both variables used as proxies for firm risk.

Profitability (*profbt*) and one largest ownership concentration (*Eci*) are used as proxies for the agency problems. The endogenous variables that have to be jointly determined on firm performance are managerial block ownership (*MBO*) and firm's debt (*lntd*).

The equation (3) can be used to re-examine the link between firm's performance and ownership structure such as managerial block ownership, and external block ownership. Jensen and Meckling (1976), argue that ownership concentration has a positive impact on corporate value because the concentrated ownership will minimize agency costs. This empirical evidence shows that the relationship between firm performance and ownership structure is not linear. For instance, Mat Nor et al. (1999) used Tobin's Q as a proxy for firm's performance and found Tobin's Q rise as board ownership increases from 0% to 5%, falls as ownership rise further to 25% and the continues to rise as board ownership rises beyond 25%[20].

Other prior studies also show that at low levels of managerial ownership, an increase in managerial ownership would closely align the interests of managers and shareholders, thereby increasing corporate value. At high levels of managerial ownership, an increase in managerial ownership would make management becomes more entrenched and less subject to market discipline, thereby reducing corporate value (Morck Shleifer & Vishny, 1988; McConnel & Servaes, 1990; Cho, 1998). Collin (1998) in similar vein argues that the ownership concentration is curvilinear correlated with firm performance.

Concerning to the external block ownership, it can be hypothesized that at low level of external block ownership, an increase in external block ownership would aligns more closely the interests of shareholders–debtholders, thereby increasing corporate value. At high level of external block ownership, however an increase in external block ownership is highly likely to lead the company to excessive borrowing behavior, which in turn reduces corporate value.

IV. CONCLUSION AND SUGGESTION FOR THE FUTURE STUDY

The endogeneity issue becomes important because the ordinary least square in turn results generate in inconsistent parameter estimates that can lead to misinterpretation of regression results, and incorrect management decision. The optimal debt-equity choice is posited to be an *ex ante* efficient trade-off between costs and benefits of debt. Previous studies have been criticized due to the implicit assumption that ownership structure is exogenous. In the meanwhile, other studies have assumed the ownership structure as an endogenous variable.

In order to overcome this endogeneity bias, this study would like to offer three simultaneous equations that can be used to reexamine the determinants of debt-equity choice. In addition, this model can be

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[20] *Mat Nor et al. (1999) examine the relationship between firm's performance and ownership concentration.*

...to investigate the links between the debt-equity choice, the ownership structure and the firm performance *vice versa.*

...although, 2SLS and 3SLS can overcome this endogeneity problem, previous studies shows that 2SLS and 3SLS finding are not quite similar. Both 2SLS and 3SLS need a special condition in which to judge which one has a more adequate tool. Regarding to econometric viewpoint, if the correlation between the residual of 2SLS take place, the 2SLS result will be bias, and 3SLS have more valid results.

This methodological review, leads to some suggestions for future studies that one method is not quiet sufficient in financial research. It needs a series of test in order to choose the adequate tools. In this paper, it has been argued that looking at debt-equity choice issue in isolation of other related endogenous variables, which are jointly determined, lead to incorrect management decision.

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Appendix

Table 1

A Review of the using simultaneous equations in some previous studies

Author	Simultaneous equations	Data	Finding
Jensen, Solberg & Zorn (1992)	(1) **Debt** = f (insider, dividend, business risk, profitability, R&D, Fixed Assets) (2) **Dividend** = f (insider, debt, business risk, profitability, growth, investment) (3) **Insider** = f (debt, dividend, business risk, size, divisions, R&D)	565 firms in 1982 and 632 in 1987. Data from the Compustat data file and its level of insider ownership listed in the Value line Investment Survey.	Insider ownership and firm financial decisions are interdependent and the results of single equation have been inconsistent. The 3SLS approach allows for the interdependence of firm debt, dividend policy and insider ownership. Higher inside ownership firms choosing lower levels of both debt and dividends.
Agrawal & Knoeber (1996)	(1) POD = f(M,σ, ASSET, REG, TENURE, FOUNDER, NOD) (2) PFIVE = f(M, σ, ASSET, REG, RDAL) (3) PINST = f(M, ASSET, REG, NINSTI, NYSE) (4) OBOARD = f(M, ASSET, REG, FOUNDER, LOB3) (5) FSHC = f(M, FOUNDER, AGE, REG, JOBS3) (6) D/V = f(M, ASSET, REG, CR)	383 large US firms from Forbes 800 in 1987.	They find that ownership by officers and directors is a significantly positive determinant of Q, the proportion of outsiders on the board is significantly negative, and ownership by institutions insignificant. The results of 3SLS show ownership by officers and directors and the proportion of outside directors are insignificant, while institutional ownership is significant positive.
Bathala, Moon, & Rao (1994)	(1) DR = f(ERNVOL, DEPR, RDAD, GROWTH, INSTL, MGROWN) (2) MGROWN = f(STKVOL, RDAD, GROWTH, TA, INSTL, DR)	516 firms in 1988. This study uses a sample of firms from the New York Stock Exchange, the American Stock Exchange.	OLS results show no relation between debt ratio and managerial ownership. 2SLS results show debt ratio and managerial ownership are jointly determined.
Cho (1998)	(1) Insider ownership = f (market value of firm's common equity, corporate value, investment, volatility of earnings, liquidity, industry) (2) Corporate value = f (insider ownership, investment, financial leverage, asset size, industry) (3) Investment = f (insider ownership, corporate value, volatility of earnings, liquidity, industry)	326 firms in 1991 of Fortunes 500 firms.	OLS results show ownership structure affects investment therefore, corporate value. Simultaneous regression reveal that investment affects ownership structure but not vice versa.
Barnhart & Rosenstein (1998)	(1) Q = f (OWN, OUT, Adv, RD, DT, TA) (2) OUT = f (OWN, Q, BDSIZE, DT) (3) OWN = f (OUT, Q, BDSIZE, INST, ADV, DT)	321 sample firms in 1990. Financial statement data is obtained from the Industrial Compustat tapes.	Managerial ownership, board composition and firm performance are jointly determined, and the results indicate some support for the curvilinear relation between managerial ownership and performance. The evidence show there is a weak curvilinear relation between the proportion of outside directors and firm performance.
Chen & Steiner (1999)	(1) LOWN = F (LRISK, LRISK2, LDEBT, LDIV, LVAL, R&D, FIVE, INST) (2) LRISK = F (LOWN, LDEBT, LDIV, LSIZE, R&D, OL, DINDEX) (3) LDEBT = F (LRISK, LOWN, LDIV, FIXED, ROA, R&D) (4) LDIV = F (LRISK, LOWN, LDEBT, INV, ROA, GRTW)	785 sample firms in 1994 from the New York Stock Exchange	Chen & Steiner (1999) do not compare between the OLS and 3 SLS finding.

...son, Solberg & Zorn (1992):

...t is ratio of long-term debt to book value of total assets. Dividend is ratio of dividends to operating income. ...der is percentage of shares held by insider. Busi ner risk is standard deviation of the first difference in operating ...ome divided by total assets. Profitability is ratio of operating income to total assets. R&D is ratio of research and ...velopment expense to total asset. Fixed assets is ratio of fixed assets to total assets. Growth is five-year growth ...e in sales. Investment is expenditure for plant, equipment, and R&D as a percentage of total assets. Size is log of ...tal assets. Division is number of divisions operated by the firm.

...grawal & Knoeber (1996: 383 -384):

...D is insider shareholding, defined as the percentage of shares owned by officers and directors. ASSET is defined ...the book value of total assets. REG is dummy variable for regulation, which equals one for regulated firms and ...ro otherwise. TENURE is years as CEO. FOUNDER is the presence of founding CEO. NOD is the number of ...ficers and directors. PFIVE is the percentage of shares held by owners of 5 percent or more of the equity. RDAL ...R&D to asset ratio. PINST is institutional shareholdings as the percentage of shares held by institutions. NINSTI ...additional measure of attractiveness to institutions as the average number of institutional shareholders for firms ...the industry. NYSE is dummy variable indicating listing on the NYSE. OBOARD is the percentage of board ...ts held by non-officers. LOB3 is the number of different lines of business at the 3-digit SIC level which a firm is ...gaged. AGE is the number of years that a CEO can be employed by a firm rises with age. JOBS3 is the number of ...her NYSE firms in the same primary 3-digit SIC industry as the firm. D/V is the ratio of book value of debt to firm ...lue. CR is the availability of internal funds/ firm's cash flow.

...thala, Moon, & Rao (1994)

...RNVOL is earning volatility measured as the standard deviation of earning before depreciation, interest, and taxes ...aled by total assets. DEPR is non-debt tax shields defined as the ratio of annual depreciation to earnings before ...depreciation, interest and taxes. RDAD is expenditures in non-tangible assets, defined as the ratio of R&D and advertising ...expenses to earning before depreciation, interest, and taxes. GROWTH is the annual compounded growth rate (1 + ...ate) in total assets. INSTL is institutional ownership defined as the proportion of common stock held by institutions. ...GROWN is managerial stock ownership, defined as the proportion of common stock held by officers and directors ...f the firm. TA is size of the firm, defined as the log of the total assets. DR is debt ratio defined as the ratio of long-term ...ebt to market value of equity. STKVOL is the standard deviation of monthly stock returns of the firm.

Cho (1998)

...verage is market value of the long-term debt divided by the replacement costs of assets. Asset size is the logarithm ...f the replacement costs of assets. Liquidity is the cash flow divided by the replacement cost of assets. Volatility is ...he standard deviation in changes in profit rate during the period 1996-1991. Profit rate is defined as profit before ...extraordinary items divided by the replacement cost of assets.

Barnhart & Rosenstein (1998)

...WN is managerial ownership. Defined as the percentage of shares owned by officers and directors as a group, ...cluding shares for which officers have shared voting power, plus hares available for purchase and options or ...warrants excisable within sixty days of the proxy date. OUT is the proportion of nonaffiliated or independent ...outside directors. Adv is advertising expenses to total assets. RD is research and development expense to total ...assets. TA is a total asset. DT is the debt to total assets. BDSIZE is overall board size. INST is common stock owned ...by institutional.

Chen & Steiner (1999)

...own is managerial ownership, defined as the log of the percentage of managerial ownership. LRIK is the log of the ...standard deviation of stock returns. LDEBT is the log of the debt to equity ratio. LDIV is the measure of dividend ...payout. LVAL is the log of the market value of equity. FIXED is the ratio of property, plant, and equipment to total ...assets. INV is the ratio of capital expenditures to total assets; LSIZE is the log of the total assets. INST is the ...percentage of institutional ownership. FIVE is the percentage of 5% ownership. R&A is research and development ...expenditure. ROA is return on assets. GRTW is the growth in sales revenue over the past four years. OL is a ...measure of operating leverage. DINDEX is the concentric diversification index.

Table 2
Variable Measurement

Variable		Definition of Measurement	Theoretical Foundation
Endogenous variables			
Lntobin	Firm Performance	Tobin Q = Market Value of assets / Book Value of Assets Market Value of Assets = Total debt + Common Equity Common Equity = Total listed shares x closing price	de Jong (1999, 2000)
Lntd	Firm debt	Ln Total debt = total debt divided by the book value of total assets	Rajan and Zingales (1995); Brailsford, Oliver & Pua, (1999); Bevan and Danblot (2000)
MBO	Managerial block holding	Percentage of ordinary shares owned by all executive and non-executive directors.	Brailsford, Oliver & Pua, (1999)
Exogenous variables			
Variables used for the agency cost			
Lntobin²	The square of Tobin's Q	Tobin's Q (*see firm performance*)	Pandey (2002)
Lntobin³	The cubic of Tobin's Q		
Tangibil	Tangibility of assets	(Fixed asset + Inventories) / Total Assets	Titman and Wessel (1988); Banerjee (1999); Rajan and Zingales (1995)
Profbt	Profitability	Operating income before interest and taxes divided by total assets	Titman and Wessels (1988); Brailsford, Oliver & Pua (1999); de Jong (1999);
Profbt²	The square of profitability		
Variables used for the firm risk			
Sizea	Firm size	Natural log of total sales / total assets.	Titman and Wessels (1988); Banerjee (1999); Brailsford, Oliver & Pua, (1999)
Evolt	Earning volatility	The standard deviation of operating income normalized by total assets. This study uses the previous four years when estimating standard deviation before the financial crisis and also the previous four years when estimating standard deviation during the financial crisis.	Titman and Wessels (1988); Homaifar (1994); Brailsford, Oliver & Pua, (1999)
Evolt²	The square of earning volatility		
IC	Industry classification	Industry Classification (dummy variable)	Titman and Wessels (1988); Brailsford, Oliver & Pua, (1999)
Variables used for the effect of taxes			
Div	Dividend payment	Dividend payout ratio = dividend per share divided by earning per share.	Moh'd et al. (1998)
Variables used for the ownership structure			
MBO²	the square of Managerial block holding	Percentage of ordinary shares owned by all executive and non-executive directors.	Brailsford, Oliver & Pua, (1999)
ECi	External Block holding	Percentage of ordinary shares held by the largest shareholders.	Brailsford, Oliver & Pua (1999); Demsetz and Lehn (1985)
ECi²	The square of external block ownership		