Downward Sloping Demand Curves for Stock and Leverage

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Abstract

This research attempts to investigate the effect of downward sloping demand curves for stock on firms' financing decisions. For the same size of equity issuance, firms with steeper slope of demand curves for their stocks experience a larger price drop in their share price compare to their counterparts. As a consequence, firms with a steeper slope of demand curves are less likely to issue equity and hence they have higher leverage ratios. This research finds that the steeper the slope of demand curve for firm's stock, the higher the actual leverage of the firm. Furthermore, firms with a steeper slope of demand curves have higher target leverage ratios, signifying that these firms prefer debt to equity financing in order to avoid the adverse price impact of equity issuance on their share price.

Keywords: slope of demand curves for stocks, leverage, financing decisions.

INTRODUCTION

In an economic sense, the price of all assets is determined by supply and demand. However, in finance, the share price which reflects fundamental value of a firm is normally assumed not to be determined by supply and demand, but is obtained from discounting the firm's expected future cash flows by its cost of capital. This is because classical finance theories assume a horizontal demand curve for firms' equity and hence the share price is independent of supply. The term horizontal demand curve, perfectly elastic demand curve, infinite elastic demand curve is identical and they will be used interchangeably in this paper.

Contrary to the assumption of horizontal demand curves, many researchers (among others, Shleifer (1986), Loderer, Cooney, and Drunen (1991), Kaul, Mehrotra, and Morck (2000)) have found that the demand curve for firms' equity is actually downward sloping. Controlling for information effects, Shleifer (1986) tests the hypothesis of downward sloping demand curves by examining stocks price movement after they are included into S&P 500 Index. One would not expect index inclusions to result in a price effect if demand curve is horizontal. In contrast, he finds a share price increase at the announcement of the inclusion suggesting that demand curves for stock do slope down. This downward sloping demand curves for stock imply that shares need not be priced exactly at their fundamental values.

A downward sloping demand curve for stocks suggests that new equity issues result in stock price decreases, therefore firms need to take into account this price effect when making financing decisions. Since the magnitude of this price effect depends on the slope of each individual firm's demand curve, the following interesting question can be raised: *"How does downward sloping demand curve for stocks affect individual firm's financing decisions?"*

Intuitively, firms with a steeper slope of demand curves are more concerned about the price impact of equity issuance because the same amount of additional equity supply (issuance) causes a larger price drop in their share prices compared to firms with a flatter slope of demand curves. Consequently, *ceteris paribus*, firms with a steeper slope of demand curves for their stocks are less likely to issue equity and hence we should observe higher actual leverage ratios for these firms. Furthermore, to the extent that each firm has an optimal leverage ratio and cost of equity issuance is positively associated with the slope of demand curve, firms with a steeper slope of demand curves would have higher target leverage ratios. These predictions are the main hypotheses investigated in this paper.

Hypotheses testing are performed using cross-sectional leverage regressions and the target adjustment model. Following Petajisto (2004), Haggard and Pereira (2005), Hirt and Pandher (2005), Baker, Coval, and Stein (2006), this research paper employs idiosyncratic risk, estimated using various methods, to proxy for the slope of demand curve. Leverage ratio is calculated in both market and book terms.

Main findings in this research are consistent with preceding predictions. First, firms with a steeper slope of demand curve for stock have higher actual leverage ratios. The slope of demand curves for stocks is positively and significantly related to actual leverage ratios, even after controlling for others factors shown in prior studies to influence firms' leverage. Second, the slope of demand curves for stock is a positive and significant factor determining firms' target leverage ratios suggesting that firms with

steeper slope of demand curves are less likely to issue equity and prefer debt instead as a mean of financing.

This research can potentially contribute to the literature in several ways. First, it sheds light on the relationship between the slope of the demand curve for stocks and firms' capital structure. The results show that firm's leverage is positively and significantly affected by the slope of demand curve for its stock. This finding also imply that studies in capital structure should consider the slope of demand curves for stock as one of the control variable when they attempt to examine the impact of particular factor on the firms' leverage. Second, this research partly fills the gap between capital structure theories and observed behaviour of firms' financing decisions. Main findings in this research indicate that firms do and should concern about the slope of demand curves for their shares when they make financing decisions. In addition to the factors mentioned in prior literatures, the results suggest that the slope of demand curves for stock provides additional explanation for the cross-sectional differences in firms' leverage. Specifically, the downward sloping demand curves for stock is another important reason why firms tend to use debt financing instead of equity financing.

The remainder of this research paper is organized as follows. Section 2 provides a brief literature review. Section 3 presents the hypotheses development. Section 4 describes the empirical methodology adopted in this research. Section 5 presents the data and estimation procedures. Section 6 reports the results and provides discussions of the results. The final section concludes.

LITERATURE REVIEW

In this part, it will be discussed the downward sloping demand curves for stocks, followed by an outline of major capital structure theories and the implication of downward sloping demand curves for stocks on each capital structure theory.

Downward Sloping Demand Curves for Stocks

One of the most important assumptions underlying several prominent finance theories is the investors' ability to buy and sell any amount of a firm's equity without any price impacts, which suggests the demand curve for a firm's equity is horizontal. For example, the home leverage argument behind Modigliani-Miller capital structure theorem relies on the existence of perfect capital market, where the horizontal demand curve is one of the key conditions. Shleifer (1986) points out that "in CAPM and APT models, stock price is unbiased predictor of fundamental value, maintained through the workings of arbitrage". Provided close substitutes exist for a stock, its fundamental value, which equals to the expected cash flows discounted by the cost of capital, is independent of the supply of equity. Therefore, the demand curve for a stock should be almost perfectly horizontal and we should observe virtually no price impact (Petajisto, 2004). In other words, firm can sell whatever quantity of stock it desires without concerning about the falling in its share price, because a horizontal demand curve suggests that the market can always absorb the extra supply at the fundamental value.

Contrary to the theoretical assumption, there are number of studies suggesting that the demand curves for stocks are downward sloping. Scholes (1972), Holthausen, Leftwich and Mayers (1990), and Mikkelson and Partch (1985) examine stock price reactions to buyer and seller initiated large block trades and they document negative

price reactions to large block sales and positive price reactions to large block purchases. However, in a world of information asymmetry, a block trade to buy (sell) may signal good (bad) news about the stock and thus entailing a price increase (decrease). Since these prior tests fail to distinguish whether it is the signalling effect or the downward sloping demand curve causes the price impact, they can not provide conclusive evidence on the hypothesis of the downward sloping demand curves for stocks. Fortunately, subsequent studies address this problem.

To control for the impact of information effects to minimal, Shleifer (1986) tests the hypothesis of downward sloping demand curves by examining stocks price movement after they are included into S&P 500 Index. If demand curve is horizontal, one would not expect index inclusions to result in any price effect. However, if demand curves are downward sloping, we should observe a share price increase on the announcement of the inclusion. His conclusion is in favour of downward sloping demand curves for stock. Similarly, in study of positive price response to share repurchase announcements, Haggard and Pereira (2004) find that price response is greater for stocks with steeper demand curves.

Kaul, Mehrotra, and Morck (2000) use change in supply event to detect downward sloping demand curves. If horizontal demand curves for stocks exist, without any new information, stock prices should not be affected by a shift in supply. They use an event when Toronto Stock Exchange implemented a previously announced redefinition of the public float. Public float is percentage of the firm's equity that must be freely traded on the exchange in order to maintain a public firm status. When an exchange redefines public float, this action does not contain any information on firms' fundamentals, it merely change number of freely traded shares available in the market. Therefore, this redefinition can be perceived as pure supply event. Since the revision conveyed no information, one would not expect to observe any price effect if the demand curve for stock is flat. Contrary to the expectation, the affected stocks experienced statistically significant excess return during the event week and no price reversal occurred as trading volume returned to normal levels. These findings support the hypothesis that demand curves for stocks slope down.

Loderer, Cooney, and Drunen (1991) study the price elasticity of demand for the common stock of an individual corporation by investigating the price change after announcement of stock offering. Their finding suggests that the price decline is caused by finite price elasticities of demand, therefore they conclude that "issuing firms cannot treat the demand for their stock as if it were perfectly elastic".

Prior studies not only detect the presence of downward sloping demand curves but also attempt to provide probable reasons for their existence. The plausible driving forces behind downward sloping demand curves can be classified into the following four categories: limited arbitrage, liquidity induced compensation, shareholder heterogeneity, and divergence opinion among analysts.

Wurgler and Zhuravskaya (2002) claim that the absence of perfect substitute makes arbitrage activities risky, hence risk-averse arbitrageurs are reluctant to engage in unlimited arbitrage, which results in downward sloping demand curve for stock. They examined the extent of stocks price jumps after inclusion into the S&P 500 Index and found that arbitrage forces are weakest, and other pricing anomalies are severest, among stocks without close substitutes. In line with the argument above, Shleifer and Summers (1989) argue that arbitrage is insufficient to counter investor sentiment and Mayshar

(1978) points out that any firm may provide investors with a type of hedging they cannot duplicate with the shares of other firms.

Even on organized exchanges, the market is not uniformly broad, deep, and resilient. Since investors value liquidity, traders are willing to take on large positions in illiquid assets only if appropriately compensated with a lower price (Amihud & Mendelson (1986), Kamara (1989), and Warga (1990)). If the required discount is increases with the size of the position, the aggregate demand schedule for a financial asset could be downward sloping (Loderer et al., 1991).

Incomplete information cause risk averse investors attracted to different sets of risky assets (Merton, 1987). Alternatively, due to different information available (Parsons and Raviv, 1985) or different interpretations of the same information, investors may have different reservation prices for the same security. Since it takes a lower price to induce a larger number of investors with different reservation prices to buy, the aggregate demand schedules could be downward sloping (Loderer et al., 1991).

Disagreement among analysts gives a good indication of the riskiness of a security which in turn results in higher required return from investor. Therefore, when selling equity, firm has to offer discount from the fundamental value of its stock. This suggests that demand curve of firm's stock is no longer horizontal (Miller, 1977).

Taken together, the downward sloping demand curve implies that assets need not be priced exactly at their fundamental values (Petajisto, 2004). A new stock issue will cause a permanent stock price decrease (Barclay & Litzenberger, 1988), even the issuance itself does not contain any negative signalling effect. Therefore, the implication for issuer is when an equity issue is contemplated, the share price decrease resulting from downward sloping demand curve is a major cost that has to be traded off against the possible benefits from equity issue.

Capital Structure Theories

Ever since Modigliani and Miller (1958) irrelevance proposition, a large number of studies claim that financing decisions does matter. To date, there are four main theories explaining firms financing decisions. They are trade-off theory, pecking order theory, agency theory, and the market timing theory.

In trade off theory, the balance between costs and benefit of debt is the major determinant of optimal capital structure. Benefits of debt include tax deductibility of interest while costs of debt include potential bankruptcy costs. The trade-off theory predicts that the firm will achieve the optimal capital structure by borrowing up to the point where the marginal value of tax shields on additional debt is just offset by the increase in the present value of possible costs of financial distress. We believe that downward sloping demand curve for stocks therefore has no impact on firm financing decisions under this trade-off theory as the shape of demand curves affects neither tax-savings nor bankruptcy costs.

In pecking order theory proposed by Myers (1984), firms finance new investments with the following order of preference: retained earnings, safe debt, risky debt, and outside equity. This theory predicts that capital structure of the firms is the result of the pecking order financing and variation in a firm's leverage is not driven by the costs and benefits of debt but by the firm's financing deficit. Pecking order theory says that the firm will borrow, rather than issuing equity, when internal cash flow is not sufficient to fund capital expenditures, therefore "observed debt ratios will reflect the cumulative

requirement for external financing—a requirement cumulated over an extended period'' (Myers, 1984).

Driven by information asymmetry problem, pecking order theory suggests that when external financing is necessary, firms prefer to issue debt while treating equity as the last resort of financing. When information asymmetry exists, investors associate equity issuance with management's belief that the firm's equity is currently overvalued. As a result, equity issuance is usually accompanied by share price decrease. To avoid the falling share price, equity is the least preferred method of external financing.

The downward sloping demand curve for stocks amplifies the negative price impact when firms issue equity. Equity issuance can be seen as increase in supply which leads to decline in share price if the demand curve for stocks is downward sloping. Therefore, combining pecking order theory and the downward sloping demand curve for stocks, we interpret that firm's equity issuance will be more unlikely.

Under the agency theory, agency costs can arise from conflicts between bondholders and stockholders and conflicts between stockholders and managers. Conflicts between debt-holders and equity-holders introduce incentive distortion problems namely debt overhang (under-investments), risk shifting (asset substitution), managerial myopia (short sighted), and reluctance to liquidate (hang on to losers). These incentive distortion problems create agency costs of suboptimal investments and operating decisions. Thus, many growth firms tend to rely on equity to avoid losing the financing flexibility in the future and the agency costs between equity-holders and debt-holders.

On the contrary, agency conflicts between equity holders and managers can be resolved through high debt ratio. The need to constantly service debt payment forces managers to generate and pay out cash. As a result, the free cash flow available and hence manager's opportunities for value destroying behaviour are greatly reduced.

Since this theory essentially describes the cost and benefits of using debt from the perspective of agency problems, the downward sloping demand curve for stock has no implication for corporate financing decisions under this theory.

Market timing theory suggests that firms tend to issue equity when market value is high, relative to book value and past market values, and to repurchase equity when market value is low. Hence, Baker and Wurgler (2002) point out that current capital structure is the "cumulative outcome of past attempts to time the equity market". Graham and Harvey (2001) report that the extent to which companies' shares are perceived to be overvalued or undervalued is one of managers' most important considerations, when they choose the timing for equity issuance. This result is clearly supporting market timing behaviour by firms.

The downward sloping demand curves for stocks suggest that firms face price pressure when they issue equity. The extent of price pressure varies between firms due to the difference in the slope of their stock's demand curves. Compared to their counterparts with flatter demand curve, firms with steeper demand curve face higher drop in their share price. Hence, we predict that they are more reluctant to issue equity when the condition is unfavourable (when share price is undervalued), while issuing more equity when timing becomes favourable. In short, we argue that firms with steeper demand curve for their stocks will be less likely to issue equity but more likely to engage in market timing behaviour as they have more incentive to do so.

Capital Structure Decisions: A Final Trade-Off

Each capital structure theory outlined above has its own strength and drawback. There is no single theory to date that can fully explain the mix of debt and equity for each firm. Each theory works better than others under particular circumstances. As pointed out by Myers (2001) "There is no universal theory of the debt-equity choice, and no reason to expect one. There are several useful conditional theories, however".

To conclude, the final trade-off faced by firms when they determine their capital structure is synthesized in the following table.

Advantages of Debt	Disadvantages of Debt
1. Tax Benefits: the higher the tax rates, the higher the tax benefit.	1. Direct Bankruptcy Costs: the higher the business risk, the higher the cost of bankruptcy. Hence lower the ability to take financial risk.
2. Added Discipline: the greater shareholder-manager agency problems, the greater the benefit of debt.	2. Incentive Distortion: the greater the separation between stockholders and lenders, the higher the cost because the incentive distortion problems will be more severe.
3. Avoid Sending Adverse Signals: the greater the information asymmetry, the greater the benefit of issuing debt than equity because debt issuance has less pronounce announcement effects.	3. Loss of Future Financing Flexibility: the greater the uncertainty about future financing needs, the higher the cost.
	4. Forgo the Gain of Timing the Equity Market

This final trade-off implies that each firm has target leverage ratio which is the balance between the advantages and disadvantages of debt usage. To the extent that information asymmetry and stock market conditions affect managers' financing decisions, the target leverage ratio should reflect the effect of downward sloping demand curves for stocks.

HYPOTHESIS DEVELOPMENT

In terms of predicting firm's capital structure, although downward sloping demand curve for stocks has no impact on either classical trade-off theory or the agency theory, it implies that equity issuance is less likely under pecking order theory and market timing theory.

At each point in time, different firms will likely to have demand curve with different slope. Therefore, the extent of price pressure faced by equity-issuing firms varies. Firms with a steeper slope of demand curves will suffer more if they issue equity because the drop in their share price will be larger than firms with a flatter slope of demand curves. As a result, firms with a steeper slope of demand curves for their stock tend to prefer debt than equity hence we should observe higher debt ratio for these firms. This leads to the first hypothesis, other things being equal, it is expected that firms with a steeper slope of demand curves have higher leverage ratios.

Hypothesis 1: Other things being equal, firms with a steeper slope of demand curves tend to have higher (actual) leverage ratios.

The first hypothesis scrutinizes the relationship between the slope of demand curve for stock and debt ratio at a point in time. However, the final synthesized trade-off between the benefit and cost of debt suggests that firms intend to maintain a target debt ratio, hence when a firm's debt level is above the target ratio, it should issue equity; when below the target, it should issue debt. This leads us to the second hypothesis as follows.

Hypothesis 2: Other things being equal, firms with a steeper slope of demand curves tend to have high (target) leverage ratio.

EMPIRICAL METHODOLOGY

In this section, proxies for the slope of demand curves will be discussed first before presenting the empirical models to test hypotheses regarding the relationship between the slope of demand curve for stocks and firms' financing decisions.

Proxies for the Slope of Demand Curve

This research employs idiosyncratic risk as proxy for the slope of demand curve. This proxy is commonly used by many researchers (Baker, Coval, and Stein (2006), Haggard and Pereira (2005), Hirt and Pandher (2005), Petajisto (2004), etc).

Wurgler and Zhuravskaya (2002) reveal that stocks without close substitutes have higher arbitrage risk and experience higher price jumps. Idiosyncratic risk make closer substitutes more unlikely and hence resulting in downward slope of demand curve. Likewise, Haggard and Pereira (2005) point out that idiosyncratic risk prevents riskless arbitrage through elimination of perfect substitutes for stocks, which results in the downward-slope demand curve. Greater magnitude of the proxy represents steeper demand curve (less elastic demand).

Idiosyncratic risk is calculated using CAPM (market model) and Fama and French's (1993) *extended* four-factor model with Carhart's (1997) momentum factor as the fourth factor. Time series regression is performed to estimate idiosyncratic volatility of individual stock.

Fama and French (1993) three-factor asset pricing model is considered to do a better job than CAPM in capturing the cross-sectional average return on US stocks. However, as stated in Fama and French's (1996) paper, Fama and French (1993) three-factor model cannot explain profitability of momentum strategies or the continuation of short term returns documented by Jegadeesh and Titman (1993). Therefore, in addition to Fama and French's (1993) three-factor model, momentum factor is included in this research as the fourth factor following Carhart's four-factor model (1997).

In the market model, individual stock's daily excess return is regressed on market risk premium:

$$r_{i,t} = \alpha_i + \beta_{iMKT} r_{m,t} + \varepsilon_{i,t} \qquad (1)$$

Where:

$r_{i,t}$ = return of stock i in day t **in excess** of the risk-free rate

$r_{m,t}$ = $\sum_i w_{i,t} r_{i,t}$ with $w_{i,t}$ = weight of firm i at date t. It is value-weighted **excess** market return on all NYSE, AMEX, and NASDAQ stocks (from CRSP) minus the one-month Treasury bill rate (from Ibbotson Associates).

Using the estimated alpha and beta from the regression, the daily excess stock return can be predicted by substituting the market premium into the equation. The difference between this predicted value and actual excess stock return is the daily residual risk for each stock.

$$r_{i,t} = \hat{\alpha}_i + \hat{\beta}_{iMKT} r_{m,t} + \varepsilon_{i,t} \tag{2}$$

Idiosyncratic risk of the stock can be estimated in two ways. First, following the method used by Haggard and Pereira (2005), idiosyncratic volatility is calculated as standard deviation of daily residual risk obtained from equation (2).

$$sd = \sqrt{\frac{1}{N} \sum_{t=1}^{N} \left(\varepsilon_{i,t} - \bar{\varepsilon}_{i,t} \right)^2} \tag{3}$$

sd = standard deviation of the residual risk

$\varepsilon_{i,t}$ = residual risk for stock i at day t

$\bar{\varepsilon}_{i,t}$ = $\frac{1}{N} \sum_{t=1}^{N} \varepsilon_{i,t}$ = mean or average of the residual risk for stock i

N = number of trading days

Under the second approach which has been used by many researchers (e.g. Petajisto (2004), Hirt and Pandher (2005)), idiosyncratic risk volatility is estimated using root mean square error. As a kind of generalized standard deviation, Root Mean Squared Error (RMSE) is calculated as following:

$$RMSE = \sqrt{\frac{1}{N} \sum_{t=1}^{N} \left(y_{i,t} - \hat{y}_{i,t} \right)^2} = \sqrt{\frac{1}{N} \sum_{t=1}^{N} \left(r_{i,t} - \hat{r}_{i,t} \right)^2} = \sqrt{\frac{1}{N} \sum_{t=1}^{N} \varepsilon_{i,t}^2} \tag{4}$$

$\hat{r}_{i,t}$ = predicted return of stock i in day t **in excess** of the risk-free rate

$\varepsilon_{i,t}$ = residual risk for stock i at day t

N = number of trading days

Generally, the smaller the *RMSE*, the better the performance of the model will be.

Estimation of the idiosyncratic risk using Fama and French's *extended* four-factor model is done similarly. First, we regress individual stock's daily excess return on Fama and French's (1993) *extended* four-factor to estimate their factors loadings:

$$r_{i,t} = \alpha_i + \beta_{iMKT} r_{m,t} + \beta_{iSMB} SMB_t + \beta_{iHML} HML_t + \beta_{iUMD} UMD_t + \varepsilon_{i,t} \tag{5}$$

Where:

$r_{i,t}$ = return of stock i in day t **in excess** of the risk-free rate

$r_{m,t}$ = $\sum_i w_{i,t} r_{i,t}$ with $w_{i,t}$ = weight of firm i at date t. It is value-weighted **excess** market return on all NYSE, AMEX, and NASDAQ stocks (from CRSP) minus the one-month Treasury bill rate (from Ibbotson Associates).

SMB_t (Small Minus Big) = the difference between the returns on small and large capitalization portfolios (the average return on the three small portfolios minus the average return on the three big portfolios).

HML_t (High Minus Low) = the difference between the returns on high and low book to market portfolios (the average return on the two value portfolios minus the average return on the two growth portfolios).

UMD_t (Up Minus Down) = the difference between the returns on winner and loser portfolios (the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios).

These factors, definition of factors, and daily portfolio return are obtained from Kenneth French'website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).

After we get the estimation for alpha, beta, and the factor loadings for SMB, HML, and UMD, we put the actual stock's daily excess return on the estimation (the line of best fit) to find the residual risk for each day.

Subsequently, idiosyncratic risk of stock return is estimated similarly using standard deviation of daily residual risk (equation (3)) and root mean squared error of a regression of daily excess returns on the Fama and French's *extended* four-factor (equation (4)).

It should be noted that thin trading or liquidity problem can lead to a bias in the regression results. To counter this problem, idiosyncratic risk measures are set to missing if for a stock the number of days when trading take place are less than 50 days.

Empirical Model

Slope of Demand Curve and Leverage Ratio

To test the first hypothesis that firms with steeper demand curve tend to have higher leverage, the following regression is performed:

$$LEV = \alpha + \beta_1 C + \gamma_1 DCSlope + \varepsilon \qquad (6)$$

$$TDM = \alpha + \beta_1 C + \gamma_1 DCSlope + \varepsilon \qquad (6a)$$

$$TDB = \alpha + \beta_1 C + \gamma_1 DCSlope + \varepsilon \qquad (6b)$$

LEV, the leverage ratios have two variations; market leverage (TDM) and book leverage (TDB). We run the regression for both as there is no agreement among researchers over which measurement is the best one. DCSlope is the slope of demand curve for stock. C denotes pre-determined control variables (will be discussed shortly), lagged one period. After the necessary factors correlated with cross-sectional differences in leverage are controlled, the impact of downward sloping demand curve for stocks on firm's financing decisions can be observed by running the regression model above. γ_1, the coefficient of DC Slope, is predicted to be positive.

To investigate the relationship between the slope of demand curve for stock and leverage, we need to control for other variables which affect the firm's leverage. Frank and Goyal (2004) show seven core factors which are reliably important for predicting leverage decisions of publicly traded US firms from 1950 to 2000. Their study provides useful input for pre-determined control variable in this research paper. Control variables suggested by Frank and Goyal (2004) are mainly used because in the process of obtaining those factors, they have take into account the parsimony consideration and control for multicollinearity using Bayesian Information Criterion (BIC) method. This research also includes few additional factors used by Chang et al. (2006). Although there is conformity among researchers about which factors influence capital structure, there is less agreement in the interpretations of the effects. This paper provides

commonly accepted interpretations of different control variables. Alternative interpretations are possible. Factors which serve as control variables in this research are summarised below.

Firm Size. Trade-off theory predicts that larger firms should have higher leverage because generally they have lower default risk. In line with that, Harris and Raviv (1991) documented that leverage is positively related to firm size. Therefore, log of the book value of assets as a proxy for firm size is included as one of control variables.

Median Industry Leverage. Frank and Goyal (2004) show that industry leverage is major determinants of corporate leverage. Firms in high leverage industry, measured using median industry leverage, tend to have high leverage. In accordance with that, Hovakimian, Opler and Titman (2001) find that firms adjust their debt ratios towards industry median debt ratios. Hence, median industry leverage is included in the control variables.

Tangibility. From trade-off and agency theory perspective, firms that have more tangible assets tend to have more leverage because tangible assets could serve as collateral. Indeed, empirical studies support this prediction.

Research and development expense to sales ratio. Research and development expense scaled by sales can proxy for a variety of firm characteristics for instance growth potential or uniqueness of the product (Titman, 1984). Hence, it is included as one of the control variables. This paper also includes research and development dummy variable which equals to one if research and development expense is missing and zero otherwise.

Firm age or maturity of the firm. Mature firms typically have more reputation in debt markets and hence face lower agency costs of debt. For this reason, trade-off theory predicts positive relation between firm's age and leverage. To account for this, the age of the firm is included as a control variable.

Market to book ratio. Market to book ratio is included to control for growth opportunities. Empirical studies document that high growth firms tend to have less leverage. According to agency theory, this is possibly because growth firms tend to avoid incentives distortion problems.

Profitability. Frank and Goyal (2004) documented that firms with more profits tend to have less leverage. This can be explained using pecking order theory of capital structure which states that profitable firms borrow less because they have more internal source of funds.

Dividends. Frank and Goyal (2004) find that firms which pay dividends tend to have less leverage than non-payers. Their finding can be explained in a dynamic trade-off framework but cannot be explained by pecking order theory because pecking order theory predicts the contrary. Frank and Goyal (2004) propose two interpretations to account for negative relation between leverage and dividends. First, dividend-paying firms have lower agency costs of equity and hence allow firms to issue more equity. Consequently, they have less leverage. Second, "dividend-paying firms might be those that generate more cash from operations relative to investment opportunities so they pay out the difference. Such firms would be unlikely to raise more debt since that would incur the unnecessary transactions costs therefore dividend paying firms would have less leverage."

Share turnover. Share turnover is included in the control variables to proxy for liquidity. Illiquidity of firms' stock prevents them to raise equity. They will prefer debt financing instead hence they will tend to have higher leverage.

Stock return. Consistent with market timing theory and adverse selection arguments, firms are more likely to issue equity when their stock performance has been good as firms are less likely to be undervalued during such periods. Therefore, to control for past stock performance, cumulative stock returns is included in this research.

Earning volatility and Altman's unleveraged z-score. According to trade-off theory, firms react to risk by reducing leverage. Hence, earning volatility and Altman's unleveraged z-score are included to control for the risk faced by the firm (Chang et al. (2006)).

Expected inflation. Firms tend to have high leverage when expected inflation is high. "According to Taggart (1985) this may reflect features in the tax code that favour debt when inflation is expected." As noted by Frank and Goyal (2004), it might also reflect efforts by managers to time the market.

Slope of Demand Curve and Target Adjustment Model

Target adjustment model is performed to test whether firms with steeper demand curve have higher target debt ratio (the second hypothesis). In perfect capital market, firms always maintain their target leverage ratio. However, adjustment costs may prevent immediate adjustment to a firm's target. The standard target adjustment model allows partial adjustment of the firm's initial leverage ratio toward its target within each time period (Flannery and Rangan, 2004). The standard target adjustment model is estimated as follow:

$$LEV_{i,t} - LEV_{i,t-1} = \alpha_1 + \lambda\left(LEV_{i,t}^* - LEV_{i,t-1}\right) + \varepsilon_{i,t} \qquad (7)$$

$$TDM_{i,t} - TDM_{i,t-1} = \alpha_1 + \lambda\left(TDM_{i,t}^* - TDM_{i,t-1}\right) + \varepsilon_{i,t} \qquad (7a)$$

$$TDB_{i,t} - TDB_{i,t-1} = \alpha_1 + \lambda\left(TDB_{i,t}^* - TDB_{i,t-1}\right) + \varepsilon_{i,t} \qquad (7b)$$

where $LEV_{i,t}$ is leverage ratio at time t for firm i and $LEV_{i,t-1}$ is leverage ratio lagged one period. Final synthesized trade-off suggests that firms have a target debt ratio which they want to achieve hence firms that are above a target debt ratio should issue equity and firms that are below a target debt ratio should issue debt. Therefore, we include deviation of lagged one-period debt ratio from the estimated target debt ratio in the regression.

$LEV_{i,t}^*$ denotes the target leverage ratio for firm i at time t, which can be expressed as a function of demand curve slope and a set of predetermined (lagged one period) control variables (*C*):

$$LEV_{i,t}^* = \alpha_2 + \beta C_{i,t-1} + \gamma DCSlope_{i,t-1} \qquad (8)$$

$$TDM_{i,t}^* = \alpha_2 + \beta C_{i,t-1} + \gamma DCSlope_{i,t-1} \qquad (8a)$$

$$TDB_{i,t}^* = \alpha_2 + \beta C_{i,t-1} + \gamma DCSlope_{i,t-1} \qquad (8b)$$

By substituting equation (8) into (7), we reduce the target adjustment model to:

$$LEV_{i,t} = \alpha_3 + (1-\lambda)LEV_{i,t-1} + \theta C_{i,t-1} + \varphi DCSlope_{i,t-1} + \varepsilon_{i,t} \qquad (9)$$

$$TDM_{i,t} = \alpha_3 + (1-\lambda)TDM_{i,t-1} + \theta C_{i,t-1} + \varphi DCSlope_{i,t-1} + \varepsilon_{i,t} \qquad (9a)$$

$$TDB_{i,t} = \alpha_3 + (1-\lambda)TDB_{i,t-1} + \theta C_{i,t-1} + \varphi DCSlope_{i,t-1} + \varepsilon_{i,t} \qquad (9b)$$

where $\theta = \lambda\beta$ and $\varphi = \lambda\gamma$. λ is speed of adjustment of the firm to the target debt ratio. Using the target adjustment regression model in equation (9), it is predicted that φ is positive.

Regression Specifications

This research uses Ordinary Least Square (OLS) regression which assumes that errors have zero mean, constant variance (homoscedasticity), are uncorrelated with each other and normally distributed. To address the concern that the error terms are likely to violate OLS assumptions of homoscedasticity and cross-sectional independence, we also estimate parameters and standard errors based on the Fama and MacBeth (1973) approach. In other words, we estimate regression equations each year, and conduct statistical tests on the time-series means of the estimated coefficients. The results from Fama-MacBeth regression are similar to the ones from OLS regression therefore they are not reported for the purpose of conciseness. Study by Flannery and Rangan (2004) confirm this since they also find that OLS yields similar coefficient estimates for the same specifications. Therefore, we can infer that regressions results in this research are reliable and do not suffer from a serious bias.

DATA AND ESTIMATION PROCEDURES

Sample

The sample is constructed from all firms that exist in Compustat any time between 1971 and 2004. Following the common practice, non-industrial firms are excluded from the sample, specifically financial (SIC 6000-6999) and regulated (SIC 4900-4999) firms. The reason of this exclusion is because the capital decisions of financial and regulated firms may reflect special factors (Flannery and Rangan, 2004). Firms with missing book value of assets and firms which have less than two consecutive years of data are also excluded because lagged one period data is needed for most of the variables in the regression. Exclusion of non-industrial firms and firms which have less than two years consecutive data result in complete information for 99,397 firm-year observations (7,785 firms). When firms with missing book value of assets are also excluded (to run book leverage regressions), it leads to 98,715 firm-year observations.

Variety of Compustat and CRSP variables are employed. Financial statement data (debt, total assets, EBITDA, research and development expenses, etc.) are obtained from Compustat. Stock price and stock return are obtained from the Center for Research in Security Prices (CRSP). Adjustments are made, when the data is merged, to ensure that they matched each other correctly. For example, Compustat reports the number of shares in million while it is reported in thousand in CRSP. Hence, CRSP number of shares must be divided by 1,000 to arrive at the same measurement with Compustat. CRSP reports monthly data while Compustat reports annually therefore CRSP data need to be adjusted on yearly basis when they are merged.

Outliers or extreme observations can lead to misleading conclusions hence they cannot be ignored. To deal with this problem, we use winsorization under which the most extreme tails of the distribution are replaced by the most extreme value that has not been removed.

Table 1 reports the summary statistics of variables which we use and the definition of each variable. All of these variables are winsorized at 0.5% of both sides of the distribution to mitigate the impact of extreme observations and mis-recorded data.

Variables and Variables Definition

The dependent variable is leverage, measured using market leverage (TDM) and book leverage (TDB). Market leverage is ratio of total debt divided by market value of assets while book leverage is ratio of total debt divided by book value of assets.

The independent variables are slope of demand curve for stock and control variables. All explanatory variables are lagged one period. Proxy for the slope of demand curve for stock is idiosyncratic risk of stock returns which is measured using RMSE-CAPM, RMSE-FF, RSD-CAPM, and RSD-FF. RMSE-CAPM is root mean square error of residuals from a regression of daily excess returns on the market model. RMSE-FF is root mean square error of residuals from a regression of daily excess returns on the Fama and French' (1993) *extended* four-factor. RSD-CAPM is standard deviation of the residuals from a regression of daily excess returns on the market model. RSD-FF is standard deviation of the residuals from a regression of daily excess returns on the Fama and French' (1993) *extended* four-factor.

Control variables are size, age, tangibility, industry median leverage, profitability, turnover, stock return, market to book ratio, research and development to sales ratio, research and development dummy, z-score, dividend to assets ratio, and earning's variability. Firm size (LNBVAD1) is log of book value assets deflated by Consumer Price Index to account for inflation. Firm age (LNAGE1) is log of the firm's age or number of years since the Initial Public Offering (IPO) year. Tangibility (TANG1) is the net property, plant, and equipments to asset ratio. Industry median leverage (MDLEV1) is the median of the ratio of total debt to the market value of assets by industry and by year. Return on Assets (ROA1), a profitability measurement, is the operating income before depreciation and amortization divided by total assets. Share turnover (MDTNOVER1), proxy for firm's stock liquidity, is median value of monthly shares traded (volume) divided by shares outstanding over a twelve month period. Stock Return (STKRTN1) is compounded annual stock return over a twelve-month period, obtained from CRSP dataset. Market to Book Ratio (MBA1), well-known as proxy for growth opportunities, is market value of assets divided by book value of assets. Research and Development to Sales (RNDSLS1) is research and development expenses divided by net sales. Research and Development Dummy (RNDD1) is dummy variable which take value of one if firm does not have research and development expenses, zero otherwise. Altman Un-leveraged Z-score (ZSCORE1) is equals to [(3.3*pretax income + sales + 1.4*retained earnings + 1.2*(current assets – current liabilities))/total assets]. Dividend to Assets Ratio (DIVAST1) is common stocks dividends divided by total assets. Earning's Variability (EBITSD) is historical standard deviation of the ratio of EBITDA to total assets.

Summary Statistics

Table 1 displays descriptive statistics of employed variables in overall sample. All of these variables are winsorized at 0.5% of both side of the distribution to avoid the influence of extreme observations and mis-recorded data. The mean, median, and standard deviation of each variable are reported in the table. On average, market leverage ratio in overall sample is 20% while book leverage ratio is 24%. The median of market leverage ratio and book leverage ratio are 16% and 22% respectively. Idiosyncratic volatility (proxy for the slope of demand curve for stock) as measured using RMSE-CAPM, RMSE-FF, RSD-CAPM, and RSD-FF has mean, median, and standard deviation of 4%, 3%, and 3% respectively. When four decimal points are used

instead of two decimal points, we can see the slight difference of idiosyncratic volatility estimation using those various methods i.e. RMSE-CAPM, RMSE-FF, RSD-CAPM, and RSD-FF. However, the difference is trivial. Average age of firms listed in Compustat between 1971 and 2004 is 17.33 years. The minimum number of years per firm is 2, the maximum is 34, and the median is 14.

Table 1: Summary Statistics

Variable	Mean	Median	Standard Deviation
Market Leverage (TDM)	0.20	0.16	0.18
Book Leverage (TDB)	0.24	0.22	0.19
Firm Size (BVAD)	1725.31	163.00	7575.54
Age (years)	17.33	14.00	11.19
Tangibility (TANG)	0.32	0.27	0.22
Industry Median Leverage (MDLEV)	0.17	0.16	0.11
Return On Assets (ROA)	0.08	0.12	0.41
Share Turnover (MDTNOVER)	0.00	0.00	0.00
Stock Return (STKRTN)	0.16	0.05	0.68
Market to Book Ratio (MBA)	1.78	1.27	1.86
R&D to Sales Ratio (RNDSLS)	0.11	0.00	0.63
R&D Dummy (RNDD)	0.35	0.00	0.48
Un-leveraged Z-score (ZSCORE)	1.57	2.09	3.54
Dividend to Assets (DIVAST)	0.01	0.00	0.02
Earning Variability (EBITSD)	94.70	11.59	297.11
RMSE-CAPM	0.04	0.03	0.03
RMSE-FF	0.04	0.03	0.03
RSD-CAPM	0.04	0.03	0.03
RSD-FF	0.04	0.03	0.03

Table 2 reports the correlation coefficients among several key variables of interest. From pairwise correlation coefficients among various proxies for the slope of demand curves for stock, it can be inferred that various measurement (RMSE-CAPM, RMSE-FF, RSD-CAPM, and RSD-FF) to estimate idiosyncratic volatility do not differ much and their correlation coefficients are close to one. This suggests that those various measurements are consistent with each other in estimating idiosyncratic risk of individual stock.

Table 2: Correlation Coefficient between Key Variables

Correlation	TDM	TDB	BVAD	TANG	MDLEV	ROA	MDTNOVER	MBA	RMSE-CAPM	RMSE-FF	RSD-CAPM	RSD-FF
TDM	1.0000											
TDB	0.8741***	1.0000										
BVAD	0.0118***	0.0308***	1.0000									
TANG	0.2803***	0.2795***	0.1053***	1.0000								
MDLEV	0.4756***	0.3650***	0.0479***	0.3404***	1.0000							
ROA	0.0098**	-0.0170***	0.0344***	0.0721***	0.0798***	1.0000						
MDTNOVER	-0.2022***	-0.1198***	0.0278***	-0.1560***	-0.2747***	-0.0367***	1.0000					
MBA	-0.3339***	-0.1850***	-0.0232***	-0.1430***	-0.2709***	-0.2228***	0.2468***	1.0000				
RMSE-CAPM	0.0809***	0.0601***	-0.1517***	-0.1387***	-0.1511***	-0.2345***	0.0933***	0.0837***	1.0000			
RMSE-FF	0.0824***	0.0611***	-0.1525***	-0.1373***	-0.1494***	-0.2343***	0.0848***	0.0811***	0.9996***	1.0000		
RSD-CAPM	0.0809***	0.0600***	-0.1517***	-0.1387***	-0.1511***	-0.2345***	0.0934***	0.0837***	1.0000***	0.9996***	1.0000	
RSD-FF	0.0823***	0.0610***	-0.1527***	-0.1374***	-0.1496***	-0.2343***	0.0849***	0.0811***	0.9996***	1.0000***	0.9996***	1.0000

Table 2 also displays the correlation coefficients between slope of demand curves and leverage. This univariate analysis shows that the slope of demand curve for stock (as shown by RMSE-CAPM, RMSE-FF, RSD-CAPM, and RSD-FF) is positively related to the leverage ratio. Greater magnitude of RMSE-CAPM, RMSE-FF, RSD-CAPM, and RSD-FF represent steeper demand curve for a firm's stock. This preliminary evidence supports the idea that firms with steeper demand curve tend to have higher leverage ratio.

Pairwise correlation coefficients between control variables and leverage are reported in table 2 as well. Most correlation coefficients have expected signs. For instance, size and leverage are positively correlated. Tangibility and leverage are positively correlated suggesting that firms which have more tangible assets tend to have more leverage. The low correlations among independent variables indicate that one can include these variables in the same regressions without concerning about multicollinearity.

RESULTS AND ANALYSIS

Slope of Demand Curve for Stock and Actual Leverage Ratio
Actual Market Leverage

Table 3 presents the regression results of actual market leverage on the slope of demand curve for stock. Results show that there is positive and statistically significant relationship between the slope of demand curve for stock and actual market leverage and are consistent across various measurement methods of the slope of demand curve for stock (RMSE-CAPM, RMSE-FF, RSD-CAPM, and RSD-FF). Even after controlling for other factors shown in prior studies to influence leverage, the coefficient of the slope of demand curve for firm's stock on firm's actual market leverage is positive and statistically significant at 1% level demonstrating that firms with steeper slope of demand curves tend to have higher actual market leverage. This result also implies that the slope of demand curves for stock is an additional determinant factor in predicting firm's market leverage.

Most control variables are significant and have the expected signs. For instance, firm size, tangibility, and industry median leverage are positively related to leverage. This is consistent with prior literatures (e.g. Harris and Raviv (1991), Frank and Goyal (2004)). Harris and Raviv (1991) document that larger firms have higher leverage. It is well known that firms with more tangible assets tend to have higher leverage as they can pledge their assets in support of debt. Frank and Goyal (2004) find that industry leverage is prominent determinant of firm's leverage, which is exactly what is found in this research. They provide explanation that firms in high leverage industry have higher leverage since firms in the same industry must face many common factors.

Table 3: Actual Market Leverage and the Slope of Demand Curve

LEVERAGE (TDM)	(1) RMSE-CAPM	(2) RMSE-FF	(3) RSD-CAPM	(4) RSD-FF
DCSlope	1.227***	1.227***	1.230***	1.240***
	(16.9)	(16.8)	(16.9)	(16.8)
LNBVAD1	0.021***	0.022***	0.021***	0.022***
	(23.2)	(23.2)	(23.2)	(23.2)
LNAGE1	-0.005***	-0.005***	-0.005***	-0.005***
	(-2.9)	(-2.9)	(-2.9)	(-2.9)
TANG1	0.081***	0.081***	0.081***	0.081***
	(11.9)	(11.9)	(11.9)	(11.9)
MDLEV1	0.511***	0.511***	0.511***	0.511***
	(45.2)	(45.2)	(45.2)	(45.2)
ROA1	0.005	0.005	0.005	0.005
	(0.7)	(0.7)	(0.7)	(0.7)
MDTNOVER1	-18.285***	-18.058***	-18.287***	-18.064***
	(-17.2)	(-17.1)	(-17.2)	(-17.1)
STKRTN1	-0.012***	-0.012***	-0.012***	-0.012***
	(-15.8)	(-15.7)	(-15.8)	(-15.7)
MBA1	-0.013***	-0.013***	-0.013***	-0.013***
	(-22.6)	(-22.5)	(-22.6)	(-22.5)
RNDSLS1	-0.013***	-0.013***	-0.013***	-0.013***
	(-10.7)	(-10.7)	(-10.7)	(-10.7)
RNDD1	0.016***	0.016***	0.016***	0.016***
	(6.3)	(6.2)	(6.3)	(6.2)
ZSCORE1	-0.005***	-0.005***	-0.005***	-0.005***
	(-7.5)	(-7.5)	(-7.5)	(-7.5)
DIVAST1	-1.569***	-1.572***	-1.569***	-1.571***
	(-21.8)	(-21.8)	(-21.8)	(-21.8)
EBITSD	-0.000***	-0.000***	-0.000***	-0.000***
	(-12.6)	(-12.6)	(-12.6)	(-12.6)
Constant	0.010	0.010	0.010	0.010
	(1.4)	(1.4)	(1.4)	(1.3)
Observations	99397	99397	99397	99397
R-Squared	0.33	0.33	0.33	0.33

Others significant factors, namely maturity of firms, stock's liquidity, stock return, market to book ratio, R&D to sales ratio, Altman un-leveraged z-score, dividend to assets, and earning variability are negatively related to firm's actual leverage ratio. Consistent with prior studies and agency theory, market to book ratio (as proxy for growth opportunities) is found negatively related to firm's leverage possibly because growth firms want to avoid debt overhang problems. In line with that, R&D to sales ratio is negatively related to firm's leverage ratio. This research also found that stock return, to control for past stock performance, is negatively related to leverage. This result is consistent with the market timing theory which states that firms are more likely to issue equity hence having lower debt proportion when their stock performance has been good. In accordance with Frank and Goyal (2004), this paper finds that dividend paying firms tend to have lower leverage ratio.

Contrary to the view that mature firms typically have higher leverage because they have more reputation in debt markets hence can borrow at lower cost of debt, this research find that mature firms tend to borrow less. This probably because mature firms have more cash

flow in the first place thus not only need less outside financing, but also tend to pay-off debt instead of borrows more. Firms with more liquid stocks tend to have less leverage. The liquidity of firm's stocks suggests that firms can raise equity more easily and cheaply in the market because markets can absorb firm's stocks in the event of equity issuance. The more liquid firms' stocks, the more likely firms will issue equity hence the lower their leverage will be. Finally, as suggested by trade-off theory, firms react to risk by reducing leverage. In line with this view, this research paper finds that earnings variability (proxy for risk) is negatively related with leverage.

Actual Book Leverage

The regression of actual book leverage on various proxies of the slope of demand curve for stock is reported in table 4. When book leverage is used instead of market leverage, the same results are found. The slope of demand curves for stock is a positive and statistically significant factor in predicting book leverage of the firm, even though other variables shown to affect leverage had been controlled. Across various proxies of the slope of demand curve for stock (RMSE-CAPM, RMSE-FF, RSD-CAPM, and RSD-FF), the coefficient of the slope of demand curve for stock to the actual book leverage is positive and significant at 1% level suggesting that firms with steeper slope of demand curves have higher actual book leverage.

Other factors i.e. the control variables have same signs and magnitude as in market leverage regression. The only remarkable difference is that return on assets (ROA) as one of the profitability measures is a positive and statistically significant factor to explain book leverage while it is insignificant for market leverage. This is possibly because ROA as an accounting ratio, is based on book value and more backward looking which are features also shared by book leverage.

Table 4: Actual Book Leverage and the Slope of Demand Curve

LEVERAGE (TDB)	(1) RMSE-CAPM	(2) RMSE-FF	(3) RSD-CAPM	(4) RSD-FF
DCSlope	0.990***	0.994***	0.992***	1.004***
	(14.3)	(14.2)	(14.3)	(14.2)
LNBVAD1	0.022***	0.022***	0.022***	0.022***
	(21.8)	(21.9)	(21.8)	(21.9)
LNAGE1	-0.009***	-0.009***	-0.009***	-0.009***
	(-4.8)	(-4.8)	(-4.8)	(-4.8)
TANG1	0.102***	0.102***	0.102***	0.102***
	(13.1)	(13.1)	(13.1)	(13.1)
MDLEV1	0.411***	0.411***	0.411***	0.411***
	(33.9)	(33.9)	(33.9)	(33.9)
ROA1	0.047***	0.047***	0.047***	0.047***
	(5.2)	(5.2)	(5.2)	(5.2)
MDTNOVER1	-14.763***	-14.592***	-14.764***	-14.596***
	(-11.3)	(-11.2)	(-11.3)	(-11.2)
STKRTN1	-0.004***	-0.003***	-0.004***	-0.003***
	(-4.0)	(-3.9)	(-4.0)	(-3.9)
MBA1	-0.006***	-0.006***	-0.006***	-0.006***
	(-10.7)	(-10.6)	(-10.7)	(-10.6)
RNDSLS1	-0.016***	-0.016***	-0.016***	-0.016***
	(-8.9)	(-8.9)	(-8.9)	(-8.9)
RNDD1	0.024***	0.024***	0.024***	0.024***
	(8.5)	(8.5)	(8.5)	(8.5)
ZSCORE1	-0.012***	-0.012***	-0.012***	-0.012***
	(-12.2)	(-12.2)	(-12.2)	(-12.2)
DIVAST1	-1.554***	-1.555***	-1.554***	-1.555***
	(-19.7)	(-19.7)	(-19.7)	(-19.7)
EBITSD	-0.000***	-0.000***	-0.000***	-0.000***
	(-8.2)	(-8.2)	(-8.2)	(-8.2)
Constant	0.060***	0.060***	0.060***	0.060***
	(7.9)	(7.9)	(7.9)	(7.8)
Observations	98715	98715	98715	98715
R-Squared	0.23	0.23	0.23	0.23

To sum up, the results from leverage regression show that slope of demand curve for stock has positive and significant effect on the firm's actual leverage ratio (measured using either market or book leverage), even after controlling for other factors which have been shown in past literatures to influence firm's leverage. The results confirm the first hypothesis that firms with steeper demand curve for their stock suffer more from the share price drop if they issue equity hence are less likely to issue equity. Consequently, we will observe higher actual leverage ratio for these firms, which is exactly what is found from the empirical studies in this research.

Slope of Demand Curve for Stock and Target Leverage Ratio

Target Market Leverage

Table 5 reports target adjustment regression results when market leverage is used. The results show that the slope of demand curves for stocks is a positive and statistically

significant factor to explain the target market leverage ratio, even after controlling for lagged one period market leverage ratio and other factors. The findings that lagged one period market leverage ratio (TDM1) has significant positive effect on the target market leverage ratio indicating that firms gradually adjust to the target leverage ratio. From the positive and significant coefficient of lagged one period market leverage ratio, $(1-\lambda)$, we can infer how fast firms adjust their market leverage ratio to the estimated target market leverage ratio. The coefficient of the lagged market leverage is 0.841. It implies that firms close 15.9% (= 1 - 0.841) of the gap between current and target leverage within one year.

Table 5: Target Market Leverage and the Slope of Demand Curve

TARGET ADJUSTMENT MODEL (TDM)	(1) RMSE-CAPM	(2) RMSE-FF	(3) RSD-CAPM	(4) RSD-FF
TDM1	0.841***	0.841***	0.841***	0.841***
	(299.7)	(299.8)	(299.7)	(299.8)
DCSlope	0.210***	0.209***	0.211***	0.212***
	(8.7)	(8.6)	(8.7)	(8.6)
LNBVAD1	0.004***	0.004***	0.004***	0.004***
	(14.5)	(14.5)	(14.5)	(14.5)
LNAGE1	-0.007***	-0.007***	-0.007***	-0.007***
	(-16.1)	(-16.1)	(-16.1)	(-16.1)
TANG1	0.019***	0.019***	0.019***	0.019***
	(10.4)	(10.4)	(10.4)	(10.4)
MDLEV1	0.046***	0.046***	0.046***	0.046***
	(13.0)	(13.0)	(13.0)	(13.0)
ROA1	-0.004	-0.004	-0.004	-0.004
	(-0.7)	(-0.7)	(-0.7)	(-0.7)
MDTNOVER1	-0.385	-0.339	-0.386	-0.343
	(-1.0)	(-0.9)	(-1.0)	(-0.9)
STKRTN1	-0.002***	-0.002***	-0.002***	-0.002***
	(4.4)	(4.3)	(4.4)	(4.3)
MBA1	0.000	0.000	0.000	0.000
	(0.3)	(0.4)	(0.3)	(0.4)
RNDSLS1	-0.003***	-0.003***	-0.003***	-0.003***
	(-5.8)	(-5.8)	(-5.8)	(-5.8)
RNDD1	0.005***	0.005***	0.005***	0.005***
	(7.7)	(7.7)	(7.7)	(7.7)
ZSCORE1	0.001***	0.001***	0.001***	0.001***
	(2.8)	(2.7)	(2.8)	(2.7)
DIVAST1	-0.110***	-0.110***	-0.110***	-0.110***
	(-6.7)	(-6.8)	(-6.7)	(-6.8)
EBITSD	-0.000***	-0.000***	-0.000***	-0.000***
	(-13.9)	(-13.9)	(-13.9)	(-13.9)
Constant	0.015***	0.015***	0.015***	0.015***
	(6.8)	(6.8)	(6.8)	(6.8)
Observations	99397	99397	99397	99397
R-Squared	0.75	0.75	0.75	0.75

The coefficient of DCSlope to target market leverage ratio, φ, is also positive and significant. This result is consistent with Hypothesis 2 which states that firms with steeper demand curve tend to have higher target leverage ratios. We can also infer the coefficient of the slope of demand curve to the target market leverage ratio from the result. For instance,

using RMSE of Fama and French's *extended* four-factor model as proxy for the slope of demand curve, the coefficient of the slope of demand curve to market leverage ratio, φ, is 0.209. Since $\varphi = \lambda\gamma$, we can decompose them to find the impact of the slope of demand curve to the target market leverage ratio. We know that φ is 0.209 and λ is 0.159, hence we can figure out that γ, the coefficient of demand curve slope to the target market leverage ratio, is 1.314. In this case, we also found that the impact of the slope of demand curve to the target debt ratio is positive and significant which means that firms with steeper demand curve tend to have higher target market leverage ratio.

Other factors have expected sign and similar to the results found in the actual leverage regression. Note however, when lagged one period debt ratio of the firm is included in the regression, some significant explanatory variables in previous regressions (equation 6(a)), specifically stock's liquidity and market to book ratio, are no longer significant.

Target Book Leverage

Table 6 presents target adjustment regression result using book leverage as the dependent variable. Essentially, using book leverage instead of market leverage in the model does not alter the main finding.

Lagged one period book leverage ratio (TDB1) has significant positive effect on the target book leverage ratio indicating that firms gradually adjust to the target leverage ratio. Similar to the result in target adjustment regression using market leverage, the coefficient on the lagged book leverage implies that firms close 15.9% (= 1 - 0.841) of the gap between current and target leverage within one year.

The slope of demand curve for stock also has significant positive effect on the target book leverage ratio, even though other factors shown to affect leverage and lagged one period book leverage ratio had been controlled. Using RMSE of Fama and French's *extended* four-factor model as proxy for the slope of demand curve, the coefficient of the slope of demand curve to book leverage ratio, φ, is 0.187. Since $\varphi = \lambda\gamma$, we can decompose them to find the impact of the slope of demand curve to the target book leverage ratio. We know that φ is 0.187 and λ is 0.159, hence we can figure out that γ, the coefficient of demand curve slope to the target book leverage ratio is 1.176. The results support the second hypothesis which predicts that firms with steeper slope of demand curve tend to have higher target leverage ratio. The reason is because firms with a steeper slope of demand curve for their stock are less likely to issue equity since they will suffer more in the declining of their share price when they choose to do so.

Other factors have expected sign and similar to the result of actual book leverage regression. Note however, when lagged one period debt ratio of the firm is included in the regression, some significant explanatory variables in previous regressions (equation 6(b)), specifically return on assets, stock's liquidity, and market to book ratio, and Altman un-leveraged z-score are no longer significant.

Compared to market leverage target adjustment regression, one prominent difference is that the effect of Altman un-leveraged z-score on the book leverage is not significant while it is significant on the market leverage.

Table 6: Target Book Leverage and the Slope of Demand Curve

TARGET ADJUSTMENT MODEL (TDB)	(1) RMSE-CAPM	(2) RMSE-FF	(3) RSD-CAPM	(4) RSD-FF
TDB1	0.841***	0.841***	0.841***	0.841***
	(275.6)	(275.6)	(275.6)	(275.6)
DCSlope	0.186***	0.187***	0.186***	0.189***
	(7.4)	(7.4)	(7.4)	(7.4)
LNBVAD1	0.003***	0.003***	0.003***	0.003***
	(9.7)	(9.8)	(9.7)	(9.8)
LNAGE1	-0.005***	-0.005***	-0.005***	-0.005***
	(-9.5)	(-9.5)	(-9.5)	(-9.5)
TANG1	0.019***	0.019***	0.019***	0.019***
	(9.5)	(9.5)	(9.5)	(9.5)
MDLEV1	0.039***	0.039***	0.039***	0.039***
	(10.9)	(10.9)	(10.9)	(10.9)
ROA1	-0.008	-0.008	-0.008	-0.008
	(-1.6)	(-1.6)	(-1.6)	(-1.6)
MDTNOVER1	0.176	0.208	0.176	0.205
	(0.4)	(0.5)	(0.4)	(0.5)
STKRTN1	-0.005***	-0.005***	-0.005***	-0.005***
	(-7.9)	(-7.9)	(-7.9)	(-7.9)
MBA1	-0.000	-0.000	-0.000	-0.000
	(-1.3)	(-1.2)	(-1.3)	(-1.2)
RNDSLS1	-0.002**	-0.002*	-0.002**	-0.002*
	(-2.0)	(-2.0)	(-2.0)	(-2.0)
RNDD1	0.006***	0.006***	0.006***	0.006***
	(8.0)	(8.0)	(8.0)	(8.0)
ZSCORE1	-0.000	-0.000	-0.000	-0.000
	(-0.0)	(-0.0)	(-0.0)	(-0.0)
DIVAST1	-0.087***	-0.087***	-0.087***	-0.087***
	(-4.4)	(-4.4)	(-4.4)	(-4.4)
EBITSD	-0.000***	-0.000***	-0.000***	-0.000***
	(-7.0)	(-7.0)	(-7.0)	(-7.0)
Constant	0.022***	0.022***	0.022***	0.022***
	(8.7)	(8.7)	(8.7)	(8.7)
Observations	98534	98534	98534	98534
R-Squared	0.73	0.73	0.73	0.73

To summarize, results from the target adjustment regression model demonstrate that downward sloping demand curve for stock has significant positive effect on the target leverage ratio which suggests that the steeper the slope of demand curve for firm's stock, the higher the firm's target leverage ratio. This result verifies Hypothesis 2 and holds regardless whether market leverage or book leverage is used. Lagged debt ratio in the target adjustment regression model is also positive and significant which indicates that firms gradually adjust to the target leverage ratio. It is found that the estimated adjustment speed to close the gap between firm's actual leverage ratio and target leverage ratio is 15.9%.

CONCLUSIONS

This research paper empirically investigates the effect of downward sloping demand curves for stock on firms' financing decisions. Downward sloping demand curves for stock implies that when firms issue equity (which can be seen as an increase in supply), the share price of issuing firms will decrease. The decline in the firm's share price depends on the slope of demand curve. For the same amount of equity issuance, firms with a steeper slope of demand curve experience a larger price drop than firms with flatter demand curves. Therefore, *ceteris paribus*, it is argued that firms with steeper demand curves are less likely to issue equity and hence we should observe higher actual leverage ratios for these firms. To the extent that each firm has an optimal leverage ratio, these firms should also have higher target leverage ratios.

The main findings in this research paper provide supporting evidence on the proposed hypotheses. Results show that firms with steeper demand curves for stock have higher actual leverage ratios. Even after controlling for other factors which had been shown in prior studies to influence firms' leverage, it is found that the slope of demand curves for stock positively and significantly affects a firm's actual leverage. The results indicate that firms with steeper demand curves are more likely to choose debt than equity in order to avoid greater adverse price impact of equity issuance on their share price. Furthermore, firms' target leverage ratios are higher for firms with steeper demand curves. Unlike actual leverage, firms' target leverage is not directly observable. However, we can attain it using a target adjustment model. From the target adjustment regression, it can be seen that the slope of demand curve for stock is a positive, statistically significant factor for firms' target leverage ratios suggesting that there are additional incentives for these firms to use debt financing.

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VARIABLES DEFINITION AND VARIABLES CONSTRUCTION:

Market Value of Equity is defined as the number of shares outstanding multiplied by closing stock price at the end of the fiscal year (from CRSP).

Market Leverage (TDM) is ratio of total debt divided by market value of assets i.e. market value of equity plus total liability {(Compustat item 9 + Compustat item 34)/(market value of equity + (Compustat item 9 + Compustat item 34))}.

Book Leverage (TDB) is ratio of total debt divided by book value of assets {(Compustat item 9 + Compustat item 34)/Compustat item 6}.

Size (LNBVAD) is log of book value of assets deflated by Consumer Price Index to account for inflation {Compustat item number 6/Consumer Price Index}.

Age is the firm's age measured as the number of years since the Initial Public Offering (IPO) year.

Tangibility (TANG) is the net property, plant, and equipments to asset ratio {Compustat item 8/Compustat item 6}.

Industry Median Leverage (MDLEV) is the median of the ratio of total debt to the market value of assets by three-digit SIC code and by year.

Return on Assets (ROA) is the operating income before depreciation and amortization divided by total assets {Compustat item 13/Compustat item 6}.

Median turnover (MDTNOVER), proxy for firm's stock liquidity, is median value of monthly shares traded (volume) divided by shares outstanding over a twelve month period.

Annual Stock Return (STKRTN) is compounded annual stock return over a twelve-month period. Stock return is obtained from CRSP dataset.

Market-to-book ratio (MBA) is defined as market value of assets divided by total assets {(market value of equity + (Compustat item 9 + Compustat item 34))/Compustat item 6}.

R&D to Sales (RNDSLS) is research and development expenses to sales ratio {Compustat item 46/Compustat item 12}.

R&D Dummy (RNDD) is dummy variable which take value of one if research and development expense is missing, zero otherwise.

Altman's Un-leveraged Z-score (ZSCORE) is obtained from (3.3*pretax income + sales + 1.4*retained earnings + 1.2*(current assets − current liabilities)) divided by total assets. {(3.3*Compustat item 178 + Compustat item 12 + 1.4*Compustat item 36 + 1.2*(Compustat item 4 − Compustat item 5))/Compustat item 6}.

DIVAST is common stocks dividends to assets ratio {Compustat item 21/Compustat item 6}.

EBITSD is historical standard deviation (using available data during the previous 10 years) of the ratio of EBITDA to total assets. It is a measurement of earning's variability {standard deviation (Compustat item 13/Compustat item 6)}.