Testing the trade-off, pecking order and market conditions theory of capital structure: evidence from public UK firms

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Abstract

In this thesis three pairs of cross-section regressions that test predictions of the trade-off, pecking order, and market conditions theory are examined. The dataset uses 1043 public UK firms with 11797 observations. The firms are observed annually for the period of 1998 to 2017. The explanatory variables are tested using fixed effects regression models. The first pair of regressions examine (1) the split of new outside financing between share issues and debt. The second pair of regressions examine (2) the split of new debt financing between short-term and long-term debt, and the final pair of regressions examine (3) the split of new equity financing between share issues and retained earnings. Strong evidence is found for the adjustment of leverage to target predicted by the trade-off model. The response of equity financing to market valuations predicted by the market conditions model has nearly no effect on the split of new outside financing between share issues and debt. Targets for short-term debt seem to influence the mix of short-term versus long-term debt choices of small and medium firms, but not of large firms. Sticky dividends contradict the predictions of the pecking order and market conditions models about the split of equity financing between share issues and retained earnings. Overall, the results provide the most support for the trade-off theory. Nearly all the predictions of this theory are accepted. Mixed evidence is found for the market conditions model, and nearly no evidence is found for the pecking order theory.

Keywords: Pecking order theory, Trade-off theory, Market conditions theory, Capital structure

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1. Introduction

Capital structure is an important topic in corporate finance and one of the main topics taught to Corporate Finance students all over the world. Even though it has been a hot topic in financial research, the determination of capital structure remains puzzling. Since Modigliani & Miller (1958) concluded that capital structure is irrelevant for the value of the firm, a lot of researchers have tested the determinants and relevance of capital structure. Researchers have opposed the theory of capital structure modelled by Modigliani & Miller (1958) and enhanced the knowledge by adding corporate taxes (Modigliani & Miller, 1963), agency costs (Jensen & Meckling, 1976), country-specific and firm-specific factors (De Jong, Kabir & Thu, 2008), asymmetric information (Myers, 1984) and bankruptcy costs (Ross, 1977). Until now, a lot of theories have been established and tried to offer an explanation on how firms decide their capital structure. Questions that have been tried to answer are: How do firms choose their capital structure? Does an optimal capital structure exist? And what is the relation between capital structure and firm value? However, little research has been conducted on the question of which theory of capital structure tends to hold the most in practice. In this thesis I will try to answer this question by using the same method as Fama & French (2012). In this paper of 2012 a new model is introduced: the market conditions model. I will also examine the predictions of this model. Therefore, the research question is: **"Which theory of capital structure tends to hold the most in practice? Is it the trade-off, pecking order or market conditions theory?"**

I will test the predictions of all three theories to form an answer on the research question. The first theory, the pecking order theory, starts with asymmetric information as managers know more about their company's prospects, risks and value than outside investors. Asymmetric information affects the choice between internal and external financing and between the issue of debt or equity. Therefore, there exists a pecking order in the financing of new projects. Asymmetric information favours the issue of debt over equity, because the issue of debt signals the board's confidence that an investment is profitable and that the current stock price is undervalued. The issue of equity would signal a lack of confidence in the board and that they feel the share price is over-valued. An issue of equity would therefore lead to a drop of the share price (Myers and Majluf, 1984). Also, the pecking order hypothesis rejects the main prediction of the static trade-off theory, because it claims that due to asymmetric information for more riskier securities, firms have a strong preference to finance with retained earnings, but if they decide to use outside financing the firms will use primarily debt rather than new shares and debt financing is rather short-term than long-term (Myers and Majluf, 1984).

The second theory, the trade-off theory, states that a company chooses how much debt and equity to use by balancing the costs and benefits of the different forms of financing. The classical version of this hypothesis goes back to Kraus & Litzenberger (1973), who considered a balance

between the dead-weight costs of bankruptcy and the tax saving benefits of debt. The goal of this theory is to explain the fact that most corporations are financed partly with debt and partly with equity. It states that there is a trade-off between the tax benefits of debt and the costs of financial distress. The marginal benefit of debt declines as debt increases, while the marginal cost of debt increases as debt increases. This means that a firm that is optimizing its overall value will focus on this trade-off when choosing how much debt and equity to use for financing (Frank & Goyal, 2005). Thus, the central prediction of the trade-off theory is that firms have leverage targets and leverage always tends to return to its target. Opler, Pinkowitz & Stulz (1999) examine the determinants of corporate cash holdings and find that firms follow target adjustment models. Kim (1978) shows that market imperfections such as income taxes, financial distress costs and agency costs exist and concludes that there is an optimal capital structure. Additionally, Flannery & Rangan (2006) tested the trade-off theory as a partial-adjustment model and showed that firms have target capital structures and close about 33% of the gap between their current and target leverage every year.

The market conditions model has several variants. All these variants share the prediction that firms with high prices relative to a fundamental like book value issue more new shares. De Bondt & Thaler (1985) and Lakonishok, Shleifer & Vishny (1994) argue that growth stocks (stocks with a high P/B ratio) tend to be overvalued and value stocks (stocks with a low P/B ratio) tend to be undervalued. Gradual price corrections produce the value premium. This means low average returns for growth stocks and high average returns for value stocks. If growth stocks are overvalued, it seems reasonable that the debt of growth firms is also overvalued, with long-term debt more overvalued than short-term debt (Myers & Majluf, 1984).

The regression to explain total debt financing is examined by Shyam-Sunder & Myers (1999) and Frank & Goyal (2003). In this paper I will also examine the complementary regression to explain share issues. This expands the perspective provided by the debt regression. The regressions to explain the split of debt financing between short-term and long-term, and the regressions to explain the split of equity financing between retained earnings and share issues are examined by Fama & French (2012). Since 2012, these regressions have not been examined again. The UK stock market is one of the largest and most developed stock markets in the world and because of this it is interesting to examine the regressions on thus market and see if the same results as on the US stock market are found.

It is important to know which theory of capital structure holds, because the capital structure of a company is heavily analysed when determining how risky it is to invest in the business, and therefore, how expensive the financing should be. For example, more debt in the capital structure means increased fixed obligations. More obligations result in less operating buffer and therefore a greater risk. Greater risk means higher financing costs to compensate the lenders for the risk.

Consequently, if analysts and investors have more insights in the capital structure decisions of firms, it becomes easier to make the right analysis of a company and to do the right investment. Knowing which theory of capital structure holds in practice helps a lot in making these right decisions and analysis.

This study uses a sample of all public UK firms from the Compustat and Datastream databases for the period of 1998 to 2017. Financial firms, regulated utilities, and firms with missing data are excluded from the sample. The main findings can be summarized as follows:

(1) The first two regressions, which explain the split of total new outside financing between shares and debt, provide a lot of evidence that firms tend to adjust the mix of new equity and new debt to move toward their target leverage. This effect is as predicted by the trade-off theory.

(2) The second two regressions, which explain the split of new debt between short and long-term debt give results about the extended trade-off model's prediction that firms have a target mix of short-term and long-term debt. I find that when issuing debt, smaller firms with a higher short-term surplus tend to issue more long-term debt. This trade-off effect exists for all three types of firms.

(3) The regressions provide mixed evidence for the market conditions model. There is strong evidence that firms with a higher P/B_{t-1} allocate more outside financing to share issues. Also, there is evidence that firms with a higher P/B_{t-1} favour long-term debt over short-term debt, but this only holds for large firms. Finally, my tests suggest that firms with a higher P/B_{t-1} pay more dividends to be able to issue more new shares, but this effect is economically small.

(4) The pecking order model predicts that firms favour debt over share issues when issuing new outside financing and that they favour short-term debt over long-term debt. In my regressions, variation in investments, dividends, and earnings is absorbed more by debt than by share issues. However, the $dSTD_t$ and $dLTD_t$ regressions provide no support for the pecking order prediction that firms favour short-term debt, because long-term debt absorbs more of the variation in the cash flow variables than short-term debt.

Overall, the results provide the most support for the trade-off theory. Nearly all the predictions of this theory are accepted after being tested. I found mixed evidence for the predictions of the market conditions model, which leads me to sometimes accept and other times reject the predictions of this model. The least evidence is found for the pecking order model, almost all the predictions of this model are rejected. So, the trade-off theory seems to be the most realistic theory in the financing activities of public UK firms in the period of 1998 to 2017.

This result is in line with most of the studies on capital structure, because most studies found that firms have certain target ratios of capital structure. There are only two differences between the results of my thesis and the results of Fama & French (2012). The first difference is that I find evidence

for the reversion of leverage to its target for large and medium firms, not for small firms. Fama & French (2012) find exactly the opposite. They find evidence in favour of the reversion of leverage to its target for small firms, not for medium and large firms. The second difference is that I find a positive relation between new share issues and P/B_{t-1} at all three types of firms, while Fama & French (2012) find evidence for this positive relation only at small firms.

This thesis is organized as follows: section 2 provides the theoretical framework and relevant literature of the three models. Section 3 shows the methodology and data for testing the research question. Section 4 presents and discusses the empirical results. Section 5 includes the conclusion and limitations of the thesis. Lastly, in section 6, the appendix can be found.

2. Literature Review

A lot of research has been conducted on how firms finance their operations and which factors influence the choice of financing. Based on this research, two major theories arose; the pecking order and trade-off theory. In this thesis, I also evaluate the predictions of a relatively new theory of capital structure, the market conditions theory. This theory has a lot of variants. In this chapter I will discuss the relevant literature of all three theories of capital structure.

2.1 Modigliani-Miller Theorem

First, the literature of the theory that forms the foundation of all theories of capital structure is discussed. The first and most relevant version of the Modigliani-Miller theorem states that in a market without taxes, transaction costs, bankruptcy costs, and agency costs, the capital structure of a firm is irrelevant to its cost of capital and hence to investment decisions. Therefore, the capital structure of a firm has no impact on its market value (Frank & Goyal, 2007). The implication of this statement is that the value of the levered firm is the same as the value of the unlevered firm, because in a market without the frictions described above, leverage does not affect the cash flows of a firm.

This proposition was introduced by Modigliani & Miller in 1958. They showed their theorem by using the concept of homemade leverage. This concept tells that an investor can replicate the firm's financial decisions without extra costs. Therefore, the investor can create the debt level he desires. This is not realistic, because the four assumptions of the Modigliani-Miller proposition rarely hold in practice. In the real world, markets are regularly characterized by frictions like taxes, bankruptcy costs, information asymmetry and agency costs. These frictions definitely have an impact on the firm value.

Another issue is the existence of certain factors that have an influence on the capital structure. These are factors like firm size, profitability, asset tangibility, and growth opportunities. Frank & Goyal (2007) state that even if the MM-proposition does not offer a realistic description of how firms finance their investments and operations, it does provide a good explanation of why people should care about the financing of companies. The Modigliani-Miller theorem has laid the foundation for the two most popular capital structure theories in corporate finance, the pecking order and trade-off theory.

2.2 Pecking order theory

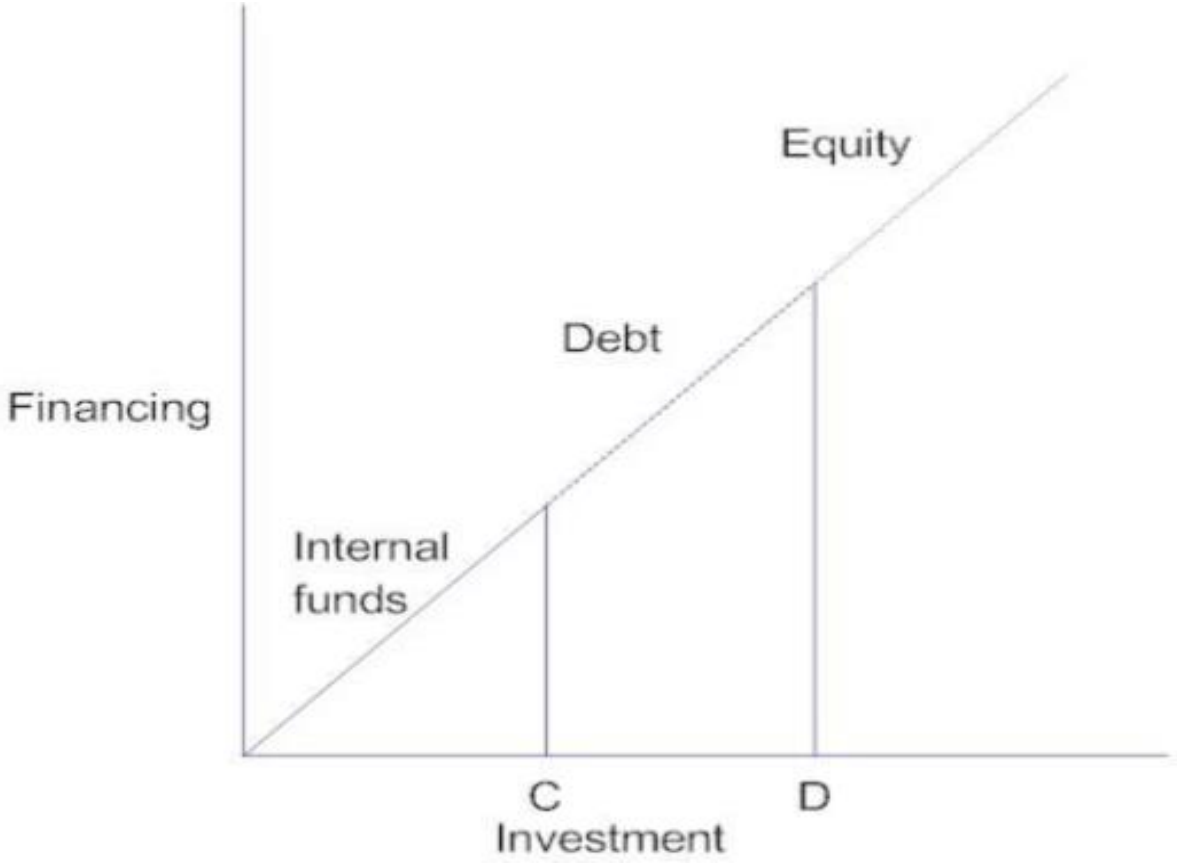
In 1984, Myers and Majluf were the first to introduce the pecking order theory. They were influenced by Donaldson (1961), who discussed the attractiveness of debt. The pecking order theory goes further on the agency theory, where the stockholders are the owners of the firm (principals), and the managers are the executors (agents). In this theory a principal-agent problem exists. In the case of the pecking order theory the principal-agent problem exists between the stockholders and managers. The

managers have superior information about the firm and future possibilities. This is called information asymmetry and it causes adverse selection, described through the 'lemons problem' by Akerlof (1970). The 'lemons problem' describes a situation where the shareholders cannot distinguish between good and bad investments, because of information asymmetry. As a result, they want a discount on the prices of the shares and the result of this is that only overvalued investments will be offered by the management, because the undervalued investments will be withdrawn to avoid a big loss.

The pecking order theory says that managers try to signal the market value of their firms to outside investors through the choice of capital structure, since the market is characterized by information asymmetry (Ross, 1977). Both investors as shareholders believe that managers issue equity when the firm's equity is overvalued, and debt when the firm's equity is undervalued (Myers, 1984). This is the reason that the pecking order theory emphasizes that when a firm want to finance its operations or invest in a new project, it initially prefers internal funds like retained earnings, cash and liquid assets. If this is not enough, the firm will borrow money in the form of debt to avoid the mispricing of the firm's value. Finally, if the first two options are exhausted, a firm will cover its financial deficits by equity. Consequently, the pecking order theory predicts that firms do not have an optimal capital structure, but instead follow a hierarchy of financial funding. Internal funds are at the top, followed by debt and lastly by external equity (Leary & Roberts, 2010). The pecking-order theory contradicts the trade-off theory.

Shyam-Sunders & Myers (1999) show that the pecking order model explains much more of the time series variance in actual debt ratios than a target adjustment model based on the trade-off theory. Acceptance of the target adjustment model leads to a rejection of the pecking order theory, since the pecking order theory contradicts the trade-off theory. Flannery & Rangan (2006) use panel data to analyse the adjustment behaviour of firms and they find that firms return quickly to their targeted leverage ratios when they are moved away from them. On the opposite, Baker & Wurgler (2002) find that the capital structure is the result of a firm's cumulative attempts to time the market, implying that a target leverage ratio does not exist.

Figure 1. Pecking order theory



Notes: the figure shows how a firm chooses its capital structure according to the pecking order theory, as it is described by the relationship between financing choice and the level of investment. Point C shows the amount of internal funds available for investment. D-C is the debt required to be issued by the firm to fill the deficit. The point total investment(end of the line) - D equals the amount of equity required beyond D.

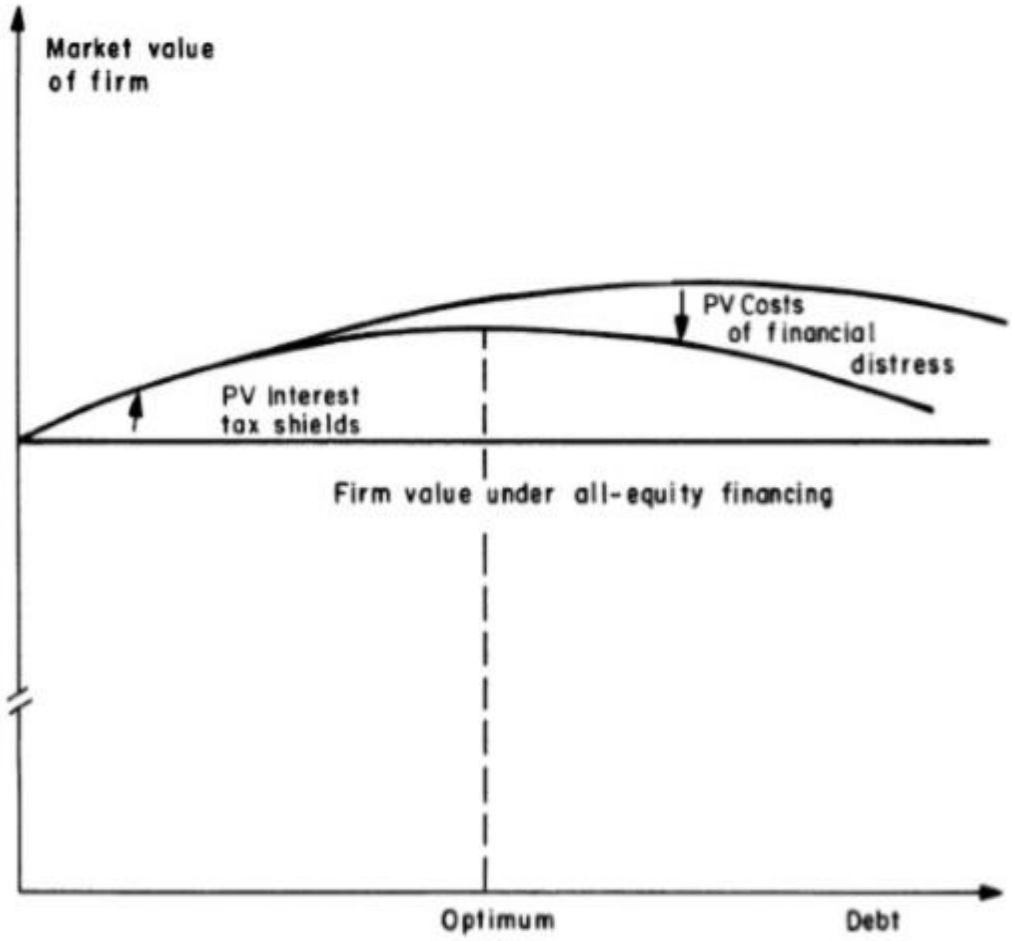
2.3 Trade-off theory

The first version of the trade-off theory was introduced by Modigliani and Miller (1963). In this static trade-off theory, they introduced taxes to the capital structure irrelevance proposition of 1958. The dynamic trade-off theory was introduced by Myers (1984). According to this paper, a firm chooses an optimal debt ratio, which is determined by a trade-off between the benefits and costs of debt. Kraus and Litzenberger mentioned this trade-off already in 1973. In the trade-off, firms try to maximize their value by issuing more or less debt until they reach their target capital structure. At the optimum, the marginal benefit of one extra dollar of debt just offsets the marginal costs of one extra dollar of debt (Myers, 1984). The main benefit of debt is the tax deductibility of interest payments. Other benefits of debt are the reduction of wasteful spending inside the firm and the reduction of agency problems. These benefits arise because of the pressure on managers to be careful with the firm's money so that the firm can make interest and principal payments to shareholders and creditors (Jensen, 1986).

However, taking on more debt has also certain costs. Examples of these costs are the loss of

future financial flexibility, the loss of the incentive of firm's management to focus on risky projects, the rise of agency costs between creditors and shareholders, and, most importantly, the direct and indirect costs of financial distress; new creditors and investors are less willing to be involved with the distressed firm because of the fear for legal disputes. This leads to significant challenges in raising capital by distressed firms and therefore these firms are often unable to finance new, profitable, investments. Another issue is that the lenders of distressed companies focus on servicing the debt of the firm while shareholders worry that they will lose the value of their equity to the creditors in the case of a default. As a result, managers face a great pressure to make decisions in favour of the shareholders. Creditors react on this by increasing the costs of borrowing for the firm, which means higher interest costs for the firm. All these costs have a negative impact on the value of the firm.

Figure 2. The trade-off theory of capital structure



Notes: at the optimum, the firm balances the present value of interest tax-shields with the present value of financial distress costs.

A lot of studies have shown that firms have a certain target for their capital structure. Antoniou, Zhao & Zhou (2002) demonstrated that companies from various European countries have target leverage ratios and adjust their leverage to achieve their optimal leverage ratio. Target leverage is one of the implications of the trade-off theory. Hovakimian & Li (2011) show that firms tend to move toward a target debt ratio. This target arises after a trade-off between the benefits and costs of debt. In 2001, Graham & Harvey conducted a survey on the capital structure decision of US firms. They found that 71% of the CFO's have a target range and 10% of the CFO's have a limit to which they readjust. Flannery & Rangan (2006) show that non-financial US firms had target capital ratios during 1996-2001. Welch (2004) uses exogenous shocks to capital structures to show whether firms adjust to a certain target capital structure. The analysis is based on data of listed firms in the US from 1962 to 2000. The results of Welch (2004) show that the adjustment behaviour of firms depends on leverage shocks based on market value of leverage. These shocks are caused by changes in stock prices. The market value of capital structure changes with the market price of equity, given the volatility in today's equity markets. This means that firms set a target debt ratio in their capital structure (Welch, 2004). Korteweg (2010) provides evidence for the trade-off theory using a sample of Dutch firms for the period of 1994 to 2004. He finds that targeted capital structures exist and the net benefit of these targets can be as high as 5.5% of the firm's value.

2.4 Market conditions model

The market conditions model has several variants. All these variants share the prediction that firms with high prices relative to a fundamental like book value issue more new shares. De Bondt & Thaler (1985) and Lakonishok, Shleifer & Vishny (1994) argue that growth stocks (stocks with a high price to book ratio) tend to be overvalued and value stocks (stocks with a low price to book ratio) tend to be undervalued. Gradual price corrections produce the value premium. This premium causes a low average return for growth stocks and a high average return for value stocks. If growth stocks are overvalued, there is a great chance that the debt of growth firms is also overvalued, with long-term debt more overvalued than short-term debt (Myers & Majluf, 1984).

The first variant of the market conditions model is called the market-timing or mispricing model. In this model managers use financing decisions to take advantage of the slow correction of pricing errors. High P/B (growth) firms prefer share issues over debt and retained earnings to take advantage of stock prices that are too high, because of the overvalued worth of the firm. When growth firms issue debt, they favour more overvalued long-term debt over short-term debt. Repurchases of overpriced shares are a bad investment for growth firms, but dividends are attractive because, holding total assets fixed, they allow growth firms to issue overvalued securities (Fama & French, 2012). For

low P/B (value firms), the exact opposite holds. This means that for these firms retained earnings are the cheapest financing, followed by undervalued short-term debt, then by more undervalued long-term debt, and most undervalued outside equity as a last option. Repurchases of undervalued shares are attractive for value firms, but dividends have high opportunity costs (Fama & French, 2012).

Other models that focus on market conditions, but do not rely on mispricing, also predict a positive relation between equity financing and the P/B ratio. An example of such a model is the rational pricing model. In this model a high P/B is a signal of the combination of high expected future cash flows to equity and low discount rates for these future cash flows, which means, a low cost of equity. If I assume a world in which security prices are rational and the capital structure irrelevance theorem of Modigliani & Miller (1958) holds, then, a low cost of equity does not imply that equity is cheaper than other forms of financing (Fama & French, 2012: 61).

However, if I suppose that managers respond to a higher P/B ratio with new equity financing, because they mistakenly believe that a higher P/B ratio signals a low relative cost of equity, then, the positive relation between P/B and share financing is what Miller (1977) calls a neutral mutation (Fama & French, 2012: 61): behaviour that signals nothing about the cost of share issues relative to other forms of financing or about mispricing. The mistaken belief might arise, for example, because managers do not understand the Modigliani-Miller theorem or because they falsely believe P/B signals mispricing (Fama & French, 2012: 61). This version of the market conditions model is consistent with evidence that capital structure choices have only a moderate impact on the value of the firm (Graham & Leary, 2011) and with evidence that manager characteristics affect capital structure choices (Bertrand & Schoar, 2003; Graham & Narasimhan, 2004).

3. Methodology

I make use of the regression framework of Fama & French (2012), which nests tests of the trade-off, pecking order, and market conditions models. Three pairs of cross-section regressions are estimated. The first pair focuses on the split of total new outside financing between share issues and debt. The second pair focuses on the split of new debt financing between short-term and long-term debt. Finally, the last pair of regressions focuses on the split of total new equity financing between retained earnings and share issues. Every regression pair imposes a different form of the cashflow constraint. Imposition of the constraint means that the two regressions in a pair are complementary (Fama & French, 2012: 62). Later in this chapter this will become clearer.

3.1 Cash flow constraints

3.1.1 Split of total new outside financing between share issues and debt

The basic cashflow constraint for all the regressions is:

$$dS_t + dL_t = dA_t + D_t - Y_t \quad (1)$$

In this equation,

dS_t = the change in book value of common stock issued,

dL_t = the change in liabilities including preferred stock,

dA_t = total investment (the change in total assets),

D_t = dividends paid,

Y_t = earnings,

*all during fiscal year t.

In words, this cash flow constraint says that total new outside financing, $dS_t + dL_t$, is equal to the demand for financing from investments and dividends minus the supply of financing from earnings (Fama & French, 2012: 62). The two regressions that follow from this constraint focus on the split of new outside financing between share issues and debt, dS_t and dL_t the left side of the constraint. The explanatory variables can be found on the right side of the constraint, dA_t, D_t, and Y_t. For this reason, the two regressions are complementary; the sum of the slopes of Y_t must add up to minus one and the slopes of dA_t and D_t must add up to one in the dS_t and dL_t regressions. So, the slopes in the two cross-section regressions measure the average split of an additional dollar of earnings between lower share and/or debt issues. The slopes also measure the average split of the financing of dividends and investments between lower share and debt issues (Fama & French, 2012: 62).

3.1.2 Split of total new debt financing between short-term and long-term

The second pair of regressions focuses on the split of total new debt financing, dL_t, between short-term and long-term debt, $dSTD_t$ and $dLTD_t$. For these tests, I move stock issues to the right side of the cash flow constraint (Fama & French, 2012: 63):

$$dSTD_t + dLTD_t = dA_t + D_t - Y_t - dS_t \quad (2)$$

In this equation (2)

$dSTD_t$ = change in short-term debt

$dLTD_t$ = change in long-term debt

dA_t = total investment (the change in total assets),

D_t = dividends

Y_t = earnings

dS_t = change in shares

*all during fiscal year t.

This cash flow constraint says that the change in total new debt; short-term debt ($dSTD_t$) + long-term debt ($dLTD_t$), must be equal to the demand of financing from investments and dividends minus the supply of financing from earnings and share issues (Fama & French, 2012: 63). Again, the explanatory variables in the regressions, include the variables on the right side of the cash flow constraint (2). Also, as before, because I impose constraint (2), the two regressions treat the quantity of new debt as fixed and focus on the split between short and long-term. The $dSTD_t$ and $dLTD_t$ regressions are again complementary; the slopes of dA_t and D_t sum to one, the slopes of Y_t and dS_t sum to minus one, and the slopes for any extra variable must sum to zero (Fama & French, 2012: 63).

3.1.3 Split of total new equity financing between retained earnings and share issues

The last pair of regressions focuses on the split of new equity financing between share issues and retained earnings. Like Fama and French (2012), I take earnings as given. This means that firms change their retained earnings by adjusting dividends. To isolate the decision between share issues and dividends, I express the cashflow constraint as:

$$dS_t - D_t = dA_t - Y_t - dL_t \quad (3)$$

In equation (3),

dS_t = change in shares

D_t = dividends

dA_t = total investment (the change in total assets),

Y_t = earnings

dL_t = the change in liabilities including preferred stock

*all during fiscal year t.

The explanatory variables in the regressions include the variables on the right side of the cash flow constraint (3). In this case, the explanatory variables to explain share issues and retained earnings are investments, earnings, and new debt issues (Fama & French, 2012: 63).

3.2 Logic of the regressions

3.2.1 Share issues versus new debt

The regressions that examine the split of new outside financing between share issues, dS_t , and debt, dL_t, build on cash flow constraint (1). Suppose that each year t, I estimate the following cross-section regression for individual firms.

$$dS_t = dA_t + D_t + Y_t$$

$$dL_t = dA_t + D_t + Y_t$$

Because I include asset growth, dividends, and earnings as explanatory variables, the sum of each year's regression to explain dS_t and dL_t must reduce to $dA_t + D_t - Y_t$ (Fama & French, 2012: 66). Also, the sum of the intercepts must be zero, the sum of the slopes for Y_t must sum to one, and the slopes for dA_t and D_t must each be one. The slopes for each additional explanatory variable must sum to zero in both regressions (Fama & French, 2012: 66).

The first important additional explanatory variable is P/B_{t-1}, the lagged price-to-book ratio, which is calculated as market capitalization at the end of December of year t-1 divided by book equity for the fiscal yearend in t-1. The second additional explanatory variable is LS_{t-1}, the lagged leverage surplus, which is calculated as the difference between leverage and target leverage for year t-1. In this calculation leverage is calculated as the ratio of book liabilities to book assets for t-1 and target leverage is the t-1 value-weighted leverage ratio for the industry in which the firm operates (Fama & French, 2012: 67). Thus, the two regressions estimated are:

$$dS_t = a_t + b_1 dA_t + b_2 D_t + b_4 Y_t + b_4 P/B_{t-1} + b_5 LS_{t-1} + e_t \quad (4)$$

$$dL_t = -a_t + (1-b_1)dA_t + (1-b_2)D_t - (1+b_4)Y_t - b_4 P/B_{t-1} - b_5 LS_{t-1} - e_t \quad (5)$$

Like I already mentioned, the slopes for investment, dividends, and earnings provide estimates of how, on average, required financing splits between share issues and debt. The slopes for the price-to-book ratio and the lagged leverage surplus tell me how firms push the allocation of outside financing away from the targets. I focus on book leverage because the results in Welch (2004) suggest that firms do not respond much to variation in market leverage if they are caused by changes in stock prices. Fama

& French (2012) replicated their results using market leverage and found similar reversion of leverage to its target as in the case of using book leverage.

The slopes of the regressions can provide evidence on the prediction of the pecking order theory that new outside financing is primarily debt. To make a conclusion about this prediction I must look if the slopes for investment, earnings, and dividends are further from zero in the new debt regression (5) than in the new shares regression (4). If this is true, it would be evidence in favour of the pecking order theory (Fama & French, 2012: 67).

In the trade-off model leverage tends to return to its target. The prediction that follows from the trade-off model is that a higher leverage relative to the target leads firms to replace debt by equity. In this way the firms can lower their surplus. This means that for the trade-off model to hold, LS_{t-1} should be positive in the share issues regression and negative in the debt issues regression. As a test for the reversion of leverage to its target, the novelty in the regressions is the use of the cash flow controls (Fama & French, 2012: 68). "For example, if pecking order forces also affect financing decisions, variation in leverage in response to cashflows may diminish the trade-off forces that push leverage toward its target. The cashflow controls in the regressions capture pecking order and all other effects. Therefore, the slopes of LS_{t-1} produce cleaner estimates of the rate at which leverage reverts to its target" (Fama & French, 2012: 68).

The slopes for the lagged price-to-book ratio, P/B_{t-1}, in regressions (4) and (5) test the prediction of the market conditions model that managers perceive P/B_{t-1} as a signal that the cost of equity is low relative to other forms of financing. This implicates that firms with a high P/B_{t-1} would be more likely to meet required outside financing with share issues rather than debt. High P/B_{t-1} (growth) firms tend to grow more quickly than low P/B_{t-1} (value) firms. Investments must be financed and if I did not include the control variables I would likely find that a high P/B_{t-1} is associated with more new debt and more new shares, and any effect of market conditions on outside financing would at least be partially undiscovered (Fama & French, 2012: 68-69).

3.2.2 Short-Term versus Long-Term debt

To test the predictions of the three models about the split of debt financing between short-term and long-term I use constraint (2), which said that new financing from short-term and long-term debt must cover the demand for financing from investment and dividends less the supply of financing from earnings and share issues. Adding dS_t to the other cashflow variables, dA_t, D_t, and Y_t, on the right side of the regressions controls for total required new debt (rather than total required outside financing), to isolate the choice between short-term and long-term debt (Fama & French, 2012: 79),

$$dSTD_t = at + b_1 dA_t + b_2 D_t + b_4 Y_t + b_4 dS_t + b_5 P/B_{t-1} + b_6 STS_{t-1} + e_t, \quad (7)$$

$$dLTD_t = -at + (1-b_1)dA_t + (1-b_2)D_t - (1+b_4)Y_t - (1+b_4)dS_t - b_5 P/B_{t-1} - b_6 STS_{t-1} - e_t. \quad (8)$$

As the notation indicates, the constraints on the sum of the coefficients and residuals in (7) and 8) are the same as those in (4) and (5). However, in this case the additional constraints are that the slopes for dSt must sum to minus one and the slopes for STSt-1 must sum to zero (Fama & French, 2012: 79).

According to the market conditions model when managers perceive that high P/B_{t-1} growth stocks are overvalued, they are also likely to judge that the debt of growth firms is overvalued. Then, long-term debt will be more overvalued than short-term debt. Because of this, the model predicts that firms with a higher P/B_{t-1} will prefer long-term debt. The pecking order model of Myers & Majluf (1984) suggests that asymmetric information problems are less severe for firms with clear growth opportunities, which also implies that controlling for cash flows, higher P/B_{t-1} firms that issue debt use more long-term debt than lower P/B_{t-1} firms (Fama & French, 2012: 78).

According to the trade-off model, various forces push firms toward an optimal mix of debt and equity. The forces include the tax deductibility of interest and potential bankruptcy costs associated with debt. The trade-off model also gives predictions about the split of new debt between short-term and long-term debt. For example, when a company shifts some of its debt from long-term to short-term the probability of bankruptcy will increase, but the incentive of its creditors to monitor management also increases (Diamond, 2004). So, there could also exist an optimal mix of short-term and long-term debt and a target ratio short-term debt ratio (Fama & French, 2012: 78). As with leverage, I use industry averages to measure target short-term debt ratios. A firm's lagged short-term surplus, STS_{t-1} is defined as the difference between its short-term and target ratio for year t-1. The target ratio is the average short-term ratio of the firms' industry, with each firm in the industry weighted by its total liabilities (see Appendix for details).

The pecking order model predicts that debt financing in response to cashflows is mostly short-term. If this is true the slopes for dA_t, D_t, Y_t, and dS_t should be further from zero for short-term debt than for long-term debt. The market conditions model and the Myers-Majluf version of the pecking order model predict that firms with a higher P/B_{t-1} substitute away from short-term debt toward long-term debt. Thus, the slopes on P/B_{t-1} should be positive in the regression to explain $dLTD_t$ and have an exactly offsetting negative slope in the $dSTD_t$ regression (Fama & French, 2012: 79). Lastly, the trade-off model predicts that firms tend to revert to their target short-term debt ratio. This implicates that the slope on STS_{t-1} should be negative in the $dSTD_t$ regression and positive in the $dLTD_t$ regression (Fama & French, 2012: 79).

3.2.3 Retained earnings versus share issues

The final task is to test the predictions of the models about the split of equity financing between retained earnings and share issues. Like I mentioned earlier, earnings are not a choice variable. Firms must vary dividends to control retained earnings. To focus on the split between dividend and share issues, I use the cash flow constraint in (3):

$$dS_t - D_t = dA_t - Y_t - dL_t \quad (3)$$

This equation says that that investment not financed by earnings and new debt must be financed by share issues minus dividends. Equation (3) implies that holding investment, earnings, and new debt fixed, every additional dollar of new shares must lead to an additional dollar of dividends. This version of the cashflow constraint suggests the paired regressions,

$$dS_t = a_t + b_1 dA_t + b_2 Y_t + b_4 dL_t + b_4 P/B_{t-1} + e_t \quad (10)$$

$$D_t = a_t + (b_1 - 1) dA_t + (b_2 + 1) Y_t + (b_4 + 1) dL_t + b_4 P/B_{t-1} + e_t \quad (11)$$

When I subtract the dividend regression (11) from the share issues regression (10), I get constraint (3). Therefore, the difference in slopes for dA_t in regression (10) and (11) is one, and the difference in slopes for Y_t and dL_t in regression (10) and (11) is minus one. The slopes for P/B_{t-1} and any other variables not in constraint (3) must be identical in the two regressions. The reason for this is that the cash flow variables in (10) and (11) control for variation in dS_t and D_t (Fama & French, 2012: 84). In other words, variation in share issues linked to other explanatory variables must be matched by variation in dividends in the same direction.

If managers interpret the price-to-book ratio as a ratio containing information about the relative cost of new share financing, a higher P/B_{t-1} should lead firms to issue more shares. The proceeds from these higher share issues can be invested and then they will show up in dA_t, or they can be paid out as dividends. Then, I can threat the market conditions model as if it predicts that, controlling for investment, higher P/B_{t-1} leads some firms to increase dividends to make larger issues of shares (Fama & French, 2012: 84-85). In the pecking order model, share issues are the most expensive form of financing, which should lead firms to lower dividends to fund investment outlays not covered by earnings and new debt.

3.3 Actual regressions

3.3.1 Share issues versus new debt

The actual regressions that I estimate in STATA are little enhancements of formula (4) and (5). The formula looks as follows:

$$dF_t = a_t + b_1 dA_t + b_2 NegY_t + b_3 PosY_t + b_4 NoD_t + b_5 D_t + b_6 MC_t + b_7 NegB_{t-1} + b_8 P/B_{t-1} + b_9 LS_{t-1} + e_t. \quad (6)$$

The dependent variable, dF_t, is either dS_t, the book value of shares issued during the fiscal year ending in calendar year t, or dL_t, the change in liabilities during fiscal year t. I estimate different slopes for negative and positive earnings, $NegY_t$ and $PosY_t$ because there is a possibility that debt is more difficult to issue for firms with negative earnings (Fama & French, 2012: 69). Like Fama & French (2012), I include MC_t, the log of market cap in June of t, to allow for differences in financing because of the size of a firm. I also include a dummy variable for firms that pay no dividends during fiscal year t, NoD_t, and a dummy for firms with negative book equity, $NegB_{t-1}$.

3.3.2 Short-Term versus Long-Term debt

The actual cross-section regression that I use to test predictions about debt financing is nearly the same as the one in (6) that I used for share issues versus new debt. However, there are two small differences. The first difference is that I add share issues, dS_t, and replace the lagged leverage surplus with the lagged short-term surplus, STS_{t-1} (Fama & French, 2012: 80). Another difference is that the dependent variables, dF_t in the paired regressions are $dSTD_t$ and $dLTD_t$, short-term and long-term debt issued in fiscal year t, as shown in the formula below:

$$dF_t = a_t + b_1 dA_t + b_2 NegY_t + b_3 PosY_t + b_4 dS_t + b_5 NoD_t + b_6 D_t + b_7 MC_t + b_8 NegB_{t-1} + b_9 P/B_{t-1} + b_{10} STS_{t-1} + e_t. \quad (9)$$

3.3.2 Retained earnings versus share issues

Again, I estimate enhanced versions of the cash flow constraints. In this case the formula is the enhanced version of constraints (10) and (11):

$$dF_t = at + b_1 dA_t + b_2 NegY_t + b_3 PosY_t + b_4 dL_t + b_5 MC_t + b_6 NegB_{t-1} + b_7 P/B_{t-1} + b_8 D_{t-1} + e_t \quad (12)$$

The dependent variable, dF_t, is either share issues, dS_t, or dividends, D_t, for the fiscal year ending in t. The new explanatory variable is D_{t-1}, dividends for fiscal year t−1. There are a lot of reasons for a firm to pay dividends, but there is convincing evidence that dividends are sticky (Babiak, 1968). For this reason, I include D_{t-1} as an explanatory variable in regression (12) to allow for management's unwillingness to change dividends (Fama & French, 2012: 85). "More precisely, D_{t-1} is an estimate of the total dividends that would be paid in fiscal year t if split-adjusted dividends per share did not change from t-1 to t" (Fama & French, 2012: 85).

3.4 Data

I retrieve data from the Datastream and Compustat databases to conduct my research. I use public UK firms in my sample because the regression framework of Fama & French (2012) has never been tested in the UK, while the UK has the second largest financial market in the world (Holodny, 2016). I apply the regressions on the period 1998 to 2017, because this is a recent period and it contains enough

years to make strong inferences. I make use of unbalanced panel data; every firm must be for at least 5 years in the sample. So, there are between 5 and 20 observations per firm. For each firm, the cash flow variables are winsorized at 1 and 99% to get rid of extreme values. By using the method of winsorizing I am able to replace extreme values without reducing the number of observations. In accordance with Fama & French (2012), all variables except MC_t, P/B_{t-1}, LS_{t-1}, STS_{t-1}, $NegB_{t-1}$, and NoD_t are divided by assets at the end of fiscal year t. The flow variables, dA_t, Y_t, $PosY_t$, $NegY_t$, dS_t , dL_t , dS_t D_t, dL_t D_t, D_t, and D_{t-1}, are then multiplied by 100.

In addition, I make use of a fixed effects model to remove all cross-sectional variation in both the explanatory as the dependent variables (Brooks, 2014). By using a fixed effects regression model I do not get rid of the within firm variation. This is exactly what I want, since I examine to what extent firm specific variables influence the capital structure choice of public UK firms. I exclude regulated utilities (SICs 4900-4999), financial firms (SICs 6000-6999) and non-classifiable establishments (SICs 9900-9999) from my sample, because these firms are mostly regulated and therefore have minimum capital requirements. Minimum capital requirements have large effects on the capital structure of the firms (Rajan and Zingales, 1995).

In addition, firms with insufficient information and missing data for one or more variables are excluded from the sample. On average, the regressions for 1998 to 2017 use 691 small, 197 medium, and 155 large firms. This means that, on average, 1043 firms are used in the regressions. A firm is classified as small if it has a market cap below 200 million pound, medium if it has a market cap between 200 and 999 million pound and large if it has a market cap of 1 billion pound or more. This follows from the classification in the US. According to a recent article, the following firm classification holds in the US (FinancialEngines, 2018):

Small firm = market cap between 300 million and 2 billion dollars.

Medium firm = market cap between 2 and 10 billion dollars

Large firm = market cap of 10 billion dollars or more

At the end of 2017 the size of the US stock market equalled approximately eight times the size of the UK stock market (Holodny, 2016), and on the moment I was sorting the firms one pound equalled 1.28 dollars. Therefore, I decided to divide the classification thresholds of the US by 10 (8x1.28≈ 10) to obtain the classification thresholds for the UK stock market.

4. Results

In this chapter I discuss the results of the analysis per regression pair and theory of capital structure. First, I interpret the slopes for the pecking order theory, thereafter I interpret the slopes for the trade-off theory, and lastly, I interpret the coefficients for the market conditions theory. A simple look at table 1 shows that, on average, 68% of the firms in the sample are small. I split the stocks in the sample intro three groups by size to prevent the large number of small stocks from dominating the economically more important large stocks in the regression. I report separate results for small, medium and large firms. The size classifications can be found in section 3.4.

4.1 Share issues versus new debt

The pecking order model – The summary statistics in Table 1 confirm that during 1998-2017, for medium and large firms, most outside financing is debt. For small firms most outside financing comes from new shares, since the coefficient for dS_t is larger than the coefficient for dL_t. For the other two types of firms; medium and large firms, the average value of dL_t is larger than dS_t. The average value of dS_t for medium firms is 2.34% and for large firms it is slightly smaller; 1.06%.

The pecking order theory predicts that outside financing in response to variation in investment, earnings and dividends is primarily debt. The regressions of Table 2 confirm this prediction. In the dS_t regression share issues on average absorb between 9% and 68% of the marginal variation in dA_t, $NegY_t$, $PosY_t$ and D_t, with an average absorption of 34%. For new debt issues, this absorption is on average between 32% and 91%, with an average absorption of 66%. In other words, the magnitude of the slopes in the dL_t regressions is about two times greater than the magnitude of the slopes in the dS_t regressions. This means that debt issues are more often used than share issues in response to variation in investment, earnings, and dividends and this finding is in line with the predictions of the pecking order model. The positive average slopes of P/B_{t-1} shown in table 2 are in line with the prediction of Myers and Majluf (1984) that the asymmetric information problems that drive pecking order financing are less severe for firms with a high P/B_{t-1} and clear growth opportunities. Thus, the summary statistics and regressions of Table 2 confirm the pecking order model for the period from 1998 to 2017, especially for medium and large firms.

Other features of the results in Table 2 are worth noting. For example, the average $NegY_t$ and $PosY_t$ slopes for large firms in the dS_t regressions are -0.29 and -0.37. This means that, given investment and dividends, the increase in share issues to cover a marginal pound of negative earnings is, on average close to the reduction in share issues in response to a pound of positive earnings. However, in medium firms this does not hold. In these firms share issues respond far more to negative earnings than to positive earnings. This suggests that from 1998 to 2017 debt is costlier to issue for medium

Table 1. Means and standard deviations (Std. Dev.) of the regression variables.

	Firms	dS_t	dL_t	$dSTD_t$	$dLTD_t$	dA_t	$NegY_t$	$PosY_t$	NoD_t	D_t	MC_t	$NegB_{t-1}$	P/B_{t-1}	LS_{t-1}	STS_{t-1}
							1998-2017								
Small	691														
Mean		4.13	-1.54	-0.80	-0.75	-1.37	-7.74	5.33	0.48	1.55	3.00	0.02	2.48	-0.12	0.22
Std. Dev.		9.67	222.85	123.15	101.10	141.51	32.74	86.70	0.50	2.97	6.97	0.15	6.12	2.24	0.24
Medium	197														
Mean		2.34	3.08	2.03	1.05	6.76	-1.96	5.86	0.18	2.57	10.14	0.02	2.71	-0.07	0.10
Std. Dev.		8.04	15.82	10.21	12.90	25.53	12.19	5.26	0.39	3.52	18.05	0.12	5.43	0.22	0.24
Large	155														
Mean		1.06	3.75	1.88	1.87	7.40	-0.87	6.54	0.09	3.07	77.56	0.03	3.00	0.02	0.02
Std. Dev.		6.79	13.38	9.00	10.11	17.32	5.20	5.05	0.28	3.29	260.56	0.16	6.78	0.21	0.19

Notes: I use data from the Compustat and Datastream databases for non-financial UK listed firms with fiscal yearends in calendar year t, for the period 1998–2017. See appendix for the definitions of the variables. Except for MC_t, P/B_{t-1}, LS_{t-1}, STS_{t-1}, and the two dummy variables, the variables are scaled by assets at the end of year t. The table shows separate results for small, medium and large firms.

firms with negative earnings.

The NoD_t variable in the dS_t regression of table 2 produces an interesting result. Firms that do not pay dividends tend to issue more equity and less debt. The incremental share issues of non-payers are large, they average 2.52%, 1.43% and 2.93% of assets per year for small, medium, and large firms (table 2A).

Also, firms with negative book equity tend to issue more stock. In the period from 1998 to 2018 negative book equity has a significant impact on the debt-equity choice, especially at smaller firms. The incremental share issues for small firms with a negative book equity in the prior fiscal year equals 6.72% of assets and 2.80% of assets for medium firms with a negative book equity in the prior fiscal year. So, firms that do not pay dividends or have negative book equity, differ from other firms in ways that affect the financing decisions. A final thing to notice is that the market cap variable, MC_t, has little explanatory power to explain both share as well as debt issues in table 2. This means that splitting the sample into small, medium, and large firms apparently captures most size effects.

The Trade-off Model – The trade-off model says that firms have leverage targets and leverage tends to revert to its target. Therefore, the prediction for outside financing is that a higher leverage surplus leads firms to issue more stock and less debt to lower the leverage ratio. In the estimates of regression pair (1), the slopes for LS_{t-1} should be positive in the regressions to explain share issues, which, given the cashflow controls, implies exactly offsetting negative slopes in the regressions to explain debt issues. Table 2 provides only for medium and large firms evidence that leverage reverts to its target, not for small firms. The average slopes for LS_{t-1} in the regressions to explain share issues are positive and between 5.84 and 8.73 standard errors from zero for medium and large firms. The benefits of moving leverage toward its target are apparently larger for medium firms, based on the magnitude of the LS_{t-1} coefficients. For small firms, I can conclude that leverage does not necessarily tend to revert to its target, because the LS_{t-1} coefficient for small firms is negative and very small. The average cross-section standard deviation of the leverage surplus for large firms is 0.21 (Table 1). The average LS_{t-1} slope for large firms in the dS_t regression is 6.82. So, roughly speaking, a leverage surplus one standard deviation above zero increases a large firm's expected annual share issues by 1.43% (6.82x0.21) of assets (and reduces debt issues by the same amount) relative to a large firm without a leverage surplus. This seems to be in line with previous evidence that leverage reverts to its target (Fama & French, 2002; Flannery & Rangan, 2006; Kayhan & Titman).

Table 2. Average slopes from estimates of regression pair (1) to explain the split of new outside financing between share issues and total debt issues.

Dep. Var. : dS_t	_cons	dA_t	$NegY_t$	$PosY_t$	NoD_t	D_t	MC_t	$NegB_{t-1}$	P/B_{t-1}	LS_{t-1}	R^2
						1998-2017					
Small											
Coef.	0.18	0.91	-0.90	-1.14	-2.52	0.34	-0.01	-6.72	-0.18	0.14	1.00
t	0.68	235.80	-166.88	-186.06	-6.62	6.68	-0.53	-6.31	-8.63	2.92	
Medium											
Coef.	-0.34	0.76	-0.61	-0.65	-1.43	0.32	-0.02	-2.80	-0.08	-10.74	0.81
t	-1.07	96.30	-36.68	-21.42	-2.69	6.45	-1.56	-1.72	-2.51	-8.73	
Large											
Coef.	0.84	0.78	-0.71	-0.63	-2.93	0.40	0.00	-0.72	-0.02	-6.82	0.83
t	2.51	103.49	-27.64	-20.65	-4.86	6.50	-0.80	-0.50	-0.62	-5.84	

Dep. Var. : dL_t	_cons	dA_t	$NegY_t$	$PosY_t$	NoD_t	D_t	MC_t	$NegB_{t-1}$	P/B_{t-1}	LS_{t-1}	R^2
						1998-2017					
Small											
Coef.	-0.18	0.09	-0.10	0.14	2.52	0.66	0.01	6.72	0.18	-0.14	0.13
t	-0.68	23.70	-19.44	22.94	6.62	12.97	0.53	6.31	8.63	-2.92	
Medium											
Coef.	0.34	0.24	-0.39	-0.35	1.43	0.68	0.02	2.80	0.08	10.74	0.28
t	1.07	29.60	-23.55	-11.65	2.69	13.71	1.56	1.72	2.51	8.73	
Large											
Coef.	-0.84	0.22	-0.29	-0.37	2.93	0.60	0.00	0.72	0.02	6.82	0.35
t	-2.51	29.57	-11.48	-11.93	4.86	9.77	0.80	0.50	0.62	5.84	

Notes: The regressions are estimated each year t during 1998-2017 using data from the Compustat and Datastream data for public UK firms with fiscal year-ends in calendar year t. The dependent variable is either dS_t or dL_t (Dep. Var.). In addition to the regression intercept, the explanatory variables are dA_t, $NegY_t$, $PosY_t$, NoD_t, D_t, MC_t, $NegB_{t-1}$, P/B_{t-1} and LS_{t-1}. (See Appendix for the definition of the variables). The table shows averages of the annual regression slopes (Coef.), t-statistics (t) for the average slopes, and R^2, the average value of the annual regression coefficient of determination. On average, the regressions for 1998 - 2017 use 691 small, 197 medium, and 155 large firms.

The Market Conditions Model – To make inferences about the market conditions model I need to look at the average slopes of P/B_{t-1}, the lagged price to book ratio. I look at the coefficients of P/B_{t-1}, because the market conditions model says that managers believe, rightly or wrongly, that higher P/B_{t-1} signals a lower cost of share issues relative to other forms of financing. Therefore, firms with a higher P/B_{t-1} allocate more outside financing to share issues. The positive coefficients for P/B_{t-1} in the regressions of table 2 to explain share issues are in line with this prediction. The average slopes are all more than 2.92 standard errors from zero and therefore statistically significant. It is also worth to notice that there exists an unusual size effect in the slopes of P/B_{t-1}. The slopes for small and medium firms are further from zero than the slopes for large firms. This suggest that the belief that P/B_{t-1} is informative about the relative cost of share issues is more prevalent among managers of smaller firms. If I combine the average slopes for P/B_{t-1} in Table 2 with the average cross-section standard deviations for P/B_{t-1} in Table 1, I can say that during 1998-2017 a one standard deviation higher value of P/B_{t-1} is associated with increases in annual share issues (and reductions in debt issues) that average about 1.10%, 0.43% and 0.14% of assets for small, medium and large firms.

4.2 Short-Term versus Long-Term debt

The pecking order model – Pecking order predictions about the response of short-term and long-term debt financing to cash flow variables get weak support from the regressions in Table 3. The regressions say that given total new debt, with few exceptions, long-term debt absorbs more of the variation in investment, earnings, dividends, and share issues than short-term debt. Thus, asymmetric information problems, issuing costs, and any other pecking order forces that predict a preference for short-term debt apparently do not play a very important role in debt financing.

The trade-off model – The trade-off model's prediction that firms have targets for the short-term debt ratio is more successful. The STS_{t-1} slopes for all three firm types are positive and more than 16.28 standard errors from zero in the long-term debt regressions. Thus, controlling for total new debt, public UK firms with a higher short-term debt surplus tend to issue more long-term debt and less short-term debt to let the short-term debt ratio revert to its target. The magnitude of this trade-off effect is big for all three types of firms, with small firms having the biggest trade-off effect. For small firms, the average STS_{t-1} slope is namely 23.74, and the average standard deviation of STS_{t-1} is 0.24. So, roughly speaking, a short-term surplus one standard deviation above the mean increases a small firm's long-term debt by 5.70% (23.74 x 0.24) of assets. For medium and large firms, the trade-off effect equals 4.82% and 3.81%.

The market conditions model – The prediction of the market conditions model and the pecking order theory of Myers & Majluf (1984) that the new debt of firms with a high P/B_{t-1} tend to be long-term gets weak support in the $dSTD_t$ and $dLTD_t$ regressions in Table 3. The average slopes for P/B_{t-1} in the $dLTD_t$ regressions are positive for all three types of firms, but only the average slope for large firms is more than 1.96 standard errors away from zero and therefore significant at the 5% significance level. The average slopes of small and medium firms have t-statistics of 0.48 and 0.21 and are not statistically significant at the 5% significance level. Consequently, only for large firms evidence for the prediction of the market conditions model about long-term debt issues is provided.

In sum, the estimates of regression pair (2) provide convincing evidence in favour of the trade-off predictions in debt maturity decisions for public UK firms. Pecking order and market conditions predictions in debt maturity decisions for public UK firms get far less support in the regressions, because there is mixed evidence for the market conditions predictions and nearly no evidence for the pecking order predictions.

4.3 Retained earnings versus share issues

Stickiness of dividends - The D_t coefficients in Table 4 suggest that there is no stickiness of dividends. The average slopes for D_t in the dividend regressions are zero, except for medium firms. For these firms the coefficient 0.03. However, this coefficient has such a small magnitude that I can make the same conclusion for medium firms as for small and large firms. So, based on the D_t coefficients there exists no stickiness in dividends.

Nevertheless, this is the only evidence rejecting persistence of dividends. I found a lot of evidence in favour of the stickiness of dividends. First, there is evidence that comes from the earning slopes in the dividend regressions of Table 4. The average slopes for $PosY_t$ are at least 7.26 standard errors from zero and the response of dividends to earnings is very small. On average, between four and eleven cents of an additional pound of positive earnings go to dividends, with the remainder used to reduce share issues. Also, dividends almost always respond less to negative earnings than to positive earnings and this in line with Lintner's (1956) claim that managers are reluctant to cut dividends when faced with negative earnings.

However, there is also a chance that firms with negative earnings do not pay dividends. In any case, the estimates of regression pair (3) say that, given investment and new debt, higher positive earnings lead almost entirely to lower share issues, rather than higher dividends, and bigger losses are almost entirely covered by share issues rather than lower dividends.

Table 3. Average slopes from estimates of regression pair (2) to explain the allocation of new liabilities between current liabilities and long-term debt.

Dep. Var. : $dSTD_t$	_cons	dA_t	$NegY_t$	$PosY_t$	dS_t	NoD_t	D_t	MC_t	$NegB_{t-1}$	P/B_{t-1}	STS_{t-1}	R^2
						1998-2017						
Small												
Coef.	3.76	0.67	-0.69	-0.35	-0.69	0.69	0.60	0.00	-12.50	-0.01	-23.74	0.99
T	8.88	119.08	-89.29	-39.53	-39.07	1.27	8.24	0.00	-8.36	-0.48	-25.26	
Medium												
Coef.	1.18	0.47	-0.71	-0.22	-0.42	-0.28	0.39	-0.03	-0.46	-0.01	-20.07	0.32
t	3.03	41.24	-31.48	-5.61	-16.30	-0.42	6.01	-2.53	-0.24	-0.21	-16.88	
Large												
Coef.	-0.93	0.46	-0.38	-0.26	-0.40	1.16	0.63	0.00	-2.34	-0.08	-20.03	0.37
t	-2.20	41.08	-11.43	-6.51	-14.73	1.53	8.03	-0.68	-1.62	-2.75	-16.28	

Dep. Var. : $dLTD_t$	_cons	dA_t	$NegY_t$	$PosY_t$	dS_t	NoD_t	D_t	MC_t	$NegB_{t-1}$	P/B_{t-1}	STS_{t-1}	R^2
						1998-2017						
Small												
Coef.	-3.76	0.33	-0.31	-0.65	-0.31	-0.69	0.40	0.00	12.50	0.01	23.74	0.98
t	-8.88	58.05	-40.23	-72.04	-17.24	-1.27	5.43	0.00	8.36	0.48	25.26	
Medium												
Coef.	-1.18	0.53	-0.29	-0.78	-0.58	0.28	0.61	0.03	0.46	0.01	20.07	0.56
t	-3.03	46.49	-12.85	-20.16	-22.81	0.42	9.54	2.53	0.24	0.21	16.88	
Large												
Coef.	0.93	0.54	-0.62	-0.74	-0.60	-1.16	0.37	0.00	2.34	0.08	20.03	0.50
t	2.20	48.44	-18.90	-18.66	-21.74	-1.53	4.69	0.68	1.62	2.75	16.28	

Notes: The regressions are estimated each year t during 1998-2017 using Compustat and Datastream data for public UK firms with fiscal year-ends in calendar year t. The dependent variable is either $dSTD_t$ or $dLTD_t$ (Dep. Var.). In addition to the regression intercept, the explanatory variables are dA_t, $NegY_t$, $PosY_t$, NoD_t, D_t, MC_t, $NegB_{t-1}$, P/B_{t-1} and STS_{t-1}. (See Appendix for the definition of the variables). The table shows averages of the annual regression slopes (Coef.), t-statistics (t) for the average slopes, and R^2, the average value of the annual regression coefficient of determination. On average, the regressions for 1998 - 2017 use 691 small firms, 197 medium firms, and 155 large firms.

The remaining cash flow controls are investment, dA_t, and debt issues, dL_t. The slopes for dA_t in the dS_t and D_t regressions again say that holding earnings and new debt fixed, higher investment is financed almost entirely by share issues and not by a reduction in dividends. Similarly, holding investment and earnings fixed, firms that issue less new debt make up almost all the shortfall with share issues instead of smaller dividend payments. Consequently, all the results except those for D_t confirm that from 1998 to 2017, dividends are sticky at public UK firms: they move hardly at all with variation in investment, earnings, and debt issues.

The pecking order model - Like I mentioned earlier, the strong version of the pecking order model predicts that the high costs of share issues (because of frictions like asymmetric information problems and transaction costs) lead firms to reduce dividends to finance investments that cannot be covered by earnings and new debt. The stickiness of dividends in response to variation in investment, earnings and debt contradicts this prediction. Myers (1984) recognizes this problem and clearly states that dividends are outside the focus of the pecking order. This means that Myers (1984), in effect, accepts that the trade-off which produces sticky dividends is more important than pecking order forces, which would produce more variation in dividends in response to variation in investment, earnings and debt (Fama & Frech, 2012: 90).

The market conditions model - Table 4 provides support for the prediction of the market conditions model that, controlling for other cash flow variables, high P/B_{t-1} growth firms increase dividends to issue shares and low P/B_{t-1} value firms repurchase shares rather than pay dividends. All three dividend regressions produce positive average P/B_{t-1} slopes predicted by the model and all three slopes are significant at the 5% significance level. However, the slopes do not have a large magnitude. The slopes vary between 0.05 and 0.09 and have nearly the same magnitude as the P/B_{t-1} slopes in the dS_t regression of Table 2. This means that the trade-off of new equity for new debt in response to variation in P/B_{t-1} (regression pair (2)) is nearly the same as the trade-off of share issues for retained earnings (regression pair(3)). As a result, I can conclude that the costs and benefits that produce sticky dividends are apparently the same as the effects of market conditions.

Table 4. Average slopes from estimates of regression pair (3) to explain the allocation of net new equity between retained earnings and share issues.

Dep. Var. : D_t	_cons	dA_t	$NegY_t$	$PosY_t$	dL_t	MC_t	$NegB_{t-1}$	P/B_{t-1}	D_{t-1}	R^2
					1998-2017					
Small										
Coef.	1.57	-0.04	0.04	0.04	0.04	-0.02	0.22	0.05	0.00	0.10
t	40.64	-10.93	10.59	8.77	10.68	-3.54	0.77	8.36	3.36	
Mid										
Coef.	1.82	-0.07	0.06	0.11	0.07	0.00	2.38	0.09	0.03	0.34
t	17.57	-9.58	7.34	8.36	8.89	0.06	3.77	6.89	20.95	
Large										
Coef.	2.50	-0.06	0.03	0.09	0.06	0.00	3.17	0.07	0.00	0.17
t	25.21	-9.68	2.99	7.26	7.77	0.08	7.73	8.34	-10.12	

Dep. Var. : dS_t	_cons	dA_t	$NegY_t$	$PosY_t$	dL_t	MC_t	$NegB_{t-1}$	P/B_{t-1}	D_{t-1}	R^2
					1998-2017					
Small										
Coef.	1.57	0.96	-0.96	-0.96	-0.96	-0.02	0.22	0.05	0.00	0.92
t	40.64	298.35	-288.49	-230.87	-286.45	-3.54	0.77	8.36	3.36	
Mid										
Coef.	1.82	0.93	-0.94	-0.89	-0.93	0.00	2.38	0.09	0.03	0.87
t	17.57	131.25	-111.46	-67.01	-113.00	0.06	3.77	6.89	20.95	
Large										
Coef.	2.50	0.94	-0.97	-0.91	-0.94	0.00	3.17	0.07	0.00	0.80
t	25.21	141.62	-83.57	-76.13	-120.89	0.08	7.73	8.34	-10.12	

Notes: The regressions are estimated each year t during 1998-2017 using Compustat and Datastream data for public UK firms with fiscal year-ends in calendar year t. The dependent variable is either D_t or dS_t. In addition to the regression intercept, the explanatory variables are dA_t, $NegY_t$, $PosY_t$, NoD_t, D_t, MC_t, $NegB_{t-1}$, P/B_{t-1} and D_t (See Appendix for the definition of the variables). The table shows averages of the annual regression slopes (Coef.), t-statistics (t) for the average slopes, and R^2, the average value of the annual regression coefficient of determination. On average, the regressions for 1998 - 2017 use 691 small, 197 medium, and 155 large firms.

5. Conclusion

In this section I conclude on the tests of the trade-off, pecking order, and market conditions theory. I tested these models by using three pairs of cross-section regressions. The first pair of regressions focused on the split of new outside financing between share issues and debt. The second pair of regressions focused on the choice between short-term and long-term debt when issuing new debt. The third pair focused on the split of new equity financing between share issues and retained earnings. Table 5 summarizes the model's predictions and the results of the regressions.

5.1 The trade-off theory

I primarily look at the regression pair that splits new outside financing between share issues and debt to take a conclusion on the trade-off model. I accept the prediction of the trade-off model that leverage reverts to its target, because I found a lot of evidence in favour of this prediction for medium and large firms. Only for small firms there is slightly less evidence for reversion of leverage to its target. I look at the pair of regressions that split total new debt between short-term and long-term to take a conclusion on an extension of the trade-off model about short-term debt targets. Like I stated in section 3.2.2, if it holds that trade-off forces push firms toward an optimal mix of short-term and long-term debt, then, controlling for total debt issues, firms below their target allocation will issue more short-term debt and firms above their target allocation will issue less short-term debt. My results for this prediction are very strong for all three types of firms. Thus, controlling for total new debt, public UK firms with a higher short-term debt surplus tend to issue more long-term debt and less short-term debt to let the short-term debt ratio revert to its target. The magnitude of this trade-off effect is big for all three types of firms, with small firms having the biggest trade-off effect. Overall, I found strong evidence for the predictions of the trade-off model.

5.2 The market conditions model

I primarily look at the paired regression that split new outside financing between share issues and debt to take a conclusion on the market conditions model. I focused on the prediction of the market conditions model that firms with a higher P/B_{t-1} allocate more outside financing to share issues and less to debt. The average slopes of P/B_{t-1} in the regressions to explain new share issues are positive for all three types of firm. Also, in economic terms, the substitution of share issues for debt in response to P/B_{t-1} is large.

Support for other predictions of the market conditions model is mixed. In the regressions that split debt between short and long-term, the prediction that a higher P/B_{t-1} is associated with more long-term than short-term debt only gets support for large firms, not for medium and small firms. The

average slopes for medium and small firms are positive, but not significant. There is evidence from the third set of regressions that a higher P/B_{t-1} leads to less payments of dividends in order to issue shares and a lower P/B_{t-1} leads to repurchases of shares rather than payments of dividends, although the magnitude of this effect is small. The slopes in the third pair of regressions have nearly the same magnitude as the slopes of P/B_{t-1} in the regressions that split total new financing between share issues and debt. This tells me that the trade-off of new equity for new debt in response to variation in P/B_{t-1} (regression (6)) is nearly the same as the trade-off of share issues for retained earnings (regression (12)). As a result, the costs and benefits that produce sticky dividends are apparently the same as the effects of market conditions. Altogether, I found mixed evidence for the predictions of the market conditions model.

5.3 The pecking order theory

The evidence that I found for the prediction of the pecking order model that firms prefer debt to new shares for outside financing is in line with earlier results (Fama & French, 2002; Frank & Goyal, 2003). The evidence for this prediction comes from the magnitude of the slopes in the dL_t regressions, which is about two times the magnitude of the slopes in the dS_t regressions (regression pair (1)).

The prediction that firms prefer short-term debt over long-term debt because of the lower issuing costs of short-term debt is tested using the regressions that split new debt issues between short-term and long-term debt. The results of my analysis suggest that this prediction does not hold. The regressions say that given total new debt, with few exceptions, long-term debt absorbs more of the variation in investment, earnings, dividends, and share issues than short-term debt. Thus, asymmetric information problems, issuing costs, and any other pecking order forces that predict a preference for short-term debt, apparently do not play a very important role in debt financing.

I also did not find support for the prediction of a strong version of the pecking order model that firms vary dividends to avoid the high costs of share issues based on the regressions to explain share issues and dividends. The stickiness of dividends in response to variation in investment, earnings and debt contradicts this prediction. Myers (1984) recognized this problem and clearly states that dividends are outside the focus of the pecking order. This means that Myers (1984), in effect, accepts that the trade-off which produces sticky dividends is more important than the effect of pecking order forces, which would produce more variation in dividends (Fama & French, 2012: 90).

5.4 Overall conclusion

Overall, the results provide the most support for the trade-off theory. Nearly all the predictions of this theory are accepted after being tested. Hereafter, there is the most support for the market conditions

Table 5. Summary of the predictions and empirical results.

	Pecking order	**Trade-off**	**Market conditions**
Predictions	Firms favour new debt over new share issues, short-term debt over long-term debt, and retained earnings over new share issues.	Firms have target leverage ratios and targets for short-term relative to long-term debt. Firms adjust their new financing to move back toward their targets.	Firms with a higher P/B_{t-1} allocate more outside financing to share issues, more debt financing to long-term debt, and more equity financing to new shares.
Results: Share issues vs. New Debt (Controlling for total outside financing)	New debt absorbs most of the variation in dA_t, Y_t, and D_t. The absorption equals approximately two times the absorption of new shares.	Reversion of leverage to target is statistically reliable and economically strong for medium and large firms. Not for small firms.	Controlling for total outside financing, new share issues are positively related to P/B_{t-1}. Also, the effect is economically large for all three types of firms.
Results: Short-term vs. Long-term Debt (controlling for total debt financing)	Long-term debt absorbs more variation in investment, earnings, dividends, and share issues than short-term debt.	Controlling for total new debt, smaller firms with a higher short-term debt surplus tend to issue more long-term debt.	There is only evidence for large firms that firms with a high P/B_{t-1} favour long-term debt over short-term debt and there is no significant evidence for small and medium firms.
Results: Share issues vs. Retained Earnings (controlling for total equity financing)	Controlling for total equity financing, share issues absorb almost all variation in investment, earnings, and dividends. So, dividends are sticky.		There is evidence that firms with a high P/B_{t-1} increase dividends to issue shares and firms with a low P/B_{t-1} repurchase shares rather than pay dividends, but the effect is small and the same as the costs and benefits that produce sticky dividends.

model. There is mixed evidence for this model which leads me to sometimes accept and other times reject the predictions of this model. The least evidence is found for the pecking order model. Almost all the predictions of this theory were rejected. **Altogether, based on the financing decisions of public UK firms in the period from 1998 to 2017, the trade-off theory holds the most in practice.** Analysts and investors should take this into account when making their analysis and decisions. It means that a higher fraction of debt in the capital structure of a firm does not necessarily mean that a firm faces a greater financial risk. Most firms have target debt ratios and therefore take on more debt voluntarily in certain situations.

5.5 Limitations and future research

I used the lagged industry leverage to proxy for target leverage. This is quite crude, but Fama & French (2012) tried alternatives like an equal-weight industry leverage for t-1 or an average equal-weight or value-weight industry leverage of five years from t-1 to t-5 and a few other alternatives and they found similar results on the reversion of leverage to target for all these alternative measures of target leverage. However, there is always a chance that another measure of target leverage will give a different result and the way I calculated target leverage is a limitation of my research. Also, I focused on book leverage, because the results in Welch (2004) suggest that because of changes in stock prices, firms do not respond much to variation in market leverage. Fama & French (2012) replicated their analysis using market leverage and found similar estimates of the rate of reversion of leverage to target and this is the reason that I used book leverage. Using both book and market leverage in future work is a relevant extension of my research method.

Rampini & Viswanathan (2010) and Welch (2011) suggest that non-debt liabilities like operating leases should be included in the measures of leverage. In line with Fama & French (2012), I did not include these liabilities and I leave such refinements for future work. There is always the possibility that a slightly other measure of leverage could lead to other outcomes of my research.

I used the lagged P/B ratio as the measure of market conditions, but there exist a lot of alternatives to this measure. De Angelo et al. (2010) examine the performance of different market conditions variables as predictors of seasoned equity offerings and find that combining different measures provides some enhancement of explanatory power. However, in economic terms, not much seems to be gained (Fama & French, 2012: 67-68). Like Fama & French (2012), I used P/B_{t-1} as the only measure of market conditions, because it is the popular choice in the past literature. I leave enhancements such as those of De Angelo et al. (2010) for future work.

Lastly, I implied that the slopes of the cross-section regressions are the same for all firms. This is a quite risky implication and a careful interpretation of the results is needed. Estimates of average effects are informative about overall responses and are surely inaccurate for certain individual firms in certain industries. A relevant extension of my work would be to allow the slopes to vary across firms, for example, through interaction variables. In my thesis I stayed with simple transparent functional forms as Fama & French (2012).

6. Appendix

Table 6. Definitions of the variables used in the regressions

Variable	Meaning
dA_t	Investment: Change in assets during fiscal year t
Y_t	Earnings: Income before extraordinary items available for common plus extraordinary income during fiscal year t
$PosY_t$	Positive earnings: Earnings if Y_t is positive, 0 if Y_t is negative
$NegY_t$	Negative earnings: Earnings if Y_t is negative, 0 if Y_t is positive
MC_t	Market cap: The log of the share price times shares outstanding at the end of June of calendar year t
D_t	Dividends: Dividends per share at the end of fiscal year t times shares outstanding at the end of t
NoD_t	No dividends: A dummy variable that is 1 if the firm does not pay dividends in fiscal year t and 0 otherwise
D_{t-1}	Lagged dividends: Split-adjusted dividends per share by ex-date (26) at the end of fiscal year t − 1 times shares outstanding at the end of t. I use the Compustat adjustment factor to adjust for splits and stock dividends during fiscal year t. For example, if there is a three-for-one split during year t, I divide dividends per share for fiscal year t − 1 by three
P/B_{t-1}	Lagged price-to-book ratio: Market equity (price times shares outstanding) in December of year t − 1 divided by aggregate book equity for the fiscal year ending in calendar year t − 1. Book equity is stockholders' equity plus balance sheet deferred taxes and investment tax credit if available, minus postretirement benefits if available, minus preferred stock liquidating value if available, or redemption value if available, or carrying value if available
$NegB_{t-1}$	Negative book equity: A dummy variable that is 1 if the firm's book equity at the end of fiscal year t − 1 is negative and 0 otherwise.
LS_{t-1}	Lagged leverage surplus: The difference between the firm's leverage ratio and its target leverage ratio. The leverage ratio is assets minus common equity at the end of fiscal year t − 1 divided by assets at the end of t − 1. The target leverage ratio is the average leverage ratio at the end of t − 1 for the firms in the same industry, with each firm weighted by its assets at the end of t − 1. Firms are assigned to one of ten industries using the SIC industry classifications.

dS_t	Book value of shares issued: Change in common equity plus dividends, D_t, minus earnings, Y_t, during fiscal year t
dL_t	Change in total liabilities, including preferred: Change in assets minus change in common equity during fiscal year t
$dSTD_t$	Change in short-term debt: Change in current liabilities during fiscal year t
$dLTD_t$	Change in long-term debt: Change in total liabilities, dL_t, minus change in current liabilities, $dSTD_t$
STS_{t-1}	Lagged short-term surplus: The difference between the firm's short-term debt ratio and its target ratio. The short-term debt ratio is current liabilities at the end of fiscal year t − 1, divided by total liabilities at the end of t − 1. The target ratio is the average short-term debt ratio at the end of t − 1 for the firms in the same industry, with each firm weighted by its total liabilities at the end of t − 1. Firms are assigned to one of ten industries using the SIC industry classifications.

Table 7. Formulas of the constraints and the regressions

Type of constraint/regression	Regression equation
Cash flow constraint for the split of total new financing (1)	$dS_t + dL_t = dA_t + D_t - Y_t$
Cash flow constraint for the split of total new debt financing (2)	$dSTD_t + dLTD_t = dA_t + D_t - Y_t - dS_t$
Cashflow constraint for the split of new equity financing (3)	$dS_t - D_t = dA_t - Y_t - dL_t$
Share issues regression following from cashflow constraint (1)	$dS_t = a_t + b_1 dA_t + b_2 D_t + b_3 Y_t + b_4 P/B_{t-1} + b_5 LS_{t-1} + e_t$
Debt issues regression following from cashflow constraint (1)	$dL_t = -a_t + (1-b_1)dA_t + (1-b_2)D_t - (1+b_4)Y_t - b_4 P/B_{t-1} - b_5 LS_{t-1} - e_t$
Actual regression pair (1)	$\mathbf{dF_t = a_t + b_1 dA_t + b_2 NegY_t + b_3 PosY_t + b_4 NoD_t + b_5 D_t + b_6 MC_t + b_7 NegB_{t-1} + b_8 P/B_{t-1} + b_9 LS_{t-1} + e_t}$
Short-term debt regression following from cashflow constraint (2)	$dSTD_t = a_t + b_1 dA_t + b_2 D_t + b_3 Y_t + b_4 dS_t + b_5 P/B_{t-1} + b_6 STS_{t-1} + e_t$
Long-term debt regression following from cashflow constraint (2)	$dLTD_t = -a_t + (1-b_1)dA_t + (1-b_2)D_t - (1+b_3)Y_t - (1+b_4)dS_t - b_5 P/B_{t-1} - b_6 STS_{t-1} - e_t$
Actual regression pair (2)	$\mathbf{dF_t = a_t + b_1 dA_t + b_2 NegY_t + b_3 PosY_t + b_4 dS_t + b_5 NoD_t + b_6 D_t + b_7 MC_t + b_8 NegB_{t-1} + b_9 P/B_{t-1} + b_{10} STS_{t-1} + e_t}$
Share issues regression following from cashflow constraint (3)	$dS_t = a_t + b_1 dA_t + b_2 Y_t + b_4 dL_t + b_4 P/B_{t-1} + e_t$
Dividend regression following from cashflow constraint (3)	$D_t = a_t + (b_1-1)dA_t + (b_2+1)Y_t + (b_4+1)dL_t + b_4 P/B_{t-1} + e_t$
Actual regression pair (3)	$\mathbf{dF_t = a_t + b_1 dA_t + b_2 NegY_t + b_3 PosY_t + b_4 dL_t + b_5 MC_t + b_6 NegB_{t-1} + b_7 P/B_{t-1} + b_8 D_{t-1} + e_t}$

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