Optimal Capital Structure and Firm Value
Australian Evidence: 1991 - 2003

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Abstract

Received theories, namely optimal capital structure, pecking order and signalling, suggest a likely change in the value of a firm at the time financing decisions are *disclosed to the market*. This paper reports new findings of such a significant change in a firm's value when *relative capital structure* changes by 10-40 per cent. Relative capital structure is the change in a firm's capital structure relative to its industry median ratio. Abnormal return to a firm adjusting its capital structure in value-enhancing financing decisions closer to the industry ratio is positive compared to the abnormal returns when the ratio is adjusted away from industry median. These findings, consistent with theories, would appear to suggest that the industry relative ratio is a likely surrogate for optimal capital structure decisions for Australian firms.

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1. Introduction

After four decades of intense scrutiny, capital structure effect on firm value continues to be a popular research topic in finance and accounting literature. Optimal capital structure (Miller-Modigliani paradigm), pecking order (Myers and Majluf), agency theory (Jensen-Meckling) and signalling (Leland and Pyle) theories have contributed very useful but sometimes mixed guidance to academic and practitioners searching what management's financing decisions do to the value of a firm. This paper takes a new direction in research by using an idea of relative capital structure, which is defined as the change in capital structure, arising from a financing decision, relative to industry average ratio: see Ariff and Lau (1996) and Hull (1999).

If capital rationing is a hard constraint faced by management of firms, then it is arguably correct to assume that fund providers such as shareholders at the time of equity offers and the debt-providers at the time of debt issues are likely to be influenced by how they revalue a firm's capital structure *relative to the industry average* capital structure at the time management discloses financing decisions to the market. Baker and Wurgler (2002), Kayhan and Titman (2004), and Welch (2004) show, over time, share price reaction considerably influences capital structure decisions and is perhaps the only well-understood factor in explaining debt-equity dynamics. However, the aspect of capital structure from relative perspective and from the equity side has yet received the attention it requires while the emphasis has been to study the impact of debt-taking on capital structure or the dynamics of debt-or-equity decisions.

Perhaps this newer approach may assist us to disentangle the mixed findings and help provide new insights to fill gaps in the literature on capital structure research. The existing empirical tests on debt-issue effects documented as tax-shield value have provided some, though mixed, support for the tax-shield value hypothesis. However, capital structure changes also occur at the time of equity offers (especially seasoned equity offers and private placements). This study therefore uses both debt and equity disclosures to measure both *value-enhancing* capital structure changes and *value-reducing* capital structure changes. The event study research design is eminently suitable to observe and measure the value change effects, adjusted for risk differences, by examining the disclosures effects of debt and equity offers, which lead to capital structure changes, measured as 10-50 per cent changes.

The remainder of the paper is structured as described. Section 2 is a very brief restatement of the literature relating to optimal capital structure, relative capital structure, pecking order, agency, bankruptcy costs and signalling theories and evidence thereof as forming the basis for hypothesis development. Section 3 is concerned with data and methodology while Section 4 is a summary of interesting new findings on this topical subject. A conclusion of the study is provided in the next section.

2. Literature Review

2.1 Optimal Capital Structure Theory

Optimal capital structure theory attributed to Modigliani-Miller paradigm suggests there exists an optimal leverage at which the firm obtains a maximum value by minimising its weighted average costs of capital, given the market imperfections, among others, of tax-deductibility of interest costs from pre-tax income of firms. This model is derived from the classic irrelevance capital structure theorem as amended when tax-deductibility of interest is brought into the valuation model.[1] Considerable debate on this idea has taken place. The proposition asserts that the value of a firm with tax-deductible interest is equal to the value of an all-equity firm as enhanced by the tax savings $\left(V_L = V_U + \tau_c D\right)$: V is value, L is firm with debt, U is firm without debt and D is debt levels and τ_c is the corporate tax rate.

By further modifying Modigliani and Miller's (1958) assumptions, several finance researchers have discovered that financial distress and bankruptcy costs may also provide an economic rationale for the existence of an optimal capital structure: Robichek and Myers (1966a), Baxter (1967), Bierman and Thomas (1972), Kraus and Litzenberger (1973) and Scott (1976). Scott goes on to say "the optimal level of debt is an increasing function of the liquidation value of the firm's assets, the corporate tax rate, and the size of the firm" (p. 50). He concludes that a unique optimal leverage exists.

$$V_L = V_U + PV\left(Tax\ Shields\right) - PV\left(Bankruptcy\ Costs\right) \quad (1)$$

where
V_L : value of firm with debt,
V_U : value of an all-equity firm stripped off the impact of debt,
PV : present value of tax shield valued at the cost of debt, and
τ_c : the corporate tax rate in an economy with positive tax on re-tax income of firm.

Introduction of bankruptcy cost when debt levels move the capital structure beyond the optimal level, the equation predicts that a firm's value is maximised when a firm maintains a debt level at the optimal capital structure. The theory does not specify the optimal capital

[1] Modigliani and Miller (1958) assume that: (i) all physical assets are owned by firms, (ii) the capital market is perfectly competitive in the sense that there are no transaction costs, full information is available to market participants at no cost, and all market participants are price takers, (iii) there are no taxes, corporate or personal, (iv) there are no bankruptcy costs, (v) both individuals and firms can borrow or lend at the same risk-free interest rate, (vi) Investors have homogeneous expectations about the future stream of firms' profits, (vii) there is no growth, so all cash flow streams are perpetuities, and (viii) all firms are in the same risk class. Some researchers point to assumptions in the theory as too unrealistic.

structure for a firm, and hence there is a need to specify that from market practices. Recent literature suggests that fund providers may be using the industry average capital structure as the optimal for a given industry. Thus, if industry average is used as a benchmark for the market's decision on optimality, then it is feasible to employ a firm's capital structure relative to that of its industry to see if market is indeed valuing the firm in the manner suggested by theory.

Jensen and Meckling (1976) introduce agency costs as another explanation for optimal capital structure. Based on their theory, the firm is viewed as a contractual relationship between managers and capital providers namely the shareholders and debt holders.[2] As utility maximisers these parties are principals of the firm but the management may not act in the best interests of the principals, given the widespread separation of ownership and control of firms listed and traded in the stock exchanges. Agency costs of equity decrease with an increase in debt usage while agency costs of debt increase with an increase in debt usage. As a firm takes on more and more debt, the agency costs of debt rise at an increasing rate. Hence, the optimal value may be determined at the point where the total agency cost is the lowest, given bankruptcy costs and value of tax shields from interest deductibility. However, in practice, it is difficult or impossible to estimate the agency costs. This is represented as:[3]

$$V_L = V_U + PV(Tax\,Shields) - PV(Bankruptcy\,Costs) - PV(Agency\,Costs) \qquad (2)$$

$$V_L = V_U + 1 - \left(\frac{(1-\tau_c)(1-\tau_{pe})}{(1-\tau_p)} \right) \times D - PV(Bankruptcy\ Costs) - PV(Agency\ Costs) \qquad (3)$$

[2] Interestingly, Black and Scholes (1973) Option Theory could be used also to study this aspect of equity value as the call value of a debt-taking firm.

[3] Agency costs are defined by Jensen and Meckling (1976) as the costs incurred when the interests of managers are not aligned with those of shareholders and bondholders. Thus, a firm with a diffuse capital structure is more likely to incur higher agency costs and hence have lower profitability than firms with less diffuse structures.

where
D : value of debt taken by a firm to perpetuity,
τ_{pd} : the personal tax rate on debt income or interest income, and
τ_{pe} : the personal tax rate on equity income or capital gains.

The important notion here that as long as the tax rate on debt income and equity income are not exactly equal – in practice these are not – then there is an effect on value of a firm from debt, in an environment with corporate tax. Studies cited in the previous paragraphs show that tax benefits initially increase as a firm takes on more debt. Once a firm reaches a leverage position where the costs of using debt offsets its tax shield advantages, it appears to achieve the optimal capital structure with the value being the maximum. However, these studies on debt do not incorporate the likely impacts from also other forms of financing the firm. Verily a firm's funding at the time of rights issues beyond this point, taking on more debt no longer benefits a firm but decreases its value instead, as the costs associated with debt override its benefits. The costs of financial distress and agency costs, therefore, provide explanations for the existence of optimal capital structure.

Based on the above optimal capital structure theory, where the use of debt is promoted, issuing equity is denoted as a movement away from the optimum (value-reducing changes) whereas issuing debt is denoted as a movement toward the optimum (value-increasing changes). It can be argued that, capital structure improvements from equity funding may lead to improved valuation of the firm, and hence lead to a positive price effect. Of course, this is conditional on offsetting the negative price effect predicted by the signalling hypothesis: investors view equity offer as signal that a firms is unable to secure debt. However, the net effect is a matter for empirical observation.

2.2 Relative capital structure

Most studies attempting to examine the existence of the optimal capital structure largely revolve around the research question of identifying variables driving the trade-off between debt-equity or demonstrating the use of financial leverage in different industries. Despite this extensive research, the question as to what the optimal level of capital structure is for a firm has yet been answered. Although Bowen, Daley and Huber (1982), Claggett Jr. (1991), Ghosh and Cai (1999) find that firms tend to move towards their industry *mean* over time, thus far, a direct empirical test on optimal capital structure using this approach has not been widely attempted: exception is perhaps Ariff and Lau (1996) and Hull (1999). However, industry norm as the benchmark for capital structure has been used by practitioners through empirical examination of accounting information. These reports/studies have indicated, respectively for the U.S. and Singapore, empirical verification of on *industry-effect*, which suggests that firms belonging to the same industry tend towards similar capital structure.

2.3 Research questions

As will be reviewed in the next sub-section, capital structure of Australian firms has been studied by several scholars. However, there is as yet a study of the valuation impact from relative capital structure changes on the value of the firm as well as the firm-specific factors driving the value changes. Given this, it is useful to explore how market reacts to a firm's capital structure changes relative to its industry benchmark.

2.4 Prior Empirical Evidence

There are a number of studies on capital structure in Australia. For example, Hamson (1989), Chiarella, Pham, Sim and Tan (1992), Shuetrim, Lowe and Morling (1993), and Love and Wickramanayake (1996) examined optimal capital structure while Allen (1993, 1994) focused on pecking order hypothesis. There are far more papers on tax effect of capital structure, which are not reviewed here. Worldwide, there is a large number of studies, of which a selection is made for the purpose of review here. This brief review highlights frequently cited studies under the various theories.

Optimal capital structure: Many studies had attempted to explain the existence of optimal leverage. However, "… direct empirical verification of the optimal capital structure predictions has not been encouraging." (Ariff and Lau, 1996, p. 391). Among the several tests of optimal capital structure in the literature, the most common is the determination of whether capital structure can be explained by variables driving the trade-off between debt and equity, and whether these variables are related negatively or positively to the levels of debt taken. For instance, some authors find that a firm's growth determines its debt-equity ratio and it is negatively related to leverage (Jensen, 1986; Smith and Watts, 1992; Gateward and Sharpe, 1993; Love, 1996; Gul, 1999). Moreover, Chiarella *et al*. (1992), Shuetrim *et al*. (1993), Love (1996), Pandey (2001), Panno (2003) report that the leverage is positively related to firm size. Uniqueness and volatility are used as determinants of capital structure. While Titman (1984) reports that unique firms should have a relatively low leverage since they are likely to suffer greater losses in bankruptcy, Bradley *et al.* (1984) indicate that firms with more volatile operating income have lower leverage. Myers and Majluf (1984) propose another variable, collateral value of assets, as a positive determinant of leverage related to debt-equity ratio since if firms able to provide high-value of collateral are unlikely to get a loan. This argument is supported by Dittmar (2004).

Studying spun-off firms, he reports that collateral value is positively related to leverage choice. Abnormal earnings are also considered as factors known to be associated with leverage and positively related to leverage. Long and Malitz (1985) document a negative relationship between research and development expenditure and leverage ratios. Mackie-Mason (1990) provide evidence that firms which carry forward tax losses are less likely to issue debt. This conclusion is consistent with Miller and Modigliani (1966), who detect positive effects of interest tax shields in the market values of electric utilities (Shyam-Sunder and Myers, 1999). Further, Barclay, Smith, and Watts (1995) examine firms and their investment opportunities and conclude that investment opportunities are the most important determinants of a firm's debt ratio and that firms with better investment opportunities tend to have much lower debt ratios than firms with low price to book ratios (Damodaran, 2001).

The debt-equity ratio is stable over time within industries unless affected by changes in tax or bankruptcy law and this ratio is approximately 0.40 to 0.65 in Atlantic countries and Australia and about 0.70 to 0.85 in East and South Asia: Ariff and Lau (1996). Solomon (1963) asserts that there are significant differences in debt ratios between firms operating in different industries. He adds that ratios of industrial groups tend to be consistent over time. Schwartz and Aronson (1967) document strong evidence of industry effects in the U.S., i.e. firms within the same industry possess similar capital structures which are different from inter-industry firms. Love and Wickramanayake (1996), using Australian data, show that capital structures varies among industries and Australian industries recognise benefits of optimal capital structure for maximisation of firm value. Similar results for other countries are reported: for U.S. in Schwartz and Aronson (1967), Scott (1972), Scott and Martin (1975), Cordes and Sheffrin (1983), and Titman and Wessels (1988); for Australia by Hamson (1989) and Shuetrim *et al*. (1993); for European countries by Prasad, Bruton, and Merikas (1996). Bowen, Daley, and Huber, Jr. (1982), Castanias (1983), and Bradley *et al*. (1984) found that firms relied on industry leverage in designing their target capital structure.

There also statements found in other studies, although not fully supported by direct tests, to assume firm's specific leverage tends to move towards its industry ratio, or in other words, the strongest determinant of capital structure is the average debt ratio of a firm's industry (Bowen *et al.*, 1982; Damodaran, 2001; Frank and Goyal, 2003): while this is documented, there is no attempt to measure the predicted price changes in the context of the theory. Jalilvand and Harris (1984). Ozkan (2001) observes that firms have long-term target leverage ratios and tend to correct their leverage relatively fast, and questions the idea that firms tend to move towards the industry average. Claggett Jr. (1991) provides anomalous results in that firms with debt ratio above industry benchmark tend to adjust their leverage toward industry benchmark more than those with debt ratio below the industry benchmark.

At a more aggregate level, Rajan and Zingales (1995) attempt to establish whether the capital structure is similar, internationally, by investigating firms from 31 countries. They found some similarities across only the G-7 countries (U.S., Japan, Germany, France, Italy, U.K., and Canada). Ronn and Senbet (1995) suggest that differences in market incompleteness or incomplete degrees of financial innovation across national boundaries may give rise to differential debt-equity ratios on a country basis. This is consistent with Krishnan and Moyer (1997), who assert that capital structure is influenced by the country of origin.

Pecking order: The pecking order hypothesis explains a firm's specific financing decisions. It also provides crucial links between debt and other firm-specific factors. For example, the negative relationship between leverage and profitability, financial slack and low leverage of healthy firms, and market response to new equity announcements. Extensive studies of this hypothesis provide support for the pecking order hypothesis. Narayanan (1988) confirms

Myers' (1984) study and finds that debt is preferable even though it is risky. In the U.S., Pinegar and Wilbricht (1989), Baskin (1989), Claggett Jr. (1991), and Kamath (1997) show that relying on a hierarchy of financing sources is more popular than adhering to target leverage. Shyam-Sunder and Myers (1999) also argue that the rationale behind the pecking order provides a better empirical explanation than do the trade-off models. Similar results supporting the pecking order hypothesis are found in Singapore (Koh, Phoon and Tan, 1993) and in Australia (Allen, 1993). Griner and Gordon (1995) Lowe and Taylor (1998) investigating SMEs in the U.K. detected pecking order behaviour. They then assert that not only large but also small firms employ the financing hierarchy. Arsiraphongphisit, Kester and Skully (2000) find that 75 per cent of respondents prefer to follow a financing hierarchy to maintain a target capital structure. Indeed, their version of the preferred financing hierarchy is consistent with the pecking order where retained earnings are ranked first, followed by bank loans and common stocks: however this is a survey response by managers.

Booth *et al*. (2001) covering many countries also provide evidence consistent with the pecking order hypothesis. They find that the more profitable the firm the lower is the debt ratio. This finding contradicts optimal theory in that why these firms do not move their leverage to the industry average. Is it that high profitable firms engage in non-optimal behaviour? Additionally, an examination of Hungarian firms by Colombo (2001) provides further support for the pecking order hypothesis. Colombo (2001) reports that "there is evidence of the existence of the pecking order in firms' financing choices suggesting the presence of forms of financial market imperfections that constrain them in the achievement of their optimal capital structure" (p. 1699).

Although the pecking order theory has been widely accepted, Ryen, Vasconcellos and Kish (1997) argue that it is inconsistent with many empirical observations. Frank and Goyal (2003) using U.S. data report that debt financing does not dominate equity financing in magnitude. In fact, equity financing is closely related to financing deficit while debt financing is not. Myers and Majluf (1984) argue that a drop in share price should be greatest for an equity issue, less for convertible debt, and the least for straight debt. However, there are several findings that contradict this view; for example, Mikkelson and Partch (1986), Noe (1988) and Constantinides and Grundy (1989).

Studies in most Asian countries tend to reject the pecking order hypothesis: South Korea (Ang and Jung, 1993) and Korea, Taiwan and Thailand (Bos and Fetherston, 1993). A recent study in Thailand by Arsiraphongphisit *et al.* (2000) contradicts this. Claggett Jr. (1991) tests the trade-off theory and pecking order hypothesis using Compustat data and observes that long-term debt to total assets ratio tends to move toward the *most recent industry mean* and firms with leverage higher than the industry mean adjust towards the industry mean more than those with leverage lower than the industry mean.

Agency: The agency problem of separation of ownership and control proposed by Jensen and Meckling (1976) has been examined by many researchers. Friend and Lang (1988) and Firth (1995) find that the level of debt is negatively related to management ownership and positively related to external ownership. Brailsford, Oliver, and Pua (2002) studied the link between ownership structure and capital structure and found that the level of managerial share ownership and leverage have a non-linear inverted U-shaped relation, with a maximum turning point at 49 per cent of management share ownership. Some found an increase in firm size generally results in greater manager compensation (Murphy, 1985; Baker, Jensen and

Murphy, 1988; Elston and Goldberg, 2003) and faster promotion, especially when a firm adopts a promotion-based reward system (Baker, 1986).

Bankruptcy costs: Attempts to examine whether bankruptcy costs are significant in contributing to debt-equity choices have produced mixed results. Miller (1977), in an old classic paper, reported bankruptcy costs do exist, but they are reasonably small relative to tax savings. Warner (1977), examining direct bankruptcy costs of railroad bankruptcies, demonstrates that bankruptcy costs are, on average, about 1 per cent of the firm's market value seven years prior to bankruptcy: it increase to 5.3 per cent immediately prior to bankruptcy. He, therefore, concludes that direct bankruptcy costs are trivial compared to the market value of a firm yet such costs rise rapidly as time to bankruptcy approaches. Robertson and Tress (1985) and Pham and Chaw (1989), in Australia, report similar results to those obtained by Warner (1977) while Bradbury and Lloyd (1994) estimated the direct costs of bankruptcy in New Zealand as being at a median value of 8 per cent of firm value. Hence, the higher a firm's capitalisation the less important direct bankruptcy costs are in capital structure decisions (Warner, 1977; Bradbury and Lloyd, 1994). de Miguel and Pindado (2001) also confirm that bankruptcy costs are significant as they considerably reduce a firm's leverage.

Signalling: A firm's current capital structure should be strongly related to the historical share price of a firm as evidenced by Baker and Wurgler (2002), Kayhan and Titman (2004), and Welch (2004). Over time, share price reaction considerably influences capital structure decisions and is perhaps the only well-understood factor in explaining debt-equity dynamics. Hertzel and Smith (1993) extend Myers and Majluf's (1984) study to include private placement issues and propose that undervalued firms with profitable opportunities can mitigate information asymmetry effect by using private placement as an alternative mechanism for equity financing. Thus, if a firm does not have good future prospects or expected earnings, it cannot afford such scrutiny. The magnitude of a positive abnormal return for private placement is correlated with the extent to which the asset is undervalued. Firm allows a small group of private investors to evaluate its firm value more closely than do public investors (Goh, Gombola, Lee and Liu, 1999): see also see Wruck (1989), Hertzel and Smith (1993) and Lee and Kocher (2001).

3. Data and Methodology

By classifying financing decision events of firms into groups according to the likely value changes those decisions should lead to the capital structure changes relative to the industry ratio, it is possible to create different samples and test the observed value changes against the predictions of the theories. Some financing decisions move a firm's capital structure from a relatively low debt-equity ratio (at the profitable stage of firm) to a higher debt-equity ratio (at the stage of going for growth) but not higher than the optimal industry benchmark: these are termed as *value-increasing* decisions as predicted by the optimal capital structure theory. Another financing decision of another firm may involve a move of capital structure towards a level higher than the benchmark by increasing the debt-equity level by moving a firm's capital structure far above that of the industry benchmark. This move will be termed a *value-reducing* move as such a financing decision would increase the already high risk of a high debt-equity firm. Similarly, firms may at time, move their capital structure by moving the capital structure away from the optimal level for the firm in an industry. Such moves are *value-reducing* financing decisions.

Thus, the above research design uses the industry median debt-equity ratio *in a given year* as the optimal for the firm for that year. By grouping the 658 observed financing events in terms of the impacts these would have on the values as predetermined by the optimality of the resulting capital structures, it is possible to observe if the industry mean indeed serves as the proxy for the unspecified optimal capital structure. The study covers a period of 13 years in a market that is known to be Fama-efficient in pricing, although it is also true that the liquidity of some of the firms in the tested market is not as high as one would wish. These test models are specified in the ensuing sub-sections.

3.1 Hypotheses

Given the themes adopted in the brief review of the literature to this point, we can expect our findings in this study to support the following hypotheses:

H_1*:* The cumulative abnormal return accruing to the firms at the disclosure times of financing decisions resulting in value-increasing capital structure adjustments is positive and significant. (The effect may arise from both debt and equity offers.)

H_2*:* The cumulative abnormal return accruing to the firms at the disclosure times of financing decisions resulting in value-decreasing capital structure adjustments is negative and significant. (The effect may arise from both debt and equity offers.)

These two hypotheses, stated in the form of expected results will be tested as null hypotheses. If the nul of zero effect is rejected, then the proposed hypotheses will be accepted as being supported. By grouping the large sample of events into different levels of capital structure changes (more than 5% and 10%; more than 10% and 20%; ….; more than 50%) a further hypothesis is tested as to whether the significant changes in value only accrue at one or more levels of debt and not at others.

H_3*:* The cumulative abnormal returns to different levels of capital structure changes are significant.

The maintained hypothesis is that that all levels of changes in capital structure will have significant changes to the value of the firm. If a given level of debt does not have significant effect, then that will be identified.

3.2 Data and Variables

Firm specific data: The overall sample of 654 observations is used in this study. This sample consists of 77 straight debt, 43 convertible debt (debt-like changes), 377 equity private placements, and 157 rights issue observations (equity-like changes). While the straight debt and convertible debt samples consist of announcements that were announced and issued between 1 January 1991 and 30 June 2003, the private placement and rights issue samples consist of announcements that were announced and issued between 1 January 1991 and 31 December 2002 by companies listed on the Australian Stock Exchange (ASX). The samples however, exclude announcements that were made by firms that were listed in the first year of announcements. Also, to be included in the sample, an announcement of interest must have a clear public disclosure date; are announced event must not concurrently have other potential confounding events such as dividends, earnings, etc. disclosures during the event window. In addition, only events that experienced at least a five percent change in capital structure of their respective firms over their market capitalisation were included in the study.

To test the effect of different degree of capital structure changes on firm value, the sample was also classified into six groups, according to levels of capital structure changes. These groups include those having percentage changes in capital structure between: (i) more than 5 per cent and 10 per cent; (ii) more than 10 per cent and 20 per cent; (iii) more than 20 per cent and 30 per cent; (iv) more than 30 per cent and 40 per cent; (v) more than 40 per cent and 50 per cent; and (vi) more than 50 per cent.

For each observation, event date, daily share price and relevant market and financial data were collected. The primary source of data for event dates and market data were DatAnalysis, SIRCA, and Bloomberg databases. The financial data were collected from various sources, including Connect4, DatAnalysis, and Aspect Financial Analysis databases.

As this study is concerned with the effect of capital structure changes on firm value, only security issues or announcements that lead to changes in capital structure of firms are included in this study. Exchange offers with the same financing types (e.g. debt for debt or equity for equity) are excluded. Conventional theory and practice identify debt and equity as the only funding sources available to the firm, and the ratio between debt and equity is used to denote the long term capital structure of the firm. Consistent with prior studies, this study employs the ratio of debt to equity (D/E) as a proxy for capital structure. While debt is book value of interest bearing debt, equity is measured by market capitalisation of a firm.

Debt-Equity industry ratio: Apart from collecting firm-specific data, our test requires the calculation of a debt-equity industry benchmark. Since the median debt-equity ratio (MedDE) is commonly used as an industry capital structure ratio (for example, Hull, 1999), it is also used as a proxy for an industry benchmark in this study. Consistent with the industry classification system currently employed by the ASX, this study uses the Global Industry Classification Standard's (GICS) system to classify industry sectors. An industry thus consists of all firms within the same industry sector. Financial information required for computing industry ratios are obtained from Aspect Financial Analysis, DatAnalysis, and Sirca commercial databases in the network of Monash University.

3.3 Test Models

The analysis of share price reaction to capital structure changes is conducted within a standard event study framework as described in Brown and Warner (1980; 1985). In this study, the market adjusted returns are employed in abnormal return computation. The model describes ex-post abnormal return as follows:

$$AR_{i,t} = R_{i,t} - R_{m,t} \tag{4}$$

where

t : days measured relative to the event date,

$AR_{i,t}$: abnormal returns,

$R_{i,t}$: the rate of return on security *i* in period *t,* and

$R_{m,t}$: the rate of return on market index in period *t.*

Once abnormal returns are computed, the abnormal returns across firms on the same event date are accumulated across firms to obtain the average abnormal return over time. Cumulative Average Residuals (CARs or the sum of average abnormal return during time t within the event window) are then calculated using the technique in Fama, Fisher, Jensen and Roll (1969**)**. The arithmetic procedure is as follows:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t} \tag{5}$$

$$CAR_{(j,k)} = \sum_{t=j}^{k} AAR_t \tag{6}$$

where

AAR_t : the average abnormal returns for *N* securities in period *t,*

N : the number of securities in the portfolio, and

$CAR_{(j,k)}$: the cumulative abnormal returns between time *j* and *k.*

To observe the effect of announcements over different periods of time, CARs are obtained from different periods, including (-10,+10), (-5,+5), (-1,0), (-1,+1), and (+2,+10).

After the event study is conducted and share price reaction to security issue announcements has been observed, changes in capital structure events are further analysed to determine whether a relationship exists between these changes and the industry benchmark and firm value.

Tests of capital structure changes relative to industry benchmark adopts a methodology consistent with the approach in Ariff and Lau (1996) and Hull (1999). This methodology is developed based on capital structure theory predictions, i.e. the effects of directional capital structure changes relative to the industry benchmark on firm value. The relationship between directional changes in capital structure and firm value is expressed in a regression equation as follows:

$$Z_{it} = b_0 + \sum_{j=1}^{4} b_j \left(X_j\right)_{it} + e_{it} \qquad (7)$$

where,

$Z_{i,t}$: three-day CAR as a proxy for firm value,

b_0 : the intercept term which is significant if the left out factors are important,

Σ : summation operator for j : 1, 2, 3, and 4 event types,

$e_{i,t}$: the residual term,

b_j : coefficients of independent dummy variables,

X_1 : a dummy variable, takes value of 1 if an event is a value-decrease capital structure adjustment event, 0 otherwise,

X_2 : a dummy variable, takes value of 1 if an event is a value-increase capital structure adjustment event, 0 otherwise,

X_3 : a dummy variable, takes value of 1 if an event is a value-increase capital structure adjustment event, 0 otherwise, and

X_4 : a dummy variable, takes value of 1 if an event is a value-decrease capital structure adjustment event, 0 otherwise.

Once events are classified into the groups, the effect of a directional change in capital structure relative to the industry median (to overcome non-normality) of each observation, firm value are observed. This analysis is based on theoretical predictions derived from optimal capital structure theory, which predicts that:

a) an increase of DE ratio closer to the industry benchmark will increase firm value

b) an increase of DE ratio away from the industry benchmark will decrease firm value,

c) a decrease of DE ratio closer to the industry benchmark will increase firm value, and

d) a decrease of DE ratio away from the industry benchmark will decrease firm value.

The significance of AR in this study is tested using conventional *t*-test statistics discussed in Brown and Warner (1985) and Corrado (1989), and Corrado and Zivney (1992). The significance tests for CARs however are calculated slightly difference.[4] The independent *t*-test statistic is used to test whether there are significant differences in the means of CARs over different windows between value-increasing group and value-decreasing group.

4. Findings

The findings from this study are presented in three sub-sections. The first sub-section is a summary of the value change measures as cumulative abnormal returns, CARs. Broadly, the abnormal returns observed are as predicted by the theories. The second sub-section reports findings related to effects of the degree of capital structure changes on firm value. The last sub-section deals with firm-specific variables that drive the value changes. Again broadly the findings are in the direction predicted by theories.

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[4] The *t*-statistics of cumulative abnormal return for any specific interval is $\frac{CAR_{(k,l)}}{SEE_{CAR}}$ while SEE_{CAR} is equal to $\sqrt{T\ \text{var}(AAR)}$, where SEE_{CAR} is the standard error of estimates of CARs of observations within the event period, $\text{var}(AAR)$ is variance of AAR, *k*is the beginning of the event period, *l* is the end of the event period, and *T* is the event period or $|k\text{-}l|+1$.

4.1 Abnormal Returns of Firms Relative to Capital Structure Changes

The CARs surrounding the announcements of interest for the sample of 168 value-increase and 294 value-decrease groups are presented in Table 2.

Table 2: Cumulative Abnormal Returns (CARs) Surrounding Straight Debt, Convertible Debt, Private Placement, and Rights Issue Announcements of 168 Firms Whose Post-Announcement D/E Ratio Is 'Closer To' Industry D/E Median (Value-Increase Group) and 294 Firms Whose Post-Announcement D/E Ratio Is 'Away From' Industry D/E Median (Value-Decrease Group)

Cumulative Periods	Value-increase Group (168)		Value-decrease Group (294)		Value-increase VS. Value-decrease Group	
	CARs	*t*-stat	CARs	*t*-stat	Diff. between CARs	*t*-stat
-10,+10	3.319	1.931*	0.129	0.102	3.190	4.417***
-5,+5	2.759	2.088**	0.336	0.373	2.423	4.036***
-1,0	0.873	1.186	0.009	0.017	0.864	2.306**
-1,+1	1.260	1.971**	-0.443	-0.695	1.703	3.230***
+2,+10	0.774	0.718	-0.006	-0.008	0.780	3.331***

***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.1 levels, respectively.

a $CAR_{(j,k)} \quad = \quad \sum_{t=j}^{k} AAR_t$

For the value-increase group, although all CARs shown in the table are positive, the CARs for the test periods of days -10 to +10, days -5 to +5, and days -1 to +1, register a significant positive effect from all four types of announcements. In particular, the CARs for these periods are positive at 3.319 per cent, 2.759 per cent, and 1.260 per cent, respectively and while the first interval is statistically significant at 0.1 level (t = 1.931), the latter two intervals are statistically significant at 0.05 levels with t value of 2.088 and 1.971, respectively. The share price reactions of the value-decrease group however do not illustrate any statistically significant correlation between the announcements in question and CARs.

When observing the difference between the CARs of the two groups, the CARs of the value-increase group for all test periods reveal a larger degree of positive market reactions to the announcements of interest than those of the value-decrease group for the same periods. Specifically, the CARs differences for the entire event periods of days -10 to +10 and days -5 to +5, are 3.190 per cent and 2.423 per cent, respectively and they both are significantly different from zero at 0.01 levels with *t* value of 4.417 and 4.036, respectively. Although the CARs differences for the on-event periods of days -1 to 0 and days -1 to +1 are also positive, they are both less positive and less statistically significant than the entire test period. That is, the CARs differences are 0.864 per cent and 1.703 per cent for the periods of days -1 to 0 and days -1 to +1, respectively and they are statistically significant at 0.05 and 0.01, respectively (t = 2.306 and 3.230, respectively).

To conclude, the positive differences in CARs obtained from all event periods, shown in Table 3, demonstrate results that support hypotheses 1 and 2.

4.2 Effects of Directional Changes of Capital Structure on Firm Value

This section reports results used to test Hypothesis 2. This study further used White test to detect for heteroskedasticity in regression equations. The problem of heteroskedasticity was corrected by performing White's heteroskedasticity-corrected (HC) standard errors.[5] Table 3 shows models revealing the effects of directional changes of different degree of capital structure changes on firm value based on theoretical predictions.

Column A of Table 3 shows the results obtained from the overall sample of 639 observations. The adjusted R^2 of 11.1 per cent is statistically significant at 0.01 level with an *F* value of

[5] Of the seven regressions only one indicated the presence of heteroskedasticity, and this was handled by White's correction.

27.624. The coefficient signs in the model illustrate that X_1 and X_2 (value-decreasing groups) are negatively correlated whereas X_3 and X_4 (value-increasing groups) are positively associated with CARs. The test parameters of these variables are statistically significant at 0.01 level: t = -10.481, -4.403, 2.927, and 5.157 for X_1, X_2, X_3, and X_4, respectively. These results are consistent with the optimal capital structure predictions in which a firm having its capital structure moving away from/closer to its relative optimal capital structure (measured as industry median ratio) will experience a decrease/increase in firm value. We believe that this is a direct test of the optimal capital structure theory. For the Australian market this result suggests behaviour consistent with the theory.

To test whether different levels of capital adjustments affect firm value differently, the observations were classified into six groups, varying between more than 5 per cent and more than 50 per cent, according to their percentage change in D/E ratio as stated previously. Columns B to G of Table 3 (graph of the plots as in Appendix A to the paper) reveal test results for different filter sizes of changes in capital structure. Although the sample size in column F appears to be small, it meets marginally the assumptions underlying the Central

Table 3: Effects of Directional Changes of Different Capital Structure (Debt-Equity Ratio) on Firm Value and Theoretical Predictions

Event types	Hypotheses		Results from different filters						
			A[#]	B	C	D	E	F	G
			All sample (n = 639)^	5%<ΔD/E ≤10% (n = 174)	10%<ΔD/E≤20 % (n = 219)	20%<ΔD/E≤30% (n = 99)	30%<ΔD/E≤40 % (n = 56)	40%<ΔD/E≤50 % (n = 23)	>50% (n = 68)
Model evaluation	H_0 = the model is not significance.	Adjusted R^2	0.111	0.179	0.084	0.055	0.271	-0.016	0.039
		F value	27.624	13.533	7.639	2.905	7.801	0.823	1.905
		Sig.	0.000***	0.000***	0.000***	0.039**	0.000***	0.453	0.138
X_1: D/E moves away from Med, without overshooting (Value-decreasing group)	β < 0	β	-0.076	-0.293	-0.287	-0.268	-0.495	-0.239	-0.221
		t-value	-10.481	-4.124	-4.356	-2.679	-4.091	-1.105	-1.82
		Sig.	0.000***	0.000***	0.000***	0.009***	0.000***	0.282	0.074*
X_2: D/E moves away from Med, with overshooting (Value-decreasing group)	β < 0	β	-0.084	-0.190	-0.070	-0.097	-0.313	-0.167	-0.164
		t -value	-4.403	-2.727	-1.072	-0.983	-2.642	-0.772	-1.359
		Sig.	0.000***	0.007***	0.285	0.328	0.011**	0.449	0.179
X_3: D/E moves closer to Med, without overshooting (Value-increasing group)	β > 0	β	0.036	0.219	0.069	0.046	0.068	0.019	0.083
		t -value	2.927	3.094	1.052	0.460	0.568	0.613	0.688
		Sig.	0.004***	0.002***	0.294	0.646	0.572	0.547	0.494
X_4: D/E moves closer to Med, with overshooting (Value-increasing group)	β > 0	β	0.030	0.018	0.036	0.028	0.033	n/a	0.039
		t -value	5.157	2.194	3.891	2.061	3.045	n/a	2.176
		Sig.	0.000***	0.030**	0.000***	0.042*	0.004***	n/a	0.033**

***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.1 levels, respectively.
[#]The White Heteroskedasticity-Consistent Standard Errors and Covariance approach is used to estimate this regression model.
^The initial sample size is 654. However, after excluding events with missing information for this test, the final sample size is down to 639 observations.

Limit Theorem.[6] As can be seen from the table, the relationship between capital structure adjustment and firm value is statistically significant when firms change their capital structure between more than 5 per cent and 40 per cent. However, interestingly, adjustment of capital structure beyond 40 per cent does not provide firms with statistically significant changes in their firm value. The last behaviour is consistent with the assumption that such firms would have become so unattractive for investors hold and trade that the price changes are no longer an indication of the state of the firm.

To conclude, the statistical significances of the models evident in columns A to E of Table 3 support Hypothesis 3.

5. Conclusions

The main motivation for this study is the verification of the relative capital structure as proxy for a management of a firm to make financing decisions. Received theories so far suggest that there is an optimal capital structure although what is the optimal capital structure of a firm remains unspecified to-date. Financing decisions are both debt and equity financing decisions of firms. Thus, the aim of this study address core practical issues that management faces to grow the firm by taking financing decisions that would not lead to loss of value for the firm. This issue is also of academic interest to sort out the mixed findings in the literature in support of the optimal capital structure idea and, most of all, also to identify the market dynamics on financing issue.

The research design is centred on the concept of relative capital structure by comparing a firm's debt-equity ratio to that of the industry median in each year over a 13-year period. Next, we proceed to identify the price impact by measuring the abnormal returns at the time of capita-structure-changing events, and the events are carefully identified by excluding confounding other events

[6]According to the Central Limit Theorem, the sampling distributions of means approach normal as the sample size increases and the sample size larger than 20 or 30 is sufficient for the normal distribution to provide an acceptable approximation and allow for inference about population parameters (Levin, 1987; Tabachnick and Fidell, 2001; Studenmund, 2001).

during the test windows. The findings indicate that the market reacts positively to announcements of financing events that lead to capital structure moving closer to their relative industry median debt-equity ratio. Firms changing debt-equity ratios away from the median (value decreasing events) leads to either less positive or negative abnormal returns. These are consistent with the idea of optimal capital structure, if relative capital structure is a proxy for optimal ratio. Thus, the market perceives the industry median as an appropriate capital structure benchmark in the Australian market.

Tests of changes in value as abnormal returns against the directional changes in the capital structure, i.e. moving closer to and moving away from the industry median, yielded a direct test of the optimal capital structure proposition using relative capital structure concept. These tests also affirm that the results are consistent with the prediction of the optimal capital structure. Market participants appear to use the information on changes in capital structure of firms at the time of announcements to react quickly by changing the value in the direction suggested by theory. Such market reactions have strong effect on firm value, particularly when firms adjust their capital structure between more than 5 per cent and 40 per cent.

The study found the effects of directional changes of capital structure on firm value against theoretical predictions. It demonstrates that more than half of the observations (61.5 per cent) have capital structure changes ranging between more than 5 per cent and 20 per cent. A possible reason for this behaviour is the fact that managers are generally risk averse, and are cautious about financial distress cost increases if there are rapid changes in capital structure. Alternatively, it could be that fund providers would not like sudden changes in the capital structure beyond a certain percentage of the existing size.

These findings are limited to the one market where this study is conducted. Further studies on more markets are encouraged so as to be able to generalise these findings to a wider literature.

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