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A review of research into corporate tax aggressiveness and leverage puzzle

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Abstract

This paper reviews previous research into the relationship between corporate tax aggressiveness and leverage and shows that the puzzle remains unsolved with mixed findings reported from prior literature. Four main propositions from previous studies to explain the association between tax avoidance and leverage are discussed in this paper, including the interest deductibility from debt tax shields, the non-debt tax shields and debt substitution effect, the debtholders' concerns about managerial rent extraction, and the uncertainty about future cash flows of tax aggressive firms. This review paper suggests four main issues that account for the inconsistent results in past empirical studies, including the causal or bi-directional relationship between tax aggressiveness and debt, the proxies for tax aggressiveness, the measures of firm leverage, and the endogeneity of corporate tax status. Suggestions are provided for future research into the tax aggressiveness and leverage puzzle with a view to reconcile the mixed findings in the existing literature.

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1. Introduction: The puzzle of corporate tax status and leverage

Researchers have for long raised questions surrounding the relationship between corporate taxes and debt levels in companies' capital structure. Literature in tax, accounting and finance fields in the last four decades have proposed different theories and performed various empirical tests on this relationship. Interestingly, since the early optimal capital structure theory put forward by Miller (1977) and DeAngelo and Masulis (1980) until now, academics across those fields have consistently reported mixed results on the association between firms' tax aggressiveness and their leverage. Myers (1984) states that "I know of no study clearly demonstrating that a firm's tax status has predictable, material effects on its debt policy". Nearly two decades after Myers (1984), Gordon and Lee (2001) in their study of taxes' impacts on corporate debt policy purport that "economists have had great difficulty providing evidence that taxes in fact affect debt/asset ratios". Since then academics in this area have provided certain significant results regarding the association between company tax status and firm's leverage (or cost of debt); however, the reported findings are mixed when it comes to the sign (i.e. positive or negative) and direction (i.e. causation) of this relationship. Indeed, while many studies find a positive relation between tax avoidance strategies and debt holdings by firms supporting the argument that companies employ high debt structure for tax planning purposes due to tax deductibility nature of interest expenses, a number of papers on the other hand report that corporate tax aggressiveness is negatively associated with leverage and also cost of debt and attribute this result to the non-debt tax shields utilised by tax sheltering firms instead of tax strategies favoured towards high interest deductions on borrowings.

On one hand, Graham (2000) observes an 'under-leverage puzzle' phenomenon where firms' leverage level is noticeably lower than expected when they are of large size and operate with good financial performance and liquidity. Graham and Tucker (2006) in an attempt to explain this 'under-leverage' question propose that tax shelters act as non-debt tax shields which substitute for the use of debt and interest deductions to companies. On the other hand, an 'under-sheltering puzzle' is observed by Weisbach (2002) who notes that some firms do not engage in tax sheltering as much as they could have done given the low expected costs associated with tax avoidance for those firms. Desai and Dharmapala (2006) put forward an explanation for this 'under-sheltering' phenomenon on the basis that company shareholders tend to have concerns about managers' rent diversion which might be concealed under opaque reporting for purposes of tax avoidance. It is highlighted here that there are still many questions not only about under-leverage but also about under-sheltering that require further examinations. From knowing this, it would be less surprising to realise that the interaction between company tax aggressive schemes and firm's leverage (or capital structure) remains a large puzzle. The corporate tax aggressiveness-leverage relationship is rather complicated when taking into account different sources of impacts on this relationship. Amongst these sources of impacts are tax deductibility of interest paid on debts (Miller 1977), non-debt tax shields (DeAngelo and Masulis 1980), agency costs (Crocker and Slemrod 2005), bankruptcy costs (Bartholdy & Mateus 2011), firm size (Stickney and Mcgee 1982), capital intensity, and research and development activities (Gupta and Newberry 1997). The empirical findings therefore have been inconclusive about the relationship between tax aggressive activities and cost of debt. This paper reviews these conflicting results and discusses the arguments and theories established in support of those results in previous literature.

This paper proceeds as follows. Section 2 documents studies that report either positive, negative or insignificant association between corporate tax aggressiveness and debt holdings. Section 3 reviews the rationale underlying these empirical results, prominently the tax deductibility of debt interest, the non-debt tax shield substitution effects and tax exhaustion theory, the debtholders' concerns about managerial rent extraction, and the uncertainty about corporation's future cash flows. In Section 4, issues in the empirical tests will be examined, including the perception of the causal relationship between tax aggressiveness and company leverage, the differences in proxies used in previous studies and the endogeneity concern in measuring corporate tax rates. Section 5 provides suggestions for potential research in this area in the future.

2. Reported relationship between corporate tax aggressiveness and leverage

2.a. Studies reporting positive association between tax aggressiveness and debt holdings

This section presents previous research that documents a positive relation between tax aggressive activities and debt levels in corporations. Firstly, Stickney and McGee (1982) in their research into the corporate effective tax rates (ETR) of the US firms use company data for three years, 1978, 1979 and 1980. Among other findings of the characteristics of tax aggressive firms, Stickney and McGee (1982) report corporations that have low ETR are likely to have high debt levels in their capital structure. One of the limitations of this paper, which is also recognised by the authors (Stickney and McGee 1982), is that the analysis does not take into the account the tax benefits from tax loss carry-forward provisions and other unused tax shields. It is possible that other non-debt tax shields could have impact on the reported association between tax avoidance and leverage. Besides, the cluster analysis employed in Stickney and McGee (1982) makes it difficult to interpret the magnitude of the impacts that the explanatory variables have on the dependent variable. In the same vein, Mills, Erickson and Maydew (1998) find evidence supporting the increase in debt use in tax aggressive firms reported by Stickney and McGee (1982). In their study of tax planning costs incurred by US corporations obtained from confidential survey data previously collected by Slemrod and Blumenthal (1996), Mills et al (1998) not only document a negative association between ETR and tax planning costs, consistent with the argument that resources invested in tax strategies bringing the benefit of reduced ETR, but also provide evidence of a negative relation between ETR and leverage. This results from Mills et al (1998) demonstrate that leverage is significantly and positively associated with tax aggressiveness.

Furthermore, Dyreng, Hanlon and Maydew (2008) conduct a study of long-run tax avoidance for a sample of 2,077 US firms in the period 1995-2004 and report that their sample's group of long-run tax avoiders (i.e. paying low taxes) on average employs more debts than the group of tax-compliant firms (i.e. paying high taxes). The credit of this research lies in its ability to capture successful tax avoidance firms in the long run with 26% of the companies in the sample having their cash ETR kept below 20% for the five-year period and 9% of the sample firms' cash ETRs below 10%, compared to the mean tax rate of 30% for the sample. This suggests that the result of the positive association between debt holdings and tax avoidance here reflects the debt structure of those firms that are committed in long-term sheltering strategies rather than firms that have ETRs decreased in one year for some special (and likely legitimate) reasons. Similarly, Seidman (2010) studying the difference in

book income and taxable income (hereon book-tax difference (BTD)) reported by US corporations between 1993 and 2004 produces regression results showing that BTD is positively related to cost of debt and contends that the paper's result is consistent with the discussion on off-balance sheet financing by Mills and Newberry (2005). In this paper, Seidman (2010) notes that the BTD measure used may only be considered a good proxy for company tax avoidance once the impacts of GAAP changes have been controlled for. Thus, the positive relation between tax aggressive status and leverage in Seid (2010) is not as strong evidence as that provided in Dyreng et al (2008).

Another US study is conducted for a longer time period, 25 years from 1982 to 2006, by Dhaliwal, Lee and Pincus (2009) and finds that BTD is positively associated with cost of capital. In this study, BTD is reported to increase in the same direction as tax aggressiveness level, indicating that tax aggressiveness has a positive relation with cost of capital. However, care should also be taken with regards to the representativeness of BTD for tax avoidance because Dhaliwal et al (2009) also document a positive relation between cost of capital and the 'earnings quality measure' measured as the standard deviation of the residuals that is not predicted by either firm characteristic or firm's tax avoidance in the BTD model. It requires further work from this finding to arrive at a conclusion about the relationship between tax sheltering and leverage levels. Also studying US companies for a 25-year period (from 1985 to 2009), Hasan et al (2014) directly test the relationship between tax avoidance by corporations and cost of debt. More specifically, Hasan et al (2014) choose to focus on only one element, but a significant element, of the firm's debt structure – loans from banks to businesses. In this study, Hasan et al (2014) produce evidence supporting the positive relation between tax sheltering and cost of bank loans. In their robustness checks, this result remains significant when tested in two quasi-experimental designs. In the first scenario, the authors account for the tax reserve figures obtained from US companies' disclosure as required by the 'Financial Accounting Standards Board Interpretation No. 48' in the US (Hasan et al 2014). In the second quasi-experimental design, Hasan et al (2014) also find that corporate tax aggressiveness has a positive effect on cost of borrowings from banks after accounting for the impacts after the public becomes aware of a firm's involvement in tax avoidance schemes. Furthermore, not only higher spreads of bank loans, higher spreads incurred in issuing public bonds, as well as stricter collateral and covenant terms imposed on bank loans, are also reported in tax aggressive companies (Halan et al 2014). It is here noted that the study by Hasan et al (2014) has focused on only bank loans and public bonds; these two sources do not fully represent the financial liabilities of companies. Moreover, Welch (2011) points out empirical studies of leverage and capital structure should concern not only the financial liabilities but also the non-financial liabilities, which could affect the overall implication about cost of debt for businesses.

In addition, Shevlin, Urcan and Vasvari (2013) examine the effects of tax aggressiveness on cost of debt from the perspective of debtholders whose only source of assessing their lending decisions is from the publicly available information. Using a sample of 6,905 company bonds issued in the US between 1990 and 2007, which cover 962 firms in total, Shevlin et al (2013) find that firms' tax avoidance activities are significantly positively associated with corporate bond yields. Further tests performed by the researchers (Shevlin et al 2013) show that the uncertainty of future cash flows is the main mechanism through which tax aggressiveness increases the bond offering rates, evidenced by the ability of the future cash flow uncertainty to explain roughly one third of the total effects that tax avoidance imposes on companies' bond yields. Interestingly, although there is no private information made available to public bondholders, information quality is found to not play a

significant role in the positive association between tax sheltering and bond yields (Shevlin et al 2013).

Moving outside the US setting, some Australian empirical works produce results supporting the positive tax aggressiveness-leverage relationship. Richardson, Taylor and Lanis (2015) perform a study of 203 companies listed on the Australian Stock Exchange and document a significant positive impact of leverage on tax aggressiveness in their regression results. The main finding in this paper shows that tax avoidance is found to be positively associated with businesses' financial distress (Richardson et al 2015). A possible explanation of this result, taking into account the higher leverage characteristic of tax aggressive firms, is that the high debt levels employed by firms have induced financial distress for tax sheltering firms. The authors (Richardson et al 2015) note that one of the limitations of their researching is the possibility of omitted variables in the regression model and suggest the potential to incorporate the impacts of tax authorities in the tax avoidance model in future studies. A few other Australian studies have also shown that tax aggressiveness is positively related to debt levels although the capital structure is not the overarching aim of these studies. Amongst those papers is Richardson and Lanis (2007) who research into the determinants of variability in effective tax rates (ETR) of Australian firms in the context of the Ralph Review tax reform in 1999 in Australia. Authors find that leverage is negatively associated with effective tax rates, i.e. leverage increases with the level of tax aggressive planning by firms (Richardson and Lanis 2007). In addition, the authors contend that following the Ralph tax reform, the ETRs are increased for highly leveraged Australian firms and argue that the reason of such increase in ETRs is due to the reduction in tax benefits from interest payments on debts.

Analogously, in a later study of corporate social responsibility and tax avoidance in the Australian setting, Richardson and Lanis (2012) also obtain a result of a negative and significant relation between leverage level and effective tax rates, i.e. companies that pay less tax have higher level of debts on their balance sheet. This finding once again gives support to the positive tax-debt relationship. In another paper by Richardson, Taylor and Lanis (2013), the researchers include leverage as one of the control variables and report that leverage is actually positively related to their tax aggressiveness measure for Australian businesses. It is interesting to note that out of the 30 firms identified as having tax disputes with the Australian Taxation Office (ATO), utilising 'deductibility of interest expenses' is the second most common type of tax strategies, only after schemes involving 'corporate restructuring' (Richardson et al 2013). Furthermore, an empirical study by Taylor and Richardson (2014) which examines the incentives for Australian corporations to engage tax planning schemes from a sample of 200 publicly listed Australian firms for the period 2006-2010. The research by Taylor and Richardson (2014) yields regression results showing the positive effects of leverage on tax avoidance activities. Nonetheless, similar to the US literature, Australian studies documented here are not without conflict with regards to the relationship between corporate tax aggressiveness and debt holdings. The studies that produce regression coefficients to reject the positive tax aggressiveness-leverage association are reported in the following Sections 2.b. and 2.c. of this review.

2.b. Studies reporting negative association between tax aggressiveness and debt holdings

Section 2.b. reviews previous studies that find tax aggressiveness is negatively associated with debt levels or with cost of debt, as opposed to the positive relationship discussed in Section 2.a. In a study of the relationship between debt and corporate marginal tax rate, Graham (1996) performs regression analysis on 10,000 US companies for a 13-year period, from 1980 to 1992, and simulates those firm's marginal tax rates (MTR) which take into consideration net operating losses, investment tax credits and alternative minimum tax. The research by Graham's (1996) finds evidence that firms with lower tax rate use less debt in their capital structure compared to firms having higher tax rate. Since companies that have marginal tax rate lower than the statutory rate are often considered as successful tax planners, the finding in Graham (1996) suggests that tax aggressiveness is negatively associated with firm leverage. Graham (1996) argues that although net operating losses can reasonably be used as a proxy for corporate tax status, simulating tax rates appears to provide a more refined proxy. Nonetheless, due to the low R-squared of the regression in Graham (1996), the paper does not seem to be able to explain a larger portion of leverage decisions by corporations. Looking at the same time period, Graham, Lemmon and Schallheim (1998) study debt and leases used by US corporations during 1981 and 1992 and report that low tax rate firms have lower debt levels, supporting the negative relation between tax avoidance and debt. At the same time, Graham et al (1998) find an increase in use of operating leases in companies with lower MTR but find no clear evidence of the association between capital leases and MTR. The authors argue that the negative relation between operating leases and MTR is due to the tax treatments of operating leases which allow low tax rate lessees to sell tax shields to high tax rate lessors in exchange of lower lease payments to the lessors (Graham et al 1998). Also according to Graham et al (1998), no clear evidence was obtained for capital leases because they represent "a mixture of true leases and non-true leases". Thus, apart from contributing an evidence of the negative relationship between tax aggressiveness and debt, the study by Graham et al (1998) also demonstrates the different properties between debt and leases in respect of their impacts on corporate taxes.

In another US study, Gordon and Lee (2001) document similar result from their empirical tests on US companies in a much longer period compared to Graham (1996) and Graham et al (1998). Gordon and Lee (2001) examine the US tax return data obtained for 37 years in between 1954 and 1995 (1962 and 1966-1969 years are excluded). The dataset of US tax return information consists of firms of different sizes, including small private companies. Results from Gordon and Lee (2001) show that there is a negative relation between debt financing and tax planning opportunities for companies, evidenced by a decrease of 3.5% in assets financed with debt when company income tax rate is reduced by 10% while holding personal tax rates fixed. Besides, Gordon and Lee (2001) also demonstrate that short-term borrowings are more responsive to tax incentives as opposed to long-term borrowings; more specifically, the impact that company tax has on the elasticity of short-term debt is found to be approximately triple of that effect for long-term debt. The authors here recognise that tax consequences are not the only issue considered by companies when changing their capital structure in response to potential tax benefits and argue that non-tax implications also play an important role in leverage decisions of corporations. It is contended in Gordon and Lee (2001) that an increase in debt holdings may induce higher bankruptcy risks and create agency problems as debt holders and equity holders often have conflicting interests.

Furthermore, in the same research line, Graham and Mills (2008) study the differences between the simulated MTR based on financial statement information and the simulated MTR from the US tax return information using a sample of firms from 1998 to 2000. Not only yielding a result that simulated book MTR performs better relative to the simulated MTR from tax returns with regards to explaining the firms' debt ratios, Graham and Mills (2008) also document a positive association between the simulated MTR and companies' debt ratios, supporting the notion that companies achieving low tax rates tend to use less debt. This notion triggers the long-standing debates regarding the tax aggressiveness-leverage puzzle.

In an attempt to explain the under-leverage puzzle in tax aggressive firms (Graham 2000), Graham and Tucker (2006) examine 44 large corporate tax shelter cases under actual litigation in the US and include in their sample of study those 44 shelter cases and matched firms of the same industries and similar asset sizes. This provides their research an advantage of ascertaining tax aggressive companies compared to other studies in tax aggressiveness that use different forms of proxy for tax aggressiveness measures, such as effective tax rates or book-tax difference. However, the authors also confirm the limitation of their study in using such sample lies in making inferences from a relatively small sample. This research (Graham and Tucker 2006) find a reduction of 8% in debt ratios in their sample of tax avoidance firms and also suggest that firms that use tax aggressive planning as 'non-debt tax shield' have lower debt levels compared to tax-compliant firms, consistent with the debt substitution effect documented in Mackie-Mason (1990). The debt substitution effect is discussed in more detail in Section 3.b of this review paper. Consistent with this finding, Wilson (2009) reports a negative association between debt holdings and tax aggressiveness for a sample of firms drawn from the data collected by Graham and Tucker (2006) and additional tax avoidance cases discovered from press articles from 1975 to 2000. Similar to Graham and Tucker (2006), because Wilson (2009) performs the tests on a set of tax shelter firms successfully identified, the generalisation power of the results here is not strong when there are several corporations whose tax avoidance schemes are not detected by the tax authorities.

In addition, in a study of Korean companies listed on the Korean Stock Exchange for the period from 1994 to 2003, Lim (2011) investigates the relation between tax avoidance and cost of debt and expands the examination to include the effects of shareholder activism on this relationship. Computing the tax avoidance measure from book-tax difference, Lim (2011) finds a negative relationship between this measure, being representative of the tax avoidance variable, and company's cost of debt. Taking a step further, Lim (2011) performs analysis involving the cut-off point of the 1997 year in respect of the Asian economic crisis to allow for examination of the post-crisis period in Korea when institutional shareholders' rights were supported by their government via reforms. The results indicate that tax aggressiveness is more significantly associated with cost of debt in corporations with higher institutional ownership level, and that this negative relationship becomes even more remarkable after 1998 as a result of the Korean corporate governance reforms allowing more powers exercisable by institutional investors. Hasan et al (2014) who find the opposite result for US companies (discussed in Section 2.a) argue that the negative relation between tax avoidance and cost of debt found in Lim (2011) is because tax aggressive entities rely more heavily on loans than bonds. However, there is not enough evidence for this argument to be persuasive, also providing that Lim (2011) studies Korean companies while Hasan et al (2014) only look at US firms.

Moreover, another evidence in support of the results found in Graham and Tucker (2006) is found by Lim (2012) in his study of Korean listed firms in a seven-year period (2000-2006). Debt-substitution effect is shown to increase with probability of losing tax shields and tax-exhaustion effect interacts with debt-substitution effect (Lim 2012). The author proposes that tax aggressive activities could offer a partial explanation for underleverage puzzle. The setting of this paper is interesting in that there was voluntary reduction in leverage after changes in government laws and ETR in Korea decreased from 20.3% in 2000 to 14.6% in 2005. Lim's (2012) paper has complemented and generalised the finding in Graham and Tucker (2006) and Wilson (2009) by employing a larger sample for the regression analysis; however, the complement from Lim (2012) should also be considered when coupling with the fact that the Korean setting may have certain differences relative to the US setting.

After Lim (2012), a study by Lin, Tong and Tucker (2014) has offered to resolve the concern in respect of the country differences (specifically between US and Korea) by examining the US firms for the period from 2006 to 2011. Lin et al (2014) extends the results in Graham and Tucker (2006) by reporting the inverse association between tax avoidance and debt levels. Lin et al (2014) in documenting the complementary characteristic between corporate tax aggressiveness and debt use provide justification for leverage choice as a result of tax aggressive planning but not the opposite direction. Also the authors argue that changes in debt structure are likely to be more costly than tax avoidance strategy (Lin et al 2014). If this argument is true, it is more probable that tax aggressiveness causes impacts on leverage and cost of debt, rather than firms changing their leverage policy to serve for tax planning purposes. However, this is not necessarily true and there is an anecdote that firms can intentionally organise their debt holdings in a manner that assists the overall tax aggressive strategy of the companies, especially when tax planning involves international tax schemes and thin capitalisation. Besides, Lin et al (2014) highlights the interesting 'sticky debt puzzle' where rigidity is observed in companies that remain their capital structures over a long period of time even when profit position and tax planning opportunities have already changed.

In another non-US study, Bartholdy and Mateus (2011) use Portugal as a setting for their study of the tax aggressiveness-leverage association in private firms and attribute the choice of Portugal, among 'the least developed countries in the OECD', to the fact that Portuguese companies use predominantly bank financing and Portugal has a relatively small financial market. Bartholdy and Mateus (2011) employ a sample of 998 Portuguese private firms in the period of 1990-2000 and only include in their sample manufacturing corporations that have more than 100 staff in order to minimise the bias from firms in which the collateral used for loans are also the owner's personal assets. This study shows that company tax has a positive impact on the debt structure for private firms, i.e. company tax aggressiveness increases as debt level becomes lower. Bartholdy and Mateus (2011) explain that it is cheaper for small private firms to finance their debts through banks as opposed to accessing funds from the financial market due to asymmetric information disadvantage to small entities. This explanation highlights the need to control for firm size when examining the relation between tax planning activities and leverage structure. At the same time, because the focus of this paper is on small private firms, the findings here may not be generalised to publicly listed companies. In addition to that, due to the special features of Portugal as mentioned, the negative tax aggressiveness-leverage association documented by Bartholdy and Mateus (2011) should be assessed carefully before relating to other developed economies. Besides, Bartholdy and Mateus (2011) suggest that the crucial factor in determining debt levels apart from consequences of taxes is

the availability of collateral, and this suggestion can be considered by future studies when modelling taxes and debt structure.

Furthermore, recognising the difficulties encountered in measuring precisely the tax benefit of debts to companies, Barclay, Heitzman and Smith (2013) research into the tax aggressiveness-leverage relationship observed in the real estate industry where the authors argue that tax benefit of debts could be computed with less error. Barclay et al (2013) attribute this advantage in measuring debt benefits to the fact that the US industry contains both taxable and non-taxable entities. The former pay corporate-level tax and the latter, consisting of entities in the form of real estate investment trust or partnership, pay zero tax. Results by Barclay et al (2013) show a corresponding increase of 4.7% in debt ratio when marginal tax rate of an entity changes from 0% (non-taxable) to 35% (taxable). On that basis, the authors conclude that non-taxable real estate firms in the US use less debt than the taxable real estate firms. A naive interpretation of this result will be that there exists a negative association between tax aggressiveness and debt levels if non-tax organisation form is considered as a strategy to avoid paying taxes. There are two limitations in this study. Firstly, the results are produced from firms in the real estate industry only and are therefore difficult to be generalised to other industries. Secondly, the research by Barclay et al (2013) essentially examines the debt structure of two different types of organisations. For that reason, the findings are hard to be interpreted as a change from a non-taxable entity (with 0% tax rate) to an organisational type that is taxable (at 35% in this case) is different from a change in tax rate level (e.g. from 30% to 35%).

In an Australian setting, Richardson, Lanis and Leung (2014) examine Australian listed firms from 2001 to 2010 and draw a conclusion that tax avoidance is inversely related to leverage, consistent with the debt substitution effect discussed in Graham and Tucker (2006). An extension from previous literature by Richardson et al (2014) is that their research suggests that outside directors magnify the debt substitution effect after finding a substitutive correlation between debt and the proportion of outside directors included in the board. This result is in contrast with the positive association between tax avoidance and leverage for Australian corporations reported in other tax aggressiveness studies (Richardson and Lanis 2012; Richardson et al 2013; Taylor and Richardson 2014). The conflicting results here are worth highlighting when these studies are carried out in the same Australian context and for similar time periods. This further emphasises the tax aggressiveness-leverage puzzle where mixed findings have been documented in respect of the relationship between tax aggressive activities and leverage levels of cost of debt.

When quantitative research yields conflicting results, one of the methods to seek a 'consensus' from the mixed findings reported in past literature is using meta-analysis. According to Stanley (2001), meta-regression analysis is an approach used in economic, social and medical sciences to synthesise results from previous literature and "can help to explain the wide study-to-study variation found among research findings and offer specific reasons, based on the studies themselves, why the evidence on a certain question may appear contradictory or overly varied". With regards to past empirical studies of debt structure and corporate taxation, Feld, Heckemeyer and Overesch (2013) conduct a meta-analysis study that synthesises findings from 48 previous studies over 25 years. From the meta-regression performed, Feld et al (2013) report marginal tax rates are negatively associated with debt ratio and suggest that a reduction in a company's marginal tax rate lowers the debt level adopted for the firm's capital structure. The authors put forward an argument that the outcomes of previous research depend on the measure of corporate tax status used and propose

that using the simulated MTR measure from Graham (1996) can tackle the issue of downward bias encountered in estimating effects of tax strategies on debt structure (Feld et al 2013). Additionally, from their meta-analysis, the authors caution that debt financing of multinational companies is also affected by the tax incentives brought about by profit shifting activities that occur in the international business environment. However, the mega-analysis study by Feld et al (2013) seems to assume that taxes cause changes in debt structure of a company. However, whether or not the tax aggressiveness-leverage association is a causal relationship is still a question to be addressed.

The literature review in this section demonstrates that previous research on one hand reports a positive relation between tax avoidance and debt holdings, and on the other hand finds that tax aggressive activities are inversely related to leverage levels as well as cost of debt. Moreover, some other papers in this same line of research have presented mixed or insignificant findings, adding to the puzzle observed for the tax aggressiveness-leverage relationship.

2.c. Studies reporting mixed or insignificant findings

Section 2.c. of this paper discusses previous studies that come up with a conclusion of mixed or insignificant findings in respect of the association between tax avoidance and firms' leverage. Firstly, Gupta and Newberry (1997) document mixed results for this association in their studies of companies' ETRs using longitudinal data for the two periods, 1982-1985 and 1987-1990, which leave out the 1986 year when the Tax Reform Act 1986 (TRA86) in the US took effect. For the first ETR measure which is calculated by dividing the income tax expense by the book income before interest and tax, Gupta and Newberry (1997) find that ETR is negatively and significantly related to debt ratio for both periods, namely pre-TRA86 and post-TRA86. In contrast to this, the results for the second ETR measure, which is the ratio of income tax expense to operating cash flows before interest and tax, show the relation between debt ratio and ETR is positive and significant for the pre-TRA86 period, but positive and insignificant for the post-TRA86 period (Gupta and Newberry 1997). In discussing this ambiguous finding, the authors suggest that the relationship between capital structure and firm's ETR is sensitive to the denominator used in computation of ETR measure (Gupta and Newberry 1997) and that their model of ETRs might be incomplete and may have potential biases from omitted variables. Thus, the sign of this relationship is quite inconclusive from this study.

Next, in a study of US companies for the 1994-2004 period, Ayers, Laplante and McGuire (2010) examine firms' credit risk and how it is assessed by credit analysts using book-tax difference (BTD) information. This research shows that both large positive and negative changes in BTD have negative impact on changes in companies' credit ratings and that such impact indicates a reduction in earnings quality (Ayers et al 2010). Since BTD can be a measure for not only earnings quality but also tax aggressiveness level of a company, the inverse association between changes in BTD and changes in credit ratings may be insufficient to draw conclusion about the relation between tax sheltering and leverage. However, further tests in Ayers et al (2010) shed light on how to interpret this result. Specifically, Ayers et al (2010) find that for 'non-tax planners', large movements in BTD, irrespective of their sign, necessarily result in less favourable rating changes, which also mean higher cost of debt. On the contrary, for 'high-tax planning firms', the authors do not find any significant association between BTD changes and credit rating changes and on that basis suggest that the association between BTD and credit risk is attenuated via tax planning activities. Nonetheless, it

should be noted that in this paper the finding of no significant relationship between changes in BTB and credit rating changes depends on the definition of 'high-tax planning' firms. Ayers et al (2010) adopt two measures to identify high tax planners, the cumulative current ETR and the cumulative cash ETR, both of which are computed over a five-year period in accordance with the approach used by Dyreng et (2008).

Besides Ayers et al (2010), Nejadmalayeri and Singh (2012) analyse corporate bonds issued by US companies from 1994 to 2006 and reports that companies with higher tax rates are likely to have smaller credit spreads, which essentially lead to lower cost of bond issues. However, the findings here need to be interpreted with care because the results in this paper also suggest that cost of debt is related to tax planning opportunities and that the sign of this relationship depends on what type of tax rate reduction strategies being employed by firms. Nejadmalayeri and Singh (2012) show evidence that credit spreads, which represent for cost of corporate bonds, decrease when the amount of tax loss carried forward grows larger; in contrast, wider credit spreads (i.e. higher cost of borrowings) are observed when depreciation tax shields increase. Additionally, the authors purport that large unutilised tax shields may give shareholders an incentive to continue to make loan payments and prevent the company from going bankrupt in order that the firm can access the unutilised tax benefits in the future. According to Nejadmalayeri and Singh (2012), "at higher tax rates, equity holders would have a greater incentive to avoid defaulting on short-term debt to preserve larger tax shields". Although this argument is understandable, there are many more important issues in respect of bankruptcy decision that the managers ought to consider. It is most likely that tax shields concern the equity holders at a much lesser degree than other operating considerations when it comes to deciding on the existence of an organisation.

Apart from the US, a study of international corporate tax avoidance practices by Taylor and Richardson (2012) using company data in Australia displays insignificant results for most of the tax aggressiveness measures employed in their research. Taylor and Richardson (2012) look at Australian publicly listed firms over four years, from 2006 to 2009 and their regression results show the ratio of long-term debt over total assets is positively related to four proxies of tax avoidance, but the associations are insignificant for three out of the four proxies used. Specifically, only the relation between debt holdings and raw BTB scaled by lagged total assets is found to be significant, whereas no significant results are obtained for the relations between leverage and the other three proxies, including two measures of long-run ETRs and the BTB residual calculated using the method developed in Desai and Dharmapala (2006). The insignificant result reported by Taylor and Richardson (2012) is intriguing when the paper concludes that thin capitalisation is one of the two main drivers of tax aggressiveness (the other one being transfer pricing). If firms utilise tax havens in combination with thin capitalisation to obtain significant tax liability reductions, it is expected that those firms would have higher debt levels. Using this argument, the expected result would be that leverage has a significantly positive association with tax avoidance. However, the insignificant coefficients of leverage documented for three out of the four tax avoidance measures in Taylor and Richardson (2012) seem rather inconclusive about this.

The discussion in this section together with Sections 2.a. and 2.b. clearly highlights the tax aggressiveness-leverage puzzle in past literature where mixed findings are documented for the direction of the relationship between tax aggressiveness and leverage (or cost of debt). In the

following section, the underlying reasons and explanations used in reporting the puzzle of tax aggressiveness and leverage are discussed in more detail.

3. Rationale underlying relationships between tax aggressiveness and leverage

Previous researchers in carrying out their empirical research also propose different theories to establish the rationale of their results of the relationship between tax aggressive activities and debt levels, or cost of debt. This section reviews the four prominent reasons supporting the association, either negative or positive, between tax sheltering and leverage. The first two propositions are the tax benefits from interest deductions and the non-debt tax shields, which are conflicting arguments frequently referred to in tax aggressiveness studies examining firms' leverage. The third and fourth propositions are, respectively, the debtholders' concerns of rent extraction by managers and the uncertainty about future cash flows. These two propositions are recently stated and put forward by Shevlin, Urcan and Vasvari (2013), although the underlying arguments have appeared in the tax aggressiveness literature prior to that.

3.a. Debt tax shield and utilising of interest deductions

First of all, one long-standing proposition that has been frequently referred to by academics in interpreting the relationship between tax aggressiveness and leverage is the debt tax shield and the deductibility of interest payments on debt. Stickney and McGee (1982) who document a positive relation between tax aggressiveness and debt holdings discuss a finding by Tambini (1969), which shows that the average after-tax cost of debt capital is around half of the average cost of equity capital. Stickney and McGee (1982) argue that the difference between cost of debt and cost of equity is the result of the tax treatment of returns to debt holders and equity holders. In particular, return to debt holders in the form of interest on debt is deductible to company for tax purposes and hence reduces the net profit upon which tax is calculated using the corporate statutory tax rate. On the contrary, return to shareholders in the form of dividend is generally not a tax deduction in calculating the firm's taxable net profit. Thus, use of debt brings tax benefit to the company due to the deductibility nature of interest payments. For this reason, researchers who find that tax avoidance activities are positively related to leverage or cost of debt often attribute this result to the debt tax shield and propose that corporations may engage in tax aggressive schemes surrounding firms' leverage in order to make the most use of the debt structure. For instance, Lanis and Richardson (2012) argue that "highly leveraged corporations are expected to use tax-deductible interest payments to promote tax aggressiveness in the corporation". In a study of thinly capitalised tax avoidance in Australia, Taylor and Richardson (2013) also advocate the debt tax shield and the interest deductions that it carries as a rationale for the positive association between tax avoidance activities and leverage.

The problem embedded in this argument is that it is against the trade-off theory of capital structure, which suggests that firms with high marginal tax rates should use more debt than firms with low marginal tax rates because benefit of interest deductions is greater for high tax rate firms (Graham and Mills 2008). The trade-off theory here implies that tax sheltering, which can effectively be

represented by low marginal tax rates, is negatively related to debt financing, as opposed to the positive association between tax aggressiveness and leverage predicted by the debt tax shield proposition. Graham and Mills (2008) put forward their argument as a reason for the negative relation between tax avoidance and debt holdings found in their research; their result is reported as simulated marginal tax rates being positively associated with debt ratios. The question here is what if we take a further step to look at what happens after firms decide to employ more debts due to the interest tax shields given their high marginal tax rates? The result would most likely be that the average tax rates (also ETRs) will be reduced. The larger the interest deduction becomes, the more the ETR is decreased, resulting in a reduction in marginal tax rates, i.e. the tax benefit of interest deduction also reduces. Therefore, there may exist an optimal point where the tax benefit from interest deduction is not sufficient for a firm to increase its leverage, given the potential bankruptcy cost that moves in the same direction with debt levels.

Furthermore, an interesting point discussed in Hasan et al (2014) is that tax aggressive activities can result in higher cost of bank loans, which may in turn reduce the incentive for companies to employ tax sheltering techniques. Nonetheless, previous research (Stickney and McGee 1982; Lanis and Richardson 2012; Taylor and Richardson 2014) would at this point argue that an increase in cost of debt means there is an incentive to further engage in tax aggressiveness by utilising any tax structure that can take advantage of the tax deductibility of interest paid. It is observed here that although Hasan et al (2014) have rigorously documented the impacts of tax avoidance on corporations' cost of bank loans, the questions about the opposite direction of this association (i.e. whether debt structure impacts on tax sheltering) remain unsolved.

3.b. Non-debt tax shields: debt substitution & tax exhaustion effects

Besides research papers that report the positive relation between tax aggressiveness and debt holdings, a number of other studies show an opposite result in which tax avoidance is found to be negatively associated with leverage; hence the tax aggressiveness-leverage puzzle. While the debt tax shield and interest deductibility argument supports the positive relationship of the two variables, another proposition, 'non-debt tax shields', is put forward as rationale to back the findings of a negative association. Revisiting the research study by DeAngelo and Masulis (1980), we can see that the authors, back to 35 years ago, propose that investment-related tax shields and probability of losing deductibility of debt tax shields are positively related, resulting in firms with high investment-related tax shields use less debt in their capital structure. According to DeAngelo and Masulis (1980), the 'non-debt tax shields' (NDTS) serve as substitutes for tax deductions from debt interest, and every firm has an optimal amount of total tax deductions. In studying the 'debt substitution effect' put forward by DeAngelo and Masulis (1980), a later research by Mackie-Mason (1990) shows that this substitution effect is more applicable to companies that are more likely to lose the tax benefits from interest deductions. The effect discussed in Mackie-Mason (1990) is referred to as 'tax exhaustion effect'.

Strong support for both of the debt substitution effect (DeAngelo and Masulis 1980) and the tax exhaustion effect (Mackie-Mason 1990) can be found in Dhaliwal, Trezevant and Wang (1992). In a further note, Dhaliwal et al (1992) also demonstrate that the tax shield substitution effect could be

dominated by the 'debt securability effect', which suggests that a firm's debt level is positively related to its fixed assets which can be used as collaterals for borrowings (Scott 1977). Trezevant (1992), who examines the debt substitution effect in a setting where there is a significant tax law change introduced by the Economic Recovery Tax Act (ERTA) in the US in 1981, provides support for the debt substitution and tax exhaustion effects after controlling for the debt securability impacts. Pertaining to Dhaliwal et al (1992) and Trezevant (1992), the reason for the negative relationship between tax avoidance and leverage (such as Graham and Tucker 2006; Lim 2011; Lin et al 2014) could be because the companies engaging in tax sheltering activities utilise the available NDTs which act as substitutes for the debt interest tax shields. The debt substitution effect predicts those corporations will reduce remarkably their leverage once the sufficiency of the NDTs can satisfy their demand for tax savings from aggressive activities.

Schallheim and Wells (2006) propose three reasons why companies may prefer NDTs to debt. Firstly, interest payments required for servicing debt make it more costly to engage in aggressive tax planning around debt rather than tax strategies using other forms of NDTs. For that reason, Schallheim and Wells (2006) purport that the return per dollar of investment in tax shields sourcing from debt is much smaller than the return from NDTs. Secondly, debt often comes with covenants that can cause high transaction costs, making companies lean towards uses of NDTs in place of debt tax shields. Thirdly, NDTs often involve exploitation of accounting rules which allow firms to lower taxes without changing the accounting profit figures. Apart from those three reasons detailed in Schallheim and Wells (2006), there are other costs associated with utilising debt structure as a tax aggressive strategy and those costs are real and significant. Bankruptcy risk is most likely to increase as debt level goes up. Additionally, highly leveraged structure is often not viewed favourably by debtholders, who may consequently demand for higher yields on their lending to compensate for the additional risks. Graham's (1996) study shows that a company will use less debt financing if it has sufficient amount of NDTs compared to an identical firm without NDTs. Once again, the tax exhaustion effect is supported by Graham (1996), who contends that firms experiencing tax exhaustion tend to avoid issuing debt because the interest deductions from debt is 'crowded out' by NDTs.

However, it is possible that different forms of NDTs may have different impacts on leverage. Nejadmalayeri and Singh (2012) report that firms with higher depreciation expenses, which is a form of NDTs, are likely to have higher cost of issuing bonds because such depreciation expenses limit tax benefits from loss carry-forwards and consequently increase cost of debt. This finding in Nejadmalayeri and Singh (2012) suggests loss carry-forwards and depreciation expenses have opposite effects on cost of debt: the former is negatively associated with credit spreads (i.e. consistent with debt substitution effect in DeAngelo and Masulis (1980)), while the latter is positively associated with cost of borrowings. The finding of a positive relation between depreciation expenses and cost of debt is difficult to interpret and appears to be in contrast with the substitution effect of NDTs, which may also exist in the form of depreciation expenses, in accordance with DeAngelo and Masulis (1980) and Dhaliwal et al (1992). In explaining the results of their research, Nejadmalayeri and Singh (2012) argue that the properties of depreciation expenses and tax-loss carry-forwards are different and that any "tax shields that reduce the efficacy of loss carry provisions should increase the cost of debt".

Moreover, the magnitude of the debt substitution effect may vary depending on the types of tax sheltering strategies being employed by the firms, according to Lin et al (2014). In particular, Lin et al (2014) show that debt use is more weakly associated with benign tax aggressive schemes and argue that tax avoidance strategies must be powerful and beneficial enough in order for a firm to justify the costs of adjusting their capital structure for tax planning purposes. Lin et al (2014) purport that the substitution effect is evident in companies that are more heavily involved in tax sheltering, but this effect is reduced in more benign forms of tax aggressiveness and during financial crisis time.

Therefore, although previous research that documents a negative relationship between tax aggressiveness and leverage often attributes this result to the NDTs and debt substitution effect (Graham and Tucker 2006; Lim 2011; Richardson et al 2014), there are still questions surrounding this proposition. Firstly, we are still unsure about whether the substitution effect varies for different forms of NDTs (Nejadmalayeri and Singh 2012). Secondly, more research is required to examine whether different types and degrees of tax avoidance strategies result in different magnitude of debt substitution effect as proposed by Lin et al (2014).

3.c. Debtholders' concerns about managerial rent extraction

Shevlin et al (2013) in their study of corporate bonds issued by US firms report that corporate tax avoidance is found to be positively associated with bond yields. One of the reasons Shevlin et al (2013) use to explain this result is related to the possibility of wealth expropriation by managers. Shevlin et al (2013) propose that debtholders have concerns about potential rent extraction activities by managers since those activities can be performed via obfuscated reporting for purposes of concealing tax sheltering from the tax authorities (Desai and Dharmapala 2006). In respect of these concerns, the authors suggest that debtholders view large blockholders negatively because they do not only have incentive to expropriate resources and tax aggressive activities but are also capable of making it happen (Shevlin et al 2013). The debtholders' concerns about managers' rent extraction lead to demand by debtholders for higher return from lending to corporations that engage in tax avoidance.

The argument of the debtholders' concerns is developed from Desai and Dharmapala's (2006) contention that managers may employ opaque financial reporting to facilitate the tax aggressive activities of the firm. In addition, Desai, Dyck and Zingales (2007) suggest that the design of the corporate tax system has certain impacts on the private rent diversion carried out by the company's managers and reduction of such diversion activity is the common goal shared between the tax authorities and outside shareholders. However, managerial rent diversion is argued to also be a significant concern to debtholders, and especially to holders of public debts who only have access to publicly available information as opposed to banks or credit rating agencies who may obtain privileged information (Shevlin et al 2013). This concern is real because it has been documented that aggressive tax reporting is accompanied with aggressiveness in financial (book) reporting (Frank, Lynch and Rego 2009). The concern of debtholders about manager's rent extraction becomes more pronounced in firms heavily involved in tax sheltering schemes.

Therefore, besides the proposition of interest deductibility from debt tax shields discussed in Section 3.a., managerial rent diverting activities provide another rationale to support the positive

relationship between tax aggressiveness and cost of debt. However, this argument has not taken into account the benefits from tax avoidance activities which can be viewed favourably by debtholders. It is possible that lenders evaluate tax aggressive schemes as projects that effectively reduce tax liabilities and consequently increase cash flows and net profit position. Such favourable view by debtholders may counter their concerns about potential resource expropriation by managers. For that reason, it is possible that the result of increased cost of debt for tax avoiders documented in Shevlin et al (2013) reflects that the debtholders' concerns about managerial rent extraction is stronger than their favourable view of cash savings from tax aggressiveness, rather than merely reflecting the additional risk from managers' rent diversion which induce an increase in cost of borrowings.

3.d. Uncertainty about future cash flows

Besides the argument of debtholders' concerns about managerial resource expropriation, Shevlin et al (2013) also attribute their finding of a positive relation between tax sheltering and cost of public debt to the uncertainty about the firm's future cash flows. Shevlin et al (2013) argue that tax avoidance leads to lower cash flow levels and higher cash flow volatility in the future, which make bond investors view corporate tax sheltering negatively. The research by Shevlin et al (2013) find empirical evidence to support this argument after examining three mechanisms through which tax aggressiveness increases bond yields, including future cash flow levels, future cash flow volatility and information quality. The results in Shevlin et al (2013) highlight that decreased cash flow levels in the future account for one third of the total effect that tax aggressiveness has on public debt cost, but at the same time report that information quality has a very small impact on the tax aggressiveness-leverage relationship. The result of little role of information quality is particularly interesting because Balakrishnan, Blouin and Guay (2014) find tax avoidance significantly reduces corporate transparency. If the finding in Balakrishnan et al (2014) is true, coupled with the opaque financial reporting found in tax aggressive corporations (Desai and Dharmapala 2006), it is reasonable to expect information quality to play a crucial role in debtholders' negative view about tax avoidance strategies. However, information quality is not found to have a compelling effect in Shevlin et al (2013).

Similar to concerns about managers' rent extraction, uncertainty about future cash flows of tax aggressive companies results in debtholders' demand for higher bond yields in order to compensate for the additional risk from lower expected cash flows and more volatility in the firm's liquidity position in the future. However, this argument seems to be in stark contrast with the common notion that debtholders view tax aggressiveness favourably due to the cash savings in tax payments required, which can be economically significant for profitable firms. Even for companies that are in need of cash for research and development and other investing activities, in spite of operating profitably, their tax aggressive activities may also be viewed positively by lenders as firms investing in further growth in the future. Hence, although the uncertainty of future cash flows proposed by Shevlin et al (2013) is one possible reason to explain the positive relation between tax avoidance and cost of debt, it is still inconclusive about how lenders evaluate corporate tax aggressiveness. And the answers might differ from one type of lenders (e.g. banks) to another (e.g. public bondholders).

In summary, this review paper discusses four main propositions put forward by previous researchers in explaining the relationship between tax aggressiveness and debt levels (or cost of debt). On the one hand, the proposition of interest deductibility from debt tax shields supports the finding of tax avoidance being positively associated with leverage. On the other hand, the non-debt tax shields theory together with the debt substitution and tax exhaustion effects provides support for the negative relationship between tax aggressiveness and debt holdings. In addition, the last two propositions, the debtholders' concerns about managerial rent extraction and the uncertainty about firm's future cash flows, explain the positive association between corporate tax avoidance and cost of debt. Nevertheless, interpretation of the results of prior research using those four propositions (and any others) should be subject to a number of factors that could impact on the empirical tests conducted. These factors are discussed in Section 4 of this review paper.

4. Issues in empirical tests

Upon observing conflicting findings regarding the association between tax avoidance and debt reported in previous literature, besides the various theories used in explaining those results, another natural question that comes to mind is how the empirical tests were conducted. Essentially the differences in the way empirical analysis is performed can give rise to variation in the results, as in the case of the tax aggressiveness-leverage puzzle. Specifically, this section discusses four main issues in empirical studies of tax avoidance and leverage: the causal or bi-directional relationship between the two variables, the proxies used for tax aggressiveness, the leverage measures employed, and the endogeneity nature of this relationship.

4.a. Causal or bi-directional relationship between tax aggressiveness and leverage

In empirical tests of the relation between tax avoidance and debt, most studies which directly examine this relationship often model leverage as the dependent variable and corporate tax status as the independent variable (Graham 1996; Graham and Tucker 2006; Lim 2010; Bartholder et al 2011; Lin et al 2014). However, it is observed that a number of other studies may use tax aggressiveness as the dependent variable and include leverage as a regressor in their models (Gupta and Newberry 1997; Richardson and Lanis 2007; Seidman 2010; Lanis and Richardson 2012). It is worthwhile noting that the way the regression model is constructed does not always necessarily mean that the research using such model advocates for a causal relationship in which the dependent variable is a result of variation in the regressor of interest.

A great amount of prior tax aggressiveness studies seem to view the relationship between corporate tax avoidance and leverage as a causal relationship in which companies' debt policy changes under the impacts of tax aggressive activities. For instance, Richardson, Lanis and Leung (2014) argue that corporate tax aggressiveness and corporate governance mechanism affect debt financing. In the same vein, Feld, Heckemeyer and Overesch (2013) in their mega analysis contend that an increase in marginal tax rate, which implies a lower level of tax aggressiveness, causes an increase in debt ratio. However, some other research advocates the idea that the relationship between tax avoidance and debt holdings should be bi-directional. Graham and Tucker (2006) purport that it is difficult to prove

the direction of this relationship, as in the case of most corporate finance research, and suggest that the coefficients reported in their study should be interpreted as correlation rather than as causality. In addition, Hasan et al (2014) suggest that firms with higher cost of debt have incentives to use alternative ways to fund operations and engaging in tax sheltering is one of the alternatives, making it challenging to conclude about the causal inference in research findings. Hasan et al's (2014) view is consistent with the contention by Graham and Tucker (2006), supporting the argument that the association between tax aggressive strategies and leverage should be a two-way, rather than causal, relationship.

Quite often higher leverage is interpreted as higher cost of debt; however, this review paper finds it difficult to infer a relationship between tax aggressiveness and debt levels from a documented association between tax aggressiveness and cost of debt, and vice versa. For instance, Shevlin et al (2013) claim to provide evidence that is consistent with the debt substitution effect in Graham and Tucker (2006) and Wilson (2009) who produce results of a negative relation between tax sheltering and leverage. The authors advocate an explanation that "tax avoidance makes borrowing more expensive thus incentivizing the firms to have lower leverage" (Shevlin et al 2013). This point is not clearly supported by the findings in Shevlin et al (2013) because what the authors find is only a positive impact that tax sheltering has on bond yields, not a direct negative relationship between tax sheltering and debt levels. Although the incentive for tax aggressive firms to reduce borrowings from having high cost of debt (or bond rates in the case of public bonds as in Shevlin et al (2013)) is a legitimate and highly likely explanation, this argument might have not captured the complete picture of a firm's capital structure and there are many other important factors that could alter the firm's decision to increase or decrease their debt levels. Factors such as cash flows, liquidity position, bankruptcy costs and agency costs will enter this leverage puzzle. It is possible that the high cost of debt found is a result of a heavily leveraged structure regardless of whether such structure is related to tax avoidance strategies; therefore, companies may not be able to cut down on the committed borrowings in spite of their awareness of the high interest rates on debts, at least in the short or medium term. Another possibility is that the firm's engagement in tax avoidance involves uses of debt interest deductibility and hence high debt ratio (or high amount of debt holdings in general) is part of such tax aggressive scheme. Also because of this, it is indeed challenging to conclude whether the association between tax aggressiveness and leverage (or cost of debt) is a causal relationship. Most likely this relationship is a two-sided correlation, as suggested by Graham and Tucker (2006).

4.b. Proxies for corporate tax status

Since tax avoidance is a sensitive issue to corporations and tax aggressive activities are not directly observable, prior studies use a number of different measures to proxy for tax avoidance. There is possibility that previous mixed findings for the association between tax aggressiveness and leverage are due to the proxies employed in tax aggressiveness research. Some proxies may capture tax aggressiveness in its broad meaning of reduction in tax liabilities whereas the others may represent tax sheltering at the extreme scale of aggressiveness level.

Firstly, in tax aggressiveness research, a number of academics use book-tax difference (BTD) as a source to derive their proxy for corporate tax avoidance (Lim 2011; Richardson et al 2014; Taylor and Richardson 2014; Lin et al 2014 and so on). Taylor and Richardson (2012) purport that companies that are successful at avoiding taxes are likely to sustain large difference between book income and taxable income. Meanwhile, Frank et al (2009) in studying corporations' aggressiveness in both financial reporting and tax reporting suggest that BTD may reflect not only tax aggressive activities but also earnings management. In order to isolate the component of BTD that is attributable to earnings management, Lim (2011) uses discretionary accruals from BTD in his study of tax avoidance by Korean firms. Lim (2011) suggests that firms avoid tax liability by using both permanent and temporary difference components while managing earnings using mostly temporary difference component. An interesting point in the Korean setting of Lim's (2011) study is that the taxable income data of Korean companies are disclosed in the notes to their financial statements and such disclosure avoids errors arisen from estimating taxable income from financial reports, which is an important problem encountered in most US studies. Therefore, the BTD measure obtained in Lim's (2011) is much more reliable than that computed from estimates of taxable income as often seen in research examining BTD measures.

Wilson (2009) reports that BTD is positively associated with tax sheltering cases, suggesting that BTD could be an appropriate proxy for tax aggressiveness. If that is the case, the bias produced from studies using BTD, if any, may not be strong enough to impact the overall results in those papers. Furthermore, Seidman (2010) who examines the interpretation of book-tax income gap (also BTD) adjusts the BTD for three factors: changes in the Generally Accepted Accounting Principles (GAAP), macroeconomic conditions and earnings management. Seidman (2010) finds that BTD adjusted for the GAAP changes can provide a better proxy for tax sheltering in most contexts although the BTD measure which is not adjusted for any of the three factors is generally a reasonable proxy for earnings management. Overall, it is concluded in Seidman (2010) that BTD can be a reasonable proxy for tax avoidance although care is to be taken when the variable of interest of the research is likely to be affected under macroeconomic conditions.

Secondly, some studies explore the marginal tax rates (MTR) as a measure of corporate tax status (Graham 1996; Graham and Mills 2008; Bartholdy and Mateus 2011; Barclay et al 2013). A firm with lower MTR may be interpreted as successful tax avoidance compared to a higher MTR firm. In Graham's (1996) paper, MTR is explicitly calculated, using an expanded version of the method by Shevlin (1990) who simulated MTR while also accounting for carry-forward and carry-back tax opportunities. The MTR variable in Graham (1996) involves two main features, which are mimicking the tax calculation under the US tax law and measuring the managers' expectations of the firm's tax rate. Graham (1996) proposes that the true tax rate to reflect the tax benefit of interest deductibility should be an average of the future expected MTRs and should account for the effects of the total amount of interest deduction available. In another study by Graham and Mills (2008), the research shows that the simulated MTR based on financial statements is highly correlated with the MTR simulated from tax return information, advocating the reasonableness of using book-simulated MTR as a proxy of companies' dynamic tax status. Besides, Graham and Mills (2008) also provide a summary of suggestions of MTR measures to be used for domestic and international studies. Since MTR mainly reflects future tax benefits (Nejadmalayeri & Singh 2012), MTR may not be a good proxy for tax aggressive strategies which are associated with past decisions but lead to the existing leverage structure.

Thirdly, effective tax rate (ETR) is probably the most commonly used proxy for corporate tax aggressiveness (Richardson and Lanis 2007; Dyreng et al 2008; Minnick and Noga 2010; Lanis and Richardson 2012; Lin et al 2014 and so on). An ETR value that is lower than the corporate statutory tax rate is a strong indicator that the firm engages in some tax aggressive planning. In spite of its frequent use in tax avoidance studies, there is no consensus about how to compute ETR. In calculating the ETR measure, the numerator is often either the income tax expense recorded in the financial report or the cash taxes paid, whereas the denominator is often chosen between the pre-tax book income or the operating cash flows. In Richardson and Lanis (2007), two ETR measures are employed for their research: the first proxy ETR1 is the income tax expense divided by the pre-tax book income; the second proxy ETR2 is the ratio of income tax expense over the operating cash flows. Hasan et al (2014) compute their cash ETR measure as the cash taxes paid divided by the pre-tax book income less special items. Dyreng et al (2008) prefer cash ETR than book ETR, arguing that cash ETR is not affected by accounting rules whereas cash taxes paid across all jurisdictions can reflect global tax aggressive activities in multinational firms. In their study, Dyreng et al (2008) calculate the long-run cash ETR over a ten-year period (1995 – 2004) in order to examine long-run corporate tax avoidance. Some other studies however use a shorter period of time, i.e. average ETR over five years rather than ten years, when analysing long-term tax measures (Minnick and Noga 2010). Nevertheless, ETR is often viewed as a rather static proxy and an important drawback of using ETR lies in the fact that ETR cannot take into account the interaction between tax advantage of debt and the firm's future profitability (Feld et al 2013).

Fourthly, recent studies in the US take advantage of the Financial Accounting Standards Board Interpretation No. 48 (referred to as FIN 48) which requires US companies to disclose their tax reserve for uncertain tax positions (Hasan et al 2014). The amount of tax reserve reported under FIN 48 disclosure requirement is used as a proxy for tax avoidance activities (i.e. a larger reserve generally indicates a highly uncertain tax position due to involvement in aggressive tax planning). Lin et al (2014) also use FIN 48 tax reserve as one of the proxies for tax aggressiveness in their research and find significant association between this measure and leverage. The problem with this proxy is that it depends largely on the level of firms' compliance with the FIN 48 requirement. If corporate aggressiveness in financial reporting is indeed positively correlated to tax aggressive reporting as documented in Frank et al (2009), FIN 48 reserve may not be a reliable measure to capture firms that are aggressive in both tax and financial reporting.

Fifthly, some researchers use actual tax shelter cases in the form of dummy variable in their tax avoidance studies (Graham and Tucker 2006; Wilson 2009; Hasan et al 2014). For instance, Graham and Tucker (2006) examine the under-leverage phenomenon in tax aggressive firms by analysing 44 actual tax shelters, which are used later on together with additional identified tax shelter cases in another study by Wilson (2009). In another study of the relation between tax avoidance and bank loan cost, Hasan et al (2014) perform two quasi-experimental settings, one of which uses tax avoidance news announced to the public (while the other one uses FIN 48 disclosure). Like any other measure of tax aggressiveness, utilising actual tax avoidance cases has both advantages and disadvantages. The advantage of this method is that the sheltering schemes are already identified with high degree of certainty and thus there is no need to indirectly infer the propensity of sheltering such as using BTD or ETR. The disadvantages include the small sample of observations used (e.g. Graham and Tucker 2006; Wilson 2009) and the inability to generalise the results due to the extreme degree of tax avoidance captured in the sheltering cases that are detected, prosecuted

and announced to the public. Regarding the latter, it comes back to the definition of tax aggressiveness, which generally refers to activities that result in tax liability reduction, whereas the tax shelter cases caught under litigation reflect the higher end of the tax aggressiveness scale.

This section reviews the five proxies of tax aggressiveness frequently used in the accounting and tax literature, including: BTB-sourced proxy, MTR, ETR, FIN 48 tax reserve and actual tax avoidance cases. Further on the topic of measuring tax avoidance, Hanlon and Heitzman (2010, pp. 139-146) provide a comprehensive discussion in their review of prior tax research in accounting.

4.c. Measures of company debt levels and cost of debt

Not only measures of corporate tax status but also measures of leverage are also likely to cause variation in the previously reported mixed findings in the relationship between tax aggressiveness and debt. As mentioned above, while some studies explicitly test debt holding levels (or debt ratios) and how they are related to tax avoidance, the others examine the tax aggressiveness and leverage puzzle through cost of debt in the tax aggressive firms. It is observed that prior literature employs a variety of methods to measure debt; therefore, the previous results that may seem prima facie conflicting are indeed not directly comparable and difficult to contrast against each other.

First of all, in respect of using debt holdings as a variable representing a firm's debt structure, there are a number of issues that concern researchers in carrying out the empirical tests. These issues include the forms of debt holding measure used (i.e. absolute value or ratio), length to maturity (short-term vs long-term), and differences in debtholder types. For example, Bartholdy and Mateus (2011) use three debt measures: short-term bank loans, long-term bank loans, and total bank loans which is the sum of the short-term and long-term loans. Lin et al (2014) among others employ debt variables in the form of ratios, including: debt to assets ratio, long-term-debt to assets ratio, debt over debt-and-equity ratio, and industry-adjusted leverage ratio. In both examples, length to maturity is an explicit concern when the researchers examine the impact of liabilities of both short and long terms on taxes. In discussing the potential effects of the different maturity on the results, Feld et al (2013) put forward their argument: "On the one hand, a smaller tax response of long-term debt can be expected because it can hardly adjust to yearly fluctuations in the tax rate. On the other hand, long-term debt is associated with higher interest deductions relative to short-term debt, containing also trade payables that do not carry any interest deductions." Also according to Feld et al (2013), long-term debt might be more tax responsive since tax deductions from interest payments are the main tax advantage of debt over equity.

Besides, book and market values of the firm are also taken into account in the computation of debt ratio. In both Graham and Tucker (2006) and Richardson et al (2014), leverage is measured in both forms, debt over book value of total assets and debt over market value of total assets. However, in Nejadmalayeri and Singh (2012), the two measures of debt ratio used by the authors are the ratio of total liabilities to market value of equity, and the ratio of long-term debt to total book value of assets. Furthermore, Graham (1996) focuses his examination on incremental financing by testing changes in debts rather than using debt levels as the leverage variable in his study.

In addition to examining debt levels as well as changes in debt levels, previous literature in this area also tests the relationship between tax avoidance and cost of debt. The measure for cost of debt varies from study to study, depending on the focus of the authors' analysis. While Ayers et al (2010) look at credit rating changes, Hasan et al (2014) focus on cost of bank loans. Quite different from these two papers, Dhaliwal et al (2009) measures cost of capital by averaging the four cost of capital estimates adopted from previous studies consisting of: Gebhart et al (2001), Claus & Thomas (2001), Gode & Mohanram (2003), and Easton (2004). Besides, Shevlin et al (2013) in his study of the association between tax avoidance and public debt cost highlight the differences between the types of debtholders. More specifically, Shevlin et al (2013) pay attention to corporate bond issues and argue that public lenders only have access to publicly available information as opposed to some private information about the firms that only credit analysts or banks may be able to access. Thus, contrasting the research focus in Shevlin et al (2013) against that in Ayers et al (2010) who study the credit ratings imposed by credit analysts, or in Hasan et al (2014) who analyse loan rates determined by banks, it is worthwhile noting that the results in those studies cannot be directly comparable.

This section demonstrates that the wide variety of debt measures used in prior literature may partly account for the puzzle observed in the relationship between tax aggressiveness and debt. The following section discusses the endogeneity issue in studying this relationship.

4.d. Endogeneity of corporate tax status

Another concern of empirical research into the tax aggressiveness and leverage puzzle is the endogeneity of corporate tax status because such endogeneity can influence the reliability of the results reported in prior research. The company tax rate is considered endogenous because when a firm increases its debt financing, taxable income is reduced as a result of interest payments, leading to a reduction in MTR. The more highly leveraged a firm is, the more obvious this reduction in MTR becomes. Graham et al (1998) document evidence showing that company tax rate is endogenous to financing decisions of the firms and this endogeneity can potentially result in a spurious relation between corporate tax proxies and measures of debt policy. In a discussion on this issue, Graham et al (1998) contend that: "If not properly addressed, this endogeneity of the tax rate can bias an experiment [...] against finding a positive relation between debt and taxes." The authors conclude that the endogeneity problem can have real, substantial impacts on the interpretation of associations with tax variables reported in previous research (Graham et al 1998). Additionally, the endogeneity issue may affect all forms of tax proxies, including tax variable based on net operating losses or average tax rate (also ETR) (Graham 2003).

This endogeneity issue is addressed in Graham et al (1998) by constructing a measure of company's MTR based on before-financing taxable income in order to take out the interaction between interest expenses and MTR. Following this approach, Bartholdy and Mateus (2011) compute the MTR variable in their research as before financing, i.e. using net income before interest deductions instead of net taxable profit after interest. In another study of corporate taxes and debt, Gordon and Lee (2001) deal with the endogenous nature of corporate tax rate by employing an instrumental variable which uses average profit rate before interest deductions to correct for any potential bias from endogeneity. In a review of research into taxes and corporate finance, Graham (2003) suggests

lagging the estimated MTR by one period as another method to account for endogeneity issue (following MacKie-Mason 1990), in addition to using before-financing taxable income. In Richardson et al (2013), endogeneity is controlled for by lagging independent variables, as opposed to lagging the MTR variable as suggested in Graham (2003).

The endogeneity issue of corporate tax avoidance is also discussed in Hasan et al (2014) who use instrumental variable two-stage regressions to directly address the endogeneity concern. In the first stage, Hasan et al (2014) perform a regression for tax avoidance using the instrument variables and the firm-level control variables. In the second stage, the fitted estimate of tax aggressiveness is obtained from the first-stage regression and the base line model is then estimated using this fitted tax avoidance estimate.

In summary, there are a number of methods that researchers can use to account for the endogeneity concern in examining tax-related effects. It is emphasised again here that addressing the endogeneity problem is necessary when studying the relationship between tax aggressiveness and leverage. Studies of the puzzle of tax avoidance and debt relationship which do not control for endogeneity must therefore be interpreted with caution as the potential bias arisen from endogeneity is real and material.

5. Conclusion and suggestions for future research

The relationship between tax aggressiveness and leverage has been a topic of research to academics in tax, accounting and finance in the last four decades, especially after the discussion of debt, taxes and equilibrium in company's capital structure by Mills (1977). A review of prior literature into this topic shows that until today the relationship between tax aggressiveness and leverage still remains a puzzle in spite of nearly forty years of research. There appear to be two lines of conflicting results. The first line reports corporate tax avoidance is positively associated with debt holdings. The propositions put forward to explain this result include the interest deductibility from debt tax shields, the debtholders' concerns about rent extraction by managers, and the uncertainty about the firm's future cash flows. The second line reports a negative association between tax aggressive activities and leverage. A number of researchers attribute this finding to the non-debt tax shields and the documented effects of debt substitution and tax exhaustion. Besides, some other studies show mixed or insignificant findings in respect of the tax aggressiveness-leverage relationship.

The inconsistent results of research into the association between corporate tax avoidance and debt have puzzled researchers in this area. Since there have been several conflicting propositions and arguments proposed to explain the signs and directions of the relation between tax aggressiveness and corporate debt policy, a framework is now needed to systematically understand the factors that drive this relationship. This review paper suggests the four main issues, among others, in empirical tests conducted in previous studies which partly account for the opposite findings: (i) the causal or bi-directional relationship between tax avoidance and debt, (ii) the proxies used for firm's engagement in tax aggressive activities, (iii) the measures of debt levels and cost of debt, and (iv) the endogeneity of corporate tax status. Although Feld et al (2013) perform a meta-regression analysis and report marginal tax rates lead to lower debt ratio, the meta-analysis in itself has certain limitations as discussed in Stanley (2001). Additionally, Feld et al (2013) assume that taxes cause

changes in corporate debt structure but this review paper argues that the relation between tax avoidance and leverage should be bi-directional rather than a causal relationship. Therefore further studies are required to reconcile mixed results previously reported and to validate the finding from the meta-analysis by Feld et al (2013).

There are a number of issues surrounding the puzzle of tax aggressiveness and leverage that require further examination in future research. Firstly, since there are many competing theories and arguments that support for both negative and positive relations between tax avoidance and debt, it is crucial to uncover which proposition is the most relevant or which theory has the most dominating effect. Secondly, although several previous studies have analysed in-depth the tax shields arising from debt interest and the non-debt tax shields (NDTS) under the debt substitution and tax exhaustion effects, we are still unsure about whether the substitution effect varies for different forms of NDTS (Nejadmalayeri and Singh 2012). There is possibility that different types and degrees of tax avoidance strategies result in different magnitude of debt substitution effect as suggested in Lin et al (2014). Future research can examine how each type of tax aggressive scheme (e.g. debt restructuring, transfer pricing, use of tax havens, etc.) may relate to the debt substitution effect, and subsequently to the firm's decision on its debt structure. Thirdly, future research may also attempt to document the association between tax avoidance and debt for each level of tax aggressiveness. For instance, a firm which has an average tax rate 5% below the company statutory tax rate can have different properties in respect of debt structure compared to its counterpart which has successfully achieved an average tax rate 15% or 20% below the statutory rate. Fourthly, it is important to recognise that while debtholders' concerns about managerial rent extraction and uncertain future cash flows are real in firms that are aggressive in both tax reporting and financial reporting, debtholders may at the same time view tax sheltering favourable due to the tax savings yielded from tax sheltering. There is potential to employ other methodologies of research, most likely in the form of interviews or surveys, to obtain insights about how debtholders view tax avoidance by corporations. Interviews can possibly be conducted with either the bank managers who make decisions about companies' bank loans, or with senior credit analysts. Surveys can potentially be carried out to understand how the general public perceive the tax aggressive activities by companies and what level of risks (returns) is accepted (demanded). When traditional archival research consistently reports mixed findings, research using qualitative methods or mixed methods can provide opportunities to explore the inconsistency in previous findings and to triangulate the new results. Fifthly, agency cost in tax is another aspect that may impact the association between tax avoidance and leverage, and the CEOs when making decisions about level of tax aggressiveness as well as the debt structure of the firms will take into consideration not only the real and perceived benefits to shareholders but also their personal interests. Thus, future research can make further inquiries into how CEOs make decisions in respect of tax aggressiveness and leverage structure by using interviews, surveys or a combination of both. As an example, Lavermicocca and McKerchar (2013) previously conducted successful interviews with tax managers and directors in large Australian companies, followed by surveys, in their study of tax compliance behaviour of large corporations. Mixed methodology in this regard can meaningfully inform researchers of the tax avoidance and leverage relation through understanding the decision-making process used by firms' CEOs or at least through gauging the important issues and concerns evaluated by CEOs. Finally, heavy use of debt is often associated with company's bankruptcy probability, which becomes higher when the economy experiences a financial crisis. Nejadmalayeri and Singh (2012) in their US study of

company taxes and cost of debt observe that during the global financial crisis (GFC) large losses have greater impact on reduction in credit spread (i.e. lower cost of debt) through tax subsidies. Future studies can potentially provide further insights into the relationship between tax avoidance and leverage by examining this relationship not only during stable macroeconomic environments but also during an economic downturn, with the GFC being a good setting for this experiment.

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