UNIVERSITY OF TWENTE.

The Pecking Order Hypothesis or Static Tradeoff Theory

Research on capital structure based on a U.K. sample

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Abstract

This master thesis aims to test two important theories in the field of capital structure, e.g. the pecking order hypothesis and the static tradeoff theory, under the UK setting. Thus the main research question of the thesis is:" Which theory can better explain the UK non-financial firms' capital structure, the pecking order hypothesis or the static tradeoff theory?"

By using the sample of non-financial firms headquartered in the UK during the period from 2006 to 2011, the relationship between financing deficit and long-term debt ratio is investigated in order to test the pecking order hypothesis, and the leverage determinants assumed by the tradeoff theory are used to verify whether the relationships are consistent with the prediction of tradeoff theory. The main conclusion is that the tradeoff theory has much more explanatory power than the pecking order hypothesis in UK firms' capital structure. Specifically, debt ratio is negative with non-debt tax-shields and volatility but positive with profitability and tangibility of assets. The negative relation between the change of debt ratio and financing deficit implies that the UK firms do not follow a specific financing hierarchy and it is plausible there is a target debt ratio. UK firms' seem to utilize tax-shields effect and they are affected by the costs of financial distress when finance externally. However, to verify whether there is an actual target debt ratio, new models should be adopted in the further study.

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1. Introduction

The capital structure, which refers to the way of financing the assets through the combination of internal cash flow, debt, equity, or hybrid securities[1], has been an ongoing issue since the publication of Modigliani and Miller's (1958, 1961) articles. According to the MM theorem, the total value of a firm is irrelevant to either issuing equity or financing via debt under the assumption of a perfect market which is in the absence of taxes, bankruptcy costs, agency costs, asymmetric information and difference in interest rates between individuals and corporations. However, in the real market with the existence of various costs, financial distress and asymmetric information; capital structure does have impact on the total value of a firm. For instance, by using debt, due to the fact that debt costs are deducted before tax, firms can reduce income taxes by tax-shields so that to save cash flows. However, too much debt will increase the risk of bankruptcy and the accumulated debt service stressed by a firm.

In this context, Myers (1984) contrasts two frameworks to think about capital structure, which are static tradeoff theory and pecking order hypothesis. The static tradeoff theory predicts the moving of actual debt ratio towards a target or optimum which is determined by the balance of tax shield benefits and financial distress in a firm. According to the theory, the market value of a firm would be optimal at a relatively high leverage level which is safe and profitable for firms by using tax-shields. There are some prior works which have presented evidences for optimal ratios. Bradley et al. (1984) review prior literature about optimal capital structure and conclude that previous findings support the tradeoff theory. Titman and Wessels (1988), however, take the factor-analytic approach to measuring unobservable or latent variables (e.g. uniqueness of products) and find some firms use book value target debt-to-equity ratios. In contrast, Myers (1984) suggests that the costs of issuing risky debt or equity overwhelm the forces of moving leverage to an optimal level, thus many authors are in favor of pecking

[1] Hybrid securities possess the characteristics of both debt and equity, such as a convertible bond which can be converted into a number of shares of common stock or cash of equal value.

order hypothesis. In terms of the pecking order hypothesis, firms behave as following specific order without a well-defined target debt-to-value ratio when they finance. They prefer internal to external financing and debt to equity if securities are issued. Recently, several studies evaluate the core assumption of pecking order hypothesis that information asymmetry is a determinant of capital structure decisions. The financing costs that generate pecking order behavior consist of the transaction costs on new issues and the costs generated by information asymmetry which refers to management's superior information to market participants (Fama and French, 2002). On the one hand, managers are assumed to represent for the interests of the current shareholders. The new equity issues imply that the loss for the shareholders due to the dilution cost and it is always seen as a negative signal to market which will lead to misprice the total value of the whole firm. Therefore, managers may pass up positive NPV projects (thus lower the market value of the whole firm) with such private information when there is severe under-pricing of equity. On the other hand, where managers have discretionary decision making powers and where governance and incentive mechanisms may not succeed wholly in aligning shareholder interests, managers may exploit their information advantage to acquire perquisites via equity issues with detriment to the shareholders (Watson and Wilson, 2002). A number of papers have concentrated on the pecking order hypothesis. Shyam-Sunder and Myers (1999) suggest that the pecking order model has greater explanatory power than a static tradeoff model. However, the pecking order hypothesis is tested insignificantly by Frank and Goyal (2003) who calculate the financing deficit excluding the current portion of long-term debt.

Although many empirical studies on capital structure have been done on UK firms, very few such studies are done after 2009. Since a sovereign debt crisis occurred from late 2009, the focus on debt level within the European economic area is getting crucial. It is unclear that whether the previous findings are still applied to UK before or after the debt crisis. Additionally, there are still gaps and contradictions between the inferences from the UK setting and the findings on UK capital structure studies. First, during the 1990s,

the nature of the credit market in the UK has changed significantly with large companies using less bank finance, whereas banks increasingly lending to smaller firms (Bevan & Danbolt, 2000). This result is contrary to the findings of small growth firms are the primary issuers of equity maybe due to restrictive debt capacity constrains (Fama & French, 2002). Second, due to the UK tax regime[2] does not provide incentives to businesses for retaining profits and with less tax allowances (Michaelas, et al., 1999), UK firms may retain less internal funds and maintain higher gearing compared to other profits-incentive tax regimes. However, Rajan and Zingales (1995) investigate the leverage in G-7 countries and find that the UK has the lowest leverage among those countries; the dominant source of external finance in the UK is equity. The findings are contrary to the inference of UK tax regime and pecking order hypothesis. Third, there are conflicting findings in UK capital structure. Jordan, et al. (1998), Adedeji (1998), and Michaelas, et al. (1999) use the UK data and give out some plausible evidences to support pecking order hypothesis. However, Lasfer (1995) and Ozkan (2001) find evidences to support a target debt ratio in UK firms' capital structure. What is more, Beattie, et al. (2006) use a UK survey evidence and find mixed results which some are consistent with tradeoff theory but some follow a financing hierarchy. Above all, because of the lack of current studies on UK capital structure before or after the debt crisis of European economic area and the three existing gaps, it is worth doing such a research extensively. In this study, the relationship between deficit[3] and debt ratio under the pecking order model as well as the debt ratio determinants in the light of tradeoff theory are investigated in the UK setting. The following is the main research question:

Which theory can better explain the UK non-financial firms' capital structure, the pecking order hypothesis or the static tradeoff theory?

[2] Compared with home tax-free rules countries, UK-resident companies are taxed on profit left that are earned overseas. After 2009, new rules were introduced and double taxation rules are less common application. Also, UK corporation tax rate has been 30% since 1999 and cut to 28% after 2008, which is one of the highest rates in EU corporate tax (The IFS Green Budget, 2006 & 2009).

[3] According to pecking order hypothesis, when firms have no sufficient internal funds to fill the deficit, debt finance is preferred. Therefore, the relationship between deficit and debt should be positive. Under a perfect condition which firms without any internal funds or debt capacity, debt issue should be the same as deficit due to all deficit is financing via debt.

To answer the research question, the sub-questions should firstly be investigated.

Sub-questions:1. *Which and to what extent the determinant factors predicted by tradeoff theory can explain the debt ratio level in UK firms?*

2. *To what extend the pecking order hypothesis can explain the relationship between debt ratio and financial deficit?*

The sample used in the study consists of the listed non-financial firms in the UK during the period from 2005 to 2011. All data is extracted from the COMPUSTAT GLOBAL and ORBIS database with the flowing criteria: all listed companies' headquarters must be located in the UK; financial firms are excluded. The ordinary linear squares (OLS) method has been applied to investigate the research questions.

The results in this study suggest that tradeoff theory have more explanatory power than pecking order hypothesis in the UK sample. Non-debt tax shields, profitability, tangibility and volatility are proved the most important factors to affect UK firms' debt ratio and the relationships between the four factors and debt ratio are corresponding with the prediction of tradeoff theory. However, there is no finance hierarchy for UK firms but it is plausible an existing target debt ratio.

This study aims to add knowledge to the empirical literature by providing evidence on capital structure decisions in the UK. Additionally, the contribution of the research is to test whether prior findings on both pecking order and static tradeoff theory are consistent to the current UK's setting by applying the recent data and integrating previous plausible explanations as much as possible.

The remainder of the thesis is structured as follows: chapter 2 reviews capital structure theories in prior studies as well as the hypotheses. Chapter 3 describes the sample and methodology, followed by chapter 4 which shows the results from test and gives further discussion upon those results. The conclusion for our study will be made in chapter 5, including the summaries, the limitations and suggestions for the future research.

2. Literature review

Based on the theories in the field of capital structure, the causes of pecking order is primarily generated from information asymmetry and the movement of debt ratios toward an optimal target is subject to the balance between tax shield benefits and the costs of financial distress. Both the conceptual and empirical research, which refers to information asymmetry and agency problem, leverage determinants in capital structure refer to the tradeoff theory, and the UK institutional settings; are reviewed.

2.1. The MM theorem

Modigliani and Miller (1958) indicate that it does not matter whether to finance through equity or debt in perfect capital markets, that is the total value of firms should not be affected by the way how they are financed. As to the meaning of a perfect capital market, Myers (2001) explains that financial innovation would quickly extinguish any deviation from the predicted equilibrium in such markets. The assumptions of a perfect capital market are no taxes, no bankruptcy costs, no agency costs, no differences in interest rate, and no asymmetric information. All MM's propositions are established under a perfect market. According to proposition 1, the total firm value is irrelevant to the proportion of debt financing and each firm's weighted average cost of capital is a constant regardless of the debt ratio. Let r_D and r_E stand for the cost of debt and the cost of equity respectively, D and E represent the market values of the firm's debt and equity, V is the total market value of the firm. Then the weighted average cost of capital r_A can be expressed as: $r_A = r_D \frac{D}{V} + r_E \frac{E}{V}$. The average cost of capital depends on the portfolio of all the firm's securities. Because $V=E+D$, the equation of average cost of capital can be deformed as: $r_E = r_A + (r_A - r_D)D/E$. This equation is the MM's proposition 2, the cost of equity (or the expected yield of equity) increases with the debt to equity ratio; as the average cost of capital is not related to the debt-equity ratio, using debt to substitute for equity will not reduce the weighted average cost of capital (r_A). As a result, investment decisions should be guided only by the criterion of maximizing firm value, and the cost of capital is the total cost r_A which is measured by the required rate

of return on equity-financed firms in the same “risk class” (Pagano, 2005). Thus the MM theorem is also called the capital structure irrelevance principle.

According to Pagano (2005), the irrelevant propositions provide a benchmark with which we must constantly reckon. When the optimal leverage emerges, we can detect the set of assumptions that took us away from the benchmark. Just as Miller (1988) states: “showing what doesn’t matter can also show, by implication, what does”. By thinking of the assumptions, we can focus on and analyze what does matter in capital structure. The absent factors in MM theorem may be able to explain why leverage is relevant. Furthermore, from the perspective of MM’s arbitrage-based propositions; in a perfect market which is not affected by taxes, bankruptcy costs, and asymmetric information, investors can simply replicate the optimal mix of liabilities of a successful company to arbitrage. Then the assumptions of perfect markets are analyzed extensively in the field of capital structure.

2.2. Static tradeoff theory

The static tradeoff theory, according to the explanation of Myers (1984), states that there is an optimal target debt-to-value ratio firms’ capital structure is gradually moving toward the optimum. The optimal financial leverage is determined by the balance between the tax-shields interest and bankruptcy costs or financial distress. At the optimum, the marginal benefit of an additional dollar of debt just offsets the cost of debt (Fama and French, 2002); once beyond the target, the costs of financial distress will have a negative effect. The static tradeoff theory predicts a movement of actual debt ratio towards an optimum and it can be illustrated in figure 1.

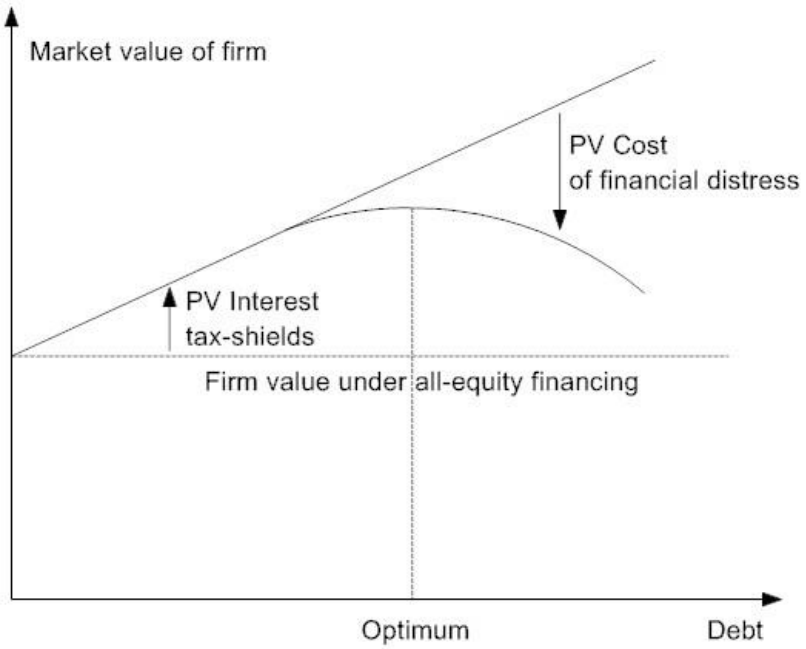

Figure 1. Illustration of static tradeoff theory which predicts reversion of actual debt ratio towards an optimal target. The optimum is determined by the balance between the interest tax-shields and the costs of financial distress. (Shyam-Sunder and Myers, 1999)

2.2.1. Tax-shields and bankruptcy costs

Tax-shields interest refers to the advantage taken by firms from the reduction in income taxes due to the allowable deduction from taxable income. Since the fact that interest payments are tax deductible but dividends are not, the debt is considered to be preferred to equity in the fiscal regime. According to Deangelo and Masulis (1980), there are 3 states (with considering tax credits) can elaborate the relationship between tax deductions and corporate tax bill (see table 1). In state 1, where earnings before interest and taxes (EBIT) just cover debt charges, the corporate tax bill is zero due to corporate tax deductions exceed the EBIT and all the earnings are paid for debt. After state 1, the residual component of earnings is paid for equity. In state 2, corporate tax bill is just equal to zero. Between state 1 and 2, corporate tax bill is zero due to corporate tax deductions still exceed the EBIT but EBIT exceeds the debt charges. In state 3, firms completely use all tax deductions and credits. Between state 2 and 3, the corporate tax bill is positive due to tax deductions are less than EBIT and tax deductions are fully used but tax credits are partially used because of the limiting credits used to a

proportion of tax liability. After state 3, corporate tax bill is positive and tax deductions and credits are totally used. Tax shields benefit has impact after state 3. According to Vanderwijst and Thurik (1993), tax effect can be complicated by several factors. First, non-debt tax-shields, such as depreciation deduction, tax loss carry-forward and investment tax credits, have the substitution effect on interest deduction by debt financing. Second, at the corporate level, personal taxes can offset the interest of debt if the personal tax on income from bonds is higher than that on income from stocks (Miller, 1977). Third, different tax regimes can generate differences in investors' preferences. In which countries with lower tax rates applying to capital gains than to dividends, investors prefer capital gains to stock ownership. On the contrary, with exemption of taxing from dividends, dividends are preferred. By considering the complex situations, the tax-shields effects may be smaller than the prediction from the theory; but generally speaking, tax-shields interest will create incentive for corporate debt financing.

	~State1	State1~State2	State2~State3	State3~
Debt	EBIT	Debt	Debt	Debt
Equity	0	EBIT - Debt	EBIT - Debt - Tax liability + Partially tax credit	EBIT - Debt - Tax liability + full tax credit

Table 1. After coporate tax cash flows to debt and equity (Deangelo and Masulis, 1980). Before state 1, corporate tax bill is 0, EBIT are paid to debtholders. During state 1 to state 2, corporate tax bill is 0 and equity is paid by the residual component of earnings. During state 2 to state 3, corporate tax bill is positive and tax deductions are fully used but tax credits are partially used. After state 3, corporate tax bill is positive, both tax deductions and credits are fully used. Tax shields are functional after state 3.

If there are no any costs to offset the interest of tax-shields, debt financing will be used maximally. However, this is not the case in practical observation. As the static tradeoff theory stating, various costs of financial distress (e.g. bankruptcy costs and reorganization) can counterbalance the debt ratio to a target level. Bankruptcy costs refer to the added costs (e.g. legal fees, reduced sales, increased production costs) that arise since the firm fails to meet its obligations to creditors without changing its operating or external financing activities (Haley and Schall, 1979). There are two types of bankruptcy costs, direct costs and indirect costs. The direct costs refer to

administrative or legal fees to deal with bankruptcy and the costs of negotiating reorganization or liquidating assets, such as employing lawyers, accounts and appraisers. In terms of different studies, direct bankruptcy costs can vary from 1% of the market value of the firm to a 20% of the estate (Vanderwijst and Thurik, 1993). The indirect costs can arise from the imperfection of secondary markets or opportunity loss, such as decline in market share and distress sales. Due to the costs of financial distress, the market value of a firm can be dragged down. As a result, the benefits generated from tax advantage can be cancelled out by the increasing debt levels.

2.2.2. Debt ratio determinants and the predictions of static tradeoff theory

Through the review of empirical research on leverage determinants of capital structure, some possible determinants of capital structure associated with tradeoff theory that proposed by previous authors are discussed in the following part. In this study, four factors, which are non-debt tax shields, profitability, tangibility and volatility, are used. Non-debt tax shields and profitability are related to the part of benefits, whereas tangibility and volatility refer to the part of costs of distress.

Non-debt tax-shields (Nondebt): As illustrated in table 1, tax shields are functional when all tax deductions and credits are used. Therefore, when non-debt tax shields are excluded in tax deductions, state 3 is faster achievable (tax deductions are getting smaller so that EBIT exceeds tax deductions faster) than which includes non-debt tax shields. DeAngelo and Masulis (1980) argue that non-debt tax-shields (e.g. tax deductions for depreciation, depletion allowances and investment tax credits) are substitutes for the tax benefits of debt financing which are deductible in the calculation of the corporate tax. Thus, in terms of the tradeoff theory, we suppose that there is a negative relationship between non-debt tax-shields and debt ratio (**H1**). However, Bradley, et al. (1984) significantly show that the non-debt tax shield is positively related to debt ratios which are in contradiction to the prediction. They explain the positive sign between the non-debt tax shield and debt ratios is due to the “secured debt” hypothesis which is proposed by Scott (1976). More non-debt tax shield suggests more investment

in tangible assets which can be seen as collateral for secured debt and thus such firms can borrow at lower interest rates.

Profitability (Profit)[4]: Modigliani and Miller (1963) argue that firms may choose debt rather than equity because of the tax deduction of interest payments. Under the tradeoff theory, more profitable firms should have higher debt ratio in order to take advantage of tax-shields effect. According to Fama and French (2002), profits are taxed more heavily than losses are subsidized, progressive corporate tax rates progress the rate from low to high taxable base. Firms with more profits also have higher effective taxes and thus increasing the potential benefits of tax shields. Profitable firms should use more debt to offset corporate tax. According to table 1, more profitability means more EBIT and thus tax deductions are hard to exceed EBIT. State 3 is easier to be achieved than less profitable firms and tax shields effects are emerging which motivate profitable firms to issue debt. Therefore, we assume that there is a positive relationship between profitability and debt ratio if the prediction of tradeoff theory is correct (**H2**). If target debt ratios exist, firms with high profitability will prefer debt to equity and higher debt ratios will be observed. However, DeAngelo and Masulis (1980) argue that tax shields interest may be not important due to other tax shields, such as depreciation.

Tangibility of assets (Tangibility)[5]: The conventional prediction relevant to tangibility is that the more highly levered the more tangible assets a firm possesses. Because tangible assets are naturally served as collateral (Frank and Goyal, 2003), firms with more collateral are likely to be more debt capacity and such firms have less bankruptcy costs which embarrass firms' debt finance. To contrast, firms with fewer tangible assets

[4] However, According to the assumption of pecking order hypothesis, more profit means more retained earnings which lead to less leverage. When firms need to finance, the first preference is retained earnings, followed by debt financing and equity issues. Therefore, profitable firms have much retained earnings on hands to invest. Prior researches, e.g. Bevan and Danbolt (2002), Lemmon and Zender (2010), Ozkan (2001), Titman and Wessels (1988); have empirically found that profitability is negatively correlated with leverage. Also, Rajan and Zingales (1995) and Fama and French (2002) report that firms with more profits have less market leverage.

[5] According to the pecking order prediction, Harris and Raviv (1991) expect that tangibility is negatively related to the debt ratio due to more information asymmetry problems in firms with few tangible assets. Also, fewer tangible assets may generate more costs to monitor the capital outlays, thus, to limit managers' consumption of perquisites, the debt issue is preferred in such firms with fewer tangible assets (Titman and Wessels, 1988).

may be required more terms by creditors and therefore, they tend to use equity financing (Titman and Wessels, 1988). Rajan and Zingales (1995) proof that, across G-7 countries, the more proportion of tangible assets, and the higher leverage will a firm be (**H3**). As to the reason, they indicate that more tangible assets may reduce the risk of agency costs of debt due to more value in liquidation is retained.

Volatility (Volatility): In the paper written by Titman and Wessels (1988), they involve the volatility of earnings as a determinant of firms' debt level. For some other authors, such as Toy, Stonehill, Remmers, Wright and Beekhuisen (1974), they name the volatility of earnings as earnings risk alternatively. It is expected that bankruptcy costs would be higher and the limits placed on debtholders by lenders are more for firms with more volatile earnings, which drives higher volatile firms toward less target leverage (Fama and French, 2002). The tradeoff theory predicts that there is a negative correlation between volatility and debt ratio (**H4**).

2.2.3. The empirical tests on tradeoff theory

Many studies have been taken to test for the existence of an optimal capital structure. Castanias (1983) empirically test the cross-sectional relationship between probability of bankruptcy and leverage. He applies historical failure rates, which are provided by Dun and Bradstreet for 21 lines of business, as a measure of the probability of failure rates within lines of business. Their results are consistent with the shelter-bankruptcy cost model that failure rates are negatively related to leverage levels in that firms in lines of business. It also implies that firms will hold an optimum mix of debt and equity which is predicted by the tradeoff theory. By using the sample of 851 firms during 1962 to 1981, Bradley et al. (1984) test the tradeoff theory applying regression of debt ratio against various proxy variables, such as volatility, non-debt tax shields and advertising plus R&D expenses. As a result, they find firm volatility and cost of financial distress are negatively related to leverage which are consistent with the implications of tradeoff theory. Because firms with high volatility of net cash flows will have high costs to issue new risky securities or be prone to forego profitable investments, they are likely to

lower dividend payouts and leverage so that to reduce the financial distress. However, the non-debt tax-shields, which substitutes for tax benefits, are contrary to the predictions. In their study, there is a significant positive relation between leverage and non-debt tax-shields. Nonetheless, they find some significant relations to support the tradeoff theory.

There is relatively not great deal of empirical work on UK firms' capital structure. Ozkan (2001) applies the UK panel data and Generalized Method of Moments (GGM) to estimate whether the firm's financial behavior is adjusted to a long-term target debt ratio. As a result, he confirms that non-debt tax shields are negative with leverage. However, there is a significant coefficient and a negative relation between current profitability and leverage. But for lagged profit, leverage is positive with past profitability. Above those evidences, long-term target leverage ratios and a relatively fast movement of adjusting to the target ratio are supported. Rajan and Zingales (1994) find that leverage for large firms is positively correlated with profitability in the UK. Lasfer (1995) exploits both cross-sectional and time-series differences in UK firms' capital structure. Finally he finds evidence that there is the same target ratio across firms. However, the result also shows that a weak relationship between leverage and the firm's effective tax rates, which implies that firms choose capital structure to mitigate agency costs rather than to benefit from tax deduction.

2.3. Pecking order hypothesis

The pecking order hypothesis, which is proposed by Myers (1984) and Myers and Majluf (1984), can be illustrated in figure 2 (Leary and Roberts, 2010). When a firm needs to finance investment, they preferentially choose internal funds, such as cash and liquid assets, up to the threshold C which represents the amount of internal funds available for investment. Once the current investment exceeds C, external finance is adopted to fill the rest of financing deficit. In this stage, debt finance is prior to equity finance and equity finance will be used only when the investment exceeds beyond D which stands for the sum of internal funds and the debt issued to fill the financing

deficit. In the case that the investment is less than or equal to the internal funds available (Point C), firms will use the internal resources and there is no any external financing activities to fund investment up. In reality, firms may not exhaust internal funds and maintain a reservoir of retained earnings for future opportunities. Once the investment exceeds the internal resources, external resources are needed. Due to the information-sensitive equity issuances, debt is issued to fill the financing gap along with insufficient internal funds if there is not significant financial distress (point C~D). Literally, firms will never issue equity and point D is infinite. Whereas too much investment will exceed the debt capacity, firms have to either pass up the investment or issue equity. If the costs of equity financing are less than the value generated by positive NPV investment and the NPV of total assets is equal or exceeds the capital gain on newly issued shares, firms will turn to equity finance. Due to there is asymmetric information between inside management and investors, the variance rate of percentage changes in equity value exists. If investors overestimate the variance rate, firms are prone to issue equity.

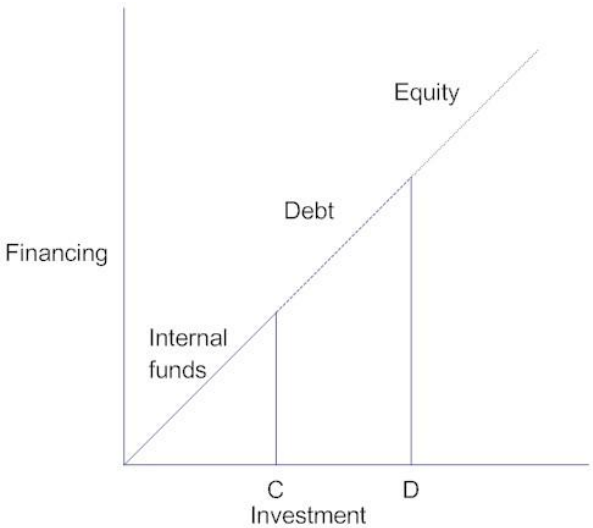

Figure 2. The firms' financing choice underlying pecking order hypothesis (Leary and Roberts, 2010). The figure illustrates the relationship between financing choice and the level of investment. Point C represents the amount of retained earnings available for investment. Point D is the sum of retained earnings and the debt issued for investment. D－C equals to the debt issued to fill the deficit and the amount of equity issued is in the part of after D (Total investment－D).

The pecking order hypothesis is reasoned from the asymmetric information between

managers and investors as well as heterogeneous expectations between current shareholders and new investors. The premise of pecking order hypothesis is that insiders are supposed to act always in current shareholders' interests; therefore, equity is the last option for financing externally due to the fact that current shareholders are not willing to share the benefits of investment or cause the decline of share prices. Because of the costs of external financing which are incurred from asymmetric information and agency costs, internal funds possess a cost advantage over external funds. Therefore, the investment decisions of firms operating in such environments are easy to be influenced by the availability of internal funds (Cleary, 1999).

2.3.1. Information asymmetry and agency problems

Under the assumption of information asymmetry, the information about firm's condition possessed by managers is superior to investors. When there are no enough retained earnings for a new investment opportunity, investors who have less information than managers will be signaled by either debt or equity issuance. If a decision of issuing equity was released, investors would feel the stock price is overvalued; therefore, leading to a drop in share price and damaging the value of firms.

Information asymmetry can cause the adverse selection which can be explained through "lemons" problem. This problem is proposed by Akerlof (1970). Suppose a situation that there are both good and bad opportunities for investment; due to investors cannot distinguish which ones are good or bad with less accurate information, they are possibly prone to take the worse opportunities while giving up the good ones according to the average level of products. As a result, the good ones are undervalued and abandoned. The paradigm, that there is significant adverse selection costs on investors is imposed by informed trading, is originated from Bagehot (1971). Brennan and Subrahmanyam (1995) empirically confirm that the estimated adverse selection cost of transacting per unit of order flow is negatively with the number of analysts following a security due to the enhanced competition between informed agents.

There are some solutions proposed for lemons problem by Healy and Palepu (2001). First, optimal contracts between investors and firm management are provided for disclosure of private information. Second, set regulation for managers to disclosure their private information. Finally, introduce information intermediaries, such as financial analysts and rating agencies, to uncover managers' superior information to investors. Such kind of problem can induce cost of capital. As noted by Barry and Brown (1984), if disclosure is imperfect and high information risk, investors bear risks in forecasting the future payoffs from their investment. Therefore, investors will demand an incremental return for bearing risks which increases the cost of equity issues. According to pecking order hypothesis, equity capital is the most information-sensitive security and has larger adverse selection cost than other securities. Thus, to avoid adverse selection cost when financing externally; debt capital, which has less adverse selection cost, is preferred.

As to the relation between adverse selection cost and firm's debt in terms of pecking order hypothesis, Bharath, et al. (2009) test the change in the relative severity of information asymmetry, i.e. the greater a firm's adverse selection cost, the greater the portion of its financing via debt in the current fiscal year. Because the small firms are typically thought to possess more asymmetric information and thus face more severe adverse selection problem than the large, the small firms[6] may perform better in pecking order hypothesis. However, from the perspective of riskiness and debt capacity, small firms which are more risky than the large firms may be forced to choose equity finance and perform worse in pecking order[7].

Information asymmetry can also induce moral hazard problem (Holmstrom, 1979) which is rooted in principal–agent problem. Due to information asymmetry, the quality

[6] When a small firm issues equity, the market value of the whole firm will be more misestimated due to more severe information asymmetry compared with larger firms. Therefore, small firms prefer debt finance to equity finance so that such firms should follow pecking order better than the large ones.

[7] This will be deeply discussed in the part 2.3.2 of debt capacity.

of financial products is indistinguishable for investors. Managers are prone to cheat or fail to make the necessary efforts, because they often fail to act in the best interest of the investors. For instance, managers can expropriate investors' funds through both issuance of debt and equity. Managers can finance through equity to acquire perquisites, pay excessive compensation, or make investment decisions that are harmful to the interests of outside investors, e.g. rejection of positive NPV projects. Through debt issuing, managers can issue more senior debt, such as a dividend or taking high risk projects, which makes the inadequate resources available in the event of financial distress. High risk investment increases the likelihood of a wealth transferring from debt holders to shareholders (Healy and Palepu, 2001).

Additionally, because the separation of ownership from management creates asymmetric information, agency problem should be considered. Agency problem arise on the premise that investors do not intend to play an active role in management; the relevant responsibilities are delegated to firm managers. It is easy for market to misprice the equity because of the less well-informed value of the firm's assets on the side of investors. Suppose another case that internal management is on behalf of the old shareholders' interests, when a firm needs to finance new projects by issuing equity, under-pricing is so severe that new investors capture more than the NPV of the new project, resulting in a loss to existing old shareholders. In this situation, the project which its NPV is positive will be rejected by the management (Harris and Raviv, 1991). As a result, the market value of the whole firm will be lowered.

2.3.2. Debt capacity

Under the pecking order hypothesis, firms which are unconstrained by concerns over debt capacity can be tested by Shyam-Sunder and Myers' (1999) original model without problems. However, for firms which are constrained by debt capacity, the original model has no power to explain. Here, we include additional variable the square of financing deficit, which is proposed by Lemmon and Zender (2008), to offset the disadvantage of the original model. Underlying the pecking order hypothesis, once

deficit exceeds too much from the debt capacity, the equity is issued and debt is reduced (i.e. the coefficient of the squared financing deficit should be negative).

Fazzari, Hubbard, and Petersen (1988) categorize the firms regarding the level of financial constraints and suggest that investment decisions are more sensitive to firm liquidity if firms with more financial constraints than those of less constrained firms. Also, financial constraints can affect the relationships between firms' riskiness and the types of external financing. If the pecking order hypothesis is correct, the most significant determinant of the type of external finance will be the riskiness of the firm (Helwege and Liang, 1996). Riskiness increases the need for sharing information which insiders are unwilling to release, and large firms with less riskiness are able to issue more straight debt which is less information-sensitive. The small firms are naturally thought to be more risky and there is more information compelled to share than large firms, according to the explanation, small firms may choose more equity finance and the pecking order hypothesis should be applying better for large firms rather than the small ones. This assumption has been evidenced by some studies, such as Frank and Goyal (2003), who find some aspects of pecking order behavior in large firms but not for the small firms in the US. When firms have restricted access to debt market, all else equal, more external financing via equity and less debt is issued.

Therefore, it is necessary to analyze the pecking order hypothesis with considering debt capacities. Debt capacity is defined by Han Kim (1978) as it can borrow no more regardless of how much more it promises to pay at the end of the period. However, the definition does not imply any implementation to measure debt capacity. Lemmon and Zender (2008) empirically measure debt capacity through the likelihood that a firm can access public debt markets (i.e. whether a firm has rated debt outstanding). In this paper, we introduce and test the hypothesis with the coefficient of squared financing deficit.

2.3.3. The empirical tests on pecking order hypothesis

A number of papers have supported the pecking order hypothesis. Mayer (1990)

examines the types of financing of eight countries during the period of 1970-85 and finds that retentions are the dominant source of financing and the most external financing comes from bank loans. Griner and Gordon (1995) use US data and provide evidence in favor of the pecking order hypothesis and managerial hypotheses. Jordan, Lowe and Taylor (1998) use models based on three capital structure measures on data from a sample of UK SME's and give a clear support for pecking order hypothesis.

However, some researchers empirically refuse the pecking order hypothesis. Shyam-Sunder and Myers (1999) develop the empirical specification of pecking order hypothesis and use the data from 1971 to 1989 on the Industrial Compustat files to test the pecking order hypothesis which is finally rejected. Frank and Goyal (2003) follow the Shyam-Sunder and Myers's (1999) approach but change financing deficit by excluding the current portion of the long-term debt to test the pecking order hypothesis, with the data on publicly traded American firms for 1971-98, they conclude that net equity issues track the financing deficit more closely than net debt. Helwege and Liang (1996) use the data of IPOs from 1983 to 1993 to test the pecking order hypothesis and find that there is no relation between the probability of obtaining external funds and the shortfall in internal funds, and that information asymmetry does not lead to debt issuance. Firms' financing patterns are not consistent with the pecking order hypothesis. Bolton and Dewatripont (2005) indicate that firms prefer to issue equity prior to debt even underlying Myers and Majluf (1984) framework.

For testing the pecking order hypothesis in the setting of UK, Beattie, Goodacre and Thomson (2006) use a comprehensive survey of corporate financing decision-making in UK firms contained in the UKQI list to suggest that the complexities and diversity of capital structure decision is hard to be captured by capital structure theories, it is more than simple associations between capital structure outcomes and firm-specific characteristics. In their study, 60% of responding firms are consistent with pecking order hypothesis.

Adedeji (1998) investigates the relationships among dividend payout ratio, financial

leverage, and investment underlying the pecking order hypothesis in the UK context. As a result, the negative interaction between dividend payout ratio and investment, the positive relation between dividend financial leverage and dividend, and investment has a positive influence on financial leverage are confirmed.

Michaelas, et al. (1999) investigate the UK small and medium size firms' capital structure for a period of ten years (1986-1995). They test the pecking order hypothesis with the assumptions that the small firms rely more heavily on retained profits and bank loans due to the costs to small firms of external equity may be higher than the larger firms and young firms finance more externally than older firms due to the less accumulated earnings. All these assumptions are supported by their findings that the positive coefficient of the growth variable and the negative relationship between profitability and gearing.

Other papers based on the UK data have also provided some evidences to support the pecking order hypothesis. Baskin (1989) uses only large public corporations span the years 1960-1972 and suggests that the pecking order hypothesis has more power in explaining corporate financing behavior than static optimal capital structure. Ozkan (2001) and Bevan and Danbolt (2002) as well confirm the profitability is negatively related to debt ratio in the UK firms respectively.

2.4. Other factors that affect capital structure

Much previous work has been provided evidences that firm size, industry classification and growth opportunities have impact on capital structure. To avoid these effects on our results, the two factors should be taken into account in the analysis.

Firm size (Size): A number of studies have suggested that the firm size has impact on debt ratios. Rajan and Zingales (1995) use the regression analysis on G-7 countries and confirm the positive relationship between size and leverage (except in Germany). Bevan and Danbolt (2002) also find that firm size (represented by logsales) is positive related to book gearing for the UK. Compared with small firms, large firms are more

diversified and have less probability to bankruptcy. The bankruptcy costs for large firms is far less than the small firms, therefore, large firms should be more leveraged. Just as we illustrated in figure 3, the small firms, which are more risky than the large ones, are prone to choose equity rather than bank debt and loans. However, from the perspective of information asymmetry and the cost of issuance, small firms are typically thought to pay more than large firms to issue equity due to their more asymmetric information. This suggests that small firms may be more leveraged than large firms. Titman and Wessels (1988) have confirmed the negative relationship between firm size and short-term debt ratios.

Industry classification (Industry): In the studies done by Schwarz and Aronson (1967) Scott (1972), they find that industry differences have impact on corporate debt ratio and there are strong intra-industry similarities relevant to leverage. Castanias (1983) tests and concludes that historical failure rates are the same across business lines and failure rates are related to leverage, which implies that different industry classifications have impact on debt ratios. However, some others empirically prove the insignificant relation between industry and debt ratio, such as R. Lee, A. Stonehill, R. Wright and T. Beekhuisen (1973). Therefore, we should consider the firm leverage is industry related in the study.

Growth opportunity (Growth): The pecking order hypothesis predicts that high-growth firms are likely to be high debt ratios because of the large financing needs and the reluctance to issue equity which will harm the shareholders' interests. However, Frank and Goyal (2003) empirically rejected the hypothesis that adverse selection is the driving force of information asymmetry between insiders and the market. They find that small firms and high-growth firms, which are thought to be subject to adverse selection problems, performs worse on pecking order than large firms when they are financed externally. To explain the contradictory result, agency problem are better introduced. Due to the tendency of equity-controlled firms to invest sub-optimally to expropriate interests from the bondholders and the agency problem is generally considered to be

more severe in growing firms, high-growth firms prefer using equity to financing via debt (Titman and Wessels, 1988). Myers (1977) suggests that firms with high debt ratios may have high risk (bankruptcy) in financing. When they face a valuable investment or a positive NPV investment opportunity which can increase the value of firms, due to the opportunities cannot be collateralized and without current income, these firms may pass up those opportunities. Also, the lenders are unwilling to see growth opportunities as collateral for debt because they concern about the fail to develop the opportunities if the borrower experience financial distress after they receive the loan (Ozkan, 2001). Just as Titman and Wessels (1988) indicate that growing firms incur higher agency costs. However, Bevan and Danbolt (2004) empirically show that growth opportunities have relatively little influence on leverage. Therefore, as the description above, growth opportunity should be considered to have impact on leverage.

2.5. UK institutional settings

2.5.1. UK governance mechanisms

According to the agency theory, managers may be incentive to take suboptimal leverage which cannot maximize shareholders' interests; and to what extent managers can take the suboptimal leverage is subject to the strength of corporate governance which is to mitigate agency risks. Therefore, it is necessary to review the corporate governance in UK's firms when considering the leverage.

There are mainly two governance models widely accepted, so-called shareholder-oriented and stakeholder-oriented models. Brounen et al. (2004) find the UK firms consider the shareholder's wealth as priority and the supplier of capital is much more important. Additionally, Georgen and Renneboog (1998) indicate that UK has the strict minority protection laws which are designed to protect outside minority shareholders from expropriation by management or major shareholders. Compared with American firms, although both of the two countries are relatively low concentration of ownership (both of them are common law countries which blockholders will need low level of ownership concentration due to the legal protection of minority shareholders),

the UK firms' ownership concentration is higher and institutional investors are key owners who are active in influencing managerial issues "behind the scenes". The fact that shareholders have a much larger influence in UK firms implies that there may be less agency conflicts in UK. As to the demands for narrative reporting, UK firms follow best-practice guidelines which has low expected regulatory and litigation costs (Aerts and Tarca, 2010). However, firms with best-practice guidelines will have less accountability pressures so it leads less detailed and relatively informal content in contrast to the mandatory requirements for reports. Therefore, it is reasonable to think the UK firms' reports are more self-serving which may cause more asymmetric information and conflicts between managers and investors.

The UK market provides blockholders an effective monitoring mechanism which allows financial institutions to build higher equity stakes and intervene more in corporate governance. Frank et al. (2001) argue that any equity issue which is more than 5% of share capital has to be in the form of a right issue so that to enhance the atomistic shareholders' ability to monitor managerial decision making. Also, the informal coalitions among blockholders in the private behind the scenes reduce the costs of monitoring and allow institutions to inhibit managerial excesses (Short and Keasey, 1999). Refer to the pension funds, unlike the US pension funds which are legally obliged to exercise their voting rights, Short and Keasey (1999) argue that the UK institutions prefer to exercise rights through private meeting with management and typically fail to exercise their voting rights. Therefore, although few barriers for institutions to monitor actions, institutions are not active in UK pension funds governance.

2.5.2. Accounting principles and financial policy in UK

As what Guenther and Young (2000) state, accounting earnings in common-law countries are more highly associated with timely economic activity than that in code-law countries due to the demands of accounting information from the side of

shareholders and creditors but not from the side of other stakeholders[8]. Common-law accounting, which is developed in the private sector by the accounting profession, does not give management any more latitude in smoothing reported accounting income. The origin of countries' legal system on which the UK is based is common-law, thus UK's financial accounting standards are to meet the market demand for accounting information. Additionally, because the legal rules in UK have strong shareholder protection, investors are willing to enter the equity market which may also be a factor to affect the level of leverage in UK. Regarding Guenther and Young's (2000) report, it shows that the UK and the US (common-law countries) have the lowest debt/asset ratios compare with the code-law countries.

In the light of Benston et al.'s (2006) discussion, although both UK and US follow the generally accepted accounting principles (GAAP), US accounting standards are more rules-based which there are comparable and verified rules that accountants can ask for. Whereas UK accounting standards are more principles-based with the inclusion of a true-and-fair override, it aims to prevent allowing or requiring accountants to follow rules literally but not intentionally and it makes the standards functional when the economic environment changes or innovative transactions are created by managers. To remedy any defect in the giving of a true and fair view, full information refer to departure from standards, reasons for it, and the effect is required. Regarding the practical experience, US firms have much worse outcome in producing misleading financial reports than UK firms (Benston et al., 2006).

According to the pecking order hypothesis, firms tend to use retained earnings preferentially and then raise debt. Therefore, the policy makers should provide an environment in which managers are encouraged and able to reserve sufficient retained profits for additional financing. However, the UK tax regime does not provide incentives to businesses for retaining profits and less tax allowances (Michaelas,

[8] Pereira Alves & Ferreira (2011), by using 25 countries sample worldwide, also confirm the negative relationship between shareholder rights protection and information asymmetry.

Chittenden, and Poutziouris, 1999), UK firms may retain less internal funds and maintain higher gearing compared to other profits-incentive tax regimes. What is more, tax considerations may affect reported accounting income due to it leads a preference of accelerated depreciation and rapid asset write-offs which make financial accounting fail to reflect the economic performance. In the UK, this problem is mitigated by the separation of financial accounting and tax accounting (Guenther and Young, 2000).

In order to find out which theory can better explain the real financing behavior in the UK setting, the relations between corporate debt ratios and financing deficit as well as the determinants of capital structure relevant to tradeoff theory should be investigated.

Authors	Data year	Sample	Relevant theories	Methodology	Results
Vanderwijst & Thurik (1993)	1955-1969 1973-1977 1949-1986	German retail trade	Modigliani-Miller theory Trade-off theory Principal-agent, information asymmetry	Least-Squares Dummy Variable (LSDV) and OLS regression analysis	Nondebt tax shields has no effects on financical struture, Industry and time can affect financial structure
Toy et al. (1974)	1966-1972	Manufacturing sectors in five industrialized countries	Optimal capital structure	OLS regression analysis	Growth rate, earinings rate & earinings risk are significant debt ratio determinants. Earinings risk is contrary to the optimal model
Titman & Wessels (1988)	1974-1982	U.S. manufacturing sector	Optimal capital structure	LISREL system developed by Joreskog & Sorbom (1981)	Debt ratios are negatively related to Uniqueness. Transcation costs is an important determinant whereas non-debt tax shields, volatility, collateral value, or future growth are not
Lemmon & Zender (2008)	1971-2001	Nonfinancial firms in the Center for Research in SecurityPrices & Compustat databases	Pecking order, Trade-off. Debt capacity	Logit regressions Pooled time-series & cross-sectional regressions	Pecking order hypothesis is proved Small, high-growth firms prefer equity finance
Bevan & Danbolt (2002)	1991	Nonfinancial firms in UK	Agency theory Trade-off theory	OLS regression analysis	Gearing is positively related with tangibility and logsales, and negatively related with market-to-book ratio and profitability
Ozkan (2001)	1984-1996	Nonfinancial firms in UK	Pecking order, Trade-off theory	OLS regression analysis Generalised Method of Moments (GMM)	Trade-off theory is supported Size has a limitedly effect on capital structure
Adedeji (1998)	1994-2000	Quoted companies in UK	Pecking order, Trade-off theory	OLS regression analysis	Both Trade-off theory and Pecking order hypothesis are supported and substantial explanatory power is added when they are combined
Shyam-Sunder & Myers (1999)	1971-1989	Nonfinancial firms on Industrial Compustat files	Pecking order, Trade-off theory	OLS regression analysis	Pecking order performs better than trade-off, both the theories are not rejected.
Frank & Goyal (2003)	1971-1998	Publicly traded firms in U.S	Pecking order theory	OLS regression analysis	Debt finance does not dominate equity finance Pecking order does not perform well

Table2. Summary of literatures. This table lists the 9 literatures on capital structure which are relatively important to this study.

3. Data source and methodology

During the 1990s, the nature of the credit market in the UK has changed significantly with large companies using less bank finance, whereas banks increasingly lending to smaller firms (Bevan & Danbolt, 2000). Small firms seem to be high in debt. However, some findings are contrary to the inferences, such as Fama and French (2002), who find small growth firms are the primary issuers of equity in UK. Since a sovereign debt crisis occurred from late 2009, the European economic area has been in difficult period. That is the same situation for the UK which is affected by the crisis and capital structure is becoming a crucial issue. Among the European countries, UK is one of the highest corporate tax rate countries. Before 2009, UK-resident companies are taxed on profit left that is earned overseas which is lack of incentives for UK firms to retain earnings. As to the legal systems, UK adopts common-law. Compare with civil-law for other European countries, such as France and Germany, common-law policy represents a market-based system and UK firms consider the shareholder's wealth as priority. These characteristics are able to affect UK firms' capital structure. In this part, by using OLS regression analysis, several models are created to test which theory can better explain UK firms' capital structure.

3.1. Research questions

The main research question which arises from the purpose of our study is that: ***Which theory can better explain the UK non-financial firms' capital structure, the pecking order hypothesis or the static tradeoff theory?***

In order to answer the research question, both the pecking order hypothesis and the static tradeoff theory should be reviewed. Additionally, the UK institutional settings are seen as crucial context for analysis as well. Then the sub-questions below should firstly be considered.

1. *Which and to what extent the determinant factors predicted by tradeoff theory can explain the debt ratio level in UK firms?*

2. *To what extend the pecking order hypothesis can explain the relationship between debt ratio and financial deficit?*

3.2. Data source

The annual reports, which include the financial data of non-financial firms in the UK, are extracted in both COMPUSTAT GLOBAL and ORBIS[9] database within each fiscal year between 2005 and 2011. For some financial data, which is unavailable in the two databases, is retrieved via the annual reports of each firm. After extracting the list of firms, the following criteria should be conformed: listed companies' headquarters must be located in the UK, financial firms are excluded. Firm-years with missing values for financing deficit and debt/equity issues are also excluded. As to the reason of excluding financial firms from the sample, such as banks and insurance companies, financial firms' operations are very different and they are substantially affected by government regulation (Rajan and Zingales, 1995). Especially for missing value of market capitalization, we calculate them by using the common share outstanding to multiply the ordinary share price at the end of the current data date. Eventually, 98 UK listed non-financial firms and 588 observations during the period from 2006~2011 are selected in the study.

In table 3, panel A summarizes the sample statistics of the variables which are used in the thesis. The mean value of long-term debt in the sample is €2053 million. Panel B and panel C summarize the firms with a positive internal funding deficit and firms with negative deficit respectively. Surprisingly, the leverage of firms with positive financing deficit (Debt/TA=.1694) is lower than firms without deficit, i.e. the deficit is negative (Debt/TA=.1854). This result is contrary to the prediction of pecking order hypothesis which supposes that the firms will use internal funds preferentially and then the debt to fill the financing deficit. According to the prediction, the leverage of firms with positive deficit should be higher than firms without deficit.

[9] Long-term Debt, Total Liability, Cash Dividends, EBIT, Capital Expenditures, Operating Income, Working Capital and Total Assets are mostly extracted from COMPUSTAT GLOBAL. Fixed Assets, Depreciation Expense, Market cap, Increase in investments, Net operating cash flow are mostly available in ORBIS.

	Mean	Median	Std.dev.	Min	Max	No.ob.
Panel A. All firms						
LongTermDebt	2052.57	256.45	4399.368	0	28632	588
Debt/TA	.1795	.1576	.15425	0	.78	588
DebtChange/TA	.0069	0	.08362	-.37	.39	588
Deficit	-237.389	-16.717	2112.3895	-19300.02	16456.08	588
Deficit/TA	-.0292	-.0335	.32429	-3.46	4.45	588
$Deficit^2/TA$	223.2606	8.4099	1418.3482	0	29283.14	588
AdjustDeficit/TA	.0568	0	.2267	0	4.45	588
Growth	1.7296	1.4200	1.6072	.20	26.10	588
Nondebt	.0332	.02	.06435	.00	.84	588
Profit	.0832	.0800	.1289	-1.27	.39	588
Tangibility	.6433	.6200	.5013	0	6.21	588
Volatility	.8734	.22	3.3142	.01	32.90	588
Size	7.2595	7.5490	2.3826	-1.33	12.32	588
Industry	.3265	0	.4693	0	1	588
Panel B. Firms deficit > 0						
LongTermDebt	2084.97	246.70	4247.764	0	21969	218
Debt/TA	.1694	.1415	.1569	0	.66	218
DebtChange/TA	.0098	0	.08922	-.37	.39	218
Deficit	769.958	131	1926.1081	.02	16456.08	218
Deficit/TA	.1542	.0622	.3532	0	4.45	218
$Deficit^2/TA$	224.4836	7.5942	2000.7707	0	29283.14	218
AdjustDeficit/TA	.1540	.0622	.3530	0	4.45	218
Growth	1.7552	1.3400	2.3064	.20	26.10	218
Nondebt	.0278	.0300	.02024	.00	.11	218
Profit	.0598	.0700	.1289	-1.27	.38	218
Tangibility	.6025	.6400	.2410	0	1.18	218
Volatility	.7638	.21	3.0124	.01	32.90	218
Size	7.1564	7.5459	2.5709	1.81	12.32	218
Industry	.3041	0	.4611	0	1	218
Panel C. Firms deficit ≤ 0						
LongTermDebt	2033.61	293.10	4491.223	0	28632	370
Debt/TA	.1854	.1635	.1526	0	.78	370
DebtChage/TA	.0052	0	.08021	-.34	.36	370
Deficit	-826.592	-126.9	1992.5344	-19300.02	0	370
Deficit/TA	-.1365	-.0775	.2505	-3.46	.01	370
$Deficit^2/TA$	216.6962	8.5555	924.3924	0	8765.23	370
AdjustDeficit/TA	0	0	0	0	0	370
Growth	1.7146	1.4800	0.9958	.40	8.62	370
Nondebt	-.0363	.0200	.07949	.00	.84	370
Profit	.0968	.0800	.0863	-.81	.39	370
Tangibility	.6671	.6100	.6027	0	6.21	370
Volatility	.9376	.22	3.4809	.01	32.82	370
Size	7.3198	7.5520	2.2667	-1.33	11.96	370
Industry	.3396	0	.4742	0	1	370

Table 3. Summary statistics of variables included in regression analysis. Panel A includes all the listed

non-financial firms in UK over 2006-2011. Panel B only includes UK firms with financing deficit ($DIV + I + \Delta W - C > 0$). Panel C only includes UK firms without financing deficit ($DIV + I + \Delta W - C \leq 0$). In the table, two dependent variables, the long-term debt ratio (Debt/TA) and the change of long-term debt ratio (DebtChange/TA) are scaled by total assets (TA) respectively. Financing deficit (Deficit), the square of financing deficit ($Deficit^2$) and the adjusted financing deficit (AdjustDeficit) are scaled by total assets (TA) to test the pecking order hypothesis. Non-debt tax shields (Nondebt), profitability (Profit), tangibility of assets (Tangibility) and volatility (Volatility) are used to test the tradeoff theory. Growth opportunities (Growth), firm size (Size) and industry classification (Industry) are control variables.

3.3. Hypotheses

The following hypotheses derived from the literatures will be ultimately examined by our regression models:

H1. Debt ratio is negative with non-debt tax-shields according to tradeoff theory

H2. Debt ratio is positive with profitability according to tradeoff theory.

H3. Debt ratio is positive with tangibility according to tradeoff theory.

H4. Debt ratio is negative with volatility according to tradeoff theory.

H5. The coefficient of financing deficit should close to 1, the coefficient of the square of financing deficit should be negative in the pecking order model.

3.4. Variables

Independent variable for testing pecking order hypothesis:

Financing deficit: by definition, the financing deficit is equal to the sum of net debt and equity issues. The decomposed variables of financing deficit includes cash dividend payments for share capital, net investment, change in working capital, and cash flow after interest and taxes ($DEF = DIV + I + \Delta W - C$)[10].

Independent variables for testing tradeoff theory:

Through the review of previous studies on the determinants of leverage according to the tradeoff theory in part 2.2.2, the following independent variables in table 4 are used to test the tradeoff theory.

[10] The definition of the variables is illustrated in table 5.

Variables	Definition
Non-debt tax-shields (*Nondebt*)	Annual depreciation expense/Total assets (Titman & Wessels, 1988)
Profitability (*Profit*)	EBIT/Total assets (Fama & French, 2002)
Tangibility of assets (*Tangibility*)	Fixed assets/Total assets
Volatility (*Volatility*)	Standard deviation of the percentage change in operating income over pass 3 fiscal years (Titman & Wessels, 1988)

Table 4. The independent variables to test tradeoff theory. All the variables are lagged for 1 year to reduce the endogeneity problem.

Dependent variables:

Debt ratio: the amount of long-term debt due after the current year scaled by the book value of total assets in current year. Debt Ratio = Long-term Debt/BV of Total Assets

The change of debt ratio: the difference between the current long-term debt and the long-term debt in previous one year scaled by the book value of total assets in current year. The Change of Debt Ratio in $year_t$ = (Long-term Debt in $year_t$—Long-term Debt in $year_{t-1}$)/BV of Total Assets in $year_t$

Control variables:

To avoid the interaction between debt ratio and other gearing factors which may weaken the validity of the research; the following three control variables are included in our regression model.

Firm size (Size): According to Rajan and Zingales (1995), firm size is positively related to gearing in the UK. This may because of larger firms tend to be high debt capacity and size may be a negative proxy for the probability of bankruptcy. In this study, the proxy for size is the natural logarithm of total assets. By using the natural logarithm of total assets, it can make the distribution more symmetric.

Industry classification (Industry): A number of prior studies have documented

evidences of industry differences have impact on debt ratios. Schwartz and Aronson (1967) show the strong industry effects in debt ratios and Titman and Wessels (1988) also state that firms manufacturing machines and equipment should be financed with less debt due to the cost liquidation of specialized servicing and spare parts. Thus, to avoid the industry effects in leverage, we classify firms to different industry groups and assign a unique dummy variable to each industry group from 0 to 1 in the study[11].

Growth opportunity (Growth): Although Bevan and Danbolt (2004) indicate there is little influence for growth opportunities. Some studies show that growth opportunities have impact on leverage, for example. Titman and Wessels (1988) indicate that growth opportunities have negative impact on leverage. In this study, we use market-to-book ratio as a indicator of growth opportunities, that is the ratio of book value of total assets less book value of equity[12] and plus market value of capitalization, to book value of total assets.

Debt ratio	Total long-term debt/ Book value of total assets
Change of debt ratio in $year_t$	(Long-term debt in $year_t$－Long-term debt in $year_{t-1}$)/BV of total assets in $year_t$
Deficit	Cash dividends (*DIV*) +Net investment (*I*)＋Change in working capital (ΔW)－Net operating cash flow (*C*) (Frank and Goyal, 2003)
$Deficit^2$	The square of deficit (i.e. Deficit×Deficit)
Adjusted Deficit	Equals to Deficit if $DIV+I+\Delta W > C$, otherwise, equals to 0
Non-debt tax shields (*Nondebt*)	Annual depreciation expense/Book value of total assets (Titman and Wessels, 1988)
Profitability (*Profit*)	EBIT/ Book value of total assets
Tangibility of assets (*Tangibility*)	Fixed assets/ Book value of total assets

[11] A dummy variable 1 is for firms with SIC codes between 2000 and 4000 (manufacturing sectors) and 0 otherwise.

[12] Book value of equity = Book value of total assets – Total liability

Volatility	Standard deviation of the percentage change in operating income[13] over pass 3 fiscal years
Growth opportunity (*Growth*)	(Book value of total assets－Book value of equity＋Market capitalization)/Book value of total assets
Size	The natural logarithm of book value of total assets
Industry	Dummy variable 1 for manufacturing and 0 for non-manufacturing industry groups respectively

Table 5. Definition of variables. Debt ratio and Change of debt ratio are dependent variables. Deficit, Deficit^2 and Adjusted Deficit are independent variables to test pecking order hypothesis. Non-debt tax shields, Profitability, Tangibility of assets and Volatility are dependent variables to test tradeoff theory. Size, Industry and Growth opportunity are control variables.

3.5. Correlation and regression analysis

The pecking order model is proposed by Shyam-Sunder and Myers (1999), it says that when firms need to finance, the internal cash is prior, followed by debt ratio. Equity is never issued except when there are high costs of financial distress and only junk debt. To be different from Shyam-Sunder and Myers's test, here we include an additional variable, which is the square of the financing deficit which is created by Lemmon and Zender (2008). a is the constant, b_{po} is the coefficient of financing deficit, c is the coefficient of squared financing deficit, and ε_{it} is the residual for observation i. All the explanatory variables to test the tradeoff theory are lagged one year to reduce the problem associated with endogeneity. When estimating the pecking order equation, both the right-hand side and the left-hand side are scaled by the same total book assets. By this scaling, the effect of differences in firm size is mitigated. The modified pecking order model with the determinants of debt ratios [E1] is showed below:

$$\Delta D_{it}/TA = a + b_{po}DEF_{it}/TA + cDEF_{it}^2/TA + b_1 Nondebt_{it-1} + b \quad Profit_{it-1} +$$

[13] Operating income data from 2002 is needed to calculate the percentage change in operating income in year 2003 which is just the past 3 years away from year 2005. So that the standard deviation in year 2005 can be calculated as a proxy for the volatility, which should be lagged 1 year to estimate the equation.

$b \;\; Tangibility_{it-1} + b_4 Volatility_{it-1} + b_5 Size_{it} + b_6 Industry_i + b_7 Growth_{it-1} + \varepsilon_{it}$ [E1] where $DEF_{it} = DIV_{it} + I_{it} + \Delta W_{it} - C_{it}$ [E2]

To observe the effect of the presence of negative deficit in the sample, the adjusted financing deficit should be used to replace the raw financing deficit in the regression. The adjusted financing deficit is represented by the following equation.

$$Adjusted\ DEF_{it} = \begin{cases} DIV_{it} + I_{it} + \Delta W_{it} - C_{it} & \text{if } DIV_{it} + I_{it} + \Delta W_{it} > C_{it} \\ 0 & \text{otherwise} \end{cases} \quad \text{[E3]}$$

The notions are defined as follows:

ΔD_{it} = the amount of long-term debt due after the current year *t*;

DEF_{it} = the funds flow deficit for firm *i* in year *t*;

DIV_t = cash dividend payments for share capital in year *t*;

I_t[14] = net investment in year *t*;

ΔW_t[15] = change in working capital in year *t*;

C_t = operating cash flow after interest and taxes in year *t*.

According to Shyam-Sunder and Myers' (1999) original model (without the variable of squared financing deficit), if there is a pecking order, the constant should be zero (a=0) and the coefficient of financing deficit b_{po} should close to 1. The modified pecking order model predicts that the coefficient of squared financing deficit *c* is negative and significant, because once debt ratio are beyond the debt capacity, the equity is assumed to be a substitute and thus the relationship between the change in debt issue and financing deficit is negative along with paying off debt.

The ordinary least squares (OLS) test will be applied in both the original pecking order model with the determinants of debt ratios and the modified model which includes the variable squared financing deficit.

[14] Net investment in $year_t$ = Capital expenditures in $year_t$ + Increase in investments in $year_t$

[15] Change in working capital in $year_t$ = Working capital in $year_t$ − Working capital in $year_{t-1}$

Before doing the regression analysis, P-P plot shows that the observed line is almost following the straight line which is described by the expected normal value. Also, the standardized residuals cluster around the vertical axis of 0. That means the sample residuals are nearly normal distribution (see figure 3). To detect whether there are interactions among independent variables, test for multicollinearity should be taken. The results of collinearity test are shown in Appendix A, the VIF index indicates that there is no multicollinearity problem (all VIFs are much smaller than 10).

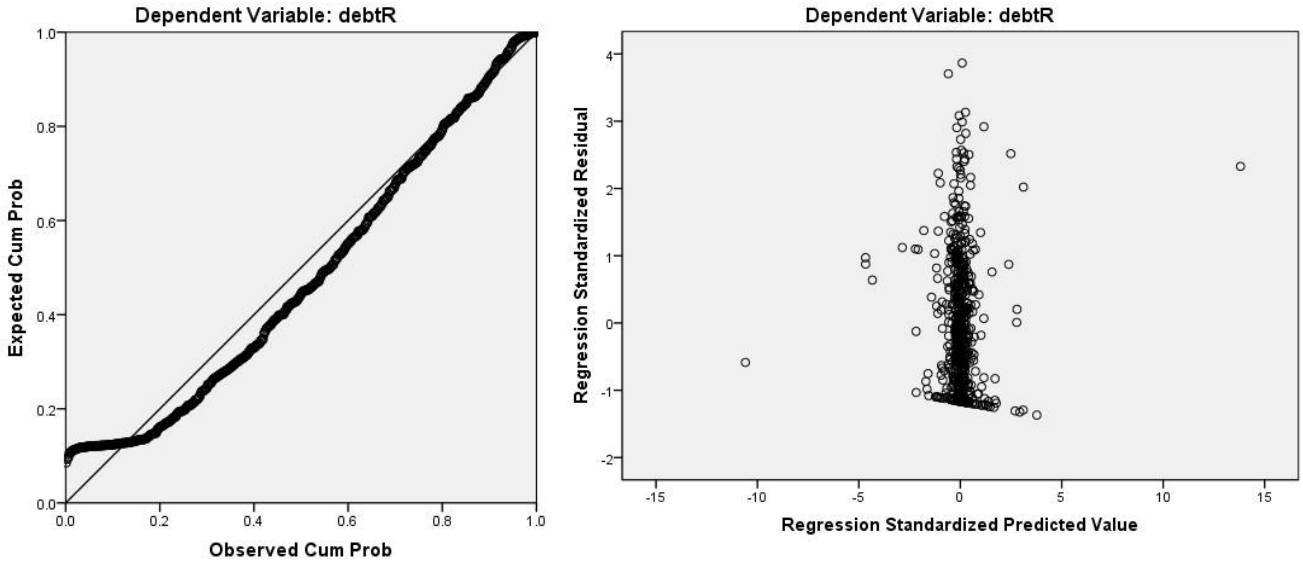

Figure 3. The P-P plot and scatter plot for standardized normal distribution check. If the observed line (constituted by probability dots) is keeping with the expected line in the P-P plot, it is thought to be normal distributed. If the standardized residuals cluster around the vertical axis of 0 in the regression standardized residuals plot, it is believed the standardized residuals are almost normal distributed.

4. Empirical results and discussion

4.1. Results from correlations

Table 6 shows that the correlations of all variables included in regression model. The square of financing deficit is significantly correlated with long-term debt ratio (corr=0.158, p<0.01), but the relationship is positive which is contrary to the prediction of pecking order hypothesis. Both raw financing deficit and adjusted financing deficit are not strongly correlated with debt ratio, but there is a significantly negative relationship between the change of long-term debt ratio and adjusted financing deficit (corr=-.114, p<0.01). Without surprise, volatility (corr=-.144, p<0.01) is negative with debt ratio and the relationship are significant. Also, profitability (corr=0.2, p<0.01) and tangibility (corr=0.288, p<0.01) are positive with debt ratio. These significant results are corresponding with the prediction of tradeoff theory. Besides, firm size is positive with the debt ratio (corr=0.287, p<0.01) but growth opportunity and industry classification have no significant impact on debt ratio according the diagnosis.

Table 6. Correlations of all variables

	Debt/TA	DebtChange/TA	Deficit/TA	$Deficit^2/TA$	AdjustDeficit/TA	GROWTH	NonDEBT	PROFIT	TANGIBILITY	VOLATILITY	IND	SIZE
Debt/TA	1											
DebtChange/TA	.161**	1										
Deficit/TA	.054	-.118**	1									
$Deficit^2/TA$	.158**	.025	.333**	1								
AdjustDeficit/TA	.072	-.114**	.766**	.690**	1							
GROWTH	-.002	.115**	.002	.109**	.152**	1						
NonDEBT	.157**	.043	-.316**	.327**	-.041	.209**	1					
PROFIT	.200**	.097*	-.204**	.034	-.249**	-.142**	.068	1				
TANGIBILITY	.288**	.034	-.287**	.287**	-.067	.134**	.871**	.078	1			
VOLATILITY	-.144**	-.011	-.031	-.024	-.027	-.037	-.050	-.054	-.053	1		
IND	-.074	.052	-.024	-.012	-.029	.079	-.078	.010	-.091*	-.038	1	
SIZE	.287**	.048	.011	.107**	-.090*	-.081	.104*	.283**	.178**	-.171**	.119**	1

** Correlation is significant at the 1% level (2-tailed).
* Correlation is significant at the 5% level (2-tailed).

As to the correlations among the independent variables, profitability (corr=-0.249, $p<0.01$) and firm size (corr=-0.9, $p<0.05$) have negative impact on adjusted financing deficit. The relationship between non-debt tax shields and raw financing deficit are negative (corr=-0.316, $p<0.01$), profitability (corr=-0.204, $p<0.01$) and tangibility (corr=-0.287, $p<0.01$) are negatively correlated with raw financing deficit as well. However, both non-debt tax shields (corr=0.327, $p<0.01$) and tangibility (corr=0.287, $p<0.01$) are positive with the square of financing deficit. Besides, Non-debt tax shields is positive with tangibility (corr=0.871, $p<0.01$).

4.2. Results from multivariate regression

Table 7 shows the summary of regression analysis results for each model. Model 1 includes the control variables only, i.e. firm size, industry classification and growth opportunities, to see whether the control variables have impact on capital structure. Model 2 contains control variables and the raw financing deficit. To more accurately simulate the realistic pecking order behavior, the square of raw financing deficit is added in Model 3. In model 4, the raw financing deficit is replaced by the adjusted financing deficit so that to test the pecking order hypothesis more intensively. Model 5 includes the control variables and the independent variables of tradeoff theory to test the prediction from the theory. Model 6 consists of the control variables, the raw and the square of raw financing deficit as well as the independent variables of tradeoff theory. Model 7 is similar to Model 6 but replacing the raw and the square of raw financing deficit with the adjusted financing deficit. Both Model 6 and Model 7 are to test if all independent variables affect debt ratio as a whole. The change of long-term debt ratio is used as a dependent variable to replace the long-term debt ratio in Model 2”, Model 3” and Model 4”.

	Model 1	Model 2	Model 2"	Model 3	Model 3"	Model 4	Model 4"	Model 5	Model 6	Model 7
Constant	0.44* (2.073)	0.045* (2.116)	-0.02 (-1.726)	0.05** (2.368)	-0.019 (-1.617)	0.039 (1.84)	-0.016 (-1.31)	0.006 (0.265)	0.009 (0.423)	-0.003 (-0.156)
Growth	0.003 (0.804)	0.003 (0.798)	0.006** (2.851)	0.002 (0.43)	0.006** (2.675)	0.002 (0.45)	0.007*** (3.274)	0.004 (0.988)	0.003 (0.784)	0.002 (0.511)
Industry	-0.37** (-2.832)	-0.037** (-2.801)	0.006 (0.802)	-0.036** (-2.733)	0.006 (0.838)	-0.036** (-2.767)	0.006 (0.778)	-0.027* (-2.199)	-0.025* (-2.002)	-0.025* (-2.05)
Size	0.02*** (7.619)	0.02*** (7.604)	0.002 (1.337)	0.019*** (7.239)	0.002 (1.179)	0.02*** (7.801)	0.002 (1.061)	0.012*** (4.641)	0.011*** (4.233)	0.012*** (4.703)
Deficit/TA		0.023 (1.23)	-0.03** (-2.887)	0.04 (0.199)	-0.035** (-3.127)				0.053* (2.445)	
$Deficit^2/TA$				1.322E-5** (2.892)	3.13E-6 (1.212)				5.057E-6 (1.033)	
AdjustedDeficit/TA						0.064* (2.352)	-0.48** (-3.148)			0.098*** (3.75)
Nondebt								-0.876*** (-4.714)	-0.84*** (-4.367)	-0.883*** (4.807)
Profit								0.156*** (3.338)	0.184*** (3.858)	0.195*** (4.113)
Tangibility								0.168*** (7.047)	0.171*** (7.222)	0.172*** (7.291)
Volatility								-0.004* (-2.545)	-0.004* (-2.452)	-0.004* (-2.417)
R^2	0.095	0.098	0.032	0.111	0.034	0.104	0.034	0.2	0.217	0.219
Adjusted R^2	0.091	0.092	0.025	0.103	0.026	0.098	0.028	0.19	0.205	0.208
N	588	588	588	588	588	588	588	588	588	588

***Correlation is significant at the 0.1% level (2-tailed).
**Correlation is significant at the 1% level (2-tailed).
*Correlation is significant at the 5% level (2-tailed).

Table 7. Coefficients of OLS models. This table reports the multivariate regression results of the 7 models are used to test the pecking order hypothesis and the tradeoff theory in this study. Model 1 only includes control variables to see if firm size and industry classification influence debt ratio. Model 2 is to test the pecking order hypothesis with the raw financing deficit. Model 3 adds the square of raw financing deficit to simulate the realistic pecking order behavior more accurately. Model 4 replaces the raw financing deficit with the adjusted deficit to test pecking order hypothesis. Model 5 is to test whether the factors of tradeoff theory affect debt ratio. Model 6 and 7 includes all independent variables to test the effects as a whole with the raw or adjusted financing deficit respectively. Model 2", 3" and 4" use the ratio of change of long-term debt as a dependent variable instead of long-term debt. T values are recorded in parentheses.

From the table, except for Model 2", 3" and 4", it implies that both industry classification ($p<0.01$ in model 1~4 and $P<0.05$ in the last 3) and firm size ($p<0.001$) have significant impact on firm's capital structure. In model 2 and model 3, the coefficients of raw financing deficit are not significant, so the coefficients are meaningless. When the square of raw financing deficit is added in model 3, it has

significantly positive influence on debt ratio ($p<0.01$). Model 4 and model 7 indicate that adjusted financing deficit is positively related to debt ratio ($p<0.05$ and $p<0.001$ respectively). When replaced the dependent variable with the change of long-term debt ratio, the relationship between the change of long-term debt ratio and raw financing deficit is becoming significant ($p<0.01$) in Model 2" and 3". However, the coefficients of raw financing deficit are negative which is contrary to the pecking order hypothesis. The negative relation between the change of long-term debt ratio and adjusted financing deficit is observed in Model 4" as well. Obviously, all the coefficients of financing deficit are much smaller than 1, the pecking order hypothesis performs poor in regression models.

As to the coefficients of variables of tradeoff theory, profitability and tangibility are positive related to debt ratio and all of the three factors are significant ($p<0.001$). Nevertheless, volatility and non-debt tax shields have significantly negative impact on debt ratio ($p<0.001$ for non-debt tax shields and $p<0.05$ for volatility). When all the independent variables are included in model 6 and model 7, the relationships between variables of tradeoff theory and debt ratio stay the same. As a result, non-debt tax shields, profitability and tangibility are important factors of tradeoff theory.

The R^2 is increasing with the sequence of models. When the control variables are involved only, 9.4% of the variance can be explained by the model ($R^2=0.094$). Model 3 and model 4, which include the raw financing deficit and the adjusted financing deficit, have similar power to explain the variance ($R^2\approx0.1$). Model 5 occupies more proportion of explaining the variance ($R^2=0.2$). When all the variables are included in model 6 and model 7, the R^2 performs better ($R^2=0.217$ and $R^2=0.219$ respectively).

4.3 Discussion of the results

From the results generated in the previous parts, it seems that firm size and industry classification do have impact on UK firms gearing. The results are consistent with the findings provided by Titman and Wessels (1988), manufacturing sectors have less debt

finance compared to other industries. Firm size has positive influence on debt ratio, that implies larger firms in UK have less riskiness to choose debt and this result is corresponding with the model of riskiness and the choice of external finance (see Figure 2). However, the results cannot support the prediction of pecking order hypothesis. The coefficients of raw financing deficit are far smaller than 1. What is more, the P value is not significant except for Model 6 and models with the change of long-term debt ratio as the dependent variable. Although the coefficients of raw financing deficit in Model 2" and 3" are significant, they are negative which is inconsistent with the pecking order hypothesis. The coefficients of the square of raw financing deficit is also failed to confirm the prediction, which are supposed to be negative according to pecking order hypothesis. Although the result indicates the significantly positive relationship between adjusted deficit and debt ratio in Model 4, the model still does not fit pecking order hypothesis well and the coefficient is far from 1 (beta=0.064, $p<0.05$). Above all, pecking order hypothesis cannot be verified. It implies that debt is not the preferred choice for external financing in UK firms; equity occupies much more proportion in UK firms' capital structure. Attracting attention, when applying the change of long-term debt ratio as the dependent variable in Model 2", 3" and 4", the negative sign of raw and adjusted financing deficit implies that there is no financing hierarchy for UK firms as predicted by pecking order hypothesis, but UK firms may be moving toward a leverage target instead.

Under the tradeoff theory, the results give positive relationships between debt ratio and profitability or tangibility. As well non-debt tax shields and volatility are negative related to debt ratio. This is in keeping with the prediction of tradeoff theory, so that hypothesis 1, 2, 3 and 4 are confirmed. Compared with the models of testing pecking order hypothesis, tradeoff theory performs much better than pecking order hypothesis when looking at whatever R^2 or beta.

By integrating all independent variables of pecking order hypothesis and tradeoff theory in model 6 and 7, the R^2 increases. That means all the variables as a whole can better

explain the variance and more accurately to simulate the reality. However, the R^2 of model 6 and 7 is increased only about 2% when compared with model 5. But there is more than 10% improvement for the R^2 in model 6 and 7 when compared with model 3 and 4. Therefore, the factors of tradeoff theory have much more contribution on the R^2 increasing than the factors of pecking order hypothesis. The raw financing deficit is significantly positive with debt ratio, but the coefficient is still inconsistent with the pecking order hypothesis. In model 6 and 7, the variables of tradeoff theory are still significant related to debt ratio except growth opportunities.

As a result, tradeoff theory performs much better than pecking order hypothesis, and debt ratio is significantly influenced by non-debt shields, profitability, tangibility and volatility. To explain the disappointing results of pecking order hypothesis, UK firms may face less information asymmetry problem due to the effective monitoring mechanism and shareholder-oriented governance in UK. The cost for issuing equity is less than the stakeholder-oriented settings and this motivates investors to enter the equity market. Because the advantage of without bankruptcy and financial distress increasing by equity issue, UK firms may rationally choose equity when external financing is needed. Also, it seems plausible that non-debt tax shields can offset tax-shields interests and UK firms which are profitable and possess more tangible assets are more willing to choose debt due to tax-shields benefit and less financial distress. UK firms with high volatility are prone to pass up investments to reduce the financial distress. From the negative sign when regressed with the change of long-term debt ratio, UK firms seems to finance without a hierarchy but the negative sign can be explained by a target debt ratio.

5. Conclusion

The results of this study are consistent with the findings proposed by Frank and Goyal (2003), whereas this study fails to support the opinion of Shyam-Sunder and Myers (1999) who suggest that pecking order model has greater explanatory power than static

tradeoff theory. Specifically, three models, which are based on Shyam-Sunder and Myers's test, are created particularly to test pecking order hypothesis. None of the models show that there are predicted relationships between debt ratio and financing deficit. To contrast, the tradeoff theory seems to be proved in UK firms. Non-debt tax shields, profitability, tangibility and volatility are significant related to debt ratio; and the results are corresponding with the prediction of tradeoff theory. Specifically, debt ratio is negative with non-debt tax-shields and volatility but positive with profitability and tangibility of assets. As a result, the main research question can be answered. The tradeoff theory definitely has more explanatory power than pecking order hypothesis under UK setting. The reasons of the different findings in this study compared with Shyam-Sunder and Myers's (1999) may relate to the UK institutional settings, it is plausible that UK firms are prone to issue equity when external financing is necessary.

Without doubt, several limitations to the study exist. First, in this study, OLS model is applied to test both pecking order hypothesis and tradeoff theory. Although several models are established to run the test, other analytical methods are proper to be used for further investigation. Second, this thesis is a cross-sectional study, to simulate the moving toward an optimum more accurately, new models of tradeoff theory are better to be created and tested in a longitudinal study. For example, the negative relation between the change of debt ratio and financing deficit implies there may be a target debt ratio, to verify that, a substitutable model should be applied to test extensively. Finally, besides pecking order hypothesis and tradeoff theory, other capital structure theories, such as market timing hypothesis, may have better explanatory power for UK firms' financing behavior. In the future study, those theories are also better to be tested.

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Appendix A: Multicollinearity check for independent variables

Multicollinearity check for independent variables under regression model includes raw financing deficit.

Collinearity Diagnostics (Dependent Variable: Debt/TA)

Variable	VIF	Tolerance	Sig.
Deficit/TA	1.562	.640	.015
$Deficit^2/TA$	1.496	.668	.303
Industry	1.048	.954	.045
Size	1.203	.831	.000
Growth	1.104	.906	.433
Nondebt	4.751	.211	.000
Profitability	1.176	.850	.000
Tangibility	4.348	.230	.000
Volatility	1.037	.964	.015
Mean VIF	1.969		

	Eigenvalue	Condition Index
1	4.568	1.000
2	1.336	1.849
3	1.156	1.988
4	.940	2.205
5	.720	2.518
6	.561	2.854
7	.361	3.556
8	.258	4.209
9	.058	8.854
10	.041	10.595
Condition Number		10.595

Multicollinearity check for independent variables under regression model includes adjusted financing deficit.

Collinearity Diagnostics (Dependent Variable: Debt/TA)

Variable	VIF	Tolerance	Sig.
Adjusted Deficit/TA	1.091	.916	.000
Industry	1.043	.959	.040
Size	1.186	.843	.000
Growth	1.119	.894	.609
Nondebt	4.359	.229	.000
Profitability	1.166	.858	.000
Tangibility	4.350	.230	.000
Volatility	1.036	.966	.016
Mean VIF	1.919		

	Eigenvalue	Condition Index
1	4.505	1.000
2	1.101	2.023
3	1.000	2.123
4	.915	2.219
5	.630	2.674
6	.440	3.199
7	.310	3.556
8	.059	8.765
9	.041	10.519
Condition Number		10.519

The VIF index and tolerance can be used as indicators of multicollinearity. Normally, if the tolerance is below 0.1 or the VIF is larger than 10, it is believed that there is multicollinearity problem (Wooldridge, 2009). All the indicators above show that there is no multicollinearity among independent variables.