# Corporate Tax Management Behaviours during Initial Public Offerings Process: Evidence from UK IPOs


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By

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# Abstract

This study investigates tax management behaviours of companies listed on London Stock Exchange by IPOs during 2004 to 2018. It is found that in the IPO process corporate tax management behaviours have significant change, companies consider tax structure in the process of going public. There is evidence that with additional scrutiny prior to IPO companies settle outstanding or disputed tax liabilities with the relevant tax administration. In addition, with enhanced scrutiny in the IPO year and the second year after going public companies have higher tax charge. There is also evidence that in the year immediately prior to IPO and the year immediately after IPO companies engage in more tax management to reduce tax charge. In the year of going public companies defer a higher amount of tax liabilities to the future.

The further analysis finds that corporate tax management behaviours are different between pre and post 2008 Banking Crisis, Main Market and Alternative Investment Market (AIM). In addition, corporate tax management behaviours during the IPO process vary by auditor change. The finding is robust to currency transition, proxy of tax loss carry-forwards and inclusion of company year ends with tax credits.

The study contributes to the literature on tax management and management behaviours in IPO process. The innovation of methodology is using effective tax rate (ETR) after standardised by statutory tax rate to measure tax management. The findings call for increased effort of the government and tax authorities on tax collection for IPO companies and enhanced scrutiny on IPO companies from market regulators, suggest market investors consider tax risks in evaluating firm value. It provides the evidence that investing in Main Market is less risky than AIM. The information of auditor change is useful in tax management identification.

**Keywords**: Tax management; Initial public offering; Ownership structure; Tax risks;

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[1] The first number is the chapter, the second number is the table.

# List of figures[2]



[2] The first number is the chapter, the second number is the table.

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# Preface

The study has been presented in the following workshops and conferences:

1. “More aggressive, more conservative or passive? Corporate tax management behaviours in UK IPOs”, *British Accounting & Finance Association (BAFA) Annual Conference 2021*, Online, 09 April 2021.

2. “Changing ownership and corporate tax management behaviours: Evidence from UK IPOs”, *Tax Research Network Conference 2019*, Preston, UK, 09 September 2019.

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4. “Changing ownership and corporate tax management behaviours: Evidence from UK IPOs”, *Cardiff Accounting and Finance PhD symposium*, Cardiff, UK, 25 March 2019.

5. “Corporate tax management behaviours in the IPO process” *Cardiff Corporate Governance workshop*, Cardiff, UK, 13 June 2018.

# Abbreviations

| | |
|---|---|
| AIM | Alternative Investment Market |
| ANOVA | Analysis of Variance |
| BP | Breusch and Pagan |
| BTDs | Book-Tax Differences |
| Cap_Int | Capital intensity |
| Cash_ETR | Cash Effective Tax Rate |
| CEO | Chief Executive Officer |
| CFO | Chief Financial Officer |
| CSR | Corporate Social Responsibility |
| Cur_ETR | Current Effective Tax Rate |
| Def _ETR | Deferred ETR |
| DTAX | Discretionary Permanent Differences |
| ETR | Effective Tax Rate |
| FAME | Financial Analysis Made Easy Database |
| FCA | Financial Conduct Authority |
| FT_Int | Foreign Turnover Intensity |
| GAAP | Generally Accepted Accounting Principle |
| HMRC | Her Majesty’s Revenue & Customs |
| IA_Int | Intangible Assets Intensity |
| IAS | International Accounting Standards |
| ICB | Industry Classification Benchmark |
| IFRS | International Financial Reporting Standards |
| IPO | Initial Public Offering |

| | |
|---|---|
| LEV | Leverage |
| LSE | London Stock Exchange |
| MTB | Market-to-Book ratio |
| MW-U | Mann -Whitney U test |
| NOLs | Net Operating Losses |
| OLS | Ordinary Least Squares |
| PBTs | Profits Before Taxes |
| PE | Private Equity |
| PPE | Plant, Property and Equipment |
| R&D | Research and Development |
| R&D_Int | R&D intensity |
| ROA | Return on Assets |
| STD ETRs | Standardised ETRs |
| TRA 1986 | Tax Reform Act of 1986 |
| UKLA | UK listing authority |
| UN_STD ETRs | Unstandardised ETRs |
| UTB | Uncertain Tax Benefit |
| VIF | Variance Inflation Factor |

# Chapter 1 Introduction

Corporate tax management is referred to all activities taken by a company to reduce tax liabilities, it includes tax planning following the purpose of tax laws to obtain tax benefits, tax avoidance that take advantage of the loophole of tax laws to avoid tax liabilities, tax evasion involving illegal transactions to reduce tax charge. As an important part of corporate business activities the investigation of tax management has received attention for decades (Dyreng et al. 2008; Dyreng et al. 2010b; Holland et al. 2016; Hanlon and Heitzman 2010).

This study investigates corporate tax management behaviours in a big event during a company's life – initial public offering (IPO). IPO refers to the first time a company sells a portion of its shares to the public, it is also called "going public". The investigation is based on agency theory that the principals (shareholders) hire agents (managers) to run business on their behalf. In the IPO process companies experience a transition of ownership structure, the ownership changes from being concentrated on management to being dispersedly held by the public, which is likely to influence managers' incentives to engage in tax management coupled with increased scrutiny given the increased public profile. Another theory underlying the study is signalling theory. Spence (1973) puts forward the signalling theory that in a market with information asymmetry, candidates use "signals" to prove quality to decision makers. In the IPO setting where there is information asymmetry, companies have incentives to engage in tax management to reduce tax charge and increase profits to signal intrinsic firm value.

The finding of this study has implication for the government, tax authorities, market regulatory authorities, managers, investors and researchers. In the process of going public whether IPO companies comply with tax rules, take tax responsibilities, report reliable tax information or engage in tax management to avoid taxes can influence tax revenue, market order and investors' interests.

This chapter is a general introduction of the study. The first section introduces the background underlying the study. The second section reviews the literature related to research topic. The third section puts forward hypotheses tested. The fourth section introduces methodology applied. The fifth section summarises results. The sixth section concludes the study and highlights the contribution. The seventh section introduces the structure of the thesis.

## 1.1 Background and motivation

Taxation is an important part of social economic activities. As an important source of government revenue, taxes are collected by tax administrations for government to make public investment, provide government service, promote social equity, regulate social and economic activities, and foster economic development (Scholes et al 2015). Corporations should pay tax payables and take social responsibility in accordance with tax laws. However, as reported by HM Revenue and Customs (HMRC), every year there is a tax gap, which is the difference between the tax in theory which should be collected by HMRC and the tax actually paid. The latest tax gap report shows that the tax gap of the year 2018 to 2019 is estimated to be £31 billion, of which £4.4 billion is resulted from corporation tax (HMRC 2020). This implies that companies are likely to use tax management strategies to avoid tax liabilities.

Corporate tax management behaviours have attracted researchers' interests (Hanlon and Heitzman 2010). Literature has investigated companies' engagement in tax management but findings are different. Dyreng et al (2008) find that some companies are able to avoid taxes in a long period, they can keep their tax liabilities at a very low level in a long period. Weisbach (2002), however, argues that although tax shelters allow companies to avoid taxes with low economic costs, many companies do not use it which he terms "undersheltering puzzle". Due to the importance of taxation for the society, the fact that companies avoid tax liabilities and the inconsistent conclusions for corporate tax management behaviours, the study is motivated to investigate why some companies engage in tax management while others not, in other words, what

factors are associated with corporate tax management behaviours.

An Initial Public Offering (IPO) provides a unique setting with unprecedented change in company ownership coupled with increased formal and informal scrutiny. In the IPO process there is increased information disclosure and additional scrutiny which increase the risks of tax management (Nikolaj Bukh et al 2005; Gao and Jain 2011; Filatotchev and Bishop 2002). Hence IPOs are an ideal setting to investigate factors influencing the level of tax management.

By conducting IPOs companies can obtain funds to expand business, initial owners also can realise private wealth by selling shares to investors in the secondary market (Daily et al 2005; Rock 1986). Thus, in order to maximise proceeds of IPOs, in the IPO process owners have incentives to signal firm value to potential investors by engaging in more tax management to reduce tax liabilities and increase after-tax earnings and cash flows (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Spence 1973). However, although tax management has the advantage of reducing tax liabilities, it also comes with risks and costs. Dyreng et al (2019) emphasise the concept of "tax risks", they argue that aggressive tax management strategies (e.g. use of tax heavens) can result in significant tax uncertainty, that is, if tax authorities challenge those strategies, the tax savings initially expected by managers may be lost. In addition, because of the increased scrutiny, the engagement in tax management may result in additional costs such as penalty on overdue taxes, reputation costs, financial costs and agency costs (Francis et al 2014; Rego and Wilson 2012; Graham et al 2014; Wahab and Holland 2012; Holland et al 2016; Desai and Dharmapala 2005; Matsunaga et al 1992; Mills 1998; Dhaliwal et al 1994). Because of higher costs managers have less incentives to engage in tax management. Those characteristics of IPO process and their association with tax management motivate the study to investigate corporate tax management behaviours in the IPO process.

## 1.2 Literature review

The literature has investigated the factors associated with corporate tax management behaviours. Firm characteristics such as capital structure, capital intensity, research and development expenditure, net operating loss, firm size, foreign operation, intangible assets, profitability are found to be associated with the level of tax management.

Because a company's decisions are made by managers, literature investigates the association between tax management and managerial characteristics. Managers' biographical information such as gender, education background, age, political preference and military experience, and managers' personality characteristics including overconfidence and narcissism are examined.

Recent studies further investigate corporate tax management behaviours under agency framework. The interests of managers and shareholders are not always consistent, in order to align the interests of managers and shareholders the corporate governance mechanism is developed. Corporate governance can affect managers' incentives and therefore influence their tax management decisions. The literature investigates the association between tax management levels and board structure, managerial incentive compensation, ownership structure and labour unions. In addition to corporate internal environment, some studies extend the investigation to external environment where companies are located. The association between corporate tax management behaviours and corporate social responsibility, auditing firms, social capital, behaviours of peer companies is investigated.

Among the factors investigated, the association between corporate tax management and ownership structure is a research topic has attracted interests of many researchers. Although some studies have investigated this topic it is still an underdeveloped research area. Hanlon and Heitzman (2010) call for more serious analysis of the association between ownership structure and corporate tax behaviours. The literature has examined the association between tax management levels with family ownership,

dual class ownership, institutional ownership, and private equity ownership. For those studies corporate tax management behaviours are investigated in a static (or single) ownership, this study makes contribution to the literature by investigating corporate tax management in a dynamic situation with a changing ownership and regulatory environment, this situation is IPO.

In the IPO process issuers are required to disclose additional information (e.g. prospectus) and encountered with increased scrutiny from investment bank, independent auditors, market regulators, analysts, solicitors, market investors, etc. In addition, issuers have incentives to signal firm quality to potential investors. Those factors are hypothesised to have influence on tax management behaviours. The literature finds that companies manage their capital structure, research and development expenditure, earnings, management prestige, corporate governance (e.g. board of directors, ownership retention, managerial incentive compensation), auditor quality, investment rank reputation in the IPO process. But there is no literature investigating the management of tax structure, this is a research gap.

London Stock Exchange suggests that companies seeking to be listed on Main Market should consider tax structure prior to IPO. Consulting firms such as Deloitte and Ernst & Young also suggest that IPO companies should review and manage tax structure during IPO preparation. Due to the importance of the research topic, this study fills the research gap to investigate corporate tax management behaviours in the IPO process.

### 1.3 Hypotheses

The study hypothesises that corporate tax management behaviours can significantly change in the IPO process. On the one hand, with additional scrutiny and monitoring companies are hypothesised to engage in less tax management. On the other hand, with the incentive to reduce tax expense and increase profits companies are likely to engage in more tax management. The first hypothesis is:

$H_1^1$: Corporate tax management behaviours significantly change in the IPO process.

The study further hypothesises that corporate tax management behaviours during IPOs are different between pre and post 2008 Banking Crisis. In addition, corporate tax management in the IPO process varies by type of market and status of auditor. The corresponding hypotheses are:

$H_2^1$: Corporate tax management during IPO process is different between pre and post 2008 Banking Crisis.

$H_3^1$: Corporate tax management during IPO process varies by listing market.

$H_4^1$: Corporate tax management during IPO process varies by auditor.

**1.4 Methodology**

The investigation of the research topic uses quantitative method. The study selects companies listed on London Stock Exchange (LSE) Main Market and the Alternative Investment Market (AIM) during the period of 2004 to 2018 as the research sample. During this period there are 1,591 UK resident companies issuing shares and listed on London Stock Exchange via IPOs. After excluding companies not qualified for research requirements, specifically, classified as financial institutions, whose incorporation date to IPO date is less than three years, the final sample consists of 217 companies. For each cross-sectional company the research window is six years, including three years prior to IPO, IPO year and two years post IPO. Because the measurement of a control variable requires data for additional one year prior to IPO, for each company seven-year of data will be collected, in total there are 1,519 company year ends.

The study builds a multivariate regression model to test the hypotheses. The dependent variables are effective tax rate (ETR) measures of tax management. ETR measures are calculated as a type of tax expense divided by pre-tax profits. Four complementary

measures, current ETRs (*Cur_ETRs*), deferred ETRs (*Def_ETRs*), Generally Accepted Accounting Principle ETRs (*GAAP_ETRs*) and cash ETRs (*Cash_ETRs*) are used to examine tax management from different aspects. An innovation of the study is to standardise ETR measures by statutory tax rates to avoid the observed changes in ETRs are resulted from the change in statutory tax rates.

The test variables include year dummies indicating years from three years prior to IPO to two years after IPO. The change in tax management can be reflected by the change and significance tests of the coefficients of year dummies. In order to test whether tax management behaviours are different between pre and post 2008 Banking Crisis, the study uses a category variable to indicate whether a company's whole company year ends are in the period of pre 2008 or post 2008. In addition, to test whether tax management behaviours vary by listing market and auditor change, the study uses a dummy variable indicating Main Market or AIM and a dummy variable representing whether companies change auditors in the IPO process. The control factors include leverage, capital intensity, R&D intensity, net operating loss, firm size, foreign turnover intensity, intangible assets intensity, profitability, financial reporting regime (International financial reporting standards or UK GAAP) and industry dummy.

Data are collected from three sources. The information on individual IPO date and listing market was obtained from London Stock Exchange. Accounting data was obtained either from the on-line database Financial Analysis Made Easy (FAME) or manually collected from annual reports obtained from Companies House.

The research design firstly investigates tax management behaviours of the full sample of IPO companies. Subsequently, because an accounting loss could result in biased ETR measures, those company year ends with losses are dropped from the sample and only tax management of the company year ends with profits is investigated. This sub-sample is further split into companies subject to scrutiny of pre and post 2008 Banking Crises. Then within each period the sample is further split into companies listed on Main Market and AIM to test whether tax management behaviours in the IPO process

vary by market. After period and market are controlled the change in auditor is further controlled to test whether tax management behaviours in IPO process vary by auditor change. In addition to main test, the study also tests whether the results are robust to currency transition, measure of tax loss carry-forwards, the inclusion of company year ends with tax credits.

In data analysis the study examines descriptive statistics of dependent variables and independent variables to understand data and check for reliability. Then the study conducts univariate analysis for dependent variables. Both nonparametric and parametric, i.e. Mann-Whitney U test and t-test are employed to test the difference in tax management levels between the period of pre and post 2008, Main Market and AIM. In order to better understand control variables, the difference in control variables is also tested by those two tests. The analysis of variance (ANOVA) is applied to test the difference in tax management of years around IPOs.

Then the multivariate analysis is conducted to analyse tax management with confounding factors are controlled. Both Spearman test and Pearson test are examined to test the correlation between dependent variables and independent variables. The ordinary least squares (OLS) method is applied to estimate multivariate linear regression model. This method estimates models by minimising the sum of squares of the differences between the values of dependent variables observed and the values of dependent variables predicted by independent variables. The study relies on the assumptions of OLS to conduct the following diagnostic tests. Firstly, the Breusch and Pagan (1979) method is used to test heteroscedasticity. For the regression with heteroscedasticity issue the standard errors robust to heteroscedasticity are used. The second diagnostic test is multicollinearity, this issue is valued by the variance inflation factors (VIFs). The third diagnostic test is for autocorrelation, the study uses cluster standard errors clustered by company id to correct for any autocorrelation within companies. The final test is for influential data. The study uses the diagnostic test “Difference in Fits (DFFITS)” introduced by Belsley et al (1980) to identify influential data and test the results before and after influential observations are taken out from the

sample.

## 1.5 Results

The results of the study are summarised in table 1.1. Through the analysis of the change in the coefficients of year dummies and significance tests between those coefficients, it is found that tax management behaviours have significant change in the IPO process consistent with the hypothesis. If those company year ends with losses are excluded from the sample the conclusion is consistent. This reflects that companies consider and manage tax structures in the process of going public.

**Table 1. 1 Summary of findings**

| Sample | Findings |
|---|---|
| Full sample | • Tax management behaviours significantly change around IPOs.<br>• There is evidence that in the year immediately prior to IPO and the year immediately after IPO companies engage in more tax management.<br>• Two years after going public companies engage in less tax management.<br>• In the IPO year companies defer a higher amount of taxes. |
| Profitable company year ends | • Tax management behaviours significantly change around IPOs.<br>• There is evidence that with additional scrutiny IPO companies reduce tax management activities.<br>• There is also evidence that companies have incentives to engage in more tax management to reduce tax liabilities.<br>• In the IPO year companies defer a higher amount of taxes. |
| Pre 2008 VS Post 2008 | • Corporate tax management behaviours are different between pre 2008 and post 2008 sub-samples.<br>• One difference is that post 2008 sub-sample has weaker evidence that companies adjust tax positions prior to IPO.<br>• The other difference is that, after going public while tax management behaviours of pre 2008 sub-sample do not significantly change, post 2008 sub-sample engages in more tax management. With further analysis this is because of AIM, see the next column. |
| Post 2008: AIM VS Main Market | After going public, companies listing on Main Market engage in less tax management, companies listing on AIM engage in more tax management. |
| No change in auditors | The level of tax management varies by auditor change. |

The study further finds that corporate tax management behaviours during IPO process are different between the period of pre and post 2008 Banking Crisis. In addition, different tax management behaviours of companies listed on Main Market and AIM is consistent with the hypothesis that corporate tax management during IPO process varies by the type of market. The change in tax management is different before and after controlling the change in auditors, supporting the hypothesis that corporate tax management behaviours during IPO process vary by auditor change.

The detailed change in the tax management behaviours of full sample is that, measured by accrual-based ETR (*GAAP_ETRs*) companies engage in more tax management in the year immediately prior to IPO. Decomposing *GAAP_ETRs* into current and deferred component, measured by *Cur_ETRs* companies show a higher level of tax management in the year immediately prior to IPO and the year immediately post IPO, measured by *Def_ETRs* there is a higher amount of tax deferrals in the IPO year. The cash-based ETR (*Cash_ETRs*) reflects that companies engage in more tax management one year prior to IPO but less tax management two years after going public.

If the company year ends with loss are excluded from the sample, *GAAP_ETRs* indicate that the first year after going public companies have a higher level of tax management. The further analysis of its components shows that measured by *Cur_ETRs* there is a higher current tax charge two years prior to IPO, in the year immediately prior to IPO companies engage in a higher level of tax management, but in the IPO year they engage in a lower level of tax management. Reflected by Def_ETRs in the IPO year there is a higher amount of tax deferrals. Measured by Cash_ETRs companies engage in more tax management in the year immediately prior to IPO, but engage in less tax management two years post IPO.

In the pre 2008 period tax management in years prior to IPO has significant change. *GAAP_ETRs* indicate that two years prior to IPO there is a higher level of total tax charge. *Cash_ETRs* indicate that two years prior to IPO there is a higher level of tax

payment, but in the year immediately prior to IPO companies engage in more tax management and therefore have a lower level of tax payment. However, in the post 2008 period measured by *GAAP_ETRs* and *Cash_ETRs* tax management behaviours do not significantly change in years prior to IPO. Another difference is that while in the pre 2008 period after going public there is no change in the level of tax management, in the post 2008 period one year after going public companies engage in more tax management. With further analysis this is resulted from companies listed on AIM.

The investigation of tax management behaviours in different markets in the post 2008 period finds that after going public companies listed on AIM engage in more tax management, companies listed on Main Market, however, engage in less tax management, Main Market has more effective scrutiny than AIM and therefore has less tax risks. In addition, although subject to additional scrutiny, companies listed on Main Market still engage in more tax management in the IPO year to reduce cash tax payment. From those findings the study calls for more scrutiny on tax charge of those companies listed on AIM in years after going public and cash tax paid of companies listed on Main Market in the IPO year. Investors are suggested to be cautious about tax risks (e.g. contingent tax payment) in making investment decisions.

The study further tests whether tax management varies by auditors. To test it the study controls auditors unchanged and investigates whether tax management will change correspondingly. It is found that the change in tax management is different after the change in auditors is controlled, supporting the hypothesis that corporate tax management behaviours during IPO process vary by auditor change. The change in auditors in the IPO process is likely to be associated with the incentives to manage taxes.

The finding that corporate tax management significantly change in the IPO process is robust for currency transition, measurement of tax loss carry-forwards and inclusion of company year ends with tax credits.

## 1.6 Contributions, limitations and future work suggestions

The study has contributions to theory, methodology and practice.

Regarding to theoretical contribution, the study initially finds that in the UK IPO process IPO companies significantly change their tax management levels. There is evidence that with increased information disclosure and additional scrutiny companies engage in less tax management. However, there is also evidence that in years close to IPO managers consider the benefits of tax management are more than costs and therefore engage in more tax management. In addition, this is the first study reporting that corporate tax management behaviours in the IPO process vary by time period, listing market and auditors. The findings contribute to the literature on corporate tax management, particularly the literature on determinants of tax management levels. It responses to the suggestion of Hanlon and Heitzman (2010) to give more detailed examination on effects of ownership structure on tax management by investigating tax management in a setting with changing ownership. This research also contributes to the literature on corporate management behaviours around IPOs. To the author's knowledge, there is no literature exploring whether managers change tax management strategies in the process of going public in the UK setting. The research fills this research gap.

In terms of methodological contribution, the measures of tax management employed in this study innovatively control the effect of statutory tax rates. The new tax management measures are calculated as traditional effective tax rate (ETR) measures divided by weighted statutory tax rates in the same accounting year. In this way the variation in ETRs caused by statutory tax rates can be eliminated and the level of tax management can be measured more accurately.

This research also has practical contributions as the findings have implication for tax authorities, market regulators and market investors. Since there is evidence that around IPOs companies engage in more tax management to avoid tax liabilities, HMRC and tax administrations generally are suggested to make policy such as stricter tax

collection on companies conducting IPOs to regulate corporate tax management behaviours and reduce the loss of tax revenue. Market regulatory authorities (e.g. Financial Conduct Authority (FCA) and London Stock Exchange)) are suggested to enhance scrutiny and monitoring on tax management behaviours of listed companies. If companies listing on the market are condemned for using risky tax management strategies to avoid tax obligations and social responsibilities, the reputation of market will be negatively affected. In addition, market regulators should remind investors of possible risks. The study also helps investors better evaluate firm value. Companies with higher profits and cash flows might be companies with higher tax risks. If tax strategies are rejected investors' interests may be damaged. Therefore, investors should pay more attention on tax information disclosed by IPO companies and consider potential tax risks when make investment decisions.

The study has limitations. There is lack of access to confidential tax payer data, instead reliance is placed on publicly available data putting the research on the same footing as investors and other users outside of the administration. The use of quantitative research method restricts the analysis to only data disclosed in financial statements and prospectus. The research window is limited to three years prior to IPO because of data limitation. Because of limited sample size the robustness of subsamples is not tested.

The future study is suggested to adopt a qualitative research approach involving case study, survey, interviews etc to further examine questions like "what factors are considered by IPO companies in tax decision making", "which bodies are involved in tax decision making", "how IPO companies trade-off the risks and benefits associated with tax management", "what approaches are used by IPO companies to manage taxes". The future work can also extend research window, further test the association between tax management behaviours and auditing firms, investigate what factors (e.g. corporate governance mechanism) can affect tax management behaviours in the IPO process.

## 1.7 Thesis structure

This thesis consists of six chapters. Chapter 1 is a general introduction of the study. Chapter 2 reviews the literature related to the research topic, including literature on corporate tax management and IPOs. Chapter 3 puts forward hypotheses to be tested. Chapter 4 introduces methodology, including sample selection, estimation model, variables definition and data collection process. The chapter also introduces analysis procedure. Chapter 5 reports all results, including results of descriptive statistics, univariate analysis, correlation test, multivariate analysis, robustness tests. Chapter 6 gives a general conclusion of the study.

# Chapter 2 Literature Review

This section is going to review the literature related to the study. The purpose of the study is to investigate corporate tax management behaviours in IPO process, therefore, "corporate tax management" and "IPO" are two important concepts. The literature review consists of two parts, the first part is about corporate tax management, including definition of tax management, measures of tax management and determinants of tax management. The second part is about IPO, including definition of IPO, introduction of UK IPO process and IPO characteristics. After literature review it can be understood that the study makes significant contribution to both literatures on corporate tax management and IPO management.

## 2.1 Corporate tax management

In this section firstly the definition of tax management will be introduced, then there will be a detailed discussion of tax management measures, finally the determinants of tax management will be reviewed.

### 2.1.1 Definition of tax management

Corporate tax management behaviour is an important topic of tax research (Hanlon and Heitzman 2010), the variation in corporate tax behaviours and its determinants and consequences have attracted widespread interest and concern from the government, market regulators, managers, investors, researchers and mass media. Although many studies have conducted to investigate corporate tax management, they have not achieved a consensus on the definition of tax management. The literature uses various terms such as "tax avoidance", "tax evasion", "tax non-compliance", "tax planning" to describe corporate tax behaviours.

The economist Slemrod (2015) suggests that corporate taxation should be analysed

within a tax system. Under the tax system there is a series of tax rules enacted by legislative bodies and administrative regulations and procedures applied to ensure the implementation of tax laws. In practice, companies have different behavioural responses to tax rules. Some companies have a passive attitude to tax minimisation. They do not have incentives to reduce taxes, the reduction in taxes is just a by-product of non-tax decisions (Hanlon and Heitzman 2010). For example, companies invest in high technology to improve production efficiency, the investment in research and development is allowed to claim for tax relief, although the purpose of this decision is not for tax avoidance, it can reduce tax charge. Weisbach (2002) finds that although the associated economic costs are very low many companies do not engage in tax sheltering (i.e. transactions designed only for tax minimisation but without any economic substance and business purpose). This phenomenon is referred to as "undersheltering puzzle" (Hanlon and Heitzman 2010; Desai and Dharmapala 2006). A possible reason is that the tax activities designed for tax reduction are associated with costs and risks. For example, Matsunaga et al (1992), Mills (1998), Dhaliwal et al (1994), Graham et al (2014) and Wahab and Holland (2012) point out that many contracts are based on financial income, the tax minimising strategies that realised by reducing financial income can cause financial costs. As a result, companies sacrifice tax benefits to avoid the negative effect on financial income. Graham et al (2014), Wahab and Holland (2012), Holland et al (2016) suggest that companies are likely to bear reputational costs if their tax avoidance behaviours are challenged by tax authorities. In addition, Desai and Dharmapala (2005) point out agency cost is a reason that restricts companies from aggressively (i.e. involves high uncertainty) reducing tax payments. Because tax avoidance activities lack transparency (Lee et al. 2015), it is difficult for shareholders to accurately value companies tax management activities. Shareholders may argue that the obscure nature of tax management activities facilitates managers to divert benefits of companies for their private interests (i.e. managerial rent diversion) (Desai and Dharmapala 2005). As a result, companies trade off tax benefits with risks when making decisions, if risks overweigh benefits they will not engage in tax reduction activities.

Another response, defined as "tax planning" by Her Majesty's Revenue & Customs (HMRC), is to comply with tax laws to gain tax benefits intended by Parliament (HMRC 2017). Tax laws give tax benefits for some industries and activities with the intention to support and encourage their development. Investing in research and development projects (R&D), increasing debts, increasing the proportion of fixed assets are typical examples of tax planning (Scholes et al 2015; HMRC 2017)[3]. Such tax planning activities are allowed and encouraged by tax authorities.

Some companies engage in tax avoidance, defined as exploiting the "loopholes" of tax law to obtain tax benefits never intended by legislators (HMRC 2017). For example, companies transfer the ownership of an asset to a country with lower tax rates or/and change the nature of an activity that is not entitled to tax relief to the activity allowed to claim for tax relief. Although literally speaking tax avoidance is not against tax laws, while tax planning is encouraged by tax administrations, tax avoidance is likely to be challenged. Dyreng et al (2008) refer to tax avoidance as any behaviour that can reduce a company's explicit taxes. This definition includes not only tax planning consistent with the intention of tax laws, but also tax avoidance that improperly interpret tax rules. Hanlon and Heitzman (2010) define tax avoidance as a spectrum of tax decisions. They suggest that whenever a company makes a tax decision, in accordance with its riskiness it can be located in any place on a spectrum. If the conservative (lower risk) term "tax planning" is at one end, the aggressive (higher risk) terms "tax aggressiveness", "tax sheltering" and "tax evasion" should be located at the other end.

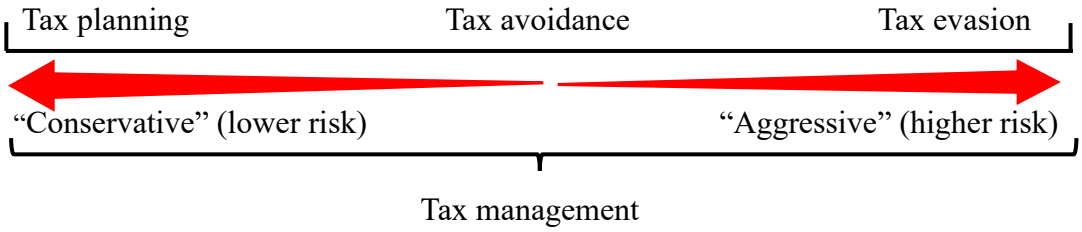
Tax evasion is an extreme tax position. It refers to illegally obtaining tax benefits through the commission of fraud (Slemrod 2007). HMRC (2017) describes tax evasion as "illegal activity, where registered individuals or business deliberately omit, conceal or misrepresent information in order to reduce their tax liabilities" (p20). Kirchler et al (2003) point out that while tax avoidance is "legal" and is often considered to be "clever", tax evasion is illegal and often described as "deceptive", "punishable" and

[3] The relevant regulation will be introduced in the section 2.1.3 "Determinants of tax management".

"criminal".

In summary, companies have different attitudes towards tax reduction. Some companies have a passive attitude, some companies engage in tax planning to conservatively reduce tax liabilities, some companies engage in tax avoidance and tax evasion to aggressively reduce tax payments. Normally researchers cannot get access to confidential tax return data, they can only use publicly-available data. However, the public data are unable to differentiate whether an observed tax outcome is resulted from tax planning, tax avoidance or tax evasion. As a result, a broad term "tax management" is used to include all activities taken a company to reduce taxes. Figure 2.1 is a diagram depicting the definition of tax management.

**Figure 2. 1 Definition of tax management**




### 2.1.2 Measures of tax management

As the engagement in tax management is difficult to be observed, various methods have been developed to measure the level of tax management. Every method has a specific scope of application, researchers should depend on research questions to select appropriate methods. Hanlon and Heitzman (2010) emphasise that the measures reflect tax management from different aspects, they cannot be used interchangeably, researchers should understand characteristics, advantages and disadvantages of each proxy to select appropriate measures on the basis of research questions.

This section introduces the measures commonly used in the literature. They include: effective tax rates, book-tax differences, tax shelters usage and tax contingency reserves. Inspired by Hanlon and Heitzman (2010), a table (table 2.1) is used to

**Table 2. 1 Summary of tax management measures**

| Measures | Definition | Calculation | Types of tax management | Advantages | Disadvantages |
|---|---|---|---|---|---|
| Current ETRs | Average current tax expense per unit of pre-tax profits | $\frac{Current\ tax\ expense}{Pre-tax\ profits}$ | Non-conforming tax management activities reducing current tax expense | 1. Can reflect tax deferral activities | 1. Only capture non-conforming tax management<br>2. On accrual basis, may overestimate/underestimate tax liabilities |
| GAAP ETRs | Average total tax expense per unit of pre-tax profits | $\frac{Total\ tax\ expense}{Pre-tax\ profits}$ | Non -conforming tax management activities reducing total tax expense | 1. Reflect the management of combined (total) tax expense | 1. Fail to reflect tax deferral activities.<br>2. Disadvantages of current ETRs |
| Cash ETRs | Average taxes paid per unit of pre-tax profits | $\frac{Cash\ taxes\ paid}{Pre-tax\ profits}$ | Non-conforming tax management activities reducing cash taxes paid | 1. Can identify tax deferrals.<br>2. On cash basis, do not overestimate/underestimate tax liabilities. | 1. Cash taxes paid may not match with profits.<br>2. Unable to identify conforming tax management |
| Long-run Cash ETRs | The ratio of sum of cash taxes paid in a long period to the sum of pre-tax profits in the same period | $\frac{\sum_{t=1}^{N} Cash\ Tax\ Paid_{it}}{\sum_{t=1}^{N} Pre-tax\ profits_{it}}$ | Non-conforming tax management activities that reduce taxes paid in the long-run | 1. Alleviate fluctuation of Cash ETR from year to year<br>2. Mitigate the asymmetry between cash taxes and pre-tax profits | 1. Only measure non-conforming tax management |
| Total BTDs | Total differences between financial income and taxable income | Profits before taxes – $\frac{Current\ tax\ expense}{Statutory\ tax\ rate}$ | Non-conforming tax management activities | 1. Provides an opportunity to measure tax management without tax returns<br>2. Can reflect tax deferrals | 1. Only can identify non-conforming tax management.<br>2. There are errors in using current tax expense to estimate taxable income.<br>3. Dividing current tax expense by statutory tax rate to estimate taxable income has errors. |

**Table 2. 1 Summary of tax management measures (continued)**

| | | | | | |
|---|---|---|---|---|---|
| Non-earnings management BTDs | Total differences between financial and taxable income that are not caused by earnings management | The residuals from $\frac{Total\ BTDs}{Total\ assets} = \beta_1 \frac{Total\ accruals}{Total\ assets} + u_i + \varepsilon_i$ | Non-conforming tax management activities | 1. Avoid the confounding effect of earnings management | Disadvantages of Total BTDs |
| Discretionary BTDs | Differences between financial income and taxable income resulted from discretionary tax management activities. | The residuals from Permanent differences $= \alpha + \beta \times$ nondiscretionary items $+ \varepsilon$ | Risky tax management | 1. Provides a way to measure aggressive tax management.<br>2. Controls the components of BTDs resulted from earnings management.<br>3. Controls the causes of permanent differences not related to tax riskiness | 1. Because lack of good structural BTDs models, the residuals may have errors.<br>2. It is difficult to accurately define "nondiscretionary" factors.<br>3. Only rely on permanent differences to measure tax riskiness is incomplete. |
| Tax shelters usage | Transactions designed only for tax purpose but without any business purpose | Dummy variable indicating the engagement of tax sheltering | Risky tax management | Allows the investigation of tax sheltering under the circumstance that financial statements do not provide information about tax shelters usage | 1. Potential selection bias<br>2. The conclusion observed from the sample cannot be generalised. |
| Tax contingency reserves | Estimated taxes paid in the future due to tax uncertainty | Directly disclosed in financial statements | Risky tax management | Provides a measure of tax riskiness. | 1. Under IFRS setting the amount of tax contingency reserves is not separately disclosed.<br>2. Tax management reflected is limited<br>3. May incorporate the effect of earnings management |

summarise the definition, calculation, characteristics of each measure.

#### 2.1.2.1 Effective tax rates

ETR measures, calculated as a type of tax expense divided by pre-tax profits, reflect the average rate of tax charges to per unit of financial income (Hanlon and Heitzman 2010; Holland 1998). If there are two companies with equal before-tax profits, the company with less tax expense, that is, having a higher level of tax management, has lower ETR. Therefore, ETRs and tax management are negatively associated.

ETRs are traditional measures of tax management. They have been adopted to investigate the association between tax management and firm characteristics such as firm size, capital structure, assets structure and profitability (Zimmerman et al. 1983; Holland 1998; Gupta and Newberry 1997). In recent years the incentives underlying tax management have been attracting the interest of researchers, ETRs are still common measures. For example, Rego and Wilson (2012) employ ETRs to examine the correlation between risky tax management and executive compensation. Minnick and Noga (2010) use ETRs to investigate the association between board structure, identical CEO and chairman, incentive compensation of directors and executives and tax management.

Depending on the type of tax expense there are different type of ETR measures, the following paragraphs will introduce four measures frequently used: Current ETRs (*Cur_ETRs*), Generally Accepted Accounting Principle ETRs (*GAAP_ETRs*), *Cash_ETRs* and long-run *Cash_ETRs*.

*Cur_ETR* is calculated as current tax (i.e. income taxes that payable or recoverable for the current year) divided by pre-tax profits (Armstrong et al. 2012; Minnick and Noga 2010; Wilson 2009). An advantage of current ETR is that it can reflect tax deferral activities (Hanlon 2003; Dyreng et al. 2008). If a company defers tax liabilities incurred in the current period to the future, deferred taxes will increase and current taxes will decrease. As a result, assuming pre-tax profit is consistent, *Cur_ETRs* will

be lower. However, *Cur_ETR* also has disadvantages. Like all income- based measures, it can only measure non-conforming tax management (i.e. activities that change tax expense without changing financial income). The activities that change tax expense and financial income simultaneously cannot be identified. Another disadvantage is that as an accrual-based measure, it could overestimate or underestimate tax liabilities. For example, under US GAAP if a company anticipates that a tax position is likely to be rejected by tax authorities, it should set an item called "tax contingency reserve" to report possible future tax payments. Under International Financial Reporting Standards (IFRS), starting from 1 January 2019, if an entity is uncertain about a tax treatment, it shall use "the most likely amount" or "the expected value" method to disclose the effect of uncertainty on tax liabilities (IFRS 2017). For this situation although tax payments have not been incurred, they have been recorded in current tax expense. The other limitation of current ETR is that it only reflects the reduction of explicit taxes directly paid to tax authorities, the reduction of implicit taxes cannot be reflected. The concept of "implicit tax" is introduced by Scholes et al (2002). If a company plans to buy assets it can choose tax-favoured and/or tax-disfavoured assets. As tax-favoured assets have tax preferences, they are highly demanded than assets without preferences (i.e. tax-disfavoured assets) and therefore have higher prices and lower before-tax rate of returns. This means that if a company buys tax-favoured assets it indirectly bares taxes in the form of lower before-tax investment returns, in other words, it pays taxes implicitly. The payment of implicit tax is not publicly disclosed and therefore cannot be captured by ETR measures.

*GAAP_ETR* is calculated as the sum of current tax expense and deferred tax expense (i.e. total tax expense) divided by pre-tax profits. Definition of current tax expense has been given in the last paragraph. Deferred tax is resulted from temporary differences between tax laws and accounting standards. A company's income is reported for two systems, one is to follow accounting standards to report accounting income (also known as book income) in financial statements for users to assess corporate performance and make decisions (Manzon Jr and Plesko 2002). The other system is to comply with tax laws to report taxable income on tax returns (Wahab and Holland

2015; Hanlon 2005). The purpose of this system is to equitably and effectively measure corporate tax liabilities, collect taxes from companies for the government to provide public service, redistribute wealth, encourage (or discourage) social and economic activities (Scholes et al 2015; Manzon Jr and Plesko 2002). With different purposes these two systems have differences in the recognition of accounting transactions. Some revenue and cost items recognised by tax laws (accounting standards) are not accepted by accounting standards (tax laws) (Hanlon 2005). As a result, accounting income and taxable income can be different. Some differences are permanent and will never reverse. For example, dividends from investment in other companies are included in the recognition of accounting income, but cannot be included in the recognition of taxable income (Wilson 2009). Some differences are temporary and will be reversed in the future. They are caused by the difference in the timing of revenue and expense recognition under accounting standards and tax laws (Wahab and Holland 2015; Hanlon 2005; Guenther and Sansing 2000). Temporary differences resulting in future tax payable are called deferred tax liability, temporary differences resulting in future tax receivables are called deferred tax asset (Lee et al. 2015). Deferred taxes reported in profit and loss account are equal to the change in deferred tax liability (closing deferred tax liability minus opening deferred tax liability) minus the change in deferred tax asset (closing deferred tax asset minus opening deferred tax asset). Expressed by formula is:

$$Deferred\ tax\ expense\ in\ income\ statement = (closing\ deferred\ tax\ liability - opening\ deferred\ tax\ liability) - (closing\ deferred\ tax\ asset - opening\ deferred\ tax\ asset) \quad (1)$$

Depreciation is an example of the item that generates temporary differences. Under accounting standards companies are allowed to depreciate tangible assets with either straight-line method or accelerated depreciation method but under tax rules companies can only use accelerated depreciation method for expenditure which qualifies for tax relief, with this method companies can report higher depreciation expense in the early years of an assets' life (Heltzer 2009; Hanlon and Heitzman 2010). With accelerated

depreciation method in the early period of an asset's life there are higher depreciation expense and therefore less taxable profits (Manzon Jr and Plesko 2002). However, because the total amount of depreciation is fixed, in the later years the depreciation reported for tax purpose will be lower than that reported for accounting purpose, the taxes deferred previously will be gradually reversed.

*GAAP_ETR* measures the management of total tax expense. As the numerator of *GAAP_ETR* includes both current taxes and deferred taxes, it is unable to reflect tax management activities deferring taxes to the future to reduce current tax liabilities (Dyreng et al. 2008), the application of accelerated depreciation method mentioned above cannot be detected. In addition, the disadvantages of *Cur_ETR* such as unable to measure conforming tax management are also the disadvantages of *GAAP_ETR*.

Another measure *Cash_ETR* captures tax management using tax paid. *Cash_ETR* is calculated as cash taxes paid divided by pre-tax profits (Dyreng et al. 2008; Minnick and Noga 2010; Rego and Wilson 2012; Balakrishnan et al. 2019; Edwards et al. 2016; Cheng et al. 2012). The advantages of *Cash_ETR* include: firstly, as *Cash_ETR* reflects cash tax payment in the current year, it can identify tax deferrals. Secondly, different from *Cur_ETR*, as *Cash_ETR* is on cash basis, it can capture tax management activities that influence tax position but not reflected in tax expense. Thirdly, also because of cash basis, it can avoid mis-capturing activities that recorded in accrual items (e.g. the tax contingency reserve) but do not affect tax charge (Dyreng et al. 2008). This measure also has disadvantages. One issue of *Cash_ETR* is that the cash taxes paid may not match with pre-tax profits because cash taxes are on cash basis while pre-tax profits are on accrual basis (Hanlon and Heitzman 2010). The second issue is that same with *GAAP_ETR* and *Cur_ETR*, *Cash_ETR* is unable to identify conforming tax management behaviours. The third issue is that it cannot reflect the change in implicit taxes.

A common characteristic of *GAAP_ETR*, *Cur_ETR* and *Cash_ETR* is that they only rely on the data of an individual year. Dyreng et al (2008) argue that for companies whose ETRs change dramatically from year to year annual ETR measures are unable

to accurately represent overall level of tax management. Therefore, they develop a long-term measure, called long-run *Cash_ETRs*, to examine whether a company can consistently manage taxes. This measure is calculated as the sum of cash taxes paid in a long term (e.g. ten years) divided by the sum of pre-tax profits in the same period. Hanlon and Heitzman (2010) point out that because long-run *Cash_ETR* is based on a long-term calculation it can alleviate the fluctuation of *Cash_ETR* from year to year and thus can better reflect overall level of tax management. In addition, because it is on a long-term basis, it mitigates the asymmetry between cash taxes and pre-tax profits (i.e. the first disadvantage of annual *Cash_ETR*) because accrual items will be reversed over the long period.

In summary, ETRs measure the average rate of taxes per unit of pre-tax profits. They are traditional measures of tax management. Different ETRs reflect tax management from different aspects. *Cur_ETR* reflects the management of current tax liabilities. *GAAP_ETR* reflects the management of total tax liabilities. Cash_ ETR reflects the management of cash tax payments. Long-term *Cash_ETR* reflects corporate long-term tax management abilities. All ETR measures can only measure non-conforming tax management. They cannot distinguish tax planning, tax avoidance and tax evasion. Among these measures, *Cur_ETR*, *Cash_ETR* and long-run *Cash_ETR* can reflect tax deferral activities but *GAAP_ETR* cannot. Because on accrual basis *Cur_ETR* and *GAAP_ETR* are likely to overvalue or undervalue the level of tax liabilities, but *Cash_ETR* can avoid this disadvantage. A drawback of *Cash_ETR* is that cash taxes and profits may result from activities in different periods, the long-term *Cash_ETR* can to some extent mitigate this issue[4].

#### 2.1.2.2 Book-tax differences

Book-tax differences (BTDs) also contain information about tax management. It can be shown algebraically that BTD can be derived from the related ETR, i.e. in terms of

[4] Although the literature has not used deferred tax-based ETR, this study uses such measure and will discuss it in the methodological chapter.

measuring tax management compared with ETR there is no new information in BTD[5], BTD measure of tax management is a pseudo of ETR measure of tax management, *vice-versa* (Wahab and Holland 2015). This section introduces definition of book-tax differences and their association with tax management. In addition, the calculation approach and characteristics of BTDs are discussed.

As mentioned earlier a company's income is reported as accounting income and taxable income under accounting standards and tax laws. The differences between accounting income and taxable income are called "book-tax differences". Controlling accounting income, the more tax management a company engages in, the less taxable income and therefore the larger BTDs it will have. Therefore, BTDs are positively associated with tax management. Hanlon and Heitzman (2010) point out that tax management is a potential source of BTDs. Wilson (2009) and Lisowsky (2010) find BTDs are positively associated with the use of tax shelters. Mills (1998) points out that BTDs are related to risky tax position, the larger BTDs a company has, the more likely to be subject to audit adjustments. This suggests that companies with larger BTDs are likely to have more uncertain tax treatments. Due to its characteristic, many studies, like Cheng et al (2012), Heltzer (2009), Chen et al (2010), Wahab and Holland (2015) and Frank et al (2009) use BTDs as a proxy for tax management.

The calculation of BTDs requires financial and taxable income data. However, for most cases researchers cannot get access to taxable income data as tax returns are not publicly available. Thus, researchers attempt to use accounting data disclosed in financial statements to estimate taxable income. A common approach is to assume current tax expense reported in income statement is a proxy for tax payable calculated in tax returns, then the taxable income can be obtained by dividing current tax expense

[5] ETR=(TI*STR)/PBT, where TI is taxable income, STR is statutory tax rate, PBT is profit before tax.
PBT*ETR=TI*STR
(PBT*ETR)/STR=TI
[(PBT*ETR)/STR]-PBT=TI-PBT
[(PBT*ETR)-(PBT*STR)]/STR=TI-PBT
[PBT(ETR-STR)]/STR=TI-PBT
PBT(ETR-STR)=(TI-PBT)STR=-(PBT-TI)STR, where PBT-TI is BTDs.

by the statutory tax rate for the current year (Hanlon 2003; Manzon Jr and Plesko 2002). BTDs equal to reported financial income minus estimated taxable income. Presented by formula is

$$BTDs_{estimated} = Profit\ before\ taxes\ (PBTs) - \frac{Current\ tax\ expense}{Statutory\ tax\ rate} \quad (2)$$

This method provides a way to estimate BTDs without taxable income data. However, this estimation approach has limitations. Firstly, interpreted from the formula same as ETRs, estimated BTDs only identify non-conforming tax management. They are unable to capture conforming behaviours that report lower financial income to reduce tax payments. Therefore, Hanlon and Heitzman (2010) emphasise that if BTDs are used to measure the level of tax management, it is necessary to control the variation in financial income. Desai and Dharmapala (2006) adopt a measure to remove the components of BTDs caused by earnings management. They firstly follow the method proposed by Manzon Jr and Plesko (2002) to estimate taxable income using current tax expense divided by statutory tax rate and subtract estimated taxable income from book income to calculate total BTDs. Then, they regress total BTDs on a measure of earnings management-total accruals and take the residuals as the measure of tax management. Secondly, same with ETRs, BTDs are calculated by public data, which cannot reflect the change in implicit taxes.

Thirdly, there are errors in using current tax expense to estimate taxable income (Hanlon 2003). The assumption that current tax expense is equivalent to actual tax payable is inaccurate. As discussed before, current tax expense is on accrual basis, it contain items that reported in current tax expense but do not affect tax payments, but leave out the items that change tax position but not reported in current tax expense. Consequently, current tax expense can overestimate/underestimate tax liabilities. In addition, it is problematic to calculate taxable income by dividing current tax expense with statutory tax rate. This is firstly because current tax expense is the expense after tax credits (e.g. research and development credit) but tax payable does not contain tax credits. Assuming there are no other factors affecting tax position, current tax expense

equals to tax payables minus tax credits. The reason why researchers use current tax expense to estimate taxable income is due to the following formula:

$$\text{Tax liability} = \text{Taxable income} \times \text{Statutory tax rate} \quad (3)$$

The "tax liability" here is tax liability pre tax credits. In the presence of tax credits current tax expense is less than tax liabilities and therefore the taxable income estimated by current tax expense will be lower than actual taxable income. International Accounting Standards (IAS) 12 requires "the amount of the benefit arising from a previously unrecognised tax loss, tax credit or temporary difference of a prior period that is used to reduce current (deferred) tax expense" to be disclosed in tax reconciliation (Wahab and Holland 2015). As a result, the error resulted from tax credits can be identified and adjusted.

Another issue of using current tax expense to estimate taxable income is related to foreign operation. The profits of multinational companies are taxed at both domestic and foreign tax rates, only using domestic tax rates to estimate taxable income is inaccurate. Wahab and Holland (2015) mitigate this issue by further disaggregating taxable income as income taxed in UK and income taxed outside the UK, that is, dividing current tax expense incurred in UK with UK statutory tax rates and dividing current tax expense incurred outside UK with oversea statutory tax rates. Specifically, the BTDs are estimated as:

$$BTDs_{estimated} = PBT - \frac{CTE}{STR_{uk}} + \frac{(STR_{os} - STR_{uk}) * TP_{os}}{STR_{uk}} \quad (4)$$

where:
PBT = Profit before tax
CTE = Current tax expense
$STR_{uk}$ = Statutory tax rate in UK
$STR_{os}$ = Statutory tax rate outside of the UK
TP = Estimated taxable profits

The above methods measure all tax management activities that generate BTDs. Frank

et al (2009) develop a method called "discretionary permanent differences" (DTAX) to measure risky tax management that designs transactions only for tax reduction purpose but without any economic substance. They suggest that permanent BTDs can measure tax riskiness better than total BTDs. Total BTDs include permanent and temporary BTDs, as temporary BTDs are found to be associated with earnings management, total BTDs may capture activities not necessarily caused by risky tax behaviours but by earnings management (Phillips et al. 2003). They firstly adopt the method of Manzon Jr and Plesko (2002) to calculate total BTDs and then subtract temporary BTDs (computed as deferred tax expense divided by statutory tax rate) from total BTDs to eliminate temporary differences (Blaylock et al. 2012). However, among activities that generate permanent differences there are some transactions (e.g. intangible assets, income reported with equity method) they argue although can produce permanent differences but are not related to aggressive tax management, they are called "nondiscretionary items". As a result, Frank et al (2009) further regress permanent differences on nondiscretionary items and use the residuals representing discretionary permanent differences (DTAX) as the proxy for aggressive (i.e. high uncertainty) tax management. They claim that DTAX is effective in measuring aggressive tax management as it controls the components of BTDs resulted from earnings management and the causes of permanent differences that are not related to tax riskiness. However, some researchers argue that this approach has problems. Hanlon and Heitzman (2010) point out the effectiveness of residual methods depends on the model used and the precision of proxy for "known" factors. However, given that there is lack of good structural BTDs models, the discretionary BTD model used may have errors. Besides, it is difficult to accurately define which activities belong to "nondiscretionary" domain. For example, the investment in R&D may result from non-tax purposes such as enhancing competitiveness and improving production efficiency, but also can be driven by tax reduction purposes. Moreover, Hanlon and Heitzman (2010) and Lisowsky (2010) argue that only relying on permanent differences to measure tax aggressiveness is not complete because studies have proven that aggressive tax management also generates temporary BTDs (Wilson 2009; Lisowsky et al. 2013). Finally, because DTAX is based on BTDs, it cannot capture the

change in implicit taxes.

#### 2.1.2.3 Tax shelters usage

The use of tax shelters is a measure of risky tax management. Tax shelters refer to transactions specially designed for tax reduction but without "economic substance" or a "business purpose" (Lisowsky 2010). Graetz (2002) describes tax shelters as "deals done by very smart people that, absent tax considerations, would be very stupid". Lisowsky (2010) defines risky tax management as activities taking tax reduction as the first-order goal and non-tax effects as second-order goals. Tax shelter is the most extreme form of tax riskiness. The engagement in tax sheltering is unobservable for outsiders as relevant information is not disclosed by companies. Researchers attempt to use company sample that has been accused or reported of using tax shelters to investigate corporate tax sheltering behaviours.

Graham and Tucker (2006) investigate the association between tax shelter usage in the US and debt policies. They use LexisNexis database to search tax sheltering firms from two sources: one is the litigation related to the engagement in tax sheltering of listed companies recorded in Tax Courts, the other is the popular press that reports companies having received a Notice of Deficiency from the tax authority due to the use of tax shelters. Finally, 43 tax sheltering companies during the period of 1975 to 2000 are collected. Graham and Tucker (2006) find that tax shelters save a large amount of taxes (approximate 9% of asset value) for sample companies every year. In addition, compared with companies without using tax shelters, companies engaging in tax sheltering on average have less debt holdings, it is hypothesised that tax-saving function of debt interest is substituted by tax shelters.

Wilson (2009) enlarges the sample size of Graham and Tucker (2006) by adding 18 public corporations identified by Factiva Database of involving in tax sheltering. The extended sample includes 59 tax sheltering participants from January 1, 1990 to December 31, 2007 (two of corporations are deleted from the sample due to data unavailability). Summarised from the common characteristics of those companies

Wilson (2009) develops a model to estimate the probability for a company to use tax shelters. He suggests that the possibility being involved in tax sheltering is positively related to BTDs, accrual-based earnings management, firm size and foreign income but negatively related to debt holdings.

Lisowsky (2010) improves Wilson (2009)' s tax sheltering probability model. He identifies 267 U.S. tax shelter cases for the period of 2000 to 2004 from a combination of Compustat, confidential tax return data provided by Internal Revenue Service and the database of Office of Tax Shelter Analysis. Apart from the characteristics examined in Wilson (2009)'s model, Lisowsky (2010) examines six additional characteristics including setting up subsidiaries in tax heavens, inconsistent accounting and tax treatment, the utilisation of financial engineering products such as convertible debt and preferred stock, employment of promoters such as auditors and investment banks, litigation expense and net operating loss carry-forwards. They find that among characteristics examined by Wilson (2009) and new characteristics, the possibility of using tax shelters is positively associated with tax heaven subsidiaries, profitability, foreign income, litigation expense, employment of tax advisors, inconsistent accounting and tax treatment, firm size, but negatively associated with debt holdings.

Collecting sample companies engaging in tax sheltering allows researchers to investigate tax sheltering behaviours under the circumstance that financial statements do not provide information about companies' tax shelters usage. This method, however, has limitations. Firstly, because the sample only includes companies accused or reported of participating in tax sheltering rather than be randomly selected, there may be selection bias issues, for example, only large tax sheltering cases are selected (Hanlon and Heitzman 2010; Graham and Tucker 2006). Secondly, these samples only include companies detected by the government and media of using tax shelters. But in reality many companies use tax shelters to successfully reduce tax charges but unfortunately their behaviours have not been found. In addition, there are various forms of tax shelters but these studies only focus on limited types of tax shelters. Thus, the conclusion observed from the sample cannot be generalised to a broader range of

tax sheltering companies (Graham and Tucker 2006; Wilson 2009). Thirdly, this method is to use companies identified of using tax shelters to analyse corporate tax management behaviours, it does not provide information on implicit taxes.

#### 2.1.2.4 Tax contingency reserves

Tax contingency reserve is a measure of tax riskiness proposed by US literature. It is proposed under the situation that companies are uncertain whether some tax treatments applied will be accepted by tax authorities. If rejected, companies will pay additional taxes. As a result, if companies consider tax treatments are unlikely to be accepted, they should estimate possible tax payments resulted from those uncertain tax treatments and reflect them as tax liabilities in balance sheet (Graham et al. 2012). These estimated tax liabilities are referred to as "tax contingency reserves", "tax cushion" or "unrecognised tax benefits". Companies reported under US GAAP have been required to measure and report tax contingency reserves in financial statements since December 15, 2016, the similar requirements were applied to IFRS from January 1, 2019 (FASB, 2006; IFRS 2017). This item, by definition, cannot reflect the change in implicit taxes.

Because larger tax contingency reserves imply higher tax uncertainty, they are highly likely to contain information about uncertain tax management (Hanlon and Heitzman 2010). Hoi et al (2013) find that companies with more socially-irresponsible activities are more aggressive in reducing tax liabilities and report a higher level of tax contingency reserves. Lisowsky et al (2013) find a significantly positive relationship between tax shelter usage and unrecognised tax benefits.

Although tax contingency reserves can reflect high-risk tax management, they are not only designed for tax purpose. As an accrual item within the expense, the manipulation of tax contingency reserve can affect post-tax profits and therefore can be resulted from financial reporting incentives (Hanlon and Heitzman 2010). Managers intend to reduce tax expense but increase post-tax profits are unlikely to recognise tax contingency reserve because larger tax contingency reserve will result in lower

accounting profits. Different from ETRs and BTDs tax contingency reserve can reflect tax management that reduce both tax profits and accounting profits (i.e. conforming tax management) (Hanlon and Heitzman 2010). Moreover, for researchers using "tax cushion" (i.e. tax contingency reserves) to measure tax management, they should identify the amount of this item is driven by tax or (and) earnings incentives.

#### 2.1.2.5 Conclusion

In summary, literature has proposed various proxies to measure corporate tax management from different aspects. ETR measures and BTDs measures (except for discretionary BTDs) capture all non-conforming tax management behaviours. Discretionary BTDs, tax shelter usage and tax contingency reserves focus on aggressive tax management. Researchers should be aware of the scope of application of each measure and select appropriate measures based on research questions. In addition, there is no perfect measure, every measure has limitations. For example, most of the measures only capture non-conforming tax management. *GAAP_ETRs* cannot reflect tax deferral activities. In addition, all measures can only reflect the reduction of explicit taxes directly paid to tax authorities. It is difficult for them to capture the reduction of implicit taxes as it is not publicly disclosed. When using those tax management measures it is worth considering what impacts of these limitations on results and how the limitations can be overcome or mitigated.

### 2.1.3 Determinants of tax management

The purpose of this section is to discuss factors associated with corporate tax management. Firm characteristics provide companies with opportunities to manage taxes. With some firm characteristics companies can take advantages of tax incentives stipulated by tax laws to reduce tax charges. Such tax planning behaviours comply with the intention of tax legislation and therefore are allowed and encouraged by tax authorities. Typical examples include tax-deductible debt interests and R&D expenditures. Some firm characteristics provide companies with opportunities to discretionarily manipulate transactions to avoid taxes. With these firm characteristics

companies can engage in tax avoidance that appears to be consistent with the letter but in fact against the intention of the tax laws. From the above discussion, corporate tax management is hypothesised to be associated with firm characteristics.

As corporate tax decisions are made by managers, managers' incentives and abilities are likely to be associated with tax management. In addition, managers' decisions can be affected by corporate governance mechanism (e.g. board structure, ownership structure). As a result, corporate governance is hypothesised to be associated with tax management behaviours. Apart from corporate internal conditions, the external environment around companies also can influence managers' decisions.

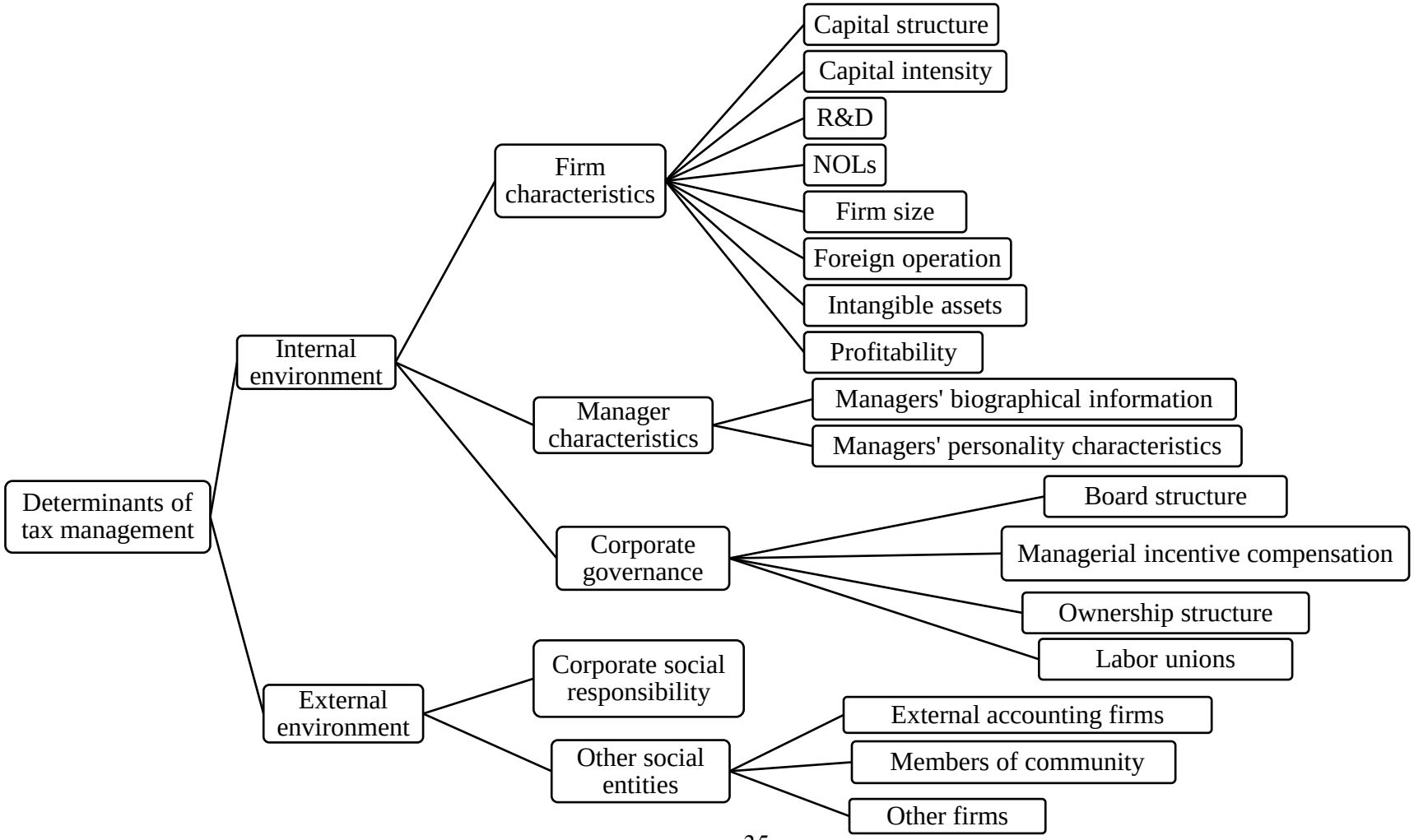
This section will discuss determinants of corporate tax management in the following orders: The first part is about firm characteristics, including firm characteristics providing tax planning opportunities and firm characteristics providing tax avoidance opportunities. The second part is about the association between managers' characteristics and corporate tax management. The third part discusses the association between corporate governance and corporate tax management. The fourth part discusses environment outside companies and tax management behaviours. Figure 2.2 is a mind map summarising the determinants of tax management.

Wilde and Wilson (2018) propose a framework for interpreting and structuring the developing literature on corporate tax management. The decision to manage taxes, given some expected tax benefit, is a function of agency costs, implementation costs and outcome costs (Wilde and Wilson 2018).

The framework assumes a company's tax decisions are made by managers, thus, managers' characteristics can influence tax management decisions. Corporate governance mechanisms in turn affect managers' incentives and therefore potentially affect tax management decisions. These combination of factors are termed the "agency costs" of tax planning.

Managers also consider potential external responses to tax management decisions e.g.

**Figure 2. 2 Mind map of determinants of tax management**



market, political and reputational costs. Such externally imposed costs are termed "outcome costs".

Finally, once a tax management practice is adopted it can be detected by observing certain tax related firm characteristics e.g. capital structure, operating structure including level of capital expenditure. Wilde and Wilson (2018) term such firm characteristics as "implementation costs".

As the focus of this dissertation is on documenting tax management behaviour during the IPO process for the first time, the modelling process focuses on implementation costs as a means of identifying tax management behaviour. The aim is to understand what tax management decisions are made during the IPO process. An area for subsequent research is to examine using agency and outcome costs to explain the variation in observed behaviour i.e. agency and outcome costs.

#### 2.1.3.1 Firm characteristics

The following firm characteristics can provide companies with tax planning opportunities that comply with the intention of tax laws.

##### 2.1.3.1.1 Capital structure

Stickney and McGee (1982) and Cheng et al (2012) suggest that in order to encourage debts repayment, the interest on debt is allowed to be deducted from taxable profits but dividends payments are not. Other things being equal, the companies with larger debt holdings are likely to take advantage of tax deductions on interest to reduce tax liabilities, but their profit before tax will be lower because of the interest payable. Stickney and McGee (1982) conclude that companies with higher leverage, measured as the ratio of long-term debt to shareholders' total equity, exhibit lower ETRs. Cheng et al (2012) also suggest that companies with higher leverage have a higher level of tax management.

Alternatively, Gupta and Newberry (1997) hypothesise that companies with high ETRs are likely to increase debts to reduce tax obligation, resulting in a positive association between ETRs and leverage. Graham and Tucker (2006) suggest that the role of debts in reducing tax liabilities can be substituted by tax shelters. Some tax sheltering transactions designed by companies can create similar tax-deductible expense like interest. In addition, tax shelters can produce more tax deductions than debt interest but have less risks of covenant violation and bankruptcy, companies therefore are willing to use more tax shelters but less debt tax shields to reduce tax charges (DeAngelo and Masulis, 1980).

#### 2.1.3.1.2. Capital intensity

The level of capital intensity, normally measured as plant, property, and equipment (PPE) scaled by total assets (Gupta and Newberry 1997; Chen et al 2010) is also associated with tax management level. Capital-intensive companies have more tax management opportunities than companies with less capital because they can manage the timing of asset acquisitions and dispositions to claim tax allowances on qualifying capital expenditure to reduce taxable profits (Mills et al. 1998; Gaertner, 2014). In addition, in order to encourage the holding of tangible assets, tax provisions stipulate that the investment in such assets can enjoy capital allowance (Stickney and McGee 1982). Specifically, financial standards allow firms to use either straight line or reduced balance method to depreciate tangible assets but tax rules allow companies to depreciate tangible assets with the accelerated depreciation method. With this method companies can generate a higher amount of-tax deductible depreciation in the earlier years of an asset's life (Manzon Jr and Plesko 2002). Therefore, the more capital intensive a company is, the larger depreciation can be deducted from taxable income and the less tax liabilities will be.

#### 2.1.3.1.3 Research and development investment

In order to encourage entities to use high technology to enhance productivity, the investment in R&D is eligible for tax relief. If companies work on projects that can

improve the development of science and technology in their field, they can claim R&D tax reliefs for these projects. Due to this provision, it is suggested that the more R&D expenditure a company has, the more tax benefits it can obtain and therefore the lower tax burdens it has. The literature uses the ratio of net sales spent on R&D investment to measure R&D intensity and hypothesises that because of tax benefits for R&D investment, companies with higher R&D intensity have more opportunities to manage taxes (Gupta and Newberry 1997; Lanis and Richardson 2015; Berger 1993; Gaertner 2014).

#### 2.1.3.1.4 Net operating loss

Net operating losses (*NOLs*) from previous periods can be used to reduce current tax charges. A company's net operating losses in the current year can be carried forward and carried back to offset against taxable income in future and past accounting periods (HMRC 2018). The reduction in taxable income will result in lower tax payments. Graham (1996) and Cooper and Knittel (2010) also point out that if a company reports an operating loss in the current year, the loss can be "carried forward" to offset future taxable income. Thus, the *NOLs* generated in prior years can be used by companies to manage taxes.

Wang (1991) finds that the presence of *NOLs* carry-forward is negatively related to ETRs, indicating that companies consider operating losses as a tax management opportunity and take advantage of it to reduce tax liabilities. Chen et al (2010) control the effect of *NOLs* by using an indicator variable representing the presence of loss carry forward. They find that companies with *NOLs* carry-forward at the beginning of the year exhibit lower ETRs and higher BTDs than companies without *NOLs* carry-forward.

Chen et al (2010), Cheng et al (2012) and Manzon Jr and Plesko (2002) adopt the $\Delta NOLs$, defined as the change in tax loss carry-forwards from the last year to the current year, to investigate the association between *NOLs* carry-forwards and tax management. The tax loss carry-forwards reported in the end of the year represent the

cumulative amount of unused *NOLs* that can be carried forward to the following years. A reduction in tax loss carry-forwards from the beginning of the year to the end of the year means that a part of *NOLs* have been used. An increase in tax loss carry-forwards means that companies do not use *NOLs* in the current year, on the contrary, they generate more *NOLs* for future use. As a result, $\Delta NOLs$ should be negatively related to the level of tax management. As predicted, Chen et al (2010), Cheng et al (2012) and Manzon Jr and Plesko (2002) find that $\Delta NOLs$ are negatively associated with BTDs measures but positively associated with ETR measures.

The following firm characteristics can provide opportunities for entities to engage in tax avoidance.

**2.1.3.1.5 Firm size**

Regarding the association between firm size and tax management the literature has different theories. One theory is "political cost theory". According to Watts and Zimmerman (1978), usually the government relies on firm size to measure a firm's success, the larger firms are regarded as more successful. As behaviours of successful companies are more visible, they are more likely to be subject to government supervision and market scrutiny, consequently, the engagement in risky tax management is more easily to be detected. In other words, companies with larger size have higher political costs (Watts and Zimmerman 1978). Zimmerman (1983) finds that as a component of political costs, tax liabilities, measured as ETRs, are positively associated with firm size. As higher ETRs represent a lower level of tax management, the finding implies that companies with larger size have a lower level of tax management.

The other theory, political power theory, suggests that larger firms have more abilities and power to lobby tax policy develop in the direction favourable to them, employ tax management experts and arrange activities and sources to minimise tax payments (Siegfried 1973; Lanis and Richardson 2012; Lanis and Richardson 2015; Gupta and Newberry 1997). Rego (2003) hypothesises that compared with small companies, the

number of transactions in big-sized companies is larger and more complex, which provides more tax management opportunities. Consistent with this theory, Singh et al (1987) find a negative association between ETRs and firm size. The larger size a company has, the more tax management it engages in.

Stickney and McGee (1982) point out that a limitation of Zimmerman (1983)'s study is only considering the association between the univariate factor – firm size and tax management. There are other firm characteristics (e.g. foreign operation and accounting income) related to tax management (Rego 2003). If those characteristics are not controlled, the observed association between firm size and tax management may be driven by confounding factors rather than firm size. Thus, Stickney and McGee (1982) use a multivariate framework to examine the association between firm size and ETRs with controlling a series of firm characteristics including leverage, capital intensity and foreign income. Based on cross-sectional data collected from 1,097 companies for years 1978 and 1980, they find that after controlling those firm characteristics, ETRs are not significantly associated with firm size. Gupta and Newberry (1997) extend the study by using panel data over periods of 1982-1985 and 1987-1990. Similar to Stickney and McGee (1982), they find that the variation in ETRs is not significantly associated with firm size.

Some studies further find that the association between firm size and tax management vary by periods. Kern and Morris (1992) argue that previous studies only examine the correlation between firm size and ETRs pre the Tax Reform Act of 1986 (TRA 1986). They repeat Zimmerman's (1983) research design but extend the time period to 1989 because they argue that TRA 1986 significantly alter corporate tax structure, which could influence the association between firm size and ETRs. The finding is that in the end of the 1980s the significant variation in ETRs between large and small companies disappears, the TRA 1986 mitigated the gap of tax burdens between large and small firms. Holland (1998) examines the relationship between tax management and firm size of UK companies in the period of 1968-1993. This study finds that the relationship between ETRs and firm size is mixed. Specifically, for the period of 1968-1979, there

is evidence that ETRs are positively associated with firm size. Over the period of 1980-1993, the size effect is weaker (the positive association is limited to a specific type of ETR). In a particular period, specifically the years of 1978 to 1981, there is evidence that ETRs are negatively associated with firm size. It may because in this period UK corporate tax rates reach the highest level from 1968 to 1993, therefore, large companies have higher incentives to reduce tax burdens.

In conclusion, there is no agreed conclusion regarding the relationship between tax management and firm size. Political cost theory suggests that companies with larger size are less likely to manage taxes while political power theory argues that larger companies are more likely to manage taxes. With different research design, research period and tax management measure the conclusions can be different.

#### 2.1.3.1.6 Foreign operation

The literature proposes that foreign operations of multinational companies incorporate tax avoidance opportunities. Mills et al (1998) hypothesise that companies operating in multiple countries can take advantage of different tax rates to strategically arrange business to minimise tax expense. They use a confidential survey of 166 large US companies to investigate whether multinational and domestic companies have different levels of tax management. With a dummy variable indicating foreign involvement and multivariate research design, they find that multinational companies engage in more tax management than domestic companies. In addition, companies with higher foreign income are more likely to be subject to audit adjustment, suggesting that tax authorities consider that companies with foreign operations have a higher possibility of engaging in aggressive tax management activities. Stickney and McGee (1982), Cheng et al (2012) introduce that according to US GAAP income generated in foreign subsidiaries will not be subject to US tax rates until repatriated to parent firms. Therefore, setting up operations in foreign regions with lower tax rates can temporarily or even permanently defer tax payments. Rego (2003) and Jacob (1996) also point out that companies with overseas operations can acquire tax management opportunities that are not available for local companies. For example,

they can transfer profits generated in high-tax countries to low-tax or zero-tax (i.e. tax heaven) countries, carry out operating activities in areas with low tax rates, take advantage of different tax rules between different tax jurisdictions to design tax management strategies. Dyreng and Lindsey (2009) conclude that firms operating in at least one tax haven have lower global tax burdens than firms without business activities in tax heavens. Rego (2003) uses a dummy variable to indicate whether a company operates abroad and the continuous variable calculated as foreign assets divided by total assets as a proxy for the scale of overseas business, Rego (2003) reports that international companies pay less taxes than domestic companies. Moreover, the more foreign income a company has, the lower ETRs it exhibits.

There is an opposite opinion. Lee and Swenson (2016) suggest that high costs associated with cross-border tax management activities may lead to positive relation between foreign operations and tax burdens. Tax rules and the level of regulation vary across countries, this requires companies to make different tax management strategies in different settings, which will generate transaction and planning costs. The more countries foreign operations involve, the more complex for tax management, the higher costs could be. If the costs exceed the benefits, multinational companies are likely to forgo taking advantage of overseas tax management opportunities to reduce tax liabilities. Because multinational companies have a wider range of customers compared with domestic companies they are likely to have more revenue, without engaging in tax management, international companies will have higher tax liabilities (Lee and Swenson 2016). The more countries a company's foreign operations involve, the higher ETRs it will exhibit.

Stickney and McGee (1982) examine the relationship between foreign operations intensity and ETRs. They use a continuous variable calculated as foreign sales scaled by total sales (domestic plus overseas) as a proxy for a firm's level of overseas operations. However, they don't find a significant relationship between the level of overseas business and ETRs.

#### 2.1.3.1.7 Intangible assets

Markle and Shackelford (2012)'s finding that a company's ETRs are negatively related to the reliance of intangible assets suggests that intangible assets provide companies with tax management opportunities to reduce their tax burdens. Intangible assets refer to assets without physical substance, such as patents, image rights, brand names, copyright, and contracts (Delios and Beamish 2001; Hall 1993). The mobility of intangible assets allows companies to separate the location of ownership and production of intangible assets at very small costs. By directly holding intangible assets in low-tax areas, the income generated from intangible assets (e.g. royalties and licence fees) can be taxed at low rates (Dischinger and Riedel 2011). Because the income derived from intangible assets is taxed in the place where intangible assets are owed, even though intangible properties are produced in areas with high tax rates, companies still can register the ownership of intangible assets in areas with low tax rates to save taxes.

With intangible assets companies can use transfer price (the price set when subsidiaries or departments inside a multinational corporations trade internally) to shift profits generated in areas with high tax rates to areas with low tax rates (Grubert 2003; Dischinger and Riedel 2011; Grubert 1998; Markle and Shackelford 2012; Desai and Hines 2002). Assuming a multinational company sets up headquarters A in a country with a tax rate of 30%, but intangible assets are owned by a subsidiary B taxed at the rate of 15%, company A is charged by company B for the use of intangible assets. For tax saving purposes, the price of intangible assets usage can be exaggerated because in this way company B can have higher income and the income will be taxed at the lower tax rate of 15%. However, because Company A spends a higher cost for the use of intangible assets, if returns are unchanged, less profits will be taxed at the higher tax rate of 30%. Transfer pricing allows the multinational company to shift profits from a high-tax area to a low-tax area, the overall tax payments are reduced.

Intangible assets are related to another factor suggested by the literature having association with tax management, market-to-book ratio (MTB), defined as the ratio of

market value determined by investors to book value disclosed in financial statements. If a company's MTB is larger than 1, it indicates that the company's share price exceeds its net asset value, the company is overvalued by the market, investors are optimistic about the company's development prospect and confident about management mechanism and have a positive expectation about its future performance. The variable MTB is usually used to measure a company's growth opportunities (Penman 1996; Goranova et al. 2010; Chen and Zhao 2006; Kogan and Papanikolaou 2014; Barth and Kasznik 1999). Because perceived growth opportunities are reflected in share prices but not recognised in financial statements as there is no realised income, a higher MTB indicates more growth opportunities. Chen et al (2010) and Stanfield (2012) point out that the MTB is likely to be associated with tax management because growing firms are more likely to invest in assets with tax incentives (like depreciable assets) to get more cash flows. However, there is another interpretation that the relationship between MTBs and tax management maybe caused by intangible assets. Some researchers suggest that the difference between market and book value is resulted from those intangible assets reflected in market value but not recognised in book value (Hall 1993; Chan et al. 2001; Sáenz 2005; Barth and Kasznik 1999). That is, if a company has a high MTB, it may because this company has a high level of intangible assets. Therefore, the relationship between MTB and tax management observed in fact is the relationship between intangible assets and tax management.

The above firm characteristics provide companies with tax management opportunities so that they are likely to be associated with tax management measures. As discussed in the section 2.1.2 the traditional tax management measures, ETRs and BTDs measures, can only measure non-conforming tax management. The activities that change both financial income and tax expense cannot be captured by those measures. As a result, Hanlon and Heitzman (2010) and Gupta and Newberry (1997) suggest that the investigation of non-conforming tax management measures should control the changes in financial income.

#### 2.1.3.1.8 Profitability

Usually, profitability is included in the model to control the change in financial income. It is measured by return on assets (*ROA*), calculated as profits before tax divided by total assets (Gupta and Newberry 1997). It measures a company's ability to generate profits with assets. Regarding the association between profitability and tax measures, on the one hand, because entities are taxed on profits before taxes, it is hypothesised that entities with higher profitability have more tax liabilities. Wilkie (1988), cited in Gupta and Newberry (1997), uses formula to deduce the association between profitability and ETRS. Wilkie (1998) decomposes ETRs as:

$$\text{ETR} = \left[1 - \frac{Tax\ benefits}{Pre{-}tax\ income}\right] \times Statutory\ tax\ rate \quad (5)$$

According to the definition of *ROA*, the pre-tax income can be substituted by *ROA*× total assets and the formula (5) can be rewritten as:

$$\text{ETR} = \left[1 - \frac{Tax\ benefits}{ROA \times Total\ assets}\right] \times Statutory\ tax\ rate \quad (6)$$

From formula (6) it can be seen that with other factors unchanged, an increase in *ROA* will ultimately result in an increase in ETR, implying a lower level of tax management. Jacob (1996) also finds that a firm's profitability is positively related to its global tax obligations, computed as worldwide taxes paid divided by worldwide assets.

On the other hand, Rego (2003) argues that companies with higher profitability have stronger incentives (because they expect they will pay more taxes) and greater ability to manage taxes. Therefore, the likelihood for more-profitable companies to engage in tax management should be higher than less-profitable companies. This hypothesis is supported by Frank et al's (2008) finding that a firm's pre-tax profit is positively associated with both total BTD and discretionary BTD. Rego and Wilson (2012) also find that companies with higher *ROA*s are more tax aggressive than companies with lower *ROA*s.

Since the association between financial income changes and tax management engagement is mentioned, it is worth discussing an interesting and controversial research topic in the literature, that is, the relationship between earnings management and tax management. A company's tax decisions may not only result from tax considerations, but also related to profits considerations. In order to increase after-tax profits companies are likely to manipulate pre-tax financial income upward or manage taxable income downward, or do them simultaneously. Whether earnings management and tax management are substitutions or complements is a controversial issue.

Some studies support the substitution theory. They consider that accounting and tax rules are conforming, an entity's earnings-increasing strategies will result in an increase in taxable income and therefore higher tax expenses (Hanlon and Heitzman 2010). Likewise, a manager's decision to reduce taxable income can result in lower financial income and financial costs (e.g. less incentive compensation, debt covenant violations, lower market price) (Cloyd et al. 1996). Thus, the requirement of conformity between book and taxable income forces companies to make a trade-off between increasing financial income reported to investors and reducing taxable income reported to tax authorities. Otherwise, investors may doubt their earnings quality and tax authorities may challenge their tax behaviours (Shackelford and Shevlin 2001; Frank et al. 2009; Erickson et al. 2004).

Erickson et al (2004) identify 27 companies accused of engaging in fraudulent earnings overstatement and find that these companies pay additional taxes for increased earnings to reduce the likelihood of being detected by investors and regulators. Lennox et al (2013) examine the association between the level of tax management and the possibility of engaging in accounting fraud. They use the same database with Erickson et al (2004) but extend the sample to 1,109 companies. Adopting ETRs and BTDs as proxies for tax management, they find that companies engaging in accounting fraud show a lower level of tax management. This negative relationship was still persistent even during the period of 1995-2001 that both accounting fraud cases and aggressive tax reporting significantly increased.

However, some studies argue that the viewpoint that the increase in financial income will result in increase in taxable income and the decrease in taxable income will lead to reduction in financial income is based on the assumption that accounting standards and tax rules are conforming, which, however, may not be the case (Frank et al. 2009; Manzon Jr and Plesko 2002). The previous sections have introduced many differences between accounting rules and tax laws (e.g. depreciation method, equity method). Such nonconformity allows companies to report higher accounting income without increasing taxable income and lower taxable income without reducing book income (Phillips et al. 2003; Manzon Jr and Plesko 2002; Hanlon and Heitzman 2010; Yin 2001; Frank et al. 2009; Erickson et al. 2004). Companies do not necessarily report conforming financial and taxable income, they can both report higher book income and lower taxable income. In other words, earnings management and tax management can be complementary.

The growing divergence between US companies' book and taxable income over the period of 1988 to 1999 indicates that companies can both exaggerate accounting income and understate taxable income in the same period (Manzon Jr and Plesko 2002). The evidence from the period of mid-1990s to the beginning of the 21st century (e.g. Enron scandal) shows that the occurrence of accounting fraud was along with tax aggressiveness (Lennox et al. 2013). Frank et al (2009) hypothesise that companies can concurrently aggressively increase earnings (financial reporting aggressiveness[6]) and reduce taxable income (tax reporting riskiness). To test the hypothesis, they adopt a so-called "performance-matched discretionary accruals" to measure financial reporting aggressiveness and develop a new proxy, the discretionary book-tax difference (DTAX), which has been introduced in the section of tax management measures (section 2.1.2.2), to measure tax reporting riskiness. The results from 8,100 firms document a significantly positive association between aggressive financial and tax reporting, implying that companies have ability to report higher accounting income

[6] Financial reporting aggressiveness is defined as "upward earnings management that may or may not be within the confines of GAAP" Frank et al (2009).

and lower taxable income in the same reporting period.

A series of studies suggest that whether a company makes conforming or non-conforming accounting and tax choices depends on its ownership structure. Conducting a mail survey for financial directors from 1,363 public manufacturing firms and 557 private firms, Cloyd et al (1996) find that the private firms with aggressive tax positions tend to report lower financial income to increase the possibility of successfully defending aggressive tax treatments challenged by tax authorities. However, for public companies with aggressive tax positions because of their reliance on governance strategies linked to accounting numbers (e.g. incentive compensation) and higher capital market pressures they are unlikely to report lower financial income. Mikhail (1999) focus on tax management behaviours of the life insurance industry and concludes that while private firms adopt various tax management methods to reduce tax burdens, public firms forgo tax management methods that negatively affect financial income.

#### 2.1.3.2 Manager characteristics

The upper echelons theory suggests that a company's strategic choices, at least in part, depend on managers' individual characteristics (Hambrick and Mason 1984). Thus, it is reasonable to conjecture that managers' characteristics are helpful to explain the variation in corporate tax management decisions. While a lot of empirical studies have been developed to investigate the association between firm characteristics and corporate tax management behaviours, the role played by managers is underexplored (Hanlon and Heitzman 2010). Recently, some studies have attempted to explore this research topic and have important findings.

##### 2.1.3.2.1 Managers' biographical information

Dyreng et al (2010) are the first to examine the role of executives including chief executive officer (CEO), chief financial officer (CFO) and other top executives (e.g. people with the title of "president") in corporate tax management. Tracking the change

of 908 executives employed by more than one company and in each company employed for at least three years between the year of 1992 and 2006 and measuring tax management with *GAAP_ETRs* and *Cash_ETRs*, Dyreng et al (2010) find that executives can set the "tone at the top" to indirectly influence corporate tax management behaviours. For example, they can decide the priority of tax reductions, resources allocated to tax advisory and remuneration offered to tax directors. In addition, executives sometimes even directly participate in the making of tax policies (Olsen and Stekelberg 2016). However, Dyreng et al (2010) notice that managers' biographical characteristics such as education background, gender, age are not significantly related to the level of tax management, which suggests that the association between executives and tax management is not resulted from specific biographical information, these effects are idiosyncratic.

While Dyreng et al (2010) test the relationship between executive gender and broad tax management activities, Francis et al (2014) focus on the association between CFO's gender and risky tax activities. They identify a sample of companies experiencing a male-to-female CFO transition and examine the change in the level of tax riskiness measured by tax sheltering probability, tax contingency reserves and DTAX. They find that female CFOs are less likely to take aggressive tax positions than male CFOs. A possible explanation is that female CFOs are more risk-averse, because the engagement in aggressive tax management is associated with potential risks such as challenges from tax authorities and the loss of reputation (Hanlon and Slemrod 2009; Rego and Wilson 2012; Graham et al 2014), they are less willing to take risks.

Managers' political preference also has an explanation power for the variation in tax management decisions. Francis et al (2016) find that the likelihood of using tax shelters in firms managed by partisan CEOs (i.e. Republican and Democratic CEOs) is higher than firms run by nonpartisan CEOs. This finding supports the political connection theory that companies with political connection are more aggressive in tax management because *"these firms can have lower detection risk, better information*

*regarding future changes in tax regulation or enforcement, lower capital market pressure for transparency, lower political costs associated with tax planning ,and higher risk-taking tendencies*" (Kim and Zhang 2016). The political ideology theory suggests relying on CEO's political beliefs to analyse their tax decisions. In US setting Republican advocate tax reduction while Democratic supports tax increasing. As a result, Francis et al (2016) find that Republican CEOs are more likely to engage in tax sheltering than Democratic CEOs.

Law and Mills (2017) document that firms run by managers with military experience exhibit higher ETRs, lower unrecognised tax benefits and less use of tax havens than firms operated by managers without military experience. That is, managers served in the army engage in less tax management. This may because the allegiance and belief of soldiers to the country make them believe that it is immoral to avoid taxes through exploiting loopholes of tax rules or even against tax laws.

#### 2.1.3.2.2 Managers' personality characteristics

A managerial personality characteristic, overconfidence, reflected as managers' assessment of their abilities and judgements and expectation of desired outcomes are higher than the actual situation (Hirshleifer et al. 2012), is found to be associated with tax management. Kubick and Lockhart (2017) use CEO awards given by media outlets such as *Time* and *Forbes* as an external shock for overconfidence and examine how tax strategies change after CEOs win awards. The result is that companies led by an award-winning CEO will be more tax aggressive. This could be caused by two reasons, firstly, overconfident managers are likely to overestimate the likelihood that tax management will bring satisfactory benefits (such as lower tax expenses) but underestimate potential risks (e.g. reputational risks). Secondly, overconfident managers believe that they have sufficient ability to select the best tax advisors, identify and take advantage of tax management opportunities. Chyz et al (2019) use CEOs' willingness to postpone the exercise of stock option (a right granted by companies to employees to buy or sell companies' shares at agreed price and date), which means they believe the firms they manage will have a better performance, as

the proxy for overconfidence. They find that managerial overconfidence is positively associated with tax avoidance.

The extreme overconfidence, narcissism, is also found to be significantly associated with aggressive tax management behaviours (Olsen and Stekelberg 2016). Narcissistic CEOs have a sense of superiority, consider that they are free from laws and can enjoy special treatment, usually lack of moral sense, blindly pursue ideal results without considering negative consequences, aggressively pursue what they believe they deserve. With these characteristics, narcissistic CEOs are more likely to aggressively engage in tax management.

#### 2.1.3.3 Corporate governance

Corporate governance is the system (or mechanism) under which a company is managed when ownership and management of the company is separated (Cadbury 2000; Larcker et al. 2007). Some literature assume that managers and owners have coincident objectives, the decisions made by managers are consistent with the interest of owners. This assumption may be applicable for firms with concentrated management and ownership. However, in firms where management and ownership are separated, managers are likely to make decisions expected by owners or harmful for owners' interests to pursue private benefits (this is called agency issues), the purpose of corporate governance is to mitigate agency issues. Corporate governance can influence managers' incentives and therefore influence their decisions. Hanlon and Heitzman (2010) emphasise that the analysis of corporate tax management should consider agency issues. This section is going to introduce corporate governance mechanisms associated with corporate tax management.

##### 2.1.3.3.1 Board structure

The board of directors is an important governance device. Researchers suggest that the size of board of directors can influence managers' tax decisions. Minnick and Noga (2010) hypothesise that a smaller board should be associated with greater tax

management because with less board members the board is more flexible and more efficient in communication, as a result it is easier for directors to communicate with executives to invest in tax management. Wahab and Holland (2012) also point out that in a large board the process of coordination, communication and decision-making is more complicated. Lanis and Richardson (2011) suggest that smaller board has a better performance in controlling management (Jensen 1993), it should be more effective in reducing risky tax management activities to avoid potential costs for shareholders.

Apart from board size, board composition is also an important characteristic of board of directors. Lanis and Richardson (2011) find that the increase in the proportion of outside (i.e. non-management) board members can restrain risky tax management. Companies' tax management activities do not always result in the increase in shareholders' wealth. Managers may take advantage of the obscured nature of tax management transactions to obtain private benefits rather than maximising firm value, this behaviour is referred to as "rent diversion" (Desai and Dharmapala 2006; Desai and Dharmapala 2009a). One example is to use deferred taxes to manipulate accounting earnings upward to increase managerial compensation (Desai and Dharmapala 2009b). Employing more external members on the board can enhance the board's independency in monitoring management, reducing managerial rent diversion associated with tax management (Lanis and Richardson 2011). In addition, according to legitimacy theory corporations seek to operate in a manner considered to be legitimate by stakeholder groups and more generally the society to be approved and supported to continue the business (Deegan 2002; Holland et al. 2016). Because aggressive tax management activities may be considered as illegitimate, outside directors monitor management to reduce such activities to ensure companies' survival and their reputation (Lanis and Richardson 2011).

However, Minnick and Noga (2010) argue that firms having more independent (i.e. non-employee) directors in the board are supposed to exhibit greater tax management. Independent directors can play an advisory role in the board, they can use knowledge and experience from their industries to provide advice for tax management strategies,

increase profits and shareholders' wealth. Armstrong et al (2015) also examine the association between board independence and the level of tax management. They regard tax management as an investment opportunity with both benefits and risks. Differences in the assessment of benefits and costs between managers and owners can lead managers to engage in more or less tax management than shareholders expect. As an important governance device, the presence of independent directors can alleviate this agency issue. Armstrong et al (2015) suggest that the relationship between the proportion of independent directors and tax management should be different at different levels of tax management. Therefore, in addition to using the linear ordinary least squares (OLS) regression to test the correlation between board independence and the average level of tax management, they adopt quantile regression to investigate the association across the entire tax management distribution. The result of OLS regression shows that the average level of tax management is not related to the proportion of independent directors. However, the result based on the quantile regression indicates that board independence and tax management are positively associated when tax management level is low. This means that independent directors may take advantage of the knowledge and experience obtained from other companies to facilitate low-risk tax management. For high levels of tax management, however, board independence is negatively related to tax management, suggesting that if the level of tax management is high, independent directors will monitor management to reduce risky tax behaviours.

Some researchers investigate the presence of experts in board of directors and the level of tax management. Robinson et al (2012) investigate the relationship between accounting experts (defined as members with accounting-related experience in financial reporting) of audit committees and tax management. Audit committee is a special committee of board of directors, it is mainly responsible for the monitoring of financial statement disclosure, internal control process and employment of auditors. They point out that the board of directors can both monitor and advice managers. The advising function promotes tax planning and the monitoring function constrains tax management with high risks. Robinson et al (2012) find that the proportion of

accounting experts on the audit committee is positively correlated with *GAAP_ETRs* and *Cash_ETRs* which are the proxies for overall tax management, but negatively correlated to uncertain tax benefits (UTBs) and tax sheltering probability which are measures for risky tax management. Armstrong et al (2015) find that having accounting experts on the board can mitigate aggressive tax management. When the level of tax management is low, the board with accounting experts will encourage tax management because this can reduce tax burden with little or no costs. However, when the level of tax management is high, accounting experts will discourage tax management because the costs of risky tax management may exceed the benefits.

CEO duality, refers to CEO and chairman are held by the same person, is an important characteristic of board of directors. Minnick and Noga (2010) examine the association between CEO duality and corporate tax management. They hypothesise that if a company's CEO and chairman are the same person, the company's management team is entrenched. On the one hand, an entrenched management team is difficult to be replaced so that it has less incentives to reduce taxes to improve firm performance. As a result, companies with CEO duality are unlikely to engage in tax management. On the other hand, however, entrenched managers have greater ability to override constrains from governance mechanisms to increase private benefits at the expense of shareholders' wealth (Berger et al. 1997; Florackis and Ozkan 2009). Consequently, managers have more opportunities to engage in tax management for rent diversion.

#### 2.1.3.3.2. Managerial incentive compensation

Another governance mechanism hypothesised to be associated with tax management is managerial incentive compensation. Managers are given incentive compensation like bonus and stock option to motivate them to take activities to increase shareholders' wealth. Empirical studies have investigated the association between managerial incentive compensation and tax management and the conclusions are mixed.

The traditional opinion considers that low-risk tax management activities can reduce tax charges and therefore enhance shareholders' wealth. Thus, companies with

separated ownership and management are likely to use incentive compensation to encourage managers to manage taxes. For example, stock option allows managers to hold a proportion of companies' shares, in this way managers' personal interests are linked to corporate performance, they therefore have greater incentives to reduce taxes and increase profits. Phillips (2003) suggests that incentive compensation based on profits after tax can encourage the engagement in tax management. Relying on after-tax accounting income to compensate managers emphases the importance of tax expenses and potentially gives manages greater incentives to cooperate with tax advisors to identify tax management opportunities and develop tax management strategies. Phillips (2003) designs a research to investigate the association between after-tax-based bonus plan of CEOs and business-unit managers and the level of tax management measured by ETRs. Consistent with the assumption, companies using after-tax profits as the basis of business-unit managers' bonus plans exhibit lower ETRs, that is, have a higher level of tax management. But they do not find significant relation between ETRs and CEO's bonus plan. Gaertner (2014) attributes this insignificant result to low statistical power resulted from small sample size. Thus, while Phillips (2003) includes 209 firms in the sample, Gaertner (2014) enlarges the sample to 354 firms. With the larger sample size Gaertner (2014) finds a significantly negative correlation between CEOs' after-tax annual bonus and ETRs. Minnick and Noga (2010) document a negative association between share-based compensation and five-year *GAAP_ETRs* and *Cash_ETRs*, implying companies providing incentive compensation have a high level of tax management in a long-term.

Rego and Wilson (2012) examine the association between CEOs and CFOs' equity risk incentives, measured as "the change in value of a manager's stock option portfolio for a given change in stock return volatility", and companies' risky tax management behaviours. They find that equity risk incentives induce risk-averse executives to take risks and therefore are positively related to risky tax management activities. Armstrong et al (2015) also document that providing CEOs with equity risk incentives can increase the average level of tax management. In addition, adopting the quantile regression, they find that the positive association between equity risk incentives and

tax management is more pronounced when the company's tax management level is high.

Although these studies show evidence of the association between top executives' incentive compensation and tax management, it is possible that the tax outcomes are by-products of managers' other decisions such as investment and operating decisions, rather than directly resulted from tax management decisions (Armstrong et al 2012). Therefore, Armstrong et al (2012) suggest that it is necessary to examine whether incentive compensation of the tax director who is the most directly in charge of a firm's tax-related decisions is associated with tax management behaviours. The result is tax directors' incentives are negatively related to *GAAP_ETRs*.

While aforementioned research assumes that shareholders expect managers to make every effort to manage taxes, Desai and Dharmapala (2006) argue that shareholders do not always encourage managers to engage in tax management activities. As mentioned before, the complex, obscure and non-transparent nature of tax management activities can provide managers with opportunities to engage in rent extraction (Chen et al. 2010; Desai and Dharmapala 2006; Desai and Dharmapala 2009a; Desai and Dharmapala 2009b). Therefore, opposite to the typical view that tax management activities can increase after-tax profits and therefore shareholders' wealth, the potential correlation between tax management and rent diversion could result in tax management having a negative effect on shareholders' benefits. For this reason, shareholders may use incentive compensation to constrain tax management activities. Consistent with this theory, Desai and Dharmapala (2006) document that the more prevalent use of incentive compensation is associated with a lower level of tax management.

#### 2.1.3.3.3 Ownership structure

The structure by which a company is owned is found to be associated with tax management. The literature has investigated the association between family ownership, dual class ownership, institutional ownership, private equity and tax management.

Although some studies have investigated the association between ownership structure and tax management, this research area is still underexplored.

#### 2.1.3.3.3.1 Family ownership

Chen et al (2010) attempt to examine the association between family ownership and the level of tax management. They hypothesise that compared with non-family companies, the ownership and management of family companies are concentrated. Family owners have large shares and usually hold positions in the management team, as a result, they are able to benefit more from tax management activities. On the other hand, however, having a large proportion of shares means taking more risks and expenses. If the engagement in tax management is challenged by tax authority, they are likely to pay additional taxes and penalty. Minority shareholders may undervalue a company's securities if they interpret dominant shareholders (in this study are family owners) use tax management for rent-seeking. Family owners have longer horizon because they have incentives to pass companies to the next generation. Due to the longer horizon they are more concerned and cautious about potential risks associated with tax management activities. Without knowing whether founding family members put more emphasis on benefits or risks of tax management, Chen et al (2010) hypothesise that family ownership is associated with tax management but they are not sure whether the association is positive or negative. Based on multiple measures of tax management (specifically, *GAAP_ETRs*, *Cash_ETRs*, total BTDs and residual BTDs) and data from 3,865 firm-year observations during the period of 1996-2000, the result is that family firms engage in less tax management than non-family firms, suggesting that family owners forgo the benefits of tax management to avoid the potential risks.

#### 2.1.3.3.3.2 Dual class ownership

McGuire et al (2014) examine tax management behaviours of companies with dual class ownership. Dual-class corporations have an agency issue between inside and outside owners. Companies with dual class ownership issue two types of stocks, one is superior class stock held by internal members (e.g. directors and officers), this stock

is not publicly traded, the other one is inferior class stock held by outsiders, it can be publicly traded. Superior stock represents more vote rights than inferior stock, allowing insiders to execute effective control on firms despite claiming the minority of residual cash flows. On the one hand, increasing the disparity between control rights and cash flow rights could lead to reduced tax management activities. Powerful voting rights possessed by insiders can increase managerial entrenchment and weaken the intervention from outside shareholders. Because tax management is expensive and risky, insiders have incentives to reduce it. On the other hand, the separation between cash flow and voting rights may be associated with greater tax management. This is because the separation of cash flow and control rights allows internal managers to enjoy benefits of tax management with little costs. The result shows that the larger difference between inside managers' cash flow and control rights, the less likely they are to manage taxes.

#### 2.1.3.3.3.3 Institutional ownership

Researchers are also interested in tax management behaviours of companies owned by institutions. Cheng et al (2012) point out that the intervention of hedge fund activists is positively associated with the level of tax management. Hedge fund is a fund that uses very complex investment and risky management techniques (e.g. derivatives and leverage) to generate returns. Hedge fund activism is a behaviour that buys a significant level of stock in a company to influence how it is managed. Because hedge fund activists usually hold a large amount of a corporation's stocks and fund managers' compensation depends on investment returns, hedge fund activists have power and incentives to influence corporate decisions. Because tax management activities can reduce tax expense and potentially increase after-tax earnings and cash flows, which can increase investment returns of hedge funds, companies targeted by hedge funds activism should be encouraged to employ tax management strategies. Making a comparison between 2,981 firms targeted by hedge fund activists and control companies constructed by propensity score matching method, Cheng et al (2012) find that after the hedge fund intervention there is an increase in tax avoidance, implying

that hedge fund activists encourage companies to engage in tax management.

Bird and Karolyi (2017) examine how institutional ownership is related to firms' tax management decisions. They find that over the period of 1996-2006, there is an increase in institutional ownership from the bottom of Russell 1000 to the top of Russell 2000, followed by a corresponding increase in international tax management in the form of tax heaven usage. Khan et al (2017) improve the research design of Bird and Karolyi (2017) (e.g. increased sample size, the employment of non-parametric method) and also get the positive association between institutional ownership and tax management. They further find that tax management is increased in the form of tax sheltering, with increased tax management companies have higher likelihood of meeting earnings forecast targets set by analysts.

#### 2.1.3.3.3.4 Private equity

Badertscher et al (2013) focus on tax management behaviours of private firms. Fama and Jensen (1983) point out that restricting shareholders and decision-makers to a small group of managers will lead to less diversified risks and therefore reduce managers' willingness to invest in risky projects. Armstrong et al (2015) and Chen et al (2010) consider that tax management activities are risky for firms due to associated costs such as contingent tax liabilities, penalties and reputation loss. Based on these theories, Badertscher et al (2013) conjecture that the more concentrated ownership and control a private firm has, the less likely for it to manage taxes. In order to test the hypothesis Badertscher et al (2013) make a comparison between tax management behaviours of private firms primarily owned by managers and private firms owned by private equity (PE). Compared with companies controlled by PE, those controlled by a small group of managers have more concentrated ownership and management. Consistent with the expectation, the degree of tax management of management-owned firms, measured by *GAAP_ETRs*, *Cash_ETRs*, discretionary BTDs and tax shelter probability, is lower than in private equity-backed firms.

#### 2.1.3.3.4 Labour unions

As a company' important members, the impact of employees on corporate decisions cannot be ignored. The evidence based on 237 employee whistleblowing cases identified from U.S. government dataset indicates that employee whistleblowing can constrain risky tax management (Wilde 2017). Chyz et al (2013) investigate the role of labour unions (an entity organised by workers with the purpose of improving workers' rights) in corporate tax management. They find that union power is negatively related to the level of tax management. There are two reasons: from the perspective of labour unions, they are interested in whether firms are capable to pay wages and benefits for employees. As a result, they suggest less investment in risky tax strategies to avoid potential losses. From the perspective of managers, labour unions' rent seeking behaviours may reduce the benefits they can obtain from aggressive tax activities. Besides, aggressive tax management has many risks and costs. Thus, they have less incentives to engage in tax management.

### 2.1.3.4 External environment

The above discussion only considers a company's internal conditions. Recent research has investigated corporate tax management from a social perspective, a company's tax management is also associated with the external environment in which a company is operated. The investigation of corporate tax management strategies based on the agency theory only considers the role of a particular stakeholder, shareholders, in managers' decision-making. As a "real-world" entity, a firm's decisions and economic activities should have effects and also be affected by a variety of stakeholders (Deegan 2002; Lanis and Richardson 2012). Scholes et al (2002) suggest that an effective tax management strategy requires managers to consider possible impacts on all parties involved. This section is going to introduce the association between tax management and external environment.

#### 2.1.3.4.1 Corporate social responsibility

Lanis and Richardson (2012) examine the association between corporate social responsibility (CSR) and tax management. They point out that corporations' engagement in risky tax management is lack of social responsibility because their avoidance of "fair share" of taxes reduces the funding provided by the government for public projects. Therefore, socially responsible companies, i.e. companies engaging in many CSR activities like protecting environment, improving employee welfare, enhancing relationship with government, suppliers and customers (Lanis and Richardson 2012; Campbell 2007) are less tax aggressive. Hoi et al (2013) examine the tax management behaviours of firms considered to be irresponsible because they engage in activities that "*are widely regarded as damaging to corporate governance, employee relations, communities, public health, human rights, diversity, the environment, etc*" (p2026). They find that firms taking irresponsible CSR activities show greater permanent and discretionary BTDs and higher tax sheltering likelihood, implying that they are more aggressive in minimising taxes.

While some firms consider paying taxes can enhance social welfare and therefore is socially responsible, other firms argue that paying high taxes will lead to negative effects on the society. As an important wealth creator, companies can provide the society with job opportunities, investment opportunities, promote technological progress and create economic benefits. Having high tax liabilities will reduce profits and consequently may reduce job opportunities and innovation incentives, restrict economic development (Davis et al. 2016; Djankov et al. 2010). On the contrary, keeping potential tax payments within firms is beneficial to society because profitable firms are more efficient in resource allocation than governments (McGee 2010). Consistent with these theories Davis et al (2016) find that firms more socially responsible engage in more tax management over a long-term.

#### 2.1.3.4.2 Other social entities

Some firms deal with tax affairs (e.g. tax payment, management, reporting and

disputes) by themselves, some firms purchase tax services from external accounting firms (Klassen et al. 2016). McGuire et al (2012), Omer et al (2006), Cook et al (2008) point out that audit firms are allowed to work with their clients to develop legitimate tax planning strategies. Thus, tax fees paid to auditing firms are expected to be positively related to the level of tax planning. Cook et al (2008) find that firms with higher tax service costs experience a greater drop in ETRs between the third and fourth quarter of a year. Omer et al (2006) report that the more tax fees a firm pays to the auditors, the lower tax burden it will have in the next year. Klassen et al (2016) report that firms with higher tax fees have a higher level of tax management.

Hasan et al (2017) find that a company's tax avoidance behaviours are related to the civic norms and social connections (together called "social capital") between members of the community where the headquarter is located. The civic norms highlight citizens' obligations and sense of social responsibility, they can be better spread and implemented in communities with close social relationship. Therefore, in communities with high levels of social capital, tax avoidance behaviours are considered as against the values of civic norms and thus are accompanied with costs such as moral condemnation and social sanctions, leading to less incentives for managers to avoid taxes. Boone et al (2013) point out that managers' tax management decisions are related to religious beliefs of the social members around the place where a company is located. Specifically, the higher level of religiosity in communities where companies are located, the more risk-averse managers are and therefore the less likely for them to avoid taxes.

A firm's tax behaviours are also associated with tax practices of other firms associated with it. Brown and Drake (2014) suggest that establishing social networks through the board of directors and auditors with companies keeping low tax burdens for a long time can increase tax management engagement. This is because the social connections provide firms with channels to share tax avoidance information, knowledge and experience. Kubick et al (2015) analyse tax avoidance behaviours of leading firms in the product market and the response of non-leading firms. They find that the leading

firms in the product market have higher, more stable and consistent profitability, which allow them to better predict and realise the benefits of tax management. Besides, due to market power and strong competitiveness leading firms are more risk tolerant, even though tax management is unsuccessful they are less likely to be threatened by competitors. These characteristics give market leaders greater incentives and opportunities to manage taxes. In addition, in order to remain competitive, non-leading firms are found to mimic the market leaders' tax management strategies.

#### 2.1.3.5 Conclusion

The section 2.1.3 introduces factors associated with tax management behaviours. Firm characteristics (capital structure, capital intensity, research and development expenditure, net operating loss, firm size, foreign operation, intangible assets, profitability) provide tax management opportunities, they are directly associated with the level of tax management. Managers set the "tone at the top" to make tax decisions so their characteristics (biographical information and personality characteristics) are associated with tax management behaviours. A company's corporate governance (board structure, incentive mechanism, ownership structure, labour unions) and external environment where a company located can influence managers' incentives and therefore are hypothesised to be associated with managers' decisions in tax management. Among those factors, ownership structure is a topic has attracted the interests of researchers in recent years. Although some studies have investigated the association between ownership structure and tax management, this is still a new area has not been fully developed. Hanlon and Heitzman (2010) suggest future study do more examination regarding the effect of ownership structure. From literature review it is noticed that prior research investigates the association between a single ownership (e.g. family ownership, dual class ownership, institutional ownership) and corporate tax management under a static situation. This study will investigate corporate tax management under a changing ownership, specifically, how tax management behaviours change during a big event of a company's life-initial public offering (IPO). As IPO is an important concept of the study, the next section is going to introduce the

literature related to it.

## 2.2. Initial public offerings

### 2.2.1 IPO definition, advantages and disadvantages

When a company develops to a certain stage, it has incentives to seek more capital for further growth and expansion. An IPO, also known as "going public", is the first time a company sells a portion of its shares to the public. A private company successfully completes IPO procedure will be transferred to a public company. The ownership changes from being concentrated on management to being dispersedly held by the public. Undertaking an IPO will bring many benefits to the issuer. The most important benefit, also the main reason for many companies to go public, is to generate capital for companies to expand operations, increase capital, continue growth, increase technological investment to enhance competitiveness, repay debt (Daily et al. 2005). For initial owners they can realise personal wealth by selling their holding shares in the secondary market where securities are traded (Rock 1986). In addition, in the IPO process companies' operating activities, accounting system, management team, corporate governance structure, and remuneration mechanism can be standardised in accordance with listing requirements.

Going public, however, is also associated with many costs. Companies will be subject to additional scrutiny and monitoring during and after the IPO process (Gao and Jain 2011; Gounopoulos and Pham 2018; Jain and Kini 2008). They are required to disclose more information to meet listing requirements, even though some information may negatively affect their market values (e.g. risk factors). The initial owners give up a part of controlling rights. A lot of fees will be occurred, such as consulting fee, reporting accountant fee and underwriting fee.

### 2.2.2 UK IPO process

This section gives an overall introduction of UK IPO process to make the following

discussion easier to understand. For clarity a diagram (figure 2.3) is used to summarise the IPO process and demonstrate where each level of scrutiny takes place. If a company decides to undertake an IPO, the first thing to consider is where to list. Companies seeking to float on the UK market usually choose London Stock Exchange (LSE). The LSE has two principal markets, Main Market and Alternative Investment Market (AIM). Main Market is set up for larger and developed companies. AIM is the market for smaller and growing companies (Cordazzo and Vergauwen 2012). Main Market has higher eligibility criteria and regulation standards than AIM. For example, companies listed on Main Market must have a minimum market cap of £700,000 but this is not necessary for companies listed on AIM; At least 25% of shares must be floated for companies listed on Main Market but this is not required for companies listed on AIM; floating on Main Market requires companies to provide an approved prospectus while AIM does not require it; issuing on Main Market must comply with the UK corporate governance code while listing on AIM is allowed to follow corporate governance guidelines for smaller listed companies; AIM listing must appoint a nominated adviser at all times but this is not necessary for Main Market flotation. As Main Market has higher eligibility criteria and regulation standards it can attract a wide range of investors, AIM, however, is more uncertain for investors.

The companies choosing Main Market need to further decide which segment to list. They can choose either premium listing or standard listing. Similar to the difference between Main Market and AIM, premium listing has more stringent listing requirements than standard listing. For example, companies applying for premium listing must have an investment bank but standard listing does not have this requirement.

After determining the market to be listed, the next step, which is vital for a successful IPO, is to do substantial preparatory work. The more adequate an IPO is prepared, the more likely to be successful. In the preparation stage IPO companies need to review and restructure their equity story, business plan, growth prospect, debt structure, tax planning strategies, financial information, financial reporting procedures,

**Figure 2. 3 Summary of IPO process**

management and corporate governance structure, compensation scheme, internal controls etc. to ensure the compliance with the Listing Rules issued by Financial Conduct Authority (FCA). The period of IPO preparation varies by company.

A critical work for IPO preparation is to build an advisory team. Members of the advisory team include sponsor, solicitor, reporting accountant and other advisors (e.g. registrar, investor relations advisor, remuneration advisor, printer). Each advisor has its specific responsibilities.

Companies seeking a premium listing must appoint a sponsor, usually is an investment bank. Companies conducting large scale IPOs can appoint multiple investment banks. The sponsor's work includes providing advice (e.g. advice on corporate governance system, compensation scheme, prospectus drafting, new issues marketing) to assist IPO process, assessing IPO companies' readiness for listing, endorse for FCA that the company applying for a premium listing has met regulatory requirements, making connections between IPO companies and FCA and stock exchange.

Reporting accountant is responsible for the review of financial situation. Its main work includes conducting a financial due diligence and based on the outcome to publish a "long form report"; Assessing working capital (the difference between current assets and current liabilities) and preparing a working capital statement; Reviewing and reporting the effectiveness of financial reporting procedures; Reviewing the financial information disclosed in the prospectus and issuing an accountant's report. The responsibilities for solicitors are conducting legal review and legal due diligence, drafting prospectus and other legal documentations, providing legal advice, etc.

Once the company completes preparation work, pass IPO readiness review and gets ready to go public, it will enter IPO execution phase. It will conduct a "Kick-off meeting" in which all IPO participants – management team, investment bank(s), solicitor, auditor, reporting accountant will attend the meeting. The purpose of the Kick-off meeting is to provide an introduction of the issuing company to ensure

involved groups are familiar with the structure and process of the execution and to establish an IPO timetable.

Because of significant information asymmetry between the current owners and potential investors a prospectus is often required. The Listing Rules stipulate that companies applying for the admission to flotation must submit a prospectus approved by UK listing authority (UKLA), which is the name used by FCA when it acts as the competent authority for Official Listing, and will be published to the public (FCA 2015a). Therefore, the advisory team must work with the management team to draft prospectus in which additional information is required to disclose. The investment bank will submit draft prospectus to UKLA for a review, it may be revised for several times in accordance with the comments from UKLA before being officially approved. A prospectus should provide the information about responsible people, statutory auditors, the issuing company's business, organisation structure, operating condition, financial performance, risk factors, management structure, corporate governance mechanism, compensation system, number of employees, major shareholders, etc (FCA 2015b). Hanley and Hoberg (2010) point out that the "Summary" section giving an overview of issuers, "Risk Factors" section introducing potential risks and uncertainties associated with issuers (e.g. tax risks, potential tax liabilities), "Management's Discussion and Analysis" and "Use of Proceeds" sections account for approximate 40% of the entire content of prospectus. Other sections include material tax consequences, management team structure, financial information, dividend policy, transactions with related-party, equity retained by CEOs, introduction of securities, future expectation, etc (Nielsen et al. 2006; Hanley and Hoberg 2010; Bartov and Mohanram 2002; Daily et al. 2005; Guenther and Willenborg 1999). The information in relation to taxation could be disclosed in the "Risk Factors" section in which issuers should mention, if they have, the risks of additional (or contingent) and volatile taxes resulted from changes on tax policy, penalty on overdue taxes, stricter interpretation of tax regulations, increased effort of government bodies on tax collection (Hussein et al. 2020). Financial information is another section from which the information on taxation can be obtained (Mohanram 2005; Roosenboom and Schramade 2006;

Venkataraman et al. 2008). Tax outcomes of the issuer, e.g. tax expense, deferred tax asset, deferred tax liability are reported in this section. Table 2.2 lists the minimum information regulated by Prospectus Rules (FCA 2015b) to be included in prospectus, usually a prospectus includes those contents. The table also summarises the information of prospectus relevant to this study, i.e. taxation information.

**Table 2. 2 Summary of prospectus contents**

| Minimum disclosure requirements for a prospectus | | Taxation information |
|---|---|---|
| Part 1 | Table of contents | |
| Part 2 | Summary | Part 6 "Risk factors" reports (if IPO companies have) the risks of contingent taxes due to change in tax policy, penalty on overdue taxes, stricter interpretation of tax regulations, increased effort of tax administrations on tax collection.<br><br>Part 22 "Financial information concerning the issuer's assets and liabilities, financial position and profits and losses" includes income statement, balance sheet, cash flow statement, which report tax expense, tax liabilities/assets, cash tax paid. |
| Part 3 | Persons responsible | |
| Part 4 | Statutory auditors | |
| Part 5 | Selected financial information | |
| Part 6 | Risk factors | |
| Part 7 | Information about the issuer | |
| Part 8 | Business overview | |
| Part 9 | Organisational structure | |
| Part 10 | Property, plants and equipment | |
| Part 11 | Operating and financial review | |
| Part 12 | Capital resources | |
| Part 13 | Research and development, patents and licences | |
| Part 14 | Trend information | |
| Part 15 | Profit forecasts or estimates | |
| Part 16 | Administrative, management, and supervisory bodies and senior management | |
| Part 17 | Remuneration and benefits | |
| Part 18 | Board practices | |
| Part 19 | Employees | |
| Part 20 | Major shareholders | |
| Part 21 | Related party transactions | |
| Part 22 | Financial information concerning the issuer's assets and liabilities, financial position and profits and losses | |
| Part 23 | Additional information | |
| Part 24 | Material contracts | |
| Part 25 | Third party information and statement by experts and declarations of any interest | |
| Part 26 | Documents on display | |
| Part 27 | Information on holdings | |
| Part 28 | Essential information of share securities | |
| Part 29 | Information concerning the securities to be offered/admitted to trading | |
| Part 30 | Terms and conditions of the offer | |
| Part 31 | Admission to trading and dealing arrangements | |
| Part 32 | Selling securities holders | |
| Part 33 | Expense of the issue/offer | |
| Part 34 | Dilution | |

Another important activity undertaken during this stage is due diligence. The advisory team will work together to conduct business, financial and legal due diligence to examine whether the information disclosed in the prospectus is accurate, credible and complete, identify if there are any potential issue may delay or damage IPO, assess whether additional restructure is required.

After the above work is completed, senior management members will meet with analysts invited by the investment bank and give a presentation about the company's current situation and future prospect. Analysts will base on the information obtained from the meeting to do research regarding to the IPO company. In the upcoming marketing process, the research will be published to potential investors to help them evaluate the company's performance.

Approximately one month later, the issuer will announce its flotation intention to the market. There are three flotation methods can be chosen: introduction, public offer and placing. Introduction method is usually used by companies where over 25 percent or more of shares have been publicly held. These companies just list their securities on the market to be traded, they do not raise any capital. Public offers include offer for sale, offer for subscription, offer for sale by tender (Goergen et al 2006). In offer for sale the securities of an issuing company are sold by the sponsor at a fixed price. However, for offer for sale by tender potential investors are invited to state the price they are willing to pay, sponsor will base on these bids to establish a strike price and all investors will buy securities at this price. Offer for subscription is usually used by investment trusts where only a part of issues is underwritten. Companies choosing a public offer can sell their issues to private or/and institutional investors so they have a wide base of investors. Their issues are underwritten, which means, issuers and underwriters (also known as sponsors) will sign an underwriting agreement in which underwriters commit they will sell issues at an agreed offering price and will purchase unsold issues if the issues are undersubscribed. This implies that the risk of IPO failure will be borne by underwriters. Companies going public via a placing method usually offer their issues to a group of institutional investors and therefore their investors are

limited. Different from public offers, the issues of companies with placing method are not underwritten. Consequently, if an IPO is failed, the costs will be borne by issuing companies.

After announcing the intention of flotation, the next step is to market the securities. Due to lack of IPO experience, issuing companies usually appoint brokers to assist the marketing of new issues. Brokers have engaged in IPO work for a long time and therefore is more professional and experienced. Besides, they have a wide range of investors network. They will discuss with potential investors (e.g. pension fund and hedge fund) to understand their purchase intention, estimated order volume and acceptable offering price. Then underwriters and management teams will establish a price range based on investors' demand. After that the underwriter will arrange a "road show" during which key members of the management will meet and give presentations to potential investors to introduce the company's business, products and services, operating situation, financial performance, market environment and explain why its securities are worth investing. A draft prospectus that only reports price range rather than a fixed offering price (also called pathfinder prospectus) will be distributed to investors. A book runner will build a list of investors tending to subscribe the shares, the volume of orders and the price they are willing to pay. The issuer and underwriters will use the information provided by the book runner to negotiate and determine the final issue size and price. They will then publish the final offering price to the market, confirm orders and allocate shares to buyers.

A few days later the IPO company will officially announce its listing. It will add the specific offering size and price in the prospectus and submit the final version of prospectus to UKLA for final approval. In addition, a formal application for listing and trading will be submitted to UKLA and the LSE, respectively. Once being admitted, the securities can be traded in the market, representing that the company completes the entire IPO process and has been successfully transferred from a private company to a public company.

### 2.2.3 Additional scrutiny in the IPO process

An important characteristic of IPO is that in the IPO process corporate behaviours will be subject to additional scrutiny, which increases the risks of tax management and therefore likely influences managers' tax management incentives.

Firstly, during the phase of IPO preparation and execution, companies intending to go public must prepare a prospectus, the disclosure requirements of prospectuses increase the amount of information disclosed in the public domain. This is a form of additional scrutiny.

Companies in private status primarily use annual reports to communicate with potential stakeholders about corporate performance, however, companies seeking to conduct IPOs are required to publish prospectuses to communicate with investors. Annual reports are required to comply with various UK companies Acts and domestic or international accounting standards while prospectuses comply with companies act and stock exchange requirements (Cordazzo and Vergauwen 2012). With different reporting standards their content are different. Nikolaj Bukh et al (2005) point out that compared to annual reports, prospectuses contain additional information on companies' future expectations, comprehensive disclosure on potential risks, companies' long-term strategies and the criteria used to evaluate the effectiveness of strategy implementation. Branswijck and Everaert (2012) also report that prospectuses provide investors with additional information on issuers' risks, future strategies and profitability.

With additional information disclosed, there is higher likelihood for tax management being exposed to the public, causing the engagement in tax management easier to identify. As a consequence, managers may have less incentives to use tax management strategies as they are riskier. For example, if companies engage in high-risk tax management they should evaluate potential risks such as contingent tax liabilities in the section of "Risk Factors" of prospectuses (Hussein et al 2020). To avoid the negative effect of such information on firm value, companies are likely to engage in

less tax management (Cordazzo and Vergauwen 2012; Freedman and Stagliano 2002).

Secondly, after successfully going public, as a public company in the ongoing market, corporate behaviours are visible to various social entities such as market investors, consumers and social media. This means that there will be increasing monitoring on tax management behaviours. This is another reflection of additional scrutiny.

Literature has pointed out that being public will experience additional scrutiny. Gounopoulos and Pham (2018) point out that with a portion of shares sold to the public in the IPO process, a part of the IPO companies' ownership will be transferred to outside investors. As a consequence, after going public the behaviours of issuers will be monitored by market investors. Gao and Jain (2011) also point out that one of vital challenges faced by issuing companies in the IPO process is additional scrutiny from potential investors and media report on investment, financing and operation decisions. Gounopoulos and Pham (2018), Jain and Kini (2008) also suggest that with the ownership transiting from private to public companies are faced with more stringent monitoring from market participants. IPO companies should adapt to additional monitoring and scrutiny, otherwise their survival could be threatened.

Extant literature finds that with additional scrutiny companies behave more conservatively. Ball and Shivakumar (2008) show that IPO companies report more conservatively in the IPO process, with more stringent scrutiny they engage in less earnings management. Ahmad-Zaluki et al (2011) also point out that the enhanced scrutiny and monitoring from market participants and regulators in the IPO process result in a lower level of earnings management. This motivates the study to argue that the increased scrutiny for publicly quoted company causes tax management behaviours more likely to be challenged, which increases the potential costs of tax management and reduces managers' incentives to engage in it.

In conclusion, the additional scrutiny involved in IPO process, reflected by more information disclosure and additional monitoring from market participants, are likely to reduce tax management engagement.

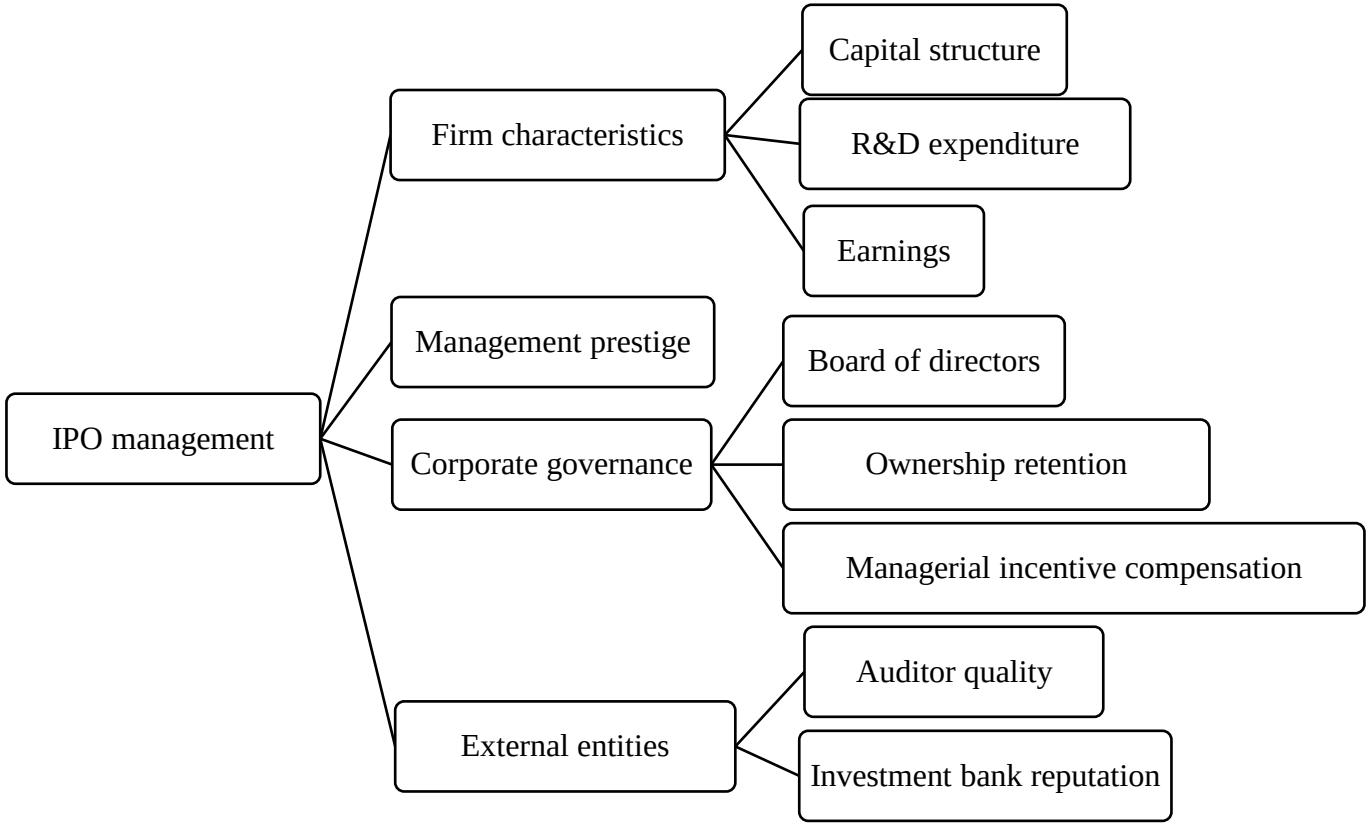
### 2.2.4 IPO management

Another characteristic of IPO is that issuers have incentives to signal quality to potential investors. Spence (1973) puts forward a signalling theory, in a market with information asymmetry, candidates use signals to prove quality to decision makers. For example, in job market candidates use education as a signal to show their ability to employers. The signalling theory has been applied to IPO setting. The IPO process is associated with significant information asymmetry (Gerard and Boivie 2004), owners of issuing companies possess private information about companies' quality. However, there is less information available for investors before companies become public. Financial statements disclosed in prospectus are the main source for investors to evaluate companies' performance (Aharony et al 1993; Friedlan 1994). If private information cannot be effectively conveyed to investors, they may value IPO companies at a value, which is lower than the "true" value (Leland and Pyle 1977). In order to be distinguished from low-quality companies to avoid being undervalued, issuers have incentives to communicate with investors to identify the true value. The price at which new issues are offered depends on the negotiation between issuers and investment bankers and market demand (Filatotchev and Bishop 2002). The section 2.2.2 mentions that before a company goes public it should do sufficient preparation work. The literature finds that during IPO preparation companies manage some behaviours to signal firm value to sponsors and outside investors to attract investors, increase market demand and achieve higher offering price. This section reviews the literature on the management work around IPOs. Similar to the structure of tax management determinants, this section will firstly introduce the management of firm characteristics, then the management of manager characteristics, the next is the management of corporate governance and finally the management of outside entities including auditors and investment banks. The figure 2.4 is a mind map summarising literature on IPO management.

#### 2.2.4.1 Management of firm characteristics

This section is to review the literature on the management of firm characteristics

**Figure 2. 4 Mind map of IPO management**



conducted by companies around IPOs.

#### 2.2.4.1.1 Capital structure

In the market with information asymmetry, uninformed investors can use informed insiders' choice of capital structure to evaluate firm value. A company with higher debt ratio may have higher value because debt interest is deductible in calculating a company's taxable income, the more debt a company has, the less taxes it will be charged and the higher after-tax profits it will have. In addition, debt is a representative of "credit", with debt holding implies that corporate performance has been evaluated by creditors, creditors have monitoring function, their willingness to give debt to companies is an indicator of company quality.

However, Sahoo (2014) argues that a company's debt level reflects its financial risks (e.g. bankruptcy), with high debt levels the performance of companies is uncertain. Sahoo (2014) argues that if an IPO company seeks to signal firm value, reduce investors' uncertainty about its performance, it is likely to reduce debt ratios.

Based on these opinions, companies undertaking IPOs may adjust debt ratios during IPO preparation period, they will trade-off deductible interests and financial risks to decide whether to increase or reduce debt holdings.

#### 2.2.4.1.2 R&D expenditure

IPO companies are found to use technology investment to show their potentials to investors. Kor and Mahoney (2005) suggest that increasing the investment in R&D projects can enhance companies' capacity to absorb new information and knowledge. With higher absorptive ability, IPO companies will have stronger market competitiveness and superior economic performance than their market peers. Deeds et al (1997) find that IPO companies use scientific capability (e.g. number of patents and new products owned by companies, R&D expenses) to signal the quality of their securities. The stronger scientific capital an IPO company has, the higher market value

it will have.

However, Darrough and Rangan (2005) find that in th IPO year IPO companies reduce R&D expense to manage earnings upward. IPO companies may consider that earnings increase is more effective in signaling corporate quality than R&D investment.

#### 2.2.4.1.3 Earnings

Fan (2007) points out that a company's earning is an important element considered by investors in performance assessment. Having higher earnings implies companies have better performance and development prospect. Thus, in order to increase investors' valuation IPO companies are likely to manage earnings upward. Earnings management in IPOs is a topic that has received widespread attention. Friedlan (1994) finds that prior to IPOs, managers take advantage of accounting discretion, measured as discretionary accruals (total accruals minus non-discretionary accruals resulting from firm growth), to report higher income in financial statements. Companies providing interim statements adopt discretionary accruals to increase the most current interim earnings, companies only have annual statements use discretionary accruals to increase income reported in the most current annual statements (Friedlan 1994). Similarly, Teoh et al (1998a) document that companies opportunistically boost earnings in the process of going public. They exhibit higher abnormal accruals (i.e. accruals not generated from economic conditions but managerial manipulation) and better earnings performance in the IPO year. However, the earnings performance is unsustainable in the long-run because they are not real earnings and therefore will be reverse or be replaced by even more managed earnings. After being listed on the market, their earnings performance is worse than companies without undertaking IPOs. Moreover, the higher discretionary accruals they have in the IPO year, the worse after-flotation earnings performance they exhibit. Teoh et al (1998b) find that companies adopting higher discretionary accruals in the IPO year have inferior post-IPO stock return performance. Due to the presence of information asymmetry and the incentive to obtain more proceeds from IPOs, issuers have opportunities and incentives to inflate earnings to convince investors to pay higher price for their securities. After flotation,

with more information disclosed via financial statements, analysts' reports and news coverage, investors may realise that the earnings are managed and such IPO companies are overvalued. They may doubt about corporate performance and future development and reduce their shareholdings. The reduction in demand for securities will lead to a reduction in share price. Ducharme et al (2001) also find that the issuing companies with higher managed accruals in years prior to IPOs will have higher initial issuing prices but lower stock returns after IPOs.

Not all literature supports the presence of pre-IPO earnings management. Examining 229 IPO companies during the period of 1985 to 1987, Aharony et al (1993) do not find an engagement in earnings management in years prior to IPOs. Ball and Shivakumar (2008) argue that companies planning to go public will be encountered with higher reporting standards, additional scrutiny and monitoring. They therefore are likely to report more conservatively rather than aggressively. Sletten et al (2018) more precisely test whether companies manipulate earnings upward in quarters around an IPO. The result indicates that there is no significantly increase in abnormal accruals in quarters prior to IPOs. However, in quarters prior to and the quarter of the expiration of lock-up period (a period after offering during which shareholders are not allowed to sell their shares), probably in order to sell shares at a higher price to obtain more personal wealth, managers have incentives to boost reported income.

#### 2.2.4.2 Management prestige

It has been mentioned that the reorganisation of management structure is an important work in IPO preparation. According to the upper echelons theory, corporate behaviours reflect top managers' strategic choices, whether a company has an effective and professional management team can significantly affect its performance. Managers' decision-making is influenced by their characteristics (Hambrick and Mason 1984). The literature hypothesises that IPO companies are likely to use management prestige, measured by top management team education, age, managerial and industry experience, to signal firm value. Lester et al (2006) suggest that having a prestigious top management team, that is, the structure, characteristics and activities of top

management team are consistent with norms, values and beliefs built in the society, can enhance organisational legitimacy (Cohen and Dean 2005; Sanders and Boivie 2004). Thus, the more prestigious top management team an IPO company has, the higher it is likely to be valued by shareholders (Cohen and Dean 2005).

#### 2.2.4.3 Management of corporate governance

IPO companies are likely to manage corporate governance mechanism in IPO readiness. During the process of going public, the owners of an IPO company have a lot of private information, but the information available for investors is limited. The information asymmetry issue leads investors to be uncertain about the company's performance and therefore unwilling to include its securities in their portfolio. Having a formal corporate governance mechanism conveys that managers' behaviours are under effective monitoring and the interests of shareholders are well protected. It is considered as a signal of firm value. The literature has investigated the management of board of directors, ownership structure, managerial incentive compensation.

##### 2.2.4.3.1 Characteristics of board of directors

Because of the vital role played by board of directors in corporate governance, Certo (2003) suggests that companies may adjust board structure to maximise the proceeds of IPOs. Certo et al (2001), Seward and Walsh (1996) and Fama and Jensen (1983) also suggest that an effective, independent and reputational board of directors can effectively review and monitor corporate activities, reduce agency costs and increase firm value. Jensen (1993) points out that as the head of internal control system, an effective board of directors can reduce corporate opportunistic behaviours. Board characteristics introduced include board size, board independence, board reputation.

Certo et al (2001) examine the association between board size and IPO under pricing. Under pricing is the offering price is lower than the closing price on the first day stocks are traded on the secondary market (Holland and Horton 1993; Lester et al. 2006; Fan 2007; Daily et al. 2005; Certo et al. 2001). Under pricing is undesirable for initial

owners of IPO companies because it represents that the investment bank's valuation on companies is lower than the market valuation, because in the first market a large number of shares have been sold to the public, the proceeds from secondary market will be transferred to public entities (e.g. investment banks, institutional owners), rather than retained in issuing companies (Daily et al. 2005; Cohen and Dean 2005; Certo et al. 2001). Thus, initial owners have incentives to signal firm value to increase offering price and reduce under pricing. The result shows that having a larger board can mitigate under pricing. Certo et al (2001) explain that larger boards have a wider variety of experience, knowledge and resources and therefore are able to provide managers with abundant of useful advice to make sensible and effective strategies. Consequently, larger board size is more credible and valuable for investors. However, Sahoo (2014) argues that smaller boards are more effective in exercising monitoring function and provides the evidence that IPO companies with smaller boards have less under pricing. Those findings suggest that prior to going public companies have incentives to change board size.

A board's effectiveness in monitoring managers also depends on its independence. It is suggested that the board predominantly consisting of outside directors performs better in monitoring and controlling corporate activities (Lanis and Richardson 2011; Beasley 1996; Fama and Jensen 1983; Certo et al. 2001). Gerard and Boivie (2004) suggest that due to the concern for reputation, outside directors prefer to serve the boards of less-risky companies. Therefore, investors may consider the presence of outside directors as a signal of high-quality companies. Cormier et al (2014) point out that enhancing board independence by increasing the proportion of independent directors and separating the positions of CEOs and board chairman can constrain earnings manipulation. Filatotchev and Bishop (2002) use the proportion of nonexecutive directors to measure board independence and find that the improvement in board independence will result in lower under pricing, implying that board independence is a signal of high quality for investors.

Another characteristic of board of directors that can affect investors' evaluation on

IPO companies is board reputation. Chemmanur and Paeglis (2005) suggest that improving the reputation of board of directors (e.g. increasing the proportion of well-educated and experienced directors, strengthening directors' contacts with other prestigious institutions) can enhance the legitimacy of IPO firms, reduce investors' uncertainty about firm performance and increase investors' valuation. They find that IPO companies whose board of directors have higher reputation are associated with lower under pricing, with board reputation as a signal of firm quality, the offering price is less likely to be undervalued.

#### 2.2.4.3.2 Ownership retention

The management team of IPO companies is found to use the retention of managerial ownership as a signal of true value. Leland and Pyle (1977) suggest that in a market with information asymmetry, if insiders (the parties holding a company's shares before flotation) that have information about a company's true quality retain ownership of the company, it indicates that they are confident about the company's prospects. This can reduce investors' uncertainty about the company, give investors' confidence to buy its securities, increase investors' valuation on corporate performance (Daily et al 2005). Downes and Heinkel (2016) find that issuing companies show investors the insiders still hold the shares of IPO companies to communicate intrinsic firm value with investors. The higher proportion of stocks retained by insiders, the higher initial offering price they will have. Fan (2007) documents that issuers use both reported earnings and continuous ownership of founders and initial investors such as venture capital and private investors to signal firm value. Hwang (1989) also finds that the proportion of equity retained by issuers is positively associated with company value.

Some researchers have contrary opinions. Certo et al (2003) argue that the shares are continuously held by parties with private information is not always good news for investors. Shareholding represents control rights, if insiders act as managers, specifically, CEOs investigated by Certo et al (2003), they may take advantage of control rights to seek private benefits. In addition, with shareholding managers' personal wealth is closely linked to companies' profits. This could lead managers to

be risk-averse, unlikely to invest in risky projects, which may reduce companies' growth potentials.

#### 2.2.4.3.3 Managerial incentive compensation

The structure of managerial compensation can affect investors' valuation for IPO companies. The underlying theory is similar with ownership retention. Offering managers with equity-based incentives represents that managers' income depends on corporate performance, their interests align with the interests of investors, they will share the benefits or costs of firm success or failure with investors (Sanders and Boivie 2004). Managers accepting incentive compensation are likely to have optimistic information about companies and therefore are confident about companies' prospects. Thus, incentive compensation structure may be used by investors to select high-quality companies. Certo et al (2003) propose that compensating CEOs with stock options has a positive effect on the pricing of IPO companies. Executives with stock options have the right to subscribe new shares in the future at the price previously agreed. The returns of stock options heavily depend on companies' market values, giving executives incentives to improve companies' performance. Besides, because there is no cash outflow until executives' exercise stock options, they will face less risks and therefore are more aggressive. With stock options managers are more likely to engage in risky activities to get higher returns. But at same time they gamble with shareholders' money, bring shareholders with higher risks. Due to the signal effect of incentive compensation companies could adjust compensation mechanism in the IPO process.

### 2.2.4.4 External entities

#### 2.2.4.4.1 Auditor quality

Under prospectus listing rules, prospectus must include "audited historical financial information covering the latest 3 financial years (or such shorter period that the issuer has been in operation), and the audit report in respect of each year" (FCA 2015b). This rule indicates the critical role played by auditors in IPO process. Prior to or in the year

of IPO, it is common that companies replace previous auditors with auditors with higher reputation and more professional skills (Carpenter and Strawser 1971; Beatty 1989; Datar et al. 1991). The literature finds that the quality of auditors can affect the amount of capital raised from IPOs, companies have incentives to change auditors pre going public.

Titman and Trueman (1986) investigate the association between auditor quality and investors' valuation. They define auditor quality as the accuracy of information an auditor provides to investors, the more accurate information provided, the higher quality for the auditor. Issuers of high-quality companies have greater incentives to employ high-quality auditors. Although employing auditors with high quality may result in enhanced monitoring and more expensive audit fees, they are confident that these auditors can convey positive information to investors to increase investors' valuation, the benefits overweigh the costs. On the contrary, issuers of lower-quality companies are unlikely to use high-quality auditors because the information reported by auditors is likely to be negative. Being aware of this, investors may use issuers' choice of auditors to judge companies' quality and are willing to pay higher price for companies having high-quality auditors. Michaely and Shaw (1995) provide the evidence that IPO companies served by prestigious auditors (Big Eight firms) are less risky (firm sizes are larger and debt ratios are lower) and exhibit better long-term performance. Datar et al (1991) find that informed insiders use both auditor quality and entrepreneurs' ownership retention to reduce investors' uncertainty about companies' future cash flows.

Regarding the association between auditor quality and financial reporting, Beatty (1989) suggests that high-quality auditors' concern about reputation gives them greater incentives to reduce financial fraud. They will conduct more stringent monitoring on corporate reporting and therefore the financial information audited by high-quality auditors is more precise and reliable, allowing investors to more accurately assess the value of IPO companies. Alhadab and Clacher (2018) also find that IPO firms audited by higher quality auditors are less likely to use abnormal accruals to manipulate

earnings. Holland and Horton (1993) examine 230 IPO companies listed on the London Unlisted Securities Market during the years of 1986 to 1989 and find that the degree to which a companies' securities are undervalued is significantly related to auditor quality. The securities of companies employing higher quality auditing firms as auditors or/and reporting accountants have a lower discount level (a smaller difference between issuing price and quoted price), implying that they are less likely to be undervalued.

#### 2.2.4.4.2 Investment bank reputation

Investment bank (or sponsor as called in the UK) is the key of a successful IPO. They guide companies to prepare for IPOs, conduct due diligence, determine the final offering price and are responsible for the marketing of new shares (Certo 2003; Daily et al. 2005). Thus, it is reasonable to hypothesise that the characteristics of investment banks can affect the proceedings obtained from IPOs (Titman and Trueman 1986; Logue 1973; Beatty and Ritter 1986; Daily et al. 2005; Holland and Horton 1993).

Same with auditor quality, high quality investment banks are a signal of company value and IPO companies have incentives to select high – reputation investment banks. The literature finds the association between the prestige of investment banks and the performance of IPO companies. Titman and Trueman (1986) suggest that the use of prestigious investment banks, similar with auditors, is a signal of effective monitoring. The finding of auditor quality introduced in the last section can be applicable to investment bankers. Cartar and Manaster (1990) point out that for reputation concern, prestigious investment banks prefer to cooperate with IPO companies with less risks. As a result, the information "working with a prestigious investment bank" can be used to reduce investors' uncertainty about corporate performance. Holland and Horton (1993) define high-quality sponsor as the sponsor entered in annual ranking of the "Top Merchant and Investment Banks" published in "The Annual Broker Survey". They point out that having higher quality audit firms and sponsors can reduce the opportunities of using less reliable information to mislead investors. Lester et al (2006) and Certo et al (2003) use an investment bank's market share to measure its reputation

and find that the more prestigious investment banker an issuing company employs, the more valuable its securities for investors.

### 2.2.5 Conclusion

In summary, IPO is an important event in a company's development process, doing sufficient preparation work to behave like a listed company is critical for a successful IPO. Companies seeking to go public have incentives to signal their quality to potential investors. In addition, in the IPO process they are encountered with requirement for additional information disclosure and increased scrutiny. These characteristics can influence the behaviours of IPO companies. The literature has shown that in the IPO process companies have incentives to manage capital structure, R&D expenditure, reported earnings, management team, corporate governance, quality of auditor and investment banks.

A company's tax behaviour is an important part of its business activities. In an IPO process the tax structure of the IPO company is likely to influence the success of IPO and the valuation given by investors. LSE and consulting firms suggest that the review and management of tax structure is an important work in IPO readiness, it is necessary for issuing companies to consider tax management prior to IPO. In addition, companies are likely to engage in tax management to reduce tax liabilities to increase earnings to signal quality to potential investors. However, there does not appear to be any research investigating IPO tax management. This study will fill this research gap by investigating corporate tax management behaviours during IPO process.

# Chapter 3 Hypotheses Development

This section introduces the hypotheses will be tested and explain the underlying theory. The first section introduces the hypothesis about tax management in the IPO process. The second section is the hypothesis about tax management behaviours in the pre and post 2008 Banking Crisis. The third section is the hypothesis about the association between tax management behaviours and type of markets. The fourth section is the hypothesis of the association between tax management and auditor changes.

From the review of literature, it has been understood that corporate tax management behaviours during IPO process is a research gap needs to be filled. Regarding this topic, the study puts forward the following hypotheses.

## 3.1 Tax management in the IPO process

The first hypothesis is that corporate tax management behaviours significantly change in the IPO process. Armstrong et al (2015) describe tax management as an investment opportunity with potential benefits and risks. The potential benefit is reducing tax liabilities, which can increase after-tax earnings and cash flows (Desai and Dharmapala 2009a; Francis et al 2014; Rego and Wilson 2012). But tax management also generates risks, which will be discussed subsequently. Prior to IPO there is lack of information about issuing companies; financial statement disclosed in prospectus is the main source for investors to evaluate company quality. Companies exhibiting higher after-tax earnings and cash flows are more likely to be considered as “valuable” and can have a higher offering price. Consistent with signalling theory (Spence 1973), in the IPO process managers have incentives to increase after-tax earnings and cash flows to signal firm value by engaging in more tax management. Another benefit, for managers, is that the information asymmetry during IPO process and the opaque nature of tax management activities provide opportunities for managers to extract corporate resources for private benefits (Desai and Dharmapala 2006; Desai and Dharmapala

2009a; Lanis and Richardson 2011). Prior to IPO the ownership is concentrated in owner/managers and therefore there is little monitoring on managers' behaviours (Chen et al 2010). Motivated by higher after-tax earnings and private benefits, in the IPO process managers are likely to engage in more tax management.

Tax management, however, also has risks. For example, if tax management behaviours are rejected by tax authority, companies are likely to pay additional tax charge and penalty on overdue taxes (Francis et al 2014; Rego and Wilson 2012). Their reputation could be damaged because of the engagement in tax management (Graham et al 2014; Wahab and Holland 2012; Holland et al 2016). Besides, the engagement in tax management can generate financial costs (Matsunaga et al 1992; Mills 1998; Dhaliwal et al 1994; Graham et al 2014; Wahab and Holland 2012). There are tax management strategies that simultaneously reduce financial and taxable income (i.e. conforming tax management strategies). Companies listed on the market face higher market pressure and they therefore are less willing to engage in conforming tax management activities to avoid the reduction in financial income. In addition, tax management has agency costs. Investors may consider tax management activities as a managerial rent diversion opportunity and argue that managers use tax management activities to divert shareholders' interests. This could lead companies' securities to be issued at discounted prices and undersubscribed by investors (Desai and Dharmapala 2005).

IPO increases the potential costs associated with tax management because of the increased scrutiny the owners face in the process of obtaining the listing and in the ongoing market as a publicly quoted company. In the process of obtaining listing, increased information is required to be disclosed to the public (Nikolaj Bukh et al 2005; Branswijck and Everaert 2012). The process of preparing this informaion involves enhanced scrutiny from auditing firms, investment banks, lawyers, regulatory bodies (FCA and LSE) and analysts (Gao and Jain 2011; Jain and Kini 2008; Jain and Tabak 2008; Filatotchev and Bishop 2002; Freedman and Stagliano 2002; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). In addition, the public profile of the company is raised which can attract attention from market investors and non-financial

stakeholders including consumers, non-government groups and civil society more generally (Holland et al 2016). The additional scrutiny increases the potential costs of tax management, reducing the incentives to engage in it.

Companies might engage in more tax management or less tax management, thus, the alternative hypothesis is non-directional and can be described as:

$H_1^1$: Corporate tax management behaviours significantly change in the IPO process.

The null hypothesis is:

$H_1^0$: Corporate tax management behaviours do not significantly change during IPO process.

### 3.2 Tax management behaviours in the pre and post 2008 Banking Crisis

The study further hypothesises that tax management behaviours of IPO companies vary by period. Specifically, tax management behaviours may be different before and after 2008 Banking Crisis. According to Holland et al (2016), after public bailouts of the banking system during the 2008-09 Banking Crisis, there was an increasing demand for enhanced scrutiny on companies tax management. In response to the Banking Crisis and the tax management behaviour of multinational firms including banks, regulatory bodies such as HMRC and Financial Reporting Council required that more information related to corporate tax status should be disclosed. Detailed requirements include requiring large corporations to disclose tax strategy, increasing tax disclosure in annual reports, and requiring more complete private disclosure between companies and specific tax administrations. The above discussion indicates that compared with the period of pre 2008, immediately after 2008 there was greater public awareness of the consequence of companies' tax management scrutiny and in turn additional disclosure requirements. Ball and Shivakumar (2008), Ahmad-Zaluki et al (2011) and Frank et al (2009) find that with greater regulatory scrutiny and higher reporting requirements companies are more conservative (i.e. less risky). Therefore,

after 2008 Banking Crisis companies should engage in less tax management because of the increased reputational and scrutiny costs associated with tax management.

However, there is also a possibility that because of financial distress companies engage in more tax management after Banking Crisis of 2008. Richardson et al (2015) point out that companies encountering financial distress have greater incentive to reduce taxes. Deteriorating financial conditions motivate them to engage in tax management to reduce tax liabilities, increase after-tax earnings and cash flows, meet the requirements of debt covenants, sustain business operations, reduce the risk of bankruptcy. The Banking Crisis of 2008 was an economic shock to the market, causing many companies in severe financial distress. This may magnify the benefit of tax management. As a result, after Banking Crisis there might be a higher level of tax management for those companies till reporting profits.

Because there is competing theory on the effect of the Banking Crisis on companies' tax management behaviour, the second hypothesis is two-tailed and can be expressed as:

$H_2^1$: Corporate tax management during IPO process is different between pre and post 2008.

The null hypothesis is:

$H_2^0$: Corporate tax management during IPO process is not different between pre and post 2008.

### 3.3 Tax management behaviours and listing markets

The level of scrutiny is by design different on the two markets. The London Stock Exchange has two principal markets, one is Main Market the other is AIM. The Main Market has higher listing requirements, stricter regulatory environment, higher reporting standards and additional scrutiny than AIM (Doukas and Hoque 2016;

Khurshed et al 2016; Mallin and Ow-Yong 2012; Rousseau 2008). With enhanced regulation and greater scrutiny in general, Main Market companies should behave more conservatively than AIM listed companies and therefore exhibit lower levels of tax management (Ball and Shivakumar 2008; Frank et al 2009).

On the other hand, however, as Main Market has higher eligibility criteria and regulation standards it can attract more investors, as a consequence, companies on Main Market may be faced with higher market pressure from their stakeholders (Parsa and Kouhy 2008). These pressures may increase the demand for tax management to reduce tax liabilities to increase profits and cash flows. As a result, companies listed on Main Market can have a higher level of tax management.

Because of conflicting arguments, the third hypothesis is non-directional and can be stated as:

$H_3^1$: Corporate tax management during IPO process varies by listing market.

null hypothesis correspondingly is:

$H_3^0$: Corporate tax management during IPO process does not vary by listing market.

### 3.4 Tax management behaviours and auditor changes

The next hypothesis focuses on the association between auditors and tax management behaviours. The status of auditor act as a signal to investors. Big (8) (6) (4) auditors are hypothesised to perform higher quality audits (DeAngelo 1981). The higher quality arises from higher detection risk and higher auditor independence. There is evidence that companies replace previous auditors with auditors with higher reputation and more professional skills prior to or in the year of IPO to signal firm quality (Carpenter and Strawser 1971; Beatty 1989; Datar et al 1991). Because of reputation concerns auditors have incentives to monitor managers' behaviours. High-quality auditors (e.g. Big 4 auditing firms) have greater reputation concerns and therefore exert more

stringent monitoring on corporate behaviours (Titman and Trueman 1986; Datar et al 1991; Beatty 1989). Michaely and Shaw (1995) and Holland and Horton (1993) find that IPO companies employing high-quality auditors are less risky. Because tax management has risks, it is likely to be constrained by auditors.

Another role acted by auditors is advisor through the provision of non-audit services. Auditors have professional knowledge and rich experience to guide companies to manage taxes (Klassen et al 2016). McGuire et al (2012), Omer et al (2006), Cook et al (2008) point out that auditors can work with managers to develop legitimate tax planning strategies. Cook et al (2008) and Omer et al (2006) also find that companies paying higher tax fees to auditors exhibit lower tax burden. This indicates auditors may facilitate the engagement in tax planning activities.

From the above discussion it is hypothesised that the status of audit firms can influence the level of tax management. If a company changes auditors during the IPO process its tax management behaviour may also change. Also, companies with a high level of tax risks may be unwilling to change auditor because a new auditor may not approve or sanction the existing tax management practices (Maydew and Shackelford 2005). The fourth hypothesis is:

$H_4^1$: Corporate tax management behaviours during IPO process vary by auditor changes.

The corresponding null hypothesis is:

$H_4^0$: Corporate tax management behaviours during IPO process do not vary by auditor changes.

### 3.5 Conclusion

In conclusion there are four hypotheses will be tested. They focus on the changing costs and benefits of tax management around the IPO process and over time e.g. pre

and post 2008 Banking Crises. In their alternative form, the hypotheses are as follow, for the first hypothesis the alternative hypothesis is corporate tax management behaviours significantly change in the IPO process. The alternate hypothesis for the second hypothesis is that corporate tax management during IPO process is different between the period of pre and post 2008. For the third hypothesis the alternate hypothesis is that corporate tax management during IPO process does vary by listing market. For the fourth hypothesis the alternate hypothesis is that the level of tax management during IPO process does vary by the change in auditors.

# Chapter 4 Methodology

In the methodology chapter the first section gives an introduction of quantitative and qualitative analysis, states the study will choose quantitative analysis and explains the reason. The second section introduces research sample and discusses detailed sample selection process. The third section builds the estimated model, introduces definition of dependent variables and independent variables, expound how data required by the study are collected. The fourth section introduces analysis procedure.

## 4.1 Quantitative or Qualitative

The investigation of a research topic can use quantitative analysis, qualitative analysis and mixed methods (both quantitative analysis and qualitative analysis). Quantitative analysis involves using sample, numbers, data, mathematical measurement, formula, statistical modelling to objectively describe the reality, deductively test the association between objects and predict the future (Creswell and Creswell 2018). The aim of this method is to answer “what” questions, like: what happened, what is the current reality, what is the relation between A and B, what is the change of an event. A typical characteristic of this method is to put forward a judgement hypothesis and use numerical measurement and statistical modelling to test it (Wood and Welch 2010; Goertz and Mahoney 2012). The examples of quantitative research design are experiment and survey (Creswell and Creswell 2018).

Qualitative analysis is related to inductive interpretation of subjective materials such as words, text or images, language, meanings, feelings, opinions to explore reasons and motivations underlying an objective fact (Creswell and Creswell 2018; Wood and Welch 2010; Yoshikawa et al. 2008). It aims to answer “why” and “how” questions, like why companies engage in tax management, how they engage in it. The methods used by qualitative analysis includes interview, questionnaire, survey and focus group.

This study aims to describe the change of corporate tax management behaviours during the IPO process and test the association between tax management and reporting period, type of market and auditor changes, this is an objective research topic. An appropriate research design is to use a numerical proxy to measure the level of tax management and track the change of this proxy, compared with descriptive measurement the numerical measurement is more tangible, intuitive and comparable. Therefore, quantitative analysis is more appropriate for this study.

## 4.2 Sample selection

**Table 4. 1 Frequency of IPOs in each year**

| Year | Frequency of IPO | Percentage | Cumulative percentage |
|---|---|---|---|
| 2004 | 44 | 20.28% | 20.28% |
| 2005 | 38 | 17.51% | 37.79% |
| 2006 | 23 | 10.60% | 48.39% |
| 2007 | 19 | 8.76% | 57.14% |
| 2008 | 3 | 1.38% | 58.53% |
| 2009 | 0 | 0 | 58.53% |
| 2010 | 6 | 2.76% | 61.29% |
| 2011 | 12 | 5.53% | 66.82% |
| 2012 | 3 | 1.38% | 68.20% |
| 2013 | 12 | 5.53% | 73.73% |
| 2014 | 17 | 7.83% | 81.57% |
| 2015 | 10 | 4.61% | 86.18% |
| 2016 | 8 | 3.69% | 89.86% |
| 2017 | 14 | 6.45% | 96.31% |
| 2018 | 8 | 3.69% | 100.00% |
| Total | 217 | 100% | |

The sample of this study consists of UK companies listed on London Stock Exchange between 2004 and 2018. They are identified from the “New Issues and IPO Summary” file (called “IPO file” in the following sections) published on London Stock Exchange

website. 2018 is the latest year available on Financial Analysis Made Easy (FAME) database. Sample period starts from year 2004 due to time availability to hand-collecting data while at the same time giving sufficient observations for statistical purposes. In addition, this time period gives sufficient period prior to banking crisis, allowing the investigation of tax management in pre and post banking crisis, it also gives sufficient observations to check other hypotheses such as change in auditors. Table 4.1 lists the frequency of IPOs in each year, the percentage of IPOs in each year to total IPOs, and the cumulative percentage. It is shown that from the year of 2008 there is a significant reduction in the number of IPOs, in year 2009 there is even no eligible IPO. The number of IPOs in the post 2008 period is less than that in the pre2008 period. This suggests that the 2008 Banking Crisis influences companies' IPO decisions.

In total there are 1,591 UK companies issuing new shares and quoted on London Stock Exchange Main Market and AIM via IPO during this period[7]. This research is only based on non-financial companies, financial institutions with Industry Classification Benchmark (ICB) codes starting from 8 are excluded. This is because of significantly different taxation rules applying to banks, insurance and other finance related companies (Wahab and Holland 2012) and different operating characteristics of financial and non-financial companies result in their accounts having different characteristics and therefore are incomparable. The number of financial institutions is 767. In addition, companies attempting to list on London Stock Exchange are required to provide three-year financial statements in prospectus. With the consideration of data availability, consistent with prospectus requirement this study selects three years prior to IPO as the pre-IPO period being investigated. A minimum three years prior IPO is

[7] The total number of companies listed in this period is 3,340, after deleting 1,242 companies floating via non-IPO methods (e.g. re-admission, transfer), 494 non-UK resident companies (including 308 non-UK companies and 186 companies registered in British Crown dependencies), 13 companies with previous listing experience (those companies either have been listed on other markets such as GXG market and NEX market or through the occurrence of some transactions such as acquisition to change corporate structure and company names and issue new shares with new names), the number of UK IPO companies is 1,591. Among those companies the financial institutions (767) and companies without three-year history (607) should be further deleted, resulting in final sample of 217 companies. Table 4.2 gives a detailed sample selection process.

imposed to attempt to observe reporting periods sufficiently distant from the IPO date where anticipation of the IPO would be less significant or even none existent. Therefore, companies whose incorporation date to IPO date is less than three years are dropped from research sample. In total there are 607 companies do not meet the requirement of three-year history.

The final sample consists of 217 companies. For each company seven-year of data will be collected (three years prior to IPO to two years after IPO, additional one year data are collected for the variable *NOLs*), as a result, in total there are 1,519 company-year observations. Table 4.2 introduces detailed sample selection process. Among these 217 companies 173 companies are listed on AIM, 44 companies are listed on Main Market. Table 4.3 lists the industry distribution of these companies. As can be seen from this table there are a range of industries included.

**Table 4. 2 Sample selection process**

| | |
|---|---|
| Companies listing on London Stock Exchange between 2004 - 2018 | 3,340 |
| **Less:** Companies listed via non-IPO methods | (1,242) |
| **Less:** Non-UK companies | (308) |
| **Less:** Companies registered in British Crown dependencies | (186) |
| **Less:** Financial institutions | (767) |
| **Less:** Companies with previous listing experience | (13) |
| **Less:** Companies whose incorporation date to IPO date is less than 3 years | (607) |
| **Final sample** | 217 |

**Table 4. 3 Industry distribution of IPO companies**

| Sector | Freq. | Percent |
|---|---|---|
| Software & Computer Services | 35 | 16.13% |
| Support Services | 30 | 13.82% |
| Pharmaceuticals & Biotechnology | 13 | 5.99% |
| General Retailers | 11 | 5.07% |
| Travel & Leisure | 11 | 5.07% |
| Media | 10 | 4.61% |
| Mining | 10 | 4.61% |
| Oil & Gas Producers | 10 | 4.61% |
| Media & Entertainment | 9 | 4.15% |
| Electronic & Electrical Equipment | 7 | 3.23% |
| Leisure & Hotels | 7 | 3.23% |
| Construction & Materials | 5 | 2.30% |
| Household Goods | 5 | 2.30% |
| Health Care Equipment & Services | 4 | 1.84% |
| Leisure Goods | 4 | 1.84% |
| Oil & Gas | 4 | 1.84% |
| Construction & Building Materials | 3 | 1.38% |
| Engineering & Machinery | 3 | 1.38% |
| Food & Drug Retailers | 3 | 1.38% |
| Food Producers | 3 | 1.38% |
| Health | 3 | 1.38% |
| Household Goods & Textiles | 3 | 1.38% |
| Technology Hardware & Equipment | 3 | 1.38% |
| Telecommunication Services | 3 | 1.38% |
| Aerospace & Defence | 2 | 0.92% |
| Chemicals | 2 | 0.92% |
| Food Producers & Processors | 2 | 0.92% |
| Industrial Transportation | 2 | 0.92% |
| Information Technology Hardware | 2 | 0.92% |
| Alternative Energy | 1 | 0.46% |
| Electricity | 1 | 0.46% |
| Forestry & Paper | 1 | 0.46% |
| Industrial Metals | 1 | 0.46% |
| Mobile Telecommunications | 1 | 0.46% |
| Oil Equipment, Services & Distribution | 1 | 0.46% |
| Personal Care & Household Products | 1 | 0.46% |
| Transport | 1 | 0.46% |
| Total | 217 | 100.00% |

### 4.3 Estimation model, variable definition, data collection

The initial model shown in equation 7 below will be described in the following section. To investigate the research topic the study establishes a statistical model:

$$STD\ Cur\_ETR_{i,t} / STD\ Def\_ETR_{i,t} / STD\ GAAP\_ETR_{i,t} / STD\ Cash\_ETR_{i,t} = \partial_{i,t} + \beta_1 YR\_b3_{i,t} + \beta_2 YR\_b2_{i,t} + \beta_3 YR\_b1_{i,t} + \beta_4 YR\_a1_{i,t} + \beta_5 YR\_a2_{i,t} + \beta_6 Account\_Year_i + \beta_7 Market\_Dummy_i + \beta_8 Auditor\_Change_i + \beta_9 LEV_{i,t} + \beta_{10} Cap\_Int_{i,t} + \beta_{11} R\&D\_Int_{i,t} + \beta_{12} NOLs_{i,t} + \beta_{13} TA_{i,t} + \beta_{14} FT\_Int_{i,t} + \beta_{15} IA\_Int_{i,t} + \beta_{16} ROA_{i,t} + \beta_{17} AP_{i,t} + \beta_{18} Industry_i + \varepsilon_{i,t} \quad (7)$$

The following sections will introduce definition of dependent variables and independent variables in detail and the sources where data are collected.

#### 4.3.1 Dependent variables

Because this study investigates total tax management behaviours of IPO companies, the measures of overall tax management including ETRs and BTDs are appropriate. The measures of risky (i.e. high uncertain) tax management such as tax shelters usage and tax contingency reserves are not appropriate. Because of the difficulties in collecting data for BTDs the study applies ETRs as the measure of tax management. Introduced in section 2.1.2.2 compared with ETRs there is no new information in BTDs in measuring tax management.

This study employs four alternate standardised ETRs (*STD* ETRs), defined as ETRs scaled the appropriate statutory tax rate, to measure tax management. The measures are based on four measures of the tax charge: current tax charge "*Cur_ETR*", deferred tax charge "*Def_ETR*", current and deferred tax charges combined or total tax charge "*GAAP_ETR*" and corporate income tax paid "*Cash_ETR*" to examine corporate tax management behaviours from different aspects. It is necessary to firstly understand the definition of unstandardised ETRs. *Cur_ETR* is tax expense occurred in the current

year divided by accounting profit before tax for the year. *GAAP_ETR* is the average total tax expense relative to per unit of pre-tax profit. *Cash_ETR* is the ratio of cash tax paid to pre-tax profit. Because these ETR measures calculate the average tax expense relative to per unit of pre-tax profit, they are negatively associated with tax management. The lower *Cur_ETR*, *GAAP_ETR* and *Cash_ETR* mean on average companies have lower tax expense per unit of pre-tax profit, that is, they engage in more tax management. *Def_ETR*, however, has different meanings with those ETR measures. The calculation of this measure extends the definition of other ETR measures, it is measured as deferred tax expense divided by profits before tax. Although it is not commonly used in the literature, it contains information about tax management. With equal pre-tax profits, a higher *Def_ETR* means that companies defer more taxes to the future, they use more deferral tax management strategies.

Because ETRs measure the percentage of a type of tax expense to pre-tax profits, normally it should be between 0 and 1, assuming non negative tax rates and a maximum tax rate of 100%. A problem of ETR is that it may be distorted by negative tax expense or negative accounting profits. Table 4.4 is a matrix demonstrating different combination of tax expense and accounting profits. For situation ① a company generates profits in the period and pays taxes for the profits, resulting ETRs to be positive. This is a contemporaneous matching of tax consequences with economic activities and is correctly reflected by ETRs. It worth noting that ETRs should not exceed 100%, the ETRs larger than 100% could be resulted from unusual activities that may cause potential bias and estimation problems (Gupta and Newberry 1997; Wahab and Holland 2015). As a result, the ETRs larger than 100% are replaced by 100% in the subsequent empirical analysis which will also include a discussion of extreme and influential observations. For cell ② as the denominator (accounting loss) is negative, although companies have tax charges the ETRs are negative, the ETRs are distorted. There is not an agreement on literature about how to deal with this distortion. Regarding this issue Gupta & Newberry (1997) set the ETRs as 100%. This study temporarily follows this method, implying that although companies are non-profitable they still pay taxes, the tax burden is very heavy. Of course, this treatment is not perfect,

it may overstate tax burden. To solve the problem the study will also take year ends with accounting losses out from sample to test results. For situations ③ and ④ there is an asymmetry between tax outcomes and economic activities. The symmetry between tax outcomes and economic activities is that if a company is profitable in a year then taxes will be charged, if the company makes loss in the year then there is no need to pay taxes, the tax charge should be 0, the tax loss can be carried forward to offset future taxable profits. As a result, tax credits for situations ③ and ④ are not only related to current economic activities but also resulted from activities (i.e. tax loss carry-forwards) of previous years. If not affected by prior period in the current year companies should not pay taxes. Therefore, in order to achieve a symmetry between tax outcome and economic activities the ETRs of companies with tax credits are replaced with 0. Another benefit of this treatment is that for companies reporting both tax credit (negative numerator) and accounting loss (negative denominator), which is situation ④, the ETRs are distorted, companies do not have tax charges but their ETRs are positive. Replacing their ETRs with zero can to some extent alleviate the distortion. This treatment of replacing tax credit with zero is also consistent with previous literature (Gupta & Newberry, 1997; Kubick et al 2015; Gaertner, 2014; Cheng et al 2012). In summary, the range of ETRs is determined between [0,1]. As the ETRs of situations ②, ③, ④ are replaced with proxies, in robustness test the study will delete these company year ends from the sample and only use companies under the situation ① to test sensitivity.

**Table 4. 4 Matrix of ETR measures**

| Accounting profit / Tax expense | Accounting profit | Accounting loss |
|---|---|---|
| Tax charge | ① ✓, maximum is 100% | ② 100% |
| Tax credit | ③ 0 | ④ 0 |

ETRs are widely used in literature to measure tax management. However, there is an issue that the level of ETR in a year depends on the statutory tax rate, if a company's tax management is consistent but statutory tax rate changes, tax expense and therefore ETRs can be different. Table 4.5 lists statutory tax rates over the period of 2004 to 2018. It shows that during this period statutory tax rates continuously decreased from 30% to 19%. If a company also shows a downward ETRs it is hard to say whether it is because of more engagement in tax management or decreasing statutory tax rates. Therefore, it is necessary to control the change in statutory tax rate.

**Table 4. 5 Statutory tax rates during 2004-2018[8]**

| Financial Year | Statutory tax rate |
|---|---|
| 2004/05 | 30% |
| 2005/06 | 30% |
| 2006/07 | 30% |
| 2007/08 | 30% |
| 2008/09 | 28% |
| 2009/10 | 28% |
| 2010/11 | 28% |
| 2011/12 | 26% |
| 2012/13 | 24% |
| 2013/14 | 23% |
| 2014/15 | 21% |
| 2015/16 | 20% |
| 2016/17 | 20% |
| 2017/18 | 19% |
| 2018/19 | 19% |

[8] Source: Data drawn from Institute for Fiscal Studies: www.ifs.org.uk/tools_and_resources/fiscal_facts

The effect of statutory tax rate is controlled by standardising ETRs with weighted or prevailing statutory tax rates. In the UK companies can chose any accounting reference date to report financial statements but corporation tax rates are determined by financial year which runs from 1st April to the 31st March the following year. As a result, a company's reporting period can cross two statutory tax rates and therefore ETR should be adjusted by weighted statutory tax rate. For example, if a company's income statement covers the period of 1 January 2017 to 31 December 2017, the unstandardised ETR is 30%, according to statutory tax rates listed on table 4.5 the weighted statutory tax rate is 20%*(3/12)+19%*(9/12)=19.25%, the standardised ETR is: 30%/19.25% = 1.56.[9]

Different from *Cur_ETR*, *GAAP_ETR* and *Cash_ETR*, because deferred tax is derived from balance sheet, it is not recognised within a period, it is recognised, like deferred tax liability/asset, at a time point. According to IAS12.47 *"deferred tax assets and liabilities shall be measured at the tax rates that are expected to apply to the period when the asset is realised or the liability is settled, based on tax rates (and tax laws) that have been enacted or substantively enacted by the end of the reporting period"*. However, the exact date on which deferred liability is settled or deferred tax asset is realised is difficult to be obtained from available information. Hence, the study uses prevailing statutory tax rate on the date deferred tax liability/asset is provided (i.e. balance sheet date) to standardise deferred ETRs.

In summary, the dependent variables of the study are *STD Cur_ETR* (*Cur_ETR* divided by weighted statutory tax rates), *STD Def_ETR* (*Def_ETR* divided by prevailing statutory tax rates), *STD GAAP_ETR* (*GAAP_ETR* divided by weighted statutory tax rates), *STD Cash_ETR* (*Cash_ETR* divided by weighted statutory tax rates). All ETR measures are winsored at 1% level to mitigate the influence of outliers. Table 4.6 summarises the definition of all variables used in the study.

[9] If a company's reporting period is less than or more than 12 months, the denominator of weighted index should be adjusted accordingly. For example, if a company's annual report is from 1 January 2017 to 31 July 2017, the weighted statutory tax rate should be 20%*(3/7) + 19%*(4/7).

**Table 4. 6 Definition of variables**

| **Dependent variables:** | |
|---|---|
| *STD Cur_ETR* | $\frac{Current\ tax\ expense/Pre-tax\ profits}{Weighted\ statutory\ tax\ rates}$ |
| *STD Def_ETR* | $\frac{Deferred\ tax\ expense/Pre-tax\ profits}{Prevailing\ statutory\ tax\ rates}$ |
| *STD GAAP ETR* | $\frac{Total\ tax\ expense/Pre-tax\ profits}{Weighted\ statutory\ tax\ rates}$ |
| *STD Cash_ETR* | $\frac{Cash\ tax\ paid/Pre-tax\ profits}{Weighted\ statutory\ tax\ rates}$ |
| **Independent variables** | |
| *YR_a+2* | 1 for the second year post IPO, 0 otherwise |
| *YR_a+1* | 1 for the first year post IPO, 0 otherwise |
| *YR_b-1* | 1 for the first year prior to IPO, 0 otherwise |
| *YR_b-2* | 1 for the second year prior to IPO, 0 otherwise |
| *YR_b-3* | 1 for the third year prior to IPO, 0 otherwise |
| *Account_Year* | 0 for companies whose testing periods are in years pre 2008<br>1 for companies whose testing periods across the year of 2008<br>2 for companies whose testing periods are in years post 2008 |
| *Market_Dummy* | 0 for companies listed on AIM; 1 for companies listed on Main Market |
| *Auditor_Change* | 0 if there is no change in auditors; 1 if there is change in auditors |

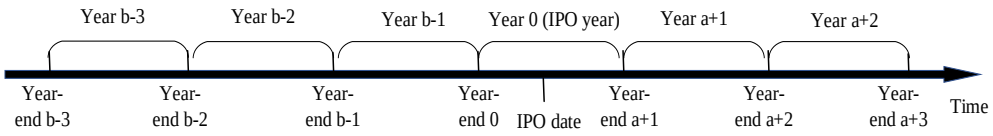
**Table 4.6 Definition of variables (continued)**

| | |
|---|---|
| Leverage (*LEV*) | Long-term debt / total assets |
| Capital intensity (*Cap_Int*) | Property, plant and equipment / total assets |
| R&D intensity (*R&D_Int*) | R&D expense / R&D expense + profit before tax |
| *NOLs* | If the last year has loss: pre-tax loss in the last year/current pre-tax profits; If there is no loss in the last year: 0 |
| Firm size (*TA*) | Natural logarithm of total assets |
| Foreign turnover intensity (*FT_Int*) | Foreign turnover / sales |
| Intangible assets intensity (*IA_Int*) | Intangible assets / Total assets |
| *ROA* | Pre-tax profits / Total assets |
| Accounting practice (*AP*) | 0 for UK GAAP; 1 for IFRS |
| *Industry* dummy | On the basis of the first digit of ICB code to generate an industry dummy |

### 4.3.2 Independent variables

The study uses year indicator variables or dummy variables to represent each year around the IPO and based on the change and significance tests of the coefficients of year dummies to analyse the change of tax management. In consideration of data availability consistent with the requirement for prospectus and previous literature (Kao et al 2009; Mazzola and Marchisio 2002; Hung et al. 2012; Ball and Shivakumar 2008) the analysis of pre-IPO period includes three years prior to IPO. IPO year of course is the year worthy to be tested. The incentives for tax management are likely to persist after going public, tax behaviours are likely to last for a period, in order to investigate whether the management of taxes changes after the IPO year the research window lasts for two years post IPO (Teoh et al. 1998a; Teoh et al. 1998b; Ducharme et al. 2001a). The time periods are demonstrated by a time line (figure 4.1). Thus, the first test variable is a set of year dummies indicating IPO relevant event years, specifically, a+2 indicating the second year after IPO, a+1 indicating the first year after IPO, b-1 indicating the first year prior to IPO, b-2 is the second year prior to IPO, b-3 is the third year prior to IPO. Year 0, representing the IPO year, is set as the baseline year and will be omitted in multivariate models.

**Figure 4. 1 Time periods in tax management analysis**




The second hypothesis is corporate tax management behaviours in the IPO process are different in the pre and post 2008 period. Thus, the second test variable, $Account\_Year$, is a categorical variable that indicates the period during which a company reports accounts. Specifically, 0 for companies whose all testing periods (b-3 to a+2) are in years of pre 2008 (pre 2008 hereafter), 2 for companies whose all testing periods are in years of post 2008 (post 2008 hereafter), 1 represents companies whose testing period crosses the year of 2008 which are dropped from this hypothesis

test. This study focuses on the difference between the category of "0" and "2".

The third hypothesis is corporate tax management during IPO process varies by listing market. In order to test this hypothesis a categorical variable *Market_Dummy* representing listing market is included in the model. "0" indicates the companies listed on AIM and "1" indicates companies listed on Main Market.

In order to test the fourth hypothesis, that is, the change in tax management during IPO process is associated with the change in auditors, the model includes a dummy variable *Auditor_Change* equals 0 if there is no change in auditor and 1 otherwise to indicate auditor changes.

Changes in ETRs can be associated with many factors, to avoid the observed change is resulted from tax management rather than other factors it is necessary to control for confounding factors. Based on the literature review the following firm characteristics are included as control variables.

a. Leverage (*LEV*), defined as the ratio of long-term debt to total assets (Cheng et al, 2012; Gupta and Newberry 1997).

b. Capital intensity (*Cap_Int*), measured as the ratio of property, plant and equipment (PPE) to total assets (Stickney and McGee 1982; Gupta and Newberry 1997; Chen et al 2010; Mills et al, 1998;).

c. R&D intensity (*R&D_Int*), defined as R&D expense divided by R&D expense plus profit before tax, that is, profits pre R&D expense (Gupta and Newberry 1997; Lanis and Richardson 2015; Berger 1993; Gaertner 2014). It measures the percentage of profits spent on R&D projects.

d. Net Operating Losses (*NOLs*). Net operating losses generated in previous years are allowed to be carried forward to offset current taxable profits, therefore the current ETRs are associated with *NOLs* in previous years. US literature uses tax loss carry-

forward indicator and/ or change in tax loss carry-forward to measure the offset effect of previous *NOLs* (Chen et al, 2010; Cheng et al 2012; Manzon Jr and Plesko 2002). However, under IFRS companies are not required to disclose tax loss carry-forward. Hence the data is not publicly available. This study uses accounting loss in the previous one year as a proxy for previous *NOLs*. It is a continuous variable that equals to the value of pre-tax loss if the last year has losses, but equals to zero if the last year is profitable. In order to reduce heterogeneity, it is scaled by current pre-tax profits. In robustness test the study selects the sub sample of companies that are profitable throughout the IPO period in an attempt to limit the influence of previous *NOLs*.

e. Firm size (*TA*), measured as the natural logarithm of total assets (Stickney and McGee, 1982; Huseynov and Klamm, 2012; Holland, 1998).

f. Foreign turnover intensity (*FT_Int*), calculated as the ratio of foreign turnover to sales (Stickney and McGee, 1982; Jacob, 1996; ). It reflects the source of sales[10].

g. Intangible assets intensity (*IA_Int*), measured as intangible assets scaled by total assets (Barth and Kasznik 1999; Chen et al, 2010; Brown and Drake, 2014)[11].

h. Profitability, also called *ROA*, is defined as pre-tax profits divided by total assets (Gupta and Newberry, 1997; Jacob, 1996).

i. Accounting practice (*AP*). Prior to be publicly listed companies are allowed to report under UK GAAP or IFRS, but after listed companies are required to only report under IFRS. As a result, for some IPO companies there is a transition from UK GAAP to IFRS, the reporting requirements may change. To control for the possibility that changes in ETRs are resulted from the variation in financial reporting regulation, a

[10] There is an observation with negative sale, in order to ensure the deflator is positive, this observation is dropped from the sample.

[11] There are seven company year-ends with negative intangible assets. Checking with annual reports this is due to negative goodwill. Negative goodwill does not provide opportunities for tax management, to avoid those observations bias the results, the negative intangible assets are replaced with zero.

dummy variable with 0 for UK GAAP and 1 for IFRS is included in the model.

j. Industry dummy. Due to different tax policy and industry characteristics the ETRs could vary by industry. Following the literature the study depends on the first digit of ICB code to generate an industry dummy to control industry effect (Nobes and Stadler 2015; Pasaribu 2017; Qiu et al. 2016).

To mitigate the effect of outliers all continuous variables are winsored at 1% level.

### 4.3.3 Data collection

According to the definition of variables, data required by this study include: current tax expense, pre-tax profits, deferred tax expense, total tax expense, cash taxes paid, accounts date, IPO date, listing market, auditors, long-term debt, total asset, PPE (i.e. tangible asset), R&D expense, foreign turnover, sales, intangible asset, accounting practice.

IPO date and listing market are provided by the LSE "New Issues and IPO Summary" file. As the purpose of this study is to investigate corporate tax management behaviours 3 years prior to IPO to 2 years post IPO, data for both public and private companies are needed. Therefore, FAME, a database contains data for both quoted and private companies registered in UK and Ireland, is an appropriate data source[12]. Although the window of testing period is six years, because the variable *NOLs* require the data for the last one year, the study collects additional one-year data, that is, the fourth year prior to IPO. As a result, for each company seven-year of data will be collected. In multivariate analysis because there is no value of *NOLs* for the year -4, this year will be omitted because of collinearity.

[12] Prior to July 2018 FAME provides up to previously 10 – year data for each company. After July 2018 a new interface is developed and this new interface can offer previously 20-year data. Because data collection process of the study started before July 2018, previously 10-year data are collected from old interface and previously 11 to 20-year data are collected from new interface.

Before directly download data from FAME for all companies the figures of the first five sample companies are double checked with figures reported in original annual reports to ensure the basis of data given by FAME is consistent with factors intend to be tested. Companies incorporated in UK are required to submit annual reports to Companies House which can be reviewed by public for free. The current tax expense and deferred tax expense are not available in FAME. FAME only gives an aggregate number of total tax expense, it does not split total tax expense into current and deferred portion. Consequently, current tax expense and deferred tax expense should be manually collected from annual reports. In addition, cash taxation given by FAME does not correspond to the figure in the downloaded annual reports[13]. As a result, cash tax paid is also manually collected. The basis of other data complies with the factors intend to be tested and therefore those data are directly exported from FAME.

Another finding when comparing figures given by FAME and annual reports is that FAME data have errors. The comparison between FAME and annual report data for companies finds that FAME frequently misses figures of R&D expense and overseas turnover. In order to increase data credibility R&D expenditure and oversea turnover of all 217 companies are downloaded from FAME and double checked with original reports. Text variables such as auditors and accounting practice are also downloaded from FAME and double checked with annual reports.

When manually collecting data it is found that 21 companies are not searchable in Companies House. A common characteristic of these companies is that they have been dissolved. Six years after the dissolution of a company the information will be removed from Companies House Service. Among those companies the annual reports of 3 companies can be found in Bloomberg. For the remaining companies, reports in relatively recent years (after 2005) can be downloaded from FAME. Reports for earlier years needed to be purchased from Companies House WebCheck service[14] which retains companies' reports for a longer time. A summary of data source and collection

[13] It is not clear how FAME calculates those figures.
[14] The website page for this service is: http://wck2.companieshouse.gov.uk/

methods is given by table 4.7.

**Table 4. 7 Data source and collection methods**

| | |
|---|---|
| Current tax expense | Manually collected from annual reports |
| Pre-tax profits | FAME |
| Deferred tax expense | Manually collected from annual reports |
| Total tax expense | FAME |
| Cash tax paid | Manually collected from annual report |
| Account date | FAME |
| IPO date | LSE file |
| Listing market | LSE file |
| Auditors | FAME+ Manually double check |
| Long-term debt | FAME |
| Total asset | FAME |
| PPE | FAME |
| R&D expense | FAME + Manually double check |
| Overseas turnover | FAME+ Manually double check |
| Sales | FAME |
| Intangible asset | FAME |
| Accounting practice | FAME + Manually double check |

Another issue encountered during data collection is that financial statements of 20 companies had year ends where foreign reporting currency was used such as Euro and US Dollar. When figures of these financial statements are exported from FAME they are by default presented as pounds sterling. However, an issue is that for the data need to be manually collected from annual reports because the reports are in foreign currency it is not clear which exchange rate should be used. The study attempted to

divide figures presented with pound sterling by figures presented with foreign currency to calculate exchange rate, FAME does not appear to use a consistent basis. In order to reduce ambiguity caused by currency transition, consistent with other companies in the sample the original figures reported by the foreign currency in the annual reports are directly used. Then companies reporting with foreign currency will be dropped to test whether the results are robust to reporting currency.

When data are exported from FAME some of them are displayed as blanks. Reasons underlying the blanks are different and therefore should be managed differently otherwise the number of observations and results may be influenced. One reason is that companies do not have such transactions (e.g. there is no investment on R&D projects) and therefore there is no amount to be reported. For this case the blank is supposed to be filled with zero. Another reason is that companies have transactions but due to some reasons such as being exempted from disclosure or some pages of annual reports are missing the information is not available. Blanks caused by data unavailability are marked with “n.a”, when model is estimated the company year ends with missing data are dropped. Sample size for the various samples is also indicated in table 5.14. The following paragraphs will introduce circumstance where data are not available.

Companies seeking to go public are different in size. According to Companies Act 2006 a company’s size can be classified as large, medium or small on the basis of turnover, total assets and the average number of employees. Large companies are required to provide complete audited income statement and balance sheet. Companies with medium and small size can have exemption. Medium-sized companies must report a profit and loss account and a balance sheet but the profit and loss account is allowed to be reported in a reduced version. If a company qualifies as a “small-sized company”, the preparation of balance sheet is still compulsory but whether to prepare a profit and loss account is optional. If a company chooses not to file a profit and loss account, it must state on the balance sheet that the filing of accounts complies with “provisions applicable to the companies subject to the small companies regime”. In

addition, in accordance with UK GAAP, specifically, Financial Reporting Standard 1 before 1 January 2015 and Financial Reporting Standard 102 after 1 January 2015, small entities are exempted from preparing cash flow statements. If a small company takes advantage of exemption and chooses not to disclose profit and loss and cash flow statements, data related to these accounts (e.g. total and current tax, profit before tax, cash flow tax, oversea turnover and R&D expense) are treated as "not available".

But there is an exception, among small companies there is a "dormant" situation. If a company is in "dormant" situation it means that it has no significant accounting transactions during a period. Similar with other small entities accountants of dormant companies must prepare a balance sheet but do not necessarily need to prepare a profit and loss account. As many dormant companies state in financial statements (for example E-Therapeutics plc), "dormant companies do not have any trading in financial year and therefore there is no income and expense incurred and consequently no profit and loss made". However, different from the small entities that have transactions but not prepare profit and loss accounts, dormant companies do not prepare profit and loss accounts because they do not have transactions. Because of this characteristic, for dormant companies if there is no data for income statement items, the blanks are filled with zero.

The final reason for data unavailability is incomplete reports. When companies submit accounts to Companies House may be because of technical issues some pages of accounts are lost, resulting in the figures reported on those pages being missed. Only two companies in the sample have this problem.

## 4.4 Analysis procedure

### 4.4.1 Hypotheses testing procedure

The test of hypotheses is conducted in the following framework. Firstly, corporate tax management behaviours around IPOs of the full sample are investigated. Secondly, due to potential issues related to negative denominator of ETR measures, those

company year ends reporting losses are dropped from sample and only tax management of profitable company year ends is investigated. Then, under profitable company year-ends the study conducts some further tests in accordance with the hypotheses discussed in chapter 3. In further tests under profitable company year-ends the sample is split into various subsamples to re-estimate the model (7) to test whether corporate tax management behaviours around IPOs vary by i) pre and post 2008 banking crises ii) listing market and iii) change in auditors. Specifically, the sample is further split into companies all testing years are prior to 2008 and companies all testing years are post 2008 to test how about the change in tax management around IPOs in these two different periods. Within each period, the sample is further split by type of market. This means within each period (pre 2008 and post 2008), the estimation model is re-run for AIM and Main market, respectively. At last, with the reporting period and type of market both controlled, only those companies employing the same auditors in the IPO process are selected to test tax management of IPO companies i.e. those companies without a change in auditor. Whether tax management behaviours can be influenced by auditors can be examined by comparing tax management behaviours before and after the change in auditors is controlled. Specifically, the results based on the no change in auditor sub-sample are compared with the sample including all companies, i.e. before the exclusion of the change in auditor companies. If tax management behaviours exhibit differences, it means that tax management can be influenced by auditors. Figure 4.2 uses a framework to demonstrate the analysis procedure. For easy reading each sample is given a standard abbreviation and a symbol, introduced in table 4.8.

In addition to primary test and further test, the study also conducts the following robustness tests: (1) In methodology section it has been mentioned that there are some accounts reported by foreign currency. As a sensitivity test, the study deletes those companies with currency transition to test the robustness of the initial results. (2) Another robustness test is to test tax management behaviours of only those companies that persistently make profits in the IPO process. This is because the measure of the *NOLs*, tax loss carry-forwards, is not available, the study uses accounting loss in the

**Figure 4. 2 Sample and sub-samples**

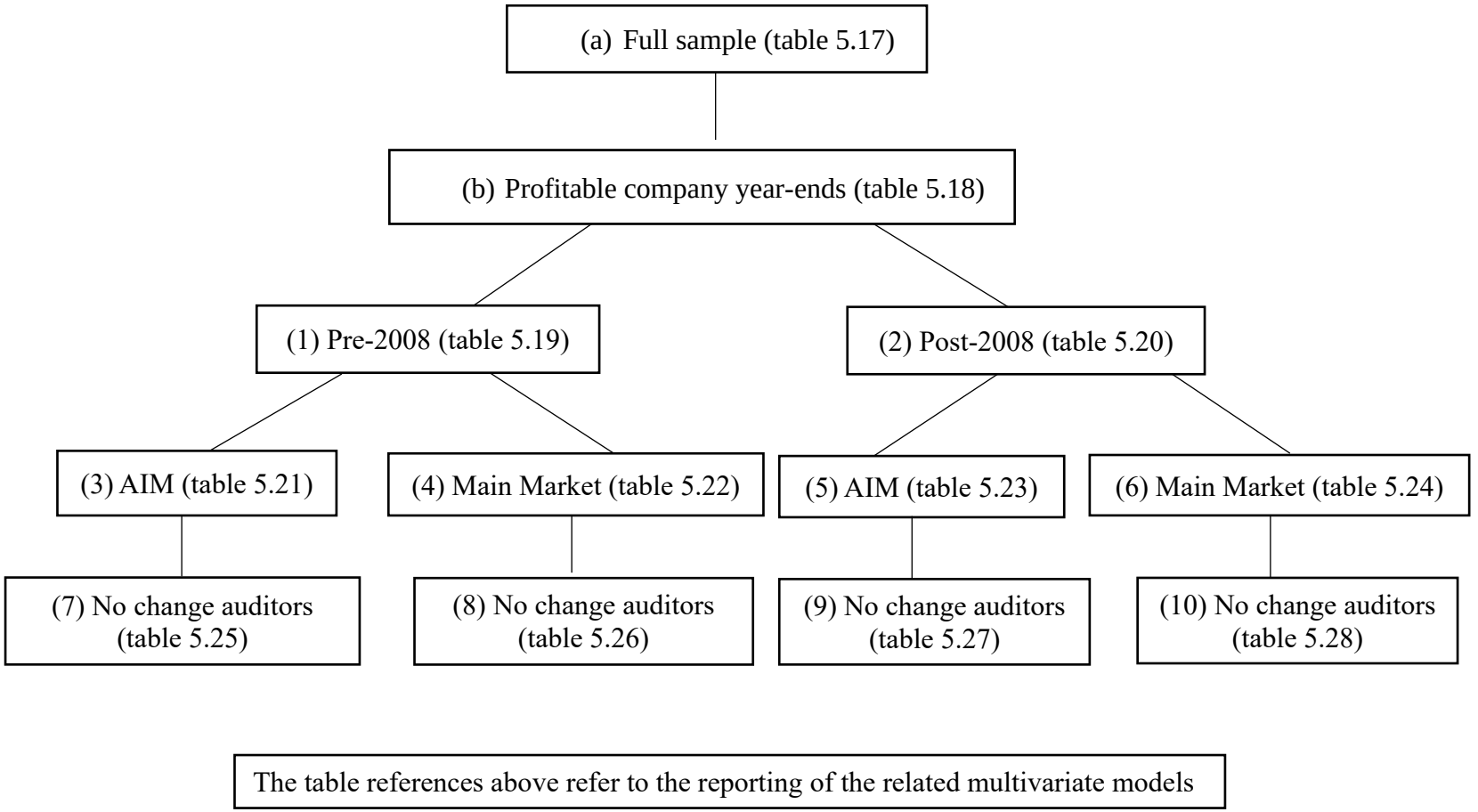


**Table 4. 8 Standard abbreviation for each sample**

| Sample standard abbreviation | Description | Symbol |
|---|---|---|
| FULL_SAMPLE | All 217 companies; 1,519 company year ends | (a) |
| PROFIT_YEAR_ENDS | Only those company year ends with profits | (b) |
| PRE | Company year ends with profits - only those companies where all year ends are pre 2008 | (1) |
| POST | Company year ends with profits - only those companies where all year ends are post 2008 | (2) |
| PRE_AIM | Company year ends with profits - only those companies where all year ends are pre 2008 - listed on AIM | (3) |
| PRE_MM | Company year ends with profits - only those companies where all year ends are pre 2008 - listed on Main Market | (4) |
| POST_AIM | Company year ends with profits - only those companies where all year ends are post 2008 - listed on AIM | (5) |
| POST_MM | Company year ends with profits - only those companies where all year ends are post 2008 - listed on Main Market | (6) |
| PRE_AIM_NC | Company year ends with profits - only those companies where all year ends are pre 2008 - listed on AIM – no change auditor | (7) |
| PRE_MM_NC | Company year ends with profits - only those companies where all year ends are pre 2008 - listed on Main Market – no change auditor | (8) |
| POST_AIM_NC | Company year ends with profits - only those companies where all year ends are post 2008 - listed on AIM – no change auditor | (9) |
| POST_MM_NC | Company year ends with profits - only those companies where all year ends are post 2008 - listed on Main Market – no change auditor | (10) |

last year as a proxy. In case this variable cannot accurately capture the influence of *NOLs*, the study selects companies profitable in every year of the whole IPO period to limit the effect of *NOLs*. Due to the presence of tax loss carry-forwards, although in the analysis of profitable company year-ends loss years are dropped, the remaining profitable years' ETRs can still be affected by loss year ends, this weaken the link between current tax outcomes with current economic activities. For example, if a company is profitable in IPO year but non-profitable in year b-1, although the non-profitable year is dropped from the sample the tax loss in this year can be carried forward to IPO year to offset taxable profits. (3) In the determination of the value of ETR measures, due to asymmetry between tax outcomes and economic activities, for years with tax credits the ETRs are replaced with 0. Some literature replace ETRs of years with tax credits with zero (Gupta and Newberry, 1997; McGuire et al 2014) while some literature take those years out of sample (Cheng et al 2012; Chen et al 2010). The third sensitivity test selects only those companies with profits and a tax charge (i.e. the denominator and numerator of ETR measures are both positive) to test the robustness of results.

### 4.4.2 Data analysis procedure

The study firstly conducts univariate analysis for data. The analysis of data starts from descriptive statistics of dependent variables and independent variables. The purpose of descriptive statistics is to understand data and check for reliability. The descriptive statistics are analysed by the full sample, profitable company year ends and various subsamples.

Then statistical analysis is conducted. The first step is to apply both nonparametric, Mann-Whitney U test (MW-U) and parametric test (t-test) to examine whether the difference between independently comparable groups, specifically, pre 2008 and post 2008, AIM market and Main Market is statistically significant. T-test examines the difference in the mean of two independent groups while MW-U test uses ranks to test whether two groups are from the same population. The null hypothesis of t-test is that

the mean difference between two groups is equal to zero, the null hypothesis of MW-U test is two independent samples are from the same populations with the same distribution. T-test requires data to be approximately normally distributed but by design MW-U does not have this assumption. Therefore, for the same sample these two tests may give what appears to be conflicting results. According to descriptive statistics the data do not always follow the normal distribution (see tables 5.1 to 5.12 reported skewness and kurtosis coefficients), in many situations the skewness exceeds 0 and kurtosis exceeds 3 which describe a normal distribution. Therefore, the primary analysis is based on MW-U test. The results of t-test are also reported to give an indication of the difference between these two tests. In order to have a better understanding of control variables the MW-U test and t-test results of control variables are also reported.

In order to better understand the necessity of controlling statutory tax rates, significance tests are conducted for both *STD* and unstandardised (*UN_STD*) ETR measures, if in a setting the significance levels of *STD* and *UN_STD* ETRs are same, only results of *STD* ETRs are reported. If significance levels are inconsistent the test statistics will be marked in bold and the results of *UN_STD* ETRs will be reported in the note to the table. In addition to MW-U test and t-test for difference between two independent sub-samples, analysis of variance (ANOVA) is applied to test the difference in the means of all IPO-related years. The null hypothesis of ANOVA is that the mean for each year is the same. Similar to MW-U and t-test, ANOVA is tested for both *STD* and *UN_STD* ETRs.

After univariate analysis the multivariate analysis is conducted to investigate the change in tax management after confounding factors (i.e. firm characteristics associated with ETR measures) are controlled. The first step is to test the pairwise correlation between dependent variables and independent variables. There are two correlation test methods, one is Pearson test, the other one is Spearman test. Pearson test assumes that population is normal distribution while Spearman does not have this assumption because it is a nonparametric test based on ranks. According to descriptive

statistics (see tables 5.1 to 5.12 reported skewness and kurtosis coefficients) data are not precisely normally distributed, therefore the analysis is primarily based on Spearman test. In order to give a feeling of the difference between these two methods, both the results of Pearson test (above the main diagonal) and Spearman test (below the main diagonal) are reported. The null hypothesis of Pearson is there is no correlation between variables, the null hypothesis of Spearman is variables are independent. In addition, in order to ensure the deflator is positive, the correlation test is for the sample with only company year ends with profits.

The Ordinary Least Squares (OLS) method is applied to estimate the linear regression model (7) for the various samples. The standard regression results report the significance of the difference between the coefficient of each annual year dummy and zero. An additional set of hypothesis testing is performed to examine the difference between each pair of annual dummy year variables. After the model is estimated, a Wald test of hypotheses about the year dummy coefficients is performed (Minnick and Noga 2010; Novikov et al 2010) (the Wald test is equivalent to t-test when there is a large sample size (Lobato and Velasco 2007; Lumley et al 2002)). The null hypothesis is no difference between the coefficients of each pair of year dummy. These tests examine whether there are significant differences between years in the relationship between a given year and the level of ETRs. OLS method estimates coefficients of a linear regression with a least squares principle, that is, minimising the sum of the squares of the differences between the values of dependent variables observed and the values of dependent variables predicted by independent variables (Akbilgic and Akinci 2009; Scholkmann and Wolf 2013). It is a popular way of estimating the relationship between dependent variables and independent variables. The OLS method has seven classical assumptions (Beutel and Minner 2012; Hayes and Cai 2007; Hanushek and Jackson 1977): (1) The coefficients and error terms of the regression models are linear. (2) The error term has a population mean of zero. (3) All independent variables are not correlated with error terms (exogeneity). (4) The observations of the error terms are not related to each other (no autocorrelation). (5) The variance of error terms should be constant (no heteroscedasticity). (6) No independent variable is a perfect linear

function of other explanatory variables (no multicollinearity). (7) The error term is normally distributed. If assumptions are violated the coefficients and/or standard errors could be biased.

In accordance with OLS assumptions the study conducts diagnostic tests for each regression. The first diagnostic test is heteroscedasticity. If the variance of error terms is consistent the error term has homoscedasticity. If the variance of error terms is inconsistent, which is against OLS assumption, it is called heteroscedasticity. The heteroscedasticity of regression is tested by Breusch and Pagan (1979) method, the null hypothesis is the error variances are all equal. If the null hypothesis is rejected it means the model has heteroscedasticity issue, resulting in the standard errors and therefore t-statistic to be biased. With this case the t-statistics that are robust to heteroscedasticity are reported, in STATA the "robust" option is implemented in the command. According to Daily et al (2005) this is equivalent to White-adjusted t-statistics (Halbert 1980; Holland 1998).

Another diagnostic test is for multicollinearity. For each regression the variance inflation factors (VIFs) are assessed for multicollinearity test. Introduced by Chatterjee and Hadi (1977), Hair et al (2006) the VIFs more than 10 are aften considered as a signal of multicollinearity. The results for the model with VIFs more than 10 are unreliable, specifically, the estimation of coefficients is biased.

As the study uses panel data autocorrelation is a potential issue, for the same cross-section, for each variable there are time-series observations that could be correlated. If there is autocorrelation issue the estimated value of coefficients remains unchanged but standard errors and consequently t-statistics are biased, resulting in misleading interpretation. The firm characteristic of a year could be correlated with it in previous years. This study follows Graham et al (2014), Wilde (2017), Desai and Dharmapala (2006a), Frank et al (2009) to uses robust standard errors, specifically cluster by company, to correct for any autocorrelation within companies.

The final test is for influential data. Although strictly speaking this is not an

assumption of OLS, as influential data can exert undue influence on coefficients this issue is a big concern in data analysis. In order to examine whether the observed results are driven by influential observations, the study applies DFITS measure (Belsley et al 1980) to identify influential data. The cut-off point for DFITS is 2*sqrt(k/n) where k is the number of predictors and n is the number of observations, sqrt represents square root calculations. The observations whose absolute values of DFITS are larger than the cut-off point are considered as influential. Both the results before and after excluding influential data are reported to show how results are influenced by influential data.

## 4.5 Conclusion

In conclusion, the investigation of the research topic uses quantitative methods. The sample selected is UK companies listed on London Stock Exchange by IPO methods during the period of 2004 to 2018. Initially there are 1,591 companies, after dropping financial institutions and companies with less than 3-year history, the final sample consists of 217 companies. For each companies 7-year data are collected and therefore in total there are 1519 observations.

The study employs a multivariate estimation model to test the hypotheses. The dependent variables are *Cur_ETRs*, *Def_ETRs*, *GAAP_ETRs* and *Cash_ETRs* standardised by statutory tax rates. The independent variables include year dummies indicating years around IPOs, dummy variable indicating whether all testing periods are in years pre 2008 or post 2008, market dummy variable indicating whether a company is listed on Main Market or AIM, auditor change dummy indicating whether auditors have changes in the IPO process. A range of control variables is used based on the earlier literature review. All continuous variables are winsored at 1% level to mitigate the influence of outliers.

The data is drawn from two sources, for some variables the data can be directly collected from FAME, however for some variables either because data error or data unavailability on FAME the data are manually collected from annual reports provided

by Companies House.

The tax management of full sample is firstly to be tested, then the sample of only profitable company year ends is investigated, then under profitable company year-ends the sample is split into companies all testing periods are pre 2008 and companies all testing periods are post 2008. Then the sample of pre 2008 and post 2008 is further split by listing market, respectively. After controlling the reporting period and listing market, the auditors are controlled consistent to test whether tax management behaviours vary by auditor change. The study also tests whether the results are robust for currency transition, the measure of *NOLs*, the range of ETR measures.

The analysis of data starts from descriptive statistics, then some univariate tests of dependent variables, specifically Mann-Whitney U test, t-test, ANOVA test are conducted. After that the Pearson test and Spearman test are employed to test the pairwise correlation between variables, then the multivariate regressions and OLS method are applied to investigate the tax management behaviours with confounding factors are controlled.

# Chapter 5 Results

This chapter reports all results of the research. The first section is univariate analysis, including descriptive statistics and significant tests (Whitney U test, t-test and ANOVA test) of dependent variables and independent variables. The second section reports multivariate results, the first part is the results of correlation test, the second part is the results of multivariate regressions, including results of full sample, profitable company year-ends and various sub-samples. The third section reports the results of robustness tests. The fourth section is the conclusion.

## 5.1 Univariate analysis

### 5.1.1 Descriptive statistics and significant tests of dependent variables

Table 5.1 shows descriptive statistics of *STD Cur_ETRs*. The format of the table will be applicable to all other variables. Because *STD Cur_ETRs* are calculated from *Cur_ETRs* it is necessary to check the distribution of *Cur_ETRs* to see whether they are seriously skewed and whether there are outstanding influential data that could bias results. Thus, in table 5.1 under the category "full sample" the first row is the descriptive statistics of *Cur_ETRs*, the secondary row is the descriptive statistics of *STD Cur_ETRs*. The following rows are descriptive statistics of *STD Cur_ETRs* for various sub-samples.

In total there are 1,311 observations having *Cur_ETRs*. The reason why the number of observations is 1,311 instead of 1,519 as mentioned earlier is because the mechanism of pooled OLS regression is excluding company year ends with missing data from model estimation. As discussed in data collection section, because of disclosure exemption and information loss some data are missing, dropping them from model the observations reduce to 1,311. The original *Cur_ETR* ranges from 0 to 100%. The mean value 0.23 means that on average current tax expense accounts for 23% of pre-tax

**Table 5. 1 Descriptive statistics and significance tests of *STD Cur_ETRs***

| | | N | Min | Median | Max | Mean | SD | Skew | Kurt | b-4 | b-3 | b-2 | b-1 | IPO | a+1 | a+2 | ANOVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | | | | | | | | | | | | | | | | |
| | *Cur_ETR* | 1,311 | 0.00 | 0.08 | 1.00 | 0.23/0.51[15] | 0.32 | 1.51 | 4.10 | 0.24 | 0.26 | 0.26 | 0.22 | 0.23 | 0.19 | 0.22 | 0.3926 |
| | *STD Cur_ETR* | 1,311 | 0.00 | 0.31 | 5.00 | 0.88 | 1.26 | 1.73 | 5.19 | 0.85 | 0.94 | 0.97 | 0.82 | 0.94 | 0.75 | 0.87 | 0.5969 |
| (b) | ***Profitable company year-ends*** | 702 | 0.00 | 0.91 | 4.96 | 0.91 | 0.82 | 1.77 | 7.79 | 0.93 | 0.90 | 1.02 | 0.86 | 0.98 | 0.84 | 0.90 | 0.6981 |
| (1) | Pre 2008 | 238 | 0.00 | 0.87 | 3.33 | 0.81 | 0.68 | 1.09 | 5.28 | 0.78 | 0.95 | 0.81 | 0.65 | 0.80 | 0.84 | 0.87 | 0.7135 |
| (2) | Post 2008 | 239 | 0.00 | 0.99 | 4.96 | 1.08 | 0.96 | 1.85 | 7.24 | 0.96 | 1.02 | 1.29 | 1.03 | 1.32 | 0.91 | 0.98 | 0.4099 |
| | MW-U/t-test | | | | | **0.0016***/0.0005*****[a] | | | | | | | | | | | |
| (3) | Pre 2008: AIM | 190 | 0.00 | 0.87 | 3.33 | 0.80 | 0.66 | 0.96 | 5.03 | 0.74 | 0.87 | 0.87 | 0.64 | 0.75 | 0.86 | 0.90 | 0.7430 |
| (4) | Pre 2008: Main market | 48 | 0.00 | 0.90 | 3.33 | 0.85 | 0.78 | 1.33 | 5.33 | 1.17 | 1.42 | 0.60 | 0.66 | 1.00 | 0.76 | 0.77 | 0.6856 |
| | MW-U/t-test | | | | | 0.9193/0.7020 | | | | | | | | | | | |
| (5) | Post 2008: AIM | 155 | 0.00 | 0.92 | 4.96 | 0.97 | 0.92 | 1.95 | 8.17 | 0.88 | 0.88 | 1.15 | 0.83 | 1.41 | 0.79 | 0.73 | 0.1453 |
| (6) | Post 2008: Main market | 84 | 0.00 | 1.06 | 4.65 | 1.28 | 1.01 | 1.77 | 6.15 | 1.17 | 1.42 | 1.59 | 1.39 | 1.15 | 1.09 | 1.26 | 0.9048 |
| | MW-U/t-test | | | | | 0.0015***/0.0182** | | | | | | | | | | | |
| (7) | Pre 2008: AIM, No change in auditor | 84 | 0.00 | 0.98 | 3.33 | 0.87 | 0.56 | 0.63 | 5.96 | 0.66 | 1.03 | 0.91 | 0.88 | 0.84 | 0.83 | 0.95 | 0.8377 |
| (8) | Pre 2008: Main market, No change in auditor | 31 | 0.00 | 0.85 | 2.35 | 0.72 | 0.58 | 0.48 | 3.22 | 1.17 | 1.18 | 0.88 | 0.41 | 0.65 | 0.63 | 0.74 | 0.6516 |
| (9) | Post 2008: AIM, No change in auditor | 57 | 0.00 | 0.82 | 4.81 | 0.84 | 0.87 | 2.89 | 13.72 | 0.55 | 0.55 | 0.99 | 0.87 | 1.85 | 0.57 | 0.39 | 0.0115** |
| (10) | Post 2008: Main market, No change in auditor | 41 | 0.00 | 1.03 | 4.65 | 1.39 | 1.23 | 1.42 | 4.25 | 0.33 | 1.91 | 1.81 | 1.79 | 1.32 | 1.33 | 1.12 | 0.5298 |

Where b-4, b-3, b-2, b-1, IPO,a+1, a+2 = t-4, t-3, t-2 t-1, t-o, t+1, t+2 with respect to the IPO year.
*** p<.01, ** p<.05, * p<.1
a Mann-Whitney test and t-test of unstandardised *Cur_ETRs*: 0.0961*/0.8247.
n=company year ends

[15] The first value is unweighted mean value, the second value is weighted mean value.

profits (table 5.1 -panel a -second row -column 7). This ratio is within the range of statutory tax rates during the period of 2004 to 2018. The skewness is 1.51 and kurtosis is 4.10, indicating *Cur_ETRs* are not strictly normally distributed. This mean value is unweighted, unweighted mean has a potential issue that each observation is given an equal weighting, the mean value can be distorted by extreme values. To provide an indication of path of ETRs over time, the weighted mean is also shown. A weighted mean, calculated as the sum of current tax expense for all observations in the whole IPO period divided by the sum of pre-tax profits for all observations in the same period, is also calculated to analyse companies collectively. The equation is:

$$Weighted\ Cur\_ETR_{i,t} = \frac{\sum_1^n Current\ tax\ expense_{1,t}}{\sum_1^n Profit\ before\ taxes_{1,t}} \quad (8)$$

The weighted mean of *Cur_ETR* is 51%.

Using *Cur_ETRs* divided by weighted statutory tax rates to calculate *STD Cur_ETRs* the range of *STD Cur_ETRs* is from 0 to 5. The very large values (e.g. *Cur_ETR* is 5 times of statutory tax rate) are caused by a large *Cur_ETR* (e.g. 100%) divided by a small statutory tax rate (e.g. 20%). The mean value is 0.88, meaning that on average *Cur_ETRs* account for 0.88 of statutory tax rates (table 5.1 -panel a -third row). On average companies' ETRs are lower than statutory tax rates, this might be a signal that on average companies engage in tax management to reduce tax liabilities owed. If company year ends with losses are excluded the observations reduce from 1,311 to 702 (table 5.1 -panel b -the first row). The average ratio of *Cur_ETRs* to statutory tax rates is 0.91, higher than the sample with loss years. The median and mean are same, the standard deviation is smaller (from 1.26 to 0.82), suggesting the mean value is less distorted by extreme values, the distribution is more concentrated.

Dividing the sample into the period of pre 2008 and post 2008 the number of observations for the pre 2008 period is 238 (table 5.1 -subsample 1), for the post 2008 period the figure is 239 (table 5.1 -subsample 2). For the pre 2008 period the range of *STD Cur_ETR* is from 0 to 3.33, the average ratio is 0.81. For the post 2008 period

*STD Cur_ETRs* are from 0 to 4.96, the mean value is 1.08. The t-test result is significant at 1% level, indicating that the difference in the mean *STD Cur_ETRs* of pre and post 2008 periods is significantly different. The p-value of MW-U test is 0.0016, indicating that the distribution of *STD Cur_ETRs* in pre and post 2008 periods is significantly different at 1% level. The average and median *STD Cur_ETRs* of pre 2008 is significantly lower than that of post 2008, which is consistent with the theory that after 2008 Banking Crisis there is enhanced scrutiny and higher reporting requirements which increase costs of tax management, as a result, companies engage in less tax management (Holland et al 2016; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). The note "a" reports that if statutory tax rates are not controlled, the p-value of MW-U test is only significant at 10% level, p-value of t-test is not statistically different. The different results reflect the necessity of controlling the change in statutory tax rates.

In the pre 2008 period the number of observations for AIM is 190 (table 5.1 - subsample 3), more than three times of the observations for Main Market (table 5.1 - subsample 4). The mean value of *STD Cur_ETRs* for AIM is 0.80, for Main Market is 0.85. The differences in the median (MW-U) and mean values (t-test) of *STD Cur_ETRs* for AIM and Main Market are not statistically significant, indicating that the difference in tax management behaviours of companies listed on AIM and Main Market are not different. In the post 2008 period the number of observations for AIM (155) (table 5.1 -subsample 5) is also larger than that of Main Market (84) (table 5.1 - subsample 6). On average *STD Cur_ETR* of AIM (0.97) is lower than that of Main Market (1.28). The MW-U test is significant at 1%, the t-test is significant at 5% level. As expected, the average and median *STD Cur_ETRs* of Main Market are significantly higher than those of AIM, supporting the hypothesis that with higher listing requirements and stricter scrutiny in general, companies listed on Main Market have a lower level of tax management than companies listed on AIM (Doukas and Hoque 2016; Khurshed et al 2016; Nielsson 2013; Ball and Shivakumar 2008).

Controlling the change in auditors the number of observations reduces. In addition,

there are changes in the distribution of *STD Cur_ETRs*. For some companies the average *STD Cur_ETR* has an increase while for some companies the average *STD Cur_ETR* has a decrease. For companies reporting pre 2008 and listed on AIM (subsample 3) the mean value increases from 0.80 to 0.87 (subsamples 3 and subsample 7). Companies reporting post 2008 and listed on Main Market (subsample 6) the average *STD Cur_ETR* increases from 1.28 to 1.39 (subsamples 6 and subsample 10). The increase in *STD Cur_ETRs* means that among subsamples 3 and 6 controlling the change in auditors, companies are likely to engage in less tax management. However, for companies reporting pre 2008 and listed on Main Market (subsamples 4) controlling the change in auditors results in a decrease in mean *STD Cur_ETRs*, from 0.85 to 0.72 (subsamples 4 and 8). The average *STD Cur_ETR* of companies reporting post 2008 and listed on AIM (subsample 5) reduces from 0.97 to 0.84 (subsamples 5 and 9). This means for subsamples 4 and 5 controlling the change in auditors, companies are likely to engage in higher levels of tax management. The changes in *STD Cur_ETR* before and after controlling auditor changes suggest that corporate tax management behaviours are likely to vary with auditor change (Klassen et al 2016; McGuire et al 2012; Omer et al 2006; Cook et al 2008; Holland and Horton 1993; Maydew and Shackelford 2005).

In terms of the difference between testing years (ANOVA), for IPO companies floating on AIM market reporting post 2008 with the same auditors (subsample 9), the *STD Cur_ETRs* are significantly different between years (p-value is 0.0115).

Table 5.2 is the descriptive statistics and significant tests of *STD Def_ETRs*. In total there are 1,311 observations having *Def_ETRs*. The minimum *Def_ETR* is 0 and the maximum *Def_ETR* is 100%. The unweighted mean value is 7%, meaning that on average deferred tax expense accounts for 7% of pre-tax profits. Dividing the sum of deferred taxes by the sum of pre-tax profits the weighted mean value is -8%. The reason for the negative value is because the sum of deferred taxes or the sum of pre-tax profits is negative. The skewness is 3.64, the kurtosis value is 15.07, indicating that the distribution is more “sharp” than normal distribution. Divided by prevailing

**Table 5. 2 Descriptive statistics and significance tests of *STD Def_ETRs***

| | | N | Min | Median | Max | Mean | SD | Skew | Kurt | b-4 | b-3 | b-2 | b-1 | IPO | a+1 | a+2 | ANOVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | | | | | | | | | | | | | | | | |
| | *Def_ETR* | 1,311 | 0.00 | 0.00 | 1.00 | 0.07/-0.08 | 0.22 | 3.64 | 15.07 | 0.06 | 0.08 | 0.05 | 0.06 | 0.09 | 0.06 | 0.09 | 0.3325 |
| | *STD Def_ETR* | 1,311 | 0.00 | 0.00 | 4.76 | 0.27 | 0.86 | 3.88 | 17.43 | 0.22 | 0.30 | 0.21 | 0.22 | 0.34 | 0.21 | 0.36 | 0.3147 |
| (b) | ***Profitable company year-ends*** | 702 | 0.00 | 0.00 | 4.76 | 0.19 | 0.51 | 4.65 | 29.69 | 0.09 | 0.16 | 0.16 | 0.23 | 0.30 | 0.17 | 0.18 | 0.1411 |
| (1) | Pre 2008 | 238 | 0.00 | 0.00 | 3.33 | 0.19 | 0.50 | 3.87 | 20.03 | 0.02 | 0.01 | 0.25 | 0.32 | 0.28 | 0.16 | 0.16 | 0.1060 |
| (2) | Post 2008 | 239 | 0.00 | 0.00 | 4.76 | 0.17 | 0.49 | 6.07 | 48.82 | 0.20 | 0.16 | 0.12 | 0.19 | 0.30 | 0.09 | 0.10 | 0.5832 |
| | MW-U/t-test | | | | | 0.9472/**0.5892** [a] | | | | | | | | | | | |
| (3) | Pre 2008: AIM | 190 | 0.00 | 0.00 | 3.33 | 0.14 | 0.41 | 4.89 | 32.78 | 0.02 | 0.02 | 0.13 | 0.24 | 0.18 | 0.13 | 0.19 | 0.3661 |
| (4) | Pre 2008: Main market | 48 | 0.00 | 0.02 | 3.22 | 0.38 | 0.74 | 2.22 | 7.25 | 0.02 | 0.00 | 0.73 | 0.63 | 0.61 | 0.25 | 0.03 | 0.3481 |
| | MW-U/t-test | | | | | 0.0151**/0.0380** | | | | | | | | | | | |
| (5) | Post 2008: AIM | 155 | 0.00 | 0.00 | 4.76 | 0.17 | 0.56 | 6.02 | 44.52 | 0.12 | 0.13 | 0.11 | 0.24 | 0.42 | 0.08 | 0.07 | 0.3369 |
| (6) | Post 2008: Main market | 84 | 0.00 | 0.00 | 2.21 | 0.16 | 0.35 | 3.44 | 17.39 | 0.43 | 0.26 | 0.13 | 0.11 | 0.08 | 0.12 | 0.13 | 0.3213 |
| | MW-U/t-test | | | | | 0.3725/0.7505 | | | | | | | | | | | |
| (7) | Pre 2008: AIM, No change in auditor | 84 | 0.00 | 0.00 | 1.48 | 0.12 | 0.27 | 2.95 | 11.98 | 0.01 | 0.02 | 0.21 | 0.13 | 0.22 | 0.13 | 0.10 | 0.3810 |
| (8) | Pre 2008: Main market, No change in auditor | 31 | 0.00 | 0.00 | 2.35 | 0.25 | 0.52 | 2.59 | 9.80 | 0.02 | 0.00 | 0.22 | 0.52 | 0.28 | 0.40 | 0.01 | 0.7197 |
| (9) | Post 2008: AIM, No change in auditor | 57 | 0.00 | 0.00 | 4.76 | 0.29 | 0.84 | 4.37 | 21.90 | 0.25 | 0.17 | 0.16 | 0.44 | 0.61 | 0.16 | 0.20 | 0.9156 |
| (10) | Post 2008: Main market, No change in auditor | 41 | 0.00 | 0.00 | 1.19 | 0.15 | 0.30 | 2.37 | 7.53 | 0.27 | 0.52 | 0.06 | 0.14 | 0.02 | 0.08 | 0.17 | 0.2947 |

Where b-4, b-3, b-2, b-1, IPO,a+1, a+2 =t-4, t-3, t-2 t-1, t-o, t+1, t+2 with respect to the IPO year.
*** p<.01, ** p<.05, * p<.1
a. t-test of unstandardised *Def_ETRs*: 0.0820*
n=company year ends

statutory tax rates the range of *STD Def_ETRs* is 0 to 4.76. On average *Def_ETRs* account for 0.27 of statutory tax rates. With loss-making company year ends excluded (table 5.2 -panel b) the observation reduces from 1,311 to 702. On average *Def_ETRs* are 0.19 of statutory tax rates.

The mean *STD Def_ETR* of pre 2008 (subsample 1) is 0.19, of post 2008 (subsample 2) is 0.17. According to MW-U test the distribution of *STD Def_ETRs* in pre 2008 and post 2008 is not statistically significant (at normally accepted reported levels). Regarding the difference between listing markets, pre 2008 the mean *STD Def_ETR* of AIM (0.14) (subsample 3) is significantly lower than the mean *STD Def_ETR* of Main Market (0.38) (subsample 4), the median *STD Def_ETR* of AIM is also significantly lower than the median *STD Def_ETR* of Main Market, MW-U test and t-test are significant at 5% level, this supports the theory that with higher market pressure companies listed on Main Market use more tax deferral strategies to reduce current tax liabilities (Parsa and Kouhy 2008). However, post 2008 the difference of *STD Def_ETRs* between different markets is not significant.

Controlling the change in auditor for most subsamples (subsamples 3, 4, 6) the average *STD Def_ETR* has a decrease, IPO companies with consistent auditors are likely to engage in less deferral tax management. Only for the subsample 5, that is, the sample that report post 2008 and listed on AIM, controlling auditor identity consistent the *STD Def_ETRs* have an increase. Controlling the change in auditors the distribution of *STD Def_ETR* has changes, indicating the change in auditors might influence tax management behaviours (Klassen et al 2016; McGuire et al 2012; Omer et al 2006; Cook et al 2008; Holland and Horton 1993; Maydew and Shackelford 2005).

Table 5.3 reports descriptive statistics and significant tests of *STD GAAP_ETR*. *GAAP_ETRs* range from 0 to 100%. If companies are given the same weighting on average total tax expense accounts for 23% of pre-tax profits. This ratio is similar with *Cur_ETRs* (Table 5.1), implying that current tax expense plays a dominant role of total tax expense. The median value is 13%. Being analysed collectively the sum of total

**Table 5. 3 Descriptive statistics and significance tests of *STD GAAP_ETRs***

| | | N | Min | Median | Max | Mean | SD | Skew | Kurt | b-4 | b-3 | b-2 | b-1 | IPO | a+1 | a+2 | ANOVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | | | | | | | | | | | | | | | | |
| | *GAAP_ETR* | 1,311 | 0.00 | 0.13 | 1.00 | 0.23/0.44 | 0.31 | 1.54 | 4.39 | 0.23 | 0.25 | 0.26 | 0.21 | 0.22 | 0.20 | 0.24 | 0.4145 |
| | *STD GAAP_ETR* | 1,311 | 0.00 | 0.56 | 5.00 | 0.87 | 1.20 | 1.79 | 5.64 | 0.83 | 0.92 | 0.99 | 0.77 | 0.87 | 0.78 | 0.92 | 0.5385 |
| (b) | ***Profitable company year-ends*** | 702 | 0.00 | 0.99 | 4.98 | 0.99 | 0.77 | 1.85 | 8.72 | 0.94 | 0.95 | 1.07 | 0.99 | 1.07 | 0.94 | 0.95 | 0.7200 |
| (1) | Pre 2008 | 238 | 0.00 | 0.97 | 3.33 | 0.91 | 0.68 | 1.05 | 5.30 | 0.75 | 0.86 | 0.97 | 0.94 | 0.90 | 0.93 | 0.97 | 0.9320 |
| (2) | Post 2008 | 239 | 0.00 | 1.03 | 4.98 | 1.10 | 0.89 | 2.18 | 9.22 | 1.03 | 1.09 | 1.24 | 1.14 | 1.36 | 0.91 | 0.90 | **0.2669** [a] |
| | MW-U/t-test | | | | | **0.0149**/0.0101**** [b] | | | | | | | | | | | |
| (3) | Pre 2008: AIM | 190 | 0.00 | 0.95 | 3.33 | 0.88 | 0.67 | 1.17 | 5.93 | 0.72 | 0.83 | 0.92 | 0.87 | 0.80 | 0.94 | 1.03 | 0.7758 |
| (4) | Pre 2008: Main market | 48 | 0.00 | 1.03 | 3.33 | 1.05 | 0.73 | 0.63 | 3.79 | 1.08 | 0.99 | 1.19 | 1.21 | 1.23 | 0.90 | 0.79 | 0.8585 |
| | MW-U/t-test | | | | | 0.0514*/0.1347 | | | | | | | | | | | |
| (5) | Post 2008: AIM | 155 | 0.00 | 0.97 | 4.98 | 1.00 | 0.87 | 2.34 | 10.86 | 0.92 | 0.91 | 1.12 | 0.99 | 1.51 | 0.80 | 0.60 | 0.0350** |
| (6) | Post 2008: Main market | 84 | 0.00 | 1.06 | 4.65 | 1.29 | 0.91 | 2.06 | 7.38 | 1.31 | 1.61 | 1.50 | 1.42 | 1.10 | 1.07 | 1.23 | 0.7724 |
| | MW-U/t-test | | | | | **0.0036*****/0.0188** [c] | | | | | | | | | | | |
| (7) | Pre 2008: AIM, No change in auditor | 84 | 0.00 | 1.01 | 3.33 | 0.96 | 0.56 | 0.78 | 6.44 | 0.62 | 0.99 | 1.10 | 1.01 | 1.04 | 0.93 | 0.98 | 0.4936 |
| (8) | Pre 2008:Main market, No change in auditor | 31 | 0.00 | 0.98 | 2.34 | 0.88 | 0.62 | 0.37 | 3.07 | 1.08 | 1.10 | 0.90 | 0.80 | 0.84 | 0.99 | 0.73 | 0.9864 |
| (9) | Post 2008:AIM,No change in auditor | 57 | 0.00 | 0.97 | 4.98 | 1.00 | 0.96 | 2.64 | 11.35 | 0.79 | 0.69 | 1.09 | 1.22 | 1.92 | 0.68 | 0.35 | **0.0406**** [d] |
| (10) | Post 2008:Main market,No change in auditor | 41 | 0.00 | 1.05 | 4.65 | 1.40 | 1.13 | 1.51 | 4.58 | 0.60 | 2.31 | 1.86 | 1.83 | 1.15 | 1.14 | 1.17 | 0.3426 |

Where b-4, b-3, b-2, b-1, IPO,a+1, a+2 = t-4, t-3, t-2 t-1, t-o, t+1, t+2 with respect to the IPO year. *** p<.01, ** p<.05, * p<.1

a. ANOVA of unstandardised *GAAP_ETRs*: 0.0924*. b. Mann-Whitney test and t-test of unstandardised *GAAP_ETRs*: 0.0001***/0.1011. c. Mann-Whitney test of unstandardised *GAAP_ETRs*: 0.0153**. d. ANOVA of unstandardised *GAAP_ETRs*: 0.0569*. n=company year ends

tax expense accounts for 44% of the sum of total pre-tax profits. Standardising *GAAP_ETRs* by statutory tax rates the range of *STD GAAP_ETRs* is 0 to 5. On average *GAAP_ETRs* account for 0.87 of statutory tax rates. If the company year ends with accounting loss are dropped the mean value increases to 0.99, *GAAP_ETRs* are almost the same with statutory tax rates. The mean is same with median, the standard deviation becomes smaller (1.20 to 0.77), meaning that the distribution is more concentrated.

According to table 5.3 the distribution of *STD GAAP_ETRs* in the pre 2008 period is significantly different from the distribution of *STD GAAP_ETRs* in the post 2008 period, MW-U test and t-test are significant at 5% level. Consistent with expectation, the median *STD GAAP_ETR* of post 2008 (1.03) (subsample 2) is significantly higher than that of pre 2008 (0.97) (subsample 1), measured by *STD GAAP_ETRs* post 2008 because of additional disclosure demand companies engage in less tax management (Holland et al 2016; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011).

In both pre and post 2008, the median *STD GAAP_ETR* of companies floating on Main market is significantly higher than that of companies listed on AIM. Specifically, pre 2008 the median *STD GAAP_ETR* for Main Market is 1.03 (subsample 4), for AIM is 0.95 (subsample 3), MW-U test is significant at 10% level. Post 2008 the median *STD* GAAP for Main Market is 1.06 (subsample 6), for AIM is 0.97 (subsample 5), the MW-U test is significant at 1% level. These findings suggest that companies listed on Main Market, because under more stringent regulation and scrutiny, have a lower level of tax management (Doukas and Hoque 2016; Khurshed et al 2016; Nielsson 2013; Mallin and Ow-Yong 2012; Rousseau 2008; Ball and Shivakumar 2008).

For different subsamples the auditor effect is various, for subsamples 3 and 6 after auditor is controlled unchanged the average *STD GAAP_ETR* has an increase, companies are likely to engage in less tax management. For subsample 4 the average *STD GAAP_ETR* decreases from 1.05 to 0.88, companies are likely to engage in more tax management. The findings indicate that tax management levels are likely to be

influenced by auditors (McGuire et al 2012; Omer et al 2006; Cook et al 2008; Klassen et al 2016; Holland and Horton 1993; Maydew and Shackelford 2005). For subsample 5, the controlling of auditors does not change the level of tax management.

The ANOVA results show that for those companies reporting post 2008, listed on AIM market (subsample 5), *STD GAAP_ETRs* are significantly different by years. If the change in auditor is controlled (subsample 9) the significant difference still holds.

Table 5.4 reports descriptive statistics and significant tests of *STD Cash_ETRs*. In total there are 1,250 observations having *Cash_ETRs*, this figure is less than *STD Cur_ETR*, *STD Def_ETR* and *STD GAAP_ETR* because some companies (e.g. small-sized companies) are allowed to omit cash flow statements. *Cash_ETRs* range from 0 to 100%, on average tax paid accounts for 27% of profit before tax. The weighted mean value is 44%.

The *STD Cash_ETRs* calculated on *Cash_ETRs* range from 0 to 5. The average *STD Cash_ETR* is 1.02, while *GAAP_ETRs* are 0.87 of statutory tax rates *Cash_ETRs* are even higher than statutory tax rates. This results in a conjecture that companies could manage reported taxes but fail to manage cash taxes paid or that the effect of non-matching of cash tax paid and profit before tax is significant. After loss years are excluded the number of observations reduces to 641. The mean value is lower, changes to 0.84.

There are 210 observations of *STD Cash_ETRs* pre 2008 (subsample 1) and 216 observations post 2008 (subsample 2). The median and mean *STD Cash_ETR* of post 2008 is significantly higher than that of pre 2008, consistent with the theory that there is additional disclosure requirements in the period of post 2008, which increases costs of tax management, as a consequence, companies engage in less tax management (Holland et al 2016; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). In the pre 2008 period the difference of tax management measured by *STD Cash_ETRs* is not significant between AIM and Main

**Table 5. 4 Descriptive statistics and significance tests of *STD Cash_ETRs***

| | | N | Min | Median | Max | Mean | SD | Skew | Kurt | b-4 | b-3 | b-2 | b-1 | IPO | a+1 | a+2 | ANOVA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | | | | | | | | | | | | | | | | |
| | *Cash_ETR* | 1,250 | 0.00 | 0.08 | 1.00 | 0.27/0.44 | 0.37 | 1.18 | 2.77 | 0.35 | 0.34 | 0.32 | 0.22 | 0.22 | 0.23 | 0.28 | 0.0006*** |
| | *STD Cash_ETR* | 1,250 | 0.00 | 0.31 | 5.00 | 1.02 | 1.41 | 1.30 | 3.38 | 1.23 | 1.21 | 1.18 | 0.85 | 0.87 | 0.89 | 1.07 | 0.0160** |
| (b) | ***Profitable company year-ends*** | 641 | 0.00 | 0.73 | 5.00 | 0.84 | 0.89 | 1.74 | 6.56 | 0.74 | 0.86 | 0.95 | 0.82 | 0.80 | 0.73 | 0.97 | 0.4082 |
| (1) | Pre 2008 | 210 | 0.00 | 0.66 | 3.33 | 0.72 | 0.76 | 1.52 | 5.72 | 0.37 | 0.86 | 1.06 | 0.62 | 0.57 | 0.74 | 0.81 | 0.0662* |
| (2) | Post 2008 | 216 | 0.00 | 0.86 | 5.00 | 1.01 | 1.00 | 1.82 | 6.73 | 1.07 | 0.94 | 1.14 | 0.96 | 1.25 | 0.76 | 0.98 | 0.5206 |
| | MW-U/t-test | | | | | **0.0010*****/0.0010***** [a] | | | | | | | | | | | |
| (3) | Pre 2008: AIM | 164 | 0.00 | 0.63 | 3.33 | 0.70 | 0.74 | 1.47 | 5.60 | 0.31 | 0.85 | 1.14 | 0.60 | 0.44 | 0.72 | 0.83 | 0.0076*** |
| (4) | Pre 2008: Main market | 46 | 0.00 | 0.68 | 3.33 | 0.82 | 0.85 | 1.57 | 5.52 | 0.75 | 0.92 | 0.79 | 0.69 | 1.03 | 0.77 | 0.76 | 0.9906 |
| | MW-U/t-test | | | | | 0.4022/0.3650 | | | | | | | | | | | |
| (5) | Post 2008: AIM | 139 | 0.00 | 0.75 | 5.00 | 0.95 | 1.02 | 1.86 | 7.02 | 0.81 | 0.93 | 1.03 | 0.76 | 1.42 | 0.70 | 0.97 | 0.2588 |
| (6) | Post 2008: Main market | 77 | 0.00 | 0.94 | 4.48 | 1.11 | 0.95 | 1.81 | 6.29 | 1.75 | 0.98 | 1.37 | 1.32 | 0.93 | 0.85 | 0.99 | 0.4201 |
| | MW-U/t-test | | | | | **0.0488****/0.2438 [b] | | | | | | | | | | | |
| (7) | Pre 2008: AIM, No change in auditor | 75 | 0.00 | 0.71 | 3.33 | 0.72 | 0.68 | 1.53 | 6.73 | 0.27 | 0.91 | 1.09 | 0.74 | 0.64 | 0.57 | 0.80 | 0.2115 |
| (8) | Pre 2008: Main market, No change in auditor | 30 | 0.00 | 0.62 | 3.33 | 0.65 | 0.71 | 1.87 | 7.68 | 0.75 | 0.88 | 0.36 | 0.43 | 0.70 | 0.84 | 0.70 | 0.9494 |
| (9) | Post 2008: AIM, No change in auditor | 50 | 0.00 | 0.62 | 4.82 | 0.72 | 0.93 | 3.01 | 13.34 | 0.47 | 0.37 | 0.52 | 0.75 | 1.75 | 0.60 | 0.22 | 0.0307** |
| (10) | Post 2008: Main market, No change in auditor | 37 | 0.00 | 1.00 | 4.48 | 1.28 | 1.13 | 1.47 | 4.31 | 1.43 | 0.98 | 1.85 | 1.70 | 1.19 | 0.95 | 0.98 | 0.7856 |

Where b-4, b-3, b-2, b-1, IPO, a+1, a+2 = b-4, t-3, t-2 t-1, t-o, t+1, t+2 with respect to the IPO year.
*** p<.01, ** p<.05, * p<.1
a. Mann-Whitney test and t-test of unstandardised *Cash_ETRs*: 0.8068/0.7919. b. Mann-Whitney test of unstandardised *Cash_ETRs*: 0.0859*
n=company year ends

Market. In the post 2008 period the median *STD Cash_ETR* of Main Market is significantly higher than that of AIM (MW-U is significant at 5% level), consistent with the argument that under stricter scrutiny, companies issuing securities on Main Market have a lower level of tax management (Doukas and Hoque 2016; Khurshed et al 2016; Nielsson 2013; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). Regarding auditor effect, there is not a consistent pattern in the change of *STD Cash_ETRs* after the change in auditors is controlled, the effect of auditors is mixed.

In terms of the difference between testing years (i.e. ANOVA test), for full sample, companies whose all company year ends are in the pre 2008 period, companies that report pre 2008 and listed on AIM market, companies that report post 2008, listed on AIM market and employ the same auditors, the *STD Cash_ETRs* between years are significantly different.

### 5.1.2 Descriptive statistics and significant tests of independent variables

This section analyses descriptive statistics and significant tests of independent variables. Same with dependent variables the descriptive statistics of full sample, profitable company year-ends, various sub-samples are analysed, both parametric and non-parametric tests (t-test and MW-U test) are used.

Table 5.5 is the descriptive statistics and significant tests of leverage (*LEV*). In total there are 1,438 observations having leverage. The minimum ratio of long-term debt to total assets is zero, the largest ratio is 110%. The mean value is 13%, meaning that on average long-term debt accounts for 13% of total assets. For profitable company year-ends although observations are reduced to 831, the minimum value, maximum value and mean value do not change, implying that the distribution of leverage is not seriously affected by loss years.

Regarding comparison between subsamples, the median *LEV* of post 2008 is 6%, higher than the median *LEV* of pre 2008, which is 4%, the MW-U test of *LEV* in pre and post 2008 is significant at 10% level, the post 2008 sub-sample has more long-

**Table 5. 5 Descriptive statistics and significance tests of *LEV***

| | | N | Min | 25% | Median | 75% | Max | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | 1,438 | 0.00 | 0.00 | 0.01 | 0.16 | 1.10 | 0.13 | 0.22 | 2.43 | 8.96 |
| (b) | ***Profitable company year-ends*** | 831 | 0.00 | 0.00 | 0.03 | 0.17 | 1.10 | 0.13 | 0.22 | 2.43 | 9.26 |
| (1) | Pre 2008 | 261 | 0.00 | 0.00 | 0.04 | 0.16 | 1.10 | 0.13 | 0.22 | 2.25 | 7.88 |
| (2) | Post 2008 | 287 | 0.00 | 0.00 | 0.06 | 0.25 | 1.10 | 0.16 | 0.25 | 2.14 | 7.51 |
| | MW-U/t-test | | | | | | | 0.0868*/0.1492 | | | |
| (3) | Pre 2008: AIM | 209 | 0.00 | 0.00 | 0.02 | 0.12 | 0.93 | 0.09 | 0.16 | 2.93 | 13.21 |
| (4) | Pre 2008: Main market | 52 | 0.00 | 0.00 | 0.17 | 0.54 | 1.10 | 0.30 | 0.33 | 0.80 | 2.49 |
| | MW-U/t-test | | | | | | | 0.0000***/0.0000*** | | | |
| (5) | Post 2008: AIM | 193 | 0.00 | 0.00 | 0.03 | 0.16 | 1.10 | 0.13 | 0.20 | 2.43 | 10.09 |
| (6) | Post 2008: Main market | 94 | 0.00 | 0.00 | 0.11 | 0.32 | 1.10 | 0.24 | 0.31 | 1.53 | 4.33 |
| | MW-U/t-test | | | | | | | 0.0399**/0.0022*** | | | |
| (7) | Pre 2008: AIM, No change in auditor | 84 | 0.00 | 0.00 | 0.06 | 0.15 | 0.93 | 0.13 | 0.20 | 2.46 | 9.19 |
| (8) | Pre 2008: Main market, No change in auditor | 31 | 0.00 | 0.00 | 0.14 | 0.49 | 0.89 | 0.26 | 0.30 | 0.95 | 2.57 |
| (9) | Post 2008: AIM, No change in auditor | 57 | 0.00 | 0.00 | 0.04 | 0.14 | 0.41 | 0.08 | 0.10 | 1.45 | 4.97 |
| (10) | Post 2008: Main market, No change in auditor | 47 | 0.00 | 0.00 | 0.17 | 0.67 | 1.10 | 0.34 | 0.39 | 0.84 | 2.17 |

*** p<.01, ** p<.05, * p<.1
n=company year ends

term debt holdings. In both pre and post 2008 periods, companies floating on Main Market have higher *LEV* than companies floating on AIM. Pre 2008 the comparison is 17% (Main Market) to 2% (AIM), the MW-U test and t-test are significant at 1% level. Post 2008 the comparison is 11% (Main Market) to 3% (AIM), the MW-U test is significant at 5%, t-test is significant at 1%. Controlling auditors unchanged, for subsamples 3 and 6 the average *LEV* increases, for subsamples 4 and 5 the average *LEV* reduces. These changes reflect that the change in auditors could influence the level of *LEV*.

Table 5.6 reports descriptive statistics and significant tests of *Cap_Int*. The ratio of fixed assets to total assets ranges from 0 to 90%. The average ratio is 15%, for profitable company year ends the average ratio is 16%. The median and mean value of *Cap_Int* for the pre 2008 sub-sample are significantly higher than those of the post 2008 sub-sample, with the significant levels of 1%. This implies that the pre 2008 sub-sample has more intensive tangible assets than the post 2008 sub-sample. This is because the percentage of companies in capital-intensive industry (i.e. industrials) for the pre 2008 sub-sample is higher than that for the post 2008 sub-sample. Another reason might be tangible assets have been impaired during the 2008 crisis. In the pre 2008 period, the average *Cap_Int* of AIM is 19%, of Main Market is 18%; In the post 2008 period, the average *Cap_Int* of AIM is 12%, of Main Market is 8%. The MW-U tests are not significant, indicating that in both periods the difference of *Cap_Int* between listing markets is not significant. Controlling auditors unchanged, except for companies reporting post 2008 and listed on Main Market, other samples have a higher *Cap_Int*. This suggests that the change in auditors can influence the level of *Cap_Int*.

Table 5.7 is the descriptive statistics and significant tests of R&D intensity (*R&D_Int*). The range of R&D intensity for the full sample is from -259% to 140%, the mean value is -3%. The negative values are resulted from negative deflators (pre-R&D accounting loss). Excluding loss years from sample ensures the deflator is positive. The minimum R&D intensity is -7%, this is due to the company "Equiniti Group PLC" has government grants for research and development, the R&D expense, and

**Table 5. 6 Descriptive statistics and significance tests of Cap_Int**

| | | N | Min | 25% | Median | 75% | Max | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | 1,438 | 0.00 | 0.01 | 0.06 | 0.19 | 0.90 | 0.15 | 0.20 | 1.95 | 6.34 |
| (b) | ***Profitable company year-ends*** | 831 | 0.00 | 0.02 | 0.07 | 0.22 | 0.90 | 0.16 | 0.20 | 1.82 | 5.89 |
| (1) | Pre 2008 | 261 | 0.00 | 0.03 | 0.08 | 0.25 | 0.90 | 0.19 | 0.24 | 1.64 | 4.67 |
| (2) | Post 2008 | 287 | 0.00 | 0.01 | 0.05 | 0.16 | 0.90 | 0.11 | 0.15 | 2.33 | 9.40 |
| | MW-U/t-test | | | | | | | 0.0003***/0.0000*** | | | |
| (3) | Pre 2008: AIM | 209 | 0.00 | 0.03 | 0.08 | 0.28 | 0.90 | 0.19 | 0.24 | 1.50 | 4.25 |
| (4) | Pre 2008: Main market | 52 | 0.00 | 0.03 | 0.08 | 0.16 | 0.90 | 0.18 | 0.27 | 2.04 | 5.71 |
| | MW-U/t-test | | | | | | | 0.8873/0.8766 | | | |
| (5) | Post 2008: AIM | 193 | 0.00 | 0.01 | 0.05 | 0.14 | 0.90 | 0.12 | 0.17 | 2.13 | 7.67 |
| (6) | Post 2008: Main market | 94 | 0.00 | 0.02 | 0.04 | 0.17 | 0.36 | 0.08 | 0.09 | 1.19 | 3.41 |
| | MW-U/t-test | | | | | | | 0.4686/0.0131** | | | |
| (7) | Pre 2008: AIM, No change in auditor | 84 | 0.00 | 0.08 | 0.20 | 0.34 | 0.90 | 0.27 | 0.24 | 1.14 | 3.50 |
| (8) | Pre 2008: Main market, No change in auditor | 31 | 0.00 | 0.03 | 0.13 | 0.32 | 0.90 | 0.26 | 0.32 | 1.32 | 3.04 |
| (9) | Post 2008: AIM, No change in auditor | 57 | 0.00 | 0.02 | 0.04 | 0.38 | 0.90 | 0.21 | 0.25 | 1.06 | 3.27 |
| (10) | Post 2008: Main market, No change in auditor | 47 | 0.00 | 0.01 | 0.04 | 0.07 | 0.20 | 0.05 | 0.05 | 1.41 | 4.20 |

*** p<.01, ** p<.05, * p<.1
n=company year ends

**Table 5. 7 Descriptive statistics and significance tests of R&D_Int**

| | | N | Min | 25% | Median | 75% | Max | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | 1,307 | -2.59 | 0.00 | 0.00 | 0.00 | 1.40 | -0.03 | 0.41 | -2.91 | 21.88 |
| (b) | ***Profitable company year-ends*** | 699 | -0.07 | 0.00 | 0.00 | 0.00 | 0.97 | 0.06 | 0.16 | 3.52 | 15.54 |
| (1) | Pre 2008 | 238 | 0.00 | 0.00 | 0.00 | 0.00 | 0.97 | 0.05 | 0.17 | 3.65 | 16.00 |
| (2) | Post 2008 | 237 | -0.07 | 0.00 | 0.00 | 0.00 | 0.83 | 0.03 | 0.11 | 5.13 | 32.07 |
| | MW-U/t-test | | | | | | | 0.4069/0.0697* | | | |
| (3) | Pre 2008: AIM | 190 | 0.00 | 0.00 | 0.00 | 0.00 | 0.97 | 0.05 | 0.15 | 3.81 | 17.39 |
| (4) | Pre 2008: Main market | 48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.95 | 0.08 | 0.23 | 2.89 | 10.13 |
| | MW-U/t-test | | | | | | | 0.1537/0.2901 | | | |
| (5) | Post 2008: AIM | 153 | 0.00 | 0.00 | 0.00 | 0.00 | 0.83 | 0.03 | 0.12 | 5.09 | 29.61 |
| (6) | Post 2008: Main market | 84 | -0.07 | 0.00 | 0.00 | 0.00 | 0.49 | 0.03 | 0.08 | 3.49 | 16.65 |
| | MW-U/t-test | | | | | | | 0.4246/0.6807 | | | |
| (7) | Pre 2008: AIM, No change in auditor | 84 | 0.00 | 0.00 | 0.00 | 0.00 | 0.68 | 0.05 | 0.15 | 3.41 | 13.45 |
| (8) | Pre 2008: Main market, No change in auditor | 31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.02 | 0.06 | 4.84 | 25.73 |
| (9) | Post 2008: AIM, No change in auditor | 57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.80 | 0.03 | 0.13 | 5.07 | 28.92 |
| (10) | Post 2008: Main market, No change in auditor | 41 | -0.07 | 0.00 | 0.00 | 0.00 | 0.29 | 0.04 | 0.09 | 1.76 | 4.98 |

*** p<.01, ** p<.05, * p<.1
n=company year ends

consequently R&D intensity is negative. The maximum value is 97%, meaning that 97% of pre-R&D profit is spent on R&D. The average investment on R&D is 6%. MW-U tests are insignificant, indicating that the difference of R&D intensity between pre and post 2008, AIM and Main Market is not statistically significant.

According to table 5.8 the *NOLs* of full sample range from -936% to 767%, the mean value is 27%. This variable is defined as accounting loss of previous one year divided by current pre-tax profits. The value of -936% means there is accounting loss in the last year but accounting profits in the current year, the prior accounting loss is around 9 times of current accounting profits. The value of 767% means there is accounting loss in both prior year and current year, the prior accounting loss is more than 7 times of current accounting loss. If the negative deflator (current accounting loss) is dropped, the absolute value of the mean value is 37%, according to the definition of *NOLs*, for companies with accounting loss in prior one year, on average the loss is 37% of current pre-tax profits. According to MW-U test results the difference in the *NOLs* between pre and post 2008, Main Market and AIM is insignificant. With the change in auditors under controlled the average *NOLs* have changes. Companies reporting pre 2008 and listed on AIM (subsample 3) have a decrease in average *NOLs*, for other subsamples the average *NOLs* have an increase.

Table 5.9 is the descriptive statistics and significant tests of firm size (*TA*). The size of the smallest firm is -6.21 thousand GBP, the reason for the negative value is that for some dormant companies the total assets are small (0.31 thousand GBP), after taking the logarithm the values become negative. In total there are 24 observations with negative firm size. The size of the largest firm is 14.10 thousand GBP. The average size is 9.20 thousand GBP, without years with losses the average firm size is larger, 9.38 thousand GBP. The median and average firm size of the post 2008 sub-sample is larger than the median and average firm size of the pre 2008 sub-sample. Regarding firm size of companies listed on different markets, the median firm size of companies listed on Main Market is significantly larger than that of AIM. If the change in auditors is controlled, for all subsamples the firm size becomes larger.

**Table 5. 8 Descriptive statistics and significance tests of NOLs**

| | | N | Min | 25% | Median | 75% | Max | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | 1,096 | -9.36 | 0.00 | 0.00 | 0.57 | 7.67 | 0.27 | 1.63 | -1.10 | 20.55 |
| (b) | ***Profitable company year-ends*** | 601 | -9.36 | 0.00 | 0.00 | 0.00 | 0.00 | -0.37 | 1.48 | -5.07 | 29.08 |
| (1) | Pre 2008 | 211 | -9.36 | 0.00 | 0.00 | 0.00 | 0.00 | -0.47 | 1.65 | -4.43 | 22.51 |
| (2) | Post 2008 | 199 | -9.36 | 0.00 | 0.00 | 0.00 | 0.00 | -0.30 | 1.38 | -5.89 | 38.28 |
| | MW-U/t-test | | | | | | | 0.1234/0.2598 | | | |
| (3) | Pre 2008: AIM | 166 | -9.36 | 0.00 | 0.00 | 0.00 | 0.00 | -0.48 | 1.66 | -4.40 | 22.27 |
| (4) | Pre 2008: Main market | 45 | -9.36 | 0.00 | 0.00 | 0.00 | 0.00 | -0.46 | 1.62 | -4.51 | 23.43 |
| | MW-U/t-test | | | | | | | 0.8436/0.9434 | | | |
| (5) | Post 2008: AIM | 124 | -9.36 | 0.00 | 0.00 | 0.00 | 0.00 | -0.34 | 1.49 | -5.48 | 32.92 |
| (6) | Post 2008: Main market | 75 | -9.36 | 0.00 | 0.00 | 0.00 | 0.00 | -0.25 | 1.16 | -6.77 | 51.78 |
| | MW-U/t-test | | | | | | | 0.4894/0.6577 | | | |
| (7) | Pre 2008: AIM, No change in auditor | 73 | -3.87 | 0.00 | 0.00 | 0.00 | 0.00 | -0.14 | 0.52 | -5.65 | 39.11 |
| (8) | Pre 2008: Main market, No change in auditor | 29 | -9.36 | 0.00 | 0.00 | 0.00 | 0.00 | -0.65 | 1.99 | -3.53 | 14.77 |
| (9) | Post 2008: AIM, No change in auditor | 48 | -9.36 | 0.00 | 0.00 | 0.00 | 0.00 | -0.47 | 1.91 | -4.33 | 20.34 |
| (10) | Post 2008: Main market, No change in auditor | 36 | -9.36 | 0.00 | 0.00 | 0.00 | 0.00 | -0.47 | 1.66 | -4.62 | 24.65 |

*** p<.01, ** p<.05, * p<.1
n=company year ends

**Table 5. 9 Descriptive statistics and significance tests of TA**

| | | N | Min | 25% | Median | 75% | Max | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | 1,438 | -6.21 | 7.96 | 9.41 | 10.83 | 14.10 | 9.20 | 2.82 | -2.22 | 13.02 |
| (b) | ***Profitable company year-ends*** | 831 | -6.21 | 8.46 | 9.82 | 11.11 | 14.10 | 9.38 | 3.24 | -2.66 | 13.19 |
| (1) | Pre 2008 | 261 | -6.21 | 8.66 | 9.69 | 10.76 | 14.10 | 9.18 | 2.96 | -3.16 | 16.23 |
| (2) | Post 2008 | 287 | -6.21 | 8.66 | 10.23 | 11.46 | 14.10 | 9.65 | 3.75 | -2.49 | 10.91 |
| | MW-U/t-test | | | | | | | 0.0006***/0.0996* | | | |
| (3) | Pre 2008: AIM | 209 | -3.91 | 8.46 | 9.28 | 10.13 | 13.19 | 8.97 | 2.24 | -2.92 | 16.90 |
| (4) | Pre 2008: Main market | 52 | -6.21 | 10.45 | 11.34 | 11.69 | 14.10 | 9.99 | 4.82 | -2.94 | 10.24 |
| | MW-U/t-test | | | | | | | 0.0000***/0.1426 | | | |
| (5) | Post 2008: AIM | 193 | -4.61 | 8.35 | 9.49 | 10.70 | 13.59 | 9.19 | 2.55 | -2.02 | 10.09 |
| (6) | Post 2008: Main market | 94 | -6.21 | 10.62 | 11.52 | 13.55 | 14.10 | 10.59 | 5.33 | -2.63 | 8.65 |
| | MW-U/t-test | | | | | | | 0.0000***/0.0177** | | | |
| (7) | Pre 2008: AIM, No change in auditor | 84 | 5.43 | 8.91 | 9.74 | 10.49 | 13.19 | 9.65 | 1.31 | -0.39 | 4.68 |
| (8) | Pre 2008: Main market, No change in auditor | 31 | 9.53 | 10.84 | 11.56 | 11.77 | 14.10 | 11.48 | 1.17 | 0.71 | 3.42 |
| (9) | Post 2008: AIM, No change in auditor | 57 | 7.15 | 9.21 | 10.18 | 10.96 | 13.59 | 10.17 | 1.52 | 0.19 | 2.75 |
| (10) | Post 2008: Main market, No change in auditor | 47 | -6.21 | 10.60 | 13.45 | 13.95 | 14.10 | 11.04 | 5.52 | -2.61 | 8.53 |

*** p<.01, ** p<.05, * p<.1
n=company year ends

Table 5.10 shows descriptive statistics and significant tests of foreign turnover intensity (*FT_Int*). This variable reflects the source of sales. It ranges from 0 to 100%, the mean ratio is 27%, means that 27% of the sales are from foreign operation. For profitable company year ends on average 21% of sales are from foreign operations. The MW-U tests are insignificant, indicating the *FT_Int* between pre and post 2008 period, Main Market and AIM is not significantly different.

The next factor to be controlled is intangible assets intensity (*IA_Int*). According to table 5.11 some companies do not have intangible assets while for some companies the majority of assets (94%) is intangible assets. For the full sample on average 21% of total assets is intangible assets. If the company year ends with losses are dropped this figure is smaller, changes to 17%.

Compared with the pre 2008 period, in the post 2008 period the intangible assets account for a higher proportion of total assets, the difference is significant at 1% level (MW-U test). In the pre 2008 period the median *IA_Int* is 3%, in the post 2008 period the median *IA_Int* increases to 15%.

The level of *IA_Int* varies by listing market. The median and mean *IA_Int* of companies issuing shares on Main Market are significantly higher than those of companies issuing shares on AIM. Industry analysis shows that this is because the percentage of technology companies on Main Market is higher than that of AIM. For companies floating on AIM (subsamples 3 and 5) and companies listed on Main Market pre 2008 (subsample 4) with the change in auditors controlled the mean value of *IA_Int* becomes lower, but for companies listed on Main Market post 2008 (subsample 6) with the change in auditors controlled the mean *IA_Int* becomes higher. The level of *IA_Int* varies with auditor change.

Table 5.12 is the descriptive statistics and significant tests of *ROA*. *ROA* measures a company's profitability. For full sample the minimum *ROA* is -346%, the maximum *ROA* is 55%, the mean level is -16%. The ability of using total assets to generate profits is low. For profitable company year-ends there is higher profitability. On average the

**Table 5. 10 Descriptive statistics and significance tests of FT_Int**

| | | N | Min | 25% | Median | 75% | Max | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | 1,170 | 0.00 | 0.00 | 0.01 | 0.52 | 1.00 | 0.27 | 0.37 | 1.04 | 2.43 |
| (b) | ***Profitable company year-ends*** | 688 | 0.00 | 0.00 | 0.00 | 0.32 | 1.00 | 0.21 | 0.33 | 1.37 | 3.35 |
| (1) | Pre 2008 | 233 | 0.00 | 0.00 | 0.00 | 0.19 | 1.00 | 0.17 | 0.30 | 1.68 | 4.36 |
| (2) | Post 2008 | 235 | 0.00 | 0.00 | 0.00 | 0.37 | 1.00 | 0.23 | 0.34 | 1.23 | 2.93 |
| | MW-U/t-test | | | | | | | 0.4189/0.0330** | | | |
| (3) | Pre 2008: AIM | 186 | 0.00 | 0.00 | 0.00 | 0.20 | 1.00 | 0.18 | 0.31 | 1.54 | 3.85 |
| (4) | Pre 2008: Main market | 47 | 0.00 | 000 | 0.02 | 0.14 | 0.91 | 0.13 | 0.24 | 2.45 | 8.12 |
| | MW-U/t-test | | | | | | | 0.8249/0.1937 | | | |
| (5) | Post 2008: AIM | 151 | 0.00 | 0.00 | 0.00 | 0.73 | 1.00 | 0.29 | 0.40 | 0.80 | 1.86 |
| (6) | Post 2008: Main market | 84 | 0.00 | 0.00 | 0.04 | 0.22 | 0.64 | 0.13 | 0.17 | 1.56 | 5.00 |
| | MW-U/t-test | | | | | | | 0.8952/0.0000*** | | | |
| (7) | Pre 2008: AIM, No change in auditor | 83 | 0.00 | 0.00 | 0.00 | 0.54 | 0.97 | 0.21 | 0.34 | 1.23 | 2.81 |
| (8) | Pre 2008: Main market, No change in auditor | 30 | 0.00 | 0.00 | 0.02 | 0.12 | 0.29 | 0.07 | 0.09 | 1.12 | 3.18 |
| (9) | Post 2008: AIM, No change in auditor | 57 | 0.00 | 0.00 | 0.03 | 0.64 | 1.00 | 0.34 | 0.40 | 0.60 | 1.72 |
| (10) | Post 2008: Main market, No change in auditor | 41 | 0.00 | 0.00 | 0.03 | 0.18 | 0.64 | 0.13 | 0.21 | 1.54 | 4.00 |

*** p<.01, ** p<.05, * p<.1
n=company year ends

**Table 5. 11 Descriptive statistics and significance tests of IA_int**

| | | N | Min | 25% | Median | 75% | Max | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | 1,431 | 0.00 | 0.00 | 0.09 | 0.38 | 0.94 | 0.21 | 0.25 | 1.08 | 3.09 |
| (b) | ***Profitable company year-ends*** | 825 | 0.00 | 0.00 | 0.07 | 0.30 | 0.81 | 0.17 | 0.21 | 1.16 | 3.17 |
| (1) | Pre 2008 | 259 | 0.00 | 0.00 | 0.03 | 0.32 | 0.79 | 0.16 | 0.21 | 1.11 | 2.80 |
| (2) | Post 2008 | 287 | 0.00 | 0.00 | 0.15 | 0.41 | 0.81 | 0.23 | 0.24 | 0.78 | 2.34 |
| | MW-U/t-test | | | | | | | 0.0000***/0.0002*** | | | |
| (3) | Pre 2008: AIM | 207 | 0.00 | 0.00 | 0.02 | 0.20 | 0.79 | 0.13 | 0.20 | 1.39 | 3.62 |
| (4) | Pre 2008: Main market | 52 | 0.00 | 0.00 | 0.26 | 0.48 | 0.70 | 0.25 | 0.24 | 0.29 | 1.55 |
| | MW-U/t-test | | | | | | | 0.0146**/0.0013*** | | | |
| (5) | Post 2008: AIM | 193 | 0.00 | 0.00 | 0.10 | 0.35 | 0.81 | 0.20 | 0.22 | 0.90 | 2.68 |
| (6) | Post 2008: Main market | 94 | 0.00 | 0.02 | 0.22 | 0.55 | 0.79 | 0.29 | 0.27 | 0.45 | 1.74 |
| | MW-U/t-test | | | | | | | 0.0048***/0.0029*** | | | |
| (7) | Pre 2008: AIM, No change in auditor | 84 | 0.00 | 0.00 | 0.03 | 0.13 | 0.53 | 0.10 | 0.16 | 1.65 | 4.32 |
| (8) | Pre 2008: Main market, No change in auditor | 31 | 0.00 | 0.00 | 0.10 | 0.45 | 0.62 | 0.22 | 0.24 | 0.57 | 1.67 |
| (9) | Post 2008: AIM, No change in auditor | 57 | 0.00 | 0.01 | 0.05 | 0.21 | 0.72 | 0.14 | 0.19 | 1.59 | 4.57 |
| (10) | Post 2008: Main market, No change in auditor | 47 | 0.00 | 0.10 | 0.51 | 0.69 | 0.79 | 0.41 | 0.28 | -0.19 | 1.47 |

*** p<.01, ** p<.05, * p<.1
n=company year ends

**Table 5. 12 Descriptive statistics and significance tests of ROA**

| | | N | Min | 25% | Median | 75% | Max | Mean | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (a) | ***Full sample*** | 1,346 | -3.46 | -0.17 | 0.01 | 0.11 | 0.55 | -0.16 | 0.59 | -3.40 | 16.82 |
| (b) | ***Profitable company year-ends*** | 739 | 0.00 | 0.04 | 0.10 | 0.17 | 0.55 | 0.13 | 0.12 | 1.56 | 5.69 |
| (1) | Pre 2008 | 252 | 0.00 | 0.04 | 0.09 | 0.17 | 0.55 | 0.12 | 0.11 | 1.52 | 6.15 |
| (2) | Post 2008 | 249 | 0.00 | 0.04 | 0.09 | 0.17 | 0.55 | 0.12 | 0.12 | 1.60 | 5.63 |
| | MW-U/t-test | | | | | | | 0.7233/0.4811 | | | |
| (3) | Pre 2008: AIM | 200 | 0.00 | 0.04 | 0.09 | 0.16 | 0.55 | 0.11 | 0.10 | 1.39 | 5.88 |
| (4) | Pre 2008: Main market | 52 | 0.00 | 0.03 | 0.10 | 0.19 | 0.55 | 0.13 | 0.14 | 1.44 | 4.84 |
| | MW-U/t-test | | | | | | | 0.9217/0.3578 | | | |
| (5) | Post 2008: AIM | 156 | 0.00 | 0.04 | 0.09 | 0.18 | 0.55 | 0.13 | 0.12 | 1.66 | 5.58 |
| (6) | Post 2008: Main market | 93 | 0.00 | 0.04 | 0.09 | 0.16 | 0.43 | 0.11 | 0.10 | 1.18 | 4.13 |
| | MW-U/t-test | | | | | | | 0.6369/0.3205 | | | |
| (7) | Pre 2008: AIM, No change in auditor | 84 | 0.00 | 0.05 | 0.09 | 0.15 | 0.43 | 0.11 | 0.08 | 1.04 | 4.27 |
| (8) | Pre 2008: Main market, No change in auditor | 31 | 0.00 | 0.04 | 0.14 | 0.20 | 0.46 | 0.14 | 0.12 | 0.86 | 3.28 |
| (9) | Post 2008: AIM, No change in auditor | 57 | 0.00 | 0.03 | 0.09 | 0.17 | 0.32 | 0.10 | 0.08 | 0.73 | 3.14 |
| (10) | Post 2008: Main market, No change in auditor | 46 | 0.00 | 0.02 | 0.07 | 0.11 | 0.25 | 0.08 | 0.07 | 0.80 | 2.75 |

*** p<.01, ** p<.05, * p<.1
n=company year ends

return on total assets is 13%. The *ROA* for the company with the strongest profitability is 55%. According to descriptive statistics the distribution of *ROA* is not significantly different between pre and post 2008. The median values are the same, both are 9%. For different listing markets the mean values of *ROA* are not significantly different.

In summary, the variables *STD Cur_ETRs*, *STD GAAP_ETRs*, *STD Cash_ETRs* are significantly different between pre and post 2008. For the pre 2008 sub-sample *STD Def_ETRs* and *STD GAAP_ETRs* are significantly different between AIM and Main Market. For the post 2008 sub-sample *STD Cur_ETRs*, *STD GAAP_ETRs*, *STD Cash_ETRs* are significantly different between different listing markets.

Regarding difference among years around IPOs (i.e. ANOVA test), the *STD Cur_ETRs* of IPO companies floating on AIM market reporting post 2008 employing the same auditors are significantly different between years. The *STD GAAP_ETRs* of IPO companies reporting post 2008 and listed on AIM market are significantly different by years, with the change in auditor is controlled this finding is still consistent. There is also evidence that *STD Cash_ETRs* are significantly different between years.

The control variables *LEV*, *Cap_Int*, *TA*, *IA_Int* are significantly different between pre and post 2008. Among companies whose annual reports for all years are prepared in the pre 2008 period, *LEV*, *TA*, *IA_Int* are significantly different between AIM and Main Market. Among companies whose annual reports for all years are prepared in the post 2008 period, *LEV*, *TA*, *IA_Int* are significantly different between different listing market.

## 5.2 Multivariate results

The last section gives a univariate analysis of dependent variables and independent variables, this section combines variables together to give a multivariate analysis. Section 5.2.1 reports correlation tests between dependent variables and independent variables. Section 5.2.2 reports results of multivariate regressions. The previous sections have demonstrated the necessity of using standardised ETRs, from now

onwards all ETR measures refer to standardised ETRs unless otherwise stated.

### 5.2.1 Correlation tests

This section reports the results of correlation test. The results of Pearson and Spearman Rank correlation test are reported in table 5.13. The results above the main diagonal are Pearson test and the results below the main diagonal are Spearman test. As discussed in methodology section because data are not always normally distributed the analysis is primarily based on Spearman test.

From table 5.13 the conclusion from Pearson test can be different from Spearman test. For example, using Pearson test *R&D_Int*, *NOLs* are not significantly correlated with *GAAP_ETRs*, but Spearman test shows that the correlation is significant at 1% level.

Reported by the table *LEV* is significantly positively correlated with *GAAP_ETRs* (at 5% level) and *Def_ETRs* (at 1% level) but not significantly correlated with *Cur_ETRs* and *Cash_ETRs*. The positive correlation between *LEV* and *GAAP_ETRs* is consistent with the argument given by Gupta and Newberry (1997) that companies with high ETRs might increase debt ratio to reduce tax liabilities, resulting in a positive association between ETRs and leverage.

The intensity of fixed assets (*Cap_Int*) has a significant negative correlation with *Cur_ETRs* and *Cash_ETRs* but a significant positive correlation with *Def_ETRs*. This means the more intensive fixed assets a company has, the lower *Cur_ETRs* and *Cash_ETRs* and the higher *Def_ETRs* will be. This is consistent with the theory that companies can take advantage of accelerated depreciation method to defer taxes to the future to manage taxes (Gupta and Newberry 1997; Chen et al 2010; Stickney and McGee 1982; Manzon Jr and Plesko 2002).

*R&D_Int* is significantly negatively correlated with *GAAP_ETR*, *Cur_ETR* and *Cash_ETR*. This finding is consistent with literature, because of the tax relief for R&D expenditure the more investment in R&D, the lower *GAAP_ETRs*, *Cur_ETRs* and

**Table 5. 13 Pearson (above) and Spearman (below) correlation test**

| | *GAAP_ETR* | *Cur_ETR* | *Cash_ETR* | *Def_ETR* | *LEV* | *Cap_Int* | *R&D_Int* | *NOLs* | *TA* | *FT_Int* | *IA_int* | *ROA* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***GAAP_ETR*** | | 0.7375*** | 0.5302*** | 0.4445*** | 0.1502*** | -0.0094 | -0.0557 | -0.0531 | 0.1780*** | -0.0726* | 0.2071*** | -0.1700*** |
| ***Cur_ETR*** | 0.7467*** | | 0.6749*** | -0.1110*** | 0.1189*** | -0.1465*** | -0.0907** | 0.0785* | 0.1847*** | -0.0343 | 0.2695*** | -0.1373*** |
| ***Cash_ETR*** | 0.5058*** | 0.6474*** | | -0.0247 | 0.0680* | -0.1470*** | -0.0569 | 0.0739* | 0.1162*** | -0.0340 | 0.2275*** | -0.1835*** |
| ***Def_ETR*** | 0.2420*** | -0.2391*** | -0.1254*** | | 0.0993*** | 0.1752*** | 0.1260*** | -0.2118*** | 0.0906** | 0.0540 | 0.0082 | -0.1940*** |
| ***LEV*** | 0.0955** | 0.0140 | -0.0059 | 0.1378*** | | 0.2520*** | 0.0252 | -0.1602*** | 0.2628*** | -0.1196*** | 0.2631*** | -0.2434*** |
| ***Cap_Int*** | 0.0383 | -0.0824** | -0.1238*** | 0.2351*** | 0.4013*** | | -0.0365 | -0.0388 | 0.2024*** | -0.1719*** | -0.2248*** | -0.1452*** |
| ***R&D_Int*** | -0.1203*** | -0.1161*** | -0.0849** | 0.0614 | 0.0183 | 0.0553 | | -0.0582 | 0.0345 | 0.2851*** | 0.0059 | -0.0876** |
| ***NOLs*** | 0.1351*** | 0.1967*** | 0.2724*** | 0.0581 | -0.1139*** | 0.0065 | -0.0133 | | 0.0891** | 0.0476 | -0.0323 | 0.1989*** |
| ***TA*** | 0.2153*** | 0.1700*** | 0.1627*** | 0.1874*** | 0.4422*** | 0.2767*** | 0.0982*** | 0.0945** | | -0.0141 | 0.3402*** | 0.0215 |
| ***FT_Int*** | -0.0555 | -0.0247 | -0.0619 | 0.0107 | -0.1025*** | -0.0971** | 0.3557*** | -0.0090 | 0.0438 | | 0.0857** | -0.0478 |
| ***IA_int*** | 0.2064*** | 0.2317*** | 0.2179*** | 0.0406 | 0.2931*** | 0.0042 | 0.0623 | -0.0166 | 0.5130*** | 0.1631*** | | -0.1821*** |
| ***ROA*** | -0.0850** | -0.0092 | -0.0554 | -0.0726* | -0.3348*** | -0.0188 | -0.0448 | 0.2793*** | -0.0910** | -0.0224 | -0.1426*** | |

See table 4.6 for variable definitions
ETR measures are standardised ETRs
*** p<.01, ** p<.05, * p<.1

*Cash_ETRs* will be (Gupta and Newberry 1997; Lanis and Richardson 2015; Berger 1993; Gaertner 2014).

There is a significantly positive relationship between *NOLs* and *GAAP_ETRs*, *Cur_ETRs* and *Cash_ETRs*, all relationships are significant at 1% level. This finding should be interpreted with care. NOL is calculated as pre-tax loss of the last year divided by current pre-tax profit. It is a continuous variable that equals to the value of loss divided by current pre-tax profit if there is a loss in the last year and zero otherwise. From descriptive statistics the range of *NOLs* is from -936% to 0. Because the values of *NOLs* are negative to zero, the positive relationship means that the larger value of *NOLs*, which is, with equal current pre-tax profit, less loss in the last year, the higher *GAAP_ETRs*, *Cur_ETRs* and *Cash_ETRs*. On the contrary, the smaller *NOLs*, in other words, the larger prior year's loss, the lower ETRs. This indicates that the last year's operating loss is utilised to reduce taxes, this is consistent with the hypothesis (Graham 1996; Cooper and Knittel 2010; Wang 1991; Chen et al 2010; Cheng et al 2012).

The next firm characteristic, firm size (*TA*), is positively correlated with all ETR measures, all at 1% significant level. This is consistent with the political cost theory that the behaviours of large company are more visible, they therefore are likely to engage in less tax management because of higher risks (Watts and Zimmerman 1978; Zimmerman 1983).

The intensity of intangible assets (*IA_Int*) is positively related to *GAAP_ETRs*, *Cur_ETRs* and *Cash_ETRs*. Opposite to expectations, companies with higher levels of intangible assets do not have lower levels of ETRs.

*ROA* is negatively correlated with *GAAP_ETRs* and *Def_ETRs*, but is not significantly correlated with *Cur_ETRs* and *Cash_ETRs*. IPO companies with greater profitability have lower *GAAP_ETRs* and *Def_ETRs*. This may because with stronger profitability, companies have stronger ability (e.g. employ more professional tax advisors) to design transactions to manage taxes (Rego 2003; Frank et al 2008; Rego and Wilson 2012).

Hair et al (2014) point out that if the correlation coefficient between independent variables is higher than 0.90 then there is substantial collinearity. As can be seen from table 5.13, there is no correlation coefficient larger than 0.90, thus, there should be no serious multicollinearity between independent variables. The study also applies variance inflation factor (VIF) to assess multicollinearity, except for the sub-sample Pre 2008 Main Market, the maximum VIFs of test variables are all less than 10 (shown in tables 5.17 to 5.28), indicating that there is no serious multicollinearity issue (Chatterjee and Hadi 1977; Hair et al 2006).

### 5.2.2 Multivariate regression results

Consistent with univariate analysis procedure, the subsection 5.2.2.1 discusses the tax management of the full sample. Then the section 5.2.2.2 is the results for only company year ends with profits. The sections 5.2.2.3, 5.2.2.4, 5.2.2.5 report the tax management behaviours of different periods, different listing markets, companies employing the same auditor in the IPO process. Because the analysis is for various samples there are a series of tables. In order to observe the change in tax management and make comparison between different samples clearly and intuitively, the coefficients and significant levels of test variables b-3, b-2, b-1, a+1 and a+2 for all samples are summarised in table 5.14. The study also tests the change and significant level between these test variables and the results are summarised in table 5.15. Detailed results are shown in the individual tables (from table 5.17 to 5.28). In order to better understand the meaning of statistical results, the interpretation of the statistical results is described and summarised with text in table 5.16.

The results are initially presented in a series of tables summarising the sign and significance of the test variables along with sample size and adjusted $R^2$ of the underlying models. These summary tables are 5.14, 5.15 and 5.16. Full details of each of the estimated models are reported in the subsequent tables: 5.17- sample: all year ends; 5.18-sample: profit company year ends; 5.19-sample: pre 2008 company year ends; 5.20-sample: post 2008 company year ends. 5.21-sample: pre 2008, AIM

**Table 5. 14 Summary of multivariate results (based on tables 5.17 to 5.28)**

| Dependent variables | *Cur_ETR* | | *Def_ETR* | | *GAAP_ETR* | | *Cash_ETR* | |
|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| **(a) Full sample (FULL_SAMPLE) (table 5.17)** | | | | | | | | |
| YR_a+2 | -.153 | -.082 | -.04 | -.023 | .009 | .035 | .117 | .171 |
| YR_a+1 | -.276** | -.166** | -.126 | -.027 | -.13 | -.056 | -.051 | .018 |
| YR_b-1 | -.035 | .028 | -.205** | -.045* | -.119 | -.034 | -.031 | .055 |
| YR_b-2 | .137 | .267*** | -.233*** | -.054* | .118 | .189** | .247 | .356*** |
| YR_b-3 | .148 | .245** | -.111 | -.076** | .039 | .033 | .07 | .251* |
| n | 986 | 906 | 986 | 930 | 986 | 906 | 953 | 873 |
| Adj $R^2$ | 0.1604 | 0.275 | 0.0772 | 0.1221 | 0.1306 | 0.2611 | 0.0828 | 0.1756 |
| **(b) Profitable company year-ends (PROFIT_YEAR_ENDS) (table 5.18)** | | | | | | | | |
| YR_a+2 | -.113 | -.065 | -.183** | -.053 | -.185 | -.113* | .057 | .145* |
| YR_a+1 | -.19* | -.092 | -.132* | -.042 | -.179* | -.117* | -.12 | .011 |
| YR_b-1 | -.051 | -.109* | -.068 | -.07* | -.042 | -.095 | .099 | .05 |
| YR_b-2 | .113 | .07 | -.18** | -.122*** | -.009 | .005 | .291** | .223* |
| YR_b-3 | .022 | -.068 | -.161* | -.106** | -.074 | -.053 | .138 | .094 |
| n | 588 | 549 | 588 | 555 | 588 | 540 | 555 | 521 |
| Adj $R^2$ | 0.1633 | 0.2754 | 0.1483 | 0.1387 | 0.1041 | 0.1911 | 0.1368 | 0.2037 |
| **(1) Sub-sample Pre 2008 (PRE) (table 5.19)** | | | | | | | | |
| YR_a+2 | -.005 | -.109 | -.128* | -.151** | -.022 | -.133 | .22 | .204* |
| YR_a+1 | -.129 | -.118 | -.05 | -.059 | -.094 | -.075 | .138 | .173 |
| YR_b-1 | -.09 | -.006 | .059 | -.077* | .121 | .047 | .049 | .189 |
| YR_b-2 | .046 | -.024 | -.011 | -.085 | .125 | .200 | .446** | .454*** |
| YR_b-3 | .119 | .032 | -.149* | -.16*** | .096 | -.014 | .109 | .160 |
| n | 204 | 191 | 204 | 191 | 204 | 185 | 188 | 174 |
| Adj $R^2$ | 0.3000 | 0.4519 | 0.3212 | 0.3715 | 0.2272 | 0.3565 | 0.2828 | 0.3570 |

**Table 5.14 Summary of multivariate results (based on tables 5.17 to 5.28) (Continued)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **(2) Sub-sample Post 2008 (POST) (table 5.20)** | | | | | | | | |
| YR_a+2 | -.534** | -.197 | -.196 | -.07 | -.578** | -.306** | -.424 | -.313* |
| YR_a+1 | -.509* | -.171 | -.242* | -.075 | -.568** | -.237* | -.56** | -.255* |
| YR_b-1 | -.25 | -.095 | -.116 | -.133* | -.23 | -.18 | -.167 | -.149 |
| YR_b-2 | .012 | .148 | -.225 | -.132 | -.109 | -.043 | -.031 | .005 |
| YR_b-3 | -.369 | -.261 | -.098 | -.099 | -.213 | -.188 | -.466 | -.314 |
| n | 197 | 180 | 197 | 188 | 197 | 180 | 185 | 169 |
| Adj $R^2$ | 0.2903 | 0.3863 | 0.2489 | 0.1513 | 0.2702 | 0.3369 | 0.2568 | 0.3163 |
| **(3) Sub-sample Pre 2008, AIM (PRE_AIM) (table 5.21)** | | | | | | | | |
| YR_a+2 | .043 | -.074 | -.128 | -.06 | -.006 | -.153 | .234 | .181 |
| YR_a+1 | -.14 | -.11 | -.059 | .014 | -.129 | -.100 | .137 | .16 |
| YR_b-1 | .088 | .086 | .077 | -.036 | .253* | .092 | .237* | .296** |
| YR_b-2 | .191 | .12 | -.037 | -.116** | .19 | .092 | .675*** | .532** |
| YR_b-3 | .22 | .164 | -.086 | -.125*** | .205 | .034 | .19 | .168 |
| n | 160 | 149 | 160 | 147 | 160 | 148 | 145 | 137 |
| Adj $R^2$ | 0.4421 | 0.5573 | 0.3952 | 0.5117 | 0.3484 | 0.3644 | 0.3985 | 0.4533 |
| **(4) Sub-sample Pre 2008, Main Market (PRE_MM) (table 5.22)** | | | | | | | | |
| YR_a+2 | -1.395** | -1.954*** | 1.124*** | -.168 | -.134 | -.671 | .482* | -.45 |
| YR_a+1 | -1.241*** | -1.863*** | 1.204*** | -.082 | -.015 | -.49 | .424 | -.593 |
| YR_b-1 | -.428 | -.349* | .214 | .079 | .144 | .251 | -.881** | -.549 |
| YR_b-2 | -.045 | -.106 | .664 | .274 | .702 | 1.024** | -.699 | -.823* |
| YR_b-3 | .641 | 0 (omitted) | -.366 | 3.325 | .503 | 0 (omitted) | 1.047 | 1.409* |
| n | 44 | 34 | 44 | 36 | 44 | 33 | 43 | 37 |
| Adj $R^2$ | 0.4741 | 0.7751 | 0.6587 | 0.6944 | 0.5117 | 0.6957 | 0.5947 | 0.7185 |

**Table 5.14 Summary of multivariate results (based on tables 5.17 to 5.28) (Continued)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **(5) Sub-sample Post 2008, AIM (POST_AIM) (table 5.23)** | | | | | | | | |
| YR_a+2 | -.826*** | -.41** | -.378* | -.149 | -.943*** | -.465*** | -.602 | -.416** |
| YR_a+1 | -.705** | -.366** | -.435** | -.159 | -.83*** | -.29** | -.741** | -.362** |
| YR_b-1 | -.477 | -.167 | -.1 | -.126 | -.386 | -.123 | -.55 | -.244 |
| YR_b-2 | -.076 | .112 | -.288 | -.186 | -.267 | -.004 | -.304 | -.055 |
| YR_b-3 | -.487 | -.138 | -.164 | -.193 | -.461 | -.041 | -.724 | -.189 |
| n | 122 | 112 | 122 | 116 | 122 | 115 | 115 | 108 |
| Adj $R^2$ | 0.4096 | 0.5771 | 0.3646 | 0.2667 | 0.3428 | 0.4733 | 0.3600 | 0.4209 |
| **(6) Sub-sample Post 2008, Main Market (POST_MM) (table 5.24)** | | | | | | | | |
| YR_a+2 | .003 | .227 | .097 | .001 | .191 | .287** | -.182 | .272* |
| YR_a+1 | -.23 | -.089 | .079 | .074 | -.096 | .107 | -.297 | .081 |
| YR_b-1 | -.106 | .001 | .019 | .006 | -.041 | -.103 | .156 | .261* |
| YR_b-2 | -.043 | .233 | .099 | .064 | .05 | .04 | .074 | .756** |
| YR_b-3 | -.112 | -.122 | .195 | .172* | .239 | -.138 | -.198 | .074 |
| n | 75 | 68 | 75 | 67 | 75 | 66 | 70 | 63 |
| Adj $R^2$ | 0.5050 | 0.7420 | 0.3353 | 0.4148 | 0.4960 | 0.6775 | 0.5605 | 0.6651 |
| **(7) Sub-sample No change auditors (table 5.25)** | | | | | | | | |
| YR_a+2 | | -.113 | | .035 | | -.134 | | .095 |
| YR_a+1 | | -.189* | | .024 | | -.18* | | -.105 |
| YR_b-1 | | .031 | | -.097** | | -.07 | | .043 |
| YR_b-2 | | .328** | | -.115 | | .206* | | .075 |
| YR_b-3 | | .19 | | -.092 | | .12 | | .207 |
| n | | 262 | | 264 | | 256 | | 245 |
| Adj $R^2$ | | 0.2560 | | 0.1595 | | 0.1953 | | 0.1455 |

**Table 5.14 Summary of multivariate results (based on tables 5.17 to 5.28) (Continued)**

| | | | | |
|---|---|---|---|---|
| **Robustness 1: No currency transition (table 5.26)** | | | | |
| YR_a+2 | -.038 | -.06 | -.129* | .149* |
| YR_a+1 | -.076 | -.04 | -.116* | -.002 |
| YR_b-1 | -.065 | -.071** | -.088 | .067 |
| YR_b-2 | .127 | -.1** | -.03 | .208* |
| YR_b-3 | -.022 | -.1** | -.044 | .118 |
| n | 522 | 527 | 513 | 494 |
| Adj $R^2$ | 0.2839 | 0.1480 | 0.2082 | 0.2056 |
| **Robustness 2: Persistent profit (table 5.27)** | | | | |
| YR_a+2 | -.111 | -.019 | -.223*** | .165 |
| YR_a+1 | -.187** | 0 | -.228*** | -.119 |
| YR_b-1 | -.02 | -.008 | -.165** | .053 |
| YR_b-2 | .123 | -.031 | -.003 | -.041 |
| YR_b-3 | .008 | -.04 | -.03 | -.067 |
| n | 260 | 256 | 262 | 244 |
| Adj $R^2$ | 0.3123 | 0.1904 | 0.2421 | 0.2282 |
| **Robustness 3: Excluding tax credit years (table 5.28)** | | | | |
| YR_a+2 | -.073 | 0 | -.079 | .182** |
| YR_a+1 | -.145** | .004 | -.136** | .014 |
| YR_b-1 | -.067 | -.053** | -.11* | .079 |
| YR_b-2 | .088 | -.077* | -.025 | .17 |
| YR_b-3 | -.062 | -.065 | -.064 | .078 |
| n | 524 | 523 | 511 | 494 |
| Adj $R^2$ | 0.2398 | 0.1585 | 0.1720 | 0.2006 |

*** p<.01, ** p<.05, * p<.1

ETR measures are standardised ETRs.

Under each ETR measure the first column is statistic results before identifying influential data, the second column is statistic results after identifying and excluding influential data.

**Table 5. 15 Summary of tests of significance between test variables b-3, b-2, b-1, IPO, a+1 and a+2**

| *Cur_ETR* | | | | | | *Def_ETR* | | | | | | *GAAP_ETR* | | | | | | *Cash_ETR* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **(a) Full sample (FULL_SAMPLE)** | | | | | | | | | | | | | | | | | | | | | | | |
| **1** | b-2 | b-1 | IPO | a+1 | a+2 | **2** | b-2 | b-1 | IPO | a+1 | a+2 | **3** | b-2 | b-1 | IPO | a+1 | a+2 | **4** | b-2 | b-1 | IPO | a+1 | a+2 |
| b-3 | + | - ** | - ** | - *** | - ** | b-3 | + | + | +** | +** | +* | b-3 | + | - | - | - | + | b-3 | + | -* | - * | - | - |
| b-2 | | - *** | - *** | - *** | - *** | b-2 | | + | +* | + | + | b-2 | | -*** | -** | -*** | - | b-2 | | - *** | - *** | - *** | - |
| b-1 | | | - | - *** | - | b-1 | | | +* | + | + | b-1 | | | + | - | + | b-1 | | | - | - | + |
| IPO | | | | - ** | - | IPO | | | | - | - | IPO | | | | - | + | IPO | | | | + | + |
| a+1 | | | | | + | a+1 | | | | | + | a+1 | | | | | + | a+1 | | | | | +* |
| **(b) Profitable company year-ends (PROFIT_YEAR_ENDS)** | | | | | | | | | | | | | | | | | | | | | | | |
| **5** | b-2 | b-1 | IPO | a+1 | a+2 | **6** | b-2 | b-1 | IPO | a+1 | a+2 | **7** | b-2 | b-1 | IPO | a+1 | a+2 | **8** | b-2 | b-1 | IPO | a+1 | a+2 |
| b-3 | +* | - | + | - | + | b-3 | - | + | +** | + | + | b-3 | + | - | + | - | - | b-3 | + | - | - | - | + |
| b-2 | | - ** | - | - * | - | b-2 | | + | +*** | +** | + | b-2 | | - | - | - | - | b-2 | | -* | -* | -* | - |
| b-1 | | | +* | + | + | b-1 | | | +* | + | + | b-1 | | | + | - | - | b-1 | | | - | - | + |
| IPO | | | | - | - | IPO | | | | - | - | IPO | | | | - * | -* | IPO | | | | + | +* |
| a+1 | | | | | + | a+1 | | | | | - | a+1 | | | | | + | a+1 | | | | | +* |
| **(1) Sub-sample Pre 2008 (PRE)** | | | | | | | | | | | | | | | | | | | | | | | |
| **9** | b-2 | b-1 | IPO | a+1 | a+2 | **10** | b-2 | b-1 | IPO | a+1 | a+2 | **11** | b-2 | b-1 | IPO | a+1 | a+2 | **12** | b-2 | b-1 | IPO | a+1 | a+2 |
| b-3 | - | - | - | - | - | b-3 | + | + | +*** | +* | + | b-3 | +* | + | + | - | - | b-3 | +* | + | - | + | + |
| b-2 | | + | + | - | - | b-2 | | + | + | + | - | b-2 | | - | - | -** | -** | b-2 | | -* | -*** | -* | - |
| b-1 | | | + | - | - | b-1 | | | +* | + | - | b-1 | | | - | - | - | b-1 | | | - | - | + |
| IPO | | | | - | - | IPO | | | | - | -** | IPO | | | | - | - | IPO | | | | + | +* |
| a+1 | | | | | + | a+1 | | | | | - | a+1 | | | | | - | a+1 | | | | | + |
| **(2) Sub-sample Post 2008 (POST)** | | | | | | | | | | | | | | | | | | | | | | | |
| **13** | b-2 | b-1 | IPO | a+1 | a+2 | **14** | b-2 | b-1 | IPO | a+1 | a+2 | **15** | b-2 | b-1 | IPO | a+1 | a+2 | **16** | b-2 | b-1 | IPO | a+1 | a+2 |
| b-3 | +*** | + | + | + | + | b-3 | - | - | + | + | + | b-3 | + | + | + | - | - | b-3 | + | + | + | + | + |
| b-2 | | - | - | -* | -* | b-2 | | - | + | + | + | b-2 | | - | + | -* | -* | b-2 | | - | - | - | - |
| b-1 | | | + | - | - | b-1 | | | +* | + | + | b-1 | | | + | - | - | b-1 | | | + | - | - |
| IPO | | | | - | - | IPO | | | | - | - | IPO | | | | -* | -** | IPO | | | | -* | -* |
| a+1 | | | | | - | a+1 | | | | | + | a+1 | | | | | - | a+1 | | | | | - |

**Table 5.15 Summary of tests of significance between test variables b-3, b-2, b-1, IPO, a+1 and a+2 (continued)**

**(3) Sub-sample Pre 2008, AIM (PRE_AIM)**

| **17** | b-2 | b-1 | IPO | a+1 | a+2 | **18** | b-2 | b-1 | IPO | a+1 | a+2 | **19** | b-2 | b-1 | IPO | a+1 | a+2 | **20** | b-2 | b-1 | IPO | a+1 | a+2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b-3 | - | - | - | - | - | b-3 | + | +** | +*** | +*** | +** | b-3 | + | + | - | - | - | b-3 | +** | + | - | - | + |
| b-2 | | - | - | -* | - | b-2 | | +** | +** | +*** | + | b-2 | | + | - | - | - | b-2 | | - | -** | -** | - |
| b-1 | | | - | -** | - | b-1 | | | + | + | - | b-1 | | | - | -* | -** | b-1 | | | -** | - | - |
| IPO | | | | - | - | IPO | | | | + | - | IPO | | | | - | - | IPO | | | | + | + |
| a+1 | | | | | + | a+1 | | | | | - | a+1 | | | | | - | a+1 | | | | | + |

**(4) Sub-sample Pre 2008, Main Market (PRE_MM)**

| **21** | b-2 | b-1 | IPO | a+1 | a+2 | **22** | b-2 | b-1 | IPO | a+1 | a+2 | **23** | b-2 | b-1 | IPO | a+1 | a+2 | **24** | b-2 | b-1 | IPO | a+1 | a+2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b-3 | N/A | | | | | b-3 | - | - | - | - | - | b-3 | N/A | | | | | b-3 | -** | -** | -* | -** | -* |
| b-2 | | - | + | -*** | -*** | b-2 | | - | - | - | - | b-2 | | - | -** | - | - | b-2 | | + | +* | + | + |
| b-1 | | | +* | -*** | -*** | b-1 | | | - | - | - | b-1 | | | - | - | - | b-1 | | | + | - | + |
| IPO | | | | -*** | -*** | IPO | | | | - | - | IPO | | | | - | - | IPO | | | | - | - |
| a+1 | | | | | - | a+1 | | | | | - | a+1 | | | | | - | a+1 | | | | | + |

**(5) Sub-sample Post 2008, AIM (POST_AIM)**

| **25** | b-2 | b-1 | IPO | a+1 | a+2 | **26** | b-2 | b-1 | IPO | a+1 | a+2 | **27** | b-2 | b-1 | IPO | a+1 | a+2 | **28** | b-2 | b-1 | IPO | a+1 | a+2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b-3 | +* | - | + | - | - | b-3 | + | + | + | + | + | b-3 | + | - | + | - | -* | b-3 | + | - | + | - | - |
| b-2 | | - | - | -** | -*** | b-2 | | + | + | + | + | b-2 | | - | + | -* | -** | b-2 | | - | + | - | - |
| b-1 | | | + | - | -* | b-1 | | | + | - | - | b-1 | | | + | - | -* | b-1 | | | + | - | - |
| IPO | | | | -** | -** | IPO | | | | - | - | IPO | | | | -** | -*** | IPO | | | | -** | -** |
| a+1 | | | | | - | a+1 | | | | | + | a+1 | | | | | - | a+1 | | | | | - |

**(6) Sub-sample Post 2008, Main Market (POST_MM)**

| **29** | b-2 | b-1 | IPO | a+1 | a+2 | **30** | b-2 | b-1 | IPO | a+1 | a+2 | **31** | b-2 | b-1 | IPO | a+1 | a+2 | **32** | b-2 | b-1 | IPO | a+1 | a+2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b-3 | +* | + | + | + | + | b-3 | - | - | -* | - | -* | b-3 | + | + | + | + | +** | b-3 | +* | + | - | + | + |
| b-2 | | - | - | - | - | b-2 | | - | - | + | - | b-2 | | - | - | + | +* | b-2 | | - | -** | -** | -* |
| b-1 | | | - | - | + | b-1 | | | - | + | - | b-1 | | | + | + | +** | b-1 | | | -* | - | + |
| IPO | | | | - | + | IPO | | | | + | + | IPO | | | | + | +** | IPO | | | | + | +* |
| a+1 | | | | | +** | a+1 | | | | | -* | a+1 | | | | | +* | a+1 | | | | | + |

**Table 5.15 Summary of tests of significance between test variables b-3, b-2, b-1, IPO, a+1 and a+2 (continued)**

**(7) Sub-sample No change auditors**

| **33** | b-2 | b-1 | IPO | a+1 | a+2 | **34** | b-2 | b-1 | IPO | a+1 | a+2 | **35** | b-2 | b-1 | IPO | a+1 | a+2 | **36** | b-2 | b-1 | IPO | a+1 | a+2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b-3 | + | - | - | -** | -* | b-3 | - | - | + | +* | +* | b-3 | + | - | - | -** | -* | b-3 | - | - | - | -* | - |
| b-2 | | -*** | -** | -*** | -*** | b-2 | | + | + | +** | +* | b-2 | | -*** | -* | -*** | -*** | b-2 | | - | - | - | + |
| b-1 | | | - | -** | - | b-1 | | | +** | +*** | +** | b-1 | | | + | - | - | b-1 | | | - | - | + |
| IPO | | | | -* | - | IPO | | | | + | + | IPO | | | | -* | - | IPO | | | | - | + |
| a+1 | | | | | + | a+1 | | | | | + | a+1 | | | | | + | a+1 | | | | | +** |

**Robustness test 1: No currency transition**

| **37** | b-2 | b-1 | IPO | a+1 | a+2 | **38** | b-2 | b-1 | IPO | a+1 | a+2 | **39** | b-2 | b-1 | IPO | a+1 | a+2 | **40** | b-2 | b-1 | IPO | a+1 | a+2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b-3 | +* | - | + | - | - | b-3 | + | + | +** | + | + | b-3 | + | - | + | - | - | b-3 | + | - | - | - | + |
| b-2 | | -** | - | -** | - | b-2 | | + | +** | +* | + | b-2 | | - | + | - | - | b-2 | | - | -* | -* | - |
| b-1 | | | + | - | + | b-1 | | | +** | + | + | b-1 | | | + | - | - | b-1 | | | - | - | + |
| IPO | | | | - | - | IPO | | | | - | - | IPO | | | | -* | -* | IPO | | | | - | +* |
| a+1 | | | | | + | a+1 | | | | | - | a+1 | | | | | - | a+1 | | | | | +** |

**Robustness test 2: Persistent profit**

| **41** | b-2 | b-1 | IPO | a+1 | a+2 | **42** | b-2 | b-1 | IPO | a+1 | a+2 | **43** | b-2 | b-1 | IPO | a+1 | a+2 | **44** | b-2 | b-1 | IPO | a+1 | a+2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b-3 | + | - | - | - | - | b-3 | + | + | + | + | + | b-3 | + | - | + | -** | -* | b-3 | + | + | + | - | + |
| b-2 | | - | - | -*** | - | b-2 | | + | + | + | + | b-2 | | -** | + | -*** | -** | b-2 | | + | + | - | + |
| b-1 | | | + | -* | - | b-1 | | | + | + | - | b-1 | | | +** | - | - | b-1 | | | - | - | + |
| IPO | | | | -** | - | IPO | | | | - | - | IPO | | | | -*** | -*** | IPO | | | | - | + |
| a+1 | | | | | + | a+1 | | | | | - | a+1 | | | | | + | a+1 | | | | | +** |

**Robustness test 3: Excluding tax credit years**

| **45** | b-2 | b-1 | IPO | a+1 | a+2 | **46** | b-2 | b-1 | IPO | a+1 | a+2 | **47** | b-2 | b-1 | IPO | a+1 | a+2 | **48** | b-2 | b-1 | IPO | a+1 | a+2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| b-3 | +* | - | + | - | - | b-3 | - | + | + | +* | + | b-3 | + | - | + | - | - | b-3 | + | + | - | - | + |
| b-2 | | - ** | - | - ** | - | b-2 | | + | +* | +** | +* | b-2 | | - | + | - | - | b-2 | | - | - | - | + |
| b-1 | | | + | - | - | b-1 | | | +** | +** | +* | b-1 | | | +* | - | + | b-1 | | | - | - | + |
| IPO | | | | -** | - | IPO | | | | + | + | IPO | | | | - ** | - | IPO | | | | + | +** |
| a+1 | | | | | + | a+1 | | | | | - | a+1 | | | | | + | a+1 | | | | | +** |

The positive / negative signs indicate that there is an increase (+) / decrease (-) from rows to columns.
*** p<.01, ** p<.05, * p<.1

**Table 5. 16 Description of multivariate results**

| **Sample** | ***STD Cur_ETR*** | ***STD Def_ETR*** | ***STD GAAP_ETR*** | ***STD Cash_ETR*** | **Comparison** |
|---|---|---|---|---|---|
| Full sample | b-1: increased tax management<br>a+1: increased tax management | IPO year: defer a higher amount of tax liabilities to the future | b-1: increased tax management | b-1: increased tax management<br>a+2: less tax management, higher tax payment | |
| Profitable company year-ends | b-2: less tax management, higher current tax charge<br>b-1: increased tax management<br>IPO: less engagement in tax management | IPO year: defer a higher amount of tax liabilities to the future | a+1: increased tax management | b-1: increased tax management<br>a+2: less tax management, higher tax payment | |
| Pre 2008 | No significant change in tax management | IPO year: defer a higher amount of tax liabilities to the future | b-2: less tax management, higher total tax charge | b-2: less tax management, higher tax payment<br>b-1: increased tax management | Compared with pre 2008, post 2008 companies are unlikely to manipulate tax position in the period prior to IPO. But in the first year after going public, they exhibit a higher level of tax management |
| Post 2008 | b-2: less tax management, higher current tax charge | IPO year: defer a higher amount of tax liabilities to the future | a+1: increased tax management | a+1: increased tax management | |
| Pre 2008, AIM | No significant change in tax management | b-1: defer a higher amount of tax liabilities to the future | No significant change in tax management | b-2: less tax management, higher tax payment<br>IPO year: increased tax management | N/A |
| Pre 2008, Main Market | N/A | N/A | N/A | N/A | |

**Table 5.16 Description of multivariate results (continued)**

| | | | | | |
|---|---|---|---|---|---|
| Post 2008, AIM | b-2: less tax management, higher current tax charge<br>a+1: increased tax management | No tax management | a+1: increased tax management | a+1: increased tax management | After going public companies listed on AIM exhibit a higher level of tax management, companies listed on Main Market, because of additional scrutiny, engage in less tax management. |
| Post 2008, Main Market | b-2: less tax management, higher current tax charge<br>a+2: less tax management, higher current tax charge | a+2: less use of tax deferrals | a+2: less tax management, higher total tax charge | b-2: less tax management, higher cash tax payment<br>IPO year: increased tax management | |

company year ends; 5.22-sample: pre 2008, Main Market company year ends; 5.23-sample: post 2008, AIM company year ends; 5.24-sample: post 2008, Main Market company year ends; 5.25-sample: company year ends with no change in auditors; 5.26-sample: company year ends without currency transition; 5.27-sample: companies persistently make profits in the IPO process; 5.28-sample: company year ends without tax credits.

#### 5.2.2.1 Tax management behaviours in the IPO process of full sample

The panel (a) of table 5.14 summarises multivariate results of ETRs of full sample. Under each ETR measure, the odd numbered columns show the results with the respective full sample, the even numbered columns report the results after influential company year-end observations data are omitted. Influential observations are defined using DFITS test (Belsley et al 1980) as discussed in the methodology chapter. Comparing the columns, it can be found that excluding the influential company year ends significantly influences results. Taking the *Cur_ETR* model as an example, with influential data, shown in column 1, the level of *Cur_ETRs* in years b-3 and b-2 is not significantly different from that of the IPO year, but when the influential company year ends are dropped these differences are statistically different. In order to avoid the results are driven by influential data the analysis is based on the results after excluding influential company year ends. For each regression the t-statistic is estimated using heteroscedastic-robust standard errors clustered by company id[16].

Table 5.14 only shows the change in ETRs with respect to the baseline year, that is, the IPO year. Table 5.15 distils the information in table 5.14 and uses a series of matrices to give a summary of the change and significance test between pairwise year test variables. Similarly, to avoid the results are driven by influential observations it is based on the results after excluding influential company year ends. The sign in each

[16] The Breusch and Pagan (1979) statistic is reported along with the regression results for each estimation. The adjusted standard errors can correct for potential heteroscedasticity and autocorrelation as discussed in the chapter on method.

cell represents the change from the column to the row. For example, the sign "+" in the first cell of the table 5.15 panel (a) matrix 1 means that there is an increase in *Cur_ETRs* from year b-3 to b-2 i.e. the *Cur_ETRs* of year b-2 is higher than that of year b-3. The statistical significance is indicated using standard asterisk notation. The tables and figures following the summary tables 5.14, 5.15 and 5.16 are detailed individual tables including the results of control variables and each of the related figures contains line charts drawing the change in coefficients of ETR measures in the IPO process. For example, table 5.17 is the individual table of full sample, while figure 5.1 shows the change in the coefficients of test variables b-3, b-2, b-1, a+1 and a+2 for the same sample. Each of the four plots in figure 5.1 represents a dependent variable.

The full results of the full sample are reported in table 5.17 with summaries in table 5.14 (panel "a" - FULL_SAMPLE) and table 5.15 (matrices 1 - 4). According to table 5.14 panel (a) columns under *Cur_ETRs*, with influential data (column 1) the number of observations for *Cur_ETR* model is 986. The disclosure exemption for companies subject to the small companies regime and the loss of account pages lead to missing data. With company year ends with missing data dropped from model estimation the number of observations reduces from 1,519 to 986. Table 5.14 shows number of observations for each ETR measure under various samples, both before and after influential data are excluded, in this way the sample usage is demonstrated clearly. The adjusted $R^2$ is 0.1604, meaning that the estimated model can explain 16.04% of the variance in *Cur_ETRs*. With influential data excluded (column 2) the number of observations reduces to 906, but the adjusted $R^2$ increases to 27.5%. According to significant p-value of Breusch and Pagan (BP) test the original model displays significant heteroscedasticity (table 5.17), therefore the t-values reported have been adjusted. The max VIF of the test variables is 2.19, indicating that there is no serious multicollinearity issue for *Cur_ETR* model (table 5.17).

If the level of tax management is measured by *Cur_ETRs*, shown by matrix 1 of table 5.15 the change in *Cur_ETRs* from year b-3 to year b-2 is not significant, suggesting

**Table 5. 17 Multivariate analysis of tax management of full sample (FULL_SAMPLE)**

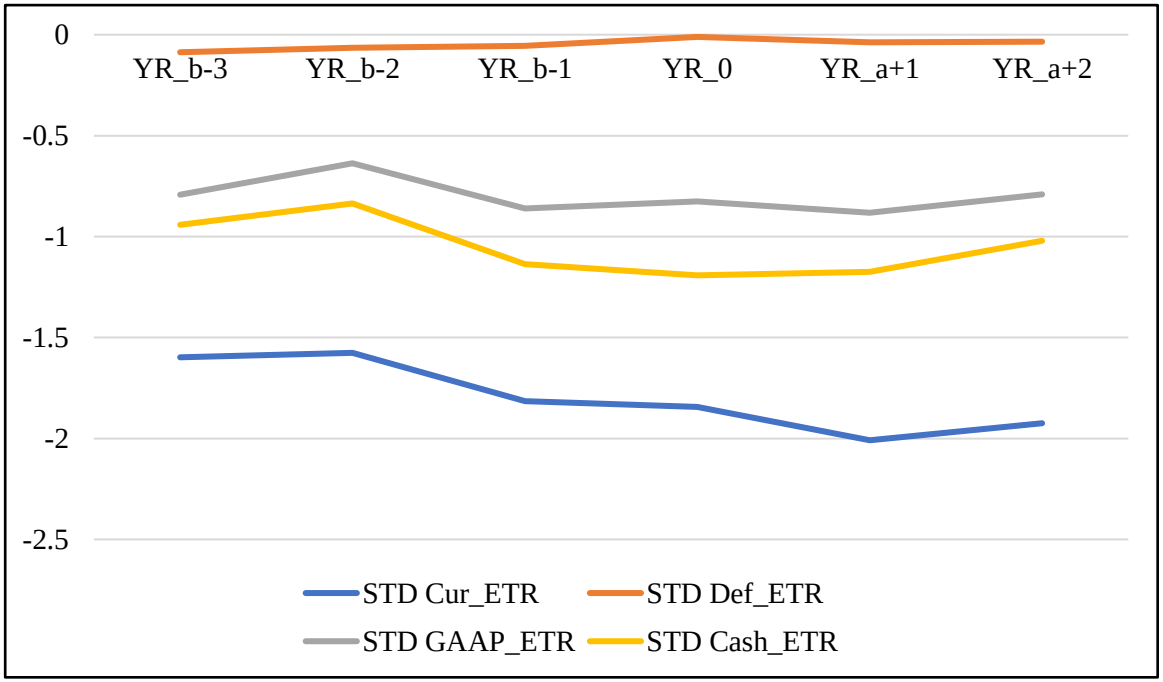
| **Dependent variables** | ***Cur_ETR*** | | ***Def_ETR*** | | ***GAAP_ETR*** | | ***Cash_ETR*** | |
|---|---|---|---|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | 8 |
| YR_a+2 | -.153 | -.082 | -.04 | -.023 | .009 | .035 | .117 | .171 |
| | (-1.14) | (-0.82) | (-0.39) | (-0.83) | (0.06) | (0.41) | (0.80) | (1.50) |
| YR_a+1 | -.276** | -.166** | -.126 | -.027 | -.13 | -.056 | -.051 | .018 |
| | (-2.41) | (-2.22) | (-1.58) | (-1.14) | (-1.19) | (-0.86) | (-0.41) | (0.19) |
| YR_b-1 | -.035 | .028 | -.205** | -.045* | -.119 | -.034 | -.031 | .055 |
| | (-0.33) | (0.39) | (-2.50) | (-1.92) | (-1.18) | (-0.50) | (-0.22) | (0.56) |
| YR_b-2 | .137 | .267*** | -.233*** | -.054* | .118 | .189** | .247 | .356*** |
| | (1.02) | (2.69) | (-2.62) | (-1.90) | (0.97) | (2.14) | (1.62) | (3.08) |
| YR_b-3 | .148 | .245** | -.111 | -.076** | .039 | .033 | .07 | .251* |
| | (1.05) | (2.26) | (-1.08) | (-2.55) | (0.30) | (0.37) | (0.42) | (1.79) |
| Account_Year | | | | | | | | |
| across 2008 | .184 | .086 | .14* | .011 | .187* | .073 | .184 | .083 |
| | (1.45) | (0.86) | (1.95) | (0.49) | (1.66) | (0.92) | (1.22) | (0.68) |
| post 2008 | .51*** | .078 | .217* | -.011 | .557*** | .072 | .341** | -.085 |
| | (3.40) | (0.79) | (1.91) | (-0.51) | (3.62) | (0.82) | (2.10) | (-0.74) |
| Market_Dummy | -.311** | -.161 | .021 | .015 | -.065 | .046 | -.334** | -.282** |
| | (-2.22) | (-1.51) | (0.21) | (0.56) | (-0.53) | (0.46) | (-2.16) | (-2.29) |
| Auditor_Change | .076 | .079 | -.108* | -.012 | -.035 | -.029 | .006 | .022 |
| | (0.70) | (1.08) | (-1.58) | (-0.69) | (-0.34) | (-0.45) | (0.05) | (0.24) |
| **Control variables** | | | | | | | | |
| LEV | .197 | .346 | .129 | .052 | .254 | .229 | .495 | .447 |
| | (0.66) | (1.58) | (0.65) | (0.92) | (0.77) | (1.10) | (1.50) | (1.37) |
| Cap_Int | -.398 | -.634*** | .588* | .237*** | .123 | -.194 | -.653** | -.971*** |
| | (-1.53) | (-3.41) | (1.79) | (3.65) | (0.38) | (-1.35) | (-2.04) | (-4.18) |
| R&D_Int | .005 | -.038 | .031 | .026** | -.113 | .008 | -.016 | .016 |
| | (0.04) | (-0.69) | (0.37) | (2.05) | (-0.89) | (0.17) | (-0.12) | (0.25) |
| NOLs | .025 | .01 | -.01 | -.008* | -.016 | -.018 | .003 | -.004 |
| | (1.06) | (0.67) | (-0.32) | (-1.70) | (-0.48) | (-1.00) | (0.13) | (-0.27) |
| TA | .208*** | .182*** | .044** | .008 | .112*** | .106*** | .138*** | .149*** |
| | (4.69) | (6.58) | (2.09) | (1.53) | (3.11) | (4.18) | (2.86) | (4.42) |

**Table 5.17 Multivariate analysis of tax management of full sample (FULL_SAMPLE) (continued)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FT_Int | .161 | .032 | .119 | -.02 | .108 | -.069 | 0.00 | -.231* |
| | (1.03) | (0.30) | (1.23) | (-0.99) | (0.74) | (-0.78) | (-0.00) | (-1.87) |
| IA_Int | .588** | .479*** | .259** | .005 | .383* | .278* | .378* | .334 |
| | (2.57) | (3.24) | (2.02) | (0.20) | (1.71) | (1.81) | (1.46) | (1.61) |
| ROA | -.147 | .134*** | -.122** | .014* | -.026 | .213*** | -.029 | .084 |
| | (-1.38) | (2.67) | (-2.33) | (1.71) | (-0.27) | (4.54) | (-0.32) | (1.45) |
| AP | -.077 | -.023 | -.211** | .002 | -.199* | -.155** | -.169 | -.054 |
| | (-0.60) | (-0.25) | (-2.14) | (0.11) | (-1.63) | (-2.00) | (-1.26) | (-0.52) |
| Industry | | | | | | | | |
| 1 Basic Materials | 0.485 | .38* | .046 | -.048 | .078 | .094 | .213 | .189 |
| | (1.05) | (1.74) | (0.21) | (-1.59) | (0.20) | (0.67) | (0.58) | (0.82) |
| 2 Industrials | 0.412 | .725*** | .045 | .012 | .099 | .559*** | .273 | .612*** |
| | (1.47) | (4.93) | (0.32) | (0.36) | (0.38) | (4.24) | (1.04) | (3.56) |
| 3 Consumer Goods | 0.394 | .392* | .266* | .066 | .262 | .393** | .234 | .235 |
| | (1.11) | (1.96) | (1.49) | (1.50) | (0.79) | (2.28) | (0.73) | (1.04) |
| 4 Health Care | 0.046 | .309** | -.076 | -.023 | -.31 | .176 | .142 | .184 |
| | (0.14) | (2.10) | (-0.51) | (-0.69) | (-1.16) | (1.26) | (0.43) | (1.00) |
| 5Consumer Services | 0.601** | .889*** | .228 | .029 | .356 | .686*** | .429 | .719*** |
| | (2.10) | (5.48) | (1.51) | (0.85) | (1.34) | (4.74) | (1.62) | (3.80) |
| 6Telecommunications | 1.069** | .859*** | .307 | .022 | .78* | .591** | .81 | .325 |
| | (2.37) | (2.71) | (1.11) | (0.33) | (1.70) | (2.48) | (1.29) | (1.37) |
| 7 Utilities | -0.335 | .184 | .139 | .155*** | -.387 | .627*** | .024 | .531** |
| | (-1.06) | (1.04) | (0.72) | (3.77) | (-1.30) | (4.14) | (0.08) | (2.57) |
| 9 Technology | 0.287 | .517*** | .092 | .005 | -.001 | .32** | .059 | .433** |
| | (0.97) | (3.24) | (0.55) | (0.14) | (-0.00) | (2.34) | (0.23) | (2.41) |
| Constant | -1.788*** | -1.843*** | -.335 | -.011 | -.567 | -.826*** | -.754 | -1.192*** |
| | (-3.47) | (-5.89) | (-1.29) | (-0.19) | (-1.26) | (-2.79) | (-1.34) | (-2.94) |
| n | 986 | 906 | 986 | 930 | 986 | 906 | 953 | 873 |
| Adj $R^2$ | 0.1604 | 0.275 | 0.0772 | 0.1221 | 0.1306 | 0.2611 | 0.0828 | 0.1756 |
| Breusch and Pagan | 134.25*** | 208.40*** | 386.14*** | 426.94*** | 117.20*** | 177.42*** | 41.90*** | 106.63*** |
| Max VIF of test variables | 2.29 | 2.19 | 2.29 | 2.29 | 2.29 | 2.20 | 2.38 | 2.37 |

*** p<.01, ** p<.05, * p<.1 ETR measures are standardised ETRs.
Under each ETR measure the first column is statistic results before identifying influential data, the second column is statistic results after identifying and excluding influential data.
t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 1 Change in ETR measures of full sample (FULL_SAMPLE)**



that the level of tax management does not have significant change. However, from year b-2 to year b-1 *Cur_ETRs* have a significant decrease, resulting in the *Cur_ETR* in year b-1 and all years afterwards (IPO, a+1, a+2) are significantly lower than that of years b-3 and year b-2, suggesting that in b-1 there is a higher level of tax management. One year immediately prior to IPO companies engage in more tax management to reduce current tax charge, this is likely to because managers' incentives to increase profits to "signal" intrinsic value to investors, they believe that the benefits of tax management exceed risks (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Spence 1973). However, although the profit is increased, investors should be cautious that tax management has risks, the engagement in tax management is likely to result in contingent tax liabilities, penalties, reputation cost (Francis et al 2014; Rego and Wilson 2012; Graham et al 2014; Wahab and Holland 2012; Holland et al 2016).

In the year of going public there is no significant change in tax management. But the first year after going public *Cur_ETRs* have a significant decrease, indicating that companies engage in more tax management to reduce tax liabilities, this is likely to because the demand for increasing after-tax profits to meet profit target (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). From year a+1 to a+2 there is no significant change in the level of tax management.

Regarding test variables of reporting period (*Account_Year*), listing market (*Market_Dummy*) and auditing firm (*Auditor_Change*), according to detailed individual table 5.17 column 2 under *Cur_ETR*, the average *Cur_ETRs* does not vary by these factors. For the association between *Cur_ETRs* and control variables, consistent with literature, *Cur_ETRs* have a significantly positive association with *TA* and *ROA*, this is consistent with the literature that companies with larger size and higher profitability engage in less tax management (Watts and Zimmerman 1978; Zimmerman 1983; Gupta and Newberry 1997; Jacob 1996). As expected, *Cur_ETRs* have a significantly negative association with *Cap_Int*, supporting prior studies that companies with more intensive capital engage in more tax management (Gupta and

Newberry 1997; Chen et al 2010; Mills et al 1998; Gaertner 2014; Stickney and McGee 1982). But unexpected, companies do not take advantage of intangible assets to reduce tax charge, on the contrary, the intensity of intangible assets is positively related to *Cur_ETR*, companies with more intensive intangible assets engage in less tax management.

Reported in table 5.14 – panel (a) FULL_SAMPLE – columns 3 and 4 under *Def_ETR*, 56 observations of *Def_ETRs* are identified as influential data, excluding influential data the number of observations reduce from 986 to 930. The estimated model explains 12.21% of the variance in *Def_ETRs*. Suggested by VIF values (maximum 2.29) reported in table 5.17 the model does not have significant multicollinearity issue.

Using *Def_ETRs* to reflect the use of tax deferral strategies, through the analysis of table 5.15 – panel a – matrix 2, prior to IPO from years b-3 to b-1 the level of tax deferral does not significantly change. In the IPO year *Def_ETRs* significantly increase, resulting in the *Def_ETR* in the IPO year is significantly higher than other years prior to IPO. This suggests that companies are on average deferring a higher amount of tax liabilities in the year of going public, they have incentives to reduce tax liabilities by deferring tax liabilities to the future (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Dyreng et al 2008). *Def_ETRs* do not significantly vary between years of IPO and a+1 and a+2, suggesting that the level of tax deferral management does not significantly change in the years post IPOs.

Reported in table 5.17 the average level of *Def_ETR* does not significantly vary by Banking Crisis (*Account_Year*), listing market (*Market_Dummy*) and auditor change (*Auditor_Change*). Regarding the association between *Def_ETRs* and control variables, *Cap_Int* has a positive association with *Def_ETRs*, consistent with the literature that due to capital allowance, companies with more intensive capital defer a higher amount of taxes (Stickney and McGee 1982; Manzon Jr and Plesko 2002), *R&D_Int* and *ROA* are positively associated with *Def_ETRs* but *NOLs* are negatively associated with *Def_ETRs*.

According to table 5.14 - panel (a) FULL_SAMPLE - column 6 the number of observations for *GAAP_ETR* model is 906 (after influential data are excluded). The adjusted $R^2$ is 0.2611, indicating that 26.11% of the variance in *GAAP_ETRs* can be explained by the estimated model. The maximum VIF is 2.20 (table 5.17) and therefore multicollinearity is not a concern.

If using combined ETR (*GAAP_ETRs*) to measure the level of tax management consistent with hypothesis $H_1^1$ tax management behaviours significantly change in years around IPOs. Reported in table 5.15 – panel a – matrix 3, there are three pairs of years with significant differences. *GAAP_ETR* of year b-1 is significantly lower than that of year b-2, there is evidence of increased tax management in the year immediately prior to IPO. The increased tax management results in total tax charge in years IPO and a+1 significantly lower than that of year b-2. The results indicate that prior to IPO managers are motivated to engage in more tax management to reduce total tax liabilities, they believe tax management has more benefits than costs (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a).

Regarding the association between *GAAP_ETRs* with Banking Crisis (*Account_Year*), listing market (*Market_Dummy*), auditor changes (*Auditor_Change*) and control variables, reported in table 5.17 the average level of *GAAP_ETRs* does not significantly vary with reporting period, listing market and change in auditing firm. Same with *Cur_ETRs*, *GAAP_ETRs* are positively associated with *TA*, *IA_Int*, *ROA*, supporting the prior studies that the larger size, higher intangible intensity and stronger profitability a company has, the less tax management it engages in (Watts and Zimmerman 1978; Zimmerman 1983; Gupta and Newberry 1997; Jacob 1996). There is an occasional finding that the level of *GAAP_ETR* is associated with accounting practice, the average level of *GAAP_ETRs* reported in IFRS financial statements is lower than that of UK GAAP financial statements.

The results of the *Cash_ETR* model are reported in columns 7 and 8 of table 5.14 panel (a). In total there are 873 observations for the model of *Cash_ETRs*. 17.56% of the

variance in *Cash_ETRs* can be explained by the model. The maximum VIF is 2.37 (table 5.17), there is no evidence of significant multicollinearity issue.

According to matrix 4 reported in table 5.15, for the full sample it is in year b-1 *Cash_ETRs* significantly decrease, resulting in the *Cash_ETR* in year b-1 is significantly lower than that of years b-3 and b-2. Consistent with using accrual basis ETR measures (*Cur_ETRs* and *GAAP_ETRs*), measured by cash basis ETR (*Cash_ETR*) in the year immediately prior to IPO companies engage in more tax management. The increased tax management results in lower tax payments until years IPO and a+1. This supports the theory that in the IPO process managers have incentives to engage in more tax management (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). However, after being listed, from year a+1 to a+2 there is an increase in *Cash_ETRs*, statistically significant at 10% level. With additional scrutiny after IPOs, in a+2 companies engage in less tax management (Gao and Jain 2011; Jain and Kini 2008; Jain and Tabak 2008; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011).

Reported in table 5.17 the level of *Cash_ETRs* significantly varies by listing market. Companies listed on Main Market on average have lower *Cash_ETRs* than companies listed on AIM. This is consistent with the hypothesis $H_3^1$ that corporate tax management behaviours during IPO process vary by listing market, specifically, the higher market pressure of Main Market is likely to increase the demand for tax management for better corporate performance (Parsa and Kouhy 2008). Regarding the association between *Cash_ETRs* with firm characteristics, *Cash_ETRs* are negatively associated with *Cap_Int* and *FT_Int* but positively associated with *TA*, consistent with literature, companies with more intensive capital and foreign operation, and smaller firm size have a higher level of tax management (Gupta and Newberry 1997; Chen et al 2010; Stickney and McGee 1982; Manzon Jr and Plesko 2002; Mills et al 1998; Rego 2003; Jacob 1996; Zimmerman 1983).

In summary, for the full sample measured by *Cur_ETRs* IPO companies engage in

more tax management in the year immediately prior to IPO and the year immediately post IPO to reduce current tax charge. Reflected by *Def_ETRs* companies defer a higher amount of tax liabilities in the IPO year. Measured by *GAAP_ETRs* issuers increase the level of tax management in the year immediately prior to IPO. Measured by *Cash_ETRs* companies engage in more tax management in the year immediately prior to IPO, but after going public, with enhanced scrutiny they engage in less tax management.

#### 5.2.2.2 Corporate tax management of profitable company year ends

In this section those company year ends with losses are excluded from sample and only company year ends with profits are selected to investigate the tax management of profitable company year-ends. The full results are reported in table 5.18 with summaries in table 5.14 (panel b - PROFIT_YEAR_ENDS) and table 5.15 (panel b - matrices 5 - 8). Figure 5.2 is the line chart depicting the change in the coefficients of ETR measures.

According to table 5.14 panel (b) column 2, excluding those company year ends with loss there are 549 observations for *Cur_ETR* model. The adjusted $R^2$ value indicates that the estimation model can explain 27.54% of the variance in *Cur_ETRs*. Reported in table 5.18 the maximum VIF is 2.36, indicating there is no multicollinearity issue. The BP test is significant indicating the model has heteroscedasticity issue, therefore, t-test is calculated by heteroscedastic-robust standard errors.

An investigation of the *Cur_ETR* matrix (table 5.15 matrix 5) shows the level of tax management measured *Cur_ETRs* has significant changes during the IPO process. The *Cur_ETR* of year b-2 is significantly higher than that of year b-3, indicating there is higher current tax charge. With increased scrutiny companies settle outstanding or disputed amount of tax with the relevant tax administration two years prior to IPO. The enhanced scrutiny increases the risks of tax management, resulting in less tax management engagement (Filatotchev and Bishop 2002). Then in b-1 there is a higher level of tax management, although there is increased scrutiny companies still

**Table 5. 18 Multivariate analysis of tax management of profitable company year-ends (PROFIT_YEAR_ENDS)**

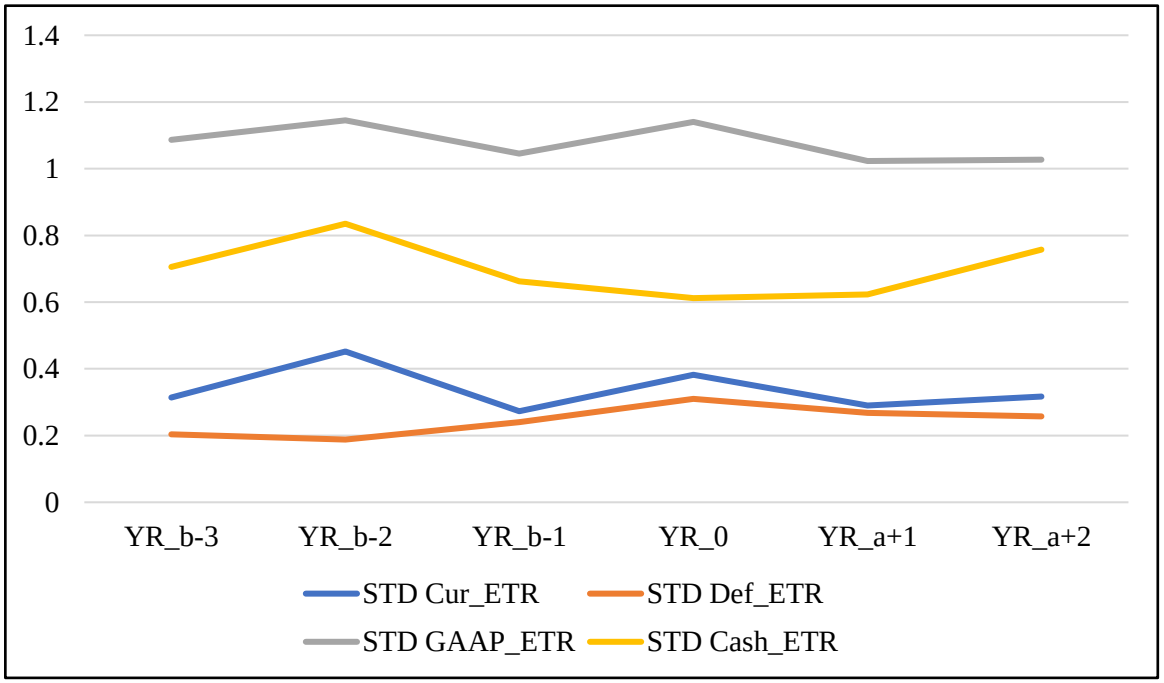
| **Dependent variables** | ***Cur_ETR*** | | ***Def_ETR*** | | ***GAAP_ETR*** | | ***Cash_ETR*** | |
|---|---|---|---|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| YR_a+2 | -.113 | -.065 | -.183** | -.053 | -.185 | -.113* | .057 | .145* |
| | (-0.88) | (-0.79) | (-2.48) | (-1.26) | (-1.66) | (-1.66) | (0.42) | (1.68) |
| YR_a+1 | -.19* | -.092 | -.132* | -.042 | -.179* | -.117* | -.12 | .011 |
| | (-1.85) | (-1.46) | (-1.94) | (-1.15) | (-1.79) | (-1.90) | (-1.12) | (0.15) |
| YR_b-1 | -.051 | -.109* | -.068 | -.07* | -.042 | -.095 | .099 | .05 |
| | (-0.52) | (-1.74) | (-0.85) | (-1.94) | (-0.40) | (-1.42) | (0.86) | (0.64) |
| YR_b-2 | .113 | .07 | -.18** | -.122*** | -.009 | .005 | .291** | .223* |
| | (0.96) | (0.84) | (-2.37) | (-2.74) | (-0.08) | (0.06) | (2.08) | (1.90) |
| YR_b-3 | .022 | -.068 | -.161* | -.106** | -.074 | -.053 | .138 | .094 |
| | (0.16) | (-0.69) | (-1.84) | (-2.19) | (-0.57) | (-0.56) | (0.89) | (0.83) |
| Account_Year | | | | | | | | |
| across 2008 | .088 | -.078 | .081 | .047 | .102 | -.043 | .061 | -.033 |
| | (0.69) | (-0.93) | (1.42) | (1.34) | (0.82) | (-0.54) | (0.47) | (-0.33) |
| post 2008 | .193* | .092 | .031 | .03 | .193 | .032 | .077 | .077 |
| | (1.62) | (1.00) | (0.51) | (0.91) | (1.55) | (0.36) | (0.59) | (0.75) |
| Market_Dummy | -.134 | -.154** | .105 | .056 | -.01 | -.056 | -.05 | -.114 |
| | (-1.14) | (-1.60) | (1.31) | (1.54) | (-0.08) | (-0.60) | (-0.43) | (-1.21) |
| Auditor_Change | -.008 | -.009 | -.035 | -.019 | -.086 | -.076 | -.004 | .006 |
| | (-0.10) | (-0.14) | (-0.68) | (-0.70) | (-0.98) | (-1.24) | (-0.05) | (0.07) |
| **Control variables** | | | | | | | | |
| LEV | .096 | .137 | -.017 | .011 | .066 | .221 | .029 | .038 |
| | (0.33) | (0.77) | (-0.10) | (0.13) | (0.22) | (1.24) | (0.08) | (0.15) |
| Cap_Int | -.594** | -.611*** | .483*** | .338*** | -.03 | -.224 | -.553** | -.606*** |
| | (-2.60) | (-3.22) | (3.03) | (3.82) | (-0.14) | (-1.50) | (-2.06) | (-2.91) |
| R&D_Int | -.585** | -.715*** | .276** | -.056 | -.373 | -.696*** | -.297 | -.275 |
| | (-2.36) | (-5.12) | (0.90) | (-0.73) | (-1.28) | (-5.09) | (-0.80) | (-1.63) |
| NOLs | .05 | .089*** | -.045*** | -.021 | .003 | .063* | .077* | .105*** |
| | (1.29) | (6.11) | (-1.07) | (-0.77) | (0.05) | (1.87) | (1.75) | (6.60) |
| TA | .073* | .065** | -.018 | -.009 | .019 | .033 | -.006 | .013 |
| | (1.71) | (2.09) | (-0.84) | (-0.79) | (0.44) | (1.13) | (-0.12) | (0.34) |

**Table 5.18 Multivariate analysis of tax management of profitable company year-ends (PROFIT_YEAR_ENDS) (continued)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FT_Int | -.089 | -.221* | .12* | .013 | -.116 | -.208* | -.171 | -.408*** |
| | (-0.65) | (-1.94) | (1.52) | (0.30) | (-0.80) | (-1.92) | (-1.12) | (-3.32) |
| IA_Int | .623** | .317* | .124 | -.003 | .586** | .287* | .477* | .253 |
| | (2.49) | (1.82) | (1.14) | (-0.04) | (2.46) | (1.76) | (1.83) | (1.40) |
| ROA | -1.008** | -.18 | -.611*** | -.352*** | -.922** | -.094 | -1.94*** | -.83** |
| | (-2.54) | (-0.60) | (-2.66) | (-2.84) | (-2.37) | (-0.35) | (-4.18) | (-2.37) |
| AP | -.072 | -.017 | -.031 | -.003 | -.076 | .001 | .179 | .089 |
| | (-0.63) | (-0.21) | (-0.43) | (-0.09) | (-0.68) | (0.01) | (1.42) | (0.94) |
| industry | | | | | | | | |
| 1 Basic Materials | .476 | .505* | .224 | -.114 | .306 | .338*** | -.107 | .01 |
| | (0.90) | (1.91) | (0.51) | (-1.08) | (0.50) | (2.93) | (-0.24) | (0.04) |
| 2 Industrials | .213 | .077 | -.052 | -.069 | .004 | -.34*** | .144 | .248 |
| | (0.95) | (0.39) | (-0.52) | (-0.93) | (0.02) | (-3.50) | (0.51) | (1.34) |
| 3 Consumer Goods | .037 | -.237 | .149 | -.024 | .036 | -.494*** | -.087 | -.06 |
| | (0.12) | (-1.05) | (1.01) | (-0.28) | (0.15) | (-3.71) | (-0.26) | (-0.28) |
| 4 Health Care | .119 | .079 | -.107 | -.117 | -.078 | -.46*** | .018 | .206 |
| | (0.47) | (0.40) | (-0.62) | (-1.34) | (-0.31) | (-4.31) | (0.05) | (0.95) |
| 5 Consumer Services | .224 | .034 | -.028 | -.06 | .021 | -.401*** | .111 | .145 |
| | (0.99) | (0.17) | (-0.30) | (-0.85) | (0.12) | (-3.88) | (0.39) | (0.80) |
| 6 Telecommunications | .515 | .168 | .128 | -.099 | .295 | -.343** | .448 | .278 |
| | (1.11) | (0.68) | (0.61) | (-1.26) | (0.65) | (-1.97) | (1.12) | (1.30) |
| 7 Utilities | -.345 | -.597*** | .113 | -.066 | -.412* | -.696*** | -.129 | -.227 |
| | (-1.36) | (-2.74) | (0.88) | (-0.80) | (-1.94) | (-5.55) | (-0.41) | (-1.06) |
| 9 Technology | .23 | .071 | 0.00 | -.068 | -.047 | -.407*** | .067 | .146 |
| | (0.98) | (0.35) | (-0.00) | (-0.87) | (-0.26) | (-3.62) | (0.22) | (0.75) |
| Constant | .168 | .382 | .392 | .31** | .918* | 1.14*** | .977 | .612 |
| | (0.32) | (0.95) | (1.61) | (2.05) | (1.78) | (3.26) | (1.56) | (1.33) |
| n | 588 | 549 | 588 | 555 | 588 | 540 | 555 | 521 |
| Adj $R^2$ | 0.1633 | 0.2754 | 0.1483 | 0.1387 | 0.1041 | 0.1911 | 0.1368 | 0.2037 |
| Breusch and Pagan | 102.14*** | 17.42*** | 724.49*** | 168.73*** | 168.52*** | 12.36*** | 66.95*** | 39.08*** |
| Max VIF of test variables | 2.36 | 2.36 | 2.36 | 2.38 | 2.36 | 2.40 | 2.50 | 2.50 |

*** p<.01, ** p<.05, * p<.1 . ETR measures are standardised ETRs .Under each ETR measure the first column is statistic results before identifying influential data, the second column is statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 2 Change in ETR measures of profitable company year-ends (PROFIT_YEAR_ENDS)**



have incentives to engage in more tax management to reduce tax liabilities. This is probably because managers consider that reducing tax liabilities can increase after-tax profits, thereby increasing investors' valuation on the company, the benefits of tax management are larger than costs (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Spence 1973). However, the engagement in tax management is a risk factor, it is likely to be rejected by tax authorities, resulting in contingent liabilities (Francis et al 2014; Rego and Wilson 2012). In the year of going public under additional scrutiny in order to go public successfully companies have less incentives to take risks, as a result, they reduce the level of tax management (Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011; Frank et al 2009). After going public from IPO year to years a+1 and a+2 tax management behaviours do not significantly change. From the analysis it can be noticed that the results of *Cur_ETRs* in year b-2 and IPO year for full sample and profitable company year-ends are different, suggesting that the company year ends with loss have influence on results.

Regarding the tax management behaviours of different periods (*Account_Year*), markets (*Market_Dummy*) and auditing firms (*Auditor_Change*), from table 5.18 column 2 (results of *Cur_ETRs* without influential data) it is shown that consistent with hypothesis $H_3^1$ tax management behaviours are different between Main Market and AIM, the average *Cur_ETR* of Main Market is significantly lower than that of AIM, indicating that with higher market pressure for corporate performance, companies listed on Main Market have more incentives to engage in tax management (Parsa and Kouhy 2008). The findings of control variables suggest that consistent with expectations companies with more intensive PPE (*Cap_Int*), R&D expenditure (*R&D_Int*) and foreign turnover (*FT_Int*), more losses in the last year (*NOLs*) and smaller firm size (*TA*) have a higher level of tax management (Gupta and Newberry 1997; Lanis and Richardson 2015; Mills et al 1998; Wang 1991; Zimmerman 1983). However, inconsistent with expectations the companies with more intensive intangible assets (*IA_Int*) have a lower level of tax management (the expectation is that the more intensive intangible assets a company has, the higher level of tax management).

Reported in table 5.14 panel (b) PROFIT_YEAR_ENDS column 4 there are 555 observations for *Def_ETR* model, the estimated model explains 13.87% of the variance in *Def_ETRs.* The maximum VIF (table 5.18) is 2.38 suggesting that multicollinearity is not an issue. The BP test is significant, hence, heteroscedastic-robust standard errors are needed.

The change in *Def_ETRs* of profitable company year-ends is consistent with full sample. The change in tax deferral engagement reflected by *Def_ETRs* (table 5.15, panel b, matrix 6) shows that prior to IPO, specifically, in years b-3, b-2 and b-1 *Def_ETRs* do not significantly change, that is, tax deferral strategies do not significantly change. But in the IPO year *Def_ETRs* significantly increase, resulting in the *Def_ETR* in this year is significantly higher than any other pre-IPO years, this means that in the IPO year companies use more tax deferral strategies to reduce current tax burden (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Dyreng et al 2008). After IPOs the change in *Def_ETRs* between years IPO and a+1 and a+2 is not significant.

According to detailed results reported in table 5.18 the tax deferral strategies do not significantly vary by reporting period (*Account_Year*), listing market (*Market_Dummy*) and auditing firms (*Auditor_Change*). *Cap_Int* is positively associated with *Def_ETRs*, significant at 1% level, this is consistent with the theory that companies can take advantage of capital allowance to defer tax liabilities to the future (Gupta and Newberry 1997; Chen et al 2010; Stickney and McGee 1982). *ROA* is negatively associated with *Def_ETRs*, indicating that companies with higher profitability use less tax deferral strategies.

An investigation of *GAAP_ETR* model (table 5.14 - panel b - PROFIT_YEAR_ENDS - column 6) shows that there are 540 observations for *GAAP_ETR* model. The estimated model can explain 19.11% of the variance in *GAAP_ETR.* The maximum VIF is 2.40 (table 5.18) indicating no multicollinearity issue. The significant BP test requires for heteroscedastic-robust standard errors.

The *GAAP_ETRs* of profitable company year ends reported in table 5.15 (matrix 7) shows that while measured by *Cur_ETRs* the level of tax management significantly changes in years prior to IPO, measured by *GAAP_ETRs* (i.e. combine *Cur_ETR* and *Def_ETR*) in years prior to IPO the level of tax management does not significantly change consistent with the overall effects of current tax and deferred tax changes netting out. This reflects the limitation of *GAAP_ETR* measure that it cannot reflect the tax management strategies that take advantage of tax deferrals (Dyreng et al 2008; Hanlon and Heitzman 2010). In the years after going public, maybe to meet profit targets and show a good performance to investors, or maybe companies have more ability to employ high-quality tax management advisors, after going public companies engage in more tax management to reduce tax expense (Francis et al 2014; Rego and Wilson 2012; Spence 1973; McGuire et al 2012; Omer et al 2006; Cook et al 2008), the *GAAP_ETRs* in years a+1 and a+2 are significantly lower than that in IPO year.

According to table 5.18 measured by *GAAP_ETRs* the level of tax management does not significantly vary by period, market and auditing firm. Regarding control variables, *GAAP_ETRs* are negatively related to *R&D_Int*, *FT_Int*, positively associated with *NOLs* and *IA_Int*. Same with prior studies, companies with more R&D expenditure, foreign operation and tax loss carry-forward exhibit a higher level of tax management (Gupta and Newberry 1997; Mills et al 1998; Wang 1991).

The above paragraphs discuss accrual basis measures, this paragraph discusses the cash basis measure, i.e. *Cash_ETR*. The investigation of *Cash_ETR* model (table 5.14 - panel b - PROFIT_YEAR_ENDS - column 8) shows that there are 521 observations for *Cash_ETR* model. The estimated model can explain 20.37% of the variance in *Cash_ETR*. The maximum VIF is 2.50 (table 5.18) indicating no multicollinearity issue. The significant BP test requires for heteroscedastic-robust standard errors.

If tax management is measured by *Cash_ETRs*, in accordance with matrix 8 under reported in table 5.15 panel b, there is a significant decrease in *Cash_ETRs* in year b-1, consistent with *Cur_ETRs*, in the year immediately prior to IPO companies have a

higher level of tax management and therefore a lower level of tax payment. The increased tax management leads tax payments in years b-1, IPO and a+1 to be significantly lower than that in year b-2. This is likely to because of managers' incentives to increase cash flow to signal firm quality magnifies the positive side of tax management, which increases managers' tax management incentives (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Spence 1973). However, the change of *Cur_ETRs* in years b-2 and IPO is not applied to *Cash_ETRs*, implying that the change in tax management in those years is likely to be related to accruals. After IPOs, from a+1 to a+2 *Cash_ETRs* have a significant increase, suggesting with increased scrutiny after going public companies engage in less tax management (Gao and Jain 2011; Jain and Kini 2008; Jain and Tabak 2008; Filatotchev and Bishop 2002; Freedman and Stagliano 2002; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011) According to table 5.18, same with prior studies companies with more intensive PPE (*Cap_Int*) and foreign turnovers (*FT_Int*), larger *NOLs* in the last year, higher profitability (*ROA*) have a higher level of tax management (Mills et al 1998; Gaertner 2014; Rego 2003; Jacob 1996; Chen et al 2010; Cheng et al 2012; Rego 2003; Rego and Wilson 2012).

In summary, measured by *Cur_ETRs* companies settle outstanding tax with relevant tax administration in year b-2, engage in more tax management in year b-1 but less tax management in year IPO. The deferred tax charge is significantly higher at IPO. The combined measure (*GAAP_ETR*) indicates more engagement in tax management post IPO. Measured by *Cash_ETRs* there is a higher level of tax management in the year immediately prior to IPO, but a lower level of tax management post IPO.

#### 5.2.2.3 Tax management in different periods

The above section gives an overall analysis of tax management of profitable company year-ends. As the study hypothesises that tax management behaviours can be different in different periods, this section further reports corporate tax management behaviours in the periods of pre and post 2008.

#### 5.2.2.3.1 Pre 2008

The full results are reported in table 5.19 with summaries in table 5.14 (subsample 1 Pre 2008, the abbreviation is PRE) and table 5.15 (matrices 9 - 12). The number of observations for *Cur_ETR* is 191, the adjusted $R^2$ is 45.19%, indicating that the estimated model can explain 45.19% of the variance in *Cur_ETRs*. The maximum VIF value is 2.23, indicating there is no multicollinearity issue. The BP test is not significant, indicating the null hypothesis that the error variances are all equal is accepted and there is no heteroscedasticity issue.

An investigation of the *Cur_ETRs* matrix reported in table 5.15 PRE (matrix 9) finds that for companies subject to the scrutiny of the pre 2008 period, from years b-3 to a+2 there are no significant changes in the level of tax management. Figure 5.3 also shows that the line graph of *Cur_ETRs* is relatively smooth.

According to the individual table 5.19 (column 2) the average level of *Cur_ETRs* in the pre 2008 period significantly varies by listing market (*Market_Dummy*) and auditing firms (*Auditor_change*). The level of *Cur_ETRs* for companies listed on Main Market is significantly lower than that of companies listed on AIM, indicating companies listed on Main Market have a higher level of tax management, this supports the theory that the higher market pressure for Main Market companies increases their incentives to reduce tax expense by using tax strategies (Parsa and Kouhy 2008). In addition, the level of *Cur_ETRs* for companies changing auditing firms in the IPO process is lower than that of companies without changing auditing firms, suggesting that companies may change auditors to manage taxes (Klassen et al 2016; McGuire et al 2012; Omer et al 2006; Cook et al 2008). For control variables *Cap_Int* and *R&D_Int* are negatively associated with *Cur_ETRs*, *NOLs* and *IA_Int* are positively associated with *Cur_ETRs*. The findings of *Cap_Int, R&D_Int* and *NOLs* are consistent with prior studies, the more fixed assets, R&D expenditure, tax loss carry-forwards a company has, the more tax management it engages in (Gupta and Newberry 1997; Chen et al 2010; Lanis and Richardson 2015; Berger 1993; Gaertner 2014).

**Table 5. 19 Multivariate analysis of tax management behaviours of the pre 2008 sub-sample (PRE)**

| **Dependent variables** | ***Cur_ETR*** | | ***Def_ETR*** | | ***GAAP_ETR*** | | ***Cash_ETR*** | |
|---|---|---|---|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| YR_a+2 | -.005 | -.109 | -.128* | -.151** | -.022 | -.133 | .22 | .204* |
| | (-0.03) | (-0.87) | (-1.77) | (-2.32) | (-0.15) | (-1.03) | (1.46) | (1.73) |
| YR_a+1 | -.129 | -.118 | -.05 | -.059 | -.094 | -.075 | .138 | .173 |
| | (-1.01) | (-1.18) | (-0.67) | (-1.19) | (-0.74) | (-0.76) | (0.94) | (1.46) |
| YR_b-1 | -.09 | -.006 | .059 | -.077* | .121 | .047 | .049 | .189 |
| | (-0.77) | (-0.08) | (0.49) | (-1.78) | (0.82) | (0.47) | (0.35) | (1.68) |
| YR_b-2 | .046 | -.024 | -.011 | -.085 | .125 | .200 | .446** | .454*** |
| | (0.31) | (-0.24) | (-0.09) | (-1.02) | (0.93) | (1.67) | (2.05) | (2.71) |
| YR_b-3 | .119 | .032 | -.149* | -.16*** | .096 | -.014 | .109 | .160 |
| | (0.66) | (0.25) | (-1.88) | (-2.70) | (0.51) | (-0.10) | (0.46) | (1.01) |
| Market_Dummy | -.13 | -.278* | .286* | .02 | .058 | -.105 | .146 | .135 |
| | (-0.69) | (-1.78) | (1.97) | (0.24) | (0.29) | (-0.60) | (0.59) | (0.64) |
| Auditor_Change | -.167 | -.228** | .14** | .072* | -.095 | -.141 | -.137 | -.117 |
| | (-1.28) | (-2.45) | (2.21) | (1.87) | (-0.71) | (-1.31) | (-0.93) | (-1.15) |
| **Control variables** | | | | | | | | |
| LEV | .137 | -.087 | .088 | .229* | .111 | .315 | .407 | .072 |
| | (0.46) | (-0.39) | (0.33) | (1.89) | (0.28) | (1.21) | (1.04) | (0.26) |
| Cap_Int | -.59 | -.703** | .617*** | .457*** | .05 | -.153 | -.809** | -1.081*** |
| | (-1.59) | (-2.64) | (3.84) | (3.17) | (0.16) | (-0.61) | (-2.16) | (-4.60) |
| R&D_Int | -.556 | -.807*** | .459 | .29 | -.35 | -.728*** | .215 | -.352 |
| | (-1.61) | (-3.88) | (1.26) | (1.24) | (-0.72) | (-2.76) | (0.43) | (-1.63) |
| NOLs | .108*** | .096*** | -.017 | .007 | .058 | .074** | .164*** | .099*** |
| | (3.79) | (4.50) | (-0.29) | (0.38) | (0.85) | (2.34) | (4.47) | (4.14) |
| TA | .01 | .048 | -.017 | .013 | .033 | .072 | -.11 | .025 |
| | (0.14) | (0.91) | (-0.50) | (0.69) | (0.44) | (1.43) | (-1.36) | (0.36) |

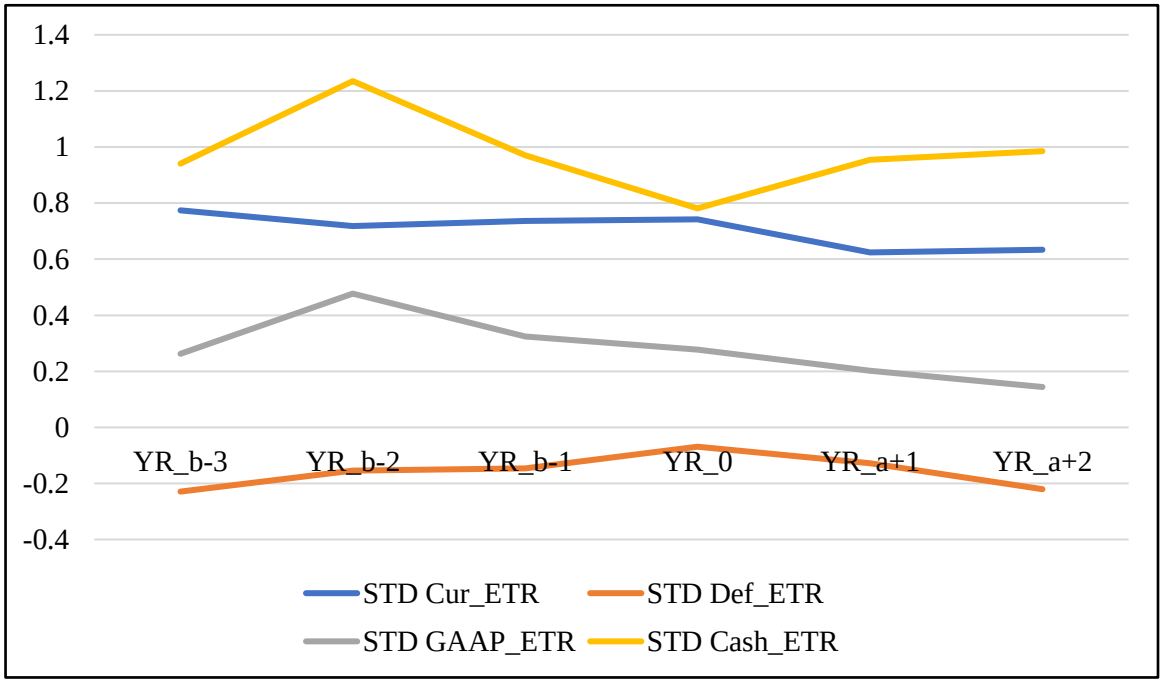
**Table 5.19 Multivariate analysis of tax management behaviours of the pre 2008 sub-sample (PRE) (continued)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FT_Int | .356 | .113 | .171* | -.012 | .433* | .153 | .099 | -.029 |
| | (1.33) | (0.55) | (1.71) | (-0.18) | (1.73) | (0.74) | (0.33) | (-0.12) |
| IA_Int | .841* | .851*** | .383** | .003 | 1.103** | .898*** | .487 | .247 |
| | (1.94) | (3.13) | (2.10) | (0.03) | (2.50) | (2.97) | (1.22) | (0.89) |
| ROA | -1.024* | -.67 | -.271 | -.108 | -.673 | -.275 | -2.322*** | -1.617*** |
| | (-1.71) | (-1.40) | (-0.86) | (-0.65) | (-1.00) | (-0.52) | (-3.15) | (-3.62) |
| AP | .021 | .012 | -.192 | .005 | -.182 | -.169 | .056 | -.226 |
| | (0.11) | (0.09) | (-1.40) | (0.08) | (-0.88) | (-1.25) | (0.21) | (-1.34) |
| industry | | | | | | | | |
| 2 Industrials | .94** | N/A | .558** | N/A | 1.303*** | N/A | .837* | N/A |
| | (2.17) | | (2.61) | | (3.00) | | (1.96) | |
| 3 Consumer Goods | .675 | -.266* | .761*** | .082 | 1.121** | -.13 | .559 | -.262 |
| | (1.45) | (-1.97) | (3.14) | (1.05) | (2.47) | (-1.26) | (1.28) | (-1.62) |
| 4 Health Care | .148 | -.587*** | .554** | .095 | .692* | -.362* | -.362 | -.661*** |
| | (0.49) | (-3.11) | (2.61) | (1.29) | (1.98) | (-1.91) | (-1.21) | (-3.21) |
| 5ConsumerServices | .9** | -.075 | .571*** | -.009 | 1.309*** | -.038 | .759* | .07 |
| | (2.26) | (-0.50) | (2.86) | (-0.16) | (3.15) | (-0.28) | (1.82) | (0.47) |
| 6Telecommunications | .895* | -.157 | .652** | -.047 | 1.298** | -.097 | .909* | .108 |
| | (1.88) | (-1.38) | (2.33) | (-0.75) | (2.46) | (-0.82) | (1.95) | (0.92) |
| 9 Technology | .969** | .044 | .54** | -.058 | 1.185*** | -.118 | .581 | -.186 |
| | (2.33) | (0.34) | (2.44) | (-1.12) | (2.94) | (-0.81) | (1.35) | (-1.20) |
| Constant | .079 | .742 | -.519 | -.069 | -.762 | .277 | 1.377* | .781 |
| | (0.13) | (1.39) | (-1.34) | (-0.38) | (-1.06) | (0.53) | (1.76) | (1.09) |
| n | 204 | 191 | 204 | 191 | 204 | 185 | 188 | 174 |
| Adj $R^2$ | 0.3000 | 0.4519 | 0.3212 | 0.3715 | 0.2272 | 0.3565 | 0.2828 | 0.3570 |
| Breusch and Pagan | 8.84*** | 0.91 | 190.88*** | 136.38*** | 27.20*** | 2.31 | 29.70*** | 19.86*** |
| Max VIF of test variables | 2.20 | 2.23 | 2.20 | 2.15 | 2.20 | 2.20 | 2.35 | 2.36 |

*** p<.01, ** p<.05, * p<.1

ETR measures are standardised ETRs. Under each ETR measure the first column is statistic results before identifying influential data, the second column is statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 3 Change in ETR measures of the pre 2008 sub-sample (PRE)**



Reported in table 5.14 (PRE – column 4) the number of observations for *Def_ETR* is 191, the adjusted $R^2$ is 37.15%, indicating that the estimated model can explain 37.15% of the variance in *Def_ETRs*. The maximum VIF value is 2.15, indicating there is no multicollinearity issue. The BP test is significant, indicating there is heteroscedasticity issue and heteroscedastic-robust standard errors are required.

The change in tax deferral engagement reflected by *Def_ETRs* (table 5.15, sub-sample 1 PRE, matrix 10) is consistent with full sample and profitable company year ends, there is a significant increase in *Def_ETRs* in the IPO year. This means that in the year of going public companies defer a higher amount of tax liabilities (Dyreng et al 2008; Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). Suggested by table 5.19, the change in auditing firms (*Auditor_change*) is significantly associated with the level of *Def_ETRs*. Companies changing auditing firms in the IPO process use more tax deferral strategies, supporting prior literature that auditors provide advice on the making of tax planning strategies (Klassen et al 2016; McGuire et al 2012; Omer et al 2006; Cook et al 2008).

The number of observations for *GAAP_ETR* model is 185 (table 5.14 – subsample 1 PRE column 6), the adjusted $R^2$ shows that the estimated model can explain 35.65.% of the variance in *GAAP_ETRs*. The BP test is not statistically significant, indicating there is no heteroscedasticity issue.

The *GAAP_ETRs* of the pre 2008 subsample reported in table 5.15 (matrix 11) show three pairs of years with significant differences. The *GAAP_ETR* in year b-2 is significantly higher than that in year b-3, indicating with enhanced scrutiny companies engage in less tax management, they settle outstanding or disputed amounts of tax with the relevant tax administration before the IPO (Branswijck and Everaert 2012; Filatotchev and Bishop 2002; Freedman and Stagliano 2002; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). In years a+1 and a+2, *GAAP_ETR* is lower than that in year b-2. The significant difference is the result of accumulative effect of prior years (there is a decreasing trend from b-1 to a+1, although for each year the change is not

statistically different the accumulative decrease can be significant), rather than the level of tax management has significant change in these years (the change in *GAAP_ETRs* in years a+1 and a+2 itself does not significant). From the year b-1 to a+2 the level of *GAAP_ETRs* does not significantly changes, indicating that during this period corporate tax management behaviours do not significantly change.

According to table 5.19, the level of *GAAP_ETRs* for the pre 2008 subsample does not significantly vary by listing market (*Market_Dummy*) and auditing firms (*Auditor_Change*). The *GAAP_ETRs* of those companies are negatively associated with *R&D_Int* but positively associated with *NOLs* and *IA_Int*, the findings on *R&D_Int* and *NOLs* agree with prior literature, the companies with more R&D expenditure and tax loss carry-forwards exhibit higher tax management levels (Gupta and Newberry 1997; Lanis and Richardson 2015; Berger 1993; Gaertner 2014; Wang 1991; Chen et al 2010).

The number of observations for *Cash_ETR* model is 174 (table 5.14 – subsample 1 PRE – column 8). The adjusted $R^2$ value shows the estimated model can explain 35.70% of the variance in *Cash_ETRs*. According to the individual table, table 5.19, the maximum VIF for *Cash_ETR* model is 2.36, indicating no multicollinearity issue. The BP test is significant, indicating the model has heteroscedasticity issue, to solve this problem the heteroscedastic-robust standard errors are used.

If tax management is measured by *Cash_ETRs*, in accordance with the matrix 12 reported in table 5.15, the *Cash_ETR* in year b-2 is significantly higher than that of year b-3 consistent with under more stringent scrutiny companies have less incentives to engage in tax management because there is increased risks, they settle outstanding tax liabilities with tax administrations two years prior to IPO (Jain and Tabak 2008; Filatotchev and Bishop 2002; Freedman and Stagliano 2002; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). In year b-1 there is a lower *Cash_ETRs*, indicating in the year immediately prior to IPO companies engage in more tax management to reduce tax payments (Francis et al 2014; Rego and Wilson 2012; Desai and

Dharmapala 2009a).

Reported in table 5.19 *Cash_ETRs* do not vary by listing market (*Market_Dummy*) and auditor change (*Auditor_Change*), they are negatively associated with *Cap_Int* and *ROA*, positively associated with *NOLs*, which means that the more intensive capital, higher profitability, and larger prior losses a company has, the more tax management strategies it uses (Manzon Jr and Plesko 2002; Gupta and Newberry 1997; Chen et al 2010; Rego 2003; Wang 1991).

In summary, while there is no evidence of tax management via the current tax charge (measured using *Cur_ETR*), the deferred tax charge is significantly higher at IPO consistent with increased tax deferral. The combined measure (*GAAP_ETR*) indicates increased tax charge two years prior to IPO. Tax cash payments measured by *Cash_ETR* indicate significant higher level of payment in b-2 but lower level of payment in b-1.

**5.2.2.3.2 Post 2008**

If the sample only includes those companies whose all company year ends are in the years post 2008 (the abbreviation is POST) the full results are reported in table 5.20 with summaries in table 5.14 (subsample 2 POST) and table 5.15 (matrices 13 - 16). According to table 5.14-subsample 2-POST the number of observations for *Cur_ETR* model is 180, for *Def_ETR* model is 188, for *GAAP_ETR* model is 180 and for *Cash_ETR* model is 169. The goodness of fit of *Cur_ETR* model is 38.63%, indicating the model can explain 38.63% of the variance in *Cur_ETR*, for other ETR measures the estimated models can explain 15.13% of the variance in *Def_ETRs*, 33.69% of the variance in *GAAP_ETRs* and 31.63% of the variance in *Cash_ETRs*. The maximum VIFs of the models are all smaller than 3 so the models do not have multicollinearity issue (table 5.20).

If using *Cur_ETRs* to measure tax management, according to matrix 13 reported in table 5.15, while tax management behaviours of the pre 2008 sub-sample do not

**Table 5. 20 Multivariate analysis of tax management behaviours of the post 2008 sub-sample (POST)**

| **Dependent variables** | ***Cur_ETR*** | | ***Def_ETR*** | | ***GAAP_ETR*** | | ***Cash_ETR*** | |
|---|---|---|---|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| YR_a+2 | -.534** | -.197 | -.196 | -.07 | -.578** | -.306** | -.424 | -.313* |
| | (-2.07) | (-1.35) | (-1.58) | (-0.95) | (-2.55) | (-2.15) | (-1.49) | (-1.92) |
| YR_a+1 | -.509* | -.171 | -.242* | -.075 | -.568** | -.237* | -.56** | -.255* |
| | (-1.92) | (-1.46) | (-1.77) | (-1.13) | (-2.35) | (-1.82) | (-2.43) | (-1.75) |
| YR_b-1 | -.25 | -.095 | -.116 | -.133* | -.23 | -.18 | -.167 | -.149 |
| | (-1.20) | (-0.68) | (-0.85) | (-1.90) | (-1.11) | (-1.37) | (-0.67) | (-0.83) |
| YR_b-2 | .012 | .148 | -.225 | -.132 | -.109 | -.043 | -.031 | .005 |
| | (0.04) | (0.84) | (-1.52) | (-1.53) | (-0.47) | (-0.32) | (-0.10) | (0.02) |
| YR_b-3 | -.369 | -.261 | -.098 | -.099 | -.213 | -.188 | -.466 | -.314 |
| | (-1.13) | (-1.30) | (-0.78) | (-1.08) | (-0.76) | (-1.13) | (-1.35) | (-1.25) |
| Market_Dummy | .062 | -.067 | -.015 | .028 | .139 | .085 | -.148 | -.118 |
| | (0.38) | (-0.46) | (-0.20) | (0.71) | (0.90) | (0.76) | (-1.05) | (-1.05) |
| Auditor_Change | .125 | .188* | -.001 | .037 | .071 | .081 | .165 | .116 |
| | (0.93) | (1.70) | (-0.01) | (0.81) | (0.56) | (0.94) | (1.25) | (1.09) |
| **Control variables** | | | | | | | | |
| LEV | .302 | .358 | -.173 | -.08 | .15 | .049 | -.156 | .036 |
| | (0.50) | (1.34) | (-0.69) | (-0.68) | (0.30) | (0.23) | (-0.27) | (0.09) |
| Cap_Int | -.656 | -.618** | .985 | .099 | .381 | -.288 | -.412 | -.38 |
| | (-1.59) | (-2.16) | (1.55) | (0.82) | (0.59) | (-0.91) | (-1.07) | (-1.29) |
| R&D_Int | -.786 | -.665** | -.725* | -.395*** | -1.085 | -1.15*** | -.937 | -.395 |
| | (-1.15) | (-2.44) | (-1.69) | (-2.71) | (-1.48) | (-3.30) | (-1.55) | (-1.02) |
| NOLs | -.024 | .061 | -.102 | .016 | -.144 | .226** | -.003 | .232** |
| | (-0.30) | (1.41) | (-1.05) | (0.38) | (-1.43) | (2.63) | (-0.03) | (2.37) |
| TA | .084 | .102* | -.026 | -.02 | .024 | .015 | .074 | .037 |
| | (1.29) | (1.99) | (-0.76) | (-1.08) | (0.35) | (0.35) | (1.07) | (0.79) |
| FT_Int | -.152 | -.214 | -.043 | -.026 | -.367 | -.348** | -.277 | -.457*** |
| | (-0.61) | (-1.42) | (-0.49) | (-0.37) | (-1.43) | (-2.37) | (-1.04) | (-2.84) |

**Table 5.20 Multivariate analysis of tax management behaviours of the post 2008 sub-sample (POST) (continued)**

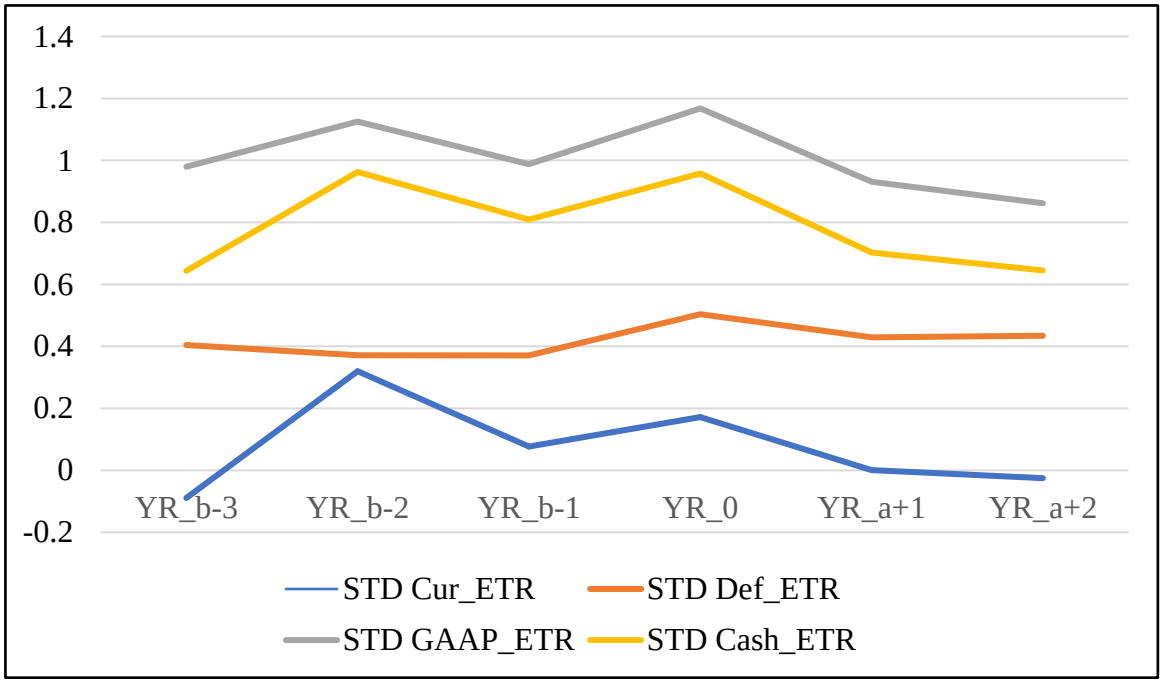
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IA_Int | .435 | .218 | .239 | .019 | .461 | .245 | .604 | .58** |
| | (1.16) | (0.78) | (1.16) | (0.19) | (1.14) | (0.97) | (1.37) | (2.26) |
| ROA | -2.189** | -.628 | -.641 | -.592** | -1.273 | -.513 | -2.845*** | -1.256 |
| | (-2.28) | (-1.07) | (-1.66) | (-2.23) | (-1.36) | (-0.93) | (-2.74) | (-1.58) |
| AP | -.106 | -.115 | -.024 | -.098** | -.002 | -.099 | -.042 | -.037 |
| | (-0.55) | (-0.71) | (-0.22) | (-2.35) | (-0.01) | (-0.81) | (-0.16) | (-0.18) |
| industry | | | | | | | | |
| 3 Consumer Goods | -.857*** | -.586*** | .399** | .165* | -.227 | -.175 | -.798*** | -.578*** |
| | (-3.41) | (-2.78) | (2.11) | (1.77) | (-0.89) | (-1.24) | (-3.80) | (-3.15) |
| 4 Health Care | .022 | .146 | -.012 | -.039 | .092 | -.046 | .361 | .227* |
| | (0.09) | (1.09) | (-0.14) | (-0.75) | (0.39) | (-0.43) | (1.50) | (1.90) |
| 5 Consumer Services | -.018 | .051 | .075 | .05 | .203 | .07 | -.113 | -.234 |
| | (-0.10) | (0.43) | (0.87) | (0.99) | (1.16) | (0.64) | (-0.62) | (-1.68) |
| 7 Utilities | -.752*** | -.815*** | -.01 | .069 | -.629** | -.358*** | -.359* | -.62*** |
| | (-4.13) | (-5.81) | (-0.04) | (1.32) | (-2.69) | (-3.12) | (-1.88) | (-3.18) |
| 9 Technology | .043 | -.047 | .195 | .059 | .032 | -.044 | .332* | .102 |
| | (0.23) | (-0.28) | (1.65) | (0.99) | (0.14) | (-0.32) | (1.76) | (0.56) |
| Constant | .828 | .172 | .446 | .504** | 1.077 | 1.168** | .892 | .958 |
| | (0.87) | (0.25) | (1.10) | (2.03) | (1.13) | (2.13) | (0.93) | (1.42) |
| n | 197 | 180 | 197 | 188 | 197 | 180 | 185 | 169 |
| Adj $R^2$ | 0.2903 | 0.3863 | 0.2489 | 0.1513 | 0.2702 | 0.3369 | 0.2568 | 0.3163 |
| Breusch and Pagan | 66.44*** | 23.45*** | 751.32*** | 115.14*** | 94.61*** | 15.63*** | 51.21*** | 24.68*** |
| Max VIF of test variables | 2.54 | 2.72 | 2.54 | 2.63 | 2.54 | 2.61 | 2.27 | 2.49 |

*** p<.01, ** p<.05, * p<.1

ETR measures are standardised ETRs.

Under each ETR measure the first column is statistic results before identifying influential data, the second column is statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 4 Change in ETR measures of the post 2008 sub-sample (POST)**



significantly change in the IPO process the post 2008 sub-sample shows a lower level of tax management in year b-2. This indicates with additional scrutiny companies have lower tax management levels, they settle outstanding or disputed tax liabilities with tax administration prior to IPO (Gao and Jain 2011; Jain and Kini 2008; Jain and Tabak 2008; Filatotchev and Bishop 2002; Freedman and Stagliano 2002; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). This also supports the hypothesis $H_2^1$ that corporate tax management behaviours during IPO process are different between pre and post 2008 Banking Crisis.

According to the results of table 5.20, the *Cur_ETRs* of the post 2008 sub-sample significantly vary by auditor change. The average *Cur_ETRs* of companies changing auditing firms in the IPO process are higher than that of the companies employing the same auditors, companies employing the same auditors have a higher level of tax management. In line with the opinion of Maydew and Shackelford (2005), if companies change auditors, previous tax management practices may not be approved by new auditors. The *Cur_ETRs* of the post 2008 sub-sample are negatively associated with *Cap_Int* and *R&D_Int*, but positively associated with *TA*, these findings are consistent with the literature, the more intensive capital, higher R&D expenditure, and smaller size a company has, the higher level of tax management it shows (Mills et al 1998; Gaertner 2014; Gupta and Newberry 1997; Lanis and Richardson 2015; Watts and Zimmerman 1978; Zimmerman 1983).

The change in tax deferral engagement reflected by *Def_ETRs* (table 5.15, subsample 2 POST, matrix 14) is consistent with the pre 2008 sub-sample, companies are on average deferring a higher amount of tax liabilities in the year of going public, indicating that in the IPO process managers use tax deferral strategies to reduce tax liabilities (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Dyreng et al 2008). The level of *Def_ETRs* does not vary by listing market (*Market_Dummy*) and auditor change (*Auditor_Change*).

The *GAAP_ETRs* of subsample (2) POST reported in table 5.15 (matrix 15) shows that

if tax management is measured by *GAAP_ETRs* while the pre 2008 sub-sample engage in less tax management in b-2 the post 2008 sub-sample does not significantly change tax management in years prior to IPO. Using *Cash_ETRs* to measure tax management in the pre 2008 period in year b-2 companies engage in less tax management but in year b-1 engage in more tax management (table 5.15 - matrix 12), but in the post 2008 period the level of tax management does not significantly change in years prior to IPO. This is consistent with the hypothesis that tax management behaviours around IPOs are different between the sub-samples of pre and post 2008, for the post 2008 sub-sample with more stringent scrutiny and additional reporting requirements, in IPO preparation and the IPO year companies do not adjust tax positions (Holland et al 2016; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011; Frank et al 2009).

Another difference is that in the pre 2008 period after going public tax management measured by *GAAP_ETRs* does not significantly change between years of IPO, a+1 and a+2 (matrix 11). The tax cash payment of year a+2 is significantly higher than that of IPO year (matrix 12). However, in the post 2008 period after going public both *GAAP_ETRs* and *Cash_ETRs* have a significant decrease in year a+1, the average *GAAP_ETRs* and *Cash_ETRs* of year a+2 are also lower than those of the IPO year, the results indicate once companies successfully go public they engage in a higher level of tax management, this may be because managers intend to increase profits to meet profit targets (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a).

According to table 5.20, for those companies whose all company year ends are in the post 2008 period, the *GAAP_ETRs* are negatively associated with *R&D_Int*, *FT_Int*, positively associated with *NOLs*. The *Cash_ETRs* are positively associated with *NOLs* and *IA_Int*, negatively associated with *FT_Int*. Those findings support prior literature that R&D expenditure, foreign operation, and tax loss carry-forwards provide companies with tax management opportunities (Gupta and Newberry 1997; Lanis and Richardson 2015; Mills et al 1998; Rego 2003; Jacob 1996; Wang 1991; Chen et al 2010; Cheng et al 2012).

#### 5.2.2.4 Tax management on different listing markets

##### 5.2.2.4.1 Pre 2008: AIM and Main Market

In order to investigate tax management behaviours of different listing markets, within each period the sample is further split by type of market. This section discusses tax management behaviours of companies listed on AIM and Main Market in the period of pre 2008. For companies of AIM the full results are reported in table 5.21 with summaries in table 5.14 (subsample 3 PRE_AIM) and table 5.15 (matrices 17 - 20). The number of observations for *Cur_ETR* model is 149, for *Def_ETR* model is 147, for *GAAP_ETR* model is 148, for *Cash_ETR* model is 137. Regarding the explanation power of the models, according to the values of adjusted $R^2$ the models can explain 55.73% of the variance in *Cur_ETRs*, 51.17% of the variance in *Def_ETRs*, 36.44% of the variance in *GAAP_ETRs* and 45.33% of the variance in *Cash_ETRs*. The BP test is significant for *Cur_ETR*, *Def_ETR* and *Cash_ETR* models, thus, for those models heteroscedastic-robust standard errors are applied.

An investigation of the *Cur_ETRs* matrix reported in table 5.15 subsample PRE_AIM (matrix 17) shows that the change in the coefficients of *Cur_ETRs* between sequent years is not significant, the level of tax management measured by *Cur_ETRs* does not significantly change around IPOs. The average *Def_ETR* (matrix 18) in b-1 is significantly higher than that of b-2 and b-3, suggesting that one year prior to IPO companies defer a higher amount of tax liabilities to the future, reflecting the hypothesis that in the IPO process managers increase the level of tax management (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Lanis and Richardson 2011). Because the coefficients of *GAAP_ETRs* (matrix 19) do not significantly vary from year b-3 to a+2, using *GAAP_ETRs* as the proxy for tax management the level of tax management does not significantly change in the IPO process. Using *Cash_ETRs* to measure tax management, however, the tax management has significant changes (matrix 20). In

**Table 5. 21 Multivariate analysis of tax management behaviours of pre 2008, AIM (PRE_AIM)**

| **Dependent variables** | ***Cur_ETR*** | | ***Def_ETR*** | | ***GAAP_ETR*** | | ***Cash_ETR*** | |
|---|---|---|---|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| YR_a+2 | .043 | -.074 | -.128 | -.06 | -.006 | -.153 | .234 | .181 |
| | (0.25) | (-0.57) | (-1.56) | (-1.08) | (-0.03) | (-1.09) | (1.53) | (1.34) |
| YR_a+1 | -.14 | -.11 | -.059 | .014 | -.129 | -.100 | .137 | .16 |
| | (-1.04) | (-1.10) | (-1.03) | (0.27) | (-0.93) | (-0.92) | (1.01) | (1.45) |
| YR_b-1 | .088 | .086 | .077 | -.036 | .253* | .092 | .237* | .296** |
| | (1.00) | (1.11) | (0.69) | (-0.87) | (1.71) | (1.01) | (1.73) | (2.44) |
| YR_b-2 | .191 | .12 | -.037 | -.116** | .19 | .092 | .675*** | .532** |
| | (1.63) | (1.31) | (-0.36) | (-2.08) | (1.38) | (0.79) | (2.76) | (2.72) |
| YR_b-3 | .22 | .164 | -.086 | -.125*** | .205 | .034 | .19 | .168 |
| | (1.35) | (1.14) | (-0.95) | (-2.88) | (1.07) | (0.24) | (0.84) | (1.07) |
| Auditor_Change | -.288** | -.332*** | -.027 | .001 | -.342** | -.306** | -.259* | -.234* |
| | (-2.15) | (-3.10) | (-0.37) | (0.02) | (-2.23) | (-2.47) | (-1.89) | (-1.89) |
| **Control variables** | | | | | | | | |
| LEV | -.767* | -.435 | -.331 | .277* | -.977 | -.154 | -.505 | -.373 |
| | (-1.76) | (-1.14) | (-0.63) | (1.87) | (-1.62) | (-0.34) | (-0.91) | (-0.80) |
| Cap_Int | -.688 | -.947*** | .759*** | .391*** | .038 | -.223 | -.879** | -1.206*** |
| | (-1.64) | (-3.39) | (4.38) | (3.57) | (0.11) | (-0.86) | (-2.28) | (-4.85) |
| R&D_Int | -1.028*** | -1.176*** | -.272 | -.159** | -1.234*** | -1.049*** | -.531** | -.636*** |
| | (-4.80) | (-6.61) | (-0.98) | (-2.24) | (-3.82) | (-3.98) | (-2.68) | (-4.00) |
| NOLs | .078** | .067* | -.081 | -.054 | -.026 | .022 | .095*** | .043* |
| | (2.05) | (1.72) | (-1.15) | (-1.43) | (-0.37) | (0.50) | (3.07) | (1.93) |
| TA | .074 | .118* | .044 | .01 | .132* | .127** | -.03 | .097 |
| | (1.04) | (1.96) | (1.07) | (0.71) | (1.71) | (2.32) | (-0.36) | (1.37) |
| FT_Int | .133 | -.021 | -.05 | 0.00 | .129 | -.059 | .058 | -.101 |
| | (0.52) | (-0.10) | (-0.48) | (0.00) | (0.53) | (-0.30) | (0.19) | (-0.49) |

**Table 5.21 Multivariate analysis of tax management behaviours of pre 2008, AIM (PRE_AIM) (continued)**

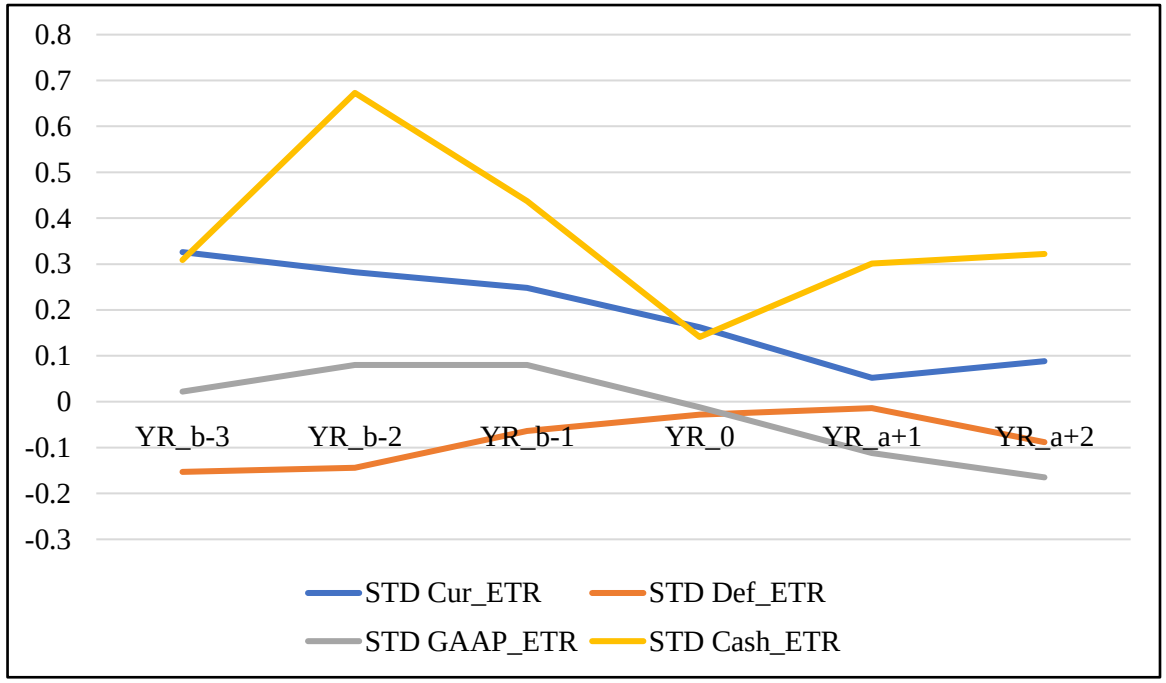
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IA_Int | 1.092* | .855** | .301* | -.092 | 1.221** | .571 | .787 | .022 |
| | (1.97) | (2.29) | (1.76) | (-0.95) | (2.07) | (1.54) | (1.51) | (0.07) |
| ROA | -1.281* | -.791 | -.233 | -.195 | -.927 | -.424 | -1.709** | -1.261** |
| | (-1.77) | (-1.34) | (-1.19) | (-1.54) | (-1.25) | (-0.72) | (-2.35) | (-2.56) |
| AP | -.088 | -.197 | 0.00 | .039 | -.147 | -.18 | .124 | -.22 |
| | (-0.33) | (-1.57) | (0.00) | (0.75) | (-0.50) | (-1.13) | (0.40) | (-1.47) |
| industry | | | | | | | | |
| 2 Industrials | .755* | N/A | .386** | N/A | 1.063** | N/A | .789* | .062 |
| | (1.74) | | (2.16) | | (2.32) | | (1.69) | (0.20) |
| 3 Consumer Goods | .556 | -.186 | .267 | -.108 | .767 | -.297** | .542 | -.193 |
| | (1.20) | (-1.41) | (1.52) | (-1.42) | (1.57) | (-2.30) | (1.04) | (-0.57) |
| 4 Health Care | .162 | -.227 | .634** | .019 | .769** | .043 | -.281 | -.418* |
| | (0.55) | (-0.96) | (2.65) | (0.36) | (2.15) | (0.18) | (-0.91) | (-1.99) |
| 5Consumer Services | .799* | .021 | .502** | .061* | 1.222** | .04 | .709 | .133 |
| | (1.93) | (0.14) | (2.50) | (1.89) | (2.69) | (0.24) | (1.59) | (0.45) |
| 6 Telecommunications | .521 | -.25* | .25 | -.046 | .681 | -.342** | .627 | .008 |
| | (1.12) | (-1.99) | (1.11) | (-0.86) | (1.28) | (-2.06) | (1.22) | (0.02) |
| 9 Technology | .76* | .071 | .456** | -.016 | .972** | -.055 | .374 | -.245 |
| | (1.87) | (0.52) | (2.20) | (-0.36) | (2.39) | (-0.37) | (0.81) | (-0.86) |
| Constant | -.212 | .162 | -.813* | -.028 | -1.231* | -.012 | .683 | .141 |
| | (-0.36) | (0.29) | (-1.81) | (-0.24) | (-1.80) | (-0.02) | (1.04) | (0.23) |
| n | 160 | 149 | 160 | 147 | 160 | 148 | 145 | 137 |
| Adj $R^2$ | 0.4421 | 0.5573 | 0.3952 | 0.5117 | 0.3484 | 0.3644 | 0.3985 | 0.4533 |
| Breusch and Pagan | 26.45*** | 4.33** | 244.36*** | 71.92*** | 40.32*** | 2.03 | 24.68*** | 14.07*** |
| Max VIF of test variables | 1.99 | 1.90 | 1.99 | 2.04 | 1.99 | 1.89 | 2.03 | 1.89 |

*** p<.01, ** p<.05, * p<.1

ETR measures are standardised ETRs.

Under each ETR measure the first column is statistic results before identifying influential data, the second column is statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 5 Change in ETR measures of pre 2008, AIM (PRE_AIM)**



year b-2 there is a higher level of cash tax payment, indicating with increased scrutiny the consequences of tax management are more uncertain, in year b-2 managers consider that the risks of tax management are more than benefits, they are likely to pay outstanding or disputed tax charges in the second year prior to going public (Gao and Jain 2011; Jain and Kini 2008; Jain and Tabak 2008; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). In the IPO year *Cash_ETRs* have a significant decrease, there is a higher level of tax management, this is likely to because of managers' incentives to increase cash flows to signal firm value (Francis et al 2014; Rego and Wilson 2012; Spence 1973).

Regarding the association between ETR measures and test variables of reporting period (*Account_Year*), listing market (*Market_Dummy*) and auditor changes (*Auditor_Change*), according to table 5.21 which is the individual table of subsample (3) PRE_AIM, *Cur_ETRs*, *GAAP_ETRs* and *Cash_ETRs* are negatively associated with auditor change, this means that for IPO companies listed on AIM, those companies employing the same auditing firms have higher ETRs than companies changing auditors, companies employing the same auditors in the whole IPO period engage in less tax management, for these companies the auditing firms play a monitoring role (Titman and Trueman 1986; Datar et al 1991; Beatty 1989; Michaely and Shaw 1995). Regarding the association between ETR measures and firm characteristics, *Cur_ETRs* of subsample (3) PRE_AIM are negatively associated with *Cap_Int*, *R&D_Int*, positively associated with *NOLs*, *TA*, and *IA_Int*, the findings are keeping with the conclusions that the more fixed assets, higher R&D expenditure, more tax loss carry-forwards, smaller size for a company, the higher level of tax management it has (Mills et al 1998; Gaertner 2014;Gupta and Newberry 1997; Lanis and Richardson 2015; Wang 1991; Chen et al 2010; Watts and Zimmerman 1978; Zimmerman 1983). *Def_ETRs* are positively associated with *LEV*, *Cap_Int*, negatively associated with *R&D_Int*. The positive association between *Def_ETRs* and *Cap_Int* supports the literature that due to capital allowance, companies with more fixed assets can defer a higher amount of taxes (Mills et al 1998; Gaertner 2014; Stickney and McGee 1982). *GAAP_ETRs* are negatively associated with *R&D_Int*, positively

associated with *TA*. *Cash_ETRs* are negatively associated with *Cap_Int*, *R&D_Int*, *ROA*, positively associated with *NOLs*. Those conclusions are consistent with prior studies, the more R&D expenditure, tangible assets and tax loss carry-forwards, higher profitability, smaller size a company has, the more likely for it to conduct tax management (Gupta and Newberry 1997; Zimmerman 1983; Mills et al 1998; Rego 2003; Wang 1991).

Regarding the results of Main Market, according to table 5.14 subsample (4) PRE_MM the number of observations is very small (the observations for all models are less than 40), resulting the VIF values are very high, the maximum value is even more than 73.53 (table 5.22), the models have serious multicollinearity issue that could bias the results. For completeness of the study the tables are reported but because of the small sample size the results are not discussed.

**5.2.2.4.2 Post 2008: AIM and Main Market**

This section discusses tax management of companies listed on AIM and Main Market in the post 2008 period. The full results of companies listed on AIM are reported in table 5.23 with summaries in table 5.14 (subsample 5 POST_AIM) and table 5.15 (matrices 25 - 28). The number of observations for *Cur_ETR* model is 112, for *Def_ETR* model is 116, for *GAAP_ETR* model is 115 and for *Cash_ETR* model is 108. Indicated by adjusted $R^2$ for subsample POST_AIM the estimated models can explain 57.71% of the variance in *Cur_ETRs*, 26.67% of the variance in *Def_ETRs*, 47.33% of the variance in *GAAP_ETRs* and 42.09% of the variance in *Cash_ETRs*. The maximum VIF values for estimated models are 2.97, 2.92, 2.86, 2.74 (table 5.23), respectively, the models do not have multicollinearity issues.

The tests of significance for *Cur_ETRs* is summarised in table 5.15 matrix 25. The average *Cur_ETR* in year b-2 is significantly higher than that of year b-3, suggesting that in the second year prior to IPO companies engage in less tax management consistent with anticipating increased scrutiny (Branswijck and Everaert 2012). In years b-1 and IPO year the level of *Cur_ETR* does not significantly change,

**Table 5. 22 Multivariate analysis of tax management behaviours of pre 2008, Main Market (PRE_MM)**

| **Dependent variables** | ***Cur_ETR*** | | ***Def_ETR*** | | ***GAAP_ETR*** | | ***Cash_ETR*** | |
|---|---|---|---|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| YR_a+2 | -1.395** | -1.954*** | 1.124*** | -.168 | -.134 | -.671 | .482* | -.45 |
| | (-3.20) | (-6.60) | (3.83) | (-0.54) | (-0.23) | (-0.33) | (1.84) | (-1.23) |
| YR_a+1 | -1.241*** | -1.863*** | 1.204*** | -.082 | -.015 | -.49 | .424 | -.593 |
| | (-3.62) | (-7.92) | (4.36) | (-0.20) | (-0.04) | (-0.24) | (0.98) | (-1.83) |
| YR_b-1 | -.428 | -.349* | .214 | .079 | .144 | .251 | -.881** | -.549 |
| | (-0.69) | (-2.14) | (0.56) | (0.18) | (0.35) | (0.43) | (-2.49) | (-1.35) |
| YR_b-2 | -.045 | -.106 | .664 | .274 | .702 | 1.024** | -.699 | -.823* |
| | (-0.07) | (-0.21) | (1.46) | (0.63) | (1.27) | (2.48) | (-1.35) | (-1.93) |
| YR_b-3 | .641 | 0 (omitted)[17] | -.366 | 3.325 | .503 | 0 (omitted) | 1.047 | 1.409* |
| | (0.73) | | (-0.57) | (1.45) | (0.68) | | (1.57) | (1.93) |
| Auditor_Change | .449 | .629*** | -.429 | -.501 | .313 | .111 | -.186 | .342 |
| | (0.89) | (3.95) | (-1.15) | (-1.31) | (0.67) | (0.34) | (-0.34) | (1.48) |
| **Control variables** | | | | | | | | |
| LEV | .04 | .904** | -1.404* | -.906 | -1.367** | -.68 | 1.833** | 1.275* |
| | (0.07) | (2.58) | (-1.90) | (-1.08) | (-2.67) | (-0.73) | (2.41) | (1.98) |
| Cap_Int | -.405 | -1.906 | 2.41 | 2.041 | 1.727 | .751 | -3.869** | -3.634 |
| | (-0.17) | (-1.36) | (1.24) | (1.61) | (1.03) | (0.39) | (-2.55) | (-1.48) |
| R&D_Int | -.573 | -2.418* | 1.681** | 1.88*** | .499 | -.717 | 2.561* | 1.231 |
| | (-0.75) | (-1.93) | (3.00) | (4.25) | (0.40) | (-0.52) | (1.98) | (0.55) |
| NOLs | -.046 | -.111 | .08 | .458 | .011 | .154 | .278** | .142** |
| | (-0.39) | (-1.49) | (1.54) | (1.76) | (0.09) | (0.29) | (2.91) | (2.64) |
| TA | .319 | .216 | -.12 | -.05 | .256 | .094 | -.001 | .246 |
| | (1.60) | (0.93) | (-0.62) | (-0.23) | (0.83) | (0.19) | (-0.00) | (0.96) |
| FT_Int | 2.637** | 1.795** | .946 | .17 | 2.456** | 2.585 | -1.737** | -.993 |
| | (2.87) | (2.31) | (1.68) | (0.31) | (2.85) | (1.32) | (-2.46) | (-0.43) |

[17] YR_b-3 omitted because of collinearity

**5.22 Multivariate analysis of tax management behaviours of pre 2008, Main Market (PRE_MM) (continued)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IA_Int | 1.727** | 1.014** | -.149 | -.004 | 1.259* | 1.694 | .748 | 1.125* |
| | (2.32) | (2.44) | (-0.16) | (-0.01) | (1.94) | (1.33) | (0.64) | (1.86) |
| ROA | 3.362 | 4.747* | -5.233** | -3.454 | -.839 | .25 | -.378 | 2.145 |
| | (1.40) | (2.21) | (-2.65) | (-1.62) | (-0.41) | (0.11) | (-0.13) | (1.77) |
| AP | .751 | 1.566*** | -1.237** | 0 (omitted) | -.344 | .226 | -.795 | 0 (omitted) |
| | (1.30) | (3.51) | (-3.25) | | (-0.54) | (0.10) | (-1.26) | |
| industry | | | | | | | | |
| 3 Consumer Goods | -.979* | -.427 | -.215 | -.214 | -.949 | -.725 | -.691 | -.59** |
| | (-2.17) | (-1.67) | (-0.34) | (-0.48) | (-1.41) | (-1.41) | (-0.92) | (-2.52) |
| 5ConsumerServices | 1.295 | 2.201 | -2.038 | -1.856 | -.381 | .06 | 2.864* | 2.884 |
| | (0.71) | (1.78) | (-1.49) | (-1.76) | (-0.30) | (0.04) | (1.92) | (1.81) |
| 6 Telecommunications | -1.535 | N/A | 3.88*** | 2.745* | 1.847 | .984 | -2.034 | -2.553*** |
| | (-1.19) | | (3.78) | (1.90) | (1.75) | (0.67) | (-1.30) | (-4.00) |
| 9 Technology | .535 | .394** | -.373 | -.353 | .297 | -.242 | -.13 | -.035 |
| | (1.47) | (2.33) | (-1.10) | (-1.31) | (0.89) | (-0.66) | (-0.32) | (-0.20) |
| Constant | -3.79 | -2.806 | 2.628 | 1.578 | -2.197 | -.556 | 1.376 | -2.178 |
| | (-1.61) | (-0.99) | (1.23) | (0.60) | (-0.63) | (-0.11) | (0.29) | (-0.78) |
| n | 44 | 34 | 44 | 36 | 44 | 33 | 43 | 37 |
| Adj $R^2$ | 0.4741 | 0.7751 | 0.6587 | 0.6944 | 0.5117 | 0.6957 | 0.5947 | 0.7185 |
| Breusch and Pagan | 15.92*** | 0.20 | 11.05*** | 5.24** | 0.62 | 0.00 | 6.30** | 0.76 |
| Max VIF of test variables | 12.65 | 18.65 | 12.65 | 45.51 | 12.65 | 73.53 | 12.78 | 5.72 |

*** p<.01, ** p<.05, * p<.1

ETR measures are standardised ETRs.

Under each ETR measure the first column is statistic results before identifying influential data, the second column is statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 6 Change in ETR measures of pre 2008, Main market (PRE_MM)**

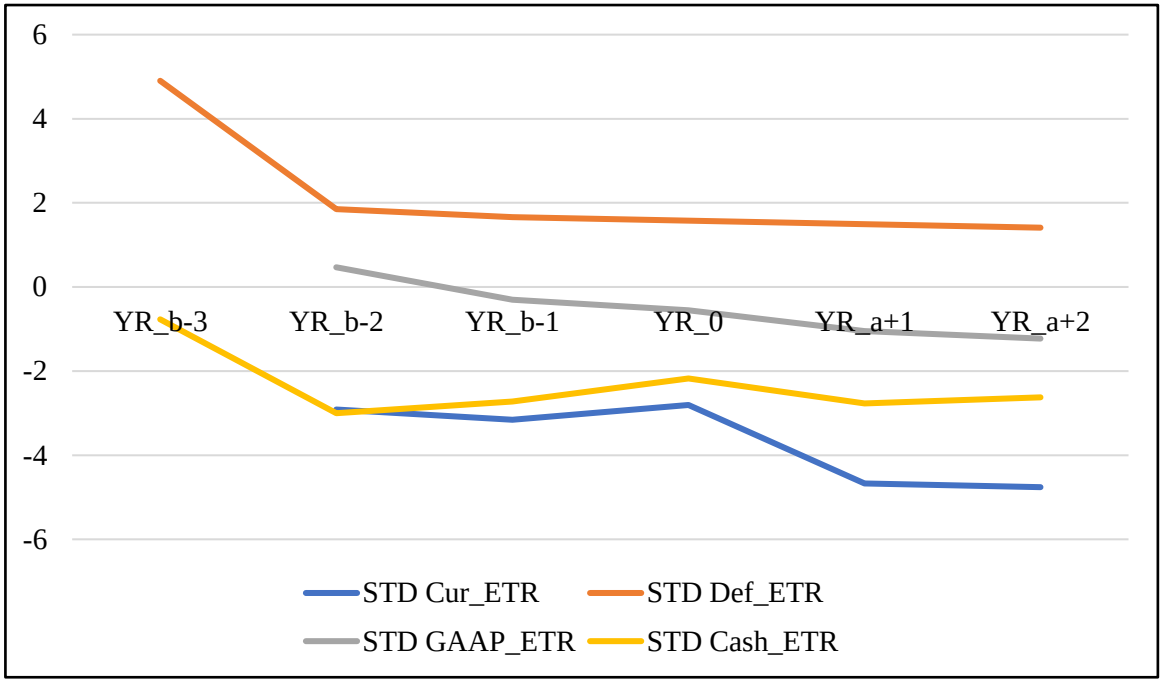


**Table 5. 23 Multivariate analysis of tax management behaviours of post 2008, AIM (POST_AIM)**

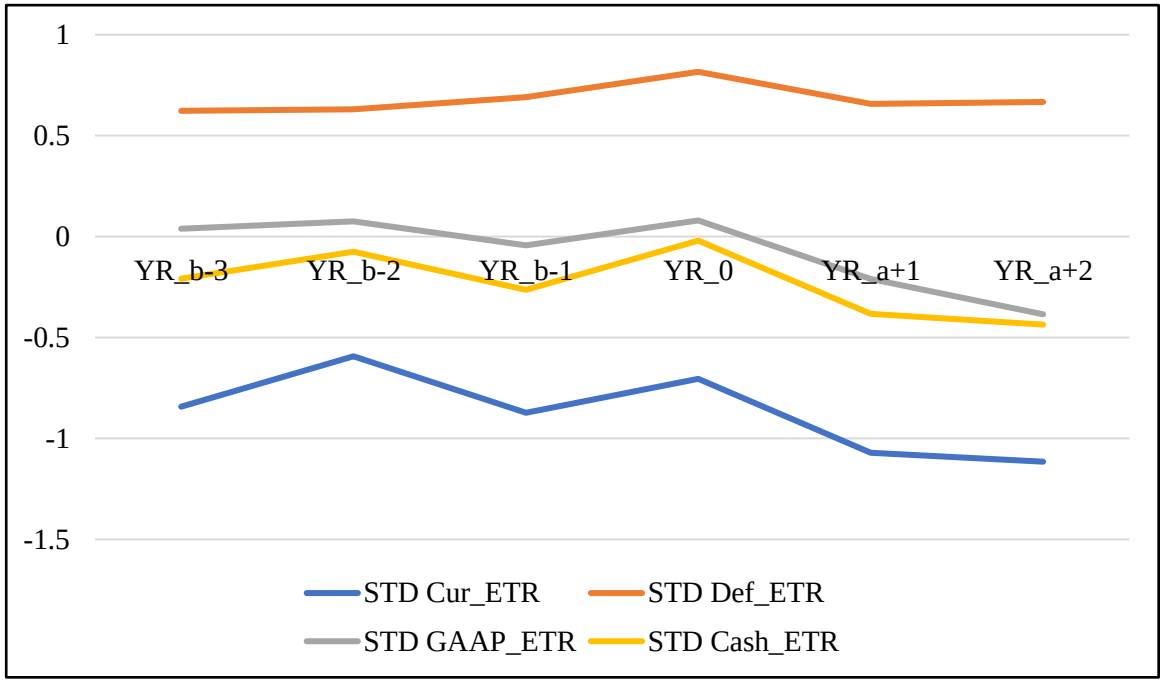
| **Dependent variables** | ***Cur_ETR*** | | ***Def_ETR*** | | ***GAAP_ETR*** | | ***Cash_ETR*** | |
|---|---|---|---|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| YR_a+2 | -.826*** | -.41** | -.378* | -.149 | -.943*** | -.465*** | -.602 | -.416** |
| | (-2.82) | (-2.33) | (-2.04) | (-1.40) | (-3.60) | ( -3.04) | (-1.54) | (-2.23) |
| YR_a+1 | -.705** | -.366** | -.435** | -.159 | -.83*** | -.29** | -.741** | -.362** |
| | (-2.28) | (-2.49) | (-2.16) | (-1.51) | (-2.83) | (-2.30) | (-2.58) | (-2.31) |
| YR_b-1 | -.477 | -.167 | -.1 | -.126 | -.386 | -.123 | -.55 | -.244 |
| | (-1.67) | (-0.87) | (-0.64) | (-1.56) | (-1.37) | (-0.72) | (-1.51) | (-1.02) |
| YR_b-2 | -.076 | .112 | -.288 | -.186 | -.267 | -.004 | -.304 | -.055 |
| | (-0.22) | (0.59) | (-1.53) | (-1.59) | (-0.90) | (-0.02) | (-0.68) | (-0.18) |
| YR_b-3 | -.487 | -.138 | -.164 | -.193 | -.461 | -.041 | -.724 | -.189 |
| | (-1.10) | (-0.56) | (-0.96) | (-1.30) | (-1.25) | (-0.20) | (-1.39) | (-0.56) |
| Auditor_Change | .071 | .184 | .138 | .152 | .219 | .141 | .066 | .082 |
| | (0.39) | (1.18) | (1.07) | (1.36) | (1.24) | (1.03) | (0.37) | (0.59) |
| **Control variables** | | | | | | | | |
| LEV | .443 | .504 | -.505 | -.511* | -.275 | .231 | -.072 | .849 |
| | (0.87) | (1.22) | (-1.36) | (-2.04) | (-0.46) | (0.70) | (-0.11) | (1.24) |
| Cap_Int | -.885** | -.547 | 1.326 | .28 | .558 | -.151 | -.664 | -.297 |
| | (-2.12) | (-1.53) | (1.66) | (1.20) | (0.79) | (-0.49) | (-1.70) | (-0.83) |
| R&D_Int | -.767* | -1.101** | -1.167* | -.746 | -1.448* | -.717** | -.91*** | -.281 |
| | (-1.70) | (-2.63) | (-1.70) | (-1.53) | (-1.80) | (-2.21) | (-2.78) | (-0.90) |
| NOLs | .065 | .057** | -.175 | .039 | -.122 | .003 | .147*** | .08** |
| | (1.64) | (2.43) | (-1.42) | (0.66) | (-0.89) | (0.05) | (4.19) | (2.26) |
| TA | .103 | .176*** | -.002 | -.04 | .053 | .099** | -.005 | .106 |
| | (1.66) | (3.21) | (-0.04) | (-1.65) | (0.66) | (2.11) | (-0.07) | (1.31) |

**Table 5.23 Multivariate analysis of tax management behaviours of post 2008, AIM (POST_AIM) (continued)**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FT_Int | -.352 | -.12 | .072 | -.034 | -.329 | -.183 | -.676** | -.209 |
| | (-1.18) | (-0.55) | (0.39) | (-0.23) | (-1.31) | (-1.04) | (-2.34) | (-0.89) |
| IA_Int | .392 | .42 | .318 | -.03 | .451 | .209 | .756 | .658 |
| | (0.88) | (1.31) | (1.07) | (-0.24) | (0.89) | (0.76) | (1.11) | (1.55) |
| ROA | -2.057* | -.707 | -.645 | -.783** | -1.592 | -.189 | -3.435*** | -.727 |
| | (-1.96) | (-0.96) | (-1.10) | (-2.32) | (-1.37) | (-0.30) | (-2.94) | (-0.76) |
| AP | .119 | .114 | -.084 | -.18** | .002 | .033 | .029 | .181 |
| | (0.50) | (0.62) | (-0.50) | (-2.61) | (0.01) | (0.23) | (0.09) | (0.78) |
| industry | | | | | | | | |
| 3 Consumer Goods | -1.052*** | -.71*** | .443 | .257 | -.359 | -.459** | -.932*** | -.909*** |
| | (-3.64) | (-3.75) | (1.43) | (1.56) | (-0.95) | (-2.25) | (-3.54) | (-3.56) |
| 4 Health Care | -.099 | -.008 | -.137 | -.132 | -.232 | -.157 | .61** | .112 |
| | (-0.34) | (-0.04) | (-0.78) | (-1.09) | (-0.93) | (-0.89) | (2.21) | (0.59) |
| 5 Consumer Services | -.082 | .034 | .034 | .036 | .064 | .029 | -.319 | -.353* |
| | (-0.37) | (0.25) | (0.28) | (0.62) | (0.29) | (0.25) | (-1.42) | (-1.82) |
| 7 Utilities | -.898*** | -.943*** | -.036 | .196** | -.792** | -.465** | -.54** | -.5 |
| | (-3.43) | (-5.44) | (-0.11) | (2.27) | (-2.28) | (-2.53) | (-2.62) | (-1.65) |
| 9 Technology | .107 | -.377 | .311 | .206* | -.151 | -.319 | .366 | -.343 |
| | (0.33) | (-1.23) | (1.38) | (1.81) | (-0.38) | (-1.26) | (1.15) | (-0.99) |
| Constant | .806 | -.705 | .185 | .816** | 1.064 | .08 | 2.22** | -.02 |
| | (0.81) | (-0.93) | (0.28) | (2.19) | (0.95) | (0.12) | (2.08) | (-0.02) |
| n | 122 | 112 | 122 | 116 | 122 | 115 | 115 | 108 |
| Adj $R^2$ | 0.4096 | 0.5771 | 0.3646 | 0.2667 | 0.3428 | 0.4733 | 0.3600 | 0.4209 |
| Breusch and Pagan | 49.25*** | 16.72*** | 352.15*** | 94.54*** | 66.67*** | 4.74** | 37.04*** | 17.47*** |
| Max VIF of test variables | 2.80 | 2.97 | 2.80 | 2.92 | 2.80 | 2.86 | 2.58 | 2.74 |

*** p<.01, ** p<.05, * p<.1 ETR measures are standardised ETRs. Under each ETR measure the first column is statistic results before identifying influential data, the second column is statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 7 Change in ETR measures of post 2008, AIM (POST_AIM)**



indicating no significant change in tax management. Post IPO *Cur_ETRs* have significant decrease, the *Cur_ETRs* in years a+1 and a+2 are significantly lower than that in IPO year, there is a higher level of tax management post IPO. This reflects managers' incentives to achieve profits target by engaging in more tax management to reduce tax expense (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). For companies all testing periods are in the years post 2008 and issuing shares on AIM, the *Cur_ETRs* do not significantly vary by auditor changes (table 5.23). They are negatively associated with *R&D_Int*, positively associated with *NOLs* and *TA*. Consistent with prior literature, for companies with higher R&D expenditure, more tax loss carry-forwards and smaller size there is a higher level of tax management (Lanis and Richardson 2015; Berger 1993; Gaertner 2014; Wang 1991; Chen et al 2010; Watts and Zimmerman 1978; Zimmerman 1983).

The difference between all coefficients of *Def_ETRs* is not statistically significant, indicating no change in tax deferral around IPOs (table 5.15 - subsample 5 POST_AIM - matrix 26). The change in auditors does not have a significant association with the level of *Def_ETRs* (table 5.23).

The change in the level of tax management measured by *GAAP_ETRs* and *Cash_ETRs* is consistent. Prior to IPO there is no significant change in tax management behaviours because the difference between all coefficients is not significant. After going public, however, *GAAP_ETRs* and *Cash_ETRs* in years a+1 and a+2 are significantly lower than those in IPO year. This suggests after going public companies engage in more tax management to reduce total tax charge and cash tax payments, in those years decision makers place more importance on the benefits of tax management rather than its risks (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). It explains the previous finding that post 2008 the *GAAP_ETRs* and *Cash_ETRs* are managed downwards after going public (subsample 2 POST) is primarily caused by IPO companies floating on AIM. This suggests there should be more scrutiny on corporate tax management behaviours of companies listed on AIM, in addition, investors make investment on AIM should consider the risks of tax management (Francis et al 2014;

Rego and Wilson 2012; Graham et al 2014; Wahab and Holland 2012; Holland et al 2016; Matsunaga et al 1992; Mills 1998; Dhaliwal et al 1994; Desai and Dharmapala 2005).

According to the individual table of sub-sample (5) POST_AIM (table 5.23), the average *GAAP_ETR* and *Cash_ETR* do not significantly vary by auditor changes (*Auditor_Change*). Consistent with literature *GAAP_ETRs* are negatively associated with *R&D_Int*, positively associated with *TA*. *Cash_ETRs* are positively associated with *NOLs*. The findings align with the literature that companies having higher R&D expenditure, smaller size, more tax loss carry-forwards engage in more tax management (Gupta and Newberry 1997; Lanis and Richardson 2015; Zimmerman 1983; Wang 1991; Chen et al 2010).

If the sample is companies subject to the scrutiny of the post 2008 period and listed on Main Market, the full results are reported in table 5.24 with summaries in table 5.14 (subsample 6 POST_MM) and table 5.15 (matrices 29-32). The number of observations for *Cur_ETR* model is 68, for *Def_ETR* model is 67, for *GAAP_ETR* model is 66, for *Cash_ETR* model is 63. Indicated by adjusted $R^2$ values the estimated models explain 74.20% of the variance in *Cur_ETRs*, 41.48% of the variance in *Def_ETRs*, 67.75% of the variance in *GAAP_ETRs* and 66.51% of the variance in *Cash_ETRs*. The VIF values are acceptable (table 5.24), for *Cur_ETR*, *Def_ETR*, *GAAP_ETR* and *Cash_ETR* models the VIF values are 3.68, 4.27, 4.33, 4.29, respectively.

The investigation of the *Cur_ETR* matrix reported in table 5.15 (matrix 29) shows that in b-2 *Cur_ETRs* have a significant increase, consistent with companies listed on AIM, in b-2 companies listed on Main Market have a higher level of current tax charge. This reflects the hypothesis that companies engage in less tax management consistent with anticipating increased scrutiny and risks (Branswijck and Everaert 2012; Gao and Jain 2011; Jain and Kini 2008; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). From b-1 to a+1 tax management does not have significant change. After going public, while

**Table 5. 24 Multivariate analysis of tax management behaviours of post 2008, Main Market (POST_MM)**

| **Dependent variables** | ***Cur_ETR*** | | ***Def_ETR*** | | ***GAAP_ETR*** | | ***Cash_ETR*** | |
|---|---|---|---|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| YR_a+2 | .003 | .227 | .097 | .001 | .191 | .287** | -.182 | .272* |
| | (0.01) | (1.58) | (1.12) | (0.02) | (0.58) | (2.81) | (-0.52) | (1.97) |
| YR_a+1 | -.23 | -.089 | .079 | .074 | -.096 | .107 | -.297 | .081 |
| | (-0.50) | (-0.57) | (1.46) | (1.60) | (-0.24) | (0.97) | (-0.89) | (0.54) |
| YR_b-1 | -.106 | .001 | .019 | .006 | -.041 | -.103 | .156 | .261* |
| | (-0.35) | (0.01) | (0.15) | (0.08) | (-0.14) | (-0.63) | (0.62) | (1.82) |
| YR_b-2 | -.043 | .233 | .099 | .064 | .05 | .04 | .074 | .756** |
| | (-0.12) | (0.82) | (0.67) | (0.73) | (0.17) | (0.34) | (0.21) | (2.65) |
| YR_b-3 | -.112 | -.122 | .195 | .172* | .239 | -.138 | -.198 | .074 |
| | (-0.24) | (-0.44) | (0.93) | (1.80) | (0.58) | (-0.71) | (-0.60) | (0.36) |
| Auditor_Change | .387 | -.059 | .115 | .149* | .21 | -.278* | -.099 | -.38 |
| | (0.80) | (-0.17) | (0.89) | (1.94) | (0.62) | (-1.67) | (-0.26) | (-1.64) |
| **Control variables** | | | | | | | | |
| LEV | .296 | -.326 | .193 | .303*** | .819 | .463 | -.259 | .001 |
| | (0.53) | (-0.77) | (1.53) | (4.39) | (1.60) | (1.39) | (-0.46) | (0.01) |
| Cap_Int | .715 | .626 | -1.697** | -.549 | -.377 | -1.084 | 4.31** | 3.035* |
| | (0.36) | (0.42) | (-2.22) | (-1.57) | (-0.26) | (-1.59) | (2.31) | (1.85) |
| R&D_Int | .668 | -3.26** | -.127 | 1.323** | .026 | -3.417*** | 1.333 | -1.62 |
| | (0.27) | (-2.31) | (-0.29) | (2.55) | (0.01) | (-5.08) | (0.75) | (-1.04) |
| NOLs | -.331*** | -.375*** | .025 | .003 | -.313*** | -.649*** | -.32*** | -.133 |
| | (-5.12) | (-7.30) | (1.50) | (0.34) | (-5.48) | (-3.10) | (-6.27) | (-0.68) |
| TA | -.071 | -.126 | -.048 | .033 | -.204 | -.243*** | .068 | -.068 |
| | (-0.46) | (-1.54) | (-0.89) | (0.91) | (-1.73) | (-5.02) | (0.61) | (-0.71) |
| FT_Int | 1.904*** | 1.752*** | -.235 | -.247** | 1.287*** | .728** | .849 | 1.686*** |
| | (4.14) | (5.41) | (-1.28) | (-2.80) | (3.06) | (2.53) | (1.52) | (3.22) |

**Table 5.24 Multivariate analysis of tax management behaviours of post 2008, Main Market (POST_MM) (continued)**

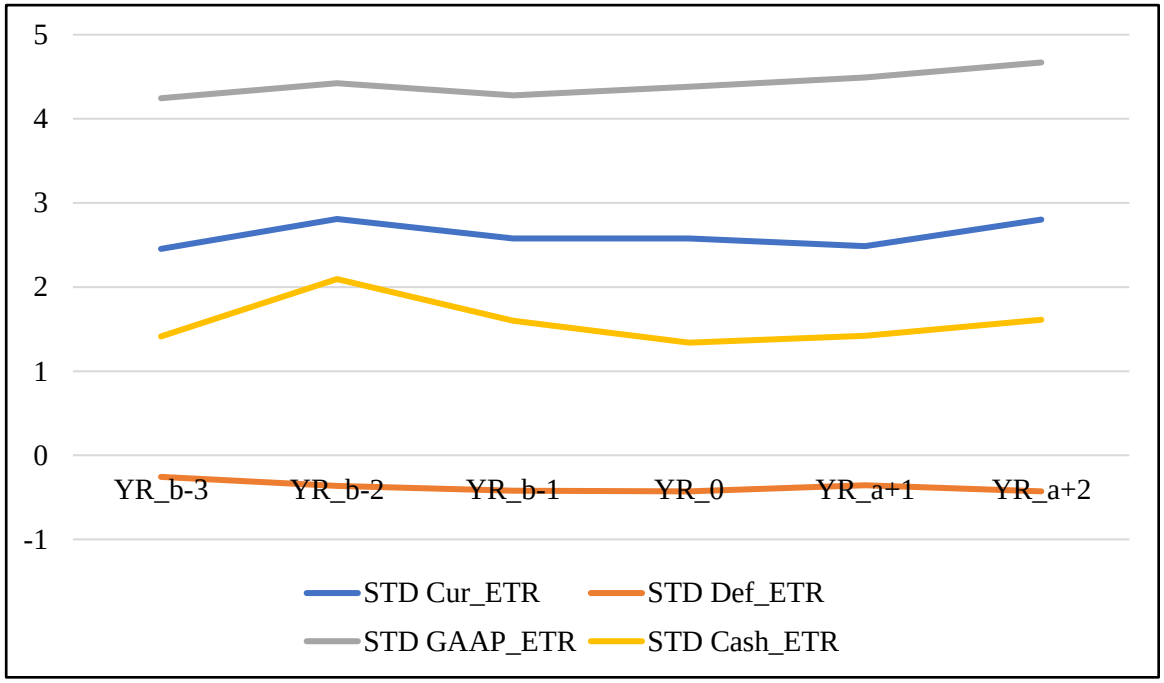
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IA_Int | .366 | .226 | -.079 | -.243* | -.177 | -.239 | .61 | -.07 |
| | (0.41) | (0.45) | (-0.55) | (-1.93) | (-0.23) | (-0.48) | (0.66) | (-0.24) |
| ROA | -4.521 | -2.616** | -.322 | .543 | -4.135 | -1.76 | -2.046 | -2.471* |
| | (-1.47) | (-2.13) | (-0.53) | (1.44) | (-1.59) | (-1.70) | (-0.94) | (-1.77) |
| AP | -.136 | -.153 | -.027 | .037 | .13 | .033 | -.089 | .077 |
| | (-0.61) | (-0.58) | (-0.24) | (0.47) | (0.45) | (0.16) | (-0.23) | (0.23) |
| industry | | | | | | | | |
| 3 Consumer Goods | .309 | .069 | -.087 | -.054 | .412 | -.116 | .448 | .159 |
| | (0.47) | (0.19) | (-0.49) | (-0.48) | (0.77) | (-0.48) | (0.78) | (0.50) |
| 4 Health Care | 1.395*** | .69 | -.324 | .029 | .837*** | -.275 | 1.117** | .712** |
| | (3.13) | (1.73) | (-1.72) | (0.29) | (3.04) | (-1.50) | (2.78) | (2.53) |
| 5ConsumerServices | .477 | .07 | .077 | .091 | .545* | -.157 | .266 | -.155 |
| | (1.21) | (0.23) | (0.68) | (1.55) | (1.82) | (-0.97) | (0.62) | (-0.95) |
| 9 Technology | .972 | .697** | -.301* | -.252* | .771 | .247 | 1.167** | .97*** |
| | (1.30) | (2.32) | (-1.68) | (-1.81) | (1.21) | (1.03) | (2.15) | (2.97) |
| Constant | 1.627 | 2.576** | .909 | -.429 | 3.248** | 4.383*** | -.554 | 1.339 |
| | (0.81) | (2.15) | (1.23) | (-0.95) | (2.35) | (7.33) | (-0.36) | (1.00) |
| n | 75 | 68 | 75 | 67 | 75 | 66 | 70 | 63 |
| Adj $R^2$ | 0.5050 | 0.7420 | 0.3353 | 0.4148 | 0.4960 | 0.6775 | 0.5605 | 0.6651 |
| Breusch and Pagan | 5.77** | 1.36 | 40.67*** | 31.02*** | 8.64*** | 0.98 | 2.84* | 1.39 |
| Max VIF of test variable | 3.60 | 3.68 | 3.60 | 4.27 | 3.60 | 4.33 | 3.97 | 4.29 |

*** p<.01, ** p<.05, * p<.1

ETR measures are standardised ETRs.

Under each ETR measure the first column is statistic results before identifying influential data, the second column is statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 8 Change in ETR measures of post 2008, Main Market (POST_MM)**



companies listed on AIM engage in more tax management in year a+1, for companies listed on Main Market the average *Cur_ETR* of year a+2 is significantly higher than that of year a+1, indicating in year a+2 companies engage in less tax management. This is consistent with the hypothesis $H_3^1$ that corporate tax management during IPO process varies by listing market. The more stringent scrutiny of Main Market magnifies the risks of tax management and therefore restricts corporate tax management engagement (Doukas and Hoque 2016; Khurshed et al 2016; Nielsson 2013; Mallin and Ow-Yong 2012; Rousseau 2008; Ball and Shivakumar 2008; Frank et al 2009).

Shown by the detailed individual table 5.24, the *Cur_ETRs* of those companies whose accounts are reported post 2008 and listed on Main Market are not related to auditor changes (*Auditor_Change*). They are negatively associated with *R&D_Int* and *ROA*, positively associated with *FT_Int*. Consistent with prior studies, the increase in R&D intensity, profitability and the reduction in foreign operation will result in a higher level of tax management (Gupta and Newberry 1997; Lanis and Richardson 2015; Rego 2003; Frank et al 2008; Rego and Wilson 2012; Lee and Swenson 2016). But unexpectedly they are negatively associate with *NOLs* (the expected association is positive), those companies do not take advantage of *NOLs* and foreign operations to reduce taxes.

Using *Def_ETRs* to reflect tax deferral strategies, as reported in table 5.15-subsample (6) POST_MM-matrix 30, prior to IPO tax deferral management does not change. After IPO in year a+2 *Def_ETRs* significantly decrease, with enhanced scrutiny companies use less tax deferral strategies (Doukas and Hoque 2016; Khurshed et al 2016; Ball and Shivakumar 2008; Frank et al 2009). The change in tax deferral management is also different between Main Market and AIM, supporting the hypothesis that corporate tax management behaviours vary by listing market.

Regarding the change in *GAAP_ETRs*, the matrix of *GAAP_ETRs* (table 5.15 - subsample 6 POST_MM - matrix 31) shows that in the years prior to IPO and IPO

year the level of tax management does not have significant change. After going public in a+2 *GAAP_ETRs* have a significant increase, resulting the *GAAP_ETR* in this year is significantly higher than that in all other years, there is a lower level of tax management in year a+2. With increased scrutiny tax management is more risky, as a result, managers have less incentives to engage in tax management (Gao and Jain 2011; Jain and Kini 2008; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). Using *GAAP_ETRs* to measure tax management while companies listed on AIM engage in more tax management post IPO companies listed on Main Market engage in less tax management. This also supports the hypothesis $H_3^1$ that corporate tax management behaviours in the IPO process vary with listing market. Because of the more stringent monitoring of Main Market companies engage in less tax management (Doukas and Hoque 2016; Khurshed et al 2016; Nielsson 2013; Mallin and Ow-Yong 2012; Rousseau 2008; Ball and Shivakumar 2008; Frank et al 2009).

From the detailed results of *GAAP_ETRs* (table 5.24) the level of *GAAP_ETRs* varies by auditor changes (*Auditor_Change*). The *GAAP_ETR* of companies employing the same auditor in the IPO process is higher than companies changing auditors, companies employing the same auditors have a lower level of tax management. For those companies auditors monitor corporate behaviours, they constrain the engagement in risky tax management activities (Titman and Trueman 1986; Datar et al 1991; Beatty 1989; Michaely and Shaw 1995). Consistent with the findings of other samples for subsample (6) POST_MM the *GAAP_ETRs* are negatively related to *R&D_Int*, but inconsistently, they are negatively associated with *NOLs* (unexpected) and *TA*. The association between *GAAP_ETRs* and *R&D_Int, TA* is supported by prior literature, because of tax relief on R&D expenditure and "political power theory", companies with higher R&D expenditure and larger firm size engage in more tax management (Gupta and Newberry 1997; Lanis and Richardson 2015; Berger 1993; Gaertner 2014; Siegfried 1973; Rego 2003; Singh et al 1987).

Using *Cash_ETRs* to measure tax management (table 5.15 matrix 32) in b-2 there is a higher level of cash tax payment, with increased scrutiny companies settle outstanding

or disputed tax payment with the relevant tax administration two years prior to IPO, supporting the hypothesis that IPO process increases the potential costs associated with tax management because of the enhanced scrutiny (Holland et al 2016; Gao and Jain 2011; Jain and Kini 2008; Jain and Tabak 2008; Filatotchev and Bishop 2002). In year b-1 corporate tax management behaviours do not significantly change. In the IPO year the level of *Cash_ETRs* is significantly lower than that in years b-1 and b-2, in the year of going public with incentives to signal firm value to investors companies increase the level of tax management to reduce cash tax liabilities (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Spence 1973). Post IPOs tax management does not have significant change. The findings suggest that more scrutiny should be put on cash flow in the IPO year of companies listed on Main Market. Their cash flows in the IPO year are likely to be increased by the engagement in tax management, however, tax management activities are likely to result in risks (e.g. contingent tax payment and reputation costs) in the future (Francis et al 2014; Rego and Wilson 2012).

Table 5.24 reports that the change in auditors is not associated with the change in *Cash_ETRs*. *Cash_ETRs* are positively associated with *Cap_Int* and *FT_Int*, the companies that all company year ends are in the post 2008 period and listed on Main Market do not take advantage of fixed assets and foreign operations to reduce cash taxes liabilities. On the contrary, because of high costs associated with multinational tax management activities, the more foreign operation a company has, the lower level of tax management it exhibits (Lee and Swenson 2016).

In summary, the findings support the hypothesis $H_3^1$ that corporate tax management during IPO process varies by listing market. Comparing tax management behaviours of companies listed on AIM and Main Market, a significant difference is that while companies listed on AIM engage in more tax management after IPOs, companies listed on Main Market engage in less tax management. This shows that the enhanced requirements in Main Market deters corporate tax management behaviours. In addition, it's worth noting that, even with stringent scrutiny, in the IPO year companies still

engage in more tax management to reduce cash tax payment, this suggests that more scrutiny emphasis should be placed on corporate cash flows in the IPO year.

#### 5.2.2.5 Tax management of companies using the same auditor

With reporting period and listing market controlled, the original research design was to further control the change in auditors (i.e. subsamples 7, 8, 9 and 10) to investigate corporate tax management behaviours of companies employing the same auditors in the IPO process. However, according to descriptive statistics of ETR measures (tables 5.1, 5.2, 5.3, 5.4) the observations for those subsamples are too small, which is likely to result in potential statistical issues (e.g. multicollinearity issue, like subsample 4 PRE_MM). In order to ensure the estimated model is valid, instead of controlling auditor changes under subsamples (3), (4), (5), (6), the test is to control auditor changes under a larger sample-profitable company year ends. The purpose of this section is to test whether the change in coefficients of year dummies is different before and after controlling the change in auditors, if it is different it means tax management behaviours vary with the change in auditors.

The full results are reported in table 5.25 with summaries in table 5.14 (subsample 7 No change auditors) and table 5.15 (matrices 33 - 36). According to table 5.14 subsample 7, after taking out companies that change auditing firms in the IPO process, the observations for *Cur_ETRs* model reduce from 549 (panel b PROFIT_YEAR_ENDS) to 262, for *Def_ETRs* model drop from 555 to 264, for *GAAP_ETRs* model drop from 540 to 256, and for *Cash_ETRs* model reduce from 521 to 245. According to $R^2$ the estimation models can explain 25.60% of the variance in *Cur_ETRs*, 15.95% of the variance in *Def_ETRs*, 19.53% of the variance in *GAAP_ETRs* and 14.55% of the variance in *Cash_ETRs*. Max VIF values for the estimated models are 2.49, 2.73, 2.60 and 2.77 respectively (table 5.25) and therefore the estimations do not have serious multicollinearity issue.

The results support the hypothesis $H_4^1$: Corporate tax management behaviours during IPO process vary by auditor changes (Titman and Trueman 1986; Klassen et al 2016;

**Table 5. 25 Multivariate analysis of companies employing same auditors**

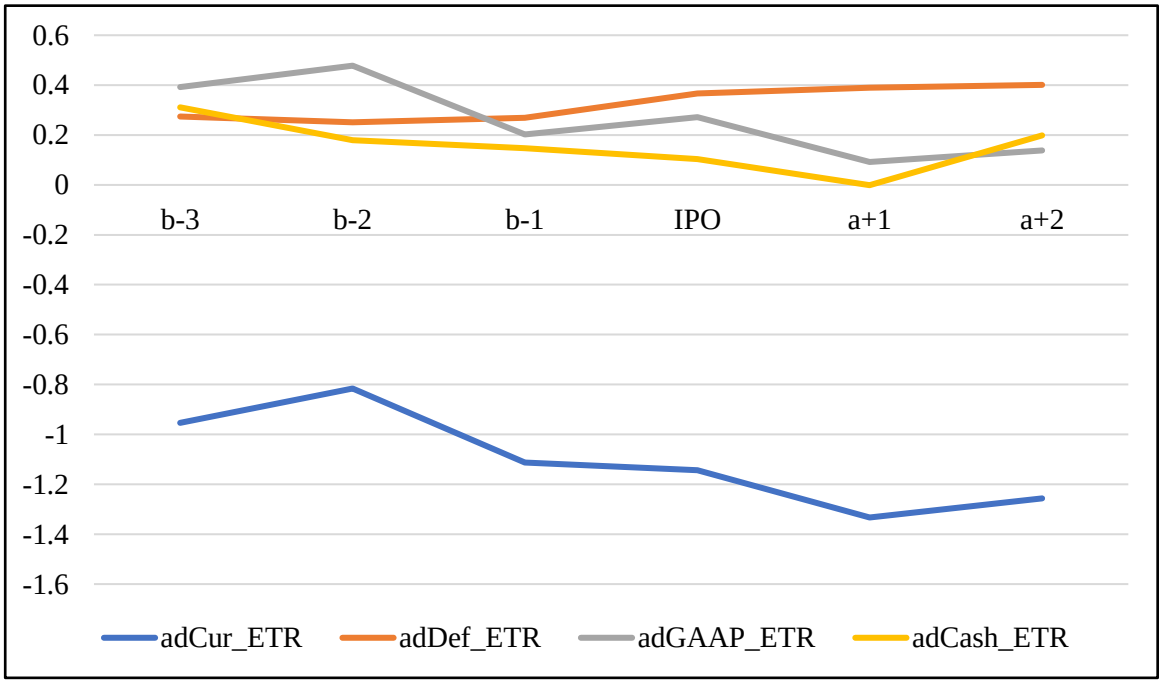
| **Dependent variables** | ***Cur_ETR*** | ***Def_ETR*** | ***GAAP_ETR*** | ***Cash_ETR*** |
|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** |
| YR_a+2 | -.113 | .035 | -.134 | .095 |
| | (-0.97) | (0.58) | (-1.33) | (0.81) |
| YR_a+1 | -.189* | .024 | -.18* | -.105 |
| | (-1.96) | (0.42) | (-1.72) | (-1.26) |
| YR_b-1 | .031 | -.097** | -.07 | .043 |
| | (0.31) | (-2.10) | (-0.71) | (0.37) |
| YR_b-2 | .328** | -.115 | .206* | .075 |
| | (2.60) | (-1.46) | (1.82) | (0.51) |
| YR_b-3 | .19 | -.092 | .12 | .207 |
| | (1.23) | (-1.28) | (0.94) | (1.15) |
| Account_Year | | | | |
| Across 2008 | -.32** | .12** | -.163 | -.107 |
| | (-2.39) | (2.46) | (-1.26) | (-0.67) |
| Post 2008 | -.303** | .043 | -.265** | -.168 |
| | (-2.28) | (0.88) | (-2.21) | (-1.14) |
| Market_Dummy | -.386*** | .083 | -.215* | -.245* |
| | (-2.91) | (1.35) | (-1.72) | (-1.68) |
| Auditor_Changes | 0 | 0 | 0 | 0 |
| **Control variables** | | | | |
| LEV | -.098 | .079 | .052 | -.141 |
| | (-0.30) | (0.90) | (0.21) | (-0.52) |
| Cap_Int | -.592*** | .336*** | -.002 | -.46* |
| | (-2.97) | (3.25) | (-0.01) | (-1.96) |
| R&D_Int | -.936*** | -.057 | -.883*** | -.486* |
| | (-3.68) | (-0.53) | (-4.72) | (-1.80) |
| NOLs | .007 | -.038 | .063 | .065** |
| | (0.14) | (-0.65) | (0.46) | (2.07) |
| TA | .172*** | -.023 | .096*** | .08 |
| | (4.01) | (-1.42) | (2.77) | (1.42) |

**Table 5.25 Multivariate analysis of companies employing same auditors (continued)**

| | | | | |
|---|---|---|---|---|
| FT_Int | -.062 | .033 | -.092 | -.279 |
| | (-0.42) | (0.53) | (-0.69) | (-1.38) |
| IA_Int | -.006 | .002 | .339 | -.096 |
| | (-0.03) | (0.02) | (1.50) | (-0.38) |
| ROA | .51 | -.399** | .202 | -.31 |
| | (1.11) | (-2.01) | (0.44) | (-0.51) |
| AP | .271** | -.021 | .145 | .207 |
| | (2.26) | (-0.39) | (1.41) | (1.54) |
| industry | | | | |
| 1 Basic Materials | .636** | -.146 | -.001 | -.107 |
| | (2.22) | (-1.25) | (-0.00) | (-0.48) |
| 2 Industrials | .38** | -.017 | -.25 | -.032 |
| | (2.18) | (-0.24) | (-1.40) | (-0.13) |
| 3 Consumer Goods | .196 | -.051 | -.339* | -.113 |
| | (0.96) | (-0.59) | (-1.91) | (-0.42) |
| 4 Health Care | .997*** | -.023 | .159 | .312 |
| | (4.57) | (-0.22) | (0.84) | (0.96) |
| 5Consumer Services | .559*** | -.077 | -.153 | .093 |
| | (3.51) | (-1.22) | (-0.98) | (0.45) |
| 6 Telecommunications | .373* | -.054 | -.322 | .09 |
| | (1.90) | (-0.64) | (-1.66) | (0.35) |
| 9 Technology | .541*** | 0 | -.124 | .091 |
| | (2.89) | (0.01) | (-0.67) | (0.39) |
| Constant | -1.144** | .366* | .272 | .104 |
| | (-2.26) | (1.73) | (0.64) | (0.14) |
| n | 262 | 264 | 256 | 245 |
| Adj $R^2$ | 0.2560 | 0.1595 | 0.1953 | 0.1455 |
| Breusch and Pagan | 6.90*** | 49.85*** | 17.63*** | 7.28*** |
| Max VIF of test variables | 2.49 | 2.73 | 2.60 | 2.77 |

*** p<.01, ** p<.05, * p<.1 ETR measures are standardised ETRs.
The results are statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 9 Change in ETR measures of companies employing same auditors**



McGuire et al 2012; Omer et al 2006; Cook et al 2008; Holland and Horton 1993; Maydew and Shackelford 2005). Indicated by table 5.15 matrix 33, whether controlling change in auditors or not can influence results. Using *Cur_ETRs* to measure tax management without controlling auditors change in year b-2 companies engage in less tax management (table 5.15 - panel b - matrix 5), however, after controlling the change in auditors in year b-2 tax management does not significantly change (table 5.15 - subsample 7 - matrix 33). The change in b-1 is consistent, controlling the auditor changes one year prior to IPO there is a higher level of tax management, managers' incentive to show firm value to investors magnifies the benefits of tax management (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). In the IPO year without controlling the change in auditors, companies engage in less tax management (matrix 5), however, for companies without changing auditors in this year their tax management does not have significant change (matrix 33). The findings suggest that the significant change in *Cur_ETRs* in year b-2 and IPO year is likely to be resulted from the change in auditors. There is an additional finding that without controlling auditor changes in year a+1 tax management does not change (matrix 5), but controlling the change in auditors in year a+1 companies engage in more tax management.

For companies employing the same auditors in the IPO process, their *Cur_ETRs* vary with reporting period and listing markets (table 5.25). Companies all testing periods are in the post 2008 period have a higher level of tax management than companies all testing period are in the pre 2008 period. This is consistent with the theory that companies are likely to fall into financial distress because of Banking Crisis of 2008, which increases managers' incentives to engage in tax management to reduce tax liabilities and increase after-tax earnings (Richardson et al 2015). Companies listed on Main Market have a higher level of tax management than companies listed on AIM. This supports the theory that Main Market companies face with higher market pressure, which increases the demand for tax management to increase profits (Parsa and Kouhy 2008). The companies with larger *Cap_Int*, *R&D_Int*, smaller *TA* have lower *Cur_ETRs*, that is, a higher level of tax management (Mills et al 1998; Gaertner 2014;

Gupta and Newberry 1997; Lanis and Richardson 2015; Watts and Zimmerman 1978; Zimmerman 1983).

The use of tax deferral strategies is consistent before and after the change in auditors is controlled. Indicated by table 5.15 for profitable company year-ends (panel b matrix 6) companies defer a higher amount of tax liabilities in IPO year. If the change in auditors is controlled (subsample 7 - matrix 34) this finding is still applicable. Reported in table 5.25 the management of *Def_ETRs* does not vary between pre and post 2008 and listing markets. Companies with higher *Cap_Int* and lower *ROA* use more tax deferral strategies (Mills et al 1998; Gaertner 2014; Stickney and McGee 1982).

The change in the level of tax management measured by *GAAP_ETRs* varies with auditor changes. Without controlling auditor changes prior to IPO tax management does not significantly change (table 5.15 - panel b - matrix 7). Controlling the change in auditors in year b-1 there is a higher level of tax management (table 5.15 - subsample 7 - matrix 35). The tax management in the years post IPO is not influenced.

The level of *GAAP_ETRs* is significantly associated with reporting periods and listing markets (table 5.25). Compared with companies all testing periods are in the pre 2008 period, companies all testing period are in the post 2008 period have a higher level of tax management. This supports the theory that after Banking Crisis of 2008 companies may suffer financial distress, which increases managers' incentives to engage in tax management to maximise tax charge and increase profits to continue business (Richardson et al 2015). The level of tax management for companies listed on Main Market is higher than that of the companies listed on AIM, supporting the hypothesis that with higher market pressure Main Market companies have a higher level of tax management (Parsa and Kouhy 2008). Same with *Cur_ETRs*, *GAAP_ETRs* are negatively associated with *Cap_Int* and *R&D_Int*, positively associated with *TA*, indicating that companies with more intensive capital, higher R&D expenditure, and smaller size have a higher level of tax management (Mills et al 1998; Gaertner 2014;

Gupta and Newberry 1997; Lanis and Richardson 2015; Zimmerman 1983).

If measuring tax management on cash basis (i.e. *Cash_ETR*) it still varies with auditor changes. Without controlling the change in auditors measured by *Cash_ETRs* one year prior to IPO there is a higher level of tax management (table 5.15 - panel b - matrix 8). Controlling the change in auditors, however, one year prior to IPO tax management does not have significant change (table 5.15 - subsample 7 - matrix 36). No matter controlling the change in auditors or not in year a+2 companies engage in less tax management. As a public company corporate behaviours attract additional attention from market investors and social entities such as social media and consumers, with increasing monitoring involved, companies engage in less tax management (Nikolaj Bukh et al 2005; Branswijck and Everaert 2012; Gao and Jain 2011; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011; Holland et al 2016).

Shown in table 5.25, using *Cash_ETRs* to measure tax management the companies listed on Main Market have a higher level of tax management than companies listed on AIM. This is consistent with the theory that Main Market IPO companies have a higher level of tax management because of higher market pressure (Parsa and Kouhy 2008). The companies with more intensive PPE (*Cap_Int*), R&D investment (*R&D_Int*) and larger loss in the previous year (*NOLs*) have a higher level of tax management, as found in the prior literature (Mills et al 1998; Gaertner 2014; Gupta and Newberry 1997; Lanis and Richardson 2015; Wang 1991; Chen et al 2010).

In summary, the change in *Cur_ETRs*, *GAAP_ETRs* and *Cash_ETRs* is different before and after controlling the change in auditors. This is consistent with the hypothesis $H_4^1$ that corporate tax management behaviours during IPO process vary by auditor changes (Holland and Horton 1993; Maydew and Shackelford 2005; Titman and Trueman 1986; Klassen et al 2016; McGuire et al 2012; Omer et al 2006; Cook et al 2008). This finding is helpful for the investigation of the reason underlying the change in the level of tax management. In addition, stakeholders can use the change in auditors as a signal to identify tax management behaviours. The future study can give a further analysis of

the influence of auditing firms (e.g auditor quality) on tax management behaviours.

### 5.3 Robustness tests

This section reports the results of a series of robustness tests. The robustness tests are based on profitable company year-ends sample to avoid the influence of loss-making years on ETR measures. Firstly, in data collection it is found that the annual accounts of some companies in certain years are reported with foreign currency (e.g. dollar or Euro). As a result, during the IPO process there is a reporting currency transition and this transition could influence the level of ETR measures because the basis of currency translation is either unknown and or may have changed[18]. As the first sensitivity test, the study deletes those companies with currency transition to test whether the initial results are sensitive to reporting currency. Secondly, as introduced in methodology section the proxy of the control variable *NOLs*, tax loss carry-forwards, is not available. As a result, the study uses accounting loss in the prior year as a proxy. The second sensitivity test selects only those companies that persistently make profits in the IPO process to alleviate the effect of tax loss carry-forwards. Thirdly, in the determination of the value of ETR measures, due to asymmetry between tax outcomes and economic activities, for years with tax credits the negative ETRs are replaced with 0. Some literature replace ETRs of years with tax credits with zero (Gupta and Newberry, 1997; McGuire et al 2014) while some literature take those years out of sample (Cheng et al 2012; Chen et al 2010). The third sensitivity test selects only those companies with profits and a tax charge (i.e. the denominator and numerator of ETR measures are both positive). Similar with other samples the multivariate results and test of significance between test variables of robustness tests are summarised in tables 5.14 and 5.15. In addition, the individual tables and corresponding figures displaying the change in coefficients of year dummies are reported from table 5.26 to table 5.28.

[18] In a number of cases it was not possible to replicate the translation process used by FAME to report the financial statements in pounds sterling.

### 5.3.1 Currency transition

The full results are reported in table 5.26 with summaries in table 5.14 (Robustness 1: No currency transition) and table 5.15 (matrices 37 - 40). Among 217 companies in total there are 20 companies experiencing currency transition in the IPO process. Taking those companies out of the sample the number of observations reduce slightly. A higher proportion of the variance in dependent variables can be explained. According to table 5.14 sub-table "Robustness 1: No currency transition" without companies reporting accounts by foreign currency the number of observations for *Cur_ETR* model is 522, for *Def_ETR* model is 527, for *GAAP_ETR* model is 513, for *Cash_ETR* model is 494. The estimation models explain 28.39% of the variance in *Cur_ETRs*, 14.80% of the variance in *Def_ETRs*, 20.82% of the variance in *GAAP_ETRs* and 20.56% of the variance in *Cash_ETRs*. The level of VIFs is acceptable, for all estimation models VIFs are around 2.50 (table 5.26).

Shown in table 5.15 sub-table "Robustness test 1: No currency translation" (matrices 37 - 40), the coefficients of *Cur_ETRs*, *Def_ETRs*, *GAAP_ETRs* and *Cash_ETRs* have significant change in the IPO process. The finding that corporate tax management behaviours significantly change in the IPO process is robust.

Regarding the change of tax management in specific years, measured by *Cur_ETRs* for years prior to IPO the results are identical with original results (table 5.15 matrices 5 and 37). Companies engage in less tax management in year b-2 in which managers believe that tax management, because of more information disclosed and additional scrutiny involved, is riskier (Gao and Jain 2011; Jain and Kini 2008; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). But in year b-1 they engage in more tax management, indicating that one year immediately prior to IPO, managers consider that the benefits of tax management exceed its risks (Francis et al 2014; Spence 1973).

The increase in *Def_ETRs* in the IPO year is more significant, the initial result is robust

**Table 5. 26 Multivariate analysis of companies without currency transition**

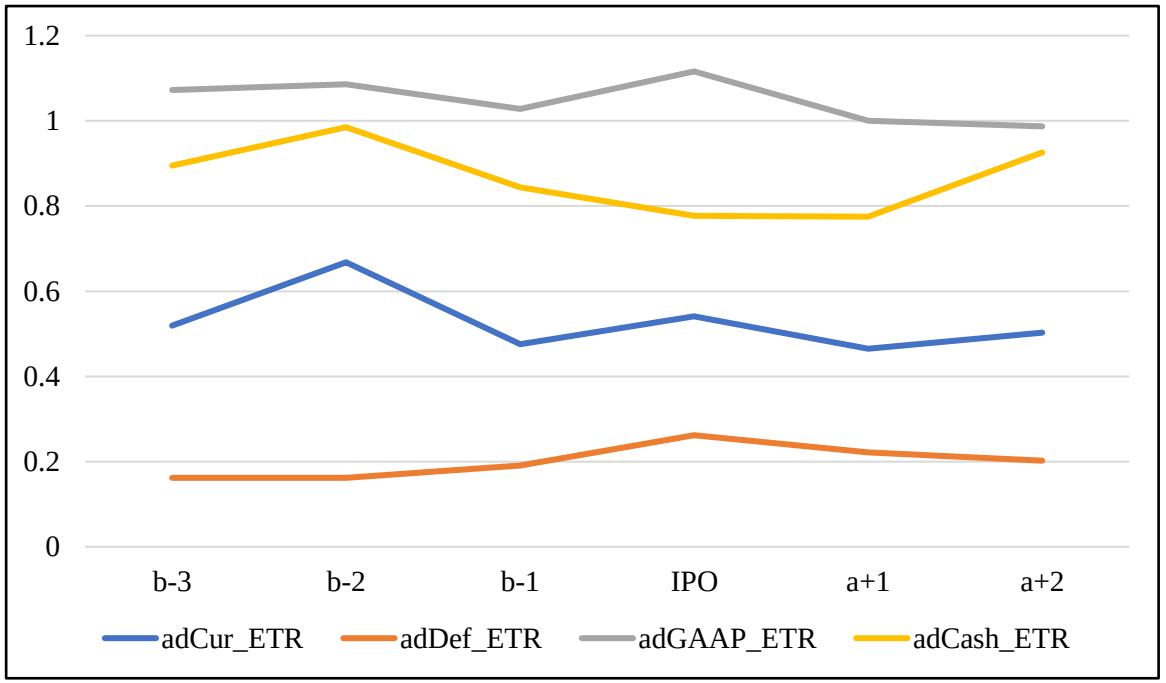
| **Dependent variables** | ***Cur_ETR*** | ***Def_ETR*** | ***GAAP_ETR*** | ***Cash_ETR*** |
|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** |
| YR_a+2 | -.038 | -.06 | -.129* | .149* |
| | (-0.47) | (-1.48) | (-1.86) | (1.68) |
| YR_a+1 | -.076 | -.04 | -.116* | -.002 |
| | (-1.21) | (-1.10) | (-1.87) | (-0.03) |
| YR_b-1 | -.065 | -.071** | -.088 | .067 |
| | (-1.02) | (-2.19) | (-1.34) | (0.85) |
| YR_b-2 | .127 | -.1** | -.03 | .208* |
| | (1.47) | (-2.28) | (-0.40) | (1.79) |
| YR_b-3 | -.022 | -.1** | -.044 | .118 |
| | (-0.22) | (-2.19) | (-0.47) | (1.00) |
| Account_Year | | | | |
| Across 2008 | -.112 | .022 | -.069 | -.05 |
| | (-1.34) | (0.66) | (-0.86) | (-0.49) |
| Post 2008 | .101 | -.002 | .045 | .056 |
| | (1.09) | (-0.06) | (0.54) | (0.54) |
| Market_Dummy | -.199** | .037 | -.103 | -.141 |
| | (-2.00) | (1.09) | (-1.16) | (-1.47) |
| Auditor_Changes | -.002 | -.017 | -.102 | -.015 |
| | (-0.03) | (-0.61) | (-1.66) | (-0.20) |
| **Control variables** | | | | |
| LEV | .134 | .034 | .186 | -.102 |
| | (0.74) | (0.45) | (1.06) | (-0.45) |
| Cap_Int | -.609*** | .331*** | -.176 | -.538*** |
| | (-3.11) | (3.82) | (-1.19) | (-2.68) |
| R&D_Int | -.738*** | -.014 | -.76*** | -.388** |
| | (-4.51) | (-0.17) | (-5.45) | (-2.19) |
| NOLs | .083*** | -.023 | .036 | .1*** |
| | (5.76) | (-0.77) | (1.35) | (6.38) |
| TA | .076** | -.003 | .039 | .021 |
| | (2.44) | (-0.30) | (1.40) | (0.57) |

**Table 5.26 Multivariate analysis of companies without currency transition (continued)**

| | | | | |
|---|---|---|---|---|
| FT_Int | -.22* | -.009 | -.204* | -.449*** |
| | (-1.68) | (-0.21) | (-1.70) | (-3.21) |
| IA_Int | .315* | .009 | .353** | .342* |
| | (1.79) | (0.14) | (2.19) | (1.85) |
| ROA | -.109 | -.269** | -.028 | -.734** |
| | (-0.36) | (-2.39) | (-0.11) | (-2.07) |
| AP | -.013 | .017 | .023 | .108 |
| | (-0.16) | (0.55) | (0.35) | (1.13) |
| industry | | | | |
| 1 Basic Materials | .187 | .054 | .385*** | -.032 |
| | (0.64) | (0.73) | (2.86) | (-0.11) |
| 2 Industrials | -.224 | -.088 | -.369*** | .001 |
| | (-1.39) | (-1.19) | (-3.31) | (0.00) |
| 3 Consumer Goods | -.587*** | -.082 | -.588*** | -.332 |
| | (-3.03) | (-1.03) | (-4.23) | (-1.20) |
| 4 Health Care | -.241 | -.141 | -.524*** | -.014 |
| | (-1.52) | (-1.65) | (-4.81) | (-0.05) |
| 5ConsumerServices | -.259 | -.081 | -.441*** | -.119 |
| | (-1.65) | (-1.15) | (-3.88) | (-0.47) |
| 6 Telecommunications | -.138 | -.115 | -.374* | .04 |
| | (-0.62) | (-1.49) | (-1.97) | (0.14) |
| 7 Utilities | -.923*** | -.084 | -.753*** | -.439 |
| | (-5.04) | (-1.02) | (-5.45) | (-1.55) |
| 9 Technology | -.151 | -.093 | -.404*** | -.059 |
| | (-0.88) | (-1.13) | (-3.31) | (-0.22) |
| Constant | .541 | .262* | 1.116*** | .777 |
| | (1.42) | (1.77) | (3.33) | (1.58) |
| n | 522 | 527 | 513 | 494 |
| Adj $R^2$ | 0.2839 | 0.1480 | 0.2082 | 0.2056 |
| Breusch and Pagan | 17.07*** | 159.13*** | 15.75*** | 31.89*** |
| Max VIF of test variables | 2.41 | 2.44 | 2.48 | 2.55 |

*** p<.01, ** p<.05, * p<.1 ETR measures are standardised ETRs. The results are statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 10 Change in ETR measures of companies without currency transition**



(matrices 6 and 38), companies defer a higher amount of tax liabilities in the IPO year, indicating that in the IPO year managers have incentives to reduce tax expense by deferring tax expense to the future (Francis et al 2014; Rego and Wilson 2012). The initial result of *GAAP_ETRs*, that is, in a+1 there is a higher level of tax management, is robust (matrices 7 and 39). This indicates that the theory that in the IPO process, managers have incentives to engage in more tax management is robust for currency transition (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Spence 1973).

Measured by *Cash_ETRs* in a+2 there is a lower level of tax management and therefore a higher level of cash tax payment (matrix 40), this is consistent with initial results (matrix 8), in year a+2 IPO companies have become public, their behaviours are monitored by more social entities, with the increase in risks, companies engage in less tax management (Gao and Jain 2011; Jain and Kini 2008; Jain and Tabak 2008; Filatotchev and Bishop 2002; Freedman and Stagliano 2002; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011).

The results of other test variables, specifically *Account_Year*, *Market_Dummy*, *Auditor_Changes* are identical with initial results.

### 5.3.2 Companies persistently make profits

The full results of this robustness test are reported in table 5.27 with summaries in table 5.14 (Robustness test 2: Persistent profit) and table 5.15 (matrices 41 - 44). The number of observations for this sub-sample is around half of the initial sample. Specifically, the number of observations for *Cur_ETRs* model reduce from 549 to 260, for *Def_ETRs* model the reduction is from 555 to 256, for *GAAP_ETRs* model the reduction is from 540 to 262, and for *Cash_ETRs* model the number reduces from 521 to 244. The adjusted $R^2$ for each ETR measure has increases. The proportion of the variance in *Cur_ETRs* explained increases from 27.54% to 31.23%, *Def_ETRs* increases from 13.87% to 19.04%, *GAAP_ETRs* increases from 19.11% to 24.21%, and *Cash_ETRs* increases from 20.37% to 22.82%.

**Table 5. 27 Multivariate analysis of companies persistently make profits**

| **Dependent variables** | ***Cur_ETR*** | ***Def_ETR*** | ***GAAP_ETR*** | ***Cash_ETR*** |
|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** |
| YR_a+2 | -.111 | -.019 | -.223*** | .165 |
| | (-0.82) | (-0.62) | (-2.74) | (1.14) |
| YR_a+1 | -.187** | 0 | -.228*** | -.119 |
| | (-2.10) | (-0.02) | (-3.39) | (-1.04) |
| YR_b-1 | -.02 | -.008 | -.165** | .053 |
| | (-0.24) | (-0.37) | (-2.07) | (0.44) |
| YR_b-2 | .123 | -.031 | -.003 | -.041 |
| | (1.29) | (-1.16) | (-0.04) | (-0.31) |
| YR_b-3 | .008 | -.04 | -.03 | -.067 |
| | (0.07) | (-1.38) | (-0.33) | (-0.39) |
| Account_Year | | | | |
| Across 2008 | -.168 | .066** | -.023 | -.091 |
| | (-1.65) | (2.04) | (-0.23) | (-0.71) |
| Post 2008 | -.133 | 0 | -.062 | -.121 |
| | (-1.16) | (0.01) | (-0.63) | (-0.80) |
| Market_Dummy | -.229** | .06 | -.12 | -.097 |
| | (-2.03) | (1.61) | (-1.57) | (-0.68) |
| Auditor_Changes | .049 | -.005 | .043 | .069 |
| | (0.62) | (-0.24) | (0.53) | (0.79) |
| **Control variables** | | | | |
| LEV | .082 | .17** | .189 | -.078 |
| | (0.29) | (2.34) | (0.92) | (-0.20) |
| Cap_Int | -.367* | .128 | -.098 | -.232 |
| | (-1.94) | (1.33) | (-0.51) | (-0.93) |
| R&D_Int | -.911*** | .096 | -.799*** | -.234 |
| | (-5.41) | (1.45) | (-5.90) | (-0.86) |
| NOLs | 0 | 0 | 0 | 0 |
| TA | .124*** | -.015 | .077** | -.019 |
| | (3.66) | (-1.34) | (2.63) | (-0.40) |

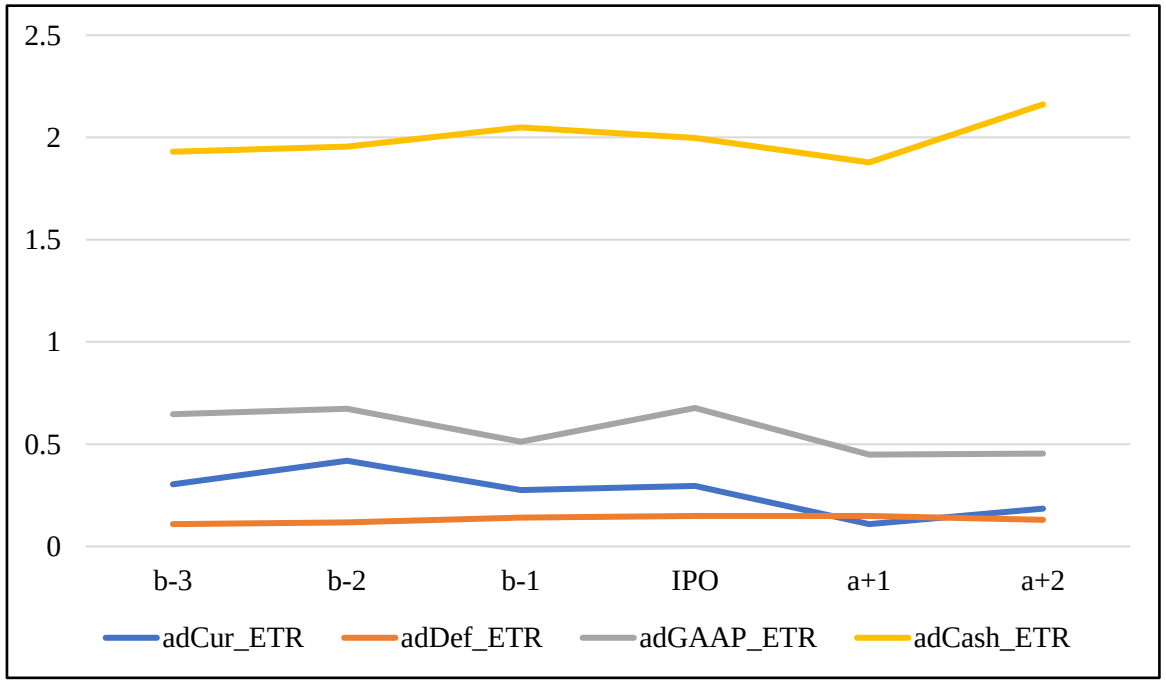
**Table 5.27 Multivariate analysis of companies persistently make profits (continued)**

| | | | | |
|---|---|---|---|---|
| FT_Int | -.094 | .042 | 0 | -.407** |
| | (-0.76) | (1.25) | (-0.00) | (-2.43) |
| IA_Int | .328 | .042 | .321* | .28 |
| | (1.56) | (0.79) | (1.90) | (1.10) |
| ROA | -.116 | -.175 | -.198 | -1.53** |
| | (-0.30) | (-1.24) | (-0.66) | (-2.58) |
| AP | .119 | .007 | -.006 | .163 |
| | (1.31) | (0.26) | (-0.08) | (1.37) |
| industry | | | | |
| 2 Industrials | -.37*** | .048 | -.277** | -.469*** |
| | (-2.74) | (0.83) | (-2.09) | (-2.99) |
| 3 Consumer Goods | -.544*** | .006 | -.29* | -.763*** |
| | (-3.04) | (0.09) | (-1.95) | (-3.62) |
| 4 Health Care | -.542*** | -.022 | -.456*** | .111 |
| | (-3.73) | (-0.45) | (-3.57) | (0.76) |
| 5 Consumer Services | -.54*** | .012 | -.397** | -.746*** |
| | (-3.29) | (0.22) | (-2.33) | (-4.50) |
| 6 Telecommunications | -.488*** | .034 | -.365** | -.627*** |
| | (-2.71) | (0.49) | (-2.01) | (-3.48) |
| 7 Utilities | -1.198*** | .047 | -.571*** | -1.195*** |
| | (-7.58) | (1.12) | (-4.55) | (-5.25) |
| 9 Technology | -.404*** | .011 | -.272* | -.436** |
| | (-2.69) | (0.20) | (-1.98) | (-2.18) |
| Constant | .296 | .149 | .677* | 1.997*** |
| | (0.77) | (1.26) | (1.88) | (3.82) |
| n | 260 | 256 | 262 | 244 |
| Adj $R^2$ | 0.3123 | 0.1904 | 0.2421 | 0.2282 |
| Breusch and Pagan | 14.66*** | 99.02*** | 11.13*** | 6.37** |
| Max VIF of test variables | 3.28 | 3.29 | 3.28 | 3.53 |

*** p<.01, ** p<.05, * p<.1

ETR measures are standardised ETRs. The results are statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 11 Change in ETR measures of companies persistently make profits**



The matrices of "Robustness test 2: Persistent profit" reported in table 5.15 (matrices 41 - 44) show that controlling the influence of *NOLs* the coefficients of *Cur_ETRs*, *GAAP_ETRs*, *Cash_ETRs* have significant change in IPO process, indicating that the original finding that corporate tax management behaviours significantly change in the IPO process is robust to the proxy of *NOLs*.

According to the matrix of *Cur_ETRs* reported in table 5.15 (matrix 41), in a+1 *Cur_ETRs* have a significant decrease, indicating companies engage in a higher level of tax management to reduce tax liabilities (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). An investigation of the *GAAP_ETRs* matrix (matrix 43) finds that in b-1 there is a higher level of tax management, in year IPO with increased scrutiny there is a lower level of tax management, after going public in year a+1 there is a higher level of tax management. The higher levels of tax management in years b-1 and a+1 support the theory that in years around IPOs managers have incentives to engage in tax management, in year b-1 the incentive is to signal firm value, in year a+1 the reason is to meet profit target (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Spence 1973). The lower level of tax management in year IPO supports the theory that the additional scrutiny in the IPO process increases the risks associated with tax management and therefore reduces managers' incentives to engage in tax management (Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). Using *Cash_ETRs* to measure tax management, according to matrix 44 reported in table 5.15 there is a lower level of tax management and consequently a higher level of tax payment in year a+2, in this year managers believe that the risks of tax management for a public company are higher than the benefits (Gao and Jain 2011; Jain and Kini 2008). For all ETR measures the results of other test variables i.e. *Account_Year*, *Market_Dummy*, *Auditor_Changes* are robust.

### 5.3.3 Company year ends without tax credit

This section employs a sub-sample of those company year ends with both profits and tax charges (i.e. without tax credit). The full results are reported in table 5.28 with

**Table 5. 28 Multivariate analysis of companies excluding tax credit years**

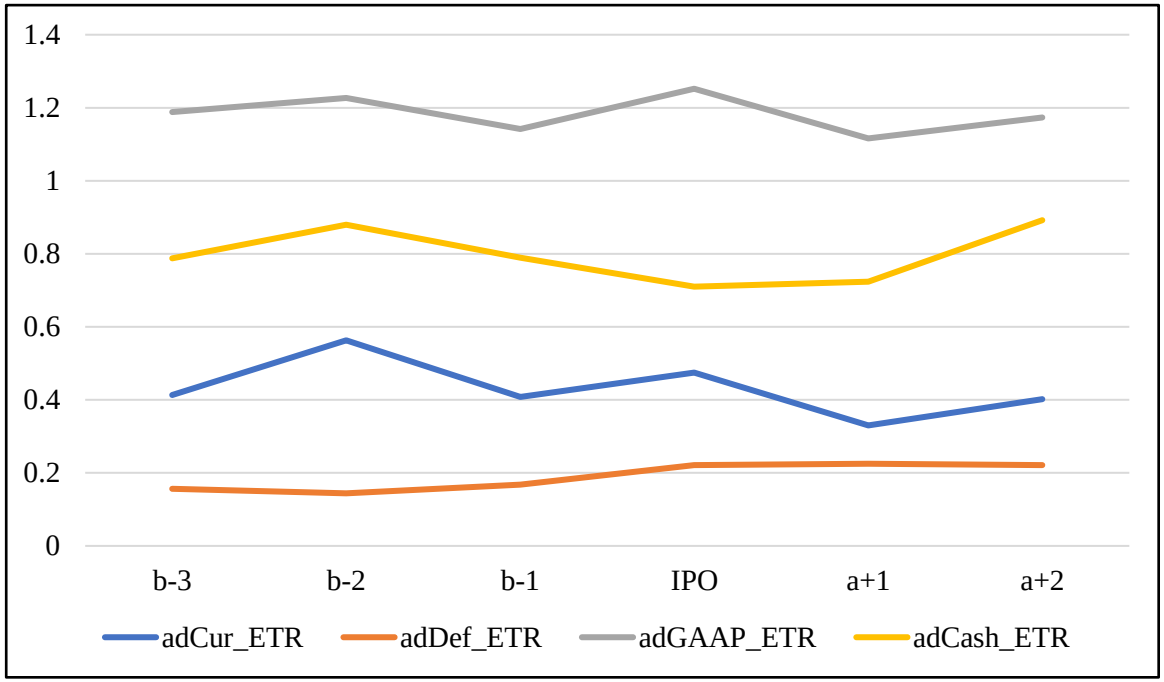
| **Dependent variables** | ***Cur_ETR*** | ***Def_ETR*** | ***GAAP_ETR*** | ***Cash_ETR*** |
|---|---|---|---|---|
| **Test variables** | **1** | **2** | **3** | **4** |
| YR_a+2 | -.073 | 0 | -.079 | .182** |
| | (-0.86) | (0.01) | (-1.12) | (2.15) |
| YR_a+1 | -.145** | .004 | -.136** | .014 |
| | (-2.35) | (0.14) | (-2.14) | (0.18) |
| YR_b-1 | -.067 | -.053** | -.11* | .079 |
| | (-1.00) | (-2.10) | (-1.71) | (0.94) |
| YR_b-2 | .088 | -.077* | -.025 | .17 |
| | (1.01) | (-1.96) | (-0.36) | (1.49) |
| YR_b-3 | -.062 | -.065 | -.064 | .078 |
| | (-0.63) | (-1.50) | (-0.70) | (0.67) |
| Account_Year | | | | |
| Across 2008 | -.033 | .041 | -.015 | .004 |
| | (-0.37) | (1.36) | (-0.19) | (0.04) |
| Post 2008 | .099 | .012 | .077 | .098 |
| | (1.06) | (0.44) | (0.87) | (0.93) |
| Market_Dummy | -.15 | .038 | -.067 | -.104 |
| | (-1.51) | (1.24) | (-0.71) | (-1.13) |
| Auditor_Changes | -.007 | -.023 | -.076 | -.016 |
| | (-0.10) | (-0.90) | (-1.24) | (-0.22) |
| **Control variables** | | | | |
| LEV | -.03 | .055 | .264 | .079 |
| | (-0.16) | (0.95) | (1.47) | (0.31) |
| Cap_Int | -.526** | .307*** | -.334** | -.598*** |
| | (-2.53) | (3.16) | (-2.24) | (-2.87) |
| R&D_Int | -.759*** | .011 | -.567*** | -.244 |
| | (-4.50) | (0.12) | (-3.73) | (-1.34) |
| NOLs | .096*** | -.023 | .072 | .109*** |
| | (6.15) | (-0.62) | (1.60) | (6.46) |
| TA | .055* | -.004 | .027 | .001 |
| | (1.73) | (-0.40) | (0.93) | (0.03) |

**Table 5.28 Multivariate analysis of companies excluding tax credit years (continued)**

| | | | | |
|---|---|---|---|---|
| FT_Int | -.175 | .019 | -.205* | -.394*** |
| | (-1.49) | (0.50) | (-1.92) | (-3.26) |
| IA_Int | .326* | -.009 | .2 | .192 |
| | (1.92) | (-0.15) | (1.34) | (1.10) |
| ROA | -.488 | -.227** | -.315 | -.927*** |
| | (-1.59) | (-2.21) | (-1.17) | (-2.64) |
| AP | -.006 | -.017 | -.017 | .089 |
| | (-0.07) | (-0.61) | (-0.25) | (0.94) |
| industry | | | | |
| 1 Basic Materials | .513** | -.09 | .341*** | .008 |
| | (2.00) | (-0.66) | (2.92) | (0.03) |
| 2 Industrials | .12 | -.071 | -.325*** | .288 |
| | (0.64) | (-1.01) | (-3.39) | (1.59) |
| 3 Consumer Goods | -.076 | -.058 | -.454*** | .04 |
| | (-0.35) | (-0.74) | (-3.56) | (0.20) |
| 4 Health Care | .106 | -.111 | -.388*** | .154 |
| | (0.56) | (-1.34) | (-3.42) | (0.75) |
| 5 Consumer Services | .079 | -.089 | -.38*** | .171 |
| | (0.42) | (-1.31) | (-3.78) | (0.97) |
| 6 Telecommunications | .264 | -.107 | -.314* | .254 |
| | (1.08) | (-1.46) | (-1.80) | (1.23) |
| 7 Utilities | .015 | -.108 | -.453*** | .534** |
| | (0.07) | (-1.46) | (-3.82) | (2.32) |
| 9 Technology | .186 | -.078 | -.383*** | .203 |
| | (0.94) | (-1.02) | (-3.58) | (1.06) |
| Constant | .475 | .221 | 1.252*** | .71 |
| | (1.19) | (1.63) | (3.62) | (1.52) |
| n | 524 | 523 | 511 | 494 |
| Adj $R^2$ | 0.2398 | 0.1585 | 0.1720 | 0.2006 |
| Breusch and Pagan | 13.77*** | 174.88*** | 11.21*** | 32.76*** |
| Max VIF of test variables | 2.34 | 2.36 | 2.40 | 2.48 |

*** p<.01, ** p<.05, * p<.1. ETR measures are standardised ETRs. The results are statistic results after identifying and excluding influential data. t-statistics (in parenthesis) are calculated by heteroscedastic-robust standard errors clustered by company.

**Figure 5. 12 Change in ETR measures of companies excluding tax credit years**



summaries in table 5.14 (Robustness test 3: "Excluding tax credit years") and table 5.15 (matrices 45 - 48). Excluding company year ends with tax credits reduces the observations of *Cur_ETRs* from 549 to 524, *Def_ETRs* reduce from 555 to 523, *GAAP_ETRs* change from 540 to 511 and *Cash_ETRs* change from 521 to 494. For this sub-sample the models explain 23.98% of the variance in *Cur_ETRs*, 15.85% of the variance in *Def_ETRs*, 17.20% of the variance in *GAAP_ETRs* and 20.06% of the variance in *Cash_ETRs*.

According to matrices 45 - 48 reported in table 5.15, the coefficients of *Cur_ETRs*, *Def_ETRs*, *GAAP_ETRs* and *Cash_ETRs* significantly change in the IPO process, the conclusion that corporate tax management significantly changes in the IPO process is robust to the inclusion of tax credits.

The analysis of the matrix of *Cur_ETRs* (matrix 45) shows that consistent with initial result in year b-2 there is a higher level of current tax charge. In IPO preparation, the disclosure requirements of prospectuses increase the amount of information disclosed to the public, which makes tax management behaviours easier to be exposed, as a result, companies engage in less tax management (Gao and Jain 2011; Jain and Kini 2008; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). In year b-1 companies engage in more tax management, resulting in a lower level of current tax charge. In the year immediately after going public (year a+1) companies engage in more tax management to reduce current tax liabilities. Because of incentives to signal firm value and achieve profit targets, in the year immediately prior to IPO and the year immediately after IPO there is a higher level of tax management (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). For *Def_ETRs* there is increased tax deferral in the year of flotation (matrix 46), indicating that companies defer a higher amount of taxes to the future to reduce current tax expense (Dyreng et al. 2008), the initial result is robust. Using *GAAP_ETRs* to measure tax management (matrix 47), in the IPO year because of additional scrutiny and increased risks there is less engagement in tax management, resulting in a higher level of total tax charge (Gao and Jain 2011; Jain and Kini 2008; Ball and Shivakumar 2008; Ahmad-Zaluki et al

2011), but after successfully going public, in year a+1 with the incentives of reducing tax liabilities, increase after-tax earnings and cash flows to signal firm value, managers increase the engagement in tax management, resulting a lower level of total tax charge (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). Measured by *Cash_ETRs* in year a+2 there is more tax payment, indicating the public profile attracts additional monitoring on corporate behaviours, as a result, managers reduce the level of tax management (matrix 48) (Filatotchev and Bishop 2002; Freedman and Stagliano 2002; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011).

## 5.4 Conclusion

In summary, the multivariate results support the hypothesis $H_1^1$ that corporate tax management behaviours significantly change in the IPO process. This suggests companies change tax positions in the process of going public. For the full sample of 217 IPO companies, measured by *Cur_ETR* one year prior to the IPO year companies engage in more tax management to reduce current tax liabilities. This is hypothesised to because of IPO companies' incentives to increase profits to signal firm value and attract investors. In the first year after going public companies engage in a higher level of tax management, it is likely to because their incentives to meet profit targets and show good firm performance. It is also found that in the IPO year companies defer a higher amount of tax charge to the future. The combined ETR measure (i.e. *GAAP_ETRs*) indicates that one year before the IPO companies engage in more tax management to reduce total tax charge for higher profits. In addition to managing accounting taxes, in year b-1 companies also engage in more tax management to manage cash taxes paid. But two years after going public, with enhanced scrutiny and additional information disclosure companies engage in less tax management.

If the company year ends with losses are excluded and only company year ends with profits are retained in the sample, the results are different. If a company will conduct an IPO, in the second year prior to IPO there is a significant increase in *Cur_ETRs*, indicating with increased scrutiny companies settle outstanding and disputed tax

liabilities with relevant tax administrations. One year prior to IPO there is a higher level of tax management, in the year immediately prior to IPO companies have incentives to reduce tax charge to increase profit to signal firm value. But in the year of going public, in order to go public successfully companies engage in less tax management. The results of *Def_ETRs* indicate that in the IPO year companies defer a higher amount of tax liabilities to the future. Although *Cur_ETRs* significantly change in the years prior to IPO, incorporating the effect of deferred taxes the management of total tax expense reflected by *GAAP_ETRs* does not significantly change consistent with the overall effects of current tax and deferred tax changes netting out. In the year immediately after going public companies engage in more tax management and this is hypothesised to because of their incentives to meet profit target. Regarding the management of cash taxes paid, in the year immediately prior to IPO companies engage in more tax management to reduce tax payment. After going public, under a higher level of scrutiny maybe because on the cash basis there are less opportunities (e.g. accruals) for companies to manage taxes, in year a+2 companies engage in less tax management. The different results between full sample and profitable company year-ends indicate that the company year ends with losses can influence results, because accounting loss can bias ETR measures, the results of profitable company year-ends are more reliable.

The tax management behaviours in years around IPOs are different between pre and post 2008 periods. This is consistent with the hypothesis $H_2^1$ that corporate tax management during IPO process is different between pre and post 2008. The difference is that while in the pre 2008 period the level of tax management measured by *GAAP_ETRs* and *Cash_ETRs* varies in the years prior to IPO, in the post 2008 period with increased scrutiny in IPO preparation corporate tax management behaviours do not significantly change, tax positions are not significantly adjusted. In years after going public while the pre 2008 sub-sample does not significantly change tax management behaviours the post 2008 sub-sample engage in more tax management to reduce total tax charge and cash tax payment. With further analysis this is resulted from companies listed on AIM, as a result, more stringent monitoring

should be given to the companies listed on AIM.

Consistent with hypothesis $H_3^1$ corporate tax management behaviours during IPO process vary by listing market. Due to very small sample size the difference in tax management between listing market in the pre 2008 period cannot be examined. In the post 2008 period in the year immediately after going public those companies listed on AIM engage in more tax management to reduce current tax liabilities, total tax liabilities and cash taxes liabilities. However, for companies listed on Main Market, after IPOs they engage in less tax management. But in the IPO year they engage in more tax management to reduce cash taxes liabilities. This suggests investors consider contingent tax payment in decision making.

The change in tax management measured by *Cur_ETRs*, *GAAP_ETRs* and *Cash_ETRs* is different before and after the change in auditors is controlled. This supports the hypothesis $H_4^1$ that corporate tax management behaviours during IPO process vary by auditor changes. Investors are suggested to be cautious about companies changing auditing firms in the IPO process.

The study also examines the robustness of results to currency transition, the measure of *NOLs* and the inclusion of tax credits. It is found that after excluding companies experiencing reporting currency transition in the IPO process, selecting those companies persistently making profits in the IPO process to control the effect of *NOLs*, dropping observations with tax credits, the finding that corporate tax management significantly change in the IPO process is robust.

# Chapter 6 Conclusion

This chapter is a conclusion for the study. The first section is an overview of the research, it reviews research motivation, objective, hypotheses and findings. The second section concludes research contribution, limitation and gives suggestions for future research.

## 6.1 Overview of the research

As an important social entity, the behaviours of corporations have a profound impact on the society. Companies can be affected by taxes as long as they have operating activities. Tax is a significant expense item in a company's life (Francis et al. 2014; Richardson et al. 2015). Tax management is important for companies because it can minimise the amount of taxes and increase after-tax earnings (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). Many studies have investigated corporate tax management but there is still call for more studies (Shackelford and Shevlin 2001; Hanlon and Heitzman 2010). IPO is an important event of a company's life, in order to successfully go public IPO companies need to manage and standardise their operation activities. The literature finds that companies manage their firm characteristics, management team and corporate governance in the IPO process (Sahoo 2014; Deeds et al 1997; Darrough and Rangan 2005; Friedlan 1994; Teoh et al 1998a; Cohen and Dean 2005; Certo 2003; Downes and Heinkel 2016), but there is no literature investigating tax management behaviours in the IPO process. Under this background, the objective of this study is to fill the research gap to investigate corporate tax management behaviours in the IPO process.

The study puts forward four hypotheses. Firstly, it is hypothesised that IPO companies manage their tax behaviours in the IPO process, that is, corporate tax management behaviours have significant change around IPOs. On the one hand, managers' incentives to increase after-tax earnings and cash flow to signal firm quality to

potential investors increases the potential benefits of tax management, as a result, managers are likely to engage in more tax management in the IPO process (Francis et al 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a; Spence 1973). On the other hand, however, the additional scrutiny and more information disclosure involved in the IPO process magnifies the risks of tax management and consequently reduces managers' incentives of employing tax management strategies, as a result, in the IPO process managers are likely to engage in less tax management (Gao and Jain 2011; Jain and Kini 2008; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). Secondly, in different periods corporate tax management is different, tax management behaviours in the IPO process are different in pre and post 2008 Banking Crisis. On the one hand, resulted from the increased reputational and scrutiny costs associated with tax management, after 2008 Banking Crisis companies should engage in less tax management (Holland et al 2016; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). On the other hand, because of 2008 Banking Crisis many companies are likely to fall into financial distress, which increases the incentives to engage in tax management till reporting profits (Richardson et al 2015). Thirdly, for companies listed on different markets their tax management behaviours around IPOs are different. One theory is that Main Market has stricter scrutiny and higher reporting standards, which increases the risks of tax management (Doukas and Hoque 2016; Khurshed et al 2016; Nielsson 2013; Ball and Shivakumar 2008; Frank et al 2009). As a result, companies listed on Main Market engage in less tax management. The other theory is that in the Main Market there is higher market pressure on corporate performance, which increases managers' incentives to engage in tax management to increase after-tax earnings (Parsa and Kouhy 2008). Fourthly, tax management behaviours in IPO process vary with auditor changes. If a company changes auditors during the IPO process its tax management behaviours may also change (McGuire et al 2012; Omer et al 2006; Cook et al 2008; Maydew and Shackelford 2005).

The study selects 217 companies listed on London Stock Exchange during the period of 2004 to 2018 as the sample to test the hypotheses. The years around IPO include three years prior to IPOs to two years after IPOs. OLS method is used to estimate

models. In order to investigate tax management from different aspects, it is measured by standardised *Cur_ETRs*, *Def_ETRs*, *GAAP_ETRs* and *Cash_ETRs*.

The results indicate that in the IPO process corporate tax management levels have significant changes, IPO companies manage tax structure in the process of going public. For full sample reflected by accrual - based ETR measure (i.e. *GAAP_ETR*) companies engage in more tax management in the year immediately prior to IPO. Decomposing it by *Cur_ETR* and *Def_ETR*, measured by *Cur_ETR* there is an increased level of tax management in the year immediately prior to IPO and the year immediately post IPO, measured by *Def_ETR* in the IPO year companies defer a higher amount of tax liabilities to the future. Using cash - based ETR (i.e. *Cash_ETR*) as the measure there is evidence that companies engage in more tax management in the year immediately prior to IPO but engage in less tax management two years post IPO. The findings imply that in the year immediately prior to IPO, IPO year, the year immediately after IPO, managers believe that the benefits of tax management exceed risks, as a result, they engage in more tax management (Francis et al. 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). But in the second years after IPO managers consider that potential costs of tax management for public companies exceed benefits and they therefore engage in less tax management (Gao and Jain 2011; Jain and Kini 2008; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011).

For the sample of profitable company year ends, measured by accrual - based *GAAP_ETR* companies engage in more tax management in the first year after going public. Further explaining it by *Cur_ETR* and *Def_ETR*, there is evidence that with additional scrutiny companies engage in less tax management in the second year prior to IPO and the IPO year. However, there is also evidence that in the year immediately prior to IPO companies engage in more tax management. In addition, in the IPO year there is a higher amount of tax deferrals. Measured by cash - based measure *Cash_ETR* there is evidence of increased tax management in the year immediately prior to IPO but decreased tax management two years after going public. The findings also support the hypothesis that corporate tax management behaviours significantly change in the

IPO process. There is a higher level of tax management in the year immediately prior to IPO and the year immediately post IPO, supporting the signalling theory (Francis et al. 2014; Rego and Wilson 2012; Desai and Dharmapala 2009a). But in year b-2, IPO year, and year a+2, there is evidence of less engagement in tax management, showing that in these years managers believe that the costs of tax management exceed its benefits (Gao and Jain 2011; Jain and Kini 2008; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011). The finding that corporate tax management behaviours have significant change in the IPO process passes all robustness tests.

The second hypothesis that corporate tax management behaviours in the IPO process are different before and after 2008 Banking Crisis is supported. Compared with the pre 2008 sub-sample the post 2008 sub-sample does not significantly change their tax management strategies in the years prior to IPOs, with greater scrutiny and additional disclosure requirements, after 2008 Banking Crisis companies engage in less tax management (Holland et al 2016; Ball and Shivakumar 2008; Ahmad-Zaluki et al 2011) After IPOs, however, the post 2008 sub-sample exhibits a higher level of tax management.

Through further analysis the more engagement in tax management after going public is derived from companies listed on AIM. In the years after going public companies listed on AIM engage in more tax management, but companies listed Main Market exhibit a lower level of tax management, supporting the conjecture that Main Market IPO companies are more conservative in engaging in tax management as they face more stringent regulation and higher reporting standards (Doukas and Hoque 2016; Khurshed et al. 2016; Nielsson 2013; Mallin and Ow-Yong 2012; Rousseau 2008). Those findings support the hypothesis that corporate tax management in the IPO process is different in different markets. The companies listed on Main Market are less risky than those companies listed on AIM.

It is also found that before and after controlling the change in auditors corporate tax management behaviours are different. Thus, the fourth hypothesis that corporate tax

management behaviours in the IPO process vary with auditor change is also supported (Klassen et al 2016; McGuire et al 2012; Omer et al 2006; Cook et al 2008; Maydew and Shackelford 2005).

## 6.2 Contributions, limitations and suggestions for future work

### 6.2.1 Contributions

From the perspective of theoretical contribution, to the author's knowledge this study is the first to investigate corporate tax management behaviours in the IPO process. It is also the first study to investigate corporate tax management behaviours between pre and post 2008 Banking Crisis, Main Market and AIM, and the first study to investigate the association between tax management behaviours in the IPO process and auditor change. This study makes contribution to the literature on corporate tax management, specially the determinants of tax management, it responds to the call of Hanlon and Heitzman (2010) to give a more detailed analysis of the association between ownership structure and corporate tax management behaviours, there is evidence that the level of tax management changes with ownership structure. In addition, this study also makes a significant contribution to the literature on IPO management.

From the perspective of methodological contribution, a significant innovation of this study is developing standardised ETR measures. Based on traditional ETR measures, the standardised ETRs further divide ETR measures by statutory tax rates. It avoids the observed change in ETRs caused by the change in statutory tax rates, resulting in more accurate measurement of tax management.

In terms of the practical and policy implications, the investigation of corporate tax management behaviours can help the government and tax regulator authorities better regulate corporate tax behaviours, restrict tax avoidance and tax evasion behaviours that are harmful to tax revenues and social benefits (Scholes et al 2015; Manzon Jr and Plesko 2002). The study provides the evidence that companies seeking to go public have incentives to engage in tax management, suggesting tax authorities be more

stringent on the tax collection of the companies in this status.

It also has implications for market regulatory authorities (e.g. FCA, London Stock Exchange). Through the analysis of the results market regulatory authorities can better understand the behaviours of quoted companies. As a result, they can conduct effective monitoring on corporate behaviours, reduce investment risks associated with listing companies, improve market reputation and maintain the market order (Cordazzo and Vergauwen 2012; Khurshed et al 2016; Nielsson 2013). The results show that after going public IPO companies listed on AIM exhibit a higher level of tax management to reduce total tax charge and cash tax payment, in the IPO year companies listed on Main Market engage in more tax management to reduce cash tax liabilities. Market regulatory authorities therefore should strengthen the scrutiny for IPO companies and remind investors of possible risks.

The investors also can benefit from the study. It helps investors to more accurately assess the firm value of IPO companies to protect their interests. There is evidence of increased tax management in the IPO process, although the tax management has benefits (e.g. reduce tax charge, increase profit and market value), it has many risks (e.g. contingent tax liabilities, penalty, reputation loss, lower market value) (Francis et al 2014; Rego and Wilson 2012; Wahab and Holland 2012; Holland et al 2016). The finding suggests investors consider tax risks in making investment decision to avoid the loss of interests. In addition, investing in companies of Main Market is less risky than investing in AIM. The change in auditing firm is a useful information to identify tax risks.

### 6.2.2 Limitations and suggestions for future work

It is acknowledged that the study has limitations. Firstly, due to the lack of access to confidential tax payer data the study can only use publicly data which put the research on the same footing as investors and other users outside of the administration. Secondly, due to data availability the study only selects six-year of research window. If there are sufficient data the future study can extend the research window to a longer

period. Thirdly, because of small sample size the robustness results cannot be examined for subsamples (e.g. companies of pre and post 2008, companies listed on Main Market and AIM), if there are sufficient data the future study can further test the robustness of the results of those subsamples.

There are additional suggests for future study. The future study can adopt a qualitative research approach involving case study and interviews to future investigate questions like “what factors are considered by IPO companies in tax decision making”, “which bodies are involved in tax decision making”, “how IPO companies trade-off the risks and benefits associated with tax management”, “what approaches are used by IPO companies to manage taxes”. If there is sufficient data the future study can also extend research window. In addition, it is found that corporate tax management behaviours in the IPO process are sensitive to auditor changes. The future study can give a more detailed analysis of the association between tax management and auditing firms, e.g. Big 4 and non-Big 4 auditing firm. Another suggestion is that this study is a fundamental study only investigating how tax management behaviours change in the IPO process. The future study can further investigate what factors affect the change in tax management around IPOs, possible factors can be the change in board structures, managerial ownership retention, managerial incentive mechanism etc.

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