Three essays on earnings quality

Tri Tri Nguyen

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To my family

with lots of love

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List of acronyms

AAER	Accounting and Auditing Enforcement Release
CEO	Chief Executive Officer
CFO	Chief Finance Officer
ERC	Earnings Response Coefficient
FASB	Financial Accounting Standards Board (US)
FRC	Financial Reporting Council (UK)
FRRP	Financial Reporting Review Panel (UK)
FTR	Future-time Reference
GAAP	Generally Accepted Accounting Principles
GAO	The US Government Accountability Office
IAASB	International Auditing and Assurance Standards Board
IASB	International Accounting Standards Board
IFRS	International Financial Reporting Standards
ISIN	International Securities Identification Number
M&A	Merger and Acquisition
OLS	Ordinary Least Square
PPE	Property, plant and equipment
R&D	Research and Development
ROA	Return on assets
SEC	The US Securities and Exchange Commission
SOX	Sarbanes-Oxley Act
UK	United Kingdom
US	United States (of America)

ABSTRACT

This thesis aims to investigate earnings quality, by employing recent methodologies. The thesis has three empirical chapters.

The first empirical chapter is about the profile of chief executive officers (CEO) and earnings quality. Based on previous studies, I introduce a measure of CEO profile, denoted PSCORE, which aggregates nine personal characteristics of CEOs. Data for the construction of the PSCORE are publicly available on the CEOs' curriculum vitae and firms' financial statements. Following previous studies, I measure earnings quality in different ways: abnormal accruals (Jones, 1991; Dechow, Sloan, and Sweeney, 1995; Peasnell, Pope, and Young, 2000b); abnormal cash flows, abnormal production costs, and abnormal discretionary expenditures (Roychowdhury, 2006); and deviations of the first digits of figures reported in financial statements from what are expected by Benford's Law (Amiram, Bozanic, and Rouen, 2015). Using a sample of UK listed companies for 2005-2012, I find positive relationships between the PSCORE and all proxies for earnings quality. Also, the evidence shows that the relationships are stronger when CEOs' equity-based compensation incentives are higher. The findings suggest that the PSCORE can be useful to signal a red flag of poor earnings quality. The study has some implications for practitioners.

The second empirical chapter examines the role of banking expertise on the board of directors on accounting conservatism. Using the working histories in banks of individual directors on the board, I measure banking expertise on the board by accumulating the numbers of years and the numbers of banks individual directors have worked for. Using a sample of UK listed companies for 2005-2012, I show that the

measures of banking expertise on the board are negatively associated with firm-year accounting conservatism. Additional analyses indicate that the relationships between accounting conservatism and banking expertise on the board are more pronounced for firms which face high bankruptcy risk and have high financial leverage. A possible explanation is that directors with banking expertise provide the board with information about the market-level demand for accounting conservatism and they also bring interpersonal networks in the banking industry that can act as a private communication channel in debt contracting, leading to a reduction in accounting conservatism which is documented in recent studies as costly for borrowing firms. The study makes a significant contribution to the existing literature, especially in that it offers an innovative way to measure banking expertise on the board and it complements the work of Erkens, Subramanyam, and Zhang (2014) and Bonetti, Ipino, and Parbonetti (2017) by providing further evidence on the relevance of boards of directors for accounting conservatism.

The last empirical chapter is about applying Benford's Law to study the earnings quality of UK listed companies. I employ Benford's Law, which is the law of digit distributions, to examine the first digits of financial statement items of UK listed companies. I find that the first digits of figures reported in financial statements of UK companies for 2005-2012 follow Benford's Law at the firm-specific level and market level. Next, the evidence suggests income statements may contain more errors (as evidenced by higher deviations of first digits from what are expected by Benford's Law) than those of balance sheets and cash flows statements. Also, I find that earnings management and accounting conservatism are two explanations for first-digit deviations. While previous studies support the positive relationship between earnings management and first-digit deviations, the study is the first which provides an alternative explanation for first-digit deviations from Benford's Law. I suggest that a plausible explanation is that accounting conservatism introduces biases to financial statements, which make accounting figures deviate from the law of digit distributions. The results have implications for auditors.

Chapter 1: AN INTRODUCTION TO THE THESIS

1.1. Introduction

The literature on earnings quality has been emerging for several decades. Researchers have been interested in responding to the call from the United States (US) Securities and Exchange Commission (SEC) and its worries about the phenomenon of "the numbers game" (Levitt Jr, 1998) in listed companies in the 1990s. The accounting scandals in the 2000s and the passage of the Sarbanes-Oxley Act (2002) in the US have also reshaped the research on earnings quality (DeFond, 2010). The numbers game, which refers to the manipulation of earnings reported in financial statements, raises concerns about the earnings quality of listed companies. That is because accounting scandals normally begin with inflating earnings up to four years prior to the collapse of corporations (e.g., García Lara, Garcia Osma, and Neophytou, 2009). Consequently, investors may suffer losses before accounting manipulations are detected.

A feature of research in accounting following the call has been building, validating and improving empirical models to estimate the quality of earnings (Dechow, Ge, and Schrand, 2010). For example, researchers have built models to estimate earnings management, a measure of poor earnings quality, by using accruals under accounting standard choices (e.g., Jones, 1991; Dechow et al., 1995; Peasnell et al., 2000b; Dechow and Dichev, 2002; Kothari, Leone, and Wasley, 2005) or by using real business transactions such as sale discounts, over productions and cutdown discretionary expenditure (Roychowdhury, 2006). A common aspect of these empirical models is that they rely on firm characteristics. Despite their importance, the models are subject to considerable criticism, e.g. due to model misspecification (Holthausen, Larcker, and Sloan, 1995; Fields, Lys, and Vincent, 2001; Dechow et al., 2010; Ball, 2013).

This thesis contributes to the research strand on earnings quality by employing recent methodologies. Relying on previous research (e.g., Wells, 2002; Francis, Huang, Rajgopal, and Zang, 2008; Malmendier and Tate, 2009; Jiang, Petroni, and Yanyan Wang, 2010; Huang, Rose-Green, and Lee, 2012; Kuang, Qin, and Wielhouwer, 2014; Ali and Zhang, 2015), the thesis proposes a new way to study the quality of earnings by using certain personal traits of chief executive officers which are more likely to be linked to earnings quality. Also, the thesis uses recently developed measures of earnings quality based on mathematics i.e., deviations of first digits of figures reported in financial statements (Amiram et al., 2015; Nigrini, 2015), rather than using model-based measures, so that the findings would contribute to the debate on earnings quality not only in the UK but in the world. Next, the thesis proposes a new way to measure banking expertise of boards of directors using working history in the banking industry of individual directors and study it with accounting conservatism. The proposed measure of banking expertise takes into account past and present working experience in banks of all board members, which overcomes limitations of recent studies considering only the presence of bankers or ex-bankers on boards of directors (Erkens et al., 2014; Bonetti et al., 2017).

The thesis has three empirical chapters. The first empirical chapter offers an innovative way to examine earnings quality using the profile of chief executive officers (CEO). The second empirical chapter uses working history in the banking industry of all individual directors on the boards of directors to study accounting conservatism. The third empirical chapter employs a recent methodology proposed by Amiram et al. (2015) and Nigrini (2015), which relies on deviations of first digits of figures reported in financial statements from what are expected by Benford's Law, to study the quality of earnings of UK listed companies.

The next section explains the features of data used in the thesis, followed by a brief introduction to the three empirical chapters.

1.2. Empirical settings

The thesis uses a sample of UK listed companies from 2005 to 2012 to examine earnings quality. There are several reasons which make this an interesting study. First, the thesis contributes to the debate on earnings quality in the UK by employing recent methodologies to study earnings quality. There are some institutional differences between the UK market and the US market, where most studies on earnings quality come from. Pope and Rees (1992) find that financial statements under UK General Accepted Accounting Principles (GAAP) and US GAAP both have information on earnings after controlling for reconciliation between those GAAPs. Pope and Walker (1999) show that UK GAAP have higher levels of discretions regarding accounting treatments for extraordinary items, leading to differences in timeliness of earnings between those GAAPs. [1] From 2005, UK firms have used the International Financial Reporting Standards (IFRS) as a result of the IFRS mandatory adoption in Europe, and there is mixed evidence on whether earnings quality has been improved following the IFRS adoption. Zeghal, Chtourou, and Fourati (2012) report that IFRS adoption results in less earnings management and higher accounting conservatism in 15 European countries

[1] It is important to note that the studies of Pope and Rees (1992) and Pope and Walker (1999) also imply that evidence on earnings quality of studies in the US can apply to research in the UK.

(including the UK). In contrast, Ahmed, Neel, and Wang (2013) use a matched sample between IFRS-adoption firms and non-adoption firms with similar legal enforcement and firm characteristics and find that IFRS-adoption firms exhibit higher income smoothing, higher levels of aggressive abnormal accruals, and lower timeliness of earnings. The contradictory findings between Zeghal et al. (2012) and Ahmed et al. (2013) might be attributable to different model specifications to estimate earnings quality, as explained in Section 1.1. This thesis does not attempt to reconcile the mixed findings of previous studies. Instead, it employs recent methodologies to provide further evidence on earnings quality in the UK.

Second, the thesis offers an innovative way to study earnings quality which is relevant for research not only in the UK but also in the US and worldwide. As classified by Dechow et al. (2010), studies on earnings quality in the US may use observable indicators of misstated earnings, namely accounting restatements databases by the US Government Accountability Office (GAO) and the Accounting and Auditing Enforcement Releases (AAER) by the SEC.[2] However, previous studies show that accounting restatements from the GAO can be a noisy proxy for accounting fraud because the database includes both restatements following SEC allegations and other restatements which result from unintentional errors or retrospective adjustments required by accounting standards (Hennes, Leone, and Miller, 2008; Dechow et al., 2010; Plumlee and Yohn, 2010). Similarly, the AAER sample is biased because it ignores aggressive earnings management within the GAAP, includes mostly large firms, as the SEC might be worried about the overall consequences of accounting manipulations on the capital market, and does not

[2] Section 2.1.2.3.1 and Section 2.1.2.3.2 will discuss in more details these measures of earnings quality.

differentiate intentional violations of accounting standards from unintentional violations, e.g. violations due to differences in interpretation of accounting principles and rules (Dechow et al., 2010). Next, there are increasing concerns that model-based measures of earnings quality, e.g. abnormal accruals (e.g., Jones, 1991; Dechow et al., 1995; Kothari et al., 2005), are biased due to poor model specifications (Fields et al., 2001; Dechow et al., 2010; Ball, 2013). Therefore, there is a promising path for future studies. Using recent methodologies to study earnings quality becomes even more important in the context of the UK where data on observable indicators of misstated firms comparable to US accounting restatements and the AAER are limited. In the UK, the Financial Reporting Review Panel (FRRP) releases firm-specific announcements for investigation of allegations regarding accounting standards, but the sample is very small. For example, the FRRP discloses only 70 cases of accounting allegations from January 1995 and December 2012 (Nguyen, 2016).

The thesis uses the sample period from 2005 to 2012 for several reasons. I start with 2005 because UK listed firms adopted the IFRS beginning in 2005, so the findings are less likely affected by consequences of IFRS adoption on earnings quality. Also, in 2012, the Financial Reporting Council (FRC) (2012) released the UK Corporate Governance Code to replace the old version issued in 1992 by the Cadbury Committee. Thus, the research period ends in 2012 to avoid the effects of changes in corporate governance on the quality of earnings in general.

1.3. Three empirical chapters

The thesis has three independent empirical chapters. This section briefly introduces each empirical chapter.

1.3.1. Chapter 3: CEO profile and earnings quality

Motivated by limitations of model-based measures of earnings quality (Holthausen et al., 1995; Fields et al., 2001; Dechow et al., 2010; Ball, 2013), I offer the PSCORE, which aggregates nine personal characteristics of chief executive officers, to study earnings quality. The PSCORE is a composite score based on publicly available data on CEOs. The PSCORE captures financial expertise (measured by experience as a CEO, previous working experience as a chief financial officer, and finance-related qualifications), reputation (measured by early years of service in the firm, performance during the last three years of tenure, and press coverage), internal power (measured by whether the CEO serves as the chairperson and whether the CEO serves as a founder of firms), and age of CEOs. The chapter hypothesises that the PSCORE is positively associated with other established proxies for earnings quality.

The chapter employs three types of measures of earnings quality: (i) accrual earnings management, measured by abnormal accruals (Jones, 1991; Dechow et al., 1995; Peasnell et al., 2000b); (ii) real earnings management, measured by abnormal cash flows, abnormal production costs, and abnormal discretionary expenditures (real earnings management) (Roychowdhury, 2006); (iii) financial statement errors, measured by deviations of first digits of figures reported in financial statements from what are expected by Benford's Law (Amiram et al., 2015; Nigrini, 2015). The analyses, derived from a sample of 3,395 firm-year observations of listed companies on the London Stock Exchange from 2005 to 2012, show positive associations between PSCORE and the established proxies for earnings quality. Specifically, the evidence indicates that the PSCORE increases monotonically with an increase in measures of earnings quality. The associations between PSCORE and abnormal accruals, abnormal cash flows, abnormal production costs, abnormal discretionary expenditures, and deviations of first digits from Benford's Law remain significant after controlling for major factors which affect the quality of earnings. Additional analyses demonstrate that the relationships between PSCORE and proxies for earnings quality are more pronounced when CEOs have higher equity-based compensation incentives. The results suggest that the PSCORE could signal the quality of earnings reported in financial statements.

The research contributes to the literature and practice in several ways. First, data used to construct the PSCORE are publicly available and mostly collected from the curriculum vitae of CEOs; thus, the application of the research is promising. Second, this is the first study which aggregates various characteristics of CEOs into a single index to signal the quality of earnings. Third, the research is the first of its kind to provide evidence that the profile of CEOs can be associated with many measures of earnings quality, e.g. accrual earnings management, real earnings management, and financial statement errors measured by deviations of first digits from Benford's Law. Practitioners could value the PSCORE because it is highly practical and can signal the misrepresentation of financial statements regardless of whether the misstatements result from intentional or unintentional acts. The PSCORE could be a useful tool for investment professionals, boards of directors, auditors, and regulators to assess the risks of poor earnings quality.

1.3.2. Chapter 4: Accounting conservativism and banking expertise on boards of directors

Previous studies show that accounting conservatism is helpful for contracting demand and for litigation, regulation, and taxation (Watts, 2003a). In debt contracting, accounting conservatism provides lending banks with an early indication of creditworthiness of borrowing firms so that the banks can take timely actions to protect their interests. Recent studies further argue that the presence of a banker on the board of directors affects demand for accounting conservatism because bankers can act as a private information-sharing channel between borrowing firms and lending banks (Erkens et al., 2014) as a corporate governance mechanism (Bonetti et al., 2017).

This chapter contributes to this path of research by examining the role of banking expertise on the board of directors on accounting conservatism. The chapter provides an innovative way to measure banking expertise based on the working history in banks of all individual directors on the board. While previous studies consider only the presence of bankers or ex-bankers on the boards of directors (Erkens et al., 2014; Bonetti et al., 2017), the proposed measure of banking expertise in this chapter accumulates past and present banking experience of all board members. There are some reasons to hypothesise that there is a negative relationship between banking expertise on the board and accounting conservatism. First, directors with banking expertise could have an information advantage about the market-level demand for accounting conservatism; hence, having them on the board can help non-financial firms avoid excessive conservatism. Second, directors with banking expertise often possess interpersonal networks in the banking industry (e.g., Engelberg, Gao, and Parsons, 2012) that could act as a private communication channel in debt contracting, resulting in less demand for accounting conservatism at the firm-specific level.

The chapter tests the hypothesis that the banking expertise of boards of directors is negatively related to accounting conservatism, using a sample of companies listed on the London Stock Exchange from 2005 to 2012. The findings support the hypothesis that banking expertise on the board helps to reduce accounting conservatism. Specifically, the chapter finds a statistically significant and negative relationship between firm-year accounting conservatism (Basu, 1997; Khan and Watts, 2009; García Lara, García Osma, and Penalva, 2016) and different measures of banking expertise on the board which are constructed from working history in the banking industry of individual directors on the board of directors. Additional analyses show that the effects of banking expertise on the board on accounting conservatism are more pronounced for firms with high financial leverage and firms with high bankruptcy risk.

The chapter makes significant contributions to the existing literature. First, it shows that not only the presence of a banker or ex-banker on the board of directors (Erkens et al., 2014; Bonetti et al., 2017) but also the working history in the banking industry of board members affects the demand for accounting conservatism. Second, the findings may be more generalised because there is no restriction in the chapter's sample construction, and they are less likely to be affected by changes in accounting standards in the UK. The results have some implications for boards of directors.

1.3.3. Chapter 5: Benford's Law, earnings management, and accounting conservatism: the UK evidence

Chapter 5 uses Benford's Law to study the earnings quality of UK listed companies. Benford's Law refers to the distributional probability of the digits of numbers in a data set. The law indicates that every digit will appear with a certain frequency in the data set, and deviations from the expected frequencies are signals of the existence of errors or biases (Nigrini, 1996; Amiram et al., 2015; Nigrini, 2015).

There are emerging accounting studies which use Benford's Law to study errors or biases in financial statements, e.g. earnings management and fraud (Carslaw, 1988; Thomas, 1989; Nigrini, 1996; Caneghem, 2002, 2004; Lin, Wu, Fang, and Wun, 2014; Amiram et al., 2015; Nigrini, 2015). The reason for the prominent application of Benford's Law is that it helps to overcome the limitations of model-based measures of earnings quality (e.g., Fields et al., 2001; Dechow et al., 2010; Ball, 2013) or sample selection biases in accounting restatements by the GAO or AAER by the SEC (e.g., Dechow et al., 2010).

The chapter hypothesises and finds that the first digits of figures reported in financial statements of UK listed companies from 2005 to 2012 follow Benford's Law at the firm-specific level and at the market level. Also, the results indicate that, compared with those in balance sheets and cash flow statements, items in income statements have larger deviations of first digits from what are expected by Benford's Law, suggesting that income statements may contain more errors or biases. Next, the chapter finds a positive association between deviations from Benford's Law and accrual earnings management (Jones, 1991; Dechow et al., 1995; Peasnell et al., 2000b) and accounting conservatism (Basu, 1997; Khan and Watts, 2009; García Lara et al., 2016). Further analysis shows that the relationship between deviations from Benford's Law and accounting conservatism exists only when there is an absence of a Big-Four auditor, implying that conservatism-related purposeful intervention by management causes biases in financial statements, leading to higher deviations of first digits from what are expected by Benford's Law.

This chapter makes at least three significant contributions to the existing literature. First, the chapter is the first paper showing that the first digits of all figures reported in financial statements follow first-digit distributions expected by Benford's Law. The approach applying Benford's Law on all items in financial statements (Amiram et al., 2015) overcomes the limitations of previous studies (Caneghem, 2002, 2004) which focus on only an individual item in financial statements such as earnings before tax. The approach has at least three major advantages because (i) it gives a chance to detect errors or fraud in assets, liabilities, incomes, expenses and cash flows, (ii) it makes errors or fraud in financial statements are more likely to be detected due to the double-entry accounting system, and (iii) it can flag up errors or fraud in accounts which do not directly affect net income because it takes into account deviations of first digits of all items reported financial statements. Second, the study provides further evidence for the notion that earnings management causes deviations of the first digits of financial statements of UK companies (Caneghem, 2002, 2004). However, while Caneghem (2002) and rely on one item in financial statements (pre-tax income), the chapter uses a recent methodology (Amiram et al., 2015; Nigrini, 2015) which relies on first digits of all items reported in financial statements. Third, the chapter is the first of its kind to provide an alternative explanation for deviations of first digits from Benford's Law. While earnings management has been widely documented as a source of deviations (Carslaw, 1988; Caneghem, 2002, 2004; Amiram et al., 2015), the chapter shows that accounting conservatism also leads to deviations of first digits. This evidence is in line with increasing concerns that managers could manipulate conservatism-related accounting choices for different purposes (LaFond and Watts, 2008; Zhang, 2008). The results of the chapter have some implications for auditors.

The thesis proceeds as follows. Chapter 2 overviews the concept of earnings quality, which is the foundation for three empirical chapters. Chapter 3 is the first empirical study "CEO profile and earnings quality". Chapter 4 is the second empirical study "Accounting conservatism and banking expertise on boards of directors". Chapter 5 is the third empirical study "Benford's Law, earnings management, and accounting conservatism: the UK evidence". Chapter 6 summarises the main findings of the thesis, limitations, and suggestions for future studies.

Chapter 2: AN OVERVIEW OF EARNINGS QUALITY

This chapter provides an overview of the concept of Earnings Quality, which is the foundation for the three empirical chapters. The chapter begins with an introduction to Earnings Quality in Section 2.1, including definitions of Earnings Quality, empirical proxies for Earnings Quality, and recent methodological advancements in estimating Earnings Quality. Then more detail is provided about Earnings Management (Section 2.2) and Accounting Conservatism (Section 2.3), which are the main focuses of three empirical chapters. Section 2.4 provides concluding remarks.

2.1. Introduction

There has been a growing body of research focusing on determinants, consequences, and empirical models to estimate earnings quality (e.g., Healy and Wahlen, 1999; Dechow and Skinner, 2000; McNichols, 2000; Fields et al., 2001; Schipper and Vincent, 2003; Lo, 2008; Holthausen, 2009; Dechow et al., 2010; DeFond, 2010). A fundamental aspect of empirical models to estimate earnings quality is that they rely on the definition of earnings quality. The following sections discuss definitions of earnings quality and empirical proxies for earnings quality.

2.1.1. Definitions of earnings quality

For several decades, the meaning of earnings quality has firstly referred to the usefulness of earnings reported in financial statements for stock valuation (Dechow et al., 2010). The use of the terminology "earnings quality" can be traced to the 1930s when earnings per share were used in security valuation (Dechow et al., 2010). Lev (1989) is also of the view that earnings are useful if earnings information is used by investors. Dechow and

Schrand (2004, p. 5) provide an early comprehensive definition of earnings quality as this: *"earnings to be of high quality when the earnings number accurately annuitizes the intrinsic value of the firm"*. This definition relies on the use of earnings information for equity valuation, and it highlights the importance of earnings in depicting current performance and in predicting the future performance of a company.

Dechow et al. (2010) take a broad view of earnings quality which is built on the concept of earnings in accounting standards. Dechow et al. (2010, p. 344) state that "*higher quality earnings provide more information about the features of a firm's financial performance that are relevant to a specific decision made by a specific decision-maker"*. The authors note three important aspects of this definition. First, the quality of earnings depends on the usefulness of the earnings information for financial statement users' specific decisions. The definition implies that users of financial statements use earnings information not only for equity valuation but also for other purposes such as tax purposes or purchases. Therefore, it is likely that earnings quality may vary for different users, given their needs. Second, earnings quality is conditional on whether reported earnings can describe the unobservable financial performance of the reporting entities. Because a "true" picture of performance (or fundamental performance) cannot be observed, users rely on financial statements in general, and reported earnings in particular, to have an idea about fundamental performance. Earnings are of high quality if it better reflects firms' fundamental performance. Third, earnings quality is affected by both the relevance of earnings information on firms' the financial performance for the decision-making process and the quality of the accounting system to record performance. In general, the broad definition of Dechow et al. (2010) embraces the usefulness of earnings for security valuation (e.g., Lev, 1989; Dechow and Schrand, 2004) and for any other decisions which rely on earnings information.

To provide a better understanding, Dechow et al. (2010) also reshape the ideas about how much earnings should be presented in financial statements. They define reported earnings as a function of unobservable "X", where X are factors determining the financial performance of companies. In their definition, the accounting system plays a major role in reporting unobservable financial performance factors in the form of observable earnings. In other words, the accounting system helps to convert the unobservable X to earnings reported in financial statements. The first importance of the definition of earnings is that the X factors are not related to a specific stakeholder. The definition can be applied for short-term or long-term debtholders, shareholders, and other stakeholders. This inference about users of earnings information is consistent with the general purpose of financial statements under accounting standards (e.g., Financial Accounting Standards Board (FASB), 2010; International Accounting Standards Board (IASB), 2010, 2018), which is to provide financial information for various users. The second importance is that earnings is a function of unobservable factors determining financial performance, not a "perfect" or "true" measure of financial performance. Dechow et al. (2010) provide three explanations for "imperfect" earnings: (i) it is unlikely that a financial statement can provide information that fits all decisions of all users, who range from finance providers (e.g., debtholders and shareholders) to other users (e.g., suppliers and other stakeholders); (ii) pre-determined accounting choices to measure X factors are limited, and thus it also is unlikely that a principle or a rule can fit all companies in all situations; and (iii) accounting standards allow the use of accounting estimates and judgments to measure unobservable X factors, a process which may introduce errors or bias (e.g., earnings management). This also has an implication for research on the use of accrual models to estimate abnormal accruals, with the notion that abnormal accruals erode earnings quality regardless of whether they result from bias or errors (Dechow et al., 2010). Taking a broad perspective, this thesis applies the definition of Dechow et al. (2010) to study the earnings quality of UK listed companies.

2.1.2. Empirical proxies for earnings quality

Most empirical models to estimate earnings quality rely on the fundamental characteristics of earnings quality. Dechow et al. (2010) classify proxies for earnings quality into three types: (i) earnings properties (e.g., earnings persistence, abnormal accruals, earnings smoothness, asymmetric timeliness and timely loss recognition, and target beating) (ii) responsiveness of investors to earnings (e.g., earnings response coefficient), and (iii) observed indicators of misstated earnings (e.g., AAER, accounting restatements, and internal control weakness reports). The next sections briefly introduce influential studies in each type of proxy for earnings quality as well as its determinants and consequences before focusing on the main proxies of interest, i.e., earnings management and accounting conservatism.

2.1.2.1. Earnings properties

2.1.2.1.1. Earnings persistence

Research on earnings persistence relies on the assumption that equity valuation models with the input of more persistent earnings result in better valuation outcomes (Dechow et al., 2010). More persistent earnings are an indication of a higher quality of earnings. The logic underlying the construction of empirical models to estimate earnings persistence is that current earnings provide good information for the estimation of future earnings when earnings are persistent, and more persistent earnings result in smaller errors in valuation. In some models, current earnings have two components: cash and accruals (e.g., Sloan, 1996).

A majority of research in this area examines determinants of the persistence of earnings (Dechow et al., 2010). Sloan (1996) finds that the cash component of earnings is more persistent than the accrual component of earnings. The author explains that the measurement of fundamental performance using accruals may induce errors or bias, which makes the accrual component of earnings less persistent. The relatively lower persistence of the accrual component may be affected by an increase in firms' fundamental performance (Fairfield, Whisenant, and Yohn, 2003), changes in operating and financial leverages (Nissim and Penman, 2001), or extreme accruals which are caused by accounting distortions (Richardson, Sloan, Soliman, and Tuna, 2006).

The empirical research further examines the effect of specific components of accruals on earnings persistence. For example, Richardson, Sloan, Soliman, and Tuna (2005) find that, compared with short-term accruals, long-term accruals result in more persistent earnings. They also find that accruals from financial assets and liabilities are more persistent than accruals from operating assets and liabilities. There is evidence that the factors that drive the low persistence of the accrual component are inventory accruals (Lev and Thiagarajan, 1993; Abarbanell and Bushee, 1997), accrual adjustments for special items (Fairfield, Sweeney, and Yohn, 1996; Dechow and Ge, 2006), and large positive book-tax differences which result from inflating reported earnings (Blaylock, Shevlin, and Wilson, 2012). Prior studies provide mixed evidence about relationships between receivable accruals and earnings persistence (e.g., Lev and Thiagarajan, 1993; Abarbanell and Bushee, 1997).

Another research direction examines the consequences of earnings persistence in the equity market. Early studies show that more persistence of earnings results in higher market reactions (e.g., Kormendi and Lipe, 1987; Collins and Kothari, 1989; Easton and

Zmijewski, 1989). Later research constructs models to predict earnings persistence and examines the awareness of investors about the determinants of earnings persistence. For example, Sloan (1996) indicates that investors do not fully understand that the accrual component of earnings is less persistent than the cash component of earnings. He also shows that a trading strategy with abnormal accruals leads to abnormal stock returns. Later studies support the findings of Sloan (1996) (e.g., Xie, 2001; Fairfield et al., 2003; Desai, Rajgopal, and Venkatachalam, 2004; Richardson et al., 2005; Kraft, Leone, and Wasley, 2006; Zhang, 2007; Khan, 2008). The existing literature also documents evidence on how investors respond to earnings persistence of specific components of accruals, e.g. write-offs accruals (Bartov, Lindahl, and Ricks, 1998; Dechow and Ge, 2006), loan loss (Beaver and Engel, 1996), or a cut in research and development expenses (Penman and Xiao-Jun, 2002). Last but not least, researchers provide evidence that the information environment and the ability to process the information of investors affect their responses to the earnings persistence of an accrual component (Collins, Gong, and Hribar, 2003; Louis and Robinson, 2005; Levi, 2007).

2.1.2.1.2. Abnormal accruals

The second proxy for earnings quality is abnormal accruals. A large and growing body of literature on earnings quality focuses particularly on developing empirical models to differentiate "abnormal accruals" and "normal accruals" (Dechow et al., 2010). Under accounting standards, accruals help to report earnings based on the recognition of incomes and expenses at the time they occur rather than at the time they are received or paid. Normal accruals are accruals needed to reflect firms' fundamental performance, but they are unobservable. Given that accruals help to reflect firms' fundamental performance, they can be estimated from firms' characteristics such as revenues, fixed assets (Jones, 1991; Dechow et al., 1995), returns on assets (Kothari et al., 2005) or cash flows from operations (Dechow and Dichev, 2002). Differences between actual accruals and normal accruals are abnormal accruals. The underlying reason for the use of abnormal accruals as a proxy for earnings quality is that if the models are appropriate in estimating normal accruals, abnormal accruals are caused by distortions in financial statements such as misapplications of accounting standards or bias such as earnings management (Dechow et al., 2010). Higher abnormal accruals indicate lower earnings quality. Because abnormal accruals are one of the main interests of this thesis, detail on accrual-based models will be provided in Section 2.2. The following paragraph only overviews the relationship between abnormal accruals and earnings persistence.

Several lines of evidence suggest that, compared to normal accruals, abnormal accruals have lower earnings persistence (Xie, 2001; Dechow and Dichev, 2002). The reason is that abnormal accruals may include extreme accruals which contain measurement errors, which in turn reduce the persistence of earnings (Dechow and Dichev, 2002). In addition, a study of the relationship between abnormal accruals and investor responses to earnings surprise by DeFond and Park (2001) shows that abnormal accruals reduce the market responses. The evidence suggests that abnormal accruals are less likely to be used to predict firms' future performance because investors may recognise that abnormal accruals are not reliable. A trading strategy with abnormal accruals yields higher abnormal returns (Xie, 2001). Last but not least, Bowen, Rajgopal, and Venkatachalam (2008) find that the weaknesses of corporate governance affect abnormal accruals and that the effect is useful to predict firms' future performance.

2.1.2.1.3. Earnings smoothness

From the perspective of standard setters, earnings smoothness, which is a result of the accrual basis of accounting standards, helps to improve the usefulness of earnings information (Dechow et al., 2010). The Conceptual Framework for Financial Reporting (IASB, 2010, 2018) indicates that accruals help to depict better past and future financial performance because the timing of cash flows received or paid may be different from the timing of the events which affect the economic resources and obligations of the reporting entities. In other words, accrual accounting helps firms to mitigate the effects of the differences in the timing of cash flows on financial performance. Accrual accounting helps to smooth earnings and therefore, helps to enhance the predictability of earnings information. However, Dechow et al. (2010) argue that accrual accounting provides an opportunity to smooth earnings as well as to hide true fundamental performance; thus earnings smoothness can be of lower earnings quality because it reduces the usefulness of earnings information.

A large body of literature investigates the determinants and consequences of earnings smoothness. Early studies focus on examining under which circumstances firms smooth earnings, but they are silent on whether earnings smoothness improves the quality of earnings (Dechow et al., 2010). The research which focuses on the consequences of earnings smoothness yields mixed evidence. In the context of the US, Tucker and Zarowin (2006) measure earnings smoothness by using the negative relationship between changes in abnormal accruals and changes in unmanaged earnings and find that earnings smoothness improves earnings quality. However, many cross-country studies (e.g., Leuz, Nanda, and Wysocki, 2003; Lang, Smith Raedy, and Wilson, 2006; Francis and Wang, 2008) provide evidence suggesting that earnings smoothness is positively correlated with lower earnings quality, which is a phenomenon in countries which have poor quality of accounting standards, less enforcement, low shareholder protections (Leuz et al., 2003).

2.1.2.1.4. Target beating

Research on target beating can be classified into two categories: small profits or small increases in earnings, and meeting or beating earnings forecasts of analysts.

2.1.2.1.4.1 Small profits or small increases in earnings

The academic literature on small profits or small increases in earnings has yielded mixed evidence on whether they are an indication of low earnings quality. On the one hand, prior research claims that small profits or small increases in earnings are evidence that firms manipulate earnings reported in financial statements to meet or beat earnings targets (e.g., Burgstahler and Dichev, 1997; Beaver, McNichols, and Nelson, 2003; Phillips, Pincus, and Rego, 2003; Altamuro, Beatty, and Weber, 2005; Jacob and Jorgensen, 2007; Kerstein and Rai, 2007; Caramanis and Lennox, 2008). For example, Burgstahler and Dichev (1997) document that earnings and changes in earnings have unusual distributions around the zero benchmark. In particular, there are unusually low frequencies of small losses and small decreases in earnings, but unusually high frequencies of small profits and small increases in earnings. Their interpretation is that companies which have earnings just below zero or below previous period earnings inflate earnings by an amount enough to avoid losses or decreases in earnings. Other studies support the view that unusually high frequencies of small profits suggest the existence of earnings management because small profits are associated with specific items in financial statements such as deferred tax expense (Phillips et al., 2003), premature recognition of revenues (Altamuro et al., 2005), and abnormal loss reserves (Beaver et al., 2003). Other determinants of small profits are incentives to manage earnings in the fourth fiscal quarter (Jacob and Jorgensen, 2007; Kerstein and Rai, 2007) or low audit quality (Caramanis and Lennox, 2008).

On the other hand, prior studies provide alternative explanations for unusual distributions of earnings around zero (e.g., Dechow, Richardson, and Tuna, 2003; Durtschi and Easton, 2005; Beaver, McNichols, and Nelson, 2007; Durtschi and Easton, 2009; Gilliam, Heflin, and Paterson, 2015). Using a large sample, Dechow et al. (2003) do not find that abnormal accruals, a common measure of earnings management, in firms with small profits are different from that in firms with small losses. If firms inflate earnings to meet the earnings targets of zero, abnormal accruals should be higher in firms which have small profits than in firms which have small losses. Dechow et al. (2003) explain that the scaling effect causes the kinked distributions of earnings because investors use different models to price loss firms versus profit firms. Income taxes, special items (Beaver et al., 2007), and sample selection bias (Durtschi and Easton, 2005, 2009) can also explain the discontinuities of earnings. In a recent study, Gilliam et al. (2015) find that the unusual distributions of earnings around zero have existed for at least 25 years, but disappeared following the passage of SOX in 2002 and have not returned. In general, there are alternative explanations for the “kink” in earnings at the zero benchmark; therefore the existence of small profits or small increases in earnings does not necessarily indicate earnings management (Dechow et al., 2010).

Consistent with the latter explanation for the kinked distribution of earnings, relatively less research provides market consequence evidence that small profits or small increases in earnings suggest low earnings quality. Bhattacharya, Daouk, and Welker (2003) are among few researchers who find that earnings opacity, e.g. loss avoidance, results in a higher cost of equity and low stock trading.

2.1.2.1.4.2 Meeting or beating earnings forecasts of analysts

Previous research provides more persuasive evidence that firms manipulate earnings reported in financial statements to meet or beat external earnings targets, e.g. analysts' earnings forecasts (e.g., Beatty, Ke, and Petroni, 2002; Moehrle, 2002; Dhaliwal, Gleason, and Mills, 2004; McVay, 2006; Brown and Pinello, 2007; Jiang et al., 2010). One trend of research in this area examines the accounting choices used to meet or beat expected levels of earnings. Firms may manipulate reported earnings using specific items such as tax expense (Dhaliwal et al., 2004), classification shifting (McVay, 2006; Fan, Barua, Cready, and Thomas, 2010), or accounting accruals related to restructuring charges (Moehrle, 2002). There is a relatively small number of studies that provide evidence that firms use actual transactions such as stock repurchases (Bens, Nagar, Skinner, and Wong, 2003; Hribar, Jenkins, and Johnson, 2006) or sales of assets (Herrmann, Inoue, and Thomas, 2003) to meet or beat expected levels of earnings. The second trend of research focuses on the relationship between target beating and equity market incentives. Researchers indicate that target beating is affected by ownership structure (Beatty et al., 2002; Matsumoto, 2002) and equity-based incentives of managers (Cheng and Warfield, 2005; Bergstresser and Philippon, 2006; McVay, 2006; Jiang et al., 2010). The third trend of research provides evidence on the relationship between governance factors and target beating. Firms have a tendency to manipulate reported earnings to meet or beat expected levels of earnings when the audit quality is low or when financial statements are unaudited (e.g., interim quarters) (Brown and Pinello, 2007). In general, the research on meeting or beating analysts' earnings forecasts yield consistent evidence on the determinants of earnings management (Dechow et al., 2010). Dechow et al. (2010) interpret this to mean that, compared with small positive profits, meeting or beating analysts' earnings forecasts is a more reliable measure of earnings management or poor earnings quality.

Regarding previous research on the consequence of target beating, there is general evidence which suggests that meeting or beating analysts' forecasts fairly contains information about earnings management, despite some conflicting evidence (Dechow et al., 2010). This chapter firstly discusses the contradictory evidence. Bhojraj, Hribar, Picconi, and McInnis (2009) find the stock price of firms which manage accruals or cut discretionary expenses to beat analysts' forecasts increases in a short term, but the trend reverses within three years. Similarly, Bartov, Givoly, and Hayn (2002) find that a trading strategy based on meeting or beating analysts' forecasts results in higher abnormal quarterly returns. The above evidence can be interpreted that investors are not of the view that firms engage in earnings management activities to beat analysts' forecasts (Dechow et al., 2010). The existing literature also indicates that analysts do not anticipate that firms manipulate reported earnings (Abarbanell and Lehavy, 2003; Burgstahler and Eames, 2003). Libby, Hunton, Tan, and Seybert (2008) suggest that analysts may ignore earnings management practices because they have incentives to maintain a good relationship with management.

In contrast with the view that target beating is not evidence of earnings management, Gleason and Mills (2008) find that firms which decrease tax expense to meet or beat earnings forecasts of analysts exhibit a decrease in the share price. Dechow et al. (2010) explain that the reason for the contradictory results compared with the non-earnings management view (Bartov et al., 2002; Abarbanell and Lehavy, 2003; Burgstahler and Eames, 2003; Bhojraj et al., 2009) may be that the manipulation of tax expense reduces earnings quality while other methods such as managing accruals do not, or that tax reductions are more obvious and visible to the market. Gleason and Mills (2008) also support the view that meeting or beating analyst forecasts suggests the presence of earnings management.

The existing literature also documents compelling evidence on whether the market's anticipation of meeting or beating earnings forecasts of analysts is an indication of earnings management (e.g., Barth, Elliott, and Finn, 1999; Kasznik and McNichols, 2002). Previous studies indicate that only firms which consistently meet or beat earnings forecasts of analysts (Kasznik and McNichols, 2002) or which consistently report an increase in earnings compared with the same period of the prior year (Barth et al., 1999) enjoy a higher market valuation. However, Kasznik and McNichols (2002) find that firms that meet or beat analyst forecasts in some years do not enjoy a market premium. This evidence suggests that investors consider target beating as an indication of earnings management only in some circumstances.

So far, the chapter has discussed most properties of earnings. Asymmetric timeliness of earnings, which is a main focus of the thesis, will be discussed in more detail in Section 2.3.

2.1.2.2. Investor responsiveness to earnings

Studies on investor responsiveness to earnings rely on the theoretical foundation offered by Holthausen and Verrecchia (1988). The logic is that investors respond to earnings reported in financial statements because it contains information which is relevant for valuation. Many of the studies in this area use the earnings response coefficient (ERC) or R-squared of regressions between earnings and returns as a measure of investor responsiveness (Dechow et al., 2010). In the earnings-return models, earnings with more value relevance result in a higher association between earnings and return, and a higher

R-squared. A higher association between earnings and return and a higher R-squared indicate higher earnings quality.

Liu and Thomas (2000) derive a model specification to directly test whether ERC can be used as a measure of earnings quality. They find that when there are high associations between the current period's abnormal earnings (which are the difference between actual earnings and forecasted earnings) and the following period's revisions in analyst forecasts, the ERC and R-squared of the earnings-return regressions are high. The interpretation is that analysts view current-period abnormal earnings as value-relevant information so that they revise future-period earnings forecasts. This is direct evidence for the relationship between ERC and the decision-making usefulness of earnings. However, Liu and Thomas (2000) indicate that the relationship between abnormal earnings and revisions in analysts' forecasts are sensitive to heterogeneity in the sample.

Most studies in this field provide indirect evidence about determinants of investor responsiveness to earnings. The first determinant is accounting choices. An accounting choice is viewed as informative to investors if it is positively correlated with ERC. Altamuro et al. (2005) studied the effect of the SEC's Staff Accounting Bulletin No. 101, which prohibits the premature recognition of revenues, on the informativeness of earnings and find that the earnings informativeness of affected firms in the period after the adoption is lower than in the period before the adoption. Prior studies also find that there is a decrease in earnings informativeness after the application of new financial reporting standards related to research and development expenses (Loudder and Behn, 1995) and the translation of foreign currency (Collins and Salatka, 1993). Investor response to earnings also decreases as a consequence of conservative accounting policies related to intangible assets (Lev and Zarowin, 1999) or recognition of losses under fair value accounting (Givoly and Hayn, 2000). Although the above studies contribute much to accounting research, Dechow et al. (2010) argue that they have some limitations such as endogeneity and omitted variables.

The second factor influencing earnings informativeness is auditor quality. The research in this area assumes that better auditor quality enhances the credibility of financial statements; thus it can enhance earnings informativeness. Prior studies find that ERC is positively related to a Big-Eight auditor, which is a proxy for high audit quality (Teoh and Wong, 1993), or negatively associated with a non-audit fee, which is a proxy for low independence and thus low audit quality (Francis and Ke, 2006). Switching auditor for reasons related to disagreements or audit fees is found to be negatively associated with the informativeness of earnings because it is an indication of lower earnings quality (Hackenbrack and Hogan, 2002). Timely review of quarterly financial reports by auditors leads to a rise in the association between unexpected earnings and quarterly stock returns (Manry, Tiras, and Wheatley, 2003).

The third factor is corporate governance. In general, prior studies hypothesise that strong corporate governance enhances the quality of financial statements; thus it is positively associated with the informativeness of earnings (Dechow et al., 2010). The evidence is mixed. Firms with a dual-class share structure have low informative earnings (Francis, Schipper, and Vincent, 2005). However, ERC is found to be positively related to the ownership of a founding family (Wang, 2006) and managerial ownership (Warfield, Wild, and Wild, 1995).

The next factor is firm fundamentals. There are relatively few studies that examine the effect of firm fundamentals on investor response to earnings (Dechow et al., 2010). Early research shows a positive relationship between ERC and earnings persistence (Kormendi and Lipe, 1987; Collins and Kothari, 1989) and a negative association between ERC and loss (Hayn, 1995). However, these studies provide only indirect evidence for the use of ERC as a measure of the quality of earnings because earnings persistence may be managed or possible loss projects may be abandoned (Dechow et al., 2010). More direct evidence on the relationship between the quality of earnings and firm fundamentals is provided by Biddle and Seow (1991), who indicate that cross-industry characteristics, e.g. barriers to entry, type of products, and operating and financial leverage affect earnings informativeness. Other research also indicates that earnings informativeness is affected by firms' cost structure and growth opportunities (Ahmed, 1994) or by dispersion in analysts' forecasts which is widely used as a measure of the uncertainty of firms' cash flows (Imhoff and Lobo, 1992).

There is also mixed evidence on the relationship between ERC and firms' information environment (Dechow et al., 2010). For example, firms which have low earnings informativeness enjoy an increase in the usefulness of earnings if they voluntarily disclose "pro forma" earnings information (Lougee and Marquardt, 2004). Also, Baber, Chen, and Kang (2006) find that investors use voluntarily disclosed information of supplementary items in the balance sheets and cash flows and that they discount share prices when the voluntary disclosure suggests that earnings management exists. Francis, Schipper, and Vincent (2002b) find that concurrent disclosure of detailed income statements increases the usefulness of earnings. Similarly, Michelle Hanlon, Laplante, and Terry Shevlin (2005) find that estimated taxable income can explain stock returns. Also, investor response to earnings may be affected by the reconciliations between US GAAP earnings and non-US GAAP earnings (Amir, Harris, and Venuti, 1993) or by analyst reports which are competing with earnings announcements (Francis, Schipper, and Vincent, 2002a).

2.1.2.3. Observable indicators of misstated earnings

2.1.2.3.1. Accounting and auditing enforcement releases

Accounting and auditing enforcement releases (AAER) issued by the SEC are an external indicator of earnings quality. Dechow, Ge, Larson, and Sloan (2011) indicate that senior managers of AAER firms could be alleged by the SEC to show negligence in the financial reporting process, or could be accused by the SEC of the intentional manipulation of financial statements, an action that satisfies the definition of fraud under auditing standards. Dechow et al. (2010) argue that although an AAER sample is more likely to provide a good indicator of earnings quality than model-based proxies such as abnormal accruals, it is subject to major limitations. Firstly, given that the SEC has limited resources, the AAER sample often includes detected and less ambiguous allegations of accounting standards, which is associated with a lower rate of Type I error in classifying misstated firms, and does not include "within the GAAP" aggressive earnings management, which is associated with a high rate of Type II error. Secondly, AAER firms are often large firms because the SEC pays more attention to the overall impact of fraudulent activities on the capital market or are firms which raise equities or debts for the first time. Thirdly, in some cases, the violation of accounting standards is not intentional because of a different interpretation of accounting rules.

Although not all AAER firms intentionally manipulate accounting numbers (Dechow et al., 2010), numerous studies which attempt to examine determinants of AAER rely on the assumption that AAER indicates the presence of earnings management, one reason for poor earnings quality. Studies on determinants of AAER focus on managerial compensation, debt covenants, capital market incentives, and corporate governance. Regarding managerial compensation, although previous research hypothesises that senior managers have incentives to manipulate accounting numbers to extract higher compensation such as bonuses or to inflate share prices which in turn affect their wealth, the evidence does not show that accounting fraud is affected by managers' bonus plan (Dechow, Sloan, and Sweeney, 1996; Beneish, 1999) or equity-based incentives (Erickson, Hanlon, and Maydew, 2006; Armstrong, Jagolinzer, and Larcker, 2010). In contrast, Johnson, Ryan, and Tian (2009) find that unrestricted stocks provide a significant source of incentive for managers to manipulate earnings because managers anticipate that a faithful presentation of financial statements would significantly reduce stock price which in turn decreases the value of stocks held by managers. Dechow et al. (2010) explain that different measurement approaches or control samples cause the above inconsistent findings.

Research on debt covenants and AAER also yield mixed results. While Dechow et al. (1996) show that firms which have high leverage manipulate earnings to avoid violating debt covenants, Beneish (1999) indicate that there is no difference in debt ratios or default risk between misstated firms and control firms.

Another factor is capital market incentives. The findings of Dechow et al. (2010), Dechow et al. (1996), and Dechow et al. (2011) support the hypothesis that firms which need external capital have tendencies to manipulate accounting numbers to decrease the cost of capital, while Beneish (1999) show conflicting results. The mixed evidence may be caused by differences in constructing control samples or measuring key variables (Dechow et al., 2010).

Regarding corporate governance, the existing literature mainly hypothesises that strong corporate governance results in good management monitoring, and therefore, managers have less opportunity to manipulate financial statements. However, the evidence is mixed.

On the one hand, there is evidence that the likelihood of accounting fraud is negatively affected by the independence of the board of directors, the separation of the board chairman or company founder from the CEO position (Beasley, 1996; Dechow et al., 1996; Farber, 2005); the existence of an audit committee (Dechow et al., 1996) or number of meetings and financial expertise of an audit committee (Farber, 2005); Big-Four auditor status (Farber, 2005); and the independence of the auditor (Joe and Vandervelde, 2007). Feng, Ge, Luo, and Shevlin (2011) indicate that powerful CEOs of AAER firms are more likely to dominate other directors, including chief financial officers, in the preparation of the financial statement. On the other hand, Farber (2005) does not find that the independence of an audit committee helps to reduce accounting manipulation. The competing evidence suggests that only an active audit committee could deter accounting fraud (Dechow et al., 2010). Also, prior research shows that there is no difference in big auditor status between AAER firms and control firms (Dechow et al., 1996; Beneish, 1999), and that accounting fraud is not affected by a non-audit fee, which is a proxy for low independence of the auditor (Joe and Vandervelde, 2007). Again, the mixed evidence may be caused by differences in constructing control samples (Dechow et al., 2010).

Turning now to consequences of AAER, a considerable amount of the literature published in this area hypothesises that AAER is evidence of "obvious" earnings management (Dechow et al., 2010), and thus AAER announcements lead to higher managerial turnover, a decrease in firm value, and higher litigation suffered by AAER firms' auditors. Management turnover rates of AAER firms are 72.4% in the year of the AAER announcement (Feroz, Park, and Pastena, 1991) and 35.9% within five years following the release of AAER (Beneish, 1999). The likelihood that individuals alleged to have involved in fraudulent activities by the SEC to leave the AAER firms is 93% in the announcement year (Karpoff, Scott Lee, and Martin, 2008). Regarding firm value, prior studies indicate that an AAER announcement is related to significant negative stock returns (Feroz et al., 1991; Dechow et al., 1996), higher bid-ask spreads, and fewer analyst followings (Dechow et al., 1996). AAER firms which enhance corporate governance within three years following an allegation of accounting fraud exhibit an improvement in stock performance (Farber, 2005). Another consequence of AAER is litigation suffered by auditors of AAER firms. Big audit companies suffer lower legal costs (Feroz et al., 1991) because big auditors are less likely to be linked to extreme cases which may impose high penalties, or they could negotiate to reduce penalties. The evidence shows that 38% of the AAER firms' auditors face litigation, and the litigation risk is higher for common frauds or fictitious transactions (Bonner, Palmrose, and Young, 1998). Although there is consistent evidence on the consequences of AAER, Dechow et al. (2010) indicate that the use of AAER is a proxy for earnings quality suffers from some limitations. The interpretation of negative reactions from the market relies on the assumption that AAER is an indicator of earnings management. Negative reactions may be caused by the earnings adjustments included in the AAER releases, reassessment of future firm growth, changes in the discount rate associated with the uncertainty of cash flows, or changes in analysts' forecasts to include possible losses related to litigation or reputation losses.

2.1.2.3.2. Accounting restatements

Early research (e.g., Palmrose, Richardson, and Scholz, 2004) on accounting restatements use the Lexis-Nexis news database, but later studies (e.g., Desai, Hogan, and Wilkins, 2006) use the GAO's restatement database. Dechow et al. (2010) indicate some advantages and disadvantages of using restatements as a measure of earnings quality. Regarding advantages, similar to the AAER sample, a restatement sample provides a good indicator of earnings quality so that it has a low rate of Type I error in classifying misstated firms. Another significant aspect of restatements is that the sample size is large because the construction of the data set is based on restatement announcements regardless of firm size. In respect to disadvantages, restatements can be a noisy proxy for accounting fraud because they include not only restatements following SEC allegations but restatements which result from unintentional errors or retrospective adjustments required by accounting standards (Hennes et al., 2008; Plumlee and Yohn, 2010).

There is a large volume of published studies examining the determinants of restatements (Dechow et al., 2010). Similar to studies on the AAER sample, the research in this area relies on the assumption that accounting restatements provide an indicator of earnings management (Dechow et al., 2010). The existing literature provides mixed evidence on the relationship between restatements and managerial compensation and corporate governance. Regarding compensation of managers, Burns and Kedia (2006) show that restatements are positively affected by the sensitivity of CEOs' option holding to changes in share prices. However, they do not find a link between restatements and incentives from other components of compensation such as equity, restricted shares, salary, and bonuses. Efendi, Srivastava, and Swanson (2007) provide similar evidence that accounting statements are positively influenced by CEOs' holding of options, which are in-the-money exercisable. In contrast to the above evidence, using the propensity score matching method, Armstrong et al. (2010) do not find that accounting restatements are affected by equity-based incentives of CEOs. Turning to the research on corporate governance, accounting restatements are associated with the presence of CEOs who also serve as the chairman of the board of directors, company founders, or audit committee's financial expertise (Agrawal and Chadha, 2005; Efendi et al., 2007). Accounting restatements are also influenced by the percentage of outside members on the board of directors and gearing ratio (Larcker, Richardson, and Tuna, 2007). However, there is evidence that the likelihood of restatements is not affected by a committee's independence and a non-audit fee, which is used as a proxy for weak corporate governance (Agrawal and Chadha, 2005). An explanation for the mixed evidence is that accounting restatements are not a good proxy for low earnings quality, e.g. earnings management, because the restatement database includes both intentional and unintentional restatements (Dechow et al., 2010).

The literature on restatements highlights several consequences of restatement announcements. First, similar to AAER firms, restatement firms have high turnover rates in management (Srinivasan, 2005; Desai et al., 2006; Hennes et al., 2008) and among audit committee members (Srinivasan, 2005). Desai et al. (2006) find that the job market is less likely to open for the ex-managers of restatement firms who were replaced after restatements. Second, prior studies on the effects of accounting restatements on capital markets show that investors discount share prices of restatement firms if restatements are caused by frauds (Palmrose et al., 2004) or if restatements need retrospective adjustments in earnings (Lev, Ryan, and Wu, 2008). Accounting restatements also have a contagion effect on other companies in the same industry in terms of negative market reaction (Gleason, Jenkins, and Johnson, 2008). The evidence also indicates that accounting restatements result in an increase in information risk (Kravet and Shevlin, 2010) and the cost of capital (Hribar and Jenkins, 2004). Third, there are relatively few studies providing evidence that accounting restatements are associated with higher litigation costs for involved parties. Palmrose et al. (2004) indicate that litigation risk is related to earnings or fraud-related restatements. The evidence shows that litigation costs are higher for restatements which affect core earnings or affect various accounts in financial statements (Palmrose et al., 2004) or need retrospective adjustments in earnings (Lev et al., 2008).

2.1.2.3.3. Internal control weaknesses

Studies on internal control weaknesses are emerging after the passage of the Sarbanes-Oxley Act of 2002 in the US (Dechow et al., 2010). Under the Sarbanes-Oxley Act, Section 302 (effective on 29th August 2002), managers must provide a certification on the effectiveness of internal control systems of their firms. Section 404 (effective on 15th November 2004) requires that firms' annual reports must include an assessment of internal control effectiveness, and independent audit reports must include an opinion on the management's assessment.

Previous studies indicate that internal control weaknesses are positively related to measures of poor earnings quality, e.g. abnormal accruals (Doyle, Ge, and McVay, 2007b; Ashbaugh-Skaife, Collins, Jr., and LaFond, 2008). Also, researchers provide consistent evidence that high internal control risks are more likely to exist in firms with complexity or changes in organisational structures or those that lack resources to invest in internal control systems (Ashbaugh-Skaife, Collins, and Kinney, 2007; Doyle, Ge, and McVay, 2007a). Prior research on the consequences of internal control weakness provide mixed evidence. Internal control weaknesses which are reported under Section 302 are related to negative stock returns (Hammersley, Myers, and Shakespeare, 2007), higher cost of capital, and lower revisions of analysts' forecasts (Beneish, Billings, and Hodder, 2008). However, Beneish et al. (2008) and Ogneva, Subramanyam, and Raghunandan (2007) do not find associations of negative stock returns, lower revisions of analysts' forecasts, and higher cost of capital with internal control weaknesses reported under Section 404. Dechow et al. (2010) explain that mixed evidence on the consequences of internal control weaknesses is due to differences in the threshold for disclosure under Section 302 and Section 404 or different information environments between Section 302 and Section 404 samples; differences in event window (disclosures under Section 404 must be included in annual reports, while disclosures under Section 302 can be made on any date); or omissions of disclosures of less severe deficiencies under Section 302.

2.1.3. Recent methodological advances in estimating earnings quality

In recent years, there have been methodological advances in measuring earnings quality. A promising trend of research relies on properties of numbers to provide an indication of the quality of earnings. Amiram et al. (2015) apply Benford's Law, which is a "law" of distributions of digits of numbers, to study earnings quality of distributed financial statements. They provide evidence that deviations of first digits of financial statement items from what are expected by Benford's Law are related to measures of the quality of earnings, e.g. abnormal accruals, meeting or beating zero earnings and earnings persistence. They also find that deviations of first digits are useful to predict accounting restatements. The importance is that their approach does not require large data for cross-sectional or time-series regressions because it only relies on distributional properties of accounting numbers. The methodology of Amiram et al. (2015) is promising, especially for studies on capital markets where there is a lack of data on earnings quality similar to the accounting restatements and AAER in the United States.

Another methodological advance in studying earnings quality relies on linguistic or textual analysis. Hobson, Mayew, and Venkatachalam (2012) use software to capture vocal emotion of CEOs from the CEOs' speeches at conferences for earnings announcements. The authors find that the markers of vocal dissonance are positively related to accounting restatements. Their approach's accuracy is similar to models which solely rely on financial data and is 11% higher than chance. Kim, Kim, and Zhou (2017) study relationships between languages' grammatical structures and earnings management. They hypothesise and find that firms in weak future-time reference (FTR)[3] countries are less likely to manage earnings using accruals or real business transactions than firms in strong FTR countries. They argue that speakers in weak FTR countries are more likely to anticipate future consequences of earnings management as there is no clear mean to distinguish between present and future in their languages so that they do not want to face future legal troubles associated with earnings management. On the same theme, applying textual analysis, Lo, Ramos, and Rogo (2017) find that firms whose annual reports are less readable, i.e., there are more complex words or long sentences in the management discussion and analysis section, have a lower quality of earnings. They explain that liars, i.e., managers who manipulate their firms' earnings, have tendencies to use complex linguistic structures in their discussions.

Recently, Liang, Marinovic, and Varas (2018) offered a theory on the impact of the credibility of managers on the credibility of financial reporting, for which earnings quality is a proxy. The authors theorised that, because of limited tenure or the horizon problem (Dechow and Sloan, 1991), managers have an incentive to maximise stock prices at the time of retirement. For dishonest managers, they could choose to manage earnings and cash in their credibility in the early stage. The model of Liang et al. (2018) indicates that abnormal accruals are higher and more volatile in firms with less credible CEOs than in firms with more credible CEOs. There are also several lines of evidence showing that

[3] An example of future-time references in languages is the use of "will" or "be going to". There are at least 28 grammatical structures related to future-time references (Kim et al., 2017).

personal traits of executives such as CEO play a major role in explaining the quality of earnings (e.g., Feng et al., 2011; Huang et al., 2012; Yim, 2013; Serfling, 2014).

2.2. Earnings management

2.2.1. Definitions

Early research defines earnings management as managerial discretion by using predetermined accounting choices under accounting standards to affect earnings reported in financial statements. Schipper (1989, p. 92) defines earnings management as "purposeful intervention in the external financial reporting process, with the intent of obtaining some private gain". An important feature of this definition is that it assumes managerial involvement as a determinant of earnings numbers. Managers may exercise professional judgements and use different accounting policies allowed by accounting standards to recognize a particular business transaction so that they can impact reported earnings. For example, managers may apply judgments in estimating the useful life of fixed assets, provisions for bad debts, or provisions for obsolete inventory. Managers may also choose predetermined accounting choices, e.g. policies regarding depreciation methods or inventory valuations, to affect reported earnings.

Extending the work of Schipper (1989), Healy and Wahlen (1999) define earnings management as follows

> *"earnings management occurs when managers use judgment in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers."*

This definition also views earnings management as misleading shareholders and other stakeholders about "true earnings" of reporting firms. Like the definition of Schipper (1989), this definition admits that there are several ways to manipulate earnings numbers. Under this definition, managers can intentionally choose permitted accounting choices to exercise judgment in estimating accounting numbers to affect the bottom line of financial statements. This definition also views managers can manipulate earnings by using real business operations. For example, managers may delay research and development (R&D) or maintenance activities to avoid the recognition of significant amounts of expenses, thus to increase the annual profit.

Consistent with Healy and Wahlen (1999)'s definition in terms of the manipulation of real business operations, Roychowdhury (2006, p. 337) defines real earnings management as *"departures from normal operational practices, motivated by managers' desire to mislead at least some stakeholders into believing certain financial reporting goals have been met in the normal course of operations."* Roychowdhury (2006) provides some examples of how restructuring real business transactions may affect reported earnings. For example, managers may temporarily increase sales by providing their customers with increased price discounts or more lenient credit terms, leading to abnormally low cash inflows because of a low margin for additional sales. The lower margin leads to abnormally high production costs relative to sales. Similarly, managers may also want to inflate earnings by overproduction. By producing more goods than a market's demand, overhead costs will spread over more finished goods, resulting in lower costs per unit (assuming that increases in marginal costs per unit do not offset reductions in fixed costs per unit), which in turn leads to lower cost of goods sold reported in income statements. Additionally, holding production costs in inventories in balance sheets causes abnormally low cash flows from operations relative to sales. Furthermore, managers can cut down or delay discretionary expenditures, e.g. selling and administrative expenses or R&D expenses, to inflate earnings. In such situations, financial statements exhibit abnormally low discretionary expenditures relative to sales.

For the purpose of this thesis, I adopt the definitions of earnings management following Healy and Wahlen (1999) and Roychowdhury (2006).

2.2.2. Motivations

Existing literature documents many reasons why managers are involved in earnings management practice. While Section 2.1.2 explains various factors affecting earnings quality in general, this section briefly discusses some influential studies on motivations for earnings management.

An important reason for earnings management is to impact capital markets. Managers are involved in earnings management because they want to impact their firms' share values, which are priced based on earnings. For example, earnings are managed before initial public offerings (Teoh, Welch, and Wong, 1998a; DuCharme, Malatesta, and Sefcik, 2001), seasoned equity offerings (Teoh, Welch, and Wong, 1998b; Kim and Park, 2005), and stock-based mergers and acquisitions (Agrawal, Jaffe, and Mandelker, 1992; Erickson and Wang, 1999; Botsari and Meeks, 2008). Also, managers are more likely to engage in earnings management to meet target levels, e.g. the zero benchmark, or previous period earnings, to avoid negative reactions from capital markets (Burgstahler and Dichev, 1997; Burgstahler and Eames, 2006).

The next reason is for debt contracting. Because debt contracts often include financial covenants which are based on financial statements, managers are more likely to engage in accounting manipulation to inflate earnings to help their firms avoid the violation of debt covenants (DeFond and Jiambalvo, 1994; Sweeney, 1994). There is also evidence that financially distressed firms manage earnings upward to avoid debt covenant violation when lenders do not forgive the violation and conceal earnings for future use if lenders forgive the violation (Jaggi and Lee, 2002).

Next, complying with regulations is another motivation for earnings management. For example, managers manipulate earnings to take advantages of regulatory requirements, e.g. to get or increase relief grant value, during import relief investigations (Jones, 1991), avoid political costs in the oil industry during the 1990 Persian Gulf crisis (Han and Wang, 1998), get approval for seasoned equity offerings (Chen and Yuan, 2004), and for tax purpose (Guenther, 1994; Bingxuan Lin, Rui Lu, and Zhang, 2012). Similarly, banks have incentives to comply with regulations on capital adequacy ratios, which are based on financial statements, by avoiding reporting expenses and losses related to debts and loans, and by inflating investment profits (Moyer, 1990; Scholes, Wilson, and Wolfson, 1990; Beatty, Chamberlain, and Magliolo, 1995). Also, earnings may also be manipulated to avoid violating regulations in the insurance industry (Petroni, 1992; Gaver and Paterson, 2001).

Finally, managers have incentives to manage earnings to impact their compensation, which is normally calculated based on accounting numbers. For example, Healy (1985) and Holthausen et al. (1995) find that maximising salary and bonuses is an important motivation for managers to involve in earnings management practices. In the same way, when managerial compensation is highly tied to firms' share prices, managers use earnings management to impact share prices, which in turn affect their compensation (Guidry, Leone, and Rock, 1999; Richardson and Waegelein, 2002; Cheng and Warfield, 2005; Bergstresser and Philippon, 2006). In addition, managers use earnings management to affect the bottom line of financial statements to avoid being fired as a consequence of firms' poor financial performance (Hazarika, Karpoff, and Nahata, 2012) or to get higher benefits in the future (Dechow and Sloan, 1991).

2.2.3. Deterrence mechanisms

Existing literature also documents important key gatekeepers who help firms to deter earnings management. Key gatekeepers are boards of directors, audit committee, and independent auditors.

The board of directors act as a monitoring mechanism in firms so that they can mitigate managers' incentives to manipulate earnings. One of the main responsibilities of the board of directors is to authorise financial statements for issue (Financial Reporting Council (FRC), 2012, 2016b). The board also makes decisions on the appointment or removal of CEOs and on CEOs' compensations. Previous studies show that there are negative relationships between earnings management and the number of directors on the board (Chtourou, Bedard, and Courteau, 2001), percentage of independent directors on the board (Klein, 2002a; Davidson, Goodwin-Stewart, and Kent, 2005), and the board's meetings (Xie, Davidson, and DaDalt, 2003). There is also evidence that the CEO duality, e.g. when a CEO also serves as the chairperson of the board of directors, affects earnings quality because CEO could dominate the board in those circumstances (Dechow et al., 1996). Recent research shows that earnings management is spread among firms via professional or social networks of directors, CEOs and CFOs (chief financial officers) (Krishnan, Raman, Yang, and Yu, 2011; Chiu, Teoh, and Tian, 2013; Nguyen, Iqbal, and Shiwakoti, 2015a).

Next, audit committee helps to mitigate earnings management because it oversees the effectiveness of internal controls, the integrity of financial statements, and the work performed by external auditors (Financial Reporting Council (FRC), 2012, 2016b). There is evidence that earnings management is negatively affected by the independence, financial expertise, and meetings of the audit committees (Klein, 2002b; Xie et al., 2003; Bédard, Chtourou, and Courteau, 2004; Badolato, Donelson, and Ege, 2014).

Last, independent auditors also help to reduce earnings management. They provide an assurance that financial statements are free from material misstatements so that they help to reduce earnings management either by mitigating managers' incentives to manage earnings or by detecting and correcting misstatements before the financial statements are published. Previous research shows earnings management is negatively affected by audit effort (Caramanis and Lennox, 2008) and audit quality (Becker, DeFond, Jiambalvo, and Subramanyam, 1998a; Krishnan, 2003).

2.2.4. Empirical models

This section provides an overview of models to estimate accrual earnings management and real earnings management.

2.2.4.1. Modelling accrual earnings management

Accounting studies on earnings management are mainly built on the definition of earnings management. As described above, accrual earnings management is the exercise of judgment in choosing permitted accounting choices or in estimating accounting numbers to affect reported earnings (Schipper, 1989; Healy and Wahlen, 1999). An accepted methodology to detect earnings management is to estimate "abnormal accruals" (Dechow et al., 2010). A general feature of earnings management models is to estimate "normal accruals", which are needed accruals which help to reflect firms' fundamental performance. If a model properly estimates normal accrual, abnormal accrual is an indication of earnings management.

2.2.4.1.1. Early models

Early models started with working capital accruals. Healy (1985) uses levels of total working capital accruals (divided by opening assets) as abnormal accruals. The estimation of abnormal accruals is as follows:

Equation 2-1: Healy (1985) model

$$NDA_{i,\tau} = \frac{\sum_t TA_{i,t}}{T}$$

Where NDA_{τ} is abnormal accruals of firm i in the event period τ; $TA_{i,t}$ is total accruals of firm i; t is total number of years in the period of estimation (t= 1,2…T).

DeAngelo (1986) proposes another model which also treats working capital accruals as abnormal accruals. The approach of DeAngelo (1986) is similar to that of Healy (1985), but it uses accruals in year τ-1 as abnormal accruals. The model is as follows:

Equation 2-2: DeAngelo (1986) model

$$NDA_{i,\tau} = TA_{i,\tau-1}$$

Both models of Healy (1985) and DeAngelo (1986) are criticized because they implicitly assume that abnormal accruals are constant, which may not be true as Kaplan (1985) and McNichols (2002) suggest that abnormal accruals change when economic situations change.

2.2.4.1.2. Jones and modified-Jones models

Later research developed more complicated models which isolate abnormal accruals from normal accruals, among which the most influential models are Jones-type models (Jones, 1991; Dechow et al., 1995; Kothari et al., 2005) and the Dechow and Dichev (2002) model.

Jones (1991) introduces a model, which uses firm characteristics to reflect changes in economic circumstances, to estimate accruals. In this model, normal accruals are regressed on sale changes and property, plant and equipment (PPE) divided by opening assets. The model is as follows:

Equation 2-3: Jones (1991) model

$$\frac{AC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{1}{A_{i,t-1}}\right) + \beta_2\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \beta_3\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{it}$$

Where: $\mathrm{AC_{i,t}}$ is total accruals of firm i at the end of year t; $\Delta\mathrm{REV_{i,t}}$ is sale change of firm i from year t-1 to year t; $\mathrm{PPE_{i,t}}$ is gross PPE of firm i at the end of year t; $\mathrm{A_{i,t-1}}$ is total assets of firm i at the end of year t-1.

Under this model, residuals of Equation 2-3, or differences between actual accruals and normal accruals, are abnormal accruals. A distinctive feature of the Jones (1991) model is that it differentiates abnormal accruals from normal accruals, and thus it overcomes limitations of models of Healy (1985) and DeAngelo (1986). However, as noted by Jones (1991), this model is biased when revenues are managed.

After that, in an attempt to modify the Jones (1991) model, Dechow et al. (1995) subtract changes in receivables ($\Delta REC_{i,t}$) from changes in sales to deal with situations when sales are manipulated. This model is widely referred to the modified-Jones model. Using coefficients $\hat{\alpha}$, $\hat{\beta}_1$, $\hat{\beta}_2$, and $\hat{\beta}_3$ estimated by Equation 2-3, the abnormal accruals following the modified-Jones model are calculated as differences between total accruals and predicted values (normal accruals):

Equation 2-4: Modified-Jones model

$$DCA_{i,t} = \frac{AC_{i,t}}{A_{i,t-1}} - \left[\hat{\alpha} + \hat{\beta}_1\left(\frac{1}{A_{i,t-1}}\right) + \hat{\beta}_2\left(\frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}}\right) + \hat{\beta}_3\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right)\right]$$

Another application of the modified-Jones model is to estimate Equation 2-4 using sale changes deducted by receivable changes (Kothari et al., 2005). This is because, in the research settings where there is no "event period" and "pre-event period", researchers can assume that earnings management causes all changes in account receivables. Therefore, instead of obtained coefficients from the Jones model to calculate abnormal accruals, researchers may estimate the modified-Jones equation directly.

Kothari et al. (2005) further improve the Jones and modified-Jones models by including returns on assets (ROA) to the equation to control for firm performance. The model is as follows:

Equation 2-5: Kothari et al. (2005)'s model

$$\frac{AC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{1}{A_{i,t-1}}\right) + \beta_2\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \beta_3\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right) + \beta_4 ROA_{i,t(or\ t-1)} + \varepsilon_{it}$$

In addition to the model which adds a measure of performance above, Kothari et al. (2005) also offer another approach for performance matching. Their approach is to match one firm with another in the same industry and in a year based on the nearest ROA. However, the performance-matched model may reduce test power because it requires matched observations (Dechow et al., 2010).

2.2.4.1.3. Cash flow approach to estimate abnormal accruals

In addition to Jones-type models, Dechow and Dichev (2002) propose an alternative way to estimate normal working capital accruals. In this model, working capital accruals are regressed on past, present and future cash flows because working capital accruals related to cash payments or collections will reverse when cash is paid or received. The model is as follows:

Equation 2-6: Dechow and Dichev (2002) model

$$WC_{i,t} = \alpha + \beta_1 CFO_{i,t-1} + \beta_2 CFO_{i,t} + \beta_3 CFO_{i,t+1} + \varepsilon_{i,t}$$

Where: $WC_{i,t}$ is working capital of firm i in year t; $CFO_{i,t-1}$ is operating cash flow of firm i in year t-1; $CFO_{i,t}$ is operating cash flows of firm i in year t; $CFO_{i,t+1}$ is operating cash flows of firm i in year t+1; $\varepsilon_{i,t}$ is residuals. All variables are scaled by opening assets. Standard deviations of regression residuals are used as a proxy of earnings management.

Although Dechow and Dichev (2002) provide a significant technical improvement in estimating abnormal accruals, their model has a major limitation when ignoring long term accruals, such as depreciation accruals. Francis, LaFond, Olsson, and Schipper (2005) extend the model of Dechow and Dichev (2002) by adding sales growth to control firm performance and adding PPE to include depreciation accruals (which are a type of long-term accrual). The model is as follows:

Equation 2-7: Francis et al. (2005) model

$$TAC_{i,t} = \alpha + \beta_1 CFO_{i,t-1} + \beta_2 CFO_{i,t} + \beta_3 CFO_{i,t+1} + \Delta REV_{i,t} + PPE_{i,t} + \varepsilon_{i,t}$$

Where $TAC_{i,t}$ is total current accruals. Standard deviations of residuals [$\sigma(\varepsilon_{i,t})$] from year t-4 to year t is used as a proxy of earnings management. Francis, LaFond, et al. (2005)

also attempt to differentiate discretion estimation errors from the innate estimation errors as follows:

Equation 2-8: Francis et al. (2005) model to estimate innate estimation errors

$$\sigma(\varepsilon_{i,t}) = \alpha + \beta_1 SIZE_{i,t} + \beta_2 \sigma(CFO)_{i,t} + \beta_3 \sigma(REV)_{i,t} + \beta_4 \log(CYCLE)_{i,t} + \beta_5 NEG_{i,t} + v_{i,t}$$

Where: $SIZE_{i,t}$ is log of total assets of firm i in year t; $\sigma(CFO)_{i,t}$ is the standard deviation of cash flows over a period of 10 years; $\sigma(REV)_{i,t}$ is the standard deviation of revenues over a period of 10 years; $CYCLE_{i,t}$ is operating cycle of firm i in year t; $NEG_{i,t}$ is numbers of times a firm has negative earnings over a period of 10 years. In this model, $v_{i,t}$ is affected by managerial discretion; therefore it can be used as a proxy for earnings management. However, the process to differentiate discretion estimation errors from the innate estimation errors may introduce bias because estimation errors may also result from innate characteristics (Dechow et al., 2010).

2.2.4.1.4. Recent improvements in accrual-based models

Although earnings management models have been widely applied, a major concern is that the detecting power of earnings management models is low in general (Dechow, Hutton, Kim, and Sloan, 2012; Frankel and Sun, 2018). Recent research studies are focusing on improving the test power of models to detect earnings management.

Dechow et al. (2012) introduce an approach to estimate abnormal accruals by incorporating reversals of accruals in the following periods.

Equation 2-9: Dechow et al. (2012) model

$$WAC_{i,t} = \alpha + \beta_1 PART_{i,t} + \beta_2 PARTP1_{i,t} + \beta_3 PARTP2_{i,t} + \sum_k f_k \mathrm{X}_{k,i,t} + \varepsilon_{i,t}$$

Where: $WAC_{i,t}$ is working capital of firm i in year t; $PART_{i,t}$ is equal 1 in years when earnings management is hypothesised to be existed, and 0 otherwise; $PARTP1_{i,t}$ is equal 1 in the following year, 0 otherwise; $PARTP2_{i,t}$ is equal 1 in the second following year, 0 otherwise; $\sum_k f_k \mathrm{X}_{k,i,t}$ represents determinants of normal accruals. In their tests, Dechow et al. (2012) use an AAER sample as the presence of exposed earnings management. They also employ different models to estimate normal accruals, including Jones (1991), Dechow et al. (1995), Dechow and Dichev (2002) and Francis, LaFond, et al. (2005).[4] This model helps to improve the test power by 40%.

Recently, Frankel and Sun (2018) also attempt to increase the detecting power of earnings management models by considering the probabilities of cash flows. This research is built on the theoretical framework on the earnings-accruals-cash flows relationship (Dechow, Kothari, and L. Watts, 1998), and the relationship between accruals and past, current, and future cash flows (Dechow and Dichev, 2002). They provide evidence supporting the hypothesis that changes in cash flows, serial correlations in changes in cash flows and length of the operating cycle help to increase the test power to 36.5%. The model is as follows:

Equation 2-10: Frankel and Sun (2018) model

$$WCA_{i,t} = \alpha + \beta_1 \Delta REV_{i,t} + \beta_2 rCYCLE_{i,t} + \beta_3 \Delta REV_{i,t} * rCYCLE_{i,t} + \beta_4 \Delta OCF_{i,t} + \beta_5 OCFSC_{i,t} + \beta_6 \Delta OCF_{i,t} * OCFSC_{i,t} + \varepsilon_{i,t}$$

[4] For example, the full model based on Jones (1991) becomes: $\mathrm{WAC_{i,t}} = \alpha + \beta_1 \mathrm{PART_{i,t}} + \beta_2 \mathrm{PARTP1_{i,t}} + \beta_3 \mathrm{PARTP2_{i,t}} + \beta_4 \Delta \mathrm{REV_{i,t}} + \beta_5 \mathrm{PPE_{i,t}} + \varepsilon_{i,t}$

Where: $WCA_{i,t}$ is working capital accruals of firm i in year t; $\Delta REV_{i,t}$ is change in revenues of firm i from year t-1 to year t; $rCYCLE_{i,t}$ is percentile rank of average of operating cash cycle in the three previous periods; $\Delta OCF_{i,t}$ is changes in operating cash flows of firm i from year t-1 to year t; $OCFSC_{i,t}$ is firm-specific serial correlation in changes in cash flows for firm i based on historical data.

In summary, although there are various models to detect earnings management, a general characteristic of these models is to distinguish abnormal accruals from normal accruals. Among earnings management models, Jones-type models (Jones, 1991; Dechow et al., 1995; Kothari et al., 2005) are the most common models used in accounting research.

2.2.4.2. Modelling real earnings management

As explained in Section 2.2.1, Roychowdhury (2006) argues that manipulation of earnings through real business transactions (e.g., increased price discounts or more lenient credit terms, overproduction, and cutdown or delay in discretionary expenditures), leads to abnormally low cash flows from operations, abnormally high production costs, and abnormally low discretionary expenses. He develops models to estimate abnormal cash flows, abnormal production costs, abnormal discretionary expenditures which are used as proxies for real earnings management. Similar to models to estimate accrual earnings management, Roychowdhury (2006) run regressions between cash flows, production costs, and discretionary expenses with firm characteristics. Residuals from those regressions are used as proxies for real earnings management. The models are as follows:

Equation 2-11: Roychowdhury (2006) model to estimate abnormal cash flows

$$\frac{CFO_{i,t}}{A_{i,t-1}} = \alpha\frac{1}{A_{i,t-1}} + \beta_1\frac{REV_{i,t}}{A_{i,t-1}} + \beta_2\frac{\Delta REV_{i,t}}{A_{i,t-1}} + \varepsilon_{i,t}$$

Equation 2-12: Roychowdhury (2006) model to estimate abnormal production costs

$$\frac{\mathrm{PROD_{it}}}{\mathrm{A_{i,t-1}}} = \alpha\frac{1}{\mathrm{A_{i,t-1}}} + \beta_1\frac{\mathrm{REV_{i,t}}}{\mathrm{A_{i,t-1}}} + \beta_2\frac{\Delta\mathrm{REV_{i,t}}}{\mathrm{A_{i,t-1}}} + \beta_3\frac{\Delta\mathrm{REV_{i,t-1}}}{\mathrm{A_{i,t-1}}} + \varepsilon_{\mathrm{i,t}}$$

Equation 2-13: Roychowdhury (2006) model to estimate abnormal discretionary expenditures

$$\frac{\mathrm{DISEXP_{i,t}}}{\mathrm{A_{i,t-1}}} = \alpha\frac{1}{\mathrm{A_{i,t-1}}} + \beta_1\frac{\mathrm{REV_{i,t-1}}}{\mathrm{A_{i,t-1}}} + \varepsilon_{\mathrm{i,t}}$$

Where: $CFO_{i,t}$ is cash flows from operations of firm *i* in year *t*, $PROD_{i,t}$ is production costs of firm *i* in year *t* [equals to the sum of cost of goods sold ($COGS_{i,t}$) and change in inventories from year *t-1* to year *t* ($\Delta INV_{i,t}$)]; $DISEXP_{i,t}$ is discretionary expenditures of firm *i* in year *t*; $REV_{i,t}$ is sales of firm *i* in year *t*; ΔREV_{it} is change in sales of firm *i* from year *t-1* to year *t*; ΔREV_{it-1} is change in sales of firm *i* from year *t-2* to year *t-1*; A_{it-1} is total assets of firm *i* at the end of year *t-1*.

Under these models, abnormal cash flows, abnormal productions costs and abnormal discretionary expenditures are residuals of Equation 2-11, Equation 2-12, and Equation 2-13, respectively.

Later research shows that these models are able to detect real earnings management both in the US and the UK (Cohen, Dey, and Lys, 2008; Athanasakou, Strong, and Walker, 2009; Cohen and Zarowin, 2010; Gunny, 2010; Athanasakou, Strong, and Walker, 2011; Zang, 2012).

2.3. Accounting conservatism

As mentioned above, asymmetric timeliness of bad news over good news is an indication of earnings quality. It is also a type of accounting conservatism. There has been emerging literature focusing on accounting conservatism in general and asymmetric timeliness of bad news over good news in particular (Basu, 1997; Watts, 2003a; Mora and Walker, 2015; Ruch and Taylor, 2015). This section provides a brief explanation including the definition, motivations, and models to estimate accounting conservatism.

2.3.1. *Definition of accounting conservatism*

Accounting conservatism refers to accounting policies which reduce firms' book values of net assets compared to their "true economic values". From the standard setters' view, the Financial Accounting Standard Board (US) states that

> *"Conservatism is a prudent reaction to uncertainty to try to ensure that uncertainties and risks inherent in business situations are adequately considered. Thus, if two estimates of amounts to be received or paid in the future are about equally likely, conservatism dictates using the less optimistic estimate." (Financial Accounting Standards Board (FASB), 1980)*

The standard setters' view is that accounting conservatism is essential to deal with uncertainty in future earnings. The role of accounting conservatism is not to overstate earnings and asset values. The international accounting standards also share a similar view on accounting conservatism (e.g., International Accounting Standards Committee (IASC), 1989). In accounting research, Watts and Zimmerman (1986) define accounting conservatism as predetermined accounting policy choices, which lead to the lowest (highest) values of assets (liabilities).

There are two types of accounting conservatism based on these definitions: unconditional and conditional (Ball and Shivakumar, 2005; Beaver and Ryan, 2005). Unconditional conservatism refers to accounting treatments that result in lower book values relative to neutral (economic) values of net assets, and this conservatism is called "balance sheet conservatism" or news-independent conservatism because it does not depend on the news.

Mora and Walker (2015) identify two sources of unconditional conservatism. First, unconditional conservatism results from conservative recognition of items in statements of financial positions (balance sheets) that do not meet the definitions or recognition criteria in accounting standards. For example, R&D costs are not allowed to be capitalised on balance sheets because future benefits are not "probable". Second, unconditional conservatism can also result from the conservative measurement of items on statements of financial positions. For example, assets are depreciated at a rate greater than the "economic rate of depreciation", which is the depreciation rate that matches book values of fixed assets with their economic values.

Conditional conservatism refers to the understatement of values of assets in financial statements which recognise losses in unfavourable conditions, but not gains in favourable conditions (Basu, 1997; Watts, 2003a; Ball and Shivakumar, 2005; Beaver and Ryan, 2005). Conditional conservatism is related to how fast bad news and good news are recorded in financial statements. It is also called news-dependent conservatism. In a seminal work, Basu (1997) defines accounting conservatism as "*the accountant's tendency to require a higher degree of verification to recognise good news as gains than to recognise bad news as losses*". The recognition of good news relative to bad news requires a higher level of verification. This is the asymmetric recognition of bad news over good news, which leads to conservatism. An example of conditional conservatism is the requirement that inventory must be measured at the lower value between historical cost and net realisable value, and such a requirement results in recognition of loss when there is bad news related to inventory but not a recognition of gain when there is good news.

Although they are different in definitions, both unconditional and conditional conservatism lead to an understatement of book values of assets (Watts, 2003a; Beaver and Ryan, 2005; Mora and Walker, 2015; Ruch and Taylor, 2015). The common purposes of both types of conservatism are to increase the efficiency of debt contracts and managerial contracts or reduce the costs related to litigation, tax, and regulation (Watts, 2003a; Beaver and Ryan, 2005).

2.3.2. Demand for accounting conservatism

Watts (2003a) provides a comprehensive explanation for the demand for accounting conservatism. In general, accounting conservatism arises from demand for contracting, litigation, taxation, and regulation. Among four categories, contracting demand is the early and main source of demand for accounting conservatism (Watts, 2003a); thus this section mostly focuses on the contracting demand, followed by a brief discussion on demand for litigation, taxation, and regulation.

2.3.2.1. Contracting demand

Under the contracting demand perspective, accounting conservatism is used to increase the efficiency of agency contracts between firms and other parties, e.g. debtholders and managers (Watts, 2003a). Watts and Zimmerman (1986) point out that accounting numbers can be used to reduce agency costs, which occur because contracting parties may want to take opportunistic behaviours to maximise their wealth at the expense of shareholders.

2.3.2.1.1. Debt monitoring

Prior studies show that the agency problems of debts arise because information asymmetry exists (Black and Cox, 1976; Jensen and Meckling, 1976). Managers and shareholders with superior information may take actions that negatively affect the wealth of debtholders, or they may fail to provide relevant information about the creditworthiness of the borrowing firms to debtholders.

A common mechanism to mitigate the agency problems of debts is the use of debt contracts with restrictive covenants (see, e.g., Watts, 2003a; Nikolaev, 2010; Erkens et al., 2014). For example, debt contracts may require borrowing firms to maintain net assets at a minimum level or restrict dividend payments to guarantee that the borrowing firms have sufficient resources to repay debts. Smith and Warner (1979) provide evidence that debtholders include restrictions on dividends and financing policies in debt contracts to minimise the likelihood that managers and shareholders take opportunistic actions to maximise shareholders' wealth at an expense suffered by debtholders. The intensity of financial covenants in debt contracts becomes even higher under uncertainty when the borrowing firms' creditworthiness is not revealed at the date of loan initiation (Demerjian, 2017). Debt covenants help to transfer control rights from shareholders to debtholders in certain situations, such as when borrowing firms face financial distress, so that debtholders may take appropriate actions to protect themselves in a timely manner (Watts, 2003a).

In addition to debt covenants, accounting conservatism can be used as another mechanism to mitigate the conflicts of interests between debtholders and managers and shareholders (Ahmed, Billings, Morton, and Stanford-Harris, 2002; Watts, 2003a; Nikolaev, 2010). As noted by Ball and Shivakumar (2005), two roles of accounting conservatism are to offset a potential increase in net assets and financial performance resulting from managers' opportunistic behaviours and to require managers to recognise bad news timely. More accounting conservatism would lead to faster violation of accounting-based covenants. In other words, accounting conservatism facilitates the violation of debt covenants, so that debtholders may take proactive actions, such as debt renegotiation or restructuring, to protect themselves (Watts, 2003a).

The empirical evidence supports the view that accounting conservatism can benefit debtholders because it helps to increase the efficiency of debt contracts (Ahmed et al., 2002; Beatty, Weber, and Yu, 2008; Zhang, 2008; Nikolaev, 2010). Tan (2013) indicates that borrowing firms adopt conservative accounting immediately after the violation of debt covenants, suggesting that accounting conservatism is used for debt contracting. Ahmed et al. (2002) indicate that accounting conservatism helps to mitigate the conflicts of interests between shareholders and debtholders over dividend policies. Instead of including restrictions on dividend payments in debt contracts, borrowing firms may choose to report more conservative earnings and assets, which provide lower boundaries to guarantee loan payments. Nikolaev (2010) argues that, in public debt contracts, restrictive covenants are effective only if borrowing firms report conservative earnings that include timely loss recognition. He finds that dependence on restrictive covenants is positively correlated with accounting conservatism. Zhang (2008) supports the view that accounting conservatism is beneficial because it provides lenders with an early indication of default risks of borrowing firms. Additionally, Li (2013) provides a theoretical model to examine the impact of accounting conservatism on the efficiency of debt contracting via the renegotiation of debt covenants. The author shows that accounting conservatism may increase the welfare of firms in certain conditions when the renegotiation cost is not high.

2.3.2.1.2. Managerial control

Next, accounting conservatism can be used as a management control tool (Watts, 2003a). In compensation contracts, financial performance provides a good reflection on management performance during management tenure so that compensation is measured correctly. In this case, managers with superior information may take opportunistic actions at the cost of shareholders, e.g. they may overestimate future cash flows and earnings so that they can extract higher compensation. The role of accounting conservatism is that it provides shareholders with timely information so that they may correctly evaluate managers' performance and defer compensation bonuses under uncertain circumstances.

There is evidence to support the view that accounting conservatism is useful for shareholders. For example, in a principal-agent (or shareholder-manager) setting, Kwon, Niwman, and Suh (2001) and Kwon (2005) provide theoretical models showing that accounting conservatism is useful to reduce agency costs when penalties imposed by principals for wrongful actions of agents are limited and helpful to mitigate agency costs related to suboptimal decisions made by agents. Lafond and Roychowdhury (2008) find that accounting conservatism is negatively affected by the ownerships of managers. The authors explain that, when managerial ownership decreases, there are higher agency problems, which lead to higher demand for accounting conservatism as a managerial control. LaFond and Watts (2008) indicate that accounting conservatism decreases information asymmetry between insiders and investors who are uninformed and to reduce related costs. The findings of LaFond and Watts (2008) suggest that conservative earnings benefit shareholders because it can act as a managerial control to reduce information risk. Francis, Hasan, and Wu (2013) show further evidence that accounting conservatism leads to higher firm stock performance during a financial crisis. In line with LaFond and Watts

(2008), Francis et al. (2013) also find that the relationship is stronger for firms which have weak corporate governance and for firms which have higher information risk. Furthermore, using UK compensation data, O'Connell (2006) shows that the cash component of CEO compensation is more sensitive to accounting conservatism in good news periods than in bad news periods. The findings lend support to the position that firms defer compensation awards during good news periods due to uncertainty concerns. Recent studies also support the notion that accounting conservatism can act as a managerial control, e.g. it helps to mitigate the costs of CEO overconfidence (Hsu, Novoselov, and Wang, 2017).

2.3.2.1.3. Corporate governance

Accounting conservatism can serve as a corporate governance mechanism (Watts, 2003a). Managers have motivations to conceal poor financial performance so that they can extend their tenure in companies. Managers may also be involved in activities which have negative effects on shareholders' wealth, e.g. they build their empire by investing in many projects even with negative present values. Accounting conservatism results in reduced book values which provide boards of directors and shareholders with early signals about the managers' performance for further investigation. For example, managers can be forced to abandon projects with negative present values.

There is evidence on the relationships among corporate governance, accounting conservatism, and shareholders' wealth (e.g., Ahmed and Duellman, 2007; García Lara, García Osma, and Penalva, 2009a, 2011; Louis, Sun, and Urcan, 2012; García Lara, García Osma, and Penalva, 2014; Lee, Li, and Sami, 2015; García Lara et al., 2016; Kim and Zhang, 2016; Goh, Lim, Lobo, and Tong, 2017). For example, previous research shows that strong corporate governance leads to more accounting conservatism (Ahmed and Duellman, 2007; García Lara, García Osma, et al., 2009a), which in turn helps firms gain access to the debt market and increase their investment efficiency, e.g. reduce underinvestment and overinvestment (García Lara et al., 2016). Accounting conservatism also helps to increase the values of cash holdings (Louis et al., 2012), reduce the costs of capital (García Lara et al., 2011; Li, 2015; Goh et al., 2017), mitigate information asymmetry by improving the information environment (García Lara et al., 2014), prevent negative market reactions following seasoned equity offerings (Goh et al., 2017), reduce audit fees (Lee et al., 2015), and lower the risk of a stock price crash (Kim and Zhang, 2016).

2.3.2.2. Litigation, regulation, and taxation

Empirical studies provide evidence that accounting practices are determined by litigation, regulation, and taxation. For example, Ettredge, Huang, and Zhang (2016) studied public companies which are facing lawsuits for the violation of US GAAP. The authors show that accounting conservatism helps firms mitigate litigation risk from the initiation of lawsuits against them to lawsuit resolutions. Specifically, they find that accounting conservatism helps to reduce subsequent lawsuits against them as well as negative market reactions following lawsuits, lawsuit lengths, lawsuit discharges, and penalties. Using a sample of firms investigated by the SEC for accounting fraud, Alam and Petruska (2012) examine whether changes in litigation risk affect accounting conservatism. They argue that the SEC's investigation and public discovery of accounting fraud leads to higher litigation risk for firms. They find that accounting conservatism in fraud firms is lower than in non-fraud firms in the pre-investigation period and that accounting conservatism in fraud firms increases in the post-investigation period. The findings suggest that litigation risk is an important determinant of accounting conservatism. Focusing on managerial liability coverage, Chung and Wynn (2008) find a negative relationship between the coverage of managerial liability and accounting conservatism that the relationship is more pronounced when the litigation risk is high. The findings are consistent with the notion that litigation risk has an impact on accounting conservatism.

Regarding regulations, Carel and Martien (2005) examine accounting conservatism of UK firms without cross-listing and UK firms with cross-listing in the US markets. The authors argue that cross-listing imposes more regulations and enforcements so that firms adopt more conservative earnings. The findings show that, compared to firms without cross-listing in the US, firms with cross-listing have more accounting conservatism and that accounting conservatism in cross-listing firms is higher in the early years of their cross-listing.

Further evidence on the determinants of accounting conservatism can be found in the work of Qiang (2007), García Lara, García Osma, and Penalva (2009b) and Bushman and Piotroski (2006). Qiang (2007) studied the determinants of conditional and unconditional conservatism. The author finds that conditional conservatism is determined by contracting demand and litigation while unconditional conservatism is affected by litigation, regulation, and taxation. García Lara, García Osma, et al. (2009b) further extend the finding of Qiang (2007) by providing evidence that conditional conservatism is affected by regulations and taxation in certain circumstances, e.g. when firms are able to transfer income from unfavourable periods, e.g. periods with high pressure of taxation and public scrutiny, to favourable periods, e.g. periods with low pressure of taxation and public scrutiny. Using international data, Bushman and Piotroski (2006) also provide evidence that firms' accounting conservatism is affected by national-level institutional characteristics, namely the legal system, security legislation, the political economy, and the tax regime.

2.3.3. Costly consequences of accounting conservatism

As discussed above, accounting conservatism is used for contracting demand and for litigation, regulation, and taxation. The literature also documents significant and growing evidence that accounting conservatism is associated with costs for firms.

Caskey and Laux (2017) propose a theoretical model of the relationships among corporate governance, accounting conservatism, and manipulation. The authors find that firms may prefer accounting conservatism as it plays a better overseeing role for investments. Unfortunately, they find that accounting conservatism provides managers with opportunities to manipulate financial statements to mislead boards of directors and affect the boards' decisions. In such situations, firms can only increase the benefits of accounting conservatism and reduce managers' ability to manage earnings when they effectively oversee the reporting process.

Similar to Caskey and Laux (2017), Gigler, Kanodia, Sapra, and Venugopalan (2009) and Li (2013) provide a theoretical framework indicating that accounting conservatism may be costly in some circumstances. Gigler et al. (2009) develop the statistical and informational characteristics of conservatism, which show that accounting conservatism would reduce debt contracting efficiency. Similarly, the theoretical model of Li (2013) indicates that, when the renegotiation of covenants is not viable or is induced by very high costs, accounting conservatism reduces the efficiency of debt contracts.

Direct empirical evidence on the unexpected consequences of accounting conservatism can be found in the work of Heflin, Hsu, and Jin (2014) and Kravet (2014). Heflin et al.

(2014) find that conditional conservatism reduces reported earnings' usefulness for share valuation purposes. The evidence indicates that conditional conservatism negatively affects the persistence and informativeness of earnings, which are important for earnings forecasting. The findings also suggest that analysts' exclusions of GAAP earnings make earnings forecasts more useful for investors. Kravet (2014) finds that accounting conservatism prevents managers from taking risky investments, which potentially yield high returns for shareholders. The author also finds that the negative relationship between borrowing firms' accounting conservatism and merger and acquisition activities is driven by accounting-based covenants in debt contracts.

In addition to Heflin et al. (2014) and Kravet (2014), there is a significant and growing body of research which shares the view that accounting conservatism is costly because it accelerates the violation of debt covenants, which, in turn, causes related costs to borrowers. Beneish and Press (1993) find that borrowing firms suffer significant costs for refinancing, restructuring debts or changing operations when they fall into technical default. The authors also reveal that borrowing firms even suffer more restrictions on operating and financing activities if debt contracts are renegotiated following a technical default. Debtholders with significant control rights over borrowing firms may facilitate the renegotiation of covenants even when technical default is not close, or there is no violation of covenants (Denis and Wang, 2014). The violation of debt covenants potentially affects shareholders' wealth, as evidenced by reductions in capital investments (Chava and Roberts, 2008; Nini, Smith, and Sufi, 2012), investments in profitable projects (Nash, Netter, and Poulsen, 2003), and mergers and acquisitions (Nini et al., 2012). Debt covenant violation may also cause higher bid–ask spreads and higher volatility of stock returns (Gao, Khan, and Tan, 2017), negative reactions from auditors such as an increase in audit fees, going-concern audit opinion, or even the resignation of auditors (Bhaskar, Krishnan, and Yu, 2017; Gao et al., 2017). Bhaskar et al. (2017) indicate that the negative reactions from auditors are stronger for firms that do not face financial distresses because the violation of debt covenants is an indicator that audit risks in non-distressed firms may not be assessed correctly so that accessed risks need to be adjusted, leading to higher risks and costs for auditors.

2.3.4. Modelling accounting conservatism

As discussed in Section 2.3.1, unconditional and conditional are two types of accounting conservatism (Ball and Shivakumar, 2005; Beaver and Ryan, 2005). This section introduces major empirical models to estimate accounting conservatism.

2.3.4.1. Conditional conservatism models

2.3.4.1.1. Basu (1997) model

The most influential model to estimate conditional conservatism was introduced by Basu (1997). In a seminal work, Basu (1997) offered a model to measure the asymmetric timeliness of bad news over good news. In this model, he uses stock returns as a measure of news. Basu (1997) finds that the higher degree of verification requirements underlying the concept of accounting conservatism results in asymmetric recognition of bad news over goods news. Under conservative accounting, bad news is recorded more quickly than good news, leading to lower book earnings in bad news periods relative to good news periods. In Basu (1997), the asymmetric timeliness of bad news over good news is estimated as follows:

Equation 2-14: Basu (1997) model

$$EARN_{i,t} = \beta_1 + \beta_2 D_{i,t} + \beta_3 RET_{i,t} + \beta_4 D_{i,t} * RET_{i,t} + \varepsilon_{i,t}$$

Where: $EARN_{i,t}$ is earnings per share of firm i in year t; $RET_{i,t}$ is stock returns for the period from the beginning to the end of fiscal year t; and $D_{i,t}$ is a dummy variable that equals one if $RET_{i,t} < 0$, and zero otherwise. The coefficient β_3 is the measure of good news timeliness. The coefficient β_4 is a measure of accounting conservatism, which is the incremental timeliness for bad news over good news. $\beta_3 + \beta_4$ is the total timeliness of bad news. In the model, β_3 and β_4 are expected to be positive. Equation 2-14 is run for each year in the sample.

Although this model is one of the most cited models on accounting conservatism research, the validity of the conservatism coefficient is controversial. For example, Dietrich, Muller, and Riedl (2007) claim that Basu's model is biased because it is based on some very unrealistic conditions. Pae, Thornton, and Welker (2005) and Roychowdhury and Watts (2007) suggest that there is a relationship between Basu's conservatism coefficient and price-to-book ratio. Givoly, Hayn, and Natarajan (2007) show that Basu's coefficient is sensitive to firm characteristics, which are not related to conservatism, e.g. the information environment which affects the reflections of news on returns. However, Ball, Kothari, and Nikolaev (2013b) explain that a limitation of the work of Basu (1997) is that the author does not provide formal econometric and comprehensive analyses to support the model, which could potentially invite questions from researchers about the validity of the model. Ball et al. (2013b) provide formal tests in different settings and conclude that Basu's coefficient is valid. Ball, Kothari, and Nikolaev (2013a) provide further evidence to support the validity of Basu's model. In general, regardless of some claims of bias, there is emerging and robust evidence that Basu's coefficient is a valid measure for accounting conservatism.

2.3.4.1.2. Khan and Watts (2009)'s model

So far, the chapter discusses Basu's model to estimate conservatism conditional on news and evidence to support the validity of this model. A significant disadvantage of this model is that it is less efficient to test hypotheses at the firm or industry levels because it can only estimate the measure of accounting conservatism at the market level in each year (Ryan, 2006; Khan and Watts, 2009).

Based on the work of Basu (1997), Khan and Watts (2009) developed a model to estimate firm-year conservatism. They developed empirical measures of the timeliness of good news ($GSCORE$) and the incremental timeliness of bad news over good news ($CSCORE$) based on determinants of accounting conservatism, which are mostly depicted in major firm characteristics, namely financial leverage, firm size, and market-to-book ratio. The Khan and Watts (2009) model is as follows:

Equation 2-15: Khan and Watts (2009) estimations of GSCORE and CSCORE

$$GSCORE_{i,t} = \beta_3 = \mu_1 + \mu_2 SIZE_{i,t} + \mu_3 MTB_{i,t} + \mu_4 LEV_{i,t}$$

$$CSCORE_{i,t} = \beta_4 = \gamma_1 + \gamma_2 SIZE_{i,t} + \gamma_3 MTB_{i,t} + \gamma_4 LEV_{i,t}$$

Where: μ_j and γ_j (j = 1-4) are obtained from the following annual cross-sectional regressions:

Equation 2-16: The Khan and Watts (2009) full model to estimate firm-year accounting conservatism

$$EARN_{i,t} = \beta_1 + \beta_2 D_{i,t} + (\mu_1 + \mu_2 SIZE_{i,t} + \mu_3 MTB_{i,t} + \mu_4 LEV_{i,t}) RET_{i,t} +$$

$$(\gamma_1 + \gamma_2 SIZE_{i,t} + \gamma_3 MTB_{i,t} + \gamma_4 LEV_{i,t}) D_{i,t} * RET_{i,t} +$$

$$(\delta_1 SIZE_{i,t} + \delta_2 MTB_{i,t} + \delta_3 LEV_{i,t} + \delta_4 D_{i,t} * SIZE_{i,t} + \delta_5 D_{i,t} * MTB_{i,t} + \delta_6 D_{i,t} * LEV_{i,t}) + \varepsilon_{i,t}$$

Where: $SIZE_{i,i}$ is the natural log of the market value of equity at the end of year t; $MTB_{i,t}$ is the market-to-book ratio at the end of year t; and $LEV_{i,t}$ is the sum of long-term and short-term debts at the end of year t, scaled by the market value of equity at the end of year t. The coefficients estimated from Equation 2-16 are used in Equation 2-15 to calculate $GSCORE$ and $CSCORE$.

The model of Khan and Watts (2009) enables studies which require firm-year conservatism and has been widely applied. Later, García Lara et al. (2016) further modified the measure of conditional conservatism based on the work of Basu (1997) and Khan and Watts (2009). García Lara et al. (2016) incorporated the measure of the asymmetric timeliness of bad news over good news (CSCORE) and the measure of the timeliness of good news (GSCORE) together, and they refer to the new measure as total conservatism (CONS).

Equation 2-17: García Lara et al. (2016) total conservatism estimation

$$CONS_{i,t} = GSCORE_{i,t} + CSCORE_{i,t}$$

The measure of total accounting conservatism of García Lara et al. (2016) is based on the idea of Basu (1997). As stated in Equation 2-14, in the Basu model, the coefficient β_3 is the measure of good news timeliness, while the coefficient β_4 is a measure of the incremental timeliness for bad news over good news. $\beta_3 + \beta_4$ is the total timeliness of bad news. *CONS* following García Lara et al. (2016) is the measure of total timeliness of bad news for each firm in each year (firm-year measure), while $\beta_3 + \beta_4$ in the Basu model is market measure in each year.

2.3.4.1.3. Ball and Shivakumar (2005) model

Although earnings-return models to estimate accounting conservatism have been widely applied, a major limitation is that these models cannot be used for private firms as there is no share price and returns for those firms (Ball and Shivakumar, 2005, 2008). Ball and Shivakumar (2005) introduced a model to estimate accounting conservatism, which only employs accounting numbers. They developed this model to estimate the asymmetric timeliness of loss recognition. They argue that good news and bad news affect the revisions of both current cash flows and expected future cash flows because cash flows generated from an asset are more likely to be correlated. Current-period accruals include the timely recognition of good news (gains) and bad news (losses), which reflect changes in expected future cash flows. Therefore, the timely asymmetric recognition of economic gains (good news) and losses (bad news) causes a positive relationship between current-period accruals and current-period cash flows. The model is as follows:

Equation 2-18: Ball and Shivakumar (2005) model

$$ACC_{i,t} = \alpha_1 + \beta_1 DCFO_{i,t} + \beta_2 CFO_{i,t} + \beta_3 DCFO_{i,t} * CFO_{i,t} + \varepsilon_{i,t}$$

Where: $ACC_{i,t}$ is accruals that are calculated as follows: $ACC_{i,t} = \Delta INV_{i,t} + \Delta REC_{i,t} + \Delta OCA_{i,t} - \Delta PAY_{i,t} - \Delta OCL_{i,t} - DEP_{i,t}$, where $\Delta INV_{i,t}$ is change in inventories from the end of year t-1 to the end of year t, $\Delta REC_{i,t}$ is change in receivables from the end of year t-1 to the end of year t, $\Delta OCA_{i,t}$ is change in other current assets from the end of year t-1 to the end of year t, $\Delta PAY_{i,t}$ is change in payables from the end of year t-1 to the end of year t, $\Delta OCL_{i,t}$ is change in other current liabilities from the end of year t-1 to the end of year t, and $DEP_{i,t}$ is depreciation and amortisation in year t; $CFO_{i,t}$ is cash flow from operations, which equals net income before extraordinary items ($IB_{i,t}$) minus accruals

($ACC_{i,t}$); $DCFO_{i,t}$ is a dummy variable that equals one if $CFO_{i,t} < 0$, and zero otherwise; All variables are scaled by total assets at the end of year t-1.

In this model, β_2 is expected to be negative following Dechow et al. (1998), who show that accruals have a contemporaneous negative relationship with operating cash flows. Ball and Shivakumar (2005) find that β_3 is positive, because accruals are more likely to reflect losses in periods with negative cash flows.

Later, Ball and Shivakumar (2008) further improved the model of Ball and Shivakumar (2005) by adding changes in sales and PPE to control for firm characteristics which may affect accruals.

Equation 2-19: Ball and Shivakumar (2008) model

$$ACC_{i,t} = \alpha_1 + \beta_1 DCFO_{i,t} + \beta_2 CFO_{i,t} + \beta_3 DCFO_{i,t} * CFO_{i,t} + \beta_4 \Delta SALE_{i,t} + \beta_5 PPE_{i,t} + \varepsilon_{i,t}$$

Where: $\Delta SALE_{i,t}$ is change in sales from year t-1 to year t; and $PPE_{i,t}$ is gross PPE at the end of year t; all scaled by total assets at the end of year t-1.

2.3.4.2. Unconditional conservatism models

So far, the chapter has discussed popular models to estimate conditional conservatism, which is dependent on the news (bad news versus good news). Compared with conditional conservatism models, there are relatively fewer attempts to develop a model to capture unconditional conservatism.

Givoly and Hayn (2000) proposed a measure of unconditional conservatism. Under conservative accounting practices, earnings tend to have negative skewness because of the downward book values of assets. Givoly and Hayn (2000) used the difference between the skewness of cash flows and skewness of earnings (SKEWNESS) as a measure of unconditional conservatism. The variable SKEWNESS is calculated as follows:

Equation 2-20: Givoly and Hayn (2000) calculation of the difference between cash flows skewness and earnings skewness

$$SKEWNESS_{i,t} = \frac{\left(CFO_{i,t} - \mu_{CFO,i,t}\right)^3}{\left(\delta_{CFO,i,t}\right)^3} - \frac{\left(NI_{i,t} - \mu_{NI,i,t}\right)^3}{\left(\delta_{NI,i,t}\right)^3}$$

Where: $CFO_{i,t}$ is cash flows from operations of firm *i* in year *t* and $NI_{i,t}$ is net income of firms *i* in year *t*, all scaled by total assets in year *t-1*. $\mu_{CFO,i,t}$ and $\mu_{NI,i,t}$ are the mean of cash flows from operations and net incomes, respectively, of firm *i* over a five-year period from year *t-4* to year *t*. $\delta_{CFO,i,t}$ and $\delta_{NI,i,t}$ are the standard deviations of cash flows from operations and net incomes, respectively, of firm *i* over a five-year period from year *t-4* to year *t*.

Next, Givoly and Hayn (2000) also used the accumulation of non-operating accruals as a proxy of unconditional conservatism. Non-operating accruals do not include accruals from depreciation, amortisation, and operating accruals. Instead, non-operating accruals mostly include accruals from items whose timing and recognised amount are affected by the discretion of managers, such as bad debt provisions, restructuring charges, changes in accounting estimates, disposals of assets, write-downs of assets, or revenue deferrals. Givoly and Hayn (2000) argue that the negative accumulation of non-operating accruals is an indicator of accounting conservatism. Calculation of negative non-operating accruals (NOACC) is as follows:

Equation 2-21: Givoly and Hayn (2000) calculation of negative non-operating accruals

$$NOACC_{\ t} = -1 * \{Total\ accruals\ before\ depreciation_t\ -\ Operating\ accruals_t\}$$

$$= -1 * \{[(Net\ Income_t + Depreciation_t) - Cash\ flow\ from\ operations_t] - [\Delta Accounts\ receivable_t + \Delta\ Inventories_t + \Delta\ Prepaid\ expenses_t - \Delta\ Accounts\ payable_t - \Delta\ Taxes\ payable_t]\}$$

The measures of unconditional conservatism i.e., the difference in cash flow skewness and earnings skewness and accumulation of negative non-operating accruals, proposed by Givoly and Hayn (2000), have been widely applied in accounting studies (e.g., Qiang, 2007; García Lara, García Osma, et al., 2009a; Ahmed and Duellman, 2013).

2.4. Conclusion

In this chapter, I overview the concept of earnings quality, which is the foundation for three empirical chapters. I firstly explain what earnings quality is. In short, Dechow et al. (2010) broadly define earning quality based on the concept of earnings in accounting standards. Their view is that higher earnings quality provides more information about firms' financial performance for a wide range of decision makers. This thesis takes this broad perspective to study the earnings quality of UK listed companies.

Next, I discuss proxies for earnings quality and recent methodological advancements in estimating earnings quality. Based on Dechow et al. (2010)'s classification of earnings quality, I explain the properties of earnings, the responsiveness of investors to earnings, and observed indicators of misstated earnings. I also introduce a recent trend in empirical research which employs distributions of digits of numbers (e.g., Benford's Law), linguistic and textual analysis as proxies for earnings quality.

After that, I discuss in more details about earnings management and accounting conservatism, which are the main focuses of this thesis. I firstly provide definitions of earnings management and accounting conservatism. I also explain why managers are involved in the use of earnings management and accounting conservatism. Finally, I quickly introduce empirical models to estimate earnings management and accounting conservatism.

The content of this introduction chapter is applied to the three empirical chapters: Chapter 3 “CEO profile and earnings quality”, Chapter 4 “Accounting conservatism and banking expertise on boards of directors”, and Chapter 5 “Benford’s Law, earnings management, and accounting conservatism: the UK evidence”.

Chapter 3: CEO PROFILE AND EARNINGS QUALITY

Abstract

This chapter presents the first empirical study that comprises this thesis. In this study, the relationship between CEO personal characteristics and earnings management is presented. CEO characteristics are aggregated into a PSCORE, which is a composite score based on publicly available data. The chapter reports strong positive relationships between the PSCORE and three types of proxies for earnings quality: (i) accrual earnings management, e.g. abnormal accruals (ii) real earnings management, e.g. abnormal cash flows, abnormal production costs, and abnormal discretionary expenditures (iii) financial statement errors, measured by deviations of first digits of figures reported in financial statements from what are expected by Benford's Law. Further analyses indicate that the relationships between PSCORE and proxies for earnings quality become more pronounced when CEOs have high equity-based compensation incentives. The findings have some implications for practitioners.[5]

Keywords: Earnings Quality; Benford's Law; Chief Executive Officers

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[5] I gratefully acknowledge comments received from Balasingham Balachandran, Mark Clatworthy, Halit Gonenc, Young Sang Kim, Jia Liu, Jurica Susnjara, and participants at British Accounting and Finance Association's Doctoral Masterclasses 2017, European Accounting Association's Annual Congress 2017, and European Financial Management Association's Annual Meeting 2017. The study built from this chapter was featured on the Columbia Law School's Blu Sky Blog (http://clsbluesky.law.columbia.edu/2017/02/24/using-the-profile-of-ceos-to-detect-earnings-management/).

3.1. Introduction

A substantial body of research is committed to developing, validating, and improving empirical models to estimate earnings quality (Dechow et al., 2010). This chapter contributes to the stream of literature by introducing a novel approach which captures publicly available information on the personal profile of CEOs to signal red flags of poor earnings quality in individual firms.

An accepted methodology to capture earnings quality is to estimate abnormal accruals (Dechow et al., 2010). Abnormal accruals are the residuals (or error terms) in the regressions between accruals and firms' characteristics (e.g., Jones, 1991; Dechow et al., 1995; Peasnell et al., 2000b; Dechow and Dichev, 2002; Kothari et al., 2005). Despite their importance, earnings quality models are subject to considerable criticisms. A major limitation of accrual-based models is the absence of an adequate understanding of the properties of accruals and a theory of the accrual-generating process; therefore the large magnitude of regression residuals may be inferred as showing poor quality of earnings (Fields et al., 2001; Dechow et al., 2010; Gerakos, 2012; Ball, 2013). There is also increasing concern that accrual-based models are poorly specified (Holthausen et al., 1995; Fields et al., 2001; Dechow et al., 2010; Ball, 2013), or there may be measurement errors in estimating accruals (Hribar and Collins, 2002). Also, most models require large data sets to run time-series or cross-sectional regressions, and consequently their applications are limited because of data constraints (Dechow et al., 1995; Dechow et al., 2011; Amiram et al., 2015; Nguyen, Iqbal, and Shiwakoti, 2015b). Nguyen (2016) also points out similar concerns over using the models to estimate real earnings management activities.

In this chapter, I offer a single measure which captures various CEO characteristics to signal earnings quality. The chapter constructs PSCORE based on nine CEO characteristics which have been documented in the literature as important determinants of earnings quality. These characteristics are (i) role experience as a CEO, (ii) previous working experience as a chief financial officer, (iii) finance-related qualifications, (iv) early years of service in the firm, (v) performance during the last three years of tenure, (vi) press coverage, (vii) serving as the chairperson, (viii) serving as a founder of firms, and (ix) age. The chapter hypothesises that the PSCORE is positively associated with other established proxies for earnings quality.

The chapter employs established proxies for earnings quality, acknowledging recent developments in the field. I use three types of measures of earnings quality: (i) accrual earnings management, measured by abnormal accruals (Jones, 1991; Dechow et al., 1995; Peasnell et al., 2000b); (ii) real earnings management, measured by abnormal cash flows, abnormal production costs, abnormal discretionary expenditures (real earnings management) (Roychowdhury, 2006); (iii) financial statement errors, measured by deviations of first digits of figures reported in financial statements from what are expected by Benford's Law (Amiram et al., 2015; Nigrini, 2015).

The chapter uses a sample of 3,395 firm-year observations (615 unique firms) of listed companies on the London Stock Exchange from 2005 to 2012. Consistent with predictions, the results demonstrate strong positive relationships between PSCORE and the established proxies for earnings quality. Specifically, the univariate evidence shows that the levels of all proxies for earnings quality increase monotonically as PSCORE increases. Multivariate regression findings show that PSCORE is positively and significantly related to the magnitudes of abnormal accruals, abnormal cash flows, abnormal production costs, abnormal discretionary expenditures, and deviations of first digits from Benford's Law, after controlling for important determinants of earnings quality. Also, further analyses indicate that the relationships between PSCORE and the established proxies for earnings quality are stronger for firms which have CEOs with a higher equity-based incentive. The evidence provides collaborating evidence for the idea that the profile of CEOs matters for examining earnings quality. The results are robust for several robustness tests. In general, the findings suggest that a high PSCORE could indicate poor earnings quality.

The research contributes to the literature in several ways. Firstly, a major advantage of the PSCORE is that data used to construct the PSCORE are mostly collected from publicly available curriculum vitae of CEOs. Because the PSCORE neither needs time-series data nor requires cross-sectional data to estimate, it can be widely applied, especially in some capital markets where data are not publicly available or are costly to collect. Secondly, this is the first study which aggregates various characteristics of CEOs into a single index to signal the quality of earnings. Previously published studies are limited to the effects of a few individual CEO characteristics on earnings quality (e.g., Wells, 2002; Francis et al., 2008; Malmendier and Tate, 2009; Jiang et al., 2010; Huang et al., 2012; Kuang et al., 2014; Ali and Zhang, 2015). The findings are also consistent with the recent work of Liang et al. (2018), which offers a theoretical framework indicating that abnormal accruals are higher and more volatile in firms with less credible CEOs than in firms with more credible CEOs. Thirdly, the chapter is the first research which uses CEO characteristics to study three different aspects of earnings quality: accrual earnings management, real earnings management, and financial statement errors. Practitioners could value the PSCORE because it can signal the misrepresentation of financial statements regardless of whether the misstatements result from intentional or unintentional acts.

The study, therefore, has some important implications for practitioners. The PSCORE could be a useful tool for investment professionals, boards of directors, auditors, and regulators to assess the risks of poor earnings quality. It also has potential as an even more nuanced and sophisticated tool that can identify and regulate risks related to financial reporting quality. For example, in the context of auditing, external auditors could use the PSCORE to assess the risks of material misstatements. Auditing standards (e.g., International Auditing and Assurance Standards Board (IAASB), 2009; Public Company Accounting Oversight Board, 2010) require the risk assessment procedures of auditors to include an understanding of the entity and its environment, including the management's philosophy and operating style. A high level of abnormal accruals, abnormal real business activities, and deviations of first digits from Benford's Law, which are associated with a high PSCORE, might result from the inappropriate applications of accounting standards so that they could be red flags of material accounting misstatements. The evidence implies that auditors should be cautious when clients have CEOs have high PSCOREs.

The chapter proceeds as follows. Section 3.2 explains the theoretical background for the relevance of the CEO profile. Section 3.3 explains the construction of the PSCORE. Section 3.4 describes the validity tests of the PSCORE, focusing on sample selection, calculation of empirical proxies for earnings quality, control variables, and multivariate regression models. Section 3.5 presents findings and Section 3.6 provides concluding remarks.

3.2. Theoretical background for the relevance of the CEO profile

This section briefly discusses the theoretical background for the relevance of the CEO profile in explaining earnings quality.

The upper echelons theory proposes that executive managers' characteristics, e.g. experience and personality, affect their interpretation of strategic situations, which in turn affects their decision making (Hambrick and Mason, 1984; Hambrick, 2007). Under this theory, it is predicted that organisational outcomes are directly determined by the discretion of top executive managers (Hambrick, Finkelstein, and Mooney, 2005). Given that CEOs have overall responsibilities for firm performances, it is reasonable to assume that they can indeed influence the financial statements which present the financial performance, financial position, and cash flows of their companies. Because accounting standards allow the use of professional judgments in choosing appropriate accounting policies or in estimating accounting numbers, when uncertainties exist, it makes characteristics of CEOs relevant to the financial decision-making process and therefore worthy of closer inspection.

With a particular focus on reputation, an aspect of executives' profile, there is also a good theoretical foundation to expect that the reputation of CEOs matters in the context of corporate practices. According to rent extraction theory (Hirshleifer and Thakor, 1992; Hirshleifer, 1993; Malmendier and Tate, 2009), managers opportunistically make business decisions to enhance their reputation rather than to maximise shareholders' value. Efficient contracting theory (Fama, 1980) and matching theory (Francis et al., 2008) note that highly reputable senior managers can positively affect organisational outcomes. Specifically, according to efficient contracting theory, top executives with high credibility (such as reputation) lead to high-quality organisational outcomes because they have more to lose (compensation, future career, etc.) if they are involved in unethical activities (see, e.g., Francis et al., 2008; Jian and Lee, 2011).

Recently, Liang et al. (2018) offered a theory on the relationship between the credibility of financial reporting, for which earnings quality is a proxy, and the credibility of managers. The authors theorise that, because of limited tenure or the horizon problem (Dechow and Sloan, 1991), managers have an incentive to maximise stock prices at the time of retirement. Under this theory, following the releases of periodic financial statements, risk-neutral investors reassess the credibility of financial statements previously reported by managers. Managers are dealing with a dynamic reporting problem. If they manage earnings aggressively at the beginning, e.g. release a series of very opportunistic financial statements, their credibility could be damaged so that there could be no more room to manage earnings to boost share price at the time of their retirement. If they report conservative earnings at the beginning, the book values are too low so that managers could face difficulties in boosting share price at retirement time even when managers have high credibility. For dishonest managers, they could choose to manage earnings and cash in their credibility in the early stage. The model of Liang et al. (2018) indicates that abnormal accruals are higher and more volatile in firms with less credible CEOs than in firms with more credible CEOs. What the model of Liang et al. (2018) tells us is that the profile of managers, such as CEOs, can be used to study the credibility of financial statements.

To summarise, there are theories that support the view that there are relationships between earnings quality and the profile of CEOs. Empirical studies have also documented evidence for the link between CEO characteristics and earnings quality (e.g., Wells, 2002; Francis et al., 2008; Malmendier and Tate, 2009; Jiang et al., 2010; Huang et al., 2012;

Kuang et al., 2014; Ali and Zhang, 2015). However, previously published studies are limited to only a few characteristics. The following section discusses the construction of an innovative measure which I call the PSCORE, a profile indicator of CEOs, which has been documented in previous empirical studies to be linked to earnings quality.

3.3. Construction of the PSCORE

3.3.1. Financial expertise

Financial expertise is a determinant of earnings quality. Using finance-related working experience and qualifications as proxies for financial expertise, Aier, Comprix, Gunlock, and Lee (2005) demonstrate that chief financial officers' financial expertise reduces earnings restatement, which is a measure of earnings quality. Aier et al. (2005) argue that chief financial officers having high financial expertise are less likely to be involved in earnings restatement because they would play a better role in designing and implementing the internal control and financial reporting process, resulting in higher earnings quality. Similarly, previous studies indicate that audit committees' financial expertise helps to increase earnings quality (Xie et al., 2003; Badolato et al., 2014). Financial expertise is important to the role of CEOs because CEOs have a legal duty to prepare true and fair financial statements of their companies. While Custódio and Metzger (2014) find that the financial expertise of CEOs is relevant for financial policies, there is currently a gap in the literature on the relationship between the financial expertise of CEOs and earnings quality.

Following previous studies, I expect that the expertise of CEOs is associated with high earnings quality. The first three individual factors of PSCORE are as follows (e.g., Aier et al., 2005): (i) role experience of CEOs (pROLE), where pROLE equals one if the number of years a CEO works as a CEO is fewer than the corresponding industry-year mean (identified by Datastream level-six), and zero otherwise; (ii) working experience of CEOs as a chief financial officer (pCFO), where pCFO equals one if a CEO does not have working experience as a chief financial officer, and zero otherwise; and (iii) advanced finance-related certification: a master of business administration (MBA) or a chartered professional accountancy qualification (CPA) (pCERT), where pCERT equals one if a CEO does not have an MBA or a CPA equivalent, and zero otherwise.[6] The rationale to use these three proxies is that CEOs may have different ways of gaining financial expertise. Experience in the role of CEO helps CEOs accumulate financial expertise. CEOs may also gain financial expertise if they have working experience as a chief financial officer because that position is directly responsible for financial statements. And CEOs may study for advanced finance-related certification.

Although some papers (Klein, 2002a; Bédard et al., 2004; Baxter and Cotter, 2009; Badolato et al., 2014; Cohen, Hoitash, Krishnamoorthy, and Wright, 2014) make reference to the membership of audit committees as an indicator of financial expertise, I do not use this indicator as a proxy. A member of an audit committee is most likely to have a finance-related certification or finance-related work experience as required by most corporate governance codes (FRC, 2003; FRC, 2012) and hence it has been captured by the other variables measuring financial expertise.

3.3.2. Reputation

[6] CPA equivalent refers to professional qualifications provided by accounting bodies accredited by Financial Reporting Council (FRC, 2016a).

The next individual factors of PSCORE are related to the reputation of CEOs. Currently, there is competing evidence on the relationship between reputation and earnings quality. Malmendier and Tate (2009) find that "superstar" CEOs inflate reported earnings and extract higher compensation after award winning. Similarly, Wade, Porac, Pollock, and Graffin (2006) find that the reputation of CEOs has a negative impact on organisational outcomes in the long term. In contrast, Francis et al. (2008) firms which have low earnings quality are more likely to hire reputable CEOs and that these firms do not manipulate earnings in the long term following the appointment of these reputable CEOs. This evidence suggests that reputable CEOs help to improve earnings quality because earnings management practice in the hiring firms disappears. Regardless of mixed evidence, I hypothesise that reputable CEOs are more likely to be associated with high earnings quality for several reasons. Firstly, the samples used in the papers of Malmendier and Tate (2009) and Wade et al. (2006) are unique (the samples are award-winning CEOs and CEOs selected as CEOs of the year, respectively); therefore the findings should not be generalised for all listed companies. Secondly, the results of Francis et al. (2008) are consistent with previous studies on the reputation of CEOs (e.g., Jian and Lee, 2011) in the position that, in the long term, reputable CEOs would lead to high-quality organisational outcomes because they have more to lose (compensation, future career, etc.) if they are involved with activities which are harmful to organisations they work for.

Based on prior research (Milbourn, 2003; Francis et al., 2008; Jian and Lee, 2011), the next three individual factors of PSCORE are performance during the last three years of CEO tenure (pROA), early years of service of CEOs in a firm (pEARLY), and press coverage (pPRESS).

Here I define pROA as equal to one if the average of industry-adjusted returns on assets (aveROA) during the last three years of a CEO's tenure is negative, and zero otherwise; where aveROA is (i) the sum of industry-adjusted returns on assets[7] in year *t*, *t-1*, and *t-2* if a CEO is in the third year of tenure, or (ii) the sum of industry-adjusted returns on assets in year *t* and *t-1* if a CEO is in the second year of tenure, or (iii) the industry-adjusted return on assets in year *t* if a CEO is in the first year of tenure.[8] The rationale is that reputable CEOs should have generated high firm performance (Milbourn, 2003).

Next, I define pEARLY as equal to one if a CEO is within the first three years of service in the firm, and zero otherwise. The reason is that reputable CEOs should have longer tenure, given that the board of directors acknowledges their performance (Milbourn, 2003). Empirical evidence also shows that earnings quality is low in the first three years of service of CEOs because CEOs have incentives to manipulate earnings to demonstrate their ability when the perception of the market about CEOs is uncertain in the early years (Kuang et al., 2014; Ali and Zhang, 2015).

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[7] The industry-adjusted return on assets is the difference between a firm's returns on assets and the corresponding industry's mean (identified by Datastream level-six), where returns on assets are equal to net income before extraordinary items divided by total assets.

[8] As robustness tests, this study uses different possible definitions for some factors such as pROA and pAGE. I transform pROA into pROA1, pROA2, and pROA3, in which returns on assets are calculated differently. For pROA1, returns on assets are equal to net income before extraordinary items divided by the market values of equity. For pROA2, returns on assets are equal to after-tax net income divided by total assets. For pROA3, returns on assets are equal to after-tax net income divided by the market values of equity. The results (not tabulated) do not qualitatively change.

Also, I define pPRESS as equal to one if the number of newspapers which simultaneously cite the name of a CEO and the company the CEO is working for in a year is less than the corresponding industry mean (identified by Datastream level-six), and zero otherwise. The rationale is that reputable CEOs should have been highly cited by the press (Milbourn, 2003). To measure press coverage, I search the LexisNexis using the CEO's full name and company name as the keywords. If there is no result, I search for the first name and last name (omitting the middle name). In the LexisNexis database, I tick the options to eliminate duplicates, exclude non-business news, and restrict research results to UK national newspapers.[9] I count the number of all newspapers found in the search result. Although the above procedure in measuring press coverage may be controversial, I believe that the measure reasonably captures the reputation of CEOs. Firstly, although Lafond (2008) doubts that not all news is good news for the reputation of CEOs, Milbourn (2003), Francis et al. (2008), and Jian and Lee (2011) show that overall the total number of newspapers fairly presents the reputation of CEOs. Secondly, while prior studies open search results to worldwide newspapers (for example, Francis et al., 2008), here I argue that if a global newspaper has headlines about CEOs of UK listed companies, the news is

[9] UK National newspapers which were included in research results in the LexisNexis database are the *Daily Star*, *Daily Star Sunday*, *Express Online*, *Independent Print Ltd*, *MailOnline*, *Morning Star*, *The Business*, *The Daily Mail and Mail* on Sunday (London), *The Daily Telegraph* (London), *Telegraph* (London), telegraph.co.uk, *The Express*, *The Guardian*, *The Independent* (United Kingdom), *The Mirror* (*The Daily Mirror* and *The Sunday Mirror*), mirror.co.uk., *The Observer*, *The People*, *The Sunday*, *The Sunday Times* (London), and *The Times* (London).

also likely to be published in UK national newspapers; therefore expanding research results to the global realm may include duplicates.

3.3.3. Internal power

The next two individual factors of PSCORE are related to the internal power of CEOs in firms. In most companies, CEOs are powerful if they serve as the chairperson of the board of directors or are the founder of the firm. Most corporate governance codes place strong accountabilities on the position of the chairperson so that individual would play a very important role in overseeing activities such as monitoring the integrity of the financial reporting process (e.g., FRC, 2003, 2012). Also, the founders of businesses would be expected to participate in all the important business and financial policies of the company.

There are some studies presenting evidence that powerful CEOs are more likely to result in low earnings quality. Dechow et al. (1996) show that the boards of directors of fraud firms are more likely to be dominated by powerful management. They also find that firms are more likely to manipulate earnings when CEOs serve as the chairperson of the board or founder. Consistent with Dechow et al. (1996), Farber (2005) also finds that the duality role of CEO and chairperson increases the likelihood of accounting frauds. Similarly, Feng et al. (2011) provide empirical evidence which suggests that powerful CEOs are more likely to dominate firms' boards and chief financial officers so that CEOs may override internal control systems. In such situations, the chief financial officers could suffer pressure from CEOs and collude with CEOs to manipulate earnings. Later research on earnings quality uses dummy variables to control for CEOs who serve as the board chairperson or founder (e.g., Peasnell, Pope, and Young, 2005; Cohen et al., 2014; Petrou and Procopiou, 2016).

I also expect that powerful CEOs are more likely to be associated with low earnings quality. Based on the above-mentioned research, the next two individual factors are that: (i) CEOs serve as the chairperson of the board of directors (pCHAIRMAN), where pCHAIRMAN equals one if a CEO serves as the chairperson, and zero otherwise; and that (ii) CEOs serve as the founder or co-founder of the firms (pFOUNDER), where pFOUNDER equals one if a CEO serves as the founder or co-founder, and zero otherwise.

3.3.4. Age

The next individual factor of PSCORE is the age of CEOs. There are indications in the literature on the effect of age of CEOs on earnings quality. Huang et al. (2012), Serfling (2014), and Yim (2013) find that, compared to young CEOs, old CEOs are less likely to manage earnings. Because prior research does not provide a clear benchmark of how old is young, this study follows the literature to rank the age of CEOs in each industry-year to define young CEOs in relative terms. The research also considers the horizontal problem of CEOs' tenure (e.g., Dechow and Sloan, 1991; Kalyta, 2009; Ali and Zhang, 2015), which suggests that CEOs are more likely to manipulate earnings when they are young, or their age is close to retirement age. Taken together, the next factor of PSCORE is the age of CEOs (pAGE), where pAGE equals one if either (i) the age of a CEO is equal to or less than the 25th percentile of industry-year (identified by Datastream level-six) or (ii) the age of a CEO is close to retirement age by one year or less, [10] and zero otherwise.[11]

3.3.5. Other potential factors

In addition to these CEO characteristics, there might be some other potential candidates for the construction of the PSCORE. For example, gender could be a potential factor because female directors are found to be more conservative, and therefore less likely to manipulate earnings (Barua, Davidson, Rama, and Thiruvadi, 2010). The marital status could also be relevant, as Hilary, Huang, and Xu (2016) provide evidence that firms having married CEOs exhibit higher earnings quality compared with firms having single CEOs because married CEOs are more risk averse and less likely to engage in earnings management. Jia, Lent, and Zeng (2014) find that facial masculinity is positively correlated with various measures of earnings quality. They argue that the hormone testosterone, which determines face shape, is also related to risk-taking behaviour such as involvement in financial misreporting activities. Narcissistic CEOs are more likely to

[10] The retirement ages of men and women in the UK are 65 and 60, respectively, for the period from 1948 to 2010; and from April 2010 to March 2020 the retirement age of women increases one month every month until it reaches 65 (Bozio, Crawford, and Tetlow, 2010).

[11] As robustness tests, the chapter changes the definition of pAGE. Instead of considering one year prior to retirement age in the calculation of pAGE, I define pAGE1 equal to one if either (i) the age of a CEO is equal to or less than the 25th percentile of industry-year (identified by Datastream level-six) or (ii) the age of a CEO is close to retirement age by two years or less, and zero otherwise. The results (not tabulated) do not qualitatively change.

manipulate earnings, a behaviour consistent with their tendency of self-overidentification (Capalbo, Frino, Lim, Mollica, and Palumbo, 2018). There are other CEO characteristics which may also be linked with earnings quality, e.g. overconfidence (Ahmed and Duellman, 2013), managing style (Bertrand and Schoar, 2003), managerial ability (Demerjian, Lev, Lewis, and McVay, 2013), vocal tone optimism (Davis, Ge, Matsumoto, and Zhang, 2015), origin (Kuang et al., 2014), and personal life behaviours such as having a legal record or using luxury goods (Davidson, Dey, and Smith, 2015).

Regardless of this evidence, the PSCORE does not include the above potential candidates for several reasons. First, the PSCORE already has a variable for age, which is an observable summary statistic which can be used to characterise different personality traits of CEOs such as effort, risk aversion, expected tenure, and human capital (Joos, Leone, and Zimmerman, 2003). Second, the sample shows that only 81 out of 3,395 firm-year observations (2.39 percent) have female CEOs.[12] Given that there is less gender diversity among CEOs, including the gender in PSCORE may introduce bias. Third, I do not have sufficient data on marital status, masculinity, narcissism, and the other possible factors for all CEOs in the sample; therefore including those factors in the PSCORE would substantially reduce the sample.

3.3.6. The PSCORE

The construction of a single measure for CEO characteristics is important because this methodology helps to mitigate concerns about potential multicollinearity when individual

[12] This low ratio of female CEOs is similar to previous studies on boards of directors in the UK (e.g., Nguyen et al., 2015b).

factors are included in the models (see, e.g., Larcker et al., 2007; Dey, 2008; Ellul and Yerramilli, 2013; Custódio and Metzger, 2014). As explained earlier, PSCORE is a composite score which aggregates nine aspects of the characteristics of CEOs. The PSCORE of a CEO who works for firm *i* in year *t* is calculated as follows:

Equation 3-1: Calculation of PSCORE

$$PSCORE_{i,t} = pCFO_{i,t} + pCERT_{i,t} + pROLE_{i,t} + pPRESS_{i,t} + pROA_{i,t} + pEARLY_{i,t} + pFOUNDER_{i,t} + pCHAIRMAN_{i,t} + pAGE_{i,t}$$

Under this construction, the PSCORE value theoretically ranges from zero to nine. A higher PSCORE suggests lower earnings quality. I also perform principal component analysis to see whether the construction of the PSCORE based on nine equally weighted factors is defensible.

However, as discussed above, the PSCORE is not an exhaustive list of characteristics of CEOs, which could be correlated with earnings quality. Empirical evidence suggests that other potential candidates could be included in the PSCORE such as marital status, gender, masculinity, narcissism, and working experience as a member of an audit committee. Those variables are excluded because of data constraints, the introduction of bias due to less diversity if included, or internal correlation with other variables. Also, because the main purpose of the chapter is to introduce a tool which can be easily applied by average practitioners to assess risks of low earnings quality in individual firms quickly, the chapter limits the PSCORE to include CEO characteristics with publicly available data, e.g. data that can be collected from CEOs' curriculum vitae or from financial statements. Therefore, I am satisfied that the PSCORE does cover some significant categories established by previous research on CEO profiles, which serves the situation well. The hypothesis is as follows.

H1: the PSCORE is positively associated with low earnings quality

3.4. Validity tests of the PSCORE

3.4.1. Sample selection

Selection begins with all firms listed on the London Stock Exchange from 2005 to 2012. The sample starts from 2005 to avoid the effect of IFRS adoption (2005) in the UK on earnings quality, and it ends at 2012 to avoid the effect of a new corporate governance code released by the Financial Reporting Council (Financial Reporting Council (FRC), 2012) which replaced the Corporate Governance Code issued in 1992 by the Cadbury Committee. The sample includes only live stocks as of 31st December 2012. While survivorship bias may exist, I omit dead stocks because the research requires extensive data of CEOs and corporate governance, which may not be available for delisted firms. Financial statements and International Securities Identification Number (ISIN hereafter) are downloaded from Datastream. The sample excludes banks, insurance companies, financial services, and utility firms. Companies with negative market values or negative book values of equity are also deleted.

To calculate deviations of first digits of figures reported in financial statements from Benford's Law, a measure of earnings quality, the analysis firstly replaces missing values with zeros.[13] Because the research studies the first digits from one to nine, replacing missing values with zeros has no effect on the analyses. The next step is to extract the first digits of all items in balance sheets, income statements, and cash flow statements.

[13] This approach is only applied for the calculation of deviations of first digits from Benford's Law.

Similar to Amiram et al. (2015), the research takes the first digit after the negative sign if a number is negative, and takes the first non-zero digit if a number has an absolute value less than one. Total first digits for each company in each year are counted. Finally, I exclude observations with fewer than 50 first digits (or 50 figures in financial statements) in total to avoid measurement errors because those firms might be too young or not in continuing operations, and therefore including those companies may reduce the statistical meaning of the findings (Amiram et al., 2015).

In the next step, I construct CEO data. In the first stage, I use ISIN codes to search the company in the Bloomberg database; then I identify the CEO position for each company in each year. When I do not find the CEO position in a particular year in Bloomberg, I download annual reports from Key Note to find the CEO under the role description section or based on signatures (with role description) on CEO reports and financial statements, as managing directors or executive chairpersons could play the role of CEOs. If there is an appointment of a new CEO in a particular year, I choose the new CEO because I believe that the latest CEO is the person who has a higher influence on the financial statements which are prepared after year end. Companies with missing CEOs or with joint CEOs are deleted. In the second stage, I search for the biographies of CEOs in Bloomberg. If Bloomberg does not provide the biography for any CEO, I search in the Key Note platform using the CEO's name and ISIN code. If there is no biography of any CEO after the above procedures, I read the annual reports downloaded from Key Note to search for CEO information in the role description section. Then I search in the *Financial Times* and LinkedIn for missing biographies. Finally, if I cannot find sufficient information for the calculation of the PSCORE, I delete corresponding observations. Regarding the data of press coverage, I follow the procedure as stated in Section 3.3.2. I count the number of newspapers found in the search result.

To collect data on corporate governance for control variables, I proceed as follows. The information on external auditors, boards of directors, and audit committees is collected from Bloomberg. Missing information is read from Key Note. I also search for compensation and other information in the annual reports. Observations with missing data are removed.

Finally, I match financial data, CEO data, and corporate governance data together, based on the ISIN code and fiscal year. The research derives 3,395 firm-year observations (615 unique companies) in 48 industries (Datastream level-six) with sufficient data to study PSCORE with abnormal accruals. To mitigate the influence of outliers, all continuous variables in the samples are winsorized at the 1st and 99th percentiles.

3.4.2. *Earnings quality measures*

I use three types of measures of earnings quality: abnormal accruals, proxies for real earnings management, and financial statement errors.

3.4.2.1. Abnormal accruals

Under the accounting standards, accruals are used to recognise incomes and expenses when they occur rather than when they are received or paid. Prior research (Dechow et al., 2010; DeFond, 2010) indicates that abnormal accruals can be used as a proxy for earnings quality. The underlying assumption of accrual-based models to estimate earnings quality is how much accruals should be used depends on firms' characteristics. Therefore, the residuals (or error terms) in the regressions between accruals and firms' characteristics are treated as abnormal accruals (e.g., Jones, 1991; Dechow et al., 1995; Peasnell et al., 2000b; Dechow and Dichev, 2002; Kothari et al., 2005). Higher levels of abnormal accruals suggest lower earnings quality. Peasnell et al. (2000b) show that the modified Jones model is the best model for estimating abnormal accruals in the UK.

In this chapter, I use the modified-Jones model (Jones, 1991; Dechow et al., 1995) to measure abnormal accruals, where accruals are total accruals or working capital accruals. I run the following cross-sectional regressions for each (Datastream level-six) industry and each year and require at least ten observations for each regression.

Equation 3-2: The modified-Jones model

$$\frac{AC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{1}{A_{i,t-1}}\right) + \beta_2\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \beta_3\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$$

Where: $AC_{i,t}$ is total accruals ($AC_{i,t}$ = $IB_{i,t}$ - $CFO_{i,t}$; in which $IB_{i,t}$ is net income before extraordinary items, $CFO_{i,t}$ is cash flows from operations); $A_{i,t-1}$ is total opening assets*;* $\Delta REV_{i,t}$ are sale in year *t* minus sale in year *t-1*; and $PPE_{i,t}$ is gross PPE*; i* is firm *i; t* is year; and $\varepsilon_{i,t}$ is the error term. Abnormal total accruals ($DAC_{i,t}$) are calculated as follows:

Equation 3-3: Calculation of abnormal accruals

$$DAC_{i,t} = \left|\frac{AC_{i,t}}{A_{i,t-1}} - \left[\hat{\alpha} + \hat{\beta}_1\left(\frac{1}{A_{i,t-1}}\right) + \hat{\beta}_2\left(\frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}}\right) + \hat{\beta}_3\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right)\right]\right|$$

Where: $\hat{\alpha}$, $\hat{\beta}_1$, $\hat{\beta}_2$, $\hat{\beta}_3$ are the coefficients estimated by the Equation 3-2; $\Delta REC_{i,t}$ are receivables in year *t* minus receivables in year *t-1.*

DAC is the first proxy for earnings quality. Here I use absolute values of abnormal accruals because the PSCORE is designed to signal earnings quality without a particular emphasis on the directional effects of accruals on earnings. Residuals from the accrual-based models reflect the amount of earnings being transferred from one year to another year, therefore both income-inflating and income-deflating accruals are more likely to result in low earnings quality regardless of the directional effects of the amount of earnings transferred (Bergstresser and Philippon, 2006). Later studies also support the use of absolute values of accruals as a measure of earnings quality (Armstrong et al., 2010; Dechow et al., 2010; Jiang et al., 2010).

In addition to total accruals, I also use working capital accruals[14] as an alternative measure of accruals to avoid the affect of long-term accruals, e.g. depreciation accruals (Hribar and Collins, 2002). Using the same process with Equation 3-2 and Equation 3-3, I estimate abnormal working capital accruals (denoted as DWAC), which is used as the second proxy for earnings quality.

Next, I apply the margin model of Peasnell et al. (2000b) to estimate abnormal working capital accruals because the margin model is found to be effective in estimating abnormal accruals in the UK. I run cross-sectional regressions following Peasnell et al. (2000b) with each industry-year (Datastream level-six) with at least ten observations:

Equation 3-4: The margin model

$$\frac{WAC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{REV_{i,t}}{A_{i,t-1}}\right) + \beta_2\left(\frac{REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$$

[14] Working capital accruals are calculated as follows: $\mathrm{WAC_{i,t}} = (\Delta \mathrm{CA_{i,t}} - \Delta \mathrm{CHE_{i,t}}) - (\Delta \mathrm{CL_{i,t}}\text{-} - \Delta \mathrm{STD_{i,t}})$; where $\mathrm{WAC_{i,t}}$ is working capital accruals, $\Delta \mathrm{CA_{i,t}}$ is current assets in year *t* minus current assets in year *t-1*, $\Delta \mathrm{CHE_{i,t}}$ is cash and cash equivalents in year *t* minus cash and cash equivalent in year *t-1*, $\Delta \mathrm{CL_{i,t}}$ is current liabilities in year *t* minus current liabilities in year *t-1*, and $\Delta \mathrm{STD_{i,t}}$ is short-term debts in year *t* minus short-term debts in year *t-1*.

Where: $WAC_{i,t}$ is working capital accruals; $A_{i,t-1}$ is total assets*;* $REV_{i,t}$ is sales; $\Delta REC_{i,t}$ is receivables in year *t* minus receivables in year *t-1; i* is firm *i;* and *t* is year.

Abnormal working capital accruals following Peasnell et al. (2000b), denoted $DAMP_{i,t}$, are the residuals of Equation 3-4. $DAMP_{i,t}$ is the third measure of earnings quality.

Table 3-1 reports the average coefficients of Equation 3-2 and Equation 3-4 for 1995–2012 of UK listed companies. Those estimates are similar to those reported by Peasnell et al. (2000b) and Nguyen (2016). The reason to report coefficients of the regressions for a long period is to verify whether estimations are reliable. Because accrual-based models are run for each industry-year, the findings here, using a sample from 2005 to 2012, are not affected.

Table 3-1: Estimations of the accrual-based models

	DAC (a)		**DWAC (b)**		**DAMP (c)**	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
Intercept	-0.043***	-10.93	-0.002	-0.77	0.005*	1.96
$1/A_{i,t-1}$	-2.563	-0.06	73.533**	1.99		
$\Delta REV_{i,t}/A_{i,t-1}$	0.032***	3.78	0.047***	6.83		
$PPE_{i,t}/A_{i,t-1}$	-0.009	-0.44	0.025*	1.71		
$REV_{i,t}/A_{i,t-1}$					0.478***	17.59
$(REV_{i,t} - \Delta REC_{i,t})/A_{i,t-1}$					-0.484***	-17.77
Adjusted R^2	0.333		0.374		0.372	

Note: The table reports the average parameters of Equation 3-2 (columns a and b) and Equation 3-4 (column c) for the period from 1995 to 2012 of UK listed companies. The equations are run with at least ten observations for each industry-year (Datastream level-six). Variables definitions are presented in the Appendix at the end of this chapter. *, **, *** indicates significance level at 10%, 5%, 1% levels, respectively.

3.4.2.2. Proxies for real earnings management

As discussed on Chapter 1, Section 2.2.4.2, Roychowdhury (2006) develop models to estimate abnormal cash flows, abnormal production costs, and abnormal discretionary expenditures. Later research shows that the models of Roychowdhury (2006) are effective in detecting real earnings management (Athanasakou et al., 2009; Cohen and Zarowin, 2010; Zang, 2012). The chapter applies models of Roychowdhury (2006). Similar to abnormal accruals, I use absolute values of abnormal cash flows, abnormal production costs, and abnormal discretionary expenses as proxies for real earnings management.

To estimate abnormal cash flows, I run the following cross-sectional regression for each (Datastream level-six) industry and each year and require at least ten observations for each regression:

Equation 3-5: Model to estimate abnormal cash flows

$$\frac{CFO_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{1}{A_{i,t-1}}\right) + \beta_2\left(\frac{REV_{i,t}}{A_{i,t-1}}\right) + \beta_3\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$$

Where: $CFO_{i,t}$ is net cash flows from operations*;* $A_{i,t-1}$ is total opening assets*;* $REV_{i,t}$ is sales; $\Delta REV_{i,t}$ is sales in year *t* minus sales in year *t-1; i* is firm *i; t* is year; and $\varepsilon_{i,t}$ is the error term. Abnormal cash flows (denoted *DCF*) are the absolute values of the residuals of Equation 3-5.

To estimate abnoral production costs, I run the following cross-sectional regression for each (Datastream level-six) industry and each year and require at least ten observations for each regression:

Equation 3-6: Model to estimate abnormal production costs

$$\frac{PROD_{i,t}}{A_{i,t-1}} = \alpha\frac{1}{A_{i,t-1}} + \beta_1\frac{REV_{i,t}}{A_{i,t-1}} + \beta_2\frac{\Delta REV_{i,t}}{A_{i,t-1}} + \beta_3\frac{\Delta REV_{i,t-1}}{A_{i,t-1}} + \varepsilon_{i,t}$$

Where: $PROD_{i,t}$ is production costs*,* which equals to sum of cost of goods sold and change in inventories from year *t-1* to year *t*; $REV_{i,t}$ is sales; ΔREV_{it} is sales in year *t* minus sales in year *t-1*; ΔREV_{it-1} is sales in year *t-1* minus sales in year *t-2*; A_{it-1} is total opening assets; i is firm i; t is year; $\varepsilon_{i,t}$ is the error term. Abnormal production costs (denoted *DPROD*) are absolute values of residuals of Equation 3-6.

To estimate abnormal discretionary expenses, I run the following cross-sectional regression for each (Datastream level-six) industry and each year and require at least ten observations for each regression:

Equation 3-7: The model to estimate abnormal discretionary expenses

$$\frac{DISEXP_{i,t}}{A_{i,t-1}} = \alpha\frac{1}{A_{i,t-1}} + \beta_1\frac{REV_{i,t-1}}{A_{i,t-1}} + \varepsilon_{i,t}$$

Where: $DISEXP_{i,t}$ is discretionary expenditures, which equals to R&D expenses plus selling and administrative expenses; A_{it-1} is total opening assets; $REV_{i,t-1}$ is sales in year t-1; i is firm i; t is year; $\varepsilon_{i,t}$ is the error term. Abnormal discretionary expenses (denoted *DDISEXP*) are the absolute values of the residuals of Equation 3-7.

Table 3-2 reports the average coefficients of Equation 3-5, Equation 3-6, and Equation 3-7 for 1995-2012 of UK listed companies. Those estimates are similar to those reported by Nguyen (2016). The reason to report coefficients of the regressions for a long period is to verify whether estimations are reliable. Because earnings management models are run for each industry-year, the findings of this chapter, using a sample from 2005 to 2012, are not affected.

Table 3-2: Estimations of the Roychowdhury (2006) models

Variable	DCF		DPROD		DDISEXP	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	0.028**	2.01	-0.199***	-15.21	0.178***	12.51
$1/A_{i,t-1}$	-734.570***	-8.00	-664.537***	-4.07	1705.314***	9.65
$REV_{i,t}/A_{i,t-1}$	0.070***	3.96	0.772***	62.88		
$REV_{i,t-1}/A_{i,t-1}$					0.106***	8.59
$\Delta REV_{i,t}/A_{i,t-1}$	-0.021	-0.45	-0.005	-0.24		
$\Delta REV_{i,t-1}/A_{i,t-1}$			-0.014	-0.61		
Adjusted R^2	0.489		0.856		0.433	

Note: The table reports the average parameters of Equation 3-5, Equation 3-6, and Equation 3-7 for the period from 1995 to 2012 of UK listed companies. Each equation is run with at least ten observations for each industry-year (Datastream level-six). Variables definitions are presented in the Appendix at the end of this chapter. *, **, *** indicates significance at 10%, 5%, 1% levels, respectively.

In addition to the above three proxies for real earnings management, motivated by previous studies (e.g., Cohen and Zarowin, 2010; Nguyen, 2016), I have a measure for total real earnings management (denoted *REM*), which is the sum of abnormal cash flows, abnormal production costs, and abnormal discretionary expenditures. The calculation of total real earnings management is as follows:

Equation 3-8: Calculation of total real earnings management

$$REM_{i,t} = DCF_{i,t} + DPROD_{i,t} + DDISEXP_{i,t}$$

3.4.2.3. Financial statement errors

Although the accrual and real earnings management models mentioned above are widely applied in accounting research, they are criticized because of some limitations, e.g. model misspecification (e.g., Fields et al., 2001; Dechow et al., 2010; Ball, 2013; Owens, Wu, and Zimmerman, 2013). Therefore, here I employ an innovative measure of earnings quality based on Benford's Law, which is recently introduced by Amiram et al. (2015).

Benford's Law refers to the "law" of distributions of digits in a data set. In the absence of errors, every digit from 0 to 9 follows a particular frequency of distribution (Nigrini, 1996; Amiram et al., 2015). The application of Benford's Law to study earnings quality is one of the main focuses of the thesis, and a comprehensive overview of Benford's Law and its' application in accounting studies are presented in Chapter 5. This chapter briefly summarises the usefulness of Benford's Law to study earnings quality.

There is a large and growing body of accounting studies applying Benford's Law (see, e.g., Carslaw, 1988; Thomas, 1989; Nigrini, 1996; Niskanen and Keloharju, 2000; Caneghem, 2002; Nigrini and Miller, 2009; Carlos Gomes da Silva and Carreira, 2013; Amiram et al., 2015). Recently, Amiram et al. (2015) mathematically prove that an introduction of errors in financial statements results in more divergence from Benford's Law of the first digits of figures reported in financial statements. They also find that deviations from Benford's Law are associated with abnormal accruals and are helpful to predict material accounting misstatements. In their research, Amiram et al. (2015) offer a measure of deviations of first digits of figures reported in financial statements from what are expected by Benford's Law, namely FSD_SCORE. Compared with other proxies for earnings quality, FSD_SCORE has some significant advantages (Amiram et al., 2015). Firstly, FSD_SCORE needs only firm-year data to calculate. Secondly, FSD_SCORE does not need a model to estimate, and it is simply statistics without biases. Finally, it is likely that there is no *ex-ante* relationship between FSD_SCORE and firm characteristics and firm performance. Using a similar approach, Nigrini (2015) also applies Benford's Law to study abnormal patterns in accounting data of the US capital markets.

In this chapter, following Amiram et al. (2015) and Nigrini (2015), I use the mean absolute deviation of the first digits of figures reported in financial statements from what are expected by Benford's Law, or FSD_SCORE, as the next measure of earnings quality. The calculation of FSD_SCORE is as follows:

Equation 3-9: FSD_SCORE calculation

$$FSD\_SCORE_{i,t} = \frac{\sum_{d=1}^{9} \left| OBSERVED_{d,i,t} - EXPECTED_{d} \right|}{9}$$

Where: $FSD\_SCORE_{i,t}$ is the mean absolute deviation of the first digits of figures reported in financial statements from what are expected by Benford's Law*;* $OBSERVED_{d,i,t}$ is the observed (actual) probability of the first digit *d*; $EXPECTED_d$ is the expected probability of the first digit *d* as defined by Benford's Law; *d* = 1, 2, …, 9; *i* is firm *i;* and *t* is year.

When financial statements are free of errors, FSD_SCORE equals zero because financial statements follow Benford's Law (Amiram et al., 2015). An introduction of errors (which may result from intentional or unintentional acts) in financial statements increases the deviations of the first digits, and therefore FSD_SCORE can be used as a proxy for earnings quality. A higher FSD_SCORE suggests a lower earnings quality.

Next, I use the KS statistic as the last measure of earnings quality. The KS statistic also relies on Benford's Law, but it is the maximum deviation of digits from Benford's Law, where the deviation is defined as the *cumulative* absolute difference between the observed and expected probabilities of each digit (Amiram et al., 2015). The calculation of the KS statistic is as follows:

Equation 3-10: KS statistic calculation

$$KS_{i,t} = max\{|OD_{1,i,t} - ED_1|, |(OD_{1,i,t} + OD_{2,i,t}) - (ED_1 + ED_2)|, \dots, |(OD_{1,i,t} + OD_{2,i,t} + \cdots + OD_{9,i,t}) - (ED_1 + ED_2 + \cdots + ED_9)|\}$$

Where $KS_{i,t}$ is the maximum cumulative absolute deviation of the first digits of items reported in financial statements from that expected by Benford's Law; $OD_{d,i,t}$ is the cumulative observed probability of the first digit *d* (*d* = 1, 2, …, 9); ED_d is the expected probability of the first digit *d* (*d* = 1, 2, …, 9) as defined by Benford's Law; *i* is firm *i;* and *t* is year.

In summary, to test the validity of the PSCORE in signalling the quality of earnings, I use nine different proxies for earnings quality: three measures of accrual earnings management (DAC, DWAC, and DAMP), four measures of real earnings management (DCF, DPROD, DDISEXP, and REM), and two measures of financial statement errors (FSD_SCORE and KS) which are based on Benford's Law.

3.4.3. Control variables

In the main test, the study examines whether PSCORE is positively associated with the established measures of earnings quality. To differentiate the effect of other factors, I control for major determinants of earnings management.

Equity issuance

Firstly, the study controls for equity issuances. Firms are more likely to manage earnings before equity issuances because earnings are used for pricing shares. Prior research provides evidence that earnings are managed before equity offering (Teoh et al., 1998a; Teoh et al., 1998b; Iqbal, Espenlaub, and Strong, 2009; Iqbal and Strong, 2010) or before share-financed mergers and acquisitions (Erickson and Wang, 1999; Botsari and Meeks, 2008). Therefore, I control seasoned equity offerings (SEO) and share-financed mergers and acquisitions ($M\&A$). SEO is a dummy variable which is equal to one if a firm issues a significant portion of equity (outstanding shares increase at least 5 percent and proceeds from equity issuance are positive), and zero otherwise (Nguyen et al., 2015b). $M\&A$ is a dummy variable which is equal to one if a firm announces a share-financed merger and acquisition deal, and zero otherwise. I expect the coefficients of both SEO and $M\&A$ to be positive.

Corporate governance factors

The second group of determinants of earnings quality are corporate governance factors. Firstly, the board of directors plays an important role in monitoring managers by reviewing and approving financial reports prepared by CEOs (see, e.g., Financial Reporting Council (FRC), 2003, 2012). The board is also involved in appointing or firing CEOs as well as setting CEOs' compensation.[15] As a way of providing board oversight and review, independent directors significantly contribute to higher-quality monitoring activities. Previous studies show that the independence of boards of directors affects earnings quality (Klein, 2002a; Peasnell et al., 2005; Iqbal and Strong, 2010). Thus, I use the control variable $aBDIND$, which is industry-adjusted board independence, where board independence is the percentage of independent members on a board of directors.[16] I expect the coefficient of $aBDIND$ to be negative.

Secondly, the audit committee oversees the effectiveness of internal control systems, the integrity of financial statements, and the work performed by external auditors (see, e.g., Financial Reporting Council (FRC), 2003, 2012); therefore it might help to increase earnings quality. Empirical evidence shows that the independence of an audit committee negatively affects earnings management, which is related to low earnings quality (Chtourou et al., 2001; Klein, 2002a; Bédard et al., 2004; Vafeas, 2005). Following the previous research, the next control variable is industry-adjusted independence of audit

[15] The board may directly or indirectly be involved in such activities through its subcommittees, such as those for compensation and nomination.

[16] The chapter uses the industry-adjusted values because the measures of accrual and real earnings management are calculated from industry-year. Industry-adjusted values are equal to actual values minus the corresponding industry-year mean.

committees ($aACIND$), where audit committee independence is the percentage of independent members of an audit committee. I expect the coefficient of aACIND to be negative.

Thirdly, external auditors are found to be related to earnings quality, i.e., to constrain earnings management (Becker, Defond, Jiambalvo, and Subramanyam, 1998b; Balsam, Krishnan, and Yang, 2003; Krishnan, 2003). For example, Krishnan (2003) shows that firms having auditors with high expertise exhibit lower abnormal accruals than firms having auditors with low expertise. Similarly, Becker et al. (1998b) show that, compared with clients of non-Big Six auditors, clients of Big Six auditors display lower abnormal accruals. Later research (Peasnell, Pope, and Young, 2000a; Peasnell et al., 2005; Iatridis, 2012) uses a dummy variable to control for the effect of big audit firms[17] on earnings quality. In line with prior research, here I control for Big Four audit firm ($AUDIT$),[18] assigning one if a firm is audited by a Big Four audit firm, and zero otherwise. I expect the coefficient of $AUDIT$ to be negative.

Firm characteristics

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[17] The definitions of a big audit firm vary from study to study due to the specific sample. The audit market experienced several major waves of mergers and acquisitions since 1990; therefore prior research may use the Big Four, Big Five, Big Six, or even Big Eight firms.

[18] The Big Four audit companies are KPGM, Ernst and Young, Deloitte Touche Tohmatsu, and PriceWaterhouseCoopers. Missing data are replaced by zeros, as I assume that the firms are audited by non-Big Four auditors.

The next control variables are firm characteristics. I firstly control for firms' financial distress ($DISTRESS$) by calculating ZSCORE following Taffler (1983). DISTRESS is equal to one if ZSCORE is negative, and zero otherwise; where ZSCORE is calculated as follows (Taffler, 1983):

$$\text{ZSCORE} = 3.2 + 12.18 * \text{X}_1 + 2.50 * \text{X}_2 - 10.68 * \text{X}_3 + 0.029 * \text{X}_4; \text{where } \text{X}_1 = \frac{\text{Profit before tax}}{\text{current liabilities}}; \text{X}_2 = \frac{\text{Current assets}}{\text{Total liabilities}}; \text{X}_3 = \frac{\text{Current liabilities}}{\text{Total assets}}; \text{X}_4 = \frac{(\text{Quick assets} - \text{Current liabilities})}{(\text{Sales} - \text{Pretax income} - \text{Depreciation})/365}$$

Taffler (1983) and Agarwal and Taffler (2007) indicate that the probability of bankruptcy is highly associated with a negative ZSCORE. When the ZSCORE is low, firms are likely to face financial distress. Firms with financial distress might have pressure to inflate earnings to conceal their poor financial performance (Lara, Osma, and Neophytou, 2009). Therefore, I expect the coefficient on $DISTRESS$ to be positive.

The business life cycle is another factor influencing earnings quality. Beneish (1997) presents evidence that, in order to raise money from the capital market for the first time, young listed firms manipulate earnings to meet the expectation of the market. Lee, Li, and Yue (2006) find that firms having higher performance or a growth rate that exceeds expectations are likely to overstate earnings due to an increase in price responsiveness. Following Dickinson (2011), this study controls for the business life cycle ($CYCLE$). CYCLE is equal to one if a firm has negative cash flows from operation (CFO), negative cash flows from investing activities (CFI), and positive cash flows from financing activities (CFF) (young firm), or has positive CFO, negative CFI, and positive CFF (growth firm); and is equal to zero if a firm has positive CFO, negative CFI, and negative CFF (mature firm). I expect the coefficient of CYCLE to be positive.

The next control variable is the industry-adjusted firm size ($aLOGMVE$), where firm size ($LOGMVE$) equals the natural log of the market value of equity (e.g., Peasnell et al., 2000a). Lang and Lundholm (1993) propose that, due to high scrutiny, larger firms are reluctant to manipulate earnings. Dechow and Dichev (2002) also report a negative relationship between firm size and low earnings quality. I expect the coefficient of $aLOGMVE$ to be negative.

The literature also documents that market overvaluation is a determinant of earnings quality. Firms with overvalued shares have incentives to inflate earnings to maintain high market value (Jensen, 2005). Empirical evidence supports the notion that overvaluation is positively associated with income-increasing earnings management (Chi and Gupta, 2009; Houmes and Skantz, 2010). To control for overvaluation, I use industry-adjusted market-to-book ratio ($aLOGMTB$), where the market-to-book ratio ($LOGMTB$) is the natural log of the ratio of market value divided by the book value of equity. I expect the coefficient of $aLOGMTB$ to be positive.

The next characteristic which needs to be controlled for is financial leverage. On the one hand, Press and Weintrop (1990) find that debt levels are positively correlated with accruals. Debt contracts often include accounting-based covenants. Previous research shows that earnings are inflated to avoid violating debt covenants (DeFond and Jiambalvo, 1994; Sweeney, 1994). On the other hand, high financial leverage may contractually lead to conservative accounting (Watts, 2003a, 2003b), suggesting less positive abnormal accruals. Empirical evidence shows that financial leverage is negatively associated with low earnings quality (Pae, 2007). Following prior research (Peasnell et al., 2000a; Peasnell et al., 2005), I use industry-adjusted financial leverage ($aLEV$), where leverage (LEV) equals the sum of long-term debts and short-term debts, scaled by total assets. I do not expect a specific sign of the coefficient of variable $aLEV$ because the previous findings are mixed.

Lastly, the literature documents that earnings quality is affected by the ability to use accruals in the current period. Under the accrual basis of accounting, accruals are reversed in the later periods. Overstatement of net operating assets, as a result of inflating earnings in prior periods, would limit the ability to use accruals in later periods (Barton and Simko, 2002). Baber, Kang, and Li (2011) argue that the magnitude and reversal speed of abnormal accruals in later periods affect the ability to manage earnings. To deal with this issue, I use the industry-adjusted net operating asset ratio ($aNOA$), where $NOA = [CEQ + (DLTT + DLC) - CHE]/REV$, in which CEQ is total book value of equity, DLTT is long-term debts, DLC is short-term debts, CHE is cash and cash equivalent, and REV is sales. I expect the coefficient of $aNOA$ to be negative. Detailed calculations of control variables are in the Appendix.

3.4.4. Multivariate regression models

This study uses three sets of multivariate regression models to test the relationships between PSCORE and accrual earnings management, real earnings management, and financial statement errors.

Equation 3-11: PSCORE and abnormal accruals

$$\begin{aligned} EQ_{i,t} = {} & \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 aBDIND_{i,t} \\ & + \beta_6 aACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 aLOGMVE_{i,t-1} \\ & + \beta_{10} aLOGMTB_{i,t-1} + \beta_{11} aLEV_{i,t-1} + \beta_{12} aNOA_{i,t-1} + \varepsilon \end{aligned}$$

Where: $EQ_{i,t}$ can be are $DAC_{i,t}$, $DWAC_{i,t}$, and $DAMP_{i,t}$ (used as substitutes).

Equation 3-12: PSCORE and proxies for real earnings management

$$EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 aBDIND_{i,t} + \beta_5 aACIND_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 DISTRESS_{i,t-1} + \beta_8 aLOGMVE_{i,t-1} + \beta_9 aLOGMTB_{i,t-1} + \beta_{10} aLEV_{i,t-1} + \varepsilon$$

Where: $EQ_{i,t}$ can be $DCF_{i,t}$, $DPROD_{i,t}$, $DDISEXP_{i,t}$, or $REM_{i,t}$ (used as substitutes). In Equation 3-12, I do not include auditor and net operating accruals as control variables, because there is little knowledge of how those factors influence real earnings management.

Equation 3-13: PSCORE and financial statement errors

$$EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 BDIND_{i,t} + \beta_6 ACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 LOGMVE_{i,t-1} + \beta_{10} LOGMTB_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} NOA_{i,t-1} + YEAR/INDUSTRY\ FIXED\ EFFECTS + \varepsilon$$

Where: $EQ_{i,t}$ can be $FSD\_SCORE_{i,t}$ or $KS_{i,t}$ (used as substitutes). In the Equation 3-13, as I include fixed effects, I use firm values of board independence ($BDIND_{i,t}$), audit committee independence ($ACIND_{i,t}$), firm size ($LOGMVE_{i,t-1}$), market to book ratio ($LOGMTB_{i,t-1}$), financial leverage ($LEV_{i,t-1}$) and net operating asset ratio ($NOA_{i,t-1}$).

If coefficients β_1 in the Equation 3-11, Equation 3-12, and Equation 3-13 are positive and significant, this is evidence that PSCORE can indicate poor earnings quality.

3.5. Findings

3.5.1. Descriptive statistics and correlations

Table 3-3 reports the descriptive statistics of firm characteristics, individual factors of PSCORE, proxies for earnings quality, and control variables in main regressions. At first glance, the numbers of observations of FSD_SCORE and KS are smaller than those of abnormal accruals because, as discussed in Section 3.4.1, the calculation of deviations from Benford's Law requires firms with more than 50 items (or first digits) reported in financial statements. Looking at Panel A, the descriptive statistics of a firm's characteristics are broadly similar to those reported by Goh and Gupta (2016) which use similar data. The descriptive statistics on individual factors of PSCORE reported in Panel B show that, on average, CEOs have low financial expertise (medians of all proxies for financial expertise are 1) and high reputation (medians of *pPRESS*, *pROA* and *pEARLY* are 1, 0 and 0, respectively). The statistics also indicate that fewer CEOs are chairpersons or founders of firms (medians of *pCHAIRMAN* and *pFOUNDER* are 0). Turning to Panel C, I observe that the values of *DAC* are the highest in all aspects (mean, standard deviation, median, 25th and 75th percentiles), and the values of *DAMP* are the lowest. Previous studies support these findings: Botsari and Meeks (2008) find that the approach of using total accruals has a tendency to result in larger abnormal accruals than the method of using working capital accruals, and Peasnell et al. (2000b) indicate that the Jones and modified-Jones models produce higher abnormal accruals than those estimated by the margin model when cash flows are unusually high. I also observe that the mean and standard deviation of FSD_SCORE of listed companies in the UK from 2005 to 2012 are 0.0318 and 0.0097, respectively. These are similar to those of listed companies in the US reported by Amiram et al. (2015).[19] In Panel D, the mean and median of PSCORE are

[19] Amiram et al. (2015) report that the mean and the standard deviation of FSD_SCORE of listed companies in the US from 2001 to 2011 are 0.0296 and 0.0087, respectively.

3.8065 and 4 respectively, suggesting that the difference in the number of firms having CEOs with high PSCORE and firms having CEOs with low PSCORE is not large, given that PSCORE empirically ranges from zero to eight.[20] Panel D also displays that the sample has more firms without equity issuance than firms with equity issuance (all medians of SEO and M&A are 0), has more firms audited by the Big Four than firms not audited by the Big Four (median of AUDIT is 1), has more firms not facing financial distress than firms facing financial distress (median of DISTRESS is 0), and has more mature firms than young or growth firms (median of CYCLE is 0).

Table 3-4 reports Pearson correlations. The evidence shows that all correlations between PSCORE and proxies for earnings quality are positive and significant at the 1% level, suggesting positive relationships between PSCORE and earnings quality. While there are many insignificant correlations among independent variables, I still test for multicollinearity between independent variables using variance inflation factors (VIFs) obtained from the ordinary least squares regressions. The results (not tabulated) indicate that all VIFs are less than 2.47, which is well below 10, the indicative level of multicollinearity suggested by Neter, Kutner, Nachtsheim, and Wasserman (1996).

3.5.2. Principal component analysis

I employ a principal component analysis to see whether the methodology to construct PSCORE is defensible. In Table 3-5, Panel A shows that most correlation coefficients are very small (absolute values are less than 0.15), except for the correlations between

[20] While PSCORE theoretically varies from zero to nine, there is no CEO with a PSCORE of nine in the sample.

pCERT and pCFO (0.4822) and between pEARLY and pROLE (0.5159). Many correlations are statistically insignificant. The findings indicate that auto-correlation among individual factors is not a concern with the construction of PSCORE. Panel B shows that CEO characteristics have multiple dimensions, as the first component can explain only 17.86% of the variance of original data and the cumulative variance explained by the fourth component is 58.04%. In Panel C, I observe that no individual factor has a loading that is too high.

In summary, the principal component analysis suggests that no individual factor dominates other factors in explaining the variances of PSCORE; therefore, PSCORE can be used as a single measure of CEO characteristics with multiple dimensions.

Table 3-3: Descriptive statistics

Statistics	N	MIN	MAX	MEAN	STD	MEDIAN	P25	P75
Panel A: Firm characteristics								
Total assets$_{i,t}$ (£'000)	3395	1,392	28,411,781	990,192	3,623,169	79,632	18,599	419,650
Sales$_{i,t}$ (£'000)	3395	17	18,057,594	792,155	2,393,480	78,888	14,404	421,338
Net income before extraordinary items$_{i,t}$ (£'000)	3395	-84,000	2,875,916	66,335	327,540	2,535	-479	22,022
Market values$_{i,t}$ (£'000)	3395	1,222	40,444,127	1,065,417	4,692,480	62,107	15,566	389,453
Market to book ratio$_{i,t}$	3395	0.1815	21.7704	2.8619	3.3567	1.7818	1.0306	3.2930
Leverage$_{i,t}$	3395	0	0.5929	0.1483	0.1492	0.1148	0.0051	0.2407
Panel B: Individual factors of PSCORE								
pCFO$_{i,t}$	3395	0	1	0.8251	0.3799	1	1	1
pCERT$_{i,t}$	3395	0	1	0.6393	0.4803	1	0	1
pROLE$_{i,t}$	3395	0	1	0.5339	0.4989	1	0	1
pPRESS$_{i,t}$	3395	0	1	0.7697	0.4211	1	1	1
pROA$_{i,t}$	3395	0	1	0.1820	0.3859	0	0	0
pEARLY$_{i,t}$	3395	0	1	0.2488	0.4324	0	0	0
pFOUNDER$_{i,t}$	3395	0	1	0.1628	0.3693	0	0	0
pCHAIRMAN$_{i,t}$	3395	0	1	0.1007	0.3010	0	0	0
pAGE$_{i,t}$	3395	0	1	0.3442	0.4752	0	0	1
Panel C: Earnings quality proxies								
DAC$_{i,t}$	3395	0.0010	0.5185	0.0782	0.0877	0.0503	0.0241	0.0991
DWAC$_{i,t}$	3395	0.0007	0.3986	0.0617	0.0703	0.0388	0.0171	0.0786
DAMP$_{i,t}$	3395	0.0006	0.3827	0.0579	0.0658	0.0371	0.0167	0.0751
DCF$_{i,t}$	3139	0.0013	1.6551	0.1408	0.2313	0.0769	0.0334	0.1507
DPROD$_{i,t}$	3014	0.0024	1.0903	0.1780	0.1955	0.1183	0.0525	0.2264
DDISEXP$_{i,t}$	2650	0.0018	1.4821	0.2031	0.2488	0.1235	0.0502	0.2505
REM$_{i,t}$	2547	0.0040	2.7164	0.3649	0.4327	0.2380	0.1049	0.4413

$FSD\_SCORE_{i,t}$	3197	0.0132	0.0623	0.0318	0.0097	0.0309	0.0249	0.0374
$KS_{i,t}$	3197	0.0272	0.2147	0.0894	0.0387	0.0817	0.0610	0.1114
Panel D: Independent variables of main regressions								
$PSCORE_{i,t}$	3395	0	8	3.8065	1.5009	4	3	5
$SEO_{i,t}$	3395	0	1	0.2153	0.4111	0	0	0
$M\&A_{i,t}$	3395	0	1	0.0418	0.2002	0	0	0
$AUDIT_{i,t}$	3395	0	1	0.5642	0.4959	1	0	1
$aBDIND_{i,t}$	3395	-0.4200	0.4370	0.0154	0.2153	0.0422	-0.1477	0.1752
$aACIND_{i,t}$	3395	-0.5000	0.9091	0.0100	0.2739	0.0000	-0.0909	0.0000
$CYCLE_{i,t}$	3395	0	1	0.0259	0.1589	0	0	0
$DISTRESS_{i,t-1}$	3395	0	1	0.2741	0.4461	0	0	1
$aLOGMVE_{i,t-1}$	3395	-3.7015	5.9248	0.2022	1.9650	0.0423	-1.2163	1.3871
$aLOGMTB_{i,t-1}$	3395	-1.9314	2.4059	-0.0365	0.8207	-0.0530	-0.5730	0.4558
$aLEV_{i,t-1}$	3395	-0.6185	0.3844	-0.0272	0.1568	-0.0472	-0.1205	0.0709
$aNOA_{i,t-1}$	3395	-113.0504	61.4047	-2.3055	16.7590	-0.1371	-0.5842	0.2959

Note: Panel A, B, C, and D reports the number of observations (N), minimum (MIN), maximum (MAX), mean (MEAN), standard deviation (STD), median (MEDIAN), 25^{th} (P25), and 75^{th} (P75) percentiles of firm characteristics, individual factors of PSCORE, proxies for earnings quality, and variables of main regressions. Definitions of variables are in the Appendix.

Table 3-4: Pearson correlations

		DAC	DWAC	DAMP	DCF	DPROD	DDISEXP	REM	FSD_SCORE	KS	SEO
		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
DAC$_{i,t}$	**(1)**	1.00									
DWAC$_{i,t}$	**(2)**	0.47*	1.00								
DAMP$_{i,t}$	**(3)**	0.37*	0.73*	1.00							
DCF$_{i,t}$	**(4)**	0.21*	0.19*	0.17*	1.00						
DPROD$_{i,t}$	**(5)**	0.10*	0.14*	0.19*	0.14*	1.00					
DDISEXP$_{i,t}$	**(6)**	0.19*	0.18*	0.18*	0.49*	0.37*	1.00				
REM$_{i,t}$	**(7)**	0.13*	0.13*	0.17*	0.54*	0.70*	0.60*	1.00			
FSD_SCORE$_{i,t}$	**(8)**	0.11*	0.08*	0.06*	0.08*	0.03	0.10*	0.06*	1.00		
KS$_{i,t}$	**(9)**	0.07*	0.07*	0.06*	0.05	0.00	0.07*	0.03	0.73*	1.00	
SEO$_{i,t}$	**(10)**	0.17*	0.15*	0.14*	0.08*	-0.01	0.09*	0.01	0.07*	0.04	1.00
M&A$_{i,t}$	**(11)**	0.05	0.09*	0.09*	0.02	0.06*	0.06*	0.06*	-0.01	0.01	0.21*
AUDIT$_{i,t}$	**(12)**	-0.18*	-0.16*	-0.15*	-0.07*	-0.06*	-0.06*	-0.05	-0.22*	-0.18*	-0.12*
aBDIND$_{i,t}$	**(13)**	-0.08*	-0.10*	-0.10*	-0.02	-0.02	-0.06*	-0.02	-0.14*	-0.11*	-0.09*
aACIND$_{i,t}$	**(14)**	-0.08*	-0.08*	-0.09*	0.02	-0.01	-0.01	0.02	-0.11*	-0.10*	-0.09*
CYCLE$_{i,t}$	**(15)**	0.08*	0.10*	0.06*	0.06*	0.04	0.04	0.03	0.03	0.03	0.04
DISTRESS$_{i,t-1}$	**(16)**	0.13*	0.07*	0.05	0.12*	-0.00	0.09*	0.03	0.13*	0.11*	0.25*
aLOGMVE$_{i,t-1}$	**(17)**	-0.16*	-0.17*	-0.16*	-0.04	-0.06*	-0.08*	-0.04	-0.25*	-0.19*	-0.19*
aLOGMTB$_{i,t-1}$	**(18)**	0.05	0.11*	0.13*	0.09*	0.19*	0.15*	0.16*	0.01	0.01	-0.02
aLEV$_{i,t-1}$	**(19)**	-0.10*	-0.11*	-0.10*	-0.07*	-0.09*	-0.13*	-0.12*	-0.12*	-0.09*	0.03
aNOA$_{i,t-1}$	**(20)**	-0.01	-0.01	0.01	-0.06*	0.05	0.05	-0.00	0.00	-0.03	-0.01

		M&A	AUDIT	aBDIND	aACIND	CYCLE	DISTRESS	aLOGMVE	aLOGMTB	aLEV	aNOA

(Continued)		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
M&A	**(11)**	1.00									
AUDIT	**(12)**	-0.02	1.00								
aBDIND	**(13)**	0.02	0.36*	1.00							
aACIND	**(14)**	-0.02	0.25*	0.34*	1.00						
CYCLE	**(15)**	0.05	-0.06*	-0.03	-0.05	1.00					
DISTRESSt-1	**(16)**	-0.01	-0.10*	-0.14*	-0.12*	0.12*	1.00				
aLOGMVEt-1	**(17)**	-0.02	0.47*	0.58*	0.48*	-0.11*	-0.26*	1.00			
aLOGMTBt-1	**(18)**	0.01	0.08*	0.10*	0.17*	-0.03	-0.02	0.34*	1.00		
aLEVt-1	**(19)**	-0.03	0.17*	0.10*	0.11*	-0.04	0.05	0.20*	0.03	1.00	
aNOAt-1	**(20)**	0.00	-0.05	-0.09*	-0.07*	-0.01	-0.01	-0.12*	-0.01	-0.04	1.00

Note: The table reports the Pearson correlation coefficients between selected variables. * is significance at 1% level. Definitions of variables are in the Appendix.

Table 3-5: Principal component analysis

Panel A: Correlation Matrix of individual factors of PSCORE

	$pCFO_{i,t}$	$pCERT_{i,t}$	$pROLE_{i,t}$	$pPRESS_{i,t}$	$pROA_{i,t}$	$pEARLY_{i,t}$	$pFOUNDER_{i,t}$	$pCHAIRMAN_{i,t}$	$pAGE_{i,t}$
$pCFO_{i,t}$	1								
$pCERT_{i,t}$	0.4822	1							
$pROLE_{i,t}$	-0.0449	*0.0012*	1						
$pPRESS_{i,t}$	0.0335	0.0596	*0.0189*	1					
$pROA_{i,t}$	0.0243	0.0507	0.0919	0.0404	1				
$pEARLY_{i,t}$	0.0678	*0.0224*	0.5159	*0.0187*	0.1116	1			
$pFOUNDER_{i,t}$	0.0918	0.0905	-0.1426	-0.0391	0.0318	-0.0730	1		
$pCHAIRMAN_{i,t}$	0.0433	0.0333	-0.0463	0.0366	*0.0045*	*-0.0115*	0.0777	1	
$pAGE_{i,t}$	*-0.0025*	*-0.0185*	0.0869	0.0312	*0.0117*	0.0489	0.0380	*-0.0118*	1

Panel B: Eigen values of the Correlation Matrix

	Eigenvalue	Difference	Proportion	Cumulative
1	1.6077	0.0634	0.1786	0.1786
2	1.5443	0.4907	0.1716	0.3502
3	1.0537	0.0357	0.1171	0.4673
4	1.0180	0.0240	0.1131	0.5804
5	0.9940	0.0301	0.1104	0.6909
6	0.9640	0.1356	0.1071	0.7980
7	0.8284	0.2829	0.0920	0.8900
8	0.5455	0.1010	0.0606	0.9506
9	0.4445		0.0494	1.0000

Panel C: Eigen vectors

	Prin1	Prin2	Prin3	Prin4	Prin5	Prin6	Prin7	Prin8	Prin9
$pCFO_{i,t}$	-0.0011	0.6662	-0.1929	-0.0468	0.0852	0.0672	-0.1056	-0.5705	0.4104
$pCERT_{i,t}$	0.0061	0.6660	-0.1946	0.0046	0.0731	-0.0011	-0.0903	0.6172	-0.3523
$pROLE_{i,t}$	0.6674	-0.0309	-0.0104	-0.0730	-0.0396	0.1430	0.1291	0.3894	0.5982

$pPRESS_{i,t}$	0.0724	0.1169	0.1951	0.8550	0.2369	-0.1135	0.3763	-0.0350	0.0173
$pROA_{i,t}$	0.2156	0.1259	0.3403	0.0285	-0.3359	-0.7664	-0.3454	-0.0268	0.0284
$pEARLY_{i,t}$	0.6494	0.0757	0.0150	-0.1098	-0.1281	0.1497	0.2117	-0.3692	-0.5834
$pFOUNDER_{i,t}$	-0.2298	0.2396	0.5048	-0.4153	-0.0628	-0.0884	0.6661	0.0494	0.0680
$pCHAIRMAN_{i,t}$	-0.0891	0.1379	0.5101	0.2182	-0.4843	0.5806	-0.3035	0.0337	0.0147
$pAGE_{i,t}$	0.1427	-0.0007	0.5056	-0.1689	0.7496	0.0858	-0.3502	-0.0129	-0.0579

Note: The table reports the results of the principal component analysis. Panel A reports the correlations between individual factors. Italic values indicate that coefficients are not significant at 5% level. Panel B (C) reports the Eigen values (vectors) of the correlation matrix resulted from the principal component analyses on nine individual components of the PSCORE. Definitions of variables are in the Appendix.

3.5.3. *Univariate tests*

The univariate tests study how earnings quality variables change when PSCORE changes. It can be seen in Table 3-6 that the mean values of earnings quality proxies increase monotonically when PSCORE increases. Additionally, the last four rows of Table 5 report the results of the t-test under the null that the means of earnings quality proxies for the high-PSCORE group (PSCORE equals 6, 7, or 8) are the same as those of the low-PSCORE group (PSCORE equals 0, 1, or 2). The findings demonstrate that, compared to the low-PSCORE group, the high-PSCORE group exhibit higher levels of abnormal accruals, abnormal cash flows, abnormal productions costs, abnormal expenditures, and deviations of first digits from Benford's Law. The mean differences in earnings quality between the two groups are statistically significant at the 1% level.[21] In general, the findings suggest that PSCORE is positively related to earnings quality.

In the next pages, while Figure 3-1 illustrates the distribution of PSCORE, Figure 3-2, Figure 3-3, and Figure 3-4 help to visualise the distributions of abnormal accruals, proxies for real earnings management, and deviations of first digits from Benford's Law by each PSCORE. Also, Table 3-7 describes firm characteristics by each PSCORE.

[21] As a robustness test (not tabulated), I also define PSCORE groups in another way where the low-PSCORE group includes PSCORE ranging from 0 to 4 and the high-PSCORE group includes PSCORE ranging from 5 to 8. Alternatively, I use the median to define high and low PSCORE. The findings do not qualitatively change.

Table 3-6: Earnings quality by each group of PSCORE

PSCORE	N	DAC	DWAC	DAMP	DCF	DPROD	DDISEXP	REM	FSD_SCORE	KS
0	38	0.036	0.029	0.028	0.067	0.108	0.125	0.191	0.029	0.080
1	156	0.059	0.057	0.044	0.102	0.147	0.162	0.289	0.029	0.077
2	443	0.061	0.052	0.048	0.109	0.156	0.160	0.294	0.030	0.086
3	832	0.073	0.056	0.054	0.135	0.178	0.194	0.369	0.031	0.085
4	827	0.078	0.057	0.052	0.138	0.190	0.204	0.384	0.032	0.088
5	662	0.085	0.069	0.069	0.147	0.186	0.226	0.384	0.033	0.093
6	307	0.095	0.077	0.073	0.209	0.209	0.249	0.441	0.035	0.101
7	116	0.111	0.088	0.089	0.201	0.226	0.249	0.484	0.036	0.103
8	14	0.164	0.128	0.084	0.246	0.241	0.124	0.337	0.036	0.112
High (PSCORE=6,7,8)	437	0.102	0.082	0.077	0.208	0.215	0.245	0.449	0.035	0.102
Low (PSCORE=0,1,2)	637	0.059	0.052	0.046	0.105	0.151	0.159	0.287	0.030	0.084
Difference		0.043	0.030	0.032	0.103	0.064	0.086	0.162	0.006	0.018
t-statistics		7.581***	7.084***	5.977***	4.597***	4.389***	6.254***	4.599***	7.19***	3.058***

Note: The table reports the means by each PSCORE for each measure of earnings quality. The last four rows of the table show the means of the high-PSCORE and the low-PSCORE groups, the mean differences between two groups and t-statistics of the t-test.

Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Figure 3-1: Distribution of PSCORE

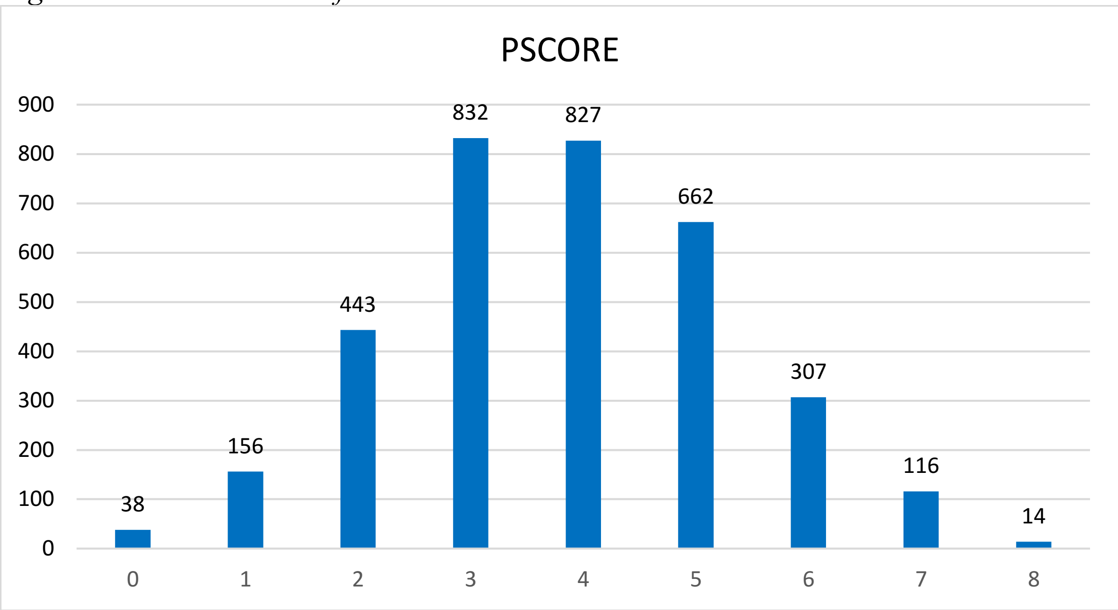

Figure 3-2: Abnormal accruals by PSCORE

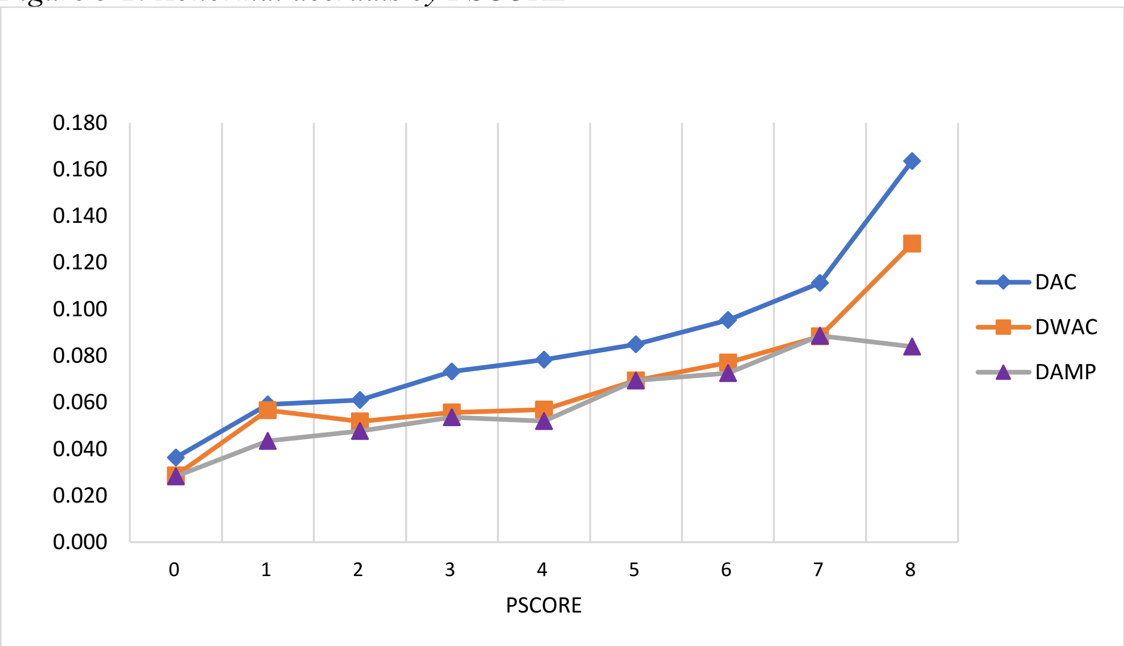

Figure 3-3: Real earnings management by PSCORE

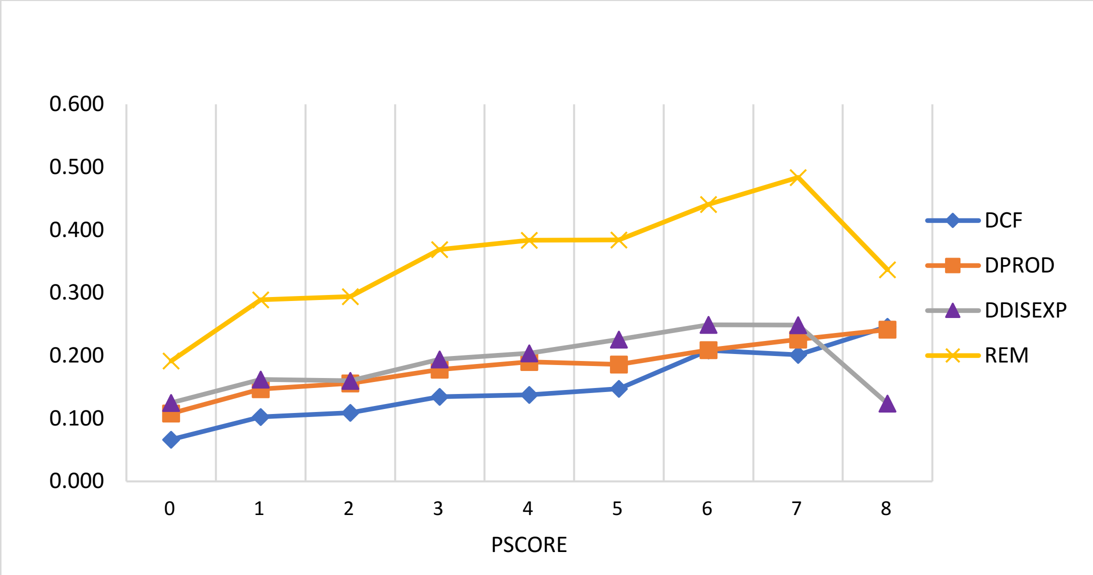

Figure 3-4: Deviations from Benford's Law by PSCORE

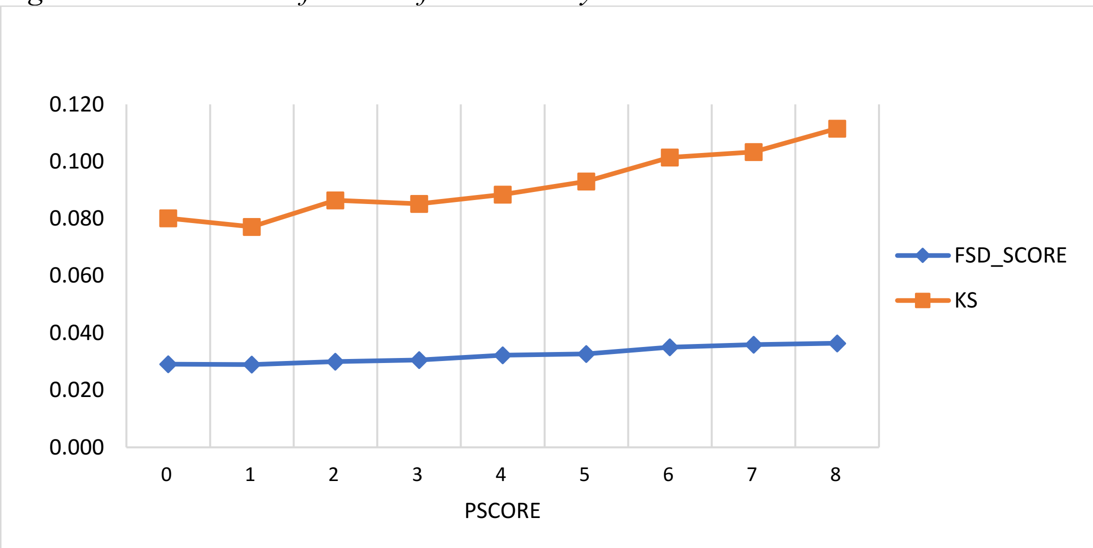

Table 3-7: Firm characteristics by PSCORE

	PSCORE								
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
$Assets_{i,t}$ (millions)	4507	3453	1712	1273	767	231	122	56	61
$Sales_{i,t}$ (millions)	3798	2634	1327	974	611	268	144	43	38
Earnings before extraordinary $items_{i,t}$ (millions)	359	266	107	85	56	10	-1	-2	-7
$pCFO_{i,t}$	0.000	0.263	0.542	0.840	0.909	0.959	0.993	0.991	1.000
$pCERT_{i,t}$	0.000	0.019	0.233	0.595	0.735	0.825	0.938	0.974	1.000
$pROLE_{i,t}$	0.000	0.141	0.305	0.332	0.538	0.793	0.912	0.991	1.000
$pPRESS_{i,t}$	0.000	0.449	0.576	0.736	0.823	0.876	0.941	0.966	1.000
$pROA_{i,t}$	0.000	0.038	0.036	0.077	0.179	0.228	0.489	0.595	1.000
$pEARLY_{i,t}$	0.000	0.006	0.038	0.070	0.185	0.455	0.645	0.888	1.000
$pFOUNDER_{i,t}$	0.000	0.026	0.084	0.077	0.184	0.219	0.280	0.474	0.714
$pCHAIRMAN_{i,t}$	0.000	0.013	0.025	0.043	0.108	0.159	0.179	0.345	0.286
$pAGE_{i,t}$	0.000	0.045	0.163	0.231	0.339	0.486	0.622	0.776	1.000
$SEO_{i,t}$	0.184	0.103	0.138	0.183	0.192	0.264	0.362	0.397	0.286
$M\&A_{i,t}$	0.026	0.032	0.036	0.041	0.044	0.047	0.046	0.026	0.143
$AUDIT_{i,t}$	0.842	0.763	0.729	0.647	0.551	0.450	0.349	0.345	0.143
$aBDIND_{i,t}$	0.117	0.111	0.086	0.046	0.018	-0.044	-0.074	-0.059	-0.122
$aACIND_{i,t}$	0.141	0.132	0.080	0.039	-0.003	-0.048	-0.057	-0.061	-0.115
$CYCLE_{i,t}$	0.000	0.013	0.016	0.019	0.021	0.036	0.055	0.043	0.000
$DISTRESS_{i,t-1}$	0.079	0.167	0.208	0.213	0.271	0.338	0.410	0.431	0.571
$aLOGMVE_{i,t-1}$	2.277	1.655	0.955	0.564	0.168	-0.465	-0.854	-0.868	-1.317
$aLOGMTB_{i,t-1}$	0.199	0.102	-0.032	-0.036	-0.051	-0.111	-0.022	0.184	-0.134
$aLEV_{i,t-1}$	0.082	0.013	-0.011	-0.016	-0.030	-0.045	-0.055	-0.063	-0.054
$aNOA_{i,t-1}$	-6.296	-2.053	-3.058	-1.876	-2.735	-2.098	-1.093	-3.539	2.985
Observations	38	156	443	832	827	662	307	116	14

Note: the table reports mean of firm characteristics by each PSCORE.

3.5.4. Multivariate regression findings

3.5.4.1. PSCORE and abnormal accruals

This section reports the findings of the main regressions. Table 3-8 presents the results of the set of Equation 3-11. Consistent with the hypothesis, I find a positive coefficient on PSCORE. The positive relationships are statistically significant in all models where dependent variables are DAC (column a), DWAC (column b), and DAMP (column c). While the PSCORE coefficients are slightly different among the models, the qualitative effects are consistent. In terms of economic significance, the coefficient on DAC suggests that a one unit increase in PSCORE is associated with an increase of 0.0118 (= 0.309/100*3.8, given that 3.8 is the mean of PSCORE as reported in Table 3-3) in DAC, which accounts for 15% of its mean (15% = 0.012/0.0782, given that 0.0782 is the mean of DAC as reported in Table 3-3). Similarly, an increase in PSCORE by one unit is associated with an increase of 0.0078 in DWAC (or 12.7% of its mean) and 0.0019 in DAMP (or 20.5% of its mean). In general, the findings provide evidence that PSCORE could signal a red flag of high levels of abnormal accruals or low earnings quality. The evidence supports the Hypothesis H1.

Table 3-8: Relationship between PSCORE and abnormal accruals

Variable	Expected sign	DAC (a)		DWAC (b)		DAMP (c)	
		Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
$PSCORE_{i,t}$	+	**0.309*** **	**2.95**	**0.206** **	**2.47**	**0.313*** **	**4.02**
$SEO_{i,t}$	+	3.134***	8.33	2.241***	7.47	1.86***	6.62
$M\&A_{i,t}$	+	1.276*	1.74	3.056***	5.22	3.004***	5.49
$AUDIT_{i,t}$	-	-2.132***	-6.34	-0.984***	-3.67	-1.018***	-4.06
$aBDIND_{i,t}$	-	-0.015	-0.01	-0.131	-0.18	0.294	0.47
$aACIND_{i,t}$	-	-0.22	-0.36	0.122	0.26	-0.1	-0.22
$CYCLE_{i,t}$	+	2.25**	2.46	2.147***	2.94	0.811	1.19
$DISTRESS_{i,t-1}$	+	0.936***	2.70	-0.036	-0.12	-0.361	-1.39
$aLOGMVE_{i,t-1}$	-	-0.212*	-1.83	-0.436***	-4.75	-0.43***	-5.01
$aLOGMTB_{i,t-1}$	+	0.927***	4.84	1.379***	9.04	1.355***	9.50
$aLEV_{i,t-1}$		-4.329***	-4.55	-3.381***	-4.46	-2.849***	-4.02
$aNOA_{i,t-1}$	-	-0.009	-1.00	-0.018***	-2.65	-0.009	-1.35
Constant		6.747***	13.93	5.289***	13.70	4.765***	13.19
Observations		3395		3395		3395	
Adjusted R^2		0.093		0.103		0.103	

Note: The table reports the estimations of Equation 3-11: $EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 aBDIND_{i,t} + \beta_6 aACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 aLOGMVE_{i,t-1} + \beta_{10} aLOGMTB_{i,t-1} + \beta_{11} aLEV_{i,t-1} + \beta_{12} aNOA_{i,t-1} + \varepsilon$;

where $EQ_{i,t}$ is $DAC_{i,t}$, $DWAC_{i,t}$ or $DAMP_{i,t}$ in the column (a), (b) or (c), respectively. All coefficients are multiplied by 100 for easy reading. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 3-8 also indicates that control variables have predicted signs and most coefficients are consistently significant across different models. As expected, the positive coefficients SEO and M&A suggest that equity issuance increases earnings management or reduces earnings quality. In addition, the coefficients on $AUDIT$, $aBDIND$, and $aACIND$ are negative, implying that strong corporate governance reduces earnings management or increases earnings quality. Also, while large firms are less likely to manipulate earnings, over-valued firms engage in more earnings management evident by higher abnormal accruals.

3.5.4.2. PSCORE and proxies for real earnings management

In regard to real earnings management, Table 3-9 shows the results of Equation 3-12. Control variables are also consistently significant across different models and have the expected signs. The findings indicate that the coefficients on all proxies for real earnings management are positive and statistically significant at least at the 10% level. In terms of economic significance, a one-unit increase in PSCORE leads to an increase of 0.043 in DCF (or 30.9% of its mean), 0.0187 in DPROD (or 10.5% of its mean), 0.023 in DDISEXP (or 11.3% of its mean), and 0.074 in REM (or 20.3% of its mean). Generally, the results support the notion that PSCORE is positively associated with the established proxies of real earnings management.

Table 3-9: Relationship between PSCORE and proxies for real earnings management

Variable	Expected sign	DCF (a)		DPROD (b)		DDISEXP (c)		REM (d)	
		Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$\mathbf{PSCORE_{i,t}}$	+	**1.142*** **	**3.78**	**0.491***	**1.87**	**0.604***	**1.78**	**1.949*** **	**3.09**
$SEO_{i,t}$	+	3.5***	3.23	-1.362	-1.43	3.144***	2.61	-1.456	-0.64
$M\&A_{i,t}$	+	2.43	1.17	5.62***	3.09	3.941*	1.72	10.301**	2.4
$aBDIND_{i,t}$	-	-1.571	-0.64	2.709	1.3	-0.625	-0.23	-0.95	-0.18
$aACIND_{i,t}$	-	3.868**	2.23	1.018	0.68	3.725*	1.88	9.197**	2.51
$CYCLE_{i,t}$	+	5.84**	2.22	5.132**	2.25	3.465	1.21	5.235	0.99
$DISTRESS_{i,t-1}$	+	4.503***	4.41	-0.239	-0.26	3.414***	2.99	1.685	0.79
$aLOGMVE_{i,t-1}$	-	-0.248	-0.77	-1.783***	-6.49	-1.424***	-3.97	-2.239***	-3.37
$aLOGMTB_{i,t-1}$	+	3.73***	6.76	5.978***	12.39	5.848***	9.53	10.491***	9.11
$aLEVtm1_{i,t-1}$	?	-12.414***	-4.55	-5.955**	-2.51	-19.408***	-6.46	-26.335***	-4.71
Constant		7.451***	5.92	16.822***	15.48	15.854***	11.16	28.923***	11
Observations		3139		3014		2650		2547	
Adjusted R2		0.052		0.068		0.077		0.057	

Note: The table reports the estimations of Equation 3-12: $EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 aBDIND_{i,t} + \beta_5 aACIND_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 DISTRESS_{i,t-1} + \beta_8 aLOGMVE_{i,t-1} + \beta_9 aLOGMTB_{i,t-1} + \beta_{10} aLEV_{i,t-1} + \varepsilon$

where $EQ_{i,t}$ is $DCF_{i,t}$, $DPROD_{i,t}$, $DDISEXP_{i,t}$, or $REM_{i,t}$ in the column (a), (b), (c), or (d), respectively (used as substitutes). All coefficients are multiplied by 100 for easy reading. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

3.5.4.3. PSCORE and deviations of first digits from Benford's Law

In respect to financial statement errors, Table 3-10 reports the findings from the set of Equation 3-13. The results show that the coefficients on PSCORE (Panel A) and KS (Panel B) in four different specifications are all positive and statistically significant. In terms of economic significance, for example in column (d), where the model controls for industry and year fixed effects, a one-unit increase in PSCORE is associated with an increase of 0.0012 in FSD_SCORE (or 3.7% of its mean) and 0.004 in KS (or 4.56% of its mean). In general, the results demonstrate that PSCORE can capture the deviations of the first digits of figures reported in financial statements from what are expected by Benford's Law.

To summarise, the findings of the multivariate regressions indicate that PSCORE is positively associated with the established proxies for earnings quality. The relationships are statistically and economically significant. The findings support Hypothesis H1 and suggest that PSCORE can be a useful tool to signal red flags of low earnings quality in individual firms.

Table 3-10: Relationship between PSCORE and deviations of first digits from Benford's Law

	Expected sign	(a)		(b)		(c)		(d)	
		Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
Panel A: FSD_SCORE									
$PSCORE_{i,t}$	+	0.034**	2.81	0.035**	2.92	0.030*	2.52	0.031**	2.59
$SEO_{i,t}$	+	0.023	0.54	0.026	0.61	-0.019	-0.44	-0.015	-0.35
$M\&A_{i,t}$	+	-0.161*	-1.96	-0.149	-1.81	-0.148	-1.81	-0.138	-1.68
$AUDIT_{i,t}$	-	-0.119**	-3.04	-0.117**	-2.99	-0.087*	-2.17	-0.085*	-2.11
$aBDIND_{i,t}$	-	-0.098	-1.09	-0.095	-1.06	0.070	0.75	0.075	0.81
$aACIND_{i,t}$	-	0.027	0.48	-0.011	-0.18	0.035	0.62	0.005	0.08
$CYCLE_{i,t}$	+	-0.104	-1.01	-0.111	-1.07	-0.141	-1.38	-0.149	-1.45
$DISTRESS_{i,t-1}$	+	0.132***	3.39	0.131***	3.36	0.098*	2.43	0.098*	2.42
$aLOGMVE_{i,t-1}$	-	-0.093***	-8.01	-0.091***	-7.79	-0.129***	-9.68	-0.129***	-9.54
$aLOGMTB_{i,t-1}$	+	0.124***	6.71	0.129***	6.70	0.149***	7.49	0.153***	7.37
$aLEV_{i,t-1}$	?	-0.463***	-4.10	-0.445***	-3.93	-0.384**	-3.19	-0.369**	-3.06
$aNOA_{i,t-1}$	?	0.000**	2.61	0.000*	2.51	0.000*	2.38	0.000*	2.27
Constant		0.042***	31.76	0.041***	28.49	0.046***	26.62	0.046***	24.91
Year fixed effects		No		Yes		No		Yes	
Industry fixed effects		No		No		Yes		Yes	
Observations		3197		3197		3197		3197	
Adjusted R^2		0.1049		0.1052		0.1293		0.1297	
Panel B: KS statistic									
$PSCORE_{i,t}$	+	0.130**	2.66	0.134**	2.75	0.104*	2.10	0.107*	2.16
$SEO_{i,t}$	+	-0.026	-0.15	-0.009	-0.05	-0.170	-0.95	-0.149	-0.83
$M\&A_{i,t}$	+	-0.342	-1.02	-0.299	-0.89	-0.302	-0.90	-0.265	-0.79
$AUDIT_{i,t}$	-	-0.622***	-3.90	-0.600***	-3.76	-0.461**	-2.79	-0.438**	-2.65
$aBDIND_{i,t}$	-	-0.182	-0.50	-0.171	-0.47	0.317	0.83	0.342	0.90

$aACIND_{i,t}$	-	-0.031	-0.13	-0.169	-0.66	-0.026	-0.11	-0.120	-0.47
$CYCLE_{i,t}$	+	-0.211	-0.50	-0.258	-0.61	-0.284	-0.67	-0.333	-0.79
$DISTRESS_{i,t-1}$	+	0.455**	2.86	0.461**	2.89	0.370*	2.24	0.376*	2.27
$aLOGMVE_{i,t-1}$	-	-0.256***	-5.43	-0.252***	-5.29	-0.377***	-6.87	-0.379***	-6.84
$aLOGMTB_{i,t-1}$	+	0.395***	5.22	0.403***	5.13	0.477***	5.84	0.480***	5.65
$aLEV_{i,t-1}$	?	-1.563***	-3.39	-1.489**	-3.22	-1.296**	-2.62	-1.237*	-2.50
$aNOA_{i,t-1}$	?	0.000	0.95	0.000	0.80	0.000	0.67	0.000	0.52
Constant		0.116***	21.77	0.112***	19.08	0.127***	17.84	0.124***	16.42
Year fixed effects		No		Yes		No		Yes	
Industry fixed effects		No		No		Yes		Yes	
Observations		3197		3197		3197		3197	
Adjusted R^2		0.0682		0.0704		0.0837		0.0858	

Note: The table reports the estimations of Equation 3-13: $EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 BDIND_{i,t} + \beta_6 ACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 LOGMVE_{i,t-1} + \beta_{10} LOGMTB_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} NOA_{i,t-1} + INDUSTRY/ YEAR\ FIXED\ EFFECTS + \varepsilon.$

Where $EQ_{i,t}$ is $FSD\_SCORE_{i,t}$ (Panel A) or $KS_{i,t}$ (Panel B). All coefficients are multiplied by 100 for easy reading. Industry fixed effects are based on Datastream's level-six codes. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

3.5.5. *Additional analysis*

3.5.5.1. Equity-based incentives

So far, the chapter provides evidence that the PSCORE can signal the presence of poor earnings quality. This section studies the impact of CEO's equity-based incentives on the relationship between the PSCORE and poor earnings quality.

Previous research indicates that CEOs' equity-based incentives negatively affect earnings quality (Cheng and Warfield, 2005; Bergstresser and Philippon, 2006; Chava and Purnanandam, 2010; Jiang et al., 2010). For example, Bergstresser and Philippon (2006) find that firms exhibit abnormally high accruals when there is a high association between the CEO's total compensation and changes in firms' share prices. Later studies support the idea that earnings quality is affected by CEOs' equity-based incentives (Cheng and Warfield, 2005; Jiang et al., 2010). Therefore, it is reasonable to predict that when CEOs have a high PSCORE and have high equity-based incentives, e.g. their compensations and wealth are highly tied to reported earnings, they have high tendencies to manage earnings numbers. In general, I conjecture that the relationships between PSCORE and the proxies for earnings quality are stronger for firms which have a CEO with high equity-based incentives.

I follow prior studies to estimate CEO's equity-based incentives (e.g., Bergstresser and Philippon, 2006; Armstrong et al., 2010; Jiang et al., 2010; Feng et al., 2011; Armstrong, Larcker, Ormazabal, and Taylor, 2013) as follows:

Equation 3-14: Calculation of equity-based Incentives

$$INCENTIVE = \frac{ONEPCT}{(ONEPCT\ +\ SALARY\ +\ BONUS)}$$

$$ONEPCT = 0.01 \, x \, PRICE \, x \, (SHARE + OPTION)$$

Where: $INCENTIVE$ is equity-based incentives of CEOs; $ONEPCT$ is change in CEOs' equity holdings corresponding to the change in stock price by one percent; $PRICE$ is share price at the end of fiscal year; $SHARE$ is shares held by CEOs; $OPTION$ is options held by the CEOs; $SALARY$ is total cash salary CEOs receive; and $BONUS$ is cash bonus CEOs receive.

I, then, re-run Equation 3-11, Equation 3-12, and Equation 3-13 using subsamples of firms which have CEOs with high or low equity-based incentives. Firms are defined as having CEOs with a high (low) equity-based incentive if $INCENTIVE$ is greater than or equal to (lower than) the median of all firms.

Table 3-11, Table 3-12, and Table 3-13 report the findings of Equation 3-11, Equation 3-12, and Equation 3-13, respectively. The evidence shows that the coefficients on PSCORE are higher in subsamples with high equity-based incentive CEOs than in subsamples with low equity-based incentive CEOs in nearly every case. Importantly, the coefficients on PSCORE are mostly statistically significant when CEOs have high equity-based incentives (e.g. columns 1, 3, and 5 in Table 3-11; columns 1, 3, 5, and 7 in Table 3-12; and columns 1 and 3 in Table 3-13), while they are not significant when CEOs have low equity-based incentives (e.g. columns 2, 4, and 6 in Table 3-11; columns 2, 4, 6, and 8 in Table 3-12; and columns 2 and 4 in Table 3-13). In general, the results are consistent with the conjecture that the relationships between PSCORE and abnormal accruals, proxies for earnings management, and financial statement errors are stronger for firms which have CEOs with high equity-based incentives.

Table 3-11: The effect of equity-based incentive on the relationship between PSCORE and abnormal accruals

	DAC		**DWAC**		**DAMP**	
	High Incentive	**Low Incentive**	**High Incentive**	**Low Incentive**	**High Incentive**	**Low Incentive**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
$PSCORE_{i,t}$	0.384*	0.172	0.182	0.158	0.354**	0.185
	(2.48)	(1.25)	(1.46)	(1.46)	(3.00)	(1.85)
$SEO_{i,t}$	3.348***	2.732***	2.765***	1.379***	2.421***	1.047**
	(6.25)	(5.27)	(6.42)	(3.38)	(5.94)	(2.78)
$M\&A_{i,t}$	1.678	0.329	2.193**	4.276***	2.680***	3.301***
	(1.68)	(0.30)	(2.74)	(5.04)	(3.53)	(4.21)
$AUDIT_{i,t}$	-1.907***	-2.322***	-0.884*	-0.998**	-0.716	-1.130***
	(-3.88)	(-5.18)	(-2.24)	(-2.83)	(-1.91)	(-3.47)
$aBDIND_{i,t}$	-0.007	0.008	0.010	-0.011	0.006	0.001
	(-0.52)	(0.76)	(1.04)	(-1.21)	(0.63)	(0.13)
$aACIND_{i,t}$	0.007	-0.012	0.007	-0.006	0.006	-0.010
	(0.74)	(-1.65)	(0.97)	(-0.95)	(0.90)	(-1.85)
$CYCLE_{i,t}$	3.497*	0.979	0.752	3.289***	-0.688	1.913*
	(2.55)	(0.83)	(0.68)	(3.53)	(-0.66)	(2.22)
$DISTRESS_{i,t-1}$	0.913	1.040*	0.012	0.104	-0.546	0.044
	(1.76)	(2.31)	(0.03)	(0.29)	(-1.39)	(0.14)
$aLOGMVE_{i,t-1}$	-0.003	-0.001	-0.006***	-0.003*	-0.005***	-0.003**
	(-1.83)	(-0.63)	(-4.23)	(-2.34)	(-4.20)	(-3.00)
$aLOGMTB_{i,t-1}$	0.013***	0.003	0.018***	0.008***	0.016***	0.010***
	(4.73)	(1.33)	(8.04)	(3.67)	(7.79)	(5.11)
$aLEV_{i,t-1}$	-0.053***	-0.030*	-0.036**	-0.027**	-0.034**	-0.021*
	(-3.78)	(-2.38)	(-3.22)	(-2.77)	(-3.21)	(-2.29)
$aNOA_{i,t-1}$	-0.000	0.000	-0.000	-0.000**	-0.000	-0.000
	(-1.91)	(0.84)	(-0.75)	(-2.81)	(-0.49)	(-1.15)

Constant	0.064***	0.070***	0.055***	0.051***	0.046***	0.050***
	(8.80)	(11.14)	(9.43)	(10.27)	(8.35)	(10.87)
Observations	1750	1645	1750	1645	1750	1645
Adjusted R^2	0.0978	0.0732	0.1007	0.0915	0.1030	0.0860

Note: The table reports the estimations of Equation 3-11: $EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 aBDIND_{i,t} + \beta_6 aACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 aLOGMVE_{i,t-1} + \beta_{10} aLOGMTB_{i,t-1} + \beta_{11} aLEV_{i,t-1} + \beta_{12} aNOA_{i,t-1} + \varepsilon$;

where $EQ_{i,t}$ is $DAC_{i,t}$ (column 1 and 2), $DWAC_{i,t}$ (column 3 and 4), or $DAMP_{i,t}$ (column 5 and 6). I run regressions for subsamples of high and low equity-based incentive of CEOs. Firms are defined as having CEOs with high (low) equity-based incentive if *INCENTIVE* is greater than or equal (lower than) the median of all firms. All coefficients are multiplied by 100 for easy reading. Figures in parentheses are t-statistics. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 3-12: The effect of equity-based incentive on the relationship between PSCORE and proxies for real earnings management

	DCF		DPROD		DDISEXP		REM	
	High Incentive	**Low Incentive**	**High Incentive**	**Low Incentive**	**High Incentive**	**Low Incentive**	**High Incentive**	**Low Incentive**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
$PSCORE_{i,t}$	1.204**	1.010*	0.218	0.624	1.144*	0.088	2.171*	1.439
	(2.82)	(2.34)	(0.56)	(1.79)	(2.42)	(0.18)	(2.24)	(1.77)
$SEO_{i,t}$	1.487	6.095***	-1.792	-1.304	1.646	5.051**	-1.852	-1.883
	(1.01)	(3.81)	(-1.33)	(-1.00)	(1.01)	(2.79)	(-0.56)	(-0.63)
$M\&A_{i,t}$	4.674	-1.018	4.367	6.794*	2.049	7.228*	7.482	13.837*
	(1.73)	(-0.31)	(1.75)	(2.54)	(0.69)	(1.97)	(1.23)	(2.30)
$aBDIND_{i,t}$	0.007	-0.044	0.096**	-0.038	-0.070	0.064	0.063	-0.072
	(0.19)	(-1.30)	(3.06)	(-1.36)	(-1.88)	(1.66)	(0.84)	(-1.14)
$aACIND_{i,t}$	0.104***	-0.021	0.001	0.015	0.048	0.024	0.175**	0.003
	(4.01)	(-0.90)	(0.05)	(0.83)	(1.67)	(0.86)	(3.02)	(0.07)
$CYCLE_{i,t}$	5.720	5.846	6.186	3.336	1.248	6.425	3.999	6.181
	(1.52)	(1.61)	(1.80)	(1.12)	(0.30)	(1.62)	(0.48)	(0.94)
$DISTRESS_{i,t}$	3.530*	5.303***	-0.972	0.967	2.963	3.792*	1.181	2.469
	(2.42)	(3.71)	(-0.73)	(0.84)	(1.84)	(2.33)	(0.36)	(0.92)
$aLOGMVE_{i,t}$	-0.008	0.005	-0.025***	-0.010**	-0.010*	-0.016**	-0.027**	-0.016
	(-1.75)	(1.08)	(-6.10)	(-2.71)	(-2.12)	(-3.09)	(-2.68)	(-1.89)
$aLOGMTB_{i,t}$	0.047***	0.023**	0.077***	0.034***	0.066***	0.048***	0.121***	0.075***
	(6.24)	(2.77)	(10.86)	(5.11)	(7.97)	(5.13)	(7.09)	(4.84)
$aLEV_{i,t}$	-0.068	-0.188***	-0.097**	-0.010	-0.158***	-0.233***	-0.243**	-0.277***
	(-1.78)	(-4.86)	(-2.78)	(-0.31)	(-3.80)	(-5.35)	(-2.87)	(-3.84)
Constant	0.082***	0.067***	0.194***	0.146***	0.144***	0.165***	0.306***	0.279***
	(4.44)	(3.85)	(11.53)	(10.38)	(6.92)	(8.24)	(7.22)	(8.52)
Observations	1615	1523	1530	1483	1359	1290	1291	1255

Adjusted R^2	0.0506	0.0562	0.0907	0.0316	0.0768	0.0710	0.0526	0.0466

Note: The table reports the estimations of Equation 3-12: $EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 aBDIND_{i,t} + \beta_5 aACIND_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 DISTRESS_{i,t-1} + \beta_8 aLOGMVE_{i,t-1} + \beta_9 aLOGMTB_{i,t-1} + \beta_{10} aLEV_{i,t-1} + \varepsilon$;

where $EQ_{i,t}$ is $DCF_{i,t}$ (column 1 and 2), $DPROD_{i,t}$ (column 3 and 4), $DDISEXP_{i,t}$ (column 5 and 6) or $REM_{i,t}$ (column 7 and 8). I run regressions for subsamples of high and low equity-based incentive of CEOs. Firms are defined as having CEOs with high (low) equity-based incentive if *INCENTIVE* is greater than or equal (lower than) the median of all firms.

All coefficients are multiplied by 100 for easy reading. Figures in parentheses are t-statistics. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 3-13: The effect of equity-based incentive on the relationship between PSCORE and deviations of first digits from Benford's Law

	FSD_SCORE		KS	
	High Incentive	Low Incentive	High Incentive	Low Incentive
	(1)	(2)	(3)	(4)
$PSCORE_{i,t}$	0.048**	0.027	0.176*	0.084
	(2.81)	(1.50)	(2.49)	(1.15)
$SEO_{i,t}$	-0.001	-0.040	-0.149	-0.235
	(-0.02)	(-0.60)	(-0.62)	(-0.86)
$M\&A_{i,t}$	-0.178	-0.048	-0.618	0.341
	(-1.70)	(-0.37)	(-1.43)	(0.63)
$AUDIT_{i,t}$	-0.120*	-0.039	-0.364	-0.604*
	(-2.18)	(-0.62)	(-1.61)	(-2.36)
$BDIND_{i,t}$	0.047	0.134	0.123	0.818
	(0.35)	(0.96)	(0.23)	(1.43)
$ACIND_{i,t}$	0.018	0.022	-0.124	-0.105
	(0.20)	(0.25)	(-0.33)	(-0.29)
$CYCLE_{i,t}$	-0.216	0.003	-0.105	-0.288
	(-1.51)	(0.02)	(-0.18)	(-0.46)
$DISTRESS_{i,t-1}$	0.076	0.086	0.198	0.445
	(1.32)	(1.46)	(0.85)	(1.84)
$LOGMVE_{i,t-1}$	-0.103***	-0.170***	-0.317***	-0.437***
	(-5.64)	(-8.10)	(-4.21)	(-5.07)
$LOGMTB_{i,t-1}$	0.160***	0.154***	0.441***	0.576***
	(5.51)	(4.94)	(3.70)	(4.48)
$LEV_{i,t-1}$	-0.370*	-0.283	-0.858	-1.446
	(-2.18)	(-1.53)	(-1.23)	(-1.90)
$NOA_{i,t-1}$	-0.001	0.000**	-0.003*	0.000
	(-1.96)	(2.87)	(-2.03)	(0.96)

Constant	0.041***	0.051***	0.108***	0.136***
	(15.14)	(19.41)	(9.74)	(12.49)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	1638	1559	1638	1559
Adjusted R^2	0.1236	0.1487	0.0761	0.0993

Note: The table reports the estimations of Equation 3-13: $EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 BDIND_{i,t} + \beta_6 ACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 LOGMVE_{i,t-1} + \beta_{10} LOGMTB_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} NOA_{i,t-1} + INDUSTRY/ YEAR\ FIXED\ EFFECTS + \varepsilon$.

Where $EQ_{i,t}$ is $FSD\_SCORE_{i,t}$ (column 1 and 2) or $KS_{i,t}$ (column 3 and 4). I run regressions for subsamples of high and low equity-based incentive of CEOs. Firms are defined as having CEOs with high (low) equity-based incentive if *INCENTIVE* is greater than or equal (lower than) the median of all firms.

All coefficients are multiplied by 100 for easy reading. Industry fixed effects are based on Datastream's level-six codes. Figures in parentheses are t-statistics. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

3.5.5.2. *A practical version of PSCORE*

One concern with my approach to construct PSCORE is that the measure of pPRESS (press coverage) may be biased. Although Milbourn (2003), Francis et al. (2008), and Jian and Lee (2011) find that overall the newspapers fairly present the reputation of CEOs, Lafond (2008) argues that not all news is good news for CEOs' reputation. Also, while one of the main purposes of the chapter is to develop a tool which can be easily applied, average practitioners may find that it is difficult to measure press coverage. To deal with those concerns, I build a practical version of PSCORE, denoted as PSCORE_P, which excludes pPRESS. The calculation of PSCORE now becomes:

Equation 3-15: The practical PSCORE

$$PSCORE\_P_{i,t} = pCFO_{i,t} + pCERT_{i,t} + pROLE_{i,t} + pROA_{i,t} + pEARLY_{i,t} + pFOUNDER_{i,t} + pCHAIRMAN_{i,t} + pAGE_{i,t}$$

The practical PSCORE includes only measures whose data are collected from the curriculum vitae of CEOs and financial statements of their companies. Then, I re-run Equation 3-11, Equation 3-12, and Equation 3-13 where PSCORE is replaced by PSCORE_P.

Table 3-14 reports the findings of Equation 3-11. The evidence indicates that the coefficients on PSCORE_P are still positive and statistically significant. In other words, there are strong positive relationships between PSCORE_P and abnormal accruals. I find similar results in Table 3-15 and Table 3-16. In general, the findings suggest that average practitioners can apply the PSCORE_P to signal cases where reported earnings have low quality.

Table 3-14: Practical PSCORE and abnormal accruals

	DAC (a)		DWAC (b)		DAMP (c)	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
$PSCORE\_P_{i,t}$	0.188	(1.67)	0.192*	(2.14)	0.357***	(4.24)
$SEO_{i,t}$	3.190***	(8.53)	2.234***	(7.49)	1.894***	(6.78)
$M\&A_{i,t}$	1.194	(1.64)	3.063***	(5.26)	2.969***	(5.45)
$AUDIT_{i,t}$	-2.170***	(-6.50)	-0.986***	(-3.70)	-0.930***	(-3.73)
$aBDIND_{i,t}$	-0.000	(-0.01)	-0.001	(-0.19)	0.003	(0.45)
$aACIND_{i,t}$	-0.002	(-0.36)	0.001	(0.19)	-0.002	(-0.42)
$CYCLE_{i,t}$	2.297*	(2.52)	2.129**	(2.94)	0.640	(0.94)
$DISTRESS_{i,t-1}$	0.970**	(2.81)	-0.006	(-0.02)	-0.302	(-1.18)
$aLOGMVE_{i,t-1}$	-0.003*	(-2.44)	-0.005***	(-5.08)	-0.005***	(-5.60)
$aLOGMTB_{i,t-1}$	0.010***	(5.22)	0.014***	(9.13)	0.014***	(9.86)
$aLEV_{i,t-1}$	-0.042***	(-4.48)	-0.033***	(-4.36)	-0.028***	(-4.02)
$aNOA_{i,t-1}$	-0.000	(-1.09)	-0.000*	(-2.48)	-0.000	(-1.17)
Constant	0.074***	(17.31)	0.055***	(16.18)	0.049***	(15.34)
Observations	3395		3395		3395	
Adjusted R^2	0.0890		0.0985		0.1008	

Note: The table reports findings with the practical version of PSCORE, which excludes press coverage.

The table shows the findings of a different version of Equation 3-11: $EQ_{i,t} = \alpha + \beta_1 PSCORE\_P_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 aBDIND_{i,t} + \beta_6 aACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 aLOGMVE_{i,t-1} + \beta_{10} aLOGMTB_{i,t-1} + \beta_{11} aLEV_{i,t-1} + \beta_{12} aNOA_{i,t-1} + \varepsilon$;

Where: $PSCORE\_P_{i,t} = pCFO_{i,t} + pCERT_{i,t} + pROLE_{i,t} + pROA_{i,t} + pEARLY_{i,t} + pFOUNDER_{i,t} + pCHAIRMAN_{i,t} + pAGE_{i,t}$; $EQ_{i,t}$ can be DAC (column a), DWAC (column b), and DAMP (column c) (used as substitutes). All coefficients are multiplied by 100 for easy reading. Figures in parentheses are t-statistics. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 3-15: Practical PSCORE and proxies for real earnings management

	DCF (a)		DPROD (b)		DDISEXP (c)		REM (d)	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
$PSCORE\_P_{i,t}$	0.994**	(3.04)	0.479	(1.69)	0.405	(1.11)	1.924**	(2.83)
$SEO_{i,t}$	3.618***	(3.34)	-1.318	(-1.40)	3.235**	(2.69)	-1.265	(-0.56)
$M\&A_{i,t}$	2.415	(1.16)	5.619**	(3.08)	3.904	(1.70)	10.234*	(2.39)
$aBDIND_{i,t}$	-0.014	(-0.60)	0.028	(1.34)	-0.006	(-0.22)	-0.005	(-0.11)
$aACIND_{i,t}$	0.037*	(2.15)	0.010	(0.65)	0.036	(1.82)	0.089*	(2.44)
$CYCLE_{i,t}$	5.922*	(2.25)	5.177*	(2.27)	3.535	(1.24)	5.440	(1.03)
$DISTRESS_{i,t-1}$	4.720***	(4.62)	-0.168	(-0.19)	3.535**	(3.10)	1.988	(0.94)
$aLOGMVE_{i,t-1}$	-0.004	(-1.27)	-0.018***	(-6.84)	-0.015***	(-4.31)	-0.025***	(-3.80)
$aLOGMTB_{i,t-1}$	0.038***	(6.96)	0.060***	(12.49)	0.059***	(9.66)	0.106***	(9.23)
$aLEV_{i,t-1}$	-0.126***	(-4.61)	-0.060*	(-2.53)	-0.195***	(-6.50)	-0.263***	(-4.71)
Constant	0.089***	(8.29)	0.173***	(18.66)	0.170***	(13.97)	0.308***	(13.68)
Observations	3138		3013		2649		2546	
Adjusted R2	0.0471		0.0649		0.0724		0.0526	

Note: The table reports findings with the practical version of PSCORE, which excludes press coverage.

The table shows the findings of a different version of Equation 3-12: $EQ_{i,t} = \alpha + \beta_1 PSCORE\_P_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 aBDIND_{i,t} + \beta_5 aACIND_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 DISTRESS_{i,t-1} + \beta_8 aLOGMVE_{i,t-1} + \beta_9 aLOGMTB_{i,t-1} + \beta_{10} aLEV_{i,t-1} + \varepsilon$;

Where: $PSCORE\_P_{i,t} = pCFO_{i,t} + pCERT_{i,t} + pROLE_{i,t} + pROA_{i,t} + pEARLY_{i,t} + pFOUNDER_{i,t} + pCHAIRMAN_{i,t} + pAGE_{i,t}$; $EQ_{i,t}$ is $DCF_{i,t}$ (column a), $DPROD_{i,t}$ (column b), $DDISEXP_{i,t}$ (column c), or $REM_{i,t}$ (column d) (used as substitutes). All coefficients are multiplied by 100 for easy reading. Figures in parentheses are t-statistics. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 3-16: Practical PSCORE and deviations of first digits from Benfords' Law

	FSD (a)		KS (b)	
	Coefficient	t-statistic	Coefficient	t-statistic
$PSCORE\_P_{i,t}$	0.010	(0.74)	0.032	(0.60)
$SEO_{i,t}$	-0.012	(-0.27)	-0.137	(-0.77)
$M\&A_{i,t}$	-0.139	(-1.70)	-0.272	(-0.81)
$AUDIT_{i,t}$	-0.087*	(-2.15)	-0.444**	(-2.68)
$BDIND_{i,t}$	0.069	(0.74)	0.321	(0.84)
$ACIND_{i,t}$	-0.001	(-0.02)	-0.141	(-0.55)
$CYCLE_{i,t}$	-0.145	(-1.42)	-0.321	(-0.76)
$DISTRESS_{i,t-1}$	0.103*	(2.55)	0.394*	(2.38)
$LOGMVE_{i,t-1}$	-0.135***	(-10.16)	-0.400***	(-7.34)
$LOGMTB_{i,t-1}$	0.158***	(7.62)	0.497***	(5.87)
$LEV_{i,t-1}$	-0.384**	(-3.18)	-1.288**	(-2.60)
$NOA_{i,t-1}$	0.000*	(2.24)	0.000	(0.50)
Constant	0.047***	(26.84)	0.129***	(17.86)
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Observations	3197		3197	
Adjusted R2	0.1279		0.0846	

Note: Note: The table reports findings with the practical version of PSCORE, which excludes press coverage.

The table shows the findings of a different version of Equation 3-13: $EQ_{i,t} = \alpha + \beta_1 PSCORE\_P_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 BDIND_{i,t} + \beta_6 ACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 LOGMVE_{i,t-1} + \beta_{10} LOGMTB_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} NOA_{i,t-1} + INDUSTRY/YEAR\ FIXED\ EFFECTS + \varepsilon$.

Where: $PSCORE\_P_{i,t} = pCFO_{i,t} + pCERT_{i,t} + pROLE_{i,t} + pROA_{i,t} + pEARLY_{i,t} + pFOUNDER_{i,t} + pCHAIRMAN_{i,t} + pAGE_{i,t}$; $EQ_{i,t}$ is $FSD\_SCORE_{i,t}$ (column a) or $KS_{i,t}$ (column b). All coefficients are multiplied by 100 for easy reading. Industry fixed effects are based on Datastream's level-six codes. Figures in parentheses are t-statistics. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

3.5.5.3. Propensity score matching

A potential problem with a non-experimental study is that estimations of multiple regressions may be biased due to confounding factors (Gow, Larcker, and Reiss, 2016; Shipman, Swanquist, and Whited, 2017). For example, there may be confounding factors such as boards of directors' preferences or interests, which determine both earnings quality and the allocation of CEOs with a high or low PSCORE. Prior studies show that the propensity score matching method, which is proposed by Rosenbaum and Rubin (1983) to match treatments with controls based on multiple dimensional factors, is common in accounting research to mitigate the effects of confounding factors (Gow et al., 2016; Shipman et al., 2017).

In this study, I use the propensity score matching method to reduce the bias of estimations caused by confounding factors (Gow et al., 2016; Shipman et al., 2017). The procedure is as follows. First, I need to identify observations with high PSCORE and low PSCORE. I create a dummy variable namely $highPSCORE$, which is equal to one if the PSCORE of a CEO is greater than or equal to the median of all firms, and zero otherwise. I classify observations into two groups: treatment ($highPSCORE$ = 1) and control ($highPSCORE$ = 0). Second, I run the following logistic regression between $highPSCORE$ and explanatory variables which are control variables in the main regressions:

Equation 3-16: Logistic regression modelling for the probability of having CEOs with a high PSCORE

$$Prob(highPSCORE_{i,t} = 1) = \alpha + \beta_1 SEO_{i,t} + \beta_2 M\&A_{i,t} + \beta_3 AUDIT_{i,t} + \beta_4 BDIND_{i,t} + \beta_5 ACIND_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 DISTRESS_{i,t-1} + \beta_8 LOGMVE_{i,t-1} + \beta_9 LOGMTB_{i,t-1} + \beta_{10} LEV_{i,t-1} + \beta_{11} NOA_{i,t-1}$$

Third, I match (without replacement) each treatment with one control which has the closest odds ratio and I require a maximum caliper of 0.01 (odds ratio). Fourth, to assess the match quality, I use a simple t-test to see whether the remaining differences between the treatments and controls are insignificant. The above four-step procedure for propensity score matching is similar to recommendations of Shipman et al. (2017). The results of the logistic regression are presented in Table 3-17. In Panel A, the evidence shows that the probability of having CEOs with high PSCOREs is highly correlated with firm characteristics. In Panel B, the findings indicate that the matching process has good quality.

Using the propensity-score-matching sample, Table 3-18 shows the findings on the relationships between PSCORE and abnormal accruals. The evidence shows that PSCORE is positively associated with DAC, DWAC, and DAMP. The relationships are still statistically significant in nearly every case. I also find positive relationships between PSCORE and proxies for real earnings management and deviations of first digits from Benford's Law. The results are consistent with the main findings reported above.

Table 3-17: Propensity score matching

Panel A: Logistic model

	Coefficient	z-statistic
$SEO_{i,t}$	0.104*	1.72
$M\&A_{i,t}$	-0.03	-0.26
$AUDIT_{i,t}$	-0.138**	-2.57
$BDIND_{i,t}$	-0.303**	-2.41
$ACIND_{i,t}$	-0.297***	-3.7
$CYCLE_{i,t}$	0.135	0.91
$DISTRESS_{i,t-1}$	0.183***	3.35
$LOGMVE_{i,t-1}$	-0.141***	-8.72
$LOGMTB_{i,t-1}$	0.133***	5.06
$LEV_{i,t-1}$	-0.404**	-2.56
$NOA_{i,t-1}$	0	-1.08
Constant	1.893***	12.26
Observations	3,395	
Pseudo R2	0.0958	

Panel B: Mean differences in firm characteristics before and after matching

	Before matching (a)			After matching (b)		
	Treated	Control	t-statistic	Treated	Control	t-statistic
$SEO_{i,t}$	0.306	0.172	8.37***	0.182	0.182	0
$M\&A_{i,t}$	0.045	0.04	0.72	0.042	0.043	-0.1
$AUDIT_{i,t}$	0.407	0.639	-13.11***	0.609	0.621	-0.56
$BDIND_{i,t}$	0.298	0.416	-14.14***	0.395	0.398	-0.33
$ACIND_{i,t}$	0.035	0.152	-12.62***	0.095	0.088	0.61
$CYCLE_{i,t}$	0.042	0.018	3.54***	0.023	0.021	0.29
$DISTRESS_{i,t-1}$	0.371	0.227	8.46***	0.216	0.234	-1

LOGMVE $_{i,t-1}$	10.3	11.745	-20.76***	11.405	11.413	-0.11
LOGMTB $_{i,t-1}$	0.702	0.682	0.54	0.669	0.644	0.63
LEV $_{i,t-1}$	0.119	0.16	-7.5***	0.141	0.146	-0.9
NOA $_{i,t-1}$	10.581	9.558	0.15	8.144	4.534	1
Observations	1099	2296		1,090	1,090	

Note: The table reports the results of the propensity score matching approach.

Panel A reports the estimations of the following logistic regression: $Prob(highPSCORE_{i,t} = 1) = \alpha + \beta_1 SEO_{i,t} + \beta_2 M\&A_{i,t} + \beta_3 AUDIT_{i,t} + \beta_4 BDIND_{i,t} + \beta_5 ACIND_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 DISTRESS_{i,t-1} + \beta_8 LOGMVE_{i,t-1} + \beta_9 LOGMTB_{i,t-1} + \beta_{10} LEV_{i,t-1} + \beta_{11} NOA_{i,t-1}$. I match each treatment (highPSCORE=1) with one control (highPSCORE = 0) without replacement; where highPSCORE equals to one if PSCORE is greater than or equals the median of all firms, zero otherwise. I require a maximum caliper of 0.01 (odds ratio) for matched samples.

Panel B reports the means of firm characteristics before matching (column a) and after matching (column b), and t-statistic for t-test under the null that the mean difference between treated and control groups is zero.

Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 3-18: Propensity score matching: PSCORE and abnormal accruals

	DAC (a)		DWAC (b)		DAMP (c)	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
$PSCORE_{i,t}$	0.280*	(2.39)	0.089	(0.94)	0.180*	(2.05)
$SEO_{i,t}$	2.130***	(4.83)	1.253***	(3.55)	1.237***	(3.75)
$M\&A_{i,t}$	1.996*	(2.43)	4.293***	(6.53)	3.468***	(5.64)
$AUDIT_{i,t}$	-2.250***	(-6.16)	-1.186***	(-4.06)	-1.163***	(-4.26)
$aBDIND_{i,t}$	0.004	(0.39)	-0.013	(-1.67)	-0.012	(-1.69)
$aACIND_{i,t}$	-0.003	(-0.40)	0.001	(0.22)	-0.004	(-0.73)
$CYCLE_{i,t}$	2.272*	(2.04)	1.592	(1.78)	0.453	(0.54)
$DISTRESS_{i,t-1}$	1.195**	(2.97)	0.179	(0.56)	-0.226	(-0.75)
$aLOGMVE_{i,t-1}$	-0.002	(-1.47)	-0.003**	(-2.98)	-0.003**	(-2.71)
$aLOGMTB_{i,t-1}$	0.008***	(3.78)	0.011***	(6.29)	0.011***	(6.69)
$aLEV_{i,t-1}$	-0.037***	(-3.37)	-0.023**	(-2.63)	-0.024**	(-2.92)
$aNOA_{i,t-1}$	0.000	(0.41)	-0.000	(-1.64)	-0.000	(-0.39)
Constant	0.069***	(13.20)	0.058***	(13.91)	0.053***	(13.66)
Observations	2180		2180		2180	
Adjusted R^2	0.0624		0.0712		0.0709	

Note: Using the propensity-score-matching sample, the table shows the results of Equation 3-11: $EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 aBDIND_{i,t} + \beta_6 aACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 aLOGMVE_{i,t-1} + \beta_{10} aLOGMTB_{i,t-1} + \beta_{11} aLEV_{i,t-1} + \beta_{12} aNOA_{i,t-1} + \varepsilon$;

Where: $EQ_{i,t}$ can be DAC (column a), DWAC (column b), and DAMP (column c) (used as substitutes). All coefficients are multiplied by 100 for easy reading. Figures in parentheses are t-statistics. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 3-19: Propensity score matching: PSCORE and proxies for real earnings management

	DCF		DPROD		DDISEXP		REM	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
$PSCORE_{i,t}$	0.498	(1.44)	0.417	(1.38)	0.437	(1.17)	1.636*	(2.28)
$SEO_{i,t}$	1.944	(1.52)	-0.721	(-0.64)	1.138	(0.83)	-2.460	(-0.94)
$M\&A_{i,t}$	1.921	(0.81)	4.567*	(2.17)	6.591**	(2.63)	6.676	(1.38)
$aBDIND_{i,t}$	-0.013	(-0.46)	0.010	(0.43)	-0.027	(-0.89)	-0.035	(-0.62)
$aACIND_{i,t}$	0.042*	(2.03)	0.018	(1.03)	0.051*	(2.27)	0.098*	(2.31)
$CYCLE_{i,t}$	3.177	(0.99)	0.244	(0.09)	1.587	(0.48)	-2.444	(-0.38)
$DISTRESS_{i,t-1}$	3.593**	(3.01)	0.720	(0.69)	4.308***	(3.30)	4.017	(1.61)
$aLOGMVE_{i,t-1}$	0.001	(0.23)	-0.015***	(-4.63)	-0.010*	(-2.45)	-0.013	(-1.69)
$aLOGMTB_{i,t-1}$	0.025***	(3.86)	0.060***	(10.51)	0.042***	(6.00)	0.103***	(7.57)
$aLEV_{i,t-1}$	-0.122***	(-3.81)	-0.074**	(-2.64)	-0.184***	(-5.39)	-0.280***	(-4.29)
Constant	0.094***	(6.73)	0.166***	(13.70)	0.164***	(10.84)	0.296***	(10.23)
Observations	2112		2035		1775		1714	
Adjusted R^2	0.0204		0.0585		0.0505		0.0495	

Note: Using the propensity-score-matching sample, the table reports the estimations of Equation 3-12: $EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 aBDIND_{i,t} + \beta_5 aACIND_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 DISTRESS_{i,t-1} + \beta_8 aLOGMVE_{i,t-1} + \beta_9 aLOGMTB_{i,t-1} + \beta_{10} aLEV_{i,t-1} + \varepsilon$

where $EQ_{i,t}$ is $DCF_{i,t}$, $DPROD_{i,t}$, $DDISEXP_{i,t}$, or $REM_{i,t}$ in the column (a), (b), (c), or (d), respectively (used as substitutes). All coefficients are multiplied by 100 for easy reading. Figures in parentheses are t-statistics. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 3-20: Propensity score matching: PSCORE and deviations of first digits from Benford's Law

	FSD_SCORE (a)		KS (b)	
	Coefficient	t-statistic	Coefficient	t-statistic
$PSCORE_{i,t}$	0.031*	(2.18)	0.108	(1.86)
$SEO_{i,t}$	-0.024	(-0.45)	-0.014	(-0.06)
$M\&A_{i,t}$	-0.143	(-1.50)	-0.450	(-1.13)
$AUDIT_{i,t}$	-0.068	(-1.48)	-0.424*	(-2.22)
$BDIND_{i,t}$	0.093	(0.82)	0.516	(1.11)
$ACIND_{i,t}$	0.007	(0.09)	-0.336	(-1.06)
$CYCLE_{i,t}$	-0.036	(-0.27)	-0.180	(-0.33)
$DISTRESS_{i,t-1}$	-0.031	(-0.64)	-0.100	(-0.50)
$LOGMVE_{i,t-1}$	-0.121***	(-7.24)	-0.345***	(-5.00)
$LOGMTB_{i,t-1}$	0.108***	(4.23)	0.317**	(2.99)
$LEV_{i,t-1}$	-0.131	(-0.89)	-0.537	(-0.88)
$NOA_{i,t-1}$	-0.000	(-1.00)	-0.001	(-0.94)
Constant	0.045***	(21.05)	0.121***	(13.62)
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Observations	2155		2155	
Adjusted R^2	0.0749		0.0535	

Note: The table reports the estimations of Equation 3-13: $EQ_{i,t} = \alpha + \beta_1 PSCORE_{i,t} + \beta_2 SEO_{i,t} + \beta_3 M\&A_{i,t} + \beta_4 AUDIT_{i,t} + \beta_5 BDIND_{i,t} + \beta_6 ACIND_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 DISTRESS_{i,t-1} + \beta_9 LOGMVE_{i,t-1} + \beta_{10} LOGMTB_{i,t-1} + \beta_{11} LEV_{i,t-1} + \beta_{12} NOA_{i,t-1} + INDUSTRY/YEAR\ FIXED\ EFFECTS + \varepsilon.$

Where $EQ_{i,t}$ is $FSD\_SCORE_{i,t}$ (column a) or $KS_{i,t}$ (column b). All coefficients are multiplied by 100 for easy reading. Industry fixed effects are based on Datastream's level-six codes. Figures in parentheses are t-statistics. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

3.6. Conclusions

This research develops a composite score, namely PSCORE, which captures the profile of CEOs and examines whether PSCORE could signal the quality of earnings. Based on prior research, PSCORE aggregates nine aspects of the profile of CEOs. I employ thee different types of proxies for earnings quality, accrual earnings management (Jones, 1991; Dechow et al., 1995; Peasnell et al., 2000b), real earnings management (Roychowdhury, 2006), and financial statement errors measured by deviations of first digits of figures reported in financial statements from Benford's Law (Amiram et al., 2015). Using a sample of 3,395 firm-year observations (615 unique firms) of listed companies on the London Stock Exchange from 2005 to 2012, the study finds that PSCORE is positively associated with abnormal accruals, abnormal cash flows, abnormal production costs, abnormal discretionary expenditures, and deviations of first digits from Benford's Law. The relationships are statistically and economically significant. Also, further analyses indicate that the associations between PSCORE and established proxies for earnings quality become more pronounced when CEOs have high equity-based incentives. The findings are robust for a practical version of the PSCORE and propensity score matching method. In general, the results demonstrate that PSCORE can be used as an effective tool to signal red flags of poor earnings quality.

The paper contributes to the existing literature and practice in several ways. First, the PSCORE developed here is easy to construct because it mainly requires data collected from the curriculum vitae of CEOs. Second, the study is the first of its kind to aggregate various characteristics of CEOs to signal earnings quality. Third, the PSCORE could highlight the presence of three different kinds of earnings manipulation – accrual earnings management, real earnings management, and financial statement errors – regardless of whether biases in financial statements result from intentional or unintentional acts of managers. This suggests that the PSCORE could be a useful risk indicator for practitioners who need an easy way to identify risks of poor earnings quality. The findings are relevant for research not only in the UK but also in the US and other international contexts.

However, the chapter has some limitations. First, the PSCORE does not cover all CEO characteristics. Due to resource and time constraints, the PSCORE exclude some potential factors such as marital status (Hilary et al., 2016), gender (Barua et al., 2010), and some other factors (e.g., Ahmed and Duellman, 2013; Demerjian et al., 2013; Jia et al., 2014; Kuang et al., 2014; Davidson et al., 2015; Davis et al., 2015; Capalbo et al., 2018). Future studies should take into account a larger group of CEO characteristics. Second, the construction of the PSCORE uses an equally-weighted binary variable. Future research may develop a measure of CEO profile based on a weighted index (e.g., Beneish, 1999; Dechow et al., 2011), and principal component analysis (e.g., Larcker et al., 2007; Florackis and Ozkan, 2009; Florackis and Sainani, 2018). While the weighted index takes into account the possibility that each factor may have different weight on earnings quality, the principal component analysis helps to mitigate potential multicollinearity of individual factors further. Third, the validation of PSCORE is not based on exposed earnings manipulation. The validity tests of the PSCORE use model-based measures (Jones, 1991; Dechow et al., 1995; Peasnell et al., 2000b; Roychowdhury, 2006) and Benford's Law-based measures (Amiram et al., 2015) of earnings quality. While model-based measures of earnings quality may be biased (Holthausen et al., 1995; Fields et al., 2001; Dechow et al., 2010; Ball, 2013), Benford's Law-based measures of earnings quality do not differentiate fraud from errors. Therefore, future studies should use exposed earnings management to revalidate the PSCORE.

Appendix 1: Variable definitions for Chapter 3

Variables	Definitions
Individual factors of PSCORE	
pAGE	equals to one if either (i) the age of a CEO equals to or less than the 25th percentile of industry-year (identified by Datastream level-six) or (ii) the age of CEOs is one year or less close to the retirement age, zero otherwise. The retirement age of men and women in the UK are 65 and 60, respectively, for the period from 1948 to 2010; and from April 2010 to March 2020 the retirement age of women increases one month every month until it reaches 65 (Bozio et al., 2010).
pCERT	equals to one if a CEO does not have an MBA or CPA equivalent, zero otherwise. CPA equivalent refers to professional qualifications provided by accounting bodies accredited by the Financial Reporting Council (FRC, 2016a).
pCFO	equals to one if a CEO does not have working experience as a chief financial officer, zero otherwise.
pCHAIRMAN	equals to one if a CEO serves as the chairperson of the board of directors of firms, zero otherwise.
pEARLY	equals to one if a CEO is within the first three years of service in the firm, zero otherwise.

pFOUNDER	equals to one if a CEO serves as the founder or co-founder of the firm, zero otherwise.
pPRESS	equals to one if the number of newspapers which simultaneously cites the name of a CEO and the company the CEO is working for in a year is less than the corresponding industry mean (identified by Datastream level-six), zero otherwise.
pROA	equals to one if the average of industry-adjusted returns on assets (aveROA) during the last three years of CEO's tenure is negative, zero otherwise; where aveROA is (i) the average of industry-adjusted returns on assets in year *t*, *t-1* and *t-2* if a CEO is in the third year of tenure, or (ii) the average of industry-adjusted returns on assets in year *t* and *t-1* if a CEO is in the second year of tenure, or (iii) the industry-adjusted return on assets in year *t* if a CEO is in the first year of tenure. Return on assets equals to net income before extraordinary items divided by total assets.
pROLE	equals to one if the number of years a CEO works as a chief executive officer is less than the corresponding industry-year mean (identify by Datastream level-six), zero otherwise.
PSCORE	$= \mathrm{pCFO} + \mathrm{pCERT} + \mathrm{pROLE} + \mathrm{pPRESS} + \mathrm{pROA} + \mathrm{pEARLY} + \mathrm{pFOUNDER} + \mathrm{pCHAIRMAN} + \mathrm{pAGE}$
PSCORE_P	$= \mathrm{pCFO} + \mathrm{pCERT} + \mathrm{pROLE} + \mathrm{pROA} + \mathrm{pEARLY} + \mathrm{pFOUNDER} + \mathrm{pCHAIRMAN} + \mathrm{pAGE}$

Proxies for earnings quality	
DAC	Absolute values of discretionary total accruals (DAC) estimated by the modified-Jones models (Jones, 1991; Dechow et al., 1995) for each (Datastream level-six) industry and each year with at least ten observations. $DAC_{i,t} = \left\| \frac{AC_{i,t}}{A_{i,t-1}} - \left[\hat{\alpha} + \hat{\beta}_1 \left(\frac{1}{A_{i,t-1}} \right) + \hat{\beta}_2 \left(\frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} \right) + \hat{\beta}_3 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) \right] \right\|;$ Where: $\hat{\alpha}, \hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3$ are coefficients estimated by the model: $\frac{AC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1 \left(\frac{1}{A_{i,t-1}} \right) + \beta_2 \left(\frac{\Delta REV_{i,t}}{A_{i,t-1}} \right) + \beta_3 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) + \varepsilon_{i,t};$ Where: $AC_{i,t}$ is total accruals ($AC_{i,t}$ = $IB_{i,t}$ - $CFO_{i,t}$; in which $IB_{i,t}$ is net income before extraordinary items, $CFO_{i,t}$ is cash flows from operations); $A_{i,t-1}$ is total opening assets*;* $\Delta REV_{i,t}$ are sale in year *t* minus sale in year *t-1*; and $PPE_{i,t}$ is gross PPE*; i* is firm *i; t* is year; and $\varepsilon_{i,t}$ is the error term.
DAMP	Absolute values of discretionary working capital accruals (DAMP) estimated by the margin model of Peasnell et al. (2000b) for each (Datastream level-six) industry and each year with at least ten observations. DAMP are absolute values of residuals of the following regression: $\frac{WAC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1 \left(\frac{REV_{i,t}}{A_{i,t-1}} \right) + \beta_2 \left(\frac{REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} \right) + \varepsilon_{i,t}$

	Where: $\mathrm{WAC_{i,t}} = (\Delta\mathrm{CA_{i,t}} - \Delta\mathrm{CHE_{i,t}}) - (\Delta\mathrm{CL_{i,t}} - \Delta\mathrm{STD_{i,t}})$; where $\mathrm{WAC_{i,t}}$ is working capital accruals, $\Delta\mathrm{CA_{i,t}}$ is current assets in year *t* minus current assets in year *t-1*, $\Delta\mathrm{CHE_{i,t}}$ is cash and cash equivalents in year *t* minus cash and cash equivalent in year *t-1*, $\Delta\mathrm{CL_{i,t}}$ is current liabilities in year *t* minus current liabilities in year *t-1*, and $\Delta\mathrm{STD_{i,t}}$ is short-term debts in year *t* minus short-term debts in year *t-1*
DCF	Absolute values of abnormal cash flows. DCF are the absolute values of the residuals of the following regression by each (Datastream level-six) industry and each year with at least ten observations: $$\frac{CFO_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{1}{A_{i,t-1}}\right) + \beta_2\left(\frac{REV_{i,t}}{A_{i,t-1}}\right) + \beta_3\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$$ Where: $CFO_{i,t}$ is net cash flows from operations; $A_{i,t-1}$ is total opening assets; $REV_{i,t}$ is sales; $\Delta REV_{i,t}$ is sales in year *t* minus sales in year *t-1; i* is firm *i; t* is year; and $\varepsilon_{i,t}$ is the error term.
DDISEXP	Absolute values of abnormal discretionary expenditures. DDISEXP are the absolute values of the residuals of the following regression by each (Datastream level-six) industry and each year with at least ten observations: $$\frac{\mathrm{DISEXP_{i,t}}}{\mathrm{A_{i,t-1}}} = \alpha\frac{1}{\mathrm{A_{i,t-1}}} + \beta_1\frac{\mathrm{REV_{i,t-1}}}{\mathrm{A_{i,t-1}}} + \varepsilon_{\mathrm{i,t}}$$ Where: $DISEXP_{i,t}$ is discretionary expenditures, which equals to R&D expenses plus selling and administrative expenses; A_{it-1} is total

	opening assets; $REV_{i,t-1}$ is sales in year t-1*; i* is firm *i; t* is year; $\varepsilon_{i,t}$ is the error term.
DPROD	Absolute values of abnormal production costs. DPROD are absolute values of the residuals of the following regression by each (Datastream level-six) industry and each year with at least ten observations: $$\frac{\mathrm{PROD_{it}}}{\mathrm{A_{i,t-1}}} = \alpha \frac{1}{\mathrm{A_{i,t-1}}} + \beta_1 \frac{\mathrm{REV_{i,t}}}{\mathrm{A_{i,t-1}}} + \beta_2 \frac{\Delta\mathrm{REV_{i,t}}}{\mathrm{A_{i,t-1}}} + \beta_3 \frac{\Delta\mathrm{REV_{i,t-1}}}{\mathrm{A_{i,t-1}}} + \varepsilon_{\mathrm{i,t}}$$ Where: $PROD_{i,t}$ is production costs*,* which equals to sum of cost of goods sold and change in inventories from year *t-1* to year *t*; $REV_{i,t}$ is sales; ΔREV_{it} is sales in year *t* minus sales in year *t-1*; ΔREV_{it-1} is sales in year *t-1* minus sales in year *t-2*; A_{it-1} is total opening assets; *i* is firm *i; t* is year; $\varepsilon_{i,t}$ is the error term.
DWAC	Absolute values of discretionary working capital accruals (DWAC) estimated by the modified-Jones models (Jones, 1991; Dechow et al., 1995) for each (Datastream level-six) industry and each year with at least ten observations. $$DWCA_{i,t} = \left| \frac{WAC_{i,t}}{A_{i,t-1}} - \left[\hat{\alpha} + \hat{\beta}_1 \left(\frac{1}{A_{i,t-1}} \right) + \hat{\beta}_2 \left(\frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} \right) + \hat{\beta}_3 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) \right] \right|;$$ where $\hat{\alpha}, \hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3$ are coefficients estimated by the model: $$\frac{WAC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1 \left(\frac{1}{A_{i,t-1}} \right) + \beta_2 \left(\frac{\Delta REV_{i,t}}{A_{i,t-1}} \right) + \beta_3 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) + \varepsilon_{i,t};$$

	Where: $WAC_{i,t} = (\Delta CA_{i,t} - \Delta CHE_{i,t}) - (\Delta CL_{i,t} - \Delta STD_{i,t})$; where $WAC_{i,t}$ is working capital accruals, $\Delta CA_{i,t}$ is current assets in year *t* minus current assets in year *t-1*, $\Delta CHE_{i,t}$ is cash and cash equivalents in year *t* minus cash and cash equivalent in year *t-1*, $\Delta CL_{i,t}$ is current liabilities in year *t* minus current liabilities in year *t-1*, and $\Delta STD_{i,t}$ is short-term debts in year *t* minus short-term debts in year *t-1*
FSD_SCORE	Mean absolute deviation of the first digits of figures reported in financial statements of firm *i* in year *t* from what are expected by Benford's Law. $FSD\_SCORE_{i,t} = \frac{\sum_{d=1}^{9} \lvert OBSERVED_{d,i,t} - EXPECTED_d \rvert}{9}$; Where: $FSD\_SCORE_{i,t}$ is the mean absolute deviation of the first digits of figures reported in financial statements from what are expected by Benford's Law; $OBSERVED_{d,i,t}$ is the observed (actual) probability of the first digit *d*; $EXPECTED_d$ is the expected probability of the first digit *d* as defined by Benford's Law; *d* = 1, 2, …, 9; *i* is firm *i;* and *t* is year.
KS	The maximum cumulative absolute deviation of the first digits of items reported in financial statements from that expected by Benford's Law $KS_{i,t} = max\{\lvert OD_{1,i,t} - ED_1 \rvert, \lvert (OD_{1,i,t} + OD_{2,i,t}) - (ED_1 + ED_2) \rvert, \ldots, \lvert (OD_{1,i,t} + OD_{2,i,t} + \cdots + OD_{9,i,t}) - (ED_1 + ED_2 + \cdots + ED_9) \rvert\}$

	Where $OD_{d,i,t}$ is the cumulative observed probability of the first digit d (d = 1, 2, …, 9) of firm i in year t; ED_d is the expected probability of the first digit d (d = 1, 2, …, 9), as defined by Benford's Law.
REM	Total real earnings management. REM = DCF + DPROD + DDISEXP
Control variables	
aACIND	industry-adjusted audit committee independence, where audit committee independence is the percentage of independent members in an audit committee. Industry-adjusted values equal to firm values minus the means of the corresponding industry-year.
aBDIND	industry-adjusted board independence, where board independence is the percentage of independent directors on a board.
aLEV	The industry-adjusted leverage*;* where leverage (LEV) equals to the sum of long-term debts and short-term debts, scaled by total assets.
aLOGMBT	the industry-adjusted market-to-book ratio, where the market-to-book ratio *(LOGMTB)* is the natural log of the ratio of market value divided by book value of equity.
aLOGMVE	the industry-adjusted firm size, where firm size *(LOGMVE)* equals to natural log of the market value of equity.
aNOA	the industry-adjusted net operating asset ratio (NOA)*;* where $NOA = [CEQ + (DLTT + DLC) - CHE]/REV$, where: CEQ is total book

	value of equity; DLTT is long-term debts; DLC is short term debts; CHE is cash and cash equivalent; REV is sales.
AUDIT	equals to one if a firm is audited by a Big Four audit firm, zero otherwise.
CYCLE	Business life cycle is calculated based on Dickinson (2011), which equals to one if a firm has negative CFO, negative CFI and positive CFF (young firm), or has positive CFO, negative CFI and positive CFF (growth firm), and zero if a firm as positive CFO, negative CFI and negative CFF (mature firm); where CFO is cash flows from operating activities, CFI is cash flows from investing activities, and CFF is cash flows from financing activities.
DISTRESS	equals to one if ZSCORE is negative, zero otherwise; where ZSCORE following Taffler (1983) is calculated as follows: $\mathrm{ZSCORE} = 3.2 + 12.18 * \mathrm{X}_1 + 2.50 * \mathrm{X}_2 - 10.68 * \mathrm{X}_3 + 0.029 * \mathrm{X}_4$; where $\mathrm{X}_1 = \frac{\text{Profit before tax}}{\text{current liabilities}}$; $\mathrm{X}_2 = \frac{\text{Current assets}}{\text{Total liabilities}}$; $\mathrm{X}_3 = \frac{\text{Current liabilities}}{\text{Total assets}}$; $\mathrm{X}_4 = \frac{(\text{Quick assets} - \text{Current liabilities})}{(\text{Sales} - \text{Pretax income} - \text{Depreciation})/365}$
INCENTIVE	equity-based incentives of CEOs. $INCENTIVE = \frac{ONEPCT}{(ONEPCT + SALARY + BONUS)}$ $ONEPCT = 0.01\ x\ PRICE\ x\ (SHARE + OPTION)$ Where: $INCENTIVE$ is equity-based incentives of CEOs; $ONEPCT$ is change in CEOs' equity holdings corresponding to the change in

	stock price by one percent; $PRICE$ is share price at the end of fiscal year; $SHARE$ is shares held by CEOs; $OPTION$ is options held by the CEOs; $SALARY$ is total cash salary CEOs receive; and $BONUS$ is cash bonus CEOs receive. Compensation data are manually collected in Bloomberg database.
M&A	equals to one if a firm announces a share-financed merger and acquisition deal, zero otherwise.
SEO	equals to one if a firm issues a significant portion of equity (outstanding shares increase at least 5 percent and proceeds from equity issuance are positive), zero otherwise.

Chapter 4: ACCOUNTING CONSERVATISM AND BANKING EXPERTISE ON BOARDS OF DIRECTORS

Abstract

This chapter examines the role of banking expertise on the board of directors on accounting conservatism, another aspect of earnings quality. I provide an innovative way to measure banking expertise based on the working history in banks of all individual directors on the board. I argue that directors with banking expertise would have an information advantage about the market-level demand for accounting conservatism; hence, having them on the board can help non-financial firms avoid excessive conservatism. Moreover, directors with banking expertise often possess an interpersonal network in the banking industry that can act as a private communication channel in debt contracting, resulting in less demand for accounting conservatism at the firm-specific level. I find that accounting conservatism is negatively affected by banking expertise on the board. Also, the evidence shows that banking expertise on the board has a more pronounced impact on accounting conservatism when firms have high bankruptcy risk, and when firms have high financial leverage. The evidence has some implications for boards of directors.

Keywords: accounting conservatism, banking expertise, boards of directors

4.1. Introduction

Accounting conservatism is major debt contracting mechanism (Basu, 1997; Watts, 2003a; Mora and Walker, 2015). Accounting conservatism results in lower book values relative to economic (or neutral) values of net assets due to lower verification requirements for the recognition of losses relative to gains (Mora and Walker, 2015). Therefore, it facilitates the violation of debt covenants, which usually are based on accounting numbers, so that debtholders may take proactive actions, such as debt renegotiation or restructuring, to protect their interests (Ahmed et al., 2002; Watts, 2003a; Nikolaev, 2010). Hence, it is in the debtholders' main interest to demand accounting conservatism.

Recently, previous studies indicate that the demand for accounting conservatism is affected by the presence of a banker on the board of directors, but the evidence is mixed. On the one hand, Erkens et al. (2014) show that executives of lending banks serving on boards of directors of borrowing firms (affiliated bankers) can act as a private channel to provide lending banks with the creditworthiness of borrowing firms, leading to a decline in accounting conservatism. Thus, affiliated bankers help borrowing firms avoid costs associated with accounting conservatism (e.g., Nash et al., 2003; Chava and Roberts, 2008; Nini et al., 2012; Kravet, 2014; Bhaskar et al., 2017; Gao et al., 2017). On the other hand, Bonetti et al. (2017) document a positive relationship between accounting conservatism and the presence of unaffiliated bankers on the board, e.g. those who are ex-bankers or bankers from non-lending banks, during the mandatory IFRS adoption of international financial reporting standards (IFRS) in

Europe. However, Erkens et al. (2014) and Bonetti et al. (2017) do not examine cases where a firm employs both an affiliated and an unaffiliated banker on the board. Also, they fail to consider the importance of working history of all individual directors on the board, who might have in-depth knowledge about debt market and therefore know how much accounting conservatism is needed for debt monitoring.

In this paper, I examine whether it is not just the presence of a banker on the board that matters, but the levels of banking expertise on the board that makes a difference. I argue that banking expertise on the board helps to reduce accounting conservatism. First, because directors who have worked in the banking industry for many years may provide boards of directors with information about market-level demand for accounting conservatism so that borrowing firms can avoid excessive accounting conservatism. Borrowing firms may prefer having directors with banking expertise for debt contracting because they do not face the conflicts of interests between shareholders and debtholders, so that they could help to mitigate costs related to the presence of an affiliated banker (e.g., Stiglitz and Weiss, 1981; Rajan, 1992; Kracaw and Zenner, 1998; Burak Güner, Malmendier, and Tate, 2008; Hilscher and Şişli-Ciamarra, 2013). Second, directors with banking expertise might bring an interpersonal network in the banking industry (Engelberg et al., 2012), which can act as a private information-sharing channel to provide debtholders with better financial information about borrowing firms for debt monitoring, the intuition promoted by Erkens et al. (2014). This argument is consistent with previous evidence showing that an interpersonal network of directors is important to access debt markets, such as raising debts with lower costs and having better subsequent stock performance (Engelberg et al., 2012). Third, I expect to provide an alternative explanation for the relationship between boards of directors and accounting conservatism. Accounting conservatism is not necessary a good organisational outcome because it can lead to biased financial statements (Mora and Walker, 2015; Glover and Lin, 2018) and reduce shareholders' wealth (Beneish and Press, 1993; Nash et al., 2003; Bhaskar et al., 2017; Gao et al., 2017). If banking expertise contributes to a stronger board of directors, it is possible that it helps to reduce costly accounting conservatism. In short, I hypothesise that banking expertise on the board negatively affects accounting conservatism.

To test the hypotheses of the study, I utilise data on the working history of individual directors on the board of companies listed on the London Stock Exchange from 2005 to 2012. I measure banking expertise on the board by using (i) the total number of years all directors on the board have worked as executives in banks, (ii) the total number of banks for which all directors on the board have worked as executives, and (iii) the presence of at least one director on the board who has worked as an executive in a bank. I calculate firm-year accounting conservatism following previous studies (Basu, 1997; Khan and Watts, 2009; García Lara et al., 2016). The baseline regression results show that accounting conservatism is negatively correlated with the measures of banking expertise on the board. The relationship is statistically and economically significant. The findings hold strongly for various robustness checks, namely alternative measures of firm-year accounting conservatism and banking expertise on the board, the propensity score matching method to deal with confounding factors, and alternative methodologies to estimate the effect of banking expertise on accounting conservatism. In general, the evidence supports the hypothesis that banking expertise on the board helps to reduce accounting conservatism. In final analyses, I investigate the impact of bankruptcy risk and financial leverage on the link between banking expertise and accounting conservatism. I conjecture and find that banking expertise on the board has more pronounced impacts on accounting conservatism when firms have high bankruptcy risk (low ZSCORE) and when firms have high financial leverage.

The research makes the following contributions to the existing literature. First, I offer an innovative way to measure banking expertise based on the working history in the banking industry of all directors on the board, which is not considered in recent studies on the effect of the presence of affiliated bankers (Erkens et al., 2014) and unaffiliated bankers (Bonetti et al., 2017) on accounting conservatism. Second, the research sample is different from that of Erkens et al. (2014) and Bonetti et al. (2017). In contrast with Erkens et al. (2014), I do not require that the firms in the sample have an outstanding lending contract with affiliated banks. Thus, the findings of this study may be more generalised. Third, because the research period in this study is the post-IFRS adoption (2005) period in the United Kingdom (UK), change in accounting conservatism is unlikely caused by the shift from local to international accounting standards, as documented in the work of Bonetti et al. (2017).

The results have some implications for boards of directors. The evidence suggests that boards of directors should consider the benefits of having directors with banking expertise on the board. However, I do not recommend that the board should differentiate between directors who have many years of working experience in the banking industry from directors who have worked for many banks, because both are relevant in reducing costly accounting conservatism.

The remaining part of the paper proceeds as follows. Section 4.2 provides relevant literature and hypothesis development. Section 4.3 explains the methodology, including sample selection, measures of banking expertise and accounting conservatism, and regression models. Section 4.4 presents findings and discussions. Section 4.5 provides concluding remarks.

4.2. Literature review and hypothesis development

4.2.1. Accounting conservatism and bankers on boards

Previous studies show that, together with debt covenants, accounting conservatism can be used as another mechanism to mitigate the conflicts of interests of managers and shareholders with debtholders (Ahmed et al., 2002; Watts, 2003a; Nikolaev, 2010). Debt covenants help to transfer control rights from shareholders to debtholders in certain situations, e.g. when borrowing firms face financial distress, so that debtholders may take appropriate actions to protect themselves in a timely manner (Watts, 2003a). Accounting conservatism, which involves the recognition of all possible losses but not unverifiable gains, results in lower book values relative to economic (or neutral) values of net assets (Basu, 1997; Watts, 2003a; Mora and Walker, 2015). It facilitates the violation of debt covenants, so that debtholders may take proactive actions, e.g. debt renegotiation or restructuring, to protect themselves (Watts, 2003a). Although accounting conservatism can be beneficial for firms (Ahmed et al., 2002; Beatty et al., 2008; Zhang, 2008; Nikolaev, 2010; García Lara et al., 2011; Louis et al., 2012; García Lara et al., 2016; Kim and Zhang, 2016), there is emerging evidence that it is costly for borrowing firms (Nash et al., 2003; Chava and Roberts, 2008; Nini et al., 2012; Bhaskar et al., 2017; Gao et al., 2017). [22]

Recently, the literature documents that having a banker on the board of directors affects the level of conservatism, but the evidence is mixed (e.g., Erkens et al., 2014; Bonetti et al., 2017). On the one hand, the existing evidence indicates that board members, who are working as executives for lending banks (affiliated bankers), can serve as an alternative mechanism to mitigate the agency problems of debts (Kroszner and Strahan, 2001; Byrd and Mizruchi, 2005; Dittmann, Maug, and Schneider, 2010; Erkens et al., 2014). Kroszner and Strahan (2001) find that affiliated bankers on the board of large firms are actively involved in debt monitoring. Byrd and Mizruchi (2005) also show that the debt ratio is negatively associated with the existence of affiliated bankers on the board, suggesting that affiliated bankers play the monitoring role in borrowing firms. Erkens et al. (2014) provide evidence that affiliated bankers on the board lead to a decrease in accounting conservatism in borrowing firms. They explain that the affiliated bankers on the board provide lending banks with better information for monitoring debt contracts so that the lending banks can take

[22] See Chapter 2, Section 2.3, for a comprehensive review of demand for accounting conservatism and its costly consequences.

appropriate disciplinary actions, such as debt renegotiation in a timelier manner, resulting in less demand for accounting conservatism. This private channel can help borrowing firms avoid costs related to accounting conservatism, as documented in previous studies (Smith and Warner, 1979; Beneish and Press, 1993; Nash et al., 2003; Chava and Roberts, 2008; Nini et al., 2012; Kravet, 2014; Bhaskar et al., 2017; Gao et al., 2017).

On the other hand, Bonetti et al. (2017) examine the effect of unaffiliated bankers on boards, such as those who are currently working or used to work for banks that do not have a lending contract with the firm, on accounting conservatism before and after the mandatory IFRS adoption in Europe. They find that, compared with firms that do not have unaffiliated bankers on the board, firms that have unaffiliated bankers on the board exhibit higher accounting conservatism in the post-IFRS period. The authors argue that, unlike affiliated bankers, unaffiliated bankers do not face the conflicts of interests between shareholders and debtholders so that they contribute to strong boards of directors that are more committed to providing higher accounting conservatism (Ahmed and Duellman, 2007; García Lara, García Osma, et al., 2009a).

In general, previous studies provide mixed evidence on how bankers on the board of directors contribute to the use of accounting conservatism. However, Erkens et al. (2014) and Bonetti et al. (2017) do not examine cases where a firm has both an affiliated banker and an unaffiliated banker on the board. Also, there are increasing concerns that having bankers on the board as a debt monitoring mechanism is costly for borrowing firms. Affiliated bankers on the board potentially constrain risky investment, which may be preferred by shareholders (Stiglitz and Weiss, 1981). Firms with affiliated bankers on the board are more likely to make acquisitions that are favourable for lenders but damage shareholders' value (Burak Güner et al., 2008; Hilscher and Şişli-Ciamarra, 2013). In the presence of information asymmetry, the conflicts of interests between shareholders and debtholders may result in rent extraction from the banks having a close relationship with firms (Rajan, 1992; Kracaw and Zenner, 1998). Kracaw and Zenner (1998) also show that the renewal of loans provided by the affiliated banks, which have executives who are also serving on the board of borrowing firms, leads to negative reactions of the stock market. Moreover, the monopoly of information may arise if a firm has a close relationship with a bank (Rajan, 1992; Kracaw and Zenner, 1998). The affiliated bank may take advantage of the information-based monopoly to match the exact cost of debts with the risk of the project (Leland and Pyle, 1977). Rajan (1992) indicates that banks without superior information from a close relationship with firms are less likely to compete for lending opportunities. The reason may be that, if banks with inferior information want to win the competition to provide loans for borrowing firms, they may overpay due to uncertainty in estimating borrowers' cash flows (Kagel and Levin, 1986). This leads to my argument that not just the presence of bankers on boards of directors that matters; banking expertise on the board also makes a difference.

4.2.2. The role of banking expertise on boards of directors

In this study, I believe that it is not just the presence of bankers on boards of directors that matters; banking expertise on the board also makes a difference. I augment the concept by examining the levels of banking expertise on the board. I measure banking expertise in several different ways by using (i) the total number of years all directors on the board have worked as executives in banks, (ii) the total number of banks for which all directors on the board have worked as executives, and (iii) the presence of at least one director on the board who has worked as an executive in a bank. The measures of banking expertise are important because individual directors may have different working histories so that they can provide the board with varying levels of banking expertise. Additionally, the aggregate measures of banking expertise possibly explain the net effect of bankers on the board on accounting conservatism, given the mixed evidence documented by Erkens et al. (2014) and Bonetti et al. (2017). I hypothesise that banking expertise on the board helps to reduce accounting conservatism for several reasons.

Firstly, I argue that boards of directors with banking expertise would have an information advantage about the market-level demand for conservatism; hence, having them on the boards can help non-financial firms avoid excessive accounting conservatism. Without banking expertise on the board, borrowing firms might adopt too much accounting conservatism because they are too worried about the costly consequences of debt-covenant violation, which are increasingly documented in previous studies (Beneish and Press, 1993; Nash et al., 2003; Chava and Roberts, 2008; Gigler et al., 2009; Nini et al., 2012; Li, 2013; Denis and Wang, 2014; Kravet, 2014; Bhaskar et al., 2017; Gao et al., 2017). In other words, there would be unnecessary conservatism. With banking expertise on the board, borrowing firms could use accounting conservatism at a needed level so that they may avoid costs related to accounting conservatism. Furthermore, the banking expertise on the board can help firms mitigate the costs associated with the presence of affiliated bankers on the board due to conflicts of interests between shareholders and debtholders (Stiglitz and Weiss, 1981; Rajan, 1992; Kracaw and Zenner, 1998; Burak Güner et al., 2008; Hilscher and Şişli-Ciamarra, 2013).

Secondly, boards of directors with banking expertise often possess an interpersonal network in the banking industry that can act as a private communication channel for debt contracting. Engelberg et al. (2012) find that an interpersonal network of directors of borrowing firms and managers of lending banks, who previously worked or studied together, can help borrowing firms raise debts with lower costs and have better subsequent stock performance. Erkens et al. (2014) show that affiliated bankers on the board can act as a private channel that provides lending banks with better information to take appropriate disciplinary actions in a timelier manner. Therefore, lending banks require less accounting conservatism as a monitoring mechanism. In this study, I argue that all directors who have worked as executives in banks can provide the boards with a network in the banking industry. This private network can also give lenders private information of borrowing firms, because it is directly related to debt markets, resulting in less demand for accounting conservatism at the firm-specific level.

Thirdly, I expect to provide an alternative explanation for the relationship between boards of directors and accounting conservatism. Previous research argues that boards of directors can play the monitoring role, which results in higher organisational outcomes (Larcker et al., 2007). A strong board of directors requires managers to report more conservative earnings, which are beneficial for firms (Ahmed and Duellman, 2007; García Lara, García Osma, et al., 2009a). The presence of bankers on the board contributes to a better monitoring role, resulting in higher accounting conservatism (Bonetti et al., 2017). This argument is based on an important assumption that accounting conservatism is an indication of good organisational outcome and is a result of strong corporate governance. However, there is evidence that the above assumption is questionable. Recent accounting standards remove the requirement of prudence (or conservatism) as a characteristic of financial statements because conservatism can mislead investors about the fundamental performance of reporting firms (Mora and Walker, 2015). In other words, from the accounting standard setters, accounting conservatism can distort the true performance of firms. Therefore, it is possible that a strong board of directors, such as a board with banking expertise, can help to reduce accounting conservatism.

To summarise, I hypothesise that firms with banking expertise on the board exhibit lower accounting conservatism. I provide further explanations on the relationship between boards of directors and accounting conservatism, which would add significantly to the studies of Erkens et al. (2014) and Bonetti et al. (2017). The hypothesis is as follows:

H1: Ceteris paribus*, the banking expertise on the board of directors is negatively associated with accounting conservatism.*

4.3. Data and methodology

4.3.1. Data

I use a sample of all companies (both dead and alive) listed on the London Stock Exchange from 2005 to 2012. I remove financial and utility firms as they are highly regulated firms so that motivations for accounting conservatism may be different (see, e.g., Watts, 2003a). The sample covers the period following the mandatory IFRS adoption in the United Kingdom[23] so that I can control for changes in accounting conservatism due to changes in accounting standards (see, e.g., Bonetti et al., 2017). To mitigate the influence of outliers on the estimation of accounting conservatism, I follow Khan and Watts (2009) to delete firms ranked annually in the top 1st and 99th percentiles of earnings, depreciation, returns, size, market-to-book ratio, and leverage in each fiscal year. I derive an initial sample of 3,428 firm-year observations with sufficient data for the calculation of all variables in the main regression models. Table 4-1 shows the sample selection procedure.

Table 4-1: Sample selection procedure

Procedure	***Firm-year observations***
Datastream's firm-year observations from 2005 to 2012 (excluding financial, insurance and utility firms)	24,168
Less:	
- Observations with missing share price and financial data for measures of accounting conservatism	-14,692

[23] European countries, including the United Kingdom, adopted the IFRS in 2005.

- Observations where the share price is less than 0.5 pence	-4,120
- Observations where book values of equity are less than 0.5 million	-226
- Observations where financial statements are not in Sterling Pound	-14
- Observations with missing data for financial expertise of boards of directors	-1,688
Final sample	3,428

4.3.2. Measures of banking expertise

This section presents how I construct data for banking expertise of the board of directors. Based on the list of companies downloaded from Datastream, I firstly search for a list of directors for each company in each fiscal year in the Bloomberg database. Then I search for the working history of each board member in Bloomberg using the full name of directors and the name of companies in which directors are currently serving on the boards (if there is no result, I omit the first name and middle name of the director). For each director, I compile a list of companies he/she has worked for in the past. If I cannot find a director's working history in Bloomberg, I use the same searching strategy as explained above in the Financial Times, then on LinkedIn. For the remaining directors who are still missing, I download the corresponding annual reports from Key Note and scan the reports for any information on the directors working history. I scan the working history of each director to determine whether a director has current or previous working experience in a bank, and I document the working position (if available). I determine a director as having working experience in a bank if at least one of the companies the director has worked for is on the 'List of

Banks' provided by the Bank of England (Bank of England, 2016)[24] or has the keywords 'bank', 'BANK', 'banks', or 'BANKS' in its name. I also require that the working position in banks is executive, which is defined as the position from the head of a division and above, excluding the non-executive chairman, independent director, supervisory board member, and other roles that are not directly involved in bank business. If I cannot identify the working position, I assume it is not an executive role.

For each company, I capture the banking expertise of all directors on the board who have served on the board of firms for at least three months to make sure that directors have a significant influence on the board. I measure banking expertise in three different ways. The first measure is the total number of years all directors on the board have worked as executives in banks ($yEXPERTISE$), and I refer to this variable as cumulative banking expertise on the board. A higher $yEXPERTISE$ indicates higher banking expertise on the board, because individual directors may accumulate banking expertise during many years working as executives in banks. The second measure is the total number of banks for which all directors on the board have worked as executives ($aEXPERTISE$), and I refer to this variable as industry-level banking expertise on the board. A higher $aEXPERTISE$ indicates higher banking expertise on

[24] Our measure of directors' working experience in the banking industry is reasonably reliable. If a director has worked for a bank outside the UK, the name of the bank may also be included in the list, because London has been known as one of the leading financial centres in the world for many years.

the board at the industry level, because working in different banks may help individual directors gain market-level banking expertise. While $yEXPERTISE$ and $aEXPERTISE$ are the aggregate measures of levels of banking expertise on the board, I have the third measure for the presence of banking expertise on the board ($EXPERTISE$), which is equal to one if a company has at least one director on the board who has worked as an executive in a bank, and zero otherwise. $EXPERTISE$ indicates whether the board has banking expertise and captures both bankers and ex-bankers.

4.3.3. The measure of accounting conservatism

Prior research shows that one of the most cited models to estimate accounting conservatism is the model offered by Basu (1997) (Ryan, 2006; Ball et al., 2013b). In this model, the asymmetric timeliness of bad news over good news is used as a measure of accounting conservatism. However, a significant disadvantage of this model is it is less efficient to test hypotheses at the firm or industry levels because it can only estimate the measure of accounting conservatism at the market level in each year (Ryan, 2006; Khan and Watts, 2009). Based on the work of Basu (1997), Khan and Watts (2009) develop a model to estimate firm-year conservatism. They develop empirical measures of the timeliness of good news (G_SCORE) and the incremental timeliness of bad news over good news (C_SCORE) based on firm characteristics (financial leverage, firm size, and market-to-book ratio), which are showed in the literature to be linked with accounting conservatism. Later, García Lara et al. (2016) further improve the measure of accounting conservatism based on the work of Basu (1997) and Khan and Watts (2009). García Lara et al. (2016) incorporate the measure of the asymmetric timeliness of bad news over good news and the measure of the timeliness of good news together, and they refer the new measure as total conservatism.

For the purpose of this study, I use the measure of total accounting conservatism following García Lara et al. (2016), which is based on Basu (1997) and Khan and Watts (2009), because the banking expertise of the boards may change across firms, industries and time, and because total conservatism is better at capturing the total effect of conservative accounting on earnings. The use of firm-year conservatism is also documented in the work of Bonetti et al. (2017), which studies accounting conservatism and bankers on boards surrounding the mandatory adoption of IFRS in the EU.[25] The remaining part of this section describes the calculation of total conservatism following Basu (1997), Khan and Watts (2009), and García Lara et al. (2016).

In the model of Basu (1997), the asymmetric timeliness of bad news over good news is calculated as follows:

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[25] A great deal of previous research uses Khan and Watts (2009) measure to study the relationship of accounting conservatism with director characteristics (Ahmed and Duellman, 2007) managerial overconfidence (Lafond and Roychowdhury, 2008) and corporate lobbying (Kong, Radhakrishnan, and Tsang, 2017), to name just a few.

Equation 4-1: Basu (1997) model

$$EARN_{i,t} = \beta_1 + \beta_2 D_{i,t} + \beta_3 RET_{i,t} + \beta_4 D_{i,t} * RET_{i,t} + \varepsilon_{i,t}$$

Where: $EARN_{i,t}$ is net income before extraordinary items, scaled by opening market value of equity; $RET_{i,t}$ is buy-and-hold stock returns over the fiscal year; $D_{i,t}$ is a dummy variable that equals one if $RET_{i,t} < 0$, and zero otherwise; i represents company i and t represents fiscal year t. The coefficient β_3 is the measure of good news timeliness. The coefficient β_4 is a measure of accounting conservatism, which is the incremental timeliness for bad news over good news. $\beta_3 + \beta_4$ is the total timeliness of bad news. In the model, β_3 and β_4 are expected to be positive. Regression (1) is run for each year in the sample.

Based on the model of Basu (1997), Khan and Watts (2009) construct the empirical measures of the timeliness of good news ($GSCORE$) and the incremental timeliness of bad news over good news ($CSCORE$) based on firm characteristics as follows: [26]

[26] Khan and Watts (2009)use SIZE, MTB, and LEV in year t to estimate GSCORE and CSCORE. In this paper, I use SIZE, MTB, and LEV in year t-1. I argue that earnings are the incomes of the whole year so that firms may rely on the conditions (characterised by LEV, SIZE, and MTB) in year t-1 to make decisions on how much accounting numbers should be conservative in year t. The idea of using firm characteristics in year t-1 is also stipulated by Ball et al. (2013a). An example of using the same approach to estimate GSCORE and CSCORE is the work of Banker, Basu, Byzalov, and Chen (2012).

Equation 4-2: Khan and Watts (2009)'s calculations of GSCORE and CSCORE

$$GSCORE_{i,t} = \beta_3 = \mu_1 + \mu_2 SIZE_{i,t-1} + \mu_3 MTB_{i,t-1} + \mu_4 LEV_{i,t-1}$$

$$CSCORE_{i,t} = \beta_4 = \gamma_1 + \gamma_2 SIZE_{i,t-1} + \gamma_3 MTB_{i,t-1} + \gamma_4 LEV_{i,t-1}$$

Where: μ_j and γ_j (j = 1-4) are obtained from the following annual cross-sectional regressions:

Equation 4-3: Khan Watts (2009)'s model to estimate firm-year accounting conservatism

$$EARN_{i,t} = \beta_1 + \beta_2 D_{i,t} + \left(\mu_1 + \mu_2 SIZE_{i,t-1} + \mu_3 MTB_{i,t-1} + \mu_4 LEV_{i,t-1}\right) RET_{i,t} +$$

$$\left(\gamma_1 + \gamma_2 SIZE_{i,t-1} + \gamma_3 MTB_{i,t-1} + \gamma_4 LEV_{i,t-1}\right) D_{i,t} * RET_{i,t} +$$

$$(\delta_1 SIZE_{i,t-1} + \delta_2 MTB_{i,t-1} + \delta_3 LEV_{i,t-1} + \delta_4 D_{i,t} * SIZE_{i,t-1} + \delta_5 D_{i,t} * MTB_{i,t-1}$$

$$+ \delta_6 D_{i,t} * LEV_{i,t-1}) + \varepsilon_{i,t}$$

$SIZE_{i,i-1}$ is the natural log of opening market value of equity; $MTB_{i,i-1}$ is the opening market-to-book ratio; and $LEV_{i,t-1}$ is the sum of opening long-term and opening short-term debts, scaled by the opening market value of equity. The coefficients estimated from Equation 4-3 are used in Equation 4-2 to calculate $GSCORE$ and $CSCORE$.

To estimate total conservatism following García Lara et al. (2016), I add $GSCORE_{i,t}$ and $CSCORE_{i,t}$ together for each company in each year, and I refer to the new variable as $CONS_{i,t}$. The calculation is as follows:

Equation 4-4: García Lara et al. (2016)' calculation of total accounting conservatism

$$CONS_{i,t} = GSCORE_{i,t} + CSCORE_{i,t}$$

After that, I calculate the average of $CONS$ across years t-2, t-1, and t (denoted $aCONS_{i,t}$); rank $aCONS_{i,t}$ of all firms for each year; and divide the ranked values by N+1, where N is the total observations in each rank group. I refer to the new variable as the annual fractional rank of total accounting conservatism, denoted $CONS\_RANK_{i,t}$. $CONS\_RANK_{i,t}$ ranges from 0 to 1, and a higher $CONS\_RANK_{i,t}$ indicates higher accounting conservatism. The use of rank values helps to mitigate nonlinearity concerns and errors in measurements (García Lara et al., 2016; Goh et al., 2017).

To check the validity of firm-year conservatism measures, I follow García Lara et al. (2016) and Khan and Watts (2009) and regress the measures of firm-year total accounting conservatism (*CONS* and *CONS_RANK*) on determinants of accounting conservatism, which are firm size (*SIZE*), financial leverage (*LEV*), and market-to-book ratio (*MTB*). For the comparison purpose, I also run regressions between the three-year average of the original *CSCORE* following Khan and Watts (2009) (denoted aCSCORE) and the annual fractional rank of a*CSCORE* (denoted *CSCORE_RANK*) with determinants of accounting conservatism. Based on Khan and Watts (2009), I expect that there is a negative relationship between measures of accounting conservatism and firm size, while there is a positive relationship between measures of accounting conservatism and financial leverage. Market-to-book is also expected to be correlated with measures of accounting conservatism, but the relationship may be either positive (Khan and Watts, 2009) or negative (Roychowdhury and Watts, 2007; García Lara et al., 2016).

Table 4-2 and Table 4-3 reports estimations of the regressions between four measures of accounting conservatism and their determinants in year t-1 and year t, respectively. The findings show that all four measures of firm-year accounting conservatism are highly correlated with firm size, financial leverage, and market-to-book ratio. Especially, adjusted R^2 values and number of significant coefficients are significantly higher in the models which use the annual fractional rank values than in the other models, suggesting that the use of fractional rank values may be more relevant. This is in line with the ideas that the use of rank values helps to mitigate nonlinearity concerns and errors in measurements (García Lara et al., 2016; Goh et al., 2017). In short, the findings show that the measures of firm-year accounting conservatism are valid. In this paper, I use CONS_RANK in main tests and CSCORE_RANK in robustness tests.

Table 4-2: Validity tests of firm-year measures of accounting conservatism against determinants of conservatism in year t

		(a) $CONS_t$		(b) $CONS\_RANK_t$		(c) $CSCORE_t$		(d) $CSCORE\_RANK_t$	
	Predicted signs	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
$SIZE_t$	-	-0.198***	-26.93	-0.116***	-87.78	-0.248***	-32.57	-0.122***	-95.79
LEV_t	+	0.326***	11.10	0.115***	21.80	0.082***	2.68	0.009*	1.73
MTB_t	+	0.002	0.46	0.002**	2.49	0.004	0.82	0.002***	2.93
Constant		2.476***	27.68	1.867***	115.99	3.068***	33.04	1.974***	127.16
Observations		3428		3428		3428		3428	
Adjusted R^2		0.209		0.715		0.245		0.735	

Note: the table reports the validity test of the measures of firm-year accounting conservatism. Each measure of firm-year accounting conservatism is regressed on determinants of conservatism in year t, which are the firm size ($SIZE_t$), financial leverage (LEV_t), and market-to-book ratio (MTB_t).
Column (a) shows the estimations of the following model: $CONS_{i,t} = \alpha + \beta_1 SIZE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 MTB_{i,t} + \varepsilon_{i,t}$.
Column (b) shows the estimations of the following model: $CONS\_RANK_{i,t} = \alpha + \beta_1 SIZE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 MTB_{i,t} + \varepsilon_{i,t}$.
Column (c) shows the estimations of the following model: $CSCORE_{i,t} = \alpha + \beta_1 SIZE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 MTB_{i,t} + \varepsilon_{i,t}$.
Column (d) shows the estimations of the following model: $CSCORE\_RANK_{i,t} = \alpha + \beta_1 SIZE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 MTB_{i,t} + \varepsilon_{i,t}$.
Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 4-3: Validity tests of firm-year measures of accounting conservatism against determinants of conservatism in year t-1

		(a) $CONS_t$		(b) $CONS\_RANK_t$		(c) $CSCORE_t$		(d) $CSCORE\_RANK_t$	
	Predicted signs	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
$SIZE_{t-1}$	-	-0.200***	-28.31	-0.115***	-88.51	-0.256***	-35.67	-0.122***	-102.94
LEV_{t-1}	+	0.099***	9.26	0.022***	11.29	0.067***	6.14	-0.001	-0.68
MTB_{t-1}	+/-	-0.003**	-2.36	-0.000*	-1.90	-0.003**	-2.30	-0.000*	-1.67
Constant		2.576***	29.61	1.887***	117.78	3.168***	35.87	1.971***	135.72
Observations		3428		3428		3428		3428	
Adjusted R^2		0.216		0.705		0.285		0.757	

Note: the table reports the validity test of the measures of firm-year accounting conservatism. Each measure of firm-year accounting conservatism is regressed on determinants of conservatism in year t-1, which are the firm size ($SIZE_{t-1}$), financial leverage (LEV_{t-1}), and market-to-book ratio (MTB_{t-1}).

Column (a) shows the estimations of the following model: $CONS_{i,t} = \alpha + \beta_1 SIZE_{i,t-1} + \beta_2 LEV_{i,t-1} + \beta_3 MTB_{i,t-1} + \varepsilon_{i,t}$.

Column (b) shows the estimations of the following model: $CONS\_RANK_{i,t} = \alpha + \beta_1 SIZE_{i,t-1} + \beta_2 LEV_{i,t-1} + \beta_3 MTB_{i,t-1} + \varepsilon_{i,t}$.

Column (c) shows the estimations of the following model: $CSCORE_{i,t} = \alpha + \beta_1 SIZE_{i,t-1} + \beta_2 LEV_{i,t-1} + \beta_3 MTB_{i,t-1} + \varepsilon_{i,t}$.

Column (d) shows the estimations of the following model: $CSCORE\_RANK_{i,t} = \alpha + \beta_1 SIZE_{i,t-1} + \beta_2 LEV_{i,t-1} + \beta_3 MTB_{i,t-1} + \varepsilon_{i,t}$.

Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively

4.3.4. Main regressions

To examine the association between accounting conservatism and the banking expertise on the board, I run the following regressions:

Equation 4-5: Baseline regression between accounting conservatism and banking expertise on the board

$$CONS\_RANK_{i,t} = \alpha + \beta_1 X_{i,t} + \gamma_j CONTROL_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$$

Where: $CONS\_RANK_{i,t}$ is the annual fractional rank of the average of total accounting conservatism in year t. $X_{i,t}$ can be $yEXPERTISE_{i,t}$, $aEXPERTISE_{i,t}$, or $EXPERTISE_{i,t}$ (used as substitutes). $CONTROL_{i,t}$ is a vector of firm characteristics associated with accounting conservatism. All continuous variables are winsorised at 1st and 99th percentiles in each year. The following part briefly discusses related literature on control variables.

Leverage (LEV) is the first control variable. Prior studies (Watts, 2003a; Ahmed and Duellman, 2007; LaFond and Watts, 2008; García Lara, García Osma, et al., 2009b; Khan and Watts, 2009; García Lara et al., 2016) show that the conflicts of interests between shareholders and debtholders are high in firms with high LEV, so that there is a higher contracting demand for accounting conservatism for firms with higher LEV. I expect that LEV has a positive sign.

Firm size ($SIZE$) is the next control variable. Large companies may have higher litigation demand for accounting conservatism (LaFond and Watts, 2008; Khan and Watts, 2009). However, large companies may need less accounting conservatism because those firms are more visible to the capital markets or have less information asymmetry (Ahmed and Duellman, 2007; LaFond and Watts, 2008; Khan and Watts, 2009). I expect that $SIZE$ has a negative sign, as documented in most empirical evidence (Ahmed and Duellman, 2007; LaFond and Watts, 2008; Khan and Watts, 2009; García Lara et al., 2016).

The next control variable is the market-to-book ratio (MTB). Firms with a high MTB might need more accounting conservatism in response to the increased agency costs resulting from more growth options (LaFond and Watts, 2008; Khan and Watts, 2009). Also, a high MTB is directly associated with understatement (or conservatism) of net assets (Givoly and Hayn, 2000; LaFond and Watts, 2008; Khan and Watts, 2009). However, begining MTB may be negatively correlated with accounting conservatism due to a reduction in loss recognition which results from unrecognition of increase in asset values (Roychowdhury and Watts, 2007; García Lara et al., 2016). Therefore, MTB might be positive or negative.

Following Ahmed and Duellman (2013), I also control for profitability by using cash flows from operations (CFO), which is equal to cash flow from operations in year t scaled by assets at the end of year t. Prior research shows that firms with low profitability are more likely to suffer higher costs related to accounting conservatism;

hence, profitability is positively correlated with accounting conservatism (Ahmed et al., 2002). I expect that CFO has a positive sign.

The next control variable is the firm business cycle ($CYCLE$). The existing literature provides mixed evidence. On the one hand, mature firms are more likely to face high litigation risks so that they demand a high degree of accounting conservatism (LaFond and Watts, 2008; Khan and Watts, 2009). On the other hand, mature firms need less external financing for business expansions (Dickinson, 2011); therefore, they need less accounting conservatism. I calculate $CYCLE$ following Dickinson (2011), which is a dummy variable with the value of one if (i) cash flows from operations in year t are positive and (ii) both cash flows from investing and financing activities in year t are negative (mature firm), and zero otherwise (young or growth firm). I expect that $CYCLE$ is associated with accounting conservatism but do not predict its sign.

Sale growth ($\Delta SALE$) is the next control variable. $\Delta SALE$ is equal to change in sales from year t-1 to year t, scaled by total assets at the end of year t. The evidence is mixed about the effects of $\Delta SALE$ on accounting conservatism. Firms with higher growth have more information asymmetry, which results in more demand for accounting conservatism (LaFond and Watts, 2008). In contrast, studies also document that it is possible that growth may result in less asymmetric timeliness of bad news over good news (Ball et al., 2013a). I expect that $\Delta SALE$ is associated with accounting conservatism but do not predict its sign.

Next, I control for debt issuance ($DEBTISSUE$) and seasoned equity offering (SEO). $DEBTISSUE$ is a dummy variable with the value of one if the change in short-term and long-term debts from the end of year t-1 to the end of year t, scaled by total assets at the end of year t, is positive and more than 5%, and zero otherwise. SEO is a dummy variable with the value of one if a firm increases outstanding shares in year t by at least 5% with positive proceeds from equity issuance, and zero otherwise. As discussed above, debt financing results in higher demand for accounting conservatism as a mechanism for debt monitoring (Watts, 2003a; Erkens et al., 2014; García Lara et al., 2016; Goh et al., 2017). However, in a recent paper, Goh et al. (2017) show that accounting conservatism is positively correlated with the choice of equity issuance versus debt issuance when firms need significant external capital. Also, recent research (Kim, Li, Pan, and Zuo, 2013) provides empirical evidence that firms with $SEOs$ use accounting conservatism to reduce the negative impact of information asymmetry on returns around SEO announcements. Therefore, I expect that SEO have a positive sign but do not expect a sign for *DEBTISSUE*. Variable calculations are presented in the Appendix at the end of this chapter.

If β_1 in the Equation 4-5 is negative and significant, it is evidence of a negative association between accounting conservatism and the banking expertise on the board in line with the hypothesis.

4.4. Findings and discussions

4.4.1. Descriptive statistics and correlations

Table 4-4 shows descriptive statistics of the selected variables. Firm characteristics' statistics are similar to the findings from prior research that uses similar data (e.g., Goh and Gupta, 2016). The statistics show that the sample has more young and growth firms than mature firms (median of $CYCLE$ is 0) and more firms that do not have seasoned equity offering or debt issuance in the fiscal year than firms that do (medians of SEO and $DEBTISSUE$ are 0). In addition, the descriptive statistics indicate that y$EXPERTISE$ has a minimum of 0 and a maximum of 42. This means that the number of years that all directors on the board have worked as executives in banks can reach 42 years. On average, the boards have 2.57 years of experience in the banking industry (MEAN of $yEXPERTISE$). Similarly, the statistics show that the largest number of banks for which all directors on the board have worked as executives is 6 (MAX of $aEXPERTISE$), and, on average, all directors on the board have worked for 0.44 banks (MEAN of $aEXPERTISE$). Moreover, the mean and median of $EXPERTISE$ are 0.23 and 0, respectively, suggesting that more observations do not have banking expertise on the board than observations that do. Those impressive statistics suggest that banking expertise could make a difference in accounting practices, e.g. the use of accounting conservatism which is under investigation in this study.

Table 4-5 reports differences in firm characteristics, firm-year accounting conservatism, and banking expertise on the board between two groups: observations that have banking expertise on the board (*EXPERTISE* = 1) and observations that do not have banking expertise on the board (*EXPERTISE* = 0). First, I find that accounting conservatism is lower in groups of observations with banking expertise on the board than in those without banking expertise on the board, and mean differences in accounting conservatism between two groups are statistically significant. Second, further statistics on $yEXPERTISE$ and $aEXPERTISE$ indicate that the means of cumulative expertise and industry-level banking expertise of the first group are 11.23 and 1.92, respectively, while those of the second group equal 0 by definition.

Table 4-6 reports Pearson correlations among the selected variables. The negative and significant correlations of $CONS\_RANK$ with $yEXPERTISE$, $aEXPERTISE$ and $EXPERTISE$ suggest that the measures of banking expertise on the board are associated with a reduction in accounting conservatism. The correlations among the independent variables are generally not too high (no pair-wise correlation coefficient is higher than 0.29) and insignificant in many cases. Therefore, it is unlikely that multicollinearity among independent variables is a major concern in this study.

Table 4-4: Descriptive statistics

	N	MEAN	MEDIAN	STD	MIN	MAX
$AT_{i,t}$ (millions)	3428	1,545	192	4,583	0	50,806
$SALE_{i,t}$ (millions)	3428	1,296	188	3,796	0	60,931
$IB_{i,t}$ (millions)	3428	103	8	451	-1,426	6,893
$RET_{i,t}$	3428	0.14	0.07	0.56	-0.98	6.21
$CONS\_RANK_{i,t}$	3428	0.50	0.50	0.29	0.01	0.99
$CSCORE\_RANK_{i,t}$	3428	0.50	0.50	0.29	0.01	0.99
$yEXPERTISE_{i,t}$	3428	2.57	0.00	6.87	0.00	42.00
$mEXPERTISE_{i,t}$	3428	1.05	0.00	2.22	0.00	10.00
$aEXPERTISE_{i,t}$	3428	0.44	0.00	1.04	0.00	6.00
$EXPERTISE_{i,t}$	3428	0.23	0.00	0.42	0.00	1.00
$LEV_{i,t}$	3428	0.32	0.16	0.50	0.00	3.12
$SIZE_{i,t}$	3428	12.16	12.08	2.03	7.63	17.38
$MTB_{i,t}$	3428	2.93	1.94	3.37	0.32	22.83
$CFO_{i,t}$	3428	0.08	0.08	0.11	-0.46	0.34
$\Delta SALE_{i,t}$	3428	0.11	0.07	0.25	-0.62	1.21
$CYCLE_{i,t}$	3428	0.06	0.00	0.24	0.00	1.00
$SEO_{i,t}$	3428	0.10	0.00	0.30	0.00	1.00
$DEBTISSUE_{i,t}$	3428	0.22	0.00	0.42	0.00	1.00
$PPE_{i,t}$	3428	0.44	0.34	0.37	0.01	1.53

Note: The table reports descriptive statistics of selected variables, including the number of observations (N), mean (MEAN), median (MEDIAN), standard deviation (STD), min (MIN), and max (MAX). Definitions of variables are in the Appendix.

Table 4-5: Descriptive statistics by firms with and without banking expertise on the board

	EPXERTISE = 1 (N = 785)					EXPERTISE = 0 (N = 2,643)					T-test	
	MEAN	**MEDIAN**	**STD**	**MIN**	**MAX**	**MEAN**	**MEDIAN**	**STD**	**MIN**	**MAX**	**MEAN**	**t-statistic**
$AT_{i,t}$ (millions)	3,647	813	7,574	3	50,806	921	131	2,918	0	39,499	-2,726***	-9.87
$SALE_{i,t}$ (millions)	2,853	701	6,137	0	60,931	833	132	2,566	0	41,591	-2,020***	-8.99
$IB_{i,t}$ (millions)	278	40	786	-1,426	6,893	51	5	262	-1,092	6,204	-227***	-7.97
$RET_{i,t}$	0.14	0.09	0.52	-0.90	4.79	0.13	0.06	0.57	-0.98	6.21	-0.008	-0.36
$CONS\_RANK_{i,t}$	0.33	0.26	0.27	0.01	0.99	0.55	0.56	0.28	0.01	0.99	0.217***	19.91
$CSCORE\_RANK_{i,t}$	0.33	0.27	0.27	0.01	0.99	0.55	0.56	0.28	0.01	0.99	0.216***	19.83
$yEXPERTISE_{i,t}$	11.23	8.00	10.45	1.00	42.00	0.00	0.00	0.00	0.00	0.00	-11.232***	-30.11
$mEXPERTISE_{i,t}$	4.60	4.00	2.30	1.00	10.00	0.00	0.00	0.00	0.00	0.00	-4.600***	-55.98
$aEXPERTISE_{i,t}$	1.92	1.00	1.38	1.00	6.00	0.00	0.00	0.00	0.00	0.00	-1.922***	-38.99
$LEV_{i,t}$	0.29	0.16	0.46	0.00	3.12	0.33	0.15	0.52	0.00	3.12	0.044**	2.25
$SIZE_{i,t}$	13.45	13.49	2.01	7.63	17.38	11.78	11.74	1.88	7.63	17.38	-1.670***	-20.77
$MTB_{i,t}$	3.33	2.25	3.57	0.32	22.83	2.81	1.86	3.30	0.32	22.83	-0.526***	-3.68
$CFO_{i,t}$	0.10	0.09	0.09	-0.46	0.34	0.07	0.08	0.12	-0.46	0.34	-0.025***	-6.23
$\Delta SALE_{i,t}$	0.09	0.07	0.20	-0.62	1.21	0.11	0.07	0.27	-0.62	1.21	0.021**	2.36
$CYCLE_{i,t}$	0.07	0.00	0.25	0.00	1.00	0.06	0.00	0.24	0.00	1.00	-0.010	-1.00
$SEO_{i,t}$	0.06	0.00	0.25	0.00	1.00	0.11	0.00	0.32	0.00	1.00	0.048***	4.48
$DEBTISSUE_{i,t}$	0.22	0.00	0.41	0.00	1.00	0.23	0.00	0.42	0.00	1.00	0.012	0.70
$PPE_{i,t}$	0.46	0.37	0.36	0.01	1.53	0.43	0.33	0.37	0.01	1.53	-0.017	-1.04

Note: The table reports descriptive statistics by two groups: firms with banking expertise on the board (EXPERTISE = 1) and without banking expertise on the board (EXPERTISE = 0). The table also shows the mean differences between the two groups and the t-statistics of the t-tests. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 4-6: Correlations

		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
AT$_{i,t}$	**1**	1.00									
SALE$_{i,t}$	**2**	0.86*	1.00								
IB$_{i,t}$	**3**	0.82*	0.71*	1.00							
RET$_{i,t}$	**4**	-0.02	-0.02	0.01	1.00						
CONS_RANK$_{i,t}$	**5**	-0.40*	-0.40*	-0.33*	0.04*	1.00					
CSCORE_RANK$_{i,t}$	**6**	-0.43*	-0.42*	-0.33*	0.05*	0.93*	1.00				
yEXPERTISE$_{i,t}$	**7**	0.31*	0.27*	0.27*	0.01	-0.28*	-0.28*	1.00			
mEXPERTISE$_{i,t}$	**8**	0.27*	0.25*	0.25*	-0.00	-0.28*	-0.28*	0.80*	1.00		
aEXPERTISE$_{i,t}$	**9**	0.29*	0.24*	0.23*	0.01	-0.31*	-0.31*	0.88*	0.71*	1.00	
EXPERTISE$_{i,t}$	**10**	0.25*	0.22*	0.21*	0.01	-0.32*	-0.32*	0.69*	0.87*	0.77*	1.00
LEV$_{i,t}$	**11**	0.08*	0.03*	-0.05*	-0.16*	0.23*	0.05*	-0.03	-0.05*	-0.01	-0.04*
SIZE$_{i,t}$	**12**	0.57*	0.54*	0.46*	0.11*	-0.82*	-0.86*	0.32*	0.32*	0.34*	0.35*
MTB$_{i,t}$	**13**	0.02	0.03	0.09*	0.15*	-0.19*	-0.16*	0.07*	0.07*	0.06*	0.07*
CFO$_{i,t}$	**14**	0.07*	0.08*	0.12*	0.16*	-0.22*	-0.23*	0.10*	0.10*	0.09*	0.09*
ΔSALE$_{i,t}$	**15**	-0.04*	-0.01	-0.02	0.13*	0.02	0.04*	-0.04*	-0.04*	-0.03*	-0.03*
CYCLE$_{i,t}$	**16**	0.02	0.01	0.01	0.02	-0.01	-0.02	0.04*	0.04*	0.03	0.02
SEO$_{i,t}$	**17**	-0.09*	-0.10*	-0.08*	0.05*	0.16*	0.17*	-0.06*	-0.06*	-0.07*	-0.07*
DEBTISSUE$_{i,t}$	**18**	0.04*	0.01	0.02	-0.09*	-0.05*	-0.06*	-0.00	-0.02	0.01	-0.01
PPE$_{i,t}$	**19**	0.07*	0.05*	0.05*	0.01	0.02	-0.03	0.02	0.02	0.01	0.02
(Continued)		**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	
LEV$_{i,t}$	**11**	1.00									
SIZE$_{i,t}$	**12**	-0.04*	1.00								
MTB$_{i,t}$	**13**	-0.18*	0.21*	1.00							
CFO$_{i,t}$	**14**	-0.07*	0.28*	0.04*	1.00						
ΔSALE$_{i,t}$	**15**	-0.08*	0.02	0.10*	0.16*	1.00					
CYCLE$_{i,t}$	**16**	0.02	0.05*	-0.03	0.02	-0.14*	1.00				
SEO$_{i,t}$	**17**	-0.05*	-0.14*	0.03	-0.29*	0.12*	-0.05*	1.00			
DEBTISSUE$_{i,t}$	**18**	0.18*	0.07*	0.05*	-0.08*	0.18*	-0.10*	0.06*	1.00		
PPE$_{i,t}$	**19**	0.17*	0.08*	-0.06*	0.17*	-0.00	-0.04*	-0.06*	0.17*	1.00	

Note: The table reports the Pearson correlation coefficients between selected variables. * is significance at 5%. Definitions of variables are in the Appendix.

4.4.2. Baseline regression results

Table 4-7 reports the results of estimating the main regression (5) between $CONS\_RANK$ and the measures of banking expertise on the board. The table shows that most control variables have expected signs and are statistically significant. The coefficients on $yEXPERTISE$ (column a), $aEXPERTISE$ (column b), and $EXPERTISE$ (column c) are negative and significant (t-statistics are -1.78, -2.28, and -3.16, respectively). The relationships are also economically significant. Also, the relationships are economically significant. For example, in column (a), the coefficient on $yEXPERTISE$ means that when the board has one additional year of banking expertise, $CONS\_RANK$ decreases by 0.00072. Although a one-year increase in $yEXPERTISE$ is associated with only a reduction of 0.144% in $CONS\_RANK$ (=0.00072/0.5, where 0.5 is the mean of $CONS\_RANK$ reported in Table 2), it is more likely that an individual director could work for banks in many years; therefore, the marginal effect of an appointment of a director with banking expertise on the board is significant in economic terms. In column (b), one unit increase in $aEXPERTISE$ is associated with a decrease by 0.00612 (a 1.22% reduction) in $CONS\_RANK$. Also, it is more likely that a director may work for several banks; therefore, the marginal effect of having a director with banking expertise on the board is economically significant. Similarly, in column (c), compared with firms without banking expertise on the board, firms with banking expertise on the board have less accounting conservatism by 0.02127, a 4.25% reduction in $CONS\_RANK$ which is non-trivial.

Table 4-7: Baseline regression results on the relationship between CONS_RANK and measures of banking expertise on the board

	Expected signs	yEXPERTISE (a)		aEXPERTISE (b)		EXPERTISE (c)	
		Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$yEXPERTISE_{i,t}$	-	-0.072*	-1.78				
$aEXPERTISE_{i,t}$	-			-0.612**	-2.28		
$EXPERTISE_{i,t}$	-					-2.127***	-3.16
$LEV_{i,t}$	+	12.280***	21.76	12.295***	21.79	12.263***	21.75
$SIZE_{i,t}$	-	-11.631***	-73.66	-11.596***	-72.65	-11.555***	-72.41
$MTB_{i,t}$	+/-	0.099	1.23	0.097	1.21	0.100	1.24
$CFO_{i,t}$	+	7.282***	2.87	7.127***	2.81	7.111***	2.80
$\Delta SALE_{i,t}$	+/-	5.176***	4.78	5.186***	4.79	5.177***	4.79
$CYCLE_{i,t}$	+/-	4.223***	3.94	4.217***	3.93	4.212***	3.93
$SEO_{i,t}$	+	6.256***	6.91	6.223***	6.88	6.232***	6.89
$DEBTISSUE_{i,t}$	+/-	-2.163***	-3.33	-2.163***	-3.33	-2.189***	-3.37
Constant		1.890***	51.59	1.888***	51.50	1.885***	51.44
Year fixed effects		Yes		Yes		Yes	
Industry fixed effects		Yes		Yes		Yes	
Observations		3428		3428		3428	
Adjusted R^2		0.749		0.749		0.749	

Note: Column (a) reports the findings of the regression: $CONS\_RANK_{i,t} = \alpha + \beta_1 yEXPERTISE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 MTB_{i,t} + \beta_5 CFO_{i,t} + \beta_6 \Delta SALE_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 SEO_{i,t} + \beta_9 DEBTISSUE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

Column (b) reports the findings of the regression: $CONS\_RANK_{i,t} = \alpha + \beta_1 aEXPERTISE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 MTB_{i,t} + \beta_5 CFO_{i,t} + \beta_6 \Delta SALE_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 SEO_{i,t} + \beta_9 DEBTISSUE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

Column (c) reports the findings of the regression: $CONS\_RANK_{i,t} = \alpha + \beta_1 EXPERTISE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 MTB_{i,t} + \beta_5 CFO_{i,t} + \beta_6 \Delta SALE_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 SEO_{i,t} + \beta_9 DEBTISSUE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

4.4.3. Alternative measures of accounting conservatism and banking expertise

4.4.3.1. Alternative measures of firm-year accounting conservatism

In the baseline regression, I use total accounting conservatism following García Lara et al. (2016), which is based on Basu (1997) and Khan and Watts (2009). Although García Lara et al. (2016, p. 236) indicate that their measure of total accounting conservatism is strongly related to determinants of accounting conservatism, the robustness tests employ two alternative measures of firm-year accounting conservatism.

First, I use the measure of asymmetric timeliness of bad news over good news (Khan and Watts, 2009). In other words, I use CSCORE obtained from Equation 4-2 rather than CONS. I also calculate CSCORE_RANK, which is the annual fractional rank of the three-year average of CSCORE, in the same way with the calculation of CONS_RANK. I then use CSCORE_RANK as an alternative measure of firm-year accounting conservatism. Table 4-8 reports the findings of Equation 4-5 where CONS_RANK is replaced by CSCORE_RANK as the dependent variable. The evidence shows that there are negative and significant relationships between CSCORE_RANK with different measures of banking expertise on boards of directors. The results hold that banking expertise on the board of directors has a negative and significant impact on accounting conservatism.

Second, I calculate the negative accumulation of non-operating accruals introduced by Givoly and Hayn (2000). Non-operating accruals do not include accruals from depreciation, amortisation and operating accruals. Instead, non-operating accruals mostly include accruals from items whose timing and amount recognised are affected by the discretion of managers, e.g. bad debt provisions, changes in accounting estimates, disposals of assets, write-downs of assets, revenue deferrals, or restructuring charges. Givoly and Hayn (2000) indicate that the negative accumulation of non-accruals is an indicator of accounting conservatism. They find that the negative accumulation of non-accruals is related to timely recognition of bad news over good news. Similar to CONS_RANK and CSCORE_RANK, I calculate NOACC_RANK which is the annual fractional rank of the three-year average of the negative accumulation of non-operating accruals. The calculation of the negative accumulation of non-operating accruals (NOACC) is as follows:

Equation 4-6: Calculation of negative non-operating accruals:

$$\begin{aligned} NOACC_{i,t} &= -1 * \{TABD_{i,t} - OA_{i,t}\} \\ &= -1 * \{[(NI_{i,t} + DEP_{i,t}) - CFO_{i,t}] \\ &\qquad - [\Delta REC_{i,t} + \Delta\, INV_{i,t} + \Delta\, PREPAID_{i,t} - \Delta\, PAY_{i,t} - \Delta\, TAX_{i,t}]\} \end{aligned}$$

Where: $NOACC_{i,t}$ is negative non-operating accruals; $TABD_{i,t}$ is total accruals before depreciation and amortisation; $OA_{i,t}$ is operating accruals; $NI_{i,t}$ is net income; $DEP_{i,t}$ is depreciation and amortisation; $CFO_{i,t}$ is cash flows from operations; $\Delta REC_{i,t}$ is receivables in year *t* minus receivables in year *t-1*. $\Delta\, INV_{i,t}$ is inventories in year *t* minus inventories in year *t-1*; $\Delta\, PREPAID_{i,t}$ is prepaid expenses in year *t* minus prepaid expenses in year *t-1*; $\Delta\, PAY_{i,t}$ is payables in year *t* minus payables in year *t-1*; $\Delta\, TAX_{i,t}$ is tax payables in year *t* minus tax payables in year *t-1*. All variables are scaled by total assets at the end of year t. i represents company i and t represents fiscal year t.

Table 4-9 reports the findings of Equation 4-5 where CONS_RANK is replaced by NOACC_RANK as the dependent variable. Consistent with the main findings, the results indicate that banking expertise has a negative and significant impact on the negative accumulation of non-operating accruals. In general, using alternative measures of firm-year accounting conservatism, I find collaborative evidence for the hypothesis that banking expertise helps to reduce costly accounting conservatism.

Table 4-8: Alternative measures of firm-year accounting conservatism: CSCORE_RANK

	yEXPERTISE		aEXPERTISE		EXPERTISE	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$yEXPERTISE_{i,t}$	**-0.041**	**-1.04**				
$aEXPERTISE_{i,t}$			**-0.448***	**-1.70**		
$EXPERTISE_{i,t}$					**-1.655****	**-2.50**
$LEV_{i,t}$	**1.116****	**2.01**	**1.125****	**2.03**	**1.100****	**1.98**
$SIZE_{i,t}$	**-12.336*****	**-79.49**	**-12.299*****	**-78.40**	**-12.262*****	**-78.16**
$MTB_{i,t}$	0.160**	2.03	0.159**	2.02	0.161**	2.04
$CFO_{i,t}$	7.519***	3.01	7.410***	2.97	7.392***	2.97
$\Delta SALE_{i,t}$	5.963***	5.60	5.953***	5.60	5.942***	5.59
$CYCLE_{i,t}$	3.569***	3.38	3.573***	3.39	3.571***	3.39
$SEO_{i,t}$	5.326***	5.99	5.295***	5.95	5.299***	5.96
$DEBTISSUE_{i,t}$	-0.528	-0.83	-0.531	-0.83	-0.552	-0.86
Constant	2.006***	55.71	2.004***	55.61	2.000***	55.54
Year fixed effects	Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes	
Observations	3428		3428		3428	
Adjusted R^2	0.757		0.757		0.757	

Note: The table reports the results of the estimation of the relationship between CSCORE_RANK and banking expertise on the boards of directors. I replace CONS_RANK in Equation 4-5 by CSCORE_RANK. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 4-9: Alternative measures of firm-year accounting conservatism: NOACC_RANK

	yEXPERTISE		aEXPERTISE		EXPERTISE	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$yEXPERTISE_{i,t}$	**-0.105**	**-1.43**				
$aEXPERTISE_{i,t}$			**-0.830***	**-1.70**		
$EXPERTISE_{i,t}$					**-3.220*****	**-2.63**
$LEV_{i,t}$	**2.609****	**2.55**	**2.630****	**2.57**	**2.585****	**2.53**
$SIZE_{i,t}$	**-0.147**	**-0.51**	**-0.108**	**-0.37**	**-0.026**	**-0.09**
$MTB_{i,t}$	0.496***	3.38	0.494***	3.37	0.498***	3.40
$CFO_{i,t}$	24.260***	5.20	24.040***	5.16	23.964***	5.14
$\Delta SALE_{i,t}$	28.000***	14.18	28.024***	14.21	27.988***	14.20
$CYCLE_{i,t}$	-11.718***	-6.02	-11.729***	-6.02	-11.731***	-6.03
$SEO_{i,t}$	8.979***	5.45	8.940***	5.42	8.952***	5.44
$DEBTISSUE_{i,t}$	0.298	0.25	0.298	0.25	0.251	0.21
Constant	0.283***	3.79	0.281***	3.75	0.274***	3.67
Year fixed effects	Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes	
Observations	3406		3406		3406	
Adjusted R^2	0.174		0.175		0.175	

Note: The table reports the results of the estimation of the relationship between NOACC_RANK and banking expertise on the boards of directors. I replace CONS_RANK in Equation 4-5 by NOACC_RANK. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

4.4.3.2. An alternative measure of banking expertise

One of my concerns is that the measures of banking expertise, e.g. yEXPERTISE which accumulate the number of years working in the banking industry of all directors on the boards of directors, may inflate the levels of banking expertise, therefore there may be estimation errors. To mitigate this concern, I use the average number of years all directors on the board have worked as executives in banks, denoted mEXPERTISE, as an alternative measure of banking expertise.

Table 4-10 reports the results of the regression Equation 4-5 where the independent variable is mEXPERTISE, and the dependent variable is CONS_RANK, CSCORE_RANK, and NOACC_RANK (used as substitutes). The results show that the coefficient on mEXPERTISE is negative and statistically significant when the dependent variable is CONS_RANK (column a) and NOACC_RANK (column c), while it is still negative when the dependent variable is CSCORE_RANK (column b). In general, the evidence is consistent with the baseline regression results.

Table 4-10: Alternative measures of banking expertise

	CONS_RANK (a)		CSCORE_RANK (b)		NOACC_RANK (c)	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$mEXPERTISE_{i,t}$	-0.255**	-2.04	-0.136	-1.11	-0.445**	-1.96
$LEV_{i,t}$	12.250***	21.70	1.100**	1.98	2.553**	2.49
$SIZE_{i,t}$	-11.622***	-73.71	-12.334***	-79.58	-0.111	-0.39
$MTB_{i,t}$	0.100	1.24	0.160**	2.04	0.497***	3.39
$CFO_{i,t}$	7.306***	2.88	7.530***	3.02	24.304***	5.21
$\Delta SALE_{i,t}$	5.174***	4.78	5.965***	5.60	27.958***	14.17
$CYCLE_{i,t}$	4.236***	3.95	3.574***	3.39	-11.681***	-6.00
$SEO_{i,t}$	6.279***	6.94	5.341***	6.01	9.013***	5.47
$DEBTISSUE_{i,t}$	-2.177***	-3.35	-0.534	-0.84	0.268	0.23
Constant	1.890***	51.63	2.006***	55.76	0.282***	3.77
Year fixed effects	Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes	
Observations	3428		3428		3406	
Adjusted R^2	0.749		0.757		0.175	

Note: The table reports the findings of regressions between the alternative measure of banking expertise on the boards of directors (mEXPERTISE) and three different firm-year measures of accounting conservatism.

Column (a) reports the results of estimating the following regression: $CONS\_RANK_{i,t} = \alpha + \beta_1 mEXPERTISE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 MTB_{i,t} + \beta_5 CFO_{i,t} + \beta_6 \Delta SALE_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 SEO_{i,t} + \beta_9 DEBTISSUE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

Column (b) reports the results of estimating the following regression: $CSCORE\_RANK_{i,t} = \alpha + \beta_1 mEXPERTISE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 MTB_{i,t} + \beta_5 CFO_{i,t} + \beta_6 \Delta SALE_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 SEO_{i,t} + \beta_9 DEBTISSUE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

Column (c) reports the results of estimating the following regression: $NOACC\_RANK_{i,t} = \alpha + \beta_1 mEXPERTISE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 MTB_{i,t} + \beta_5 CFO_{i,t} + \beta_6 \Delta SALE_{i,t} + \beta_7 CYCLE_{i,t} + \beta_8 SEO_{i,t} + \beta_9 DEBTISSUE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

4.4.4. Propensity score matching

Because this research is a non-experimental study, there may be possible confounding factors which may affect both accounting conservatism and the presence of banking expertise on the board (see, e.g., Gow et al., 2016; Shipman et al., 2017). The presence of directors with banking expertise on the board may not be random because it can be affected by firm characteristics (Kroszner and Strahan, 2001; Hilscher and Şişli-Ciamarra, 2013; Kang and Kim, 2017). Similar to the work of Erkens et al. (2014), I construct a propensity score matching sample to eliminate the effect of confounding factors. I firstly classify observations into two groups: observations where firms have directors with banking expertise on the board (treatments) and observations where firms do not have directors with banking expertise on the board (controls). I then run a probit regression to estimate the probability of having directors with banking expertise on the board based on explanatory variables, which are control variables used in the main regressions. The model is as follows:

Equation 4-7: Modelling the probability of having directors with banking expertise on the board

$$EXPERTISE_{i,t} = \alpha + \beta_1 LEV_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 MTB_{i,t} + \beta_4 CFO_{i,t} + \beta_5 \Delta \mathrm{SALE}_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 SEO_{i,t} + \beta_8 DEBTISSUE_{i,t} + \varepsilon_{i,t}.$$

Table 4-11 reports findings of Equation 4-7 modelling the probability of having directors with banking expertise on the board. The findings are broadly similar to those reported in prior studies (Booth and Deli, 1999; Kroszner and Strahan, 2001; Byrd and Mizruchi, 2005; Hilscher and Şişli-Ciamarra, 2013; Kang and Kim, 2017). In particular, I find that directors with banking expertise are more likely to serve on the boards of large firms, and firms with low sales growth.

Based on the conditional odd ratio of having directors with banking expertise on the board, I match each treatment with four controls having the closest odd ratio and a maximum caliper of 0.01. The final matched sample has 2,590 firm-year observations (679 treatments and 1,911 controls). I also perform a simple t-test and find that differences in firm characteristics between the two groups are insignificant at the 1% level in nearly all cases (see Table 4-12).

Table 4-13 reports findings of Equation 4-5, where the dependent variable is CONS_RANK, using the propensity-score-matching sample. The table shows that CONS_RANK is negatively associated with four different measures of banking expertise on boards of directors. The magnitudes of the coefficients on banking expertise are broadly equivalent to those reported in Table 4-7. I find similar evidence that banking expertise has a negative and significant impact on CSCORE_RANK (Table 4-14) and on NOACC_RANK (Table 4-15). In short, the results in this section suggest that the link between the banking expertise on the board of directors and accounting conservatism is less likely affected by confounding factors.

Table 4-11: Probit model to estimate the probability of having directors with banking expertise on the board

	EXPERTISE		
	Coefficient	z-statistic	
$LEV_{i,t}$	-0.0883	-1.61	
$SIZE_{i,t}$	**0.2555**	**18.33**	***
$MTB_{i,t}$	-0.0050	-0.65	
$CFO_{i,t}$	0.0426	0.16	
$\Delta SALE_{i,t}$	**-0.2127**	**-1.86**	*
$CYCLE_{i,t}$	-0.0589	-0.56	
$SEO_{i,t}$	-0.0719	-0.76	
$DEBTISSUE_{i,t}$	-0.0998	-1.57	
Constant	-3.8472	-22.17	
Observations	3,428		
Pseudo R2	0.1172		

Note: The table report findings of the probit regression to estimate the probability of having directors with banking expertise on the board based on explanatory variables. The model is as follows: $EXPERTISE_{i,t} = \alpha + \beta_1 LEV_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 MTB_{i,t} + \beta_4 CFO_{i,t} + \beta_5 \Delta\text{SALE}_{i,t} + \beta_6 CYCLE_{i,t} + \beta_7 SEO_{i,t} + \beta_8 DEBTISSUE_{i,t} + \varepsilon_{i,t}$. Variable definitions are in the Appendix. *, **, *** is significance at 1%, 5%, and 10% respectively.

Table 4-12: Simple t-test for key firm characteristics difference after the propensity score matching procedure

	EPXERTISE = 1 (N = 679)					EXPERTISE = 0 (N = 1,911)					T-test	
	MEAN	MEDIAN	STD	MIN	MAX	MEAN	MEDIAN	STD	MIN	MAX	MEAN	t-statistics
$LEV_{i,t}$	0.29	0.15	0.44	0.00	3.12	0.29	0.15	0.44	0.00	3.12	-0.000	-0.01
$SIZE_{i,t}$	12.43	12.42	1.67	7.63	17.38	12.43	12.42	1.67	7.63	17.38	-0.609*	-7.73
$MTB_{i,t}$	3.00	2.08	3.30	0.32	22.83	3.00	2.08	3.30	0.32	22.83	-0.268	-1.65
$CFO_{i,t}$	0.09	0.09	0.11	-0.46	0.34	0.09	0.09	0.11	-0.46	0.34	-0.006	-1.47
$\Delta SALE_{i,t}$	0.10	0.07	0.24	-0.62	1.21	0.10	0.07	0.24	-0.62	1.21	0.004	0.43
$CYCLE_{i,t}$	0.07	0.00	0.25	0.00	1.00	0.07	0.00	0.25	0.00	1.00	0.002	0.15
$SEO_{i,t}$	0.09	0.00	0.29	0.00	1.00	0.09	0.00	0.29	0.00	1.00	0.019	1.63
$DEBTISSUE_{i,t}$	0.22	0.00	0.41	0.00	1.00	0.22	0.00	0.41	0.00	1.00	-0.007	-0.39

Note: The table reports descriptive statistics of the propensity-score-matching sample by two groups: firms with banking expertise on the board (EXPERTISE = 1) and without banking expertise on the board (EXPERTISE = 0). The table also shows mean differences between the two groups and the t-statistics obtained from the t-tests under the null that the difference is zero. Variable definitions are in the Appendix. * is significance at 5% respectively.

Table 4-13: Propensity-score-matching sample: CONS_RANK and banking expertise on boards of directors

	Expected signs	yEXPERTISE		aEXPERTISE		EXPERTISE		mEXPERTISE	
		Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$yEXPERTISE_{i,t}$	**-**	**-0.117****	**-2.56**						
$aEXPERTISE_{i,t}$	**-**			**-0.887*****	**-2.96**				
$EXPERTISE_{i,t}$	**-**					**-2.569*****	**-3.58**		
$mEXPERTISE_{i,t}$								**-0.316****	**-2.34**
$LEV_{i,t}$	+	14.938***	20.52	14.979***	20.59	14.960***	20.58	14.915***	20.47
$SIZE_{i,t}$	-	-12.384***	-60.53	-12.350***	-60.04	-12.354***	-60.46	-12.406***	-60.88
$MTB_{i,t}$	+	0.244***	2.59	0.243***	2.59	0.248***	2.64	0.245***	2.61
$CFO_{i,t}$	+	4.013	1.26	3.707	1.16	3.585	1.12	3.965	1.24
$\Delta SALE_{i,t}$	+/-	4.462***	3.29	4.525***	3.34	4.589***	3.39	4.508***	3.32
$CYCLE_{i,t}$	+/-	4.037***	3.34	4.046***	3.35	4.016***	3.33	4.030***	3.33
$SEO_{i,t}$	+	6.534***	5.74	6.488***	5.70	6.516***	5.73	6.587***	5.79
$DEBTISSUE_{i,t}$	+	-2.424***	-3.15	-2.416***	-3.14	-2.454***	-3.20	-2.454***	-3.19
Constant		1.981***	43.57	1.979***	43.52	1.981***	43.65	1.985***	43.70
Year fixed effects		Yes		Yes		Yes		Yes	
Industry fixed effects		Yes		Yes		Yes		Yes	
Observations		2590		2590		2590		2590	
Adjusted R^2		0.704		0.704		0.705		0.704	

Note: This table reports the findings of Equation 4-5, where the dependent variable is CONS_RANK, using the propensity-score-matching sample. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 4-14: Propensity-score-matching sample: CSCORE_RANK and banking expertise on the board of directors

	Expected	yEXPERTISE		aEXPERTISE		EXPERTISE		mEXPERTISE	
	signs	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$yEXPERTISE_{i,t}$	**-**	**-0.095****	**-2.11**						
$aEXPERTISE_{i,t}$	**-**			**-0.730****	**-2.46**				
$EXPERTISE_{i,t}$	**-**					**-2.144*****	**-3.02**		
$mEXPERTISE_{i,t}$								**-0.226***	**-1.69**
$LEV_{i,t}$	+	2.358***	3.27	2.391***	3.32	2.376***	3.30	2.345***	3.25
$SIZE_{i,t}$	-	-12.930***	-63.83	-12.901***	-63.34	-12.903***	-63.76	-12.953***	-64.19
$MTB_{i,t}$	+	0.252***	2.71	0.251***	2.70	0.255***	2.75	0.253***	2.71
$CFO_{i,t}$	+	5.704*	1.80	5.453*	1.72	5.350*	1.69	5.655*	1.79
$\Delta SALE_{i,t}$	+/-	5.350***	3.98	5.400***	4.02	5.454***	4.06	5.396***	4.02
$CYCLE_{i,t}$	+/-	3.387***	2.83	3.395***	2.84	3.372***	2.82	3.376***	2.82
$SEO_{i,t}$	+	5.965***	5.29	5.927***	5.26	5.949***	5.28	6.009***	5.33
$DEBTISSUE_{i,t}$	+	-0.382	-0.50	-0.375	-0.49	-0.406	-0.53	-0.405	-0.53
Constant		2.087***	46.35	2.085***	46.31	2.087***	46.43	2.090***	46.48
Year fixed effects		Yes		Yes		Yes		Yes	
Industry fixed effects		Yes		Yes		Yes		Yes	
Observations		2590		2590		2590		2590	
Adjusted R^2		0.705		0.705		0.705		0.704	

Note: This table reports the findings of Equation 4-5, where the dependent variable is CSCORE_RANK, using the propensity-score-matching sample. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 4-15: Propensity-score-matching sample: NOACC_RANK and banking expertise on the board of directors

	Expected signs	yEXPERTISE		aEXPERTISE		EXPERTISE		mEXPERTISE	
		Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$yEXPERTISE_{i,t}$	**-**	**-0.085**	**-1.06**						
$aEXPERTISE_{i,t}$	**-**			**-0.679**	**-1.30**				
$EXPERTISE_{i,t}$	**-**					**-3.155****	**-2.52**		
$mEXPERTISE_{i,t}$								**-0.432***	**-1.84**
$LEV_{i,t}$	+	2.537**	2.00	2.564**	2.02	2.548**	2.01	2.482*	1.96
$SIZE_{i,t}$	-	-0.313	-0.87	-0.285	-0.79	-0.233	-0.65	-0.292	-0.82
$MTB_{i,t}$	+	0.415**	2.52	0.415**	2.52	0.421**	2.57	0.417**	2.54
$CFO_{i,t}$	+	29.631***	5.27	29.390***	5.22	29.110***	5.18	29.643***	5.27
$\Delta SALE_{i,t}$	+/-	32.593***	13.69	32.638***	13.72	32.674***	13.75	32.558***	13.68
$CYCLE_{i,t}$	+/-	-11.291***	-5.36	-11.280***	-5.35	-11.282***	-5.36	-11.258***	-5.35
$SEO_{i,t}$	+	5.196***	2.61	5.159***	2.59	5.161***	2.60	5.241***	2.64
$DEBTISSUE_{i,t}$	+	0.053	0.04	0.057	0.04	0.015	0.01	0.022	0.02
Constant		0.227**	2.46	0.226**	2.45	0.223**	2.42	0.228**	2.48
Year fixed effects		Yes		Yes		Yes		Yes	
Industry fixed effects		Yes		Yes		Yes		Yes	
Observations		2573		2573		2573		2573	
Adjusted R^2		0.192		0.193		0.194		0.193	

Note: This table reports the findings of Equation 4-5, where the dependent variable is NOACC_RANK, using the propensity-score-matching sample. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

4.4.5. ***Alternative methods to estimate the effects of banking expertise on accounting conservatism***

4.4.5.1. Original Basu (1997)'s model

To test further if the findings are robust, I employ the model of Basu (1997) to measure the asymmetric timeliness of bad news over good news as a proxy of accounting conservatism. Following prior research (e.g., Erkens et al., 2014; Lin, 2014; Kong et al., 2017; Hu and Jiang, 2018), I interact the measures of banking expertise on the board with the variables in the model. I also follow Ball et al. (2013a) to include industry and year fixed effects to mitigate heterogeneity bias. The model is as follows:

Equation 4-8: Original Basu (1997)'s model

$$EARN_{i,t} = \alpha_1 + \beta_1 D_{i,t} + \beta_2 RET_{i,t} + \beta_3 D_{i,t} * RET_{i,t} + \gamma_1 D_{i,t} * X_{i,t} + \gamma_2 * RET_{i,t} * X_{i,t} + \gamma_3 D_{i,t} * RET_{i,t} * X_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$$

Where: $X_{i,t}$ is $yEXPERTISE_{i,t}$, $aEXPERTISE_{i,t}$, $EXPERTISE_{i,t}$, or $mEXPERTISE_{i,t}$ (used as substitutes). Variable definitions are in the appendix. The coefficient γ_3 indicates the effect of banking expertise on the asymmetric timeliness of bad news over good news. I expect that γ_3 is negative and significant.

Table 4-16 reports the findings of Equation 4-8. I find that the coefficient γ_3 is negative across all measure of banking expertise and statistically significant in column (b) and (c). The evidence is consistent with the main findings that banking expertise on the board has a negative impact on accounting conservatism.

Table 4-16: Applying the Basu (1997)'s to estimate the effect of banking expertise on the asymmetric timeliness of bad news over good news

	Expected sign	yEXPERTISE (a)		aEXPERTISE (b)		EXPERTISE (c)		mEXPERTISE (d)	
		Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$D_{i,t}$		4.025*	1.87	4.232*	1.95	4.445**	1.98	4.077*	1.85
$RET_{i,t}$	+	2.750	1.59	2.673	1.53	2.849	1.59	2.811	1.60
$D_{i,t}*RET_{i,t}$	+	33.740***	6.04	35.321***	6.26	36.591***	6.25	34.574***	6.05
$D_{i,t}*yEXPERTISE_{i,t}$		-0.047	-0.18						
$RET_{i,t}*yEXPERTISE_{i,t}$		0.038	0.19						
$D_{i,t}*RET_{i,t}*yEXPERTISE_{i,t}$	**-**	**-0.695**	**-0.81**						
$D_{i,t}*aEXPERTISE_{i,t}$				-0.930	-0.57				
$RET_{i,t}*aEXPERTISE_{i,t}$				0.400	0.33				
$D_{i,t}*RET_{i,t}*aEXPERTISE_{i,t}$	**-**			**-9.125***	**-1.70**				
$D_{i,t}*EXPERTISE_{i,t}$						-2.610	-0.63		
$RET_{i,t}*EXPERTISE_{i,t}$						-0.237	-0.08		
$D_{i,t}*RET_{i,t}*EXPERTISE_{i,t}$	**-**					**-21.700***	**-1.75**		
$D_{i,t}*mEXPERTISE_{i,t}$								-0.189	-0.24
$RET_{i,t}*mEXPERTISE_{i,t}$								-0.012	-0.02
$D_{i,t}*RET_{i,t}*mEXPERTISE_{i,t}$								**-2.503**	**-1.03**
Constant		0.087	1.01	0.087	1.01	0.083	0.97	0.086	1.00
Year fixed effects		Yes		Yes		Yes		Yes	
Industry fixed effects		Yes		Yes		Yes		Yes	
Observations		3428		3428		3428		3428	
Adjusted R^2		0.026		0.027		0.028		0.027	

Note: Column (a) reports the findings of the regression: $EARN_{i,t} = \alpha_1 + \beta_1 D_{i,t} + \beta_2 RET_{i,t} + \beta_3 D_{i,t} * RET_{i,t} + \gamma_1 D_{i,t} * yEXPERTISE_{i,t} + \gamma_2 * RET_{i,t} * yEXPERTISE_{i,t} + \gamma_3 D_{i,t} * RET_{i,t} * yEXPERTISE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

Column (b) reports the findings of the regression: $EARN_{i,t} = \alpha_1 + \beta_1 D_{i,t} + \beta_2 RET_{i,t} + \beta_3 D_{i,t} * RET_{i,t} + \gamma_1 D_{i,t} * aEXPERTISE_{i,t} + \gamma_2 * RET_{i,t} * aEXPERTISE_{i,t} + \gamma_3 D_{i,t} * RET_{i,t} * aEXPERTISE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

Column (c) reports the findings of the regression: $EARN_{i,t} = \alpha_1 + \beta_1 D_{i,t} + \beta_2 RET_{i,t} + \beta_3 D_{i,t} * RET_{i,t} + \gamma_1 D_{i,t} * EXPERTISE_{i,t} + \gamma_2 * RET_{i,t} * EXPERTISE_{i,t} + \gamma_3 D_{i,t} * RET_{i,t} * EXPERTISE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

Column (d) reports the findings of the regression: $EARN_{i,t} = \alpha_1 + \beta_1 D_{i,t} + \beta_2 RET_{i,t} + \beta_3 D_{i,t} * RET_{i,t} + \gamma_1 D_{i,t} * mEXPERTISE_{i,t} + \gamma_2 * RET_{i,t} * mEXPERTISE_{i,t} + \gamma_3 D_{i,t} * RET_{i,t} * mEXPERTISE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

4.4.5.2. Ball and Shivakumar (2008)'s model

Next, I follow Ball and Shivakumar (2005) and Ball and Shivakumar (2008) to use the timeliness of loss recognition as an alternative proxy for accounting conservatism. I also interact the measures of banking expertise on the board with other variables in the model as follows (see, e.g., Kong et al., 2017):

Equation 4-9: Ball and Shivakumar (2008)'s model

$$ACC_{i,t} = \alpha_1 + \beta_1 DCFO_{i,t} + \beta_2 CFO_{i,t} + \beta_3 DCFO_{i,t} * CFO_{i,t} + \beta_4 \Delta SALE_{i,t} + \beta_5 PPE_{i,t} + \gamma_1 DCFO_{i,t} * X_{i,t} + \gamma_2 * CFO_{i,t} * X_{i,t} + \gamma_3 DCFO_{i,t} * CFO_{i,t} * X_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$$

Where: $X_{i,t}$ is $yEXPERTISE$, $aEXPERTISE$, $EXPERTISE$, or $mEXPERTISE$ (used as substitutes). Variable definitions are in the appendix 2.

In this model, the coefficient β_3 is the incremental timeliness in recognition of bad news over good news, which is used as a measure of accounting conservatism. [27] It is predicted that β_3 is positive, because accruals are more likely to reflect losses in periods with negative cash flows. Also, the coefficient γ_3 shows the effect of the banking expertise on the asymmetric timelines of loss recognition. I expect that γ_3 is negative and significant.

Table 4-17 reports the findings of Equation 4-9. Consistent with my prediction, the evidence shows that the coefficient on γ_3 is negative and significant in nearly every case. The results suggest that the measures of banking expertise have a significantly negative effect on asymmetric timeliness of loss recognition.

[27] See Chapter 2, Section 2.3.4.1.3, for a comprehensive explanation of this model.

Table 4-17: Applying the Ball and Shivakumar (2008) model to estimate the effect of banking expertise on the timeliness of loss recognition

	Expected sign	**yEXPERTISE (a)**		**aEXPERTISE (b)**		**EXPERTISE (c)**		**mEXPERTISE (d)**	
		Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$DCFO_{i,t}$		0.185	0.36	-0.008	-0.02	-0.020	-0.04	0.130	0.25
$CFO_{i,t}$	-	-40.139***	-28.35	-39.943***	-28.05	-41.667***	-27.93	-42.323***	-28.63
$DCFO_{i,t}$*$CFO_{i,t}$	+	28.500***	16.69	28.488***	16.58	30.238***	17.02	30.722***	17.44
$\Delta SALE_{i,t}$	+	8.459***	18.30	8.437***	18.26	8.399***	18.21	8.433***	18.31
$PPE_{i,t}$	-	-2.075***	-4.41	-2.060***	-4.38	-2.039***	-4.34	-2.009***	-4.28
$DCFO_{i,t}$*$yEXPERTISE_{i,t}$		-0.052	-0.51						
$CFO_{i,t}$*$yEXPERTISE_{i,t}$		0.279**	2.04						
$DCFO_{i,t}$*$CFO_{i,t}$*$yEXPERTISE_{i,t}$	**-**	**-0.913**	**-1.18**						
$DCFO_{i,t}$*$aEXPERTISE_{i,t}$				0.232	0.37				
$CFO_{i,t}$*$aEXPERTISE_{i,t}$				1.253	1.34				
$DCFO_{i,t}$*$CFO_{i,t}$*$aEXPERTISE_{i,t}$	**-**			**-10.154****	**-2.43**				
$DCFO_{i,t}$*$EXPERTISE_{i,t}$						0.439	0.33		
$CFO_{i,t}$*$EXPERTISE_{i,t}$						8.539***	3.75		
$DCFO_{i,t}$*$CFO_{i,t}$*$EXPERTISE_{i,t}$	**-**					**-17.762*****	**-3.38**		
$DCFO_{i,t}$*$mEXPERTISE_{i,t}$								-0.091	-0.37
$CFO_{i,t}$*$mEXPERTISE_{i,t}$								2.061***	5.12
$DCFO_{i,t}$*$CFO_{i,t}$*$mEXPERTISE_{i,t}$								**-3.103****	**-2.48**
Constant		0.005	0.28	0.003	0.16	0.004	0.21	0.006	0.30
Year fixed effects		Yes		Yes		Yes		Yes	
Industry fixed effects		Yes		Yes		Yes		Yes	
Observations		3421		3421		3421		3421	
Adjusted R2		0.348		0.348		0.351		0.352	

Note: Column (a) reports the findings of the regression: $ACC_{i,t} = \alpha_1 + \beta_1 DCFO_{i,t} + \beta_2 CFO_{i,t} + \beta_3 DCFO_{i,t} * CFO_{i,t} + \beta_4 \Delta SALE_{i,t} + \beta_5 PPE_{i,t} + \gamma_1 DCFO_{i,t} * yEXPERTISE_{i,t} + \gamma_2 * CFO_{i,t} * yEXPERTISE_{i,t} + \gamma_3 DCFO_{i,t} * CFO_{i,t} * yEXPERTISE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.
Column (b) reports the findings of the regression: $ACC_{i,t} = \alpha_1 + \beta_1 DCFO_{i,t} + \beta_2 CFO_{i,t} + \beta_3 DCFO_{i,t} * CFO_{i,t} + \beta_4 \Delta SALE_{i,t} + \beta_5 PPE_{i,t} + \gamma_1 DCFO_{i,t} * aEXPERTISE_{i,t} + \gamma_2 * CFO_{i,t} * aEXPERTISE_{i,t} + \gamma_3 DCFO_{i,t} * CFO_{i,t} * aEXPERTISE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.
Column (c) reports the findings of the regression: $ACC_{i,t} = \alpha_1 + \beta_1 DCFO_{i,t} + \beta_2 CFO_{i,t} + \beta_3 DCFO_{i,t} * CFO_{i,t} + \beta_4 \Delta SALE_{i,t} + \beta_5 PPE_{i,t} + \gamma_1 DCFO_{i,t} * EXPERTISE_{i,t} + \gamma_2 * CFO_{i,t} * EXPERTISE_{i,t} + \gamma_3 DCFO_{i,t} * CFO_{i,t} * EXPERTISE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.

Column (d) reports the findings of the regression: $ACC_{i,t} = \alpha_1 + \beta_1 DCFO_{i,t} + \beta_2 CFO_{i,t} + \beta_3 DCFO_{i,t} * CFO_{i,t} + \beta_4 \Delta SALE_{i,t} + \beta_5 PPE_{i,t} + \gamma_1 DCFO_{i,t} * mEXPERTISE_{i,t} + \gamma_2 * CFO_{i,t} * mEXPERTISE_{i,t} + \gamma_3 DCFO_{i,t} * CFO_{i,t} * mEXPERTISE_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon_{i,t}$.
All coefficients are multiplied by 100. Industry fixed effects are based on Datastream level-six codes. Variable definitions are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

4.4.6. *Cross-sectional analyses*

So far, the main results show that banking expertise on boards of directors negatively affects accounting conservatism. In this section, I do cross-sectional analyses to see how the effect of banking expertise on accounting conservatism varies with bankruptcy risk and financial leverage.

4.4.6.1. Bankruptcy risk

I conjecture that the effect of financial expertise on boards of directors on accounting conservatism is more pronounced for firms having higher bankruptcy risk. Opler and Titman (1994) document that firms with financial distress experience a decline in corporate performance. In those circumstances, debtholders are more likely to demand more borrowing firms' accounting conservatism, which facilitates the violation of debt covenants and the transfer to control rights from shareholders to debtholders (e.g., Watts, 2003a). However, the violation of debt covenants prevents borrowers from investing in profitable projects (Nash et al., 2003) and has other consequences such as increases in operating and restructuring costs (Beneish and Press, 1993; Bhaskar et al., 2017; Gao et al., 2017), thus limits their opportunities to increase their corporate performance. As a consequence, directors with working experience in the banking industry could help borrowing firms not only access external capital (e.g., Engelberg et al., 2012) but also reduce excessive costly accounting conservatism.

To test this conjecture, I run the Equation 4-5 using subsamples of firms with high and low bankruptcy risk. I employ the ZSCORE (Altman, 1968; Taffler, 1983) as a measure of bankruptcy risk, with a lower ZSCORE indicating higher bankruptcy risk. [28] I rank ZSCORE of all firms in the sample and define that firms have a high (low) bankruptcy risk when its ZSCORE in year t-1 is smaller than or equal (greater) than the median level of all firms.

Table 4-18 reports findings of Equation 4-5, where the dependent variable is CONS_RANK, using subsamples of firms with high and low bankruptcy risk. The results show that the magnitudes of the coefficients on banking expertise are considerably higher for firms with a low ZSCORE than for firms with a high ZSCORE. Importantly, I find that the coefficients on banking expertise are significant in subsamples of firms with a low ZSCORE, but not significant for those with a high ZSCORE. I obtain similar results on the effects of bankruptcy risk on the relationship between banking expertise with CSCORE_RANK (Table 4-19) and with NOACC_RANK (Table 4-20). In general, the evidence supports the conjecture that the effect of the board's banking expertise on accounting conservatism is more pronounced when firms have high bankruptcy risk.

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[28] Financial distress at the end of year t, measured by ZSCORE following (Taffler, 1983) as follows: $\text{ZSCORE} = 3.2 + 12.18 * \frac{\text{Profit before tax}}{\text{current liabilities}} + 2.50 * \frac{\text{Current assets}}{\text{Total liabilities}} - 10.68 * \frac{\text{Current liabilities}}{\text{Total assets}} + 0.029 * \frac{(\text{Quick assets} - \text{Current liabilities})}{(\text{Sales} - \text{Pretax income} - \text{Depreciation})/365}$

Table 4-18: Cross-sectional analysis: The effect of bankruptcy risk on the relationship between CONS_RANK and banking expertise on the board

	yEXPERTISE		**aEXPERTISE**		**EXPERTISE**		**mEXPERTISE**	
	Low ZSCORE	**High ZSCORE**	**Low ZSCORE**	**High ZSCORE**	**Low ZSCORE**	**High ZSCORE**	**Low ZSCORE**	**High ZSCORE**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
$yEXPERTISE_{i,t}$	**-0.139****	**-0.001**						
	(-2.16)	**(-0.02)**						
$aEXPERTISE_{i,t}$			**-1.074****	**-0.115**				
			(-2.55)	**(-0.34)**				
$EXPERTISE_{i,t}$					**-3.469*****	**-0.664**		
					(-3.27)	**(-0.79)**		
$mEXPERTISE_{i,t}$							**-0.425****	**-0.060**
							(-2.05)	**(-0.40)**
$LEV_{i,t}$	9.945***	14.676***	9.967***	14.679***	9.934***	14.674***	9.911***	14.670***
	(12.36)	(17.57)	(12.40)	(17.58)	(12.37)	(17.58)	(12.31)	(17.57)
$SIZE_{i,t}$	-11.258***	-12.147***	-11.212***	-12.129***	-11.155***	-12.101***	-11.258***	-12.128***
	(-46.74)	(-56.78)	(-46.13)	(-56.11)	(-45.81)	(-55.86)	(-46.60)	(-56.68)
$MTB_{i,t}$	-0.012	0.312***	-0.018	0.312***	-0.012	0.314***	-0.007	0.312***
	(-0.10)	(2.65)	(-0.15)	(2.65)	(-0.10)	(2.67)	(-0.06)	(2.65)
$CFO_{i,t}$	10.411***	4.323	10.164***	4.295	10.312***	4.200	10.478***	4.306
	(2.66)	(1.18)	(2.60)	(1.17)	(2.64)	(1.15)	(2.68)	(1.18)
$\Delta SALE_{i,t}$	4.773***	4.335***	4.796***	4.330***	4.817***	4.296***	4.816***	4.308***
	(3.06)	(2.82)	(3.08)	(2.82)	(3.10)	(2.80)	(3.09)	(2.80)
$CYCLE_{i,t}$	2.968*	4.635***	2.966*	4.624***	2.916*	4.620***	2.946*	4.636***
	(1.92)	(3.12)	(1.92)	(3.11)	(1.90)	(3.11)	(1.91)	(3.12)
$SEO_{i,t}$	4.958***	6.681***	4.897***	6.670***	4.855***	6.680***	4.954***	6.685***

	(3.56)	(5.74)	(3.51)	(5.73)	(3.49)	(5.74)	(3.55)	(5.75)
$DEBTISSUE_{i,t}$	-1.703*	-2.787***	-1.708*	-2.794***	-1.769*	-2.809***	-1.718*	-2.804***
	(-1.68)	(-3.40)	(-1.69)	(-3.41)	(-1.75)	(-3.42)	(-1.70)	(-3.41)
Constant	1.861***	1.948***	1.860***	1.947***	1.858***	1.943***	1.862***	1.947***
	(33.35)	(38.70)	(33.36)	(38.62)	(33.39)	(38.48)	(33.38)	(38.67)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1708	1720	1708	1720	1708	1720	1708	1720
Adjusted R^2	0.718	0.791	0.718	0.791	0.719	0.792	0.718	0.791

This table reports the findings on the effect of bankruptcy risk on the relationship between accounting conservatism and banking expertise on the board. I define firms with low (high) ZSCORE as having a $ZSCORE_{t-1}$ lower (greater) than the median of all firms. I use CONS_RANK as the dependent variable in Equation 4-5 for subsamples of low and high ZSCORE. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Figures in parentheses are *t*-statistics. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 4-19: Cross-sectional analysis: The effect of bankruptcy risk on the relationship between CSCORE_RANK and banking expertise on the board

	yEXPERTISE		**aEXPERTISE**		**EXPERTISE**		**mEXPERTISE**	
	Low ZSCORE	**High ZSCORE**	**Low ZSCORE**	**High ZSCORE**	**Low ZSCORE**	**High ZSCORE**	**Low ZSCORE**	**High ZSCORE**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(6)**	**(8)**
$yEXPERTISE_{i,t}$	**-0.117***	**0.021**						
	(-1.86)	**(0.43)**						
$aEXPERTISE_{i,t}$			**-0.985****	**0.004**				
			(-2.40)	**(0.01)**				
$EXPERTISE_{i,t}$					**-2.888*****	**-0.204**		
					(-2.79)	**(-0.24)**		
$mEXPERTISE_{i,t}$							**-0.305**	**0.083**
							(-1.51)	**(0.56)**
$LEV_{i,t}$	0.865	0.104	0.882	0.102	0.855	0.101	0.845	0.109
	(1.10)	(0.12)	(1.13)	(0.12)	(1.09)	(0.12)	(1.08)	(0.13)
$SIZE_{i,t}$	-12.011***	-12.665***	-11.959***	-12.644***	-11.926***	-12.629***	-12.027***	-12.671***
	(-51.25)	(-59.54)	(-50.57)	(-58.83)	(-50.31)	(-58.63)	(-51.15)	(-59.55)
$MTB_{i,t}$	0.036	0.430***	0.031	0.431***	0.037	0.432***	0.040	0.431***
	(0.32)	(3.68)	(0.27)	(3.69)	(0.32)	(3.69)	(0.36)	(3.68)
$CFO_{i,t}$	9.272**	2.132	9.043**	2.132	9.189**	2.093	9.323**	2.155
	(2.44)	(0.59)	(2.38)	(0.59)	(2.42)	(0.57)	(2.45)	(0.59)
$\Delta SALE_{i,t}$	5.345***	6.054***	5.351***	6.034***	5.382***	6.022***	5.399***	6.073***
	(3.52)	(3.97)	(3.53)	(3.95)	(3.56)	(3.94)	(3.56)	(3.98)

$CYCLE_{i,t}$	3.146**	2.873*	3.160**	2.867*	3.102**	2.862*	3.107**	2.866*
	(2.09)	(1.94)	(2.11)	(1.94)	(2.07)	(1.94)	(2.07)	(1.94)
$SEO_{i,t}$	3.704***	6.380***	3.642***	6.368***	3.618***	6.367***	3.709***	6.363***
	(2.73)	(5.51)	(2.69)	(5.50)	(2.67)	(5.50)	(2.73)	(5.50)
$DEBTISSUE_{i,t}$	-0.712	-0.295	-0.717	-0.307	-0.768	-0.314	-0.724	-0.282
	(-0.72)	(-0.36)	(-0.73)	(-0.38)	(-0.78)	(-0.39)	(-0.73)	(-0.35)
Constant	1.988***	2.022***	1.986***	2.020***	1.985***	2.018***	1.990***	2.023***
	(36.61)	(40.40)	(36.61)	(40.30)	(36.65)	(40.19)	(36.65)	(40.41)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1708	1720	1708	1720	1708	1720	1708	1720
Adjusted R^2	0.733	0.797	0.734	0.797	0.734	0.797	0.733	0.797

This table reports the findings on the effect of bankruptcy risk on the relationship between accounting conservatism and banking expertise on the board. I define firms with low (high) ZSCORE as having a $ZSCORE_{t-1}$ lower (greater) than the median of all firms. I use CSCORE_RANK as the dependent variable in Equation 4-5 for subsamples of low and high ZSCORE. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Figures in parentheses are *t*-statistics. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 4-20: Cross-sectional analysis: The effect of bankruptcy risk on the relationship between CSCORE_RANK and banking expertise on the board

	yEXPERTISE		aEXPERTISE		EXPERTISE		mEXPERTISE	
	Low ZSCORE	**High ZSCORE**	**Low ZSCORE**	**High ZSCORE**	**Low ZSCORE**	**High ZSCORE**	**Low ZSCORE**	**High ZSCORE**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(6)**	**(8)**
$yEXPERTISE_{i,t}$	**-0.175**	**-0.075**						
	(-1.58)	**(-0.76)**						
$aEXPERTISE_{i,t}$			**-1.555****	**-0.262**				
			(-2.15)	**(-0.38)**				
$EXPERTISE_{i,t}$					**-4.991*****	**-1.667**		
					(-2.74)	**(-0.99)**		
$mEXPERTISE_{i,t}$							**-0.721****	**-0.256**
							(-2.03)	**(-0.85)**
$LEV_{i,t}$	0.662	3.251*	0.688	3.263**	0.644	3.252**	0.587	3.236*
	(0.48)	(1.96)	(0.50)	(1.97)	(0.47)	(1.96)	(0.43)	(1.95)
$SIZE_{i,t}$	-0.524	0.009	-0.434	-0.023	-0.353	0.055	-0.470	0.021
	(-1.27)	(0.02)	(-1.04)	(-0.05)	(-0.84)	(0.13)	(-1.13)	(0.05)
$MTB_{i,t}$	0.428**	0.226	0.418**	0.226	0.427**	0.229	0.434**	0.225
	(2.12)	(0.97)	(2.08)	(0.97)	(2.12)	(0.98)	(2.15)	(0.96)
$CFO_{i,t}$	13.629**	48.555***	13.294**	48.491***	13.562**	48.230***	13.790**	48.472***
	(2.02)	(6.60)	(1.98)	(6.59)	(2.02)	(6.55)	(2.05)	(6.59)
$\Delta SALE_{i,t}$	24.623***	33.317***	24.610***	33.374***	24.617***	33.283***	24.586***	33.263***
	(9.24)	(10.83)	(9.25)	(10.85)	(9.26)	(10.82)	(9.23)	(10.80)
$CYCLE_{i,t}$	-13.589***	-8.844***	-13.552***	-8.849***	-13.630***	-8.864***	-13.543***	-8.822***
	(-5.14)	(-3.00)	(-5.13)	(-3.00)	(-5.17)	(-3.01)	(-5.13)	(-2.99)

$SEO_{i,t}$	9.067***	6.768***	8.966***	6.783***	8.915***	6.815***	9.035***	6.831***
	(3.79)	(2.92)	(3.75)	(2.92)	(3.74)	(2.94)	(3.78)	(2.95)
$DEBTISSUE_{i,t}$	-2.101	3.624**	-2.113	3.649**	-2.206	3.608**	-2.122	3.590**
	(-1.21)	(2.23)	(-1.22)	(2.24)	(-1.28)	(2.22)	(-1.23)	(2.20)
Constant	0.412***	0.211*	0.409***	0.215*	0.406***	0.206*	0.411***	0.211*
	(3.87)	(1.91)	(3.84)	(1.94)	(3.82)	(1.86)	(3.86)	(1.91)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1693	1713	1693	1713	1693	1713	1693	1713
Adjusted R^2	0.173	0.211	0.174	0.211	0.176	0.212	0.174	0.211

This table reports the findings on the effect of bankruptcy risk on the relationship between accounting conservatism and banking expertise on the board. I define firms with low (high) ZSCORE as having a $ZSCORE_{t-1}$ lower (greater) than the median of all firms. I use NOACC_RANK as the dependent variable in Equation 4-5 for subsamples of low and high ZSCORE. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Figures in parentheses are *t*-statistics. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

4.4.6.2. *Financial leverage*

In the final analysis, I examine how financial leverage affects the relationship between banking expertise on boards of directors and accounting conservatism. Highly levered firms face restrictive debt covenants and have a high demand for accounting conservatism as a debt monitoring mechanism (Watts, 2003a; LaFond and Watts, 2008; Khan and Watts, 2009). Because the violation of debt covenants is costly (Nash et al., 2003; Chava and Roberts, 2008; Nini et al., 2012; Gao et al., 2017) and accounting conservatism may have negative impact on shareholders' wealth (Beneish and Press, 1993; Nash et al., 2003; Bhaskar et al., 2017; Gao et al., 2017), highly levered firms are more likely to rely on financial expertise on boards of directors to mitigate the negative consequences of accounting conservatism. Therefore, I predict that the effect of banking expertise on accounting conservatism is more pronounced for firms with high financial leverage than for firms with low financial leverage.

To provide evidence for this prediction, I also run the Equation 4-5 with subsamples: firms with high and low financial leverage. I define firms with high (low) financial leverage as having financial leverage (LEV) in year t-1 greater than or equal (lower) than the median of all firms. Table 4-21 reports findings of the effect of financial leverage on the relationship between CONS_RANK and banking expertise on board. In nearly every case across all columns, I find robust evidence that the coefficients on banking expertise are substantially higher for firms with high financial leverage than for firms with low financial leverage. Also, the coefficients on banking expertise are (not) significant or firms with high (low) financial leverage. In Table 4-22 and Table 4-23, I obtain similar results on the effects of financial leverage on the relationship between banking expertise with CSCORE_RANK and with NOACC_RANK, respectively. In short, the evidence is consistent with the prediction that the effect of banking expertise on accounting conservatism is more pronounced when firms have high financial leverage.

Table 4-21: Cross-sectional analysis: the effect of financial leverage on the relationship between CONS_RANK and measures of banking expertise

	yEXPERTISE		aEXPERTISE		EXPERTISE		mEXPERTISE	
	High leverage	Low Leverage	High leverage	Low Leverage	High leverage	Low Leverage	High leverage	Low Leverage
	(1)	(2)	(3)	(4)	(5)	(6)	(6)	(8)
yEXPERTISE$_{i,t}$	**-0.127****	**0.003**						
	(-2.12)	**(0.08)**						
aEXPERTISE$_{i,t}$			**-0.998*****	**-0.323**				
			(-2.58)	**(-0.99)**				
EXPERTISE$_{i,t}$					**-2.884*****	**-1.146**		
					(-2.74)	**(-1.57)**		
mEXPERTISE$_{i,t}$							**-0.314**	**0.016**
							(-1.53)	**(0.13)**
LEV$_{i,t}$	9.090***	-5.156**	9.091***	-5.237**	9.100***	-5.270**	9.108***	-5.152**
	(12.15)	(-2.22)	(12.16)	(-2.25)	(12.17)	(-2.27)	(12.16)	(-2.21)
SIZE$_{i,t}$	-11.571***	-12.485***	-11.522***	-12.434***	-11.488***	-12.404***	-11.601***	-12.488***
	(-47.45)	(-67.84)	(-46.86)	(-66.93)	(-46.28)	(-66.67)	(-47.34)	(-67.51)
MTB$_{i,t}$	0.227	0.203***	0.222	0.203***	0.213	0.205***	0.218	0.203***
	(1.43)	(2.71)	(1.39)	(2.72)	(1.34)	(2.74)	(1.37)	(2.71)
CFO$_{i,t}$	9.720*	7.600***	9.369	7.581***	9.835*	7.490***	9.915*	7.603***
	(1.65)	(3.33)	(1.59)	(3.32)	(1.67)	(3.28)	(1.68)	(3.33)
ΔSALE$_{i,t}$	2.968	7.968***	2.985	7.945***	2.949	7.924***	3.035	7.972***
	(1.49)	(7.72)	(1.50)	(7.70)	(1.48)	(7.68)	(1.52)	(7.71)

$CYCLE_{i,t}$	2.799*	3.426**	2.815*	3.374**	2.727*	3.399**	2.709*	3.420**
	(1.90)	(2.51)	(1.92)	(2.47)	(1.86)	(2.49)	(1.84)	(2.51)
$SEO_{i,t}$	6.143***	5.543***	6.062***	5.508***	6.048***	5.519***	6.140***	5.542***
	(3.96)	(6.31)	(3.90)	(6.27)	(3.90)	(6.29)	(3.95)	(6.31)
$DEBTISSUE_{i,t}$	-1.732*	2.012**	-1.682*	1.984**	-1.716*	1.967**	-1.753*	2.014**
	(-1.70)	(2.56)	(-1.65)	(2.52)	(-1.68)	(2.50)	(-1.72)	(2.56)
Constant	1.888***	1.966***	1.885***	1.961***	1.882***	1.959***	1.891***	1.966***
	(32.33)	(50.31)	(32.30)	(50.18)	(32.19)	(50.18)	(32.35)	(50.34)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1714	1714	1714	1714	1714	1714	1714	1714
Adjusted R^2	0.739	0.838	0.739	0.838	0.740	0.838	0.739	0.838

This table reports the findings on the effect of financial distress on the relationship between accounting conservatism and measures of banking expertise. I define firms with low (high) financial leverage as having LEV_{t-1} lower (greater) than the median of all firms. I use CONS_RANK as the dependent variable in Equation 4-5 for subsamples of high and low financial leverage. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Figures in parentheses are *t*-statistics. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 4-22: Cross-sectional analysis: the effect of financial leverage on the relationship between CSCORE_RANK and measures of banking expertise

	yEXPERTISE		aEXPERTISE		EXPERTISE		mEXPERTISE	
	High Leverage	**Low Leverage**	**High Leverage**	**Low Leverage**	**High Leverage**	**Low Leverage**	**High Leverage**	**Low Leverage**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(6)**	**(8)**
$yEXPERTISE_{i,t}$	**-0.078**	**-0.008**						
	(-1.35)	**(-0.17)**						
$aEXPERTISE_{i,t}$			**-0.699***	**-0.467**				
			(-1.87)	**(-1.44)**				
$EXPERTISE_{i,t}$					**-2.263****	**-1.377***		
					(-2.23)	**(-1.89)**		
$mEXPERTISE_{i,t}$							**-0.199**	**0.000**
							(-1.01)	**(0.00)**
$LEV_{i,t}$	0.122	-8.752***	0.120	-8.847***	0.125	-8.869***	0.133	-8.739***
	(0.17)	(-3.77)	(0.17)	(-3.81)	(0.17)	(-3.82)	(0.18)	(-3.76)
$SIZE_{i,t}$	-12.281***	-12.815***	-12.235***	-12.752***	-12.194***	-12.728***	-12.298***	-12.822***
	(-52.14)	(-69.74)	(-51.50)	(-68.77)	(-50.85)	(-68.54)	(-51.97)	(-69.43)
$MTB_{i,t}$	0.233	0.273***	0.229	0.274***	0.221	0.276***	0.226	0.273***
	(1.51)	(3.67)	(1.49)	(3.68)	(1.44)	(3.71)	(1.47)	(3.67)
$CFO_{i,t}$	6.510	8.157***	6.263	8.120***	6.598	8.017***	6.633	8.152***
	(1.15)	(3.58)	(1.10)	(3.57)	(1.16)	(3.52)	(1.17)	(3.58)
$\Delta SALE_{i,t}$	3.465*	7.495***	3.457*	7.473***	3.410*	7.452***	3.503*	7.502***
	(1.80)	(7.27)	(1.80)	(7.26)	(1.77)	(7.24)	(1.82)	(7.27)
$CYCLE_{i,t}$	2.613*	3.007**	2.640*	2.939**	2.587*	2.980**	2.560*	3.011**
	(1.84)	(2.21)	(1.86)	(2.16)	(1.82)	(2.19)	(1.80)	(2.21)

$SEO_{i,t}$	4.470***	5.378***	4.412***	5.335***	4.393***	5.356***	4.468***	5.383***
	(2.98)	(6.13)	(2.94)	(6.09)	(2.93)	(6.12)	(2.98)	(6.14)
$DEBTISSUE_{i,t}$	0.607	1.976**	0.645	1.941**	0.626	1.927**	0.595	1.979**
	(0.62)	(2.52)	(0.65)	(2.47)	(0.64)	(2.45)	(0.60)	(2.52)
Constant	2.055***	1.999***	2.052***	1.993***	2.048***	1.992***	2.057***	1.999***
	(36.43)	(51.24)	(36.40)	(51.10)	(36.28)	(51.12)	(36.44)	(51.28)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1714	1714	1714	1714	1714	1714	1714	1714
Adjusted R^2	0.755	0.843	0.755	0.843	0.755	0.844	0.755	0.843

This table reports the findings on the effect of financial distress on the relationship between accounting conservatism and measures of banking expertise. I define firms with low (high) financial leverage as having LEV_{t-1} lower (greater) than the median of all firms. I use CSCORE_RANK as the dependent variable in Equation 4-5 for subsamples of high and low financial leverage. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Figures in parentheses are *t*-statistics. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 4-23: Cross-sectional analysis: the effect of financial leverage on the relationship between NOACC_RANK and measures of banking expertise

	yEXPERTISE		**aEXPERTISE**		**EXPERTISE**		**mEXPERTISE**	
	High Leverage	**Low Leverage**	**High Leverage**	**Low Leverage**	**High Leverage**	**Low Leverage**	**High Leverage**	**Low Leverage**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(6)**	**(8)**
$yEXPERTISE_{i,t}$	**-0.164***	**-0.099**						
	(-1.75)	**(-0.85)**						
$aEXPERTISE_{i,t}$			**-1.096***	**-0.910**				
			(-1.82)	**(-1.09)**				
$EXPERTISE_{i,t}$					**-4.512*****	**-2.632**		
					(-2.77)	**(-1.40)**		
$mEXPERTISE_{i,t}$							**-0.705****	**-0.385**
							(-2.22)	**(-1.16)**
$LEV_{i,t}$	2.880**	9.805*	2.885**	9.776	2.886**	9.749	2.889**	9.736
	(2.48)	(1.65)	(2.49)	(1.64)	(2.49)	(1.64)	(2.49)	(1.64)
$SIZE_{i,t}$	-0.720*	0.539	-0.692*	0.585	-0.554	0.628	-0.664*	0.583
	(-1.90)	(1.14)	(-1.81)	(1.23)	(-1.44)	(1.32)	(-1.74)	(1.23)
$MTB_{i,t}$	0.305	0.532***	0.298	0.533***	0.282	0.537***	0.284	0.535***
	(1.24)	(2.75)	(1.21)	(2.75)	(1.14)	(2.77)	(1.15)	(2.76)
$CFO_{i,t}$	23.582***	27.027***	23.221**	26.894***	23.778***	26.698***	24.036***	26.931***
	(2.59)	(4.57)	(2.55)	(4.54)	(2.61)	(4.51)	(2.64)	(4.55)
$\Delta SALE_{i,t}$	27.770***	25.838***	27.830***	25.873***	27.664***	25.836***	27.677***	25.763***
	(8.98)	(9.70)	(9.00)	(9.72)	(8.96)	(9.71)	(8.95)	(9.67)
$CYCLE_{i,t}$	-10.732***	-14.146***	-10.749***	-14.232***	-10.795***	-14.151***	-10.763***	-13.997***
	(-4.70)	(-4.06)	(-4.71)	(-4.08)	(-4.74)	(-4.06)	(-4.72)	(-4.01)

$SEO_{i,t}$	5.895**	11.109***	5.808**	11.081***	5.744**	11.123***	5.877**	11.153***
	(2.44)	(4.92)	(2.41)	(4.90)	(2.38)	(4.93)	(2.44)	(4.94)
$DEBTISSUE_{i,t}$	-1.416	0.573	-1.366	0.532	-1.381	0.502	-1.427	0.520
	(-0.89)	(0.28)	(-0.86)	(0.26)	(-0.87)	(0.25)	(-0.90)	(0.26)
Constant	0.454***	0.104	0.453***	0.101	0.442***	0.098	0.451***	0.102
	(4.49)	(0.93)	(4.49)	(0.89)	(4.38)	(0.87)	(4.47)	(0.91)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1705	1701	1705	1701	1705	1701	1705	1701
Adjusted R^2	0.199	0.195	0.199	0.195	0.201	0.196	0.200	0.195

This table reports the findings on the effect of financial distress on the relationship between accounting conservatism and measures of banking expertise. I define firms with low (high) financial leverage as having LEV_{t-1} lower (greater) than the median of all firms. I use NOACC_RANK as the dependent variable in Equation 4-5 for subsamples of high and low financial leverage. All coefficients are multiplied by 100. Industry fixed effects are based on Datastream's level six codes. Figures in parentheses are *t*-statistics. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

4.5. Conclusions

In this research, I examine the relationship between accounting conservatism and banking expertise on boards of directors. I provide an innovative way to measure banking expertise based on the working history in banks of all individual directors on the board. I hypothesise that banking expertise on the board helps to reduce demand for accounting conservatism. Using a sample of listed companies in the UK from 2005 to 2012, I find that the banking expertise on the board negatively affects accounting conservatism. The negative relationship is both statistically and economically significant. The findings hold strongly for various robustness checks. Also, further analyses show that the banking expertise on the board has a more pronounced negative impact on accounting conservatism when firms have high bankruptcy risk, and when firms have high financial leverage. The study complements the work of Erkens et al. (2014) and Bonetti et al. (2017) by providing further evidence on the relevance of boards of directors for accounting conservatism.

However, the chapter has some limitations. First, there may be measurement errors in estimating the banking expertise of boards of directors. For example, some directors may be connected to the same banking network (Renneboog and Zhao, 2011), so that having them all on the board does not necessarily increase the levels of banking expertise. Also, the chapter treats experiences gained from different positions in banks equally and does not take into account differences in experience accumulated from different positions, e.g. the CEO and CFO positions. Future studies should attempt to reduce measurement errors by excluding banking expertise gained from the same director network or by considering different positions of directors in banks. Second, there may be survival bias because the research sample does not include dead companies because of data constraints. Dead companies are less likely to disclose information on the board of directors, thus observations with missing data may be deleted during the sample selection procedure. Third, the chapter does not consider the possibility that directors might work for some banks whose names are not on the lists of banks. Future studies should extend the definition of working experience in banks by considering this concern. Finally, future studies should consider factors which may affect banking expertise on the board, such as changes in regulatory requirements, which leads to human capital movement between firms and banks. Those changes may affect levels of banking expertise on the board, but not necessarily affect accounting conservatism.

Appendix 2: Variable definitions for Chapter 4

Variable	Definitions
Accounting conservatism measures	
CONS_RANK	Annual fractional rank of the three-year average of total accounting conservatism (García Lara et al., 2016), where total accounting conservatism is the sum of the timeliness of good news (*GSCORE*) and the asymmetric timeliness of bad news over good news (*CSCORE*) estimated by the model of Khan and Watts (2009), which is based on Basu (1997). I calculate the average of total accounting conservatism across years t-2, t-1, and t (denoted $aCONS_{i,t}$); then rank $aCONS_{i,t}$ of all firms for each year; and divide the rank values by N+1, where N is the total observations in each rank group. I refer to the new variable as the annual fractional rank of total accounting conservatism.
CSCORE_RANK	Annual fractional rank of the three-year average of *CSCORE* (Basu, 1997; Khan and Watts, 2009).
NOACC_RANK	Annual fractional rank of the three-year average of the negative accumulation of non-operating accruals (Givoly and Hayn, 2000). The calculation of negative non-operating accruals is as follows: $$NOACC_{i,t} = -1 * \{TABD_{i,t} - OA_{i,t}\}$$

	$= -1 * \{[(NI_{i,t} + DEP_{i,t}) - CFO_{i,t}] - [\Delta REC_{i,t} + \Delta\, INV_{i,t} + \Delta\, PREPAID_{i,t} - \Delta\, PAY_{i,t} - \Delta\, TAX_{i,t}]\}$ Where: $NOACC_{i,t}$ is negative non-operating accruals; $TABD_{i,t}$ is total accruals before depreciation and amortisation; $OA_{i,t}$ is operating accruals; $NI_{i,t}$ is net income; $DEP_{i,t}$ is depreciation and amortisation; $CFO_{i,t}$ is cash flows from operations; $\Delta REC_{i,t}$ is receivables in year *t* minus receivables in year *t-1*. $\Delta\, INV_{i,t}$ is inventories in year *t* minus inventories in year *t-1*; $\Delta\, PREPAID_{i,t}$ is prepaid expenses in year *t* minus prepaid expenses in year *t-1*; $\Delta\, PAY_{i,t}$ is payables in year *t* minus payables in year *t-1*; $\Delta\, TAX_{i,t}$ is tax payables in year *t* minus tax payables in year *t-1*. All variables are scaled by total assets at the end of year t. i represents company i and t represents fiscal year t.
Banking expertise measures	
yEXPERTISE	Total number of years all directors on the board have worked as executives in banks.
aEXPERTISE	Total number of banks for which all directors on the board have worked as executives.
EXPERTISE	The presence of banking expertise on the board, which is equal one if a company has at least one director on board who has worked as an executive in a bank, zero otherwise.

mEXPERTISE	Average number of years all directors on the board have worked as executives in banks, which is equal *yEXPERTISE* divided by the number of board members.
Other variables	
$\Delta SALE$	Sale growth, which is equal sales in year t minus sales in year t-1, scaled by total assets.
ACC	Accruals which are calculated as follows: $ACC = \Delta INV + \Delta REC + \Delta OCA - \Delta PAY - \Delta OCL - DEP$, where ΔINV is inventories in year *t* minus inventories in year *t-1*, ΔREC is receivables in year t minus receivables in year t-1, ΔOCA is other current assets in year t minus other current assets in year t-1, ΔPAY is payables in year t minus payables in year t-1, ΔOCL is other current liabilities in year t minus other current liabilities in year t-1, DEP is depreciation and amortisation.
AT	Total assets
CASH	Ratio of cash to total assets
CFO	Cash flow from operations, which equals to net income before extraordinary items (IB) minus accruals (ACC), scaled by assets.
CYCLE	Business life cycle (Dickinson, 2011), which is a dummy variable is equal one if firms are classified based on cash flows

	as at mature stage (positive cash flows from operating activities, negative cash flows from investing activities, and negative cash flows from financing activities), and zero if firms are classified as at young stage (negative cash flows from operating activities, negative cash flows from investing activities, and positive cash flows from financing activities), or growth stage (positive cash flows from operating activities, negative cash flows from investing activities, and positive cash flows from financing activities).
D	A dummy variable that equals one if $RET < 0$, and zero otherwise.
DCFO	A dummy variable which equals to one if $CFO < 0$, and zero otherwise.
DEBTISSUE	Debt issue, which is a dummy variable with the value of one if the change in short-term and long-term debts from the end of year t-1 to the end of year t.
EARN	Net income before extraordinary items in year t, scaled by market value of equity at the end of year t-1
IB	Net income before extraordinary items
LEV	Financial leverage, which is the sum of long-term and short-term debts, scaled by the market value of equity.

MTB	Market to book ratio, which is equal to market value of equity divided by book value of equity.
PPE	Ratio of PPE (gross) to total assets.
RET	Buy-and-hold stock returns over the fiscal year
SALE	Sales
SEO	Equity issue, which is a dummy variable with the value of one if a firm increases outstanding shares at least 5% with positive proceeds from equity issuance, zero otherwise.
SIZE	Firm size, which is the log of the market value of equity
ZSCORE	Financial distress at the end of year t, measured by $ZSCORE$ following (Taffler, 1983) as follows: $\mathrm{ZSCORE} = 3.2 + 12.18 * \frac{\text{Profit before tax}}{\text{current liabilities}} + 2.50 * \frac{\text{Current assets}}{\text{Total liabilities}} - 10.68 * \frac{\text{Current liabilities}}{\text{Total assets}} + 0.029 * \frac{(\text{Quick assets} - \text{Current liabilities})}{(\text{Sales} - \text{Pretax income} - \text{Depreciation})/365}$

Chapter 5: BENFORD'S LAW, EARNINGS MANAGEMENT, AND ACCOUNTING CONSERVATISM: THE UK EVIDENCE

Abstract

Benford's Law, which is the law of digit distributions, is widely applied to study fraud or bias in a data set. In this chapter, I apply Benford's Law to examine the first digits of financial statement items of UK listed companies. The evidence shows that the first digits conform to Benford's Law at the firm-specific level and market level. Further analysis shows that deviations from Benford's Law of the first digits of income statement items are larger than those of balance sheet items and cash flow items, suggesting that income statements may contain more errors. The evidence also supports the hypothesis that, in addition to earnings management, conditional conservatism is a source of deviations of the first digits. I argue that conditional conservatism introduces biases to financial statements, which make accounting figures deviate from the law of digit distributions. The results have implications for auditors.

Keywords: Benford's Law, earnings management, accounting conservatism

5.1. Introduction

Accounting scandals normally begin with inflating earnings up to four years prior to the collapse of corporations (García Lara, Garcia Osma, et al., 2009). A significant consequence is that investors may suffer losses before accounting manipulations are detected. Therefore, building empirical models to identify earnings management in published financial statements attracts many researchers (Dechow et al., 2010).

One strand of research focuses on developing models to detect earnings management or predict accounting fraud. Some researchers use firm characteristics to estimate abnormal accruals, which are viewed as earnings management (Jones, 1991; Dechow et al., 1995; Dechow and Dichev, 2002; Kothari et al., 2005). Other researchers use actual fraud cases to construct models to predict accounting fraud (Beneish, 1997, 1999; Dechow et al., 2011). A common feature of those models is the use of time-series or cross-sectional data to estimate earnings management or fraud. Although earnings management models are widely applied, previous studies indicate that those models may be misspecified (Dechow et al., 2010).

Another line of accounting research relies on mathematics to examine risks of earnings management or fraud. Specifically, researchers apply Benford's Law, which is the law of digit distributions, to accounting numbers to study errors which may be caused by intentional or unintentional acts. Benford's Law indicates that when there is an absence of errors in a data set, every digit will appear with a certain frequency in the data set. Thus, deviations from the expected frequencies are indications of the existence of errors in data sets. The research applying Benford's Law may overcome the limitations of earnings management models because it relies on only mathematics. There is emerging evidence on the application of Benford's Law to examine errors (Carslaw, 1988; Thomas, 1989; Nigrini, 1996; Caneghem, 2002, 2004; Lin et al., 2014; Amiram et al., 2015; Nigrini, 2015).

In the context of the UK, Caneghem (2002) and Caneghem (2004) provide evidence that deviations of second digits of earnings from Benford's Law are signals of earnings management. However, a major limitation of those studies is that they examine only one item in financial statements (pre-tax income). Given that financial statements are prepared for various stakeholders, net income is not the only figure to be manipulated. The research attempts to fill this gap in the literature by examining all numbers reported in financial statements. I adopted the methodology introduced by Amiram et al. (2015), which uses firm-year data to calculate deviations of the first digits of financial statement items. Amiram et al. (2015) show that the first digits of financial statement items of US-listed companies conform to Benford's Law. In this study, I hypothesised that the first digits of financial statement items of UK listed companies also conform to Benford's Law.

I also provide an alternative explanation for sources of deviations of first digits. The literature indicates that an introduction of earnings management or fraud in financial statements would lead to greater divergence of digits from Benford's Law (Caneghem, 2002; Amiram et al., 2015). In this paper, I argue that conditional conservatism,[29] to the extent it can be purposeful manipulation by management (LaFond and Watts, 2008; Zhang, 2008) rather than a neutral selection and application of accounting policies, is also a source of deviations. This argument is consistent with the work of Mora and Walker (2015) which has indicated that accounting conservatism can introduce biases and the study of Amiram et al. (2015) which has explained that first-digit deviations could be caused by fraud, errors or biases in financial statements.

I test the hypotheses with financial statements items from a sample of UK listed companies from 2005 to 2012. I measure deviations of first digits from Benford's Law by using maximum cumulative absolute differences and mean absolute differences between expected frequencies and actual frequencies of the first digits of financial statement items. At the firm-specific level, I calculate deviations for each company by using a pool of first digits from all available financial statements of a company during the research period. I also examine deviations of first digits from Benford's Law for

[29] As discussed in Section 2.3.1, conditional conservatism refers to the understatement of values of assets in financial statements which recognise losses in unfavourable conditions, but not gains in favourable conditions. Conditional conservatism is dependent on the speed of recognition of good news and bad news in financial reports. It is also called news-dependent conservatism. In contrast, unconditional conservatism refers to accounting treatments that result in lower book values relative to neutral (economic) values of net assets, and this conservatism is called "balance sheet conservatism" or news-independent conservatism because it does not depend on the news.

the whole market by using a pool of first digits reported on financial statements of all companies in the sample. The evidence shows that financial statements of UK listed companies conform to Benford's Law at the firm-specific level and the market level. Further analysis shows that deviations of the first digits of income statement items are larger than those of balance sheet items and cash flow items, suggesting that income statements may contain more errors. Also, the results from multivariate regressions show that deviations of first digits are positively associated with earnings management and conditional conservatism. The evidence suggests that earnings management and conditional conservatism are sources of deviations of first digits.

The research makes significant contributions to the literature and accounting practice. This is the first study to analyses the first digits of all items in the financial statements of UK listed companies. Previous studies using UK data examined only the second digits of specific items, such as pre-tax income (Caneghem, 2002, 2004). Thus, the existing evidence can only suggest errors in earnings. By studying all figures reported in financial statements, this study accounts for the fact that errors may exist anywhere in financial statements. The approach applying Benford's Law on all financial statement items, rather than some single items such as net income, has some advantages. First, the approach is in line with the standard setters' view that the general purpose of financial statements is to present financial information for different users, including shareholders, debtholders and others such as employees, suppliers, customers and government (International Accounting Standards Board (IASB), 2018). Different users may require different types of accounting information. Also, the

Conceptual Framework (IASB, 2018) firstly define assets and liabilities (balance sheet items), and then incomes and expenses (income statement items) which are defined based on changes in assets and liabilities. The interpretation is that assets and liabilities are cornerstones of financial statements, and changes in assets and liabilities will affect reported earnings. While income statement items (including net income) are possibly the most important figures for shareholders, balance sheet items may also be important because they provide debtholders with information on the financial health of companies. The approach which focuses on all financial statement items gives a chance to detect errors or fraud in assets, liabilities, incomes, expenses and cash flows. Second, errors or frauds are more likely to be detected under the approach using all items in financial statements. The reason is that an error or fraud in one item may affect several other items in financial statements under double-entry accounting, for example, underestimation of bad debts affects receivable, bad debt expense and other resulting balances such as earnings before tax and net income. In other words, the manipulation in one transaction will affect several accounts so that it results in higher deviations from Benford's Law. Third, the approach can flag up errors or frauds in accounts which do not directly affect net income. In some cases, e.g. when restrictive debt covenants require that liquidity ratios must be maintained at given levels, it is more likely that current debts are understated (or current assets are overstated) if a firm is in financial distress. In general, the findings may have more implications for practitioners.

Another contribution of the paper is that I offer an alternative explanation for deviations of first digits. The existing literature explains that first digits deviate from Benford's Law because accounting data include instances of fraud or bias, such as earnings management. I hypothesised and found that accounting conservatism is also a source of deviations. The paper contributes further evidence on the debates about whether accounting conservatism introduces biases to financial statements (see, e.g., Mora and Walker, 2015; Ruch and Taylor, 2015). For example, the accounting standard setters removed the requirement that conservatism (prudence) be one of the characteristics of financial statements in the 2010 Conceptual Framework (IASB, 2010), but have recently reintroduced the concept of prudence in the 2018 Conceptual Framework for Financial Reporting (International Accounting Standards Board (IASB), 2018). It shows that conservatism is a controversial concept even among standard setters. Empirical studies support the ideas that conditional conservatism is affected by managers' purposeful intervention (LaFond and Watts, 2008; Zhang, 2008). In this paper, I provide evidence that conditional conservatism causes higher first-digit deviations from Benford's Law, to the extent it is related to purposeful biases (Amiram et al., 2015). I note that the paper is different from the recent work of Lin et al. (2014), which applies Benford's Law and finds mixed evidence on the relationships between accounting conservatism and earnings management. In their paper, the authors use deviations of individual digits (from 0s to 9s) of quarterly net income from Benford's Law as a proxy for earnings management, but they do not provide a sufficient explanation for earnings management behaviours associated with deviations of those individual digits and each position (first, second, third and fourth positions in net income numbers), especially when the empirical findings are mixed on the relationships between accounting conservatism and earnings management (Kwon, Yin, and Han, 2006; García Lara, García Osma, and Penalva, 2012). I study deviations of first digits of all items reported in annual, rather than quarterly, financial statements to examine whether conservatism is a source of deviations.

The findings also have implications for auditors. I am a proponent of the use of Benford's Law as an analytical procedure in an audit engagement because Benford's Law can indicate errors in accounting data. The findings show that income statements have larger deviations of first digits than do other types of statements, suggesting that there may be comparatively more errors in income statements. Thus, auditors should be cautious when auditing income statement items such as revenues and expenses. Also, the findings indicate that deviations of first digits may be caused by earnings management or conditional conservatism driven by managers' purposeful intervention. Thus, auditors should pay more attention to conservatism-related items such as impairment losses and inventory written-off because those items can be manipulated by managers.

5.2. Literature review and hypothesis development:

5.2.1. An Introduction to Benford's Law

Benford's Law refers to the distributional probability of the digits of numbers in a data set. The distributional probability of first digits was discovered by astronomer Simon

Newcomb in 1881 and was later tested on various data sets by physicist Frank Benford, who gave Benford's Law its name (Amiram et al., 2015).

Table 5-1: Distributions of first digits following Benford's Law [a,b]

	Position in number			
Digit	1st	2nd	3rd	4th
0		0.11968	0.10178	0.10018
1	0.30103	0.11389	0.10138	0.10014
2	0.17609	0.10882	0.10097	0.10010
3	0.12494	0.10433	0.10057	0.10006
4	0.09691	0.10031	0.10018	0.10002
5	0.07918	0.09668	0.09979	0.09998
6	0.06695	0.09337	0.09940	0.09994
7	0.05799	0.09035	0.09902	0.09990
8	0.05115	0.08757	0.09864	0.09986
9	0.04576	0.08500	0.09827	0.09982

[a] Note: The number 147 has three digits, with a 1 as the first digit, 4 as the second digit, and a 7 as the third digit. The table indicates that under Benford's Law the expected proportion of numbers with a first digit 1 is 0.30103 and the expected proportion of numbers with a third digit 7 is 0.09902.

[b] Source: Nigrini, M.J. 1996. A taxpayer compliance application of Benford's Law. *The Journal of the American Taxation Association*. 18, Spring:72–91.

The reason that the probability of the first digit being 1 is the greatest and the probability of the first digit being 9 is the smallest is as follows: As explained by Nigrini (1996), the number 1 needs 100% growth to change to the number 2 (e.g., if the population of a city increases from 100,000 to 200,000), the number 2 needs only 50% growth to change to the number 3, and so forth, until finally, the number 9, which needs only 11.1% growth to change to the number 1. Therefore, a number starting with the digit 1 (9) has the greatest (smallest) probability of existence in a population.

Mathematically, the expected frequency of the first digit of a number following Benford's Law is given by the equation (Nigrini, 1996; Amiram et al., 2015; Nigrini, 2015):

Equation 5-1: Probability of the first digits

$$\mathrm{P}(\mathrm{D}_1 = \mathrm{d}_1) = \log_{10}\left(1 + \frac{1}{\mathrm{d}_1}\right) = \log_{10}(\mathrm{d}_1 + 1) - \log_{10}(\mathrm{d}_1)$$

Where D_1 is the first digit of a number, d_1 = 1, 2, 3, …, 9.

Similar to that of the first digits, the probability of second digits can also be written in the mathematical formulas (Carslaw, 1988; Thomas, 1989; Da Silva and Carreira, 2013; Nigrini, 2015) as follows[30]:

Equation 5-2: Probability of the second digit

$$\mathrm{P}(\mathrm{D}_2 = \mathrm{d}_2) = \sum_{d_1=1}^{9} \log_{10}\left(1 + \frac{1}{\mathrm{d}_2}\right)$$

Where D_2 is the second digits, d_2 = 0, 1, 2, …, 9

Also, the probability of a combination of digits can also be written. For example, formulas for combinations of the first and second digits are as follows:

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[30] Similarly, the probability of other digits can also be written in the mathematical formulas (see, e.g., Carslaw, 1988; Thomas, 1989; Da Silva and Carreira, 2013; Nigrini, 2015).

Equation 5-3: Probability of a combination of the first and second digit

$$P(D_1D_2 = d_1d_2) = \log_{10}\left(1 + \frac{1}{d_1d_2}\right)$$

Equation 5-4: Probability of the second digit conditional on the first digit

$$P(D_2 = d_2 | D_1 = d_1) = \frac{\log_{10}\left(1 + \frac{1}{d_1d_2}\right)}{\log_{10}\left(1 + \frac{1}{d_1}\right)}$$

While this study focuses on the distributional of the first digits only, it is helpful to provide a review of accounting research on Benford's Law in general.

5.2.2. Benford's Law in accounting research

A common application of Benford's Law is to assess accounting numbers' conformity to Benford's Law in tabulated (actual) data. Nigrini (1994) indicates that non-conformity to Benford's Law may be a red flag for errors in data. From a practical perspective, Nigrini and Mittermaier (1997) propose that comparing actual and expected frequencies of a list of numbers can be used as an analytical procedure in an audit. Durtschi, Hillison, and Pacini (2004) also provide guidance for auditors to apply Benford's Law to detect suspected accounts which may contain instances of fraud. Da Silva and Carreira (2013) use predefined criteria based on Benford's Law to develop models which support auditors in constructing auditing samples containing both conforming and non-conforming transactions.

Early empirical studies applied Benford's Law to study earnings management. Examining individual tax return items, Nigrini (1996) reported that the interest received line had higher (lower) than expected frequencies of smaller (larger) first digits. In contrast, the interest paid line had lower (higher) than expected frequencies of smaller (larger) first digits. The findings suggested that interest received (paid) had been understated (overstated) due to taxpayers intentionally evading tax.

Carslaw (1988) studied the second digits of reported income in financial statements of New Zealand firms and found that the actual frequencies of 0s (9s) were higher (lower) than that expected by Benford's Law. He theorized that this phenomenon was caused by the tendency of managers to round numbers up to achieve earnings targets. For example, when an earnings target is 6,000 but the true earnings number is 5,984 (or any number just below 6,000), managers are more likely to report the earnings number as 6,004 (or any number just above 6,000) to meet or beat the earnings target. Consequently, the frequency of second-digit 0s will be abnormally high, while the frequency of second-digit 9s will be abnormally low.

Consistent with Carslaw (1988), Thomas (1989) showed similar patterns in the US, but with less deviation of earnings numbers from the expectations following Benford's Law. Thomas (1989) also reported that while firms showing losses have more second-digit 9s and fewer second-digit 0s than expected, companies showing profits have abnormally high frequencies of second-digit 0s and 5s (after the decimal points) in their earnings-per-share (EPS) numbers. Later studies provide further evidence supporting the notion that the second digits of earnings numbers do not follow Benford's Law as a result of rounding-up behaviour (Niskanen and Keloharju, 2000; Caneghem, 2002, 2004).

So far, previous discussions indicate that Benford's Law can be applied to study a specific accounting item such as earnings (Carslaw, 1988; Thomas, 1989; Niskanen and Keloharju, 2000; Caneghem, 2002, 2004) and income tax (Nigrini, 1996). The general evidence is that accounting numbers follow distributional expectations of Benford's Law and that deviations from Benford's Law suggest the existence of errors. However, an interesting question is whether financial statement items follow Benford's Law. The question is valid because there is a mixture of estimations of cash flow realisations in accounting data (Amiram et al., 2015). Financial statements are prepared to give information about realisations of all present and future cash flows which are unknown at the time of presentation. There are different cash flows related to financial statements such as cash flows received from revenues, cash flows paid to suppliers, cash flows paid to employees or cash flows paid to tax authorities. Therefore, it is expected that financial statements may result from a mixture of estimations of cash flow realisations. Studying first digits rather than second digits, Amiram et al. (2015) prove that financial statement items follow Benford's Law. Their finding is based on the work of Hill (1995), Ray and Lindsay (2005), and Pimbley (2014). Ray and Lindsay (2005) indicate that a combination of normal distributions has a nearly exact normal distribution when their means are less than two standard deviations apart, meaning that it follows the expectations of Benford's Law. Hill (1995) proves that, under certain conditions, combined distributions follow Benford's Law if there is no error in the data sets. While Pimbley (2014) shows that the Central Limit Theorem leads to the conformity to Benford's Law of data which have smooth and symmetric distributions, Amiram et al. (2015) mathematically prove that a mixture of estimations of cash flow realisations tends to have smooth and symmetric distributions, and therefore follows Benford's Law. Another significant contribution of Amiram et al. (2015) is their development of an innovative score, namely FSD_SCORE, to capture deviations from Benford's Law of the first digits of figures reported in financial statements. The FSD_SCORE is defined as the sum of first-digit deviations from Benford's Law divided by nine, where deviations are absolute differences between observed (actual) frequencies of the first digits and the expected frequencies of all items in balance sheets, income statements, and cash flow statements. Amiram et al. (2015) prove that an introduction of errors in financial statements results in more divergences of first digits from Benford's Law. The FSD_SCORE is also associated with earnings management, which makes this measure helpful to predict material accounting misstatements identified by accounting and auditing enforcement releases, or AAERs, issued by SEC.

It is worthy to note that the term "errors" used in the paper of Amiram et al. (2015) (and in the thesis) has a slightly different meaning from that is defined by auditing standards (e.g., International Auditing and Assurance Standards Board (IAASB), 2010) in which errors result from unintentional acts, leading to misstatements of financial statements. From the auditing standard perspective, accounting misstatements include errors (unintentional) and frauds (intentional). In the work of Amiram et al. (2015), the term "errors" refers to irregularities of accounting data regardless of whether they are the results of intentional or unintentional acts. In other words, the term “errors” used in that paper has a close meaning to “misstatements” used in the auditing standards.

Similar to the approach of Amiram et al. (2015), Nigrini (2015) relies on the law of the first two digits to study the conformity to Benford’s Law of accounting data, stock prices and trading volumes of US companies. To capture deviations of the first two digits, Nigrini (2015) also uses the mean absolute deviations, which is the sum of the absolute difference between expected frequencies and actual frequencies of the first two digits divided by 90 (which is the number of possible two-digit combinations between 10 to 99). Comparing MAD with predetermined ranges of conformity, the author shows that distributions of the first two digits of accounting data, stock prices, and trading volumes closely conform to Benford’s Law.

5.2.3. Accounting research on Benford’s Law in the UK

There are relatively few accounting studies applying Benford’s Law in the UK. Caneghem (2002) and Caneghem (2004) find that there is an abnormally high (low) frequency of the second-digit 0s (9s) in income numbers, and these deviations of second-digit 0s (9s) from what is expected by Benford’s Law are statistically significant. Highly abnormal distributions do not exist in other second digits. This evidence is consistent with previous studies on rounding-up behaviour (Carslaw, 1988; Thomas, 1989; Niskanen and Keloharju, 2000; Caneghem, 2002).

Caneghem (2002) attempt to explain the causes of deviations from Benford’s Law of earnings numbers. Using abnormal accruals as a proxy for earnings management, he indicates that firms which are involved in the rounding up of earnings exhibit higher abnormal accruals. The evidence suggests that firms are likely to manage accruals to achieve targeted earnings and the introduction of earnings management results in significant variations of the second digits to Benford's Law. The notion that earnings management is related to deviations from Benford's Law is also supported by findings of Amiram et al. (2015). However, while Amiram et al. (2015) study the first digits of all figures reported in financial statements, Caneghem (2002) examines the distribution of the second digits of earnings numbers.

In another research, Caneghem (2004) studies the effect of audit quality on deviation from Benford's Law, which results from the rounding up of the second digits of earnings figures. He uses deviations of second-digit 0s and 9s of pre-tax earnings as a proxy for earnings management. Contrary to evidence on the effect of audit quality on earnings management (Krishnan, 2003), he finds that the abnormal distributions of second-digit 0s and 9s are not statistically significantly different between companies audited by the Big Four firms and companies audited by non–Big Four firms.

Although some studies apply Benford's Law to examine the accounting practices of UK listed companies (Caneghem, 2002, 2004), there are still fruitful areas for further research. First, prior research only focuses on the second digits of a specific item (such as pre-tax income). This line of study provides evidence that deviations of second digits from Benford's Law are related to rounding-up behaviours (Caneghem, 2002, 2004). In this study, I follow recent studies (e.g., Amiram et al., 2015) and focus on the first digits of all numbers reported in financial statements, including balance sheets, income statements and cash flow statements because any item in financial statements could be managed. Under accounting standards, financial statements are prepared for general purposes (IASB, 2018), meaning that there may be various stakeholders who use financial statements, and different users may require different accounting information. Also, the standard setters' view is that not only income statement items but also balance sheet (and cash flows) items are important. For example, definitions of incomes and expenses under accounting standards are based on definitions of assets and liabilities and changes in asset and liability values (IASB, 2018). This means that, in addition to income statement items, assets and liabilities in balance sheets are also important, and therefore they may be the target of accounting manipulation. By examining not only income statements but also balance sheets and cash flows statements, I give every item an equal chance for investigation. Second, previous studies applying Benford's Law (Caneghem, 2002, 2004) require time series data or cross-sectional data for analyses, which can be costly for researchers. In this research, following Amiram et al. (2015), I use firm-year observations to calculate the deviations of the first digits of financial statement items from Benford's Law. In the UK context, applying Benford's Law to study errors or fraud in financial statements has even more potential because of the lack of data on earnings quality similar to that available in the US (such as accounting restatements enforced by the US Government Accountability Office or AAERs issued by the US Securities and Exchange Commission).

5.2.4. Hypothesis development

First, similar to Amiram et al. (2015), who find that the first digits of financial statement items of US-listed companies follow Benford's Law, I hypothesise that the first digits of financial statement items of UK companies conform to Benford's Law at both the firm-specific and market levels.

H1: Distributions of first digits of items reported in financial statements of UK listed companies follow Benford's Law.

In addition, previous studies show earnings management has an important implication for markets because earnings are used for equity valuation (Aharony, Lin, and Loeb, 1993; Teoh et al., 1998a; Teoh et al., 1998b; DuCharme et al., 2001; Kim and Park, 2005; Iqbal et al., 2009; Kao, Wu, and Yang, 2009; Iqbal and Strong, 2010). The consequence is that items in income statements are more likely to be manipulated than items in other types of statements because income and expense items affect net profit (earnings) directly. Therefore, it is reasonable to expect that first-digit deviations of income statement items are larger than those of balance sheet items and cash flow items. This hypothesis is consistent with findings of Amiram et al. (2015), who also report larger deviations of income statement items than those of balance sheet items and cash flow items.

H2: Deviations from Benford's Law of the first digits of income statement items are larger than those of balance sheet items and cash flow items.

Furthermore, previous studies suggest that deviations from Benford's Law can be red flags signalling earnings management (Caneghem, 2002, 2004; Durtschi et al., 2004;

Amiram et al., 2015). Examining second digits, Caneghem (2002) indicates that firms which are involved in the rounding up of earnings exhibit higher abnormal accruals. The evidence suggests that firms are likely to manage accruals to achieve targeted earnings and the introduction of earnings management results in large variations of the second digits to Benford's Law. Amiram et al. (2015) also explain that an introduction of errors, frauds or bias (such as earnings management) leads to higher divergence of digits in financial statements (Amiram et al., 2015).

H3: Earnings management leads to an increase in first-digit deviations of financial statement items from Benford's Law.

While previous studies show that earnings management is a cause of deviations of financial statements from Benford's Law, there have been few attempts to provide an alternative explanation for such deviations. Motivated by current debates on conditional conservatism (e.g., Mora and Walker, 2015), which is a type of accounting conservatism, I further examine whether it can be a source of the deviations from Benford's Law.

Mora and Walker (2015) explain that conditional conservatism is controversial because it facilitates earnings management practices, such as downward earnings management by recognising huge losses to create reserves for future use. Recently, Lin et al. (2014) use deviations of digits of quarterly net income from Benford's Law as a measure of earnings management and find that firms with higher conservatism exhibit lower earnings management, but the findings also indicate that managers of firms with higher conservatism have more incentives to manipulate earnings in the presence of institutional shareholders. This mixed evidence also contributes to the debates on whether conditional conservatism can introduce bias to financial statements. In this paper, I study deviations of first digits of all items reported in annual, rather than quarterly, financial statements to examine whether conditional conservatism is a source of deviations.

There are also growing concerns that conditional conservatism is affected by purposeful interventions by management. Managers may choose to report to different levels of conservatism to deal with problems arising from information asymmetry between insiders and outsiders (LaFond and Watts, 2008) or to provide lenders with an assurance of timely signals of their creditworthiness to get benefits from lower interest rates (Zhang, 2008). Conservatism-related biases then cause first-digit deviations of financial statement items from Benford's Law, since Amiram et al. (2015) have explained that deviations of digits from Benford's Law could result from errors, fraud or biases in financial statements. Therefore, the last hypothesis is as follows.

H4: Conditional conservatism which is caused by managers' purposeful intervention leads to an increase in first-digit deviations of financial statement items from Benford's Law.

5.3. Methodology

5.3.1. Sample selection

This research uses data of all companies listed on the London Stock Exchange from 2005 to 2012. I download all financial statements items from the Datastream database,[31] except for data on external auditors which is collected from Bloomberg and merged with the main dataset via the International Securities Identification Number (ISIN). Financial institutions and utility firms are removed. I replace missing values with 0s when calculating the distributions of first digits, but this approach does not affect the analysis because 0 cannot be a leading digit. I extract the first digits of financial statement items (including balance sheets, income statements and cash flow statements). For negative numbers, I use the first digit after the negative sign. For numbers from –1 to 1, I use the first non-zero digit. Finally, I remove observations with fewer than 50 total first digits because the inclusion of firms with few total first digits may introduce bias to the sample.[32] As a result, I derive 10,048 firm-year

[31] I acknowledge that some of our data is not 'as reported' because Datastream could make adjustments or aggregate some items when inputting the data to ensure comparability and consistency. The distribution of the first digits based on the original figures could therefore be different from the one based on adjusted figures.

[32] Amiram et al. (2015) indicate that firms with less than 50 first digits may be too young or not in continuing operations, therefore inclusion of those firms may cause measurement errors.

observations from 2005 to 2012 (1,839 unique companies) with 721,027 first digits. This sample is used to calculate measures of deviations from Benford's Law for firm-year observations and for the entire market to determine whether financial statement items of UK listed companies conform to Benford's Law.

I test hypotheses H3 and H4 using a sample of 3,633 firm-year observations with sufficient data to calculate empirical measures. All continuous variables are winsorised to the 1st and 99th percentiles.

5.3.2. Measuring conformity and deviations from Benford's Law

Previous studies have documented that conformity to Benford's Law can be tested for each digit or all digits. To test the conformity of each digit, prior research uses the chi-square (χ^2) test, which uses the z-statistic as the critical value (Carslaw, 1988; Thomas, 1989; Niskanen and Keloharju, 2000; Caneghem, 2002, 2004). To test the conformity of all digits, the existing literature suggests two methods: the Kolmogorov–Smirnov (KS) test and the mean absolute deviation (MAD) test (Nigrini and Mittermaier, 1997; Amiram et al., 2015; Nigrini, 2015). For the purposes of this study, I used the KS test and the MAD test to provide evidence for hypotheses H1 and H2. The following part explains the KS test and the MAD test.

The first test relies on the KS statistic, which uses the maximum deviation of digits from Benford's Law (where the deviation is defined as the cumulative absolute difference between the observed and expected probabilities of each digit). The calculation of the KS statistic is as follows (Amiram et al., 2015):

Equation 5-5: KS statistic calculation

$$KS_{i,t} = max\{|OD_{1,i,t} - ED_1|, |(OD_{1,i,t} + OD_{2,i,t}) - (ED_1 + ED_2)|, \ldots, |(OD_{1,i,t} + OD_{2,i,t} + \cdots + OD_{9,i,t}) - (ED_1 + ED_2 + \cdots + ED_9)|\}$$

Where $KS_{i,t}$ is the maximum cumulative absolute deviation of the first digits of items reported in financial statements from that expected by Benford's Law of firm *i* in year *t*; $OD_{d,i,t}$ is the cumulative observed probability of the first digit *d* (*d* = 1, 2, …, 9) of firm *i* in year *t*; ED_d is the expected probability of the first digit *d* (*d* = 1, 2, …, 9), as defined by Benford's Law.

The critical value (test value) used to test whether a data set conforms to Benford's Law at the 5% level of significance is $1.36/\sqrt{\mathrm{P}}$, where P is the total number of first digits. If the KS statistic is less than the test value, the distribution of first digits conforms to Benford's Law.

Table 5-2 illustrates deviations of first digits of figures reported in financial statements for the fiscal year 2012 of M&C SAATCHI PLC from what are expected by Benford's Law. Cumulative deviations are stated in column (b).

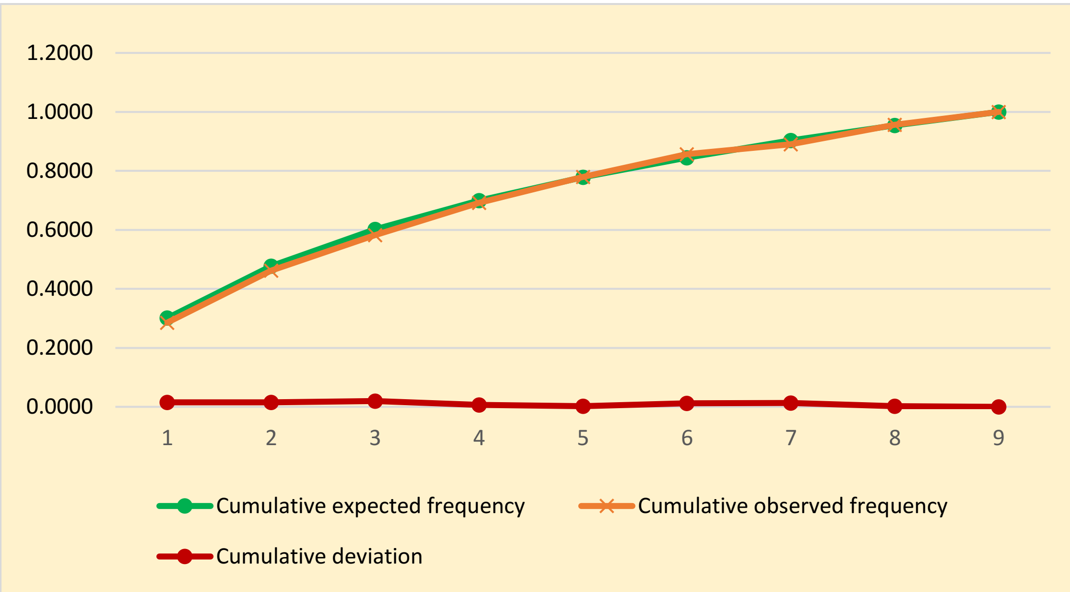
Figure 5-1 also helps to visualise the cumulative deviations. In this illustration, the maximum absolute deviation (KS statistic) is 0.0196 and the test value is equal to $1.36/\sqrt{91} = 0.1426$. Because KS statistic is less than the test value, the chapter cannot reject the null hypothesis that the distribution of the first digits follows Benford's Law at the 5% level significance. This is evidence that the distribution of first digits of figures reported in the financial statement of M&C SAATCHI PLC for the fiscal year 2012 conforms to Benford's Law.

Table 5-2: Deviation from Benford's Law of M&C SAATCHI PLC

First digit	Number of digits	*Mean absolute deviation (a)* Expected frequency	Observed frequency	Deviation	*Cumulative absolute deviation (b)* Cumulative expected frequency	Cumulative observed frequency	Cumulative deviation
1	26	0.3010	0.2857	0.0153	0.3010	0.2857	0.0153
2	16	0.1761	0.1758	0.0003	0.4771	0.4615	0.0156
3	11	0.1249	0.1209	0.0041	0.6021	0.5824	0.0196
4	10	0.0969	0.1099	0.0130	0.6990	0.6923	0.0067
5	8	0.0792	0.0879	0.0087	0.7782	0.7802	0.0021
6	7	0.0670	0.0769	0.0100	0.8451	0.8571	0.0120
7	3	0.0580	0.0330	0.0250	0.9031	0.8901	0.0130
8	6	0.0512	0.0659	0.0148	0.9542	0.9560	0.0018
9	4	0.0458	0.0440	0.0018	1.0000	1.0000	0.0000
Total	91	1.0000	1.0000	0.0929			
Mean absolute deviation				0.0103			
Maximum absolute deviation							0.0196

Note: the table reports mean absolute deviation (column a) and cumulative absolute deviation of first digits of figures reported in the financial statement (2012) of company M&C SAATCHI PLC. (Cumulative) expected frequency is (cumulative) distribution of the first digits following Benford's Law. (Cumulative) observed frequency is (cumulative) actual distribution of the first digits. (Cumulative) deviation is (cumulative) absolute difference between observed and expected frequency. The bottom of the table shows mean absolute deviation and maximum absolute deviation.

Figure 5-1: Cumulative absolute deviation of M&C SAATCHI PLC



The second test for conformity to Benford's Law relies on the mean absolute deviation (MAD), where MAD is the sum of absolute differences between observed (actual) and expected frequencies of digits (Amiram et al., 2015; Nigrini, 2015). Regarding the first digits, FSD_SCORE, developed by Amiram et al. (2015), is calculated based on MAD as follows:

Equation 5-6: FSD_SCORE calculation

$$FSD\_SCORE_{i,t} = \frac{\sum_{d=1}^{9} \left| OBSERVED_{d,i,t} - EXPECTED_{d} \right|}{9}$$

Where: $FSD\_SCORE_{i,t}$ is the mean absolute deviation of the first digits of financial statement items from that expected by Benford's Law of firm i in year *t*; $OBSERVED_{d,i,t}$ is the actual probability of the first digit *d* of firm *i* in year *t*; $EXPECTED_{d}$ is the expected probability of the first digit *d* following Benford's Law; and *d* = 1, 2, …, 9.

While there is no critical value for MAD, prior studies have suggested ranges of MAD values which indicate levels of first-digit conformity to Benford's Law. Drake and Nigrini (2000) and Nigrini (2012) indicate that there are four levels of conformity of first digits: close conformity, acceptable conformity, marginally acceptable conformity, and non-conformity. Table 5-3 shows MAD conformity ranges suggested by Drake and Nigrini (2000) and Nigrini (2012). The chapter also relies on those suggested MAD range values to test first-digit conformity.

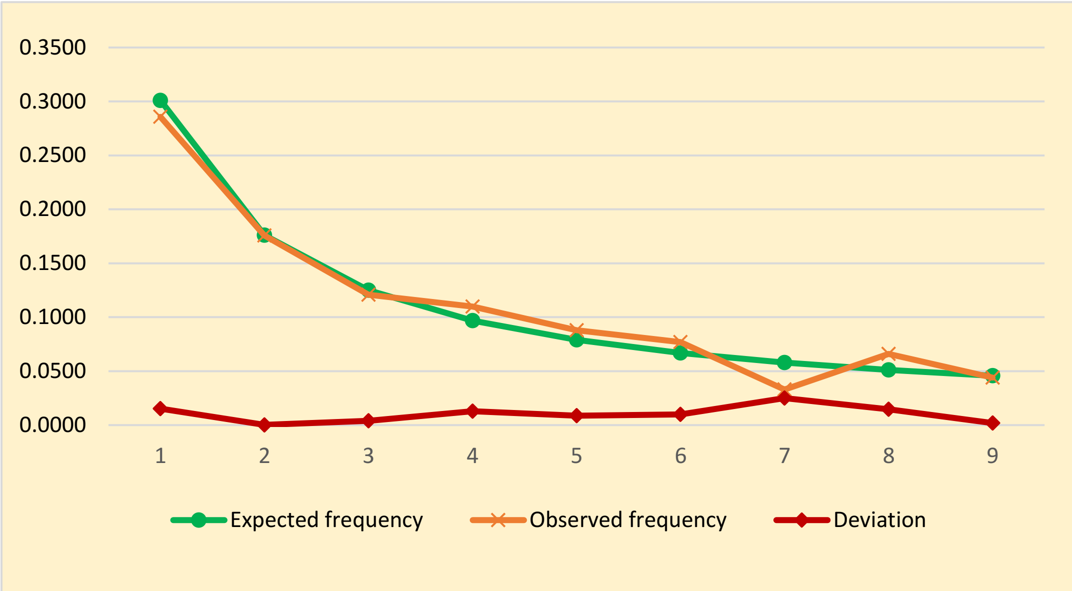
Table 5-3: MAD conformity ranges.

MAD	*Conformity level*
from 0.000 to 0.004	close conformity
from 0.004 to 0.008	acceptable conformity
from 0.008 to 0.012	marginally acceptable conformity
greater than 0.012	Nonconformity

Regarding the example of M&C SAATCHI PLC above, as reported in column (a) of Table 5-2, the FSD_SCORE in 2012 is 0.0103. Figure 5-2 also helps to visualise the absolute deviations of M&C SAATCHI PLC. Because FSD_SCORE falls between 0.008 and 0.012, this is evidence for the marginally acceptable conformity to Benford's Law of the distribution of the first digits of figures reported in the financial statement for the fiscal year 2012 of M&C SAATCHI PLC.

In this research, I use the KS for testing the conformity to Benford's Law at the firm-specific level and the FSD_SCORE for testing the conformity to Benford's Law at the market level. While the KS test becomes sensitive when P (total number of first digits) is large because the test value is calculated based on P, the construction of FSD_SCORE based on MAD overcomes the drawback of the KS statistic (Amiram 2015). For the firm-specific level test, I calculate deviations for each company using a pool of first digits from all available financial statements of that company during the research period. For the market level test, I calculate deviations using a pool of first digits of financial statements of all companies in the sample. At the market level, because the population of first digits is significant, the MAD statistic is more appropriate than the KS statistic.

Figure 5-2: Mean absolute deviations of M&C SAATCHI PLC



5.3.3. Earnings management proxy

Various models are used to estimate earnings management (Dechow et al., 2010). In this study, I apply the Modified Jones model (Jones, 1991; Dechow et al., 1995) to estimate abnormal accruals (DAC) because Peasnell et al. (2000b) find that it is the most effective model. I run the following regression with at least ten observations for each industry-year (Datastream level 6).

Equation 5-7: Jones (1991) model

$$\frac{AC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1\left(\frac{1}{A_{i,t-1}}\right) + \beta_2\left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \beta_3\left(\frac{PPE_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$$

$AC_{i,t}$ is total accruals, which equals net income before extraordinary items, minus net cash flows from operations; $A_{i,t-1}$ is total assets of firm *i* at the end of year *t–1;* $\Delta REV_{i,t}$ is the change in sales from year *t–1* to year *t* of firm *i*; $PPE_{i,t}$ is gross PPE of firm *i* at the end of year *t*.

Using $\hat{\alpha}, \hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3$, estimated from equation (4), I calculate DAC as follows:

Equation 5-8: Dechow et al. (1995)'s model

$$DAC_{i,t} = \left| \frac{AC_{i,t}}{A_{i,t-1}} - \left[\hat{\alpha} + \hat{\beta}_1 \left(\frac{1}{A_{i,t-1}} \right) + \hat{\beta}_2 \left(\frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} \right) + \hat{\beta}_3 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) \right] \right|$$

Where: $\Delta REC_{i,t}$ is the change in receivables from the end of year *t–1* to the end of year *t* of firm *i.*

In this research, I follow previous studies (e.g., Bergstresser and Philippon, 2006; Jiang et al., 2010; Armstrong et al., 2013; Hilary et al., 2016) and use the absolute values for figures used in the practice of earnings management regardless of direction (upward or downward). The reason is that both upward and downward earnings management introduce biases to financial statements, therefore leading to greater first-digit divergence from that expected by Benford's Law.

5.3.4. Accounting conservatism proxy

I follow the practice of Basu (1997) and Khan and Watts (2009) to estimate firm-year conditional conservatism. I first run the following regression for each year:

Equation 5-9: Khan and Watts (2009)'s model

$$EARN_{i,t} = \beta_1 + \beta_2 D_{i,t} + (\mu_1 + \mu_2 SIZE_{i,t-1} + \mu_3 MTB_{i,t-1} + \mu_4 LEV_{i,t-1})RET_{i,t} +$$

$$(\gamma_1 + \gamma_2 SIZE_{i,t-1} + \gamma_3 MTB_{i,t-1} + \gamma_4 LEV_{i,t-1})D_{i,t} * RET_{i,t} +$$

$$(\delta_1 SIZE_{i,t-1} + \delta_2 MTB_{i,t-1} + \delta_3 LEV_{i,t-1} + \delta_4 D_{i,t} * SIZE_{i,t-1} + \delta_5 D_{i,t} * MTB_{i,t-1}$$
$$+ \delta_6 D_{i,t} * LEV_{i,t-1}) + \varepsilon_{i,t}$$

$EARN_{i,t}$ is net income before extraordinary items in year *t*, scaled by the market value of equity at the end of year *t–1*; $RET_{i,t}$ is buy-and-hold stock returns for fiscal year *t*; $D_{i,t}$ is a dummy variable either equal to 1 if $RET_{i,t}$ < 0, otherwise it is equal to 0; $SIZE_{i,i-1}$ is the natural log of the market value of equity at the end of year *t–1*; $MTB_{i,i-1}$ is the market-to-book ratio at the end of year *t–1*; $LEV_{i,t-1}$ is the sum of long-term and short-term debts at the end of year *t–1*, scaled by the market value of equity at the end of year *t–1*.

I then calculate empirical measures of the timeliness of good news ($GSCORE$) and the incremental timeliness of bad news over good news ($CSCORE$) based on firm characteristics as follows: [33]

[33] In this research, I used lagged values of firm characteristics while Khan and Watts (2009) use values at the end of current year. Because earnings are figures for an entire year, firms can rely on financial conditions at the beginning of the year to determine needed levels of

Equation 5-10: Calculation of GSCORE and CSCORE

$$GSCORE_{i,t} = \beta_3 = \mu_1 + \mu_2 SIZE_{i,t-1} + \mu_3 MTB_{i,t-1} + \mu_4 LEV_{i,t-1}$$

$$CSCORE_{i,t} = \beta_4 = \gamma_1 + \gamma_2 SIZE_{i,t-1} + \gamma_3 MTB_{i,t-1} + \gamma_4 LEV_{i,t-1}$$

CSCORE is the measure of conditional conservatism, which I use to calculate the average of *CSCORE* across years *t–2*, *t–1* and *t*. I then calculate the annual fractional rank of conditional conservatism, denoted *CSCORE_RANK*, by ranking the average values of *CSCORE* for all observations by year and then dividing the ranked values by *N+1* (where *N* is the total number of observations in each year). I use ranked values because they help to mitigate concerns about nonlinearity and measurement errors (García Lara et al., 2016; Goh et al., 2017).

5.3.5. Multivariate regression

To provide evidence for hypotheses H3 and H4, I run the following regression:

Equation 5-11: Main regression

$$KS_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 CSCORE\_RANK_{i,t} + \beta_3 LOSS_{i,t} + \beta_4 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$$

---

conservatism for the year. The use of lagged values of firm characteristics is supported by Ball et al. (2013a) and applied by Banker et al. (2012).

In the model, I include two control variables, losses in previous years (*LOSS*) and risk of fraud (*FRAUD*) (Amiram et al., 2015). $LOSS_{i,t}$ is equal to 1 if net incomes before extraordinary items in years *t–2* and *t–1* are both negative, 0 otherwise. $FRAUD_{i,t}$ is calculated based on *FSCORE* following Dechow et al. (2011) (Model 1, Table 7). $FRAUD_{i,t}$ is equal to 1 if FSCORE is greater than 1, otherwise 0. FSCORE is calculated as follows:

Equation 5-12: Calculation of fraud score following Dechow et al. (2011)

$$Predicted\ Value = -7.893 + 0.790 * ACC\_RSST + 2.581 * \Delta REC + 1.191 * \Delta INV + 1.979 * SOFTASSET + 0.171 * \Delta CASH - 0.932 * \Delta ROA + 1.029 * SEO$$

$$Probability = \frac{e^{Predicted\ Value}}{1 + e^{Predicted\ Value}}$$

$$FSCORE = \frac{Probability}{0.0037}$$

Where: The value of $e = 2.71828183$; ACC_RSST is change in non-cash net operating assets following Richardson et al. (2005),[34] scaled by total assets at the end

[34] ACC_RSST = (chWC + ChNCO + ChFIN)/AT_{t-1}; where:

- ChWC = $WC_t - WC_{t-1}$= [(ACT_t - CHE_t) - (LCT_t - DLC_t)] - [(ACT_{t-1} - CHE_{t-1}) - (LCT_{t-1} - DLC_{t-1})]; ACT is current assets, CHE is cash and cash equivalent, LCT is current liabilities, DLC is short term debts and current portions of long term debts.

of year $t–1$; ΔREC is changes in receivables from year $t–1$ to year t, scaled by total assets at the end of year $t–1$; ΔINV is changes in inventories from year $t–1$ to year t, scaled by total assets at the end of year $t–1$; $SOFTASSET$ is soft assets in year $t–1$ (total assets minus cash and cash equivalent minus net PPE, scaled by total assets at the end of year $t–1$); $\Delta CASH$ is changes in cash and cash equivalent scaled by total assets at the end of year $t–1$; ΔROA is return on assets in year t minus return on assets in year $t–1$, where return on assets equals net income divided by total assets; SEO is actual equity issuance, which equals 1 if change in common share capital is greater than 5% and proceeds from issuance is greater than 0, otherwise 0.

I expect that β_1 would be positive and significant (hypothesis H3) and that β_2 would positive and significant (hypothesis H4). I also expect β_3 and β_4 to be positive and significant because losses and high risk of fraud may cause an increase in deviations from Benford's Law (Amiram et al., 2015).

- $ChNCO = NCO_t - NCO_{t-1} = [(AT_t - ACT_t - INVST_t) - (LT_t - LCT_t - DLTT_t)] - [(AT_{t-1} - ACT_{t-1} - INVST_{t-1}) - (LT_{t-1} - LCT_{t-1} - DLTT_{t-1})]$; INVST is total investments; LT is total liabilities, DLTT is long term debts.

- $ChFIN = FIN_t - FIN_{t-1} = [(STINVST_t + LTINVST_t) - (LT_t + LTDEBTC_t + PRESTOCK_t)] - [(STINVST_{t-1} + LTINVST_{t-1}) - (LT_{t-1} + LTDEBTC_{t-1} + PRESTOCK_{t-1})]$; STINVST is short-term investments, LTINVST is long-term investments, LTDEBTC is current portion of long term debts, PRESTOCK is preferred stock.

5.4. Findings and discussions

5.4.1. Descriptive statistics and correlations

Table 5-4 reports descriptive statistics of firm characteristics and selected variables. Firm characteristics are broadly similar to those used in prior research, which uses similar data (Goh and Gupta, 2016). At first glance, *KS* values are higher than *FSD_SCORE* in all aspects (MEAN, STD, MEDIAN, MAX, MIN, P25 and P75). The reason is that while KS values are calculated based on maximum cumulative absolute differences between expected and actual distributions of the first digits of financial statement items, whereas *FSD_SCORE* is calculated based on mean absolute differences. Also, in Table 5-4, the mean of abnormal accruals is 0.080, indicating that on average, earnings are managed by 8% of opening total assets. The descriptive statistics also indicate that the sample has fewer firms with losses in two consecutive years (median of *LOSS* is 0) and has fewer firms with a high risk of fraud (median of *FRAUD* is 0).

Table 5-5 shows the correlations of selected variables. The findings indicate that correlation coefficients between independent variables are very small (less than 0.2) and even insignificant (in italics), suggesting that multicollinearity is not a significant concern.

5.4.1. Evidence on the conformity of first digits to Benford's Law

As discussed above, there are two tests for conformity of the first digits of financial statement items to Benford's Law: the KS test and the MAD test. I rely on the KS statistic for conformity at the firm-specific level and on MAD test for conformity at the market level.

5.4.1.1. Conformity at the firm-specific level

Table 5-6 reports findings of the KS test of conformity at the firm-specific level. I observe that the percentage of firm-year observations following Benford's Law is 90.86%. This conformity ratio is slightly higher than the conformity ratio of US companies for the period from 2001 to 2011, which is 85.63% (Amiram et al., 2015, page 1584).

To have a closer look at the conformity of first digits of financial statements, I analyse distributions of first digits by year and by industry. Table 5-7 reports findings of the conformity by year. The table indicates that the conformity rates level off around 91%, suggesting that financial statements of UK listed companies maintained high levels of conformity for at least the eight-year research period. Also, Table 5-8 reports the conformity to Benford's Law at the firm-specific level for each industry. The evidence shows that the conformity rate is very high, varying between 82% to 100% (with one exception of 71%). In general, those figures reinforce the above evidence that UK-listed companies conform to Benford's Law at the firm-specific level.

5.4.1.1. *Conformity to Benford's Law at the market level*

For conformity to Benford's Law at the market level, I rely on the MAD test. As explained above, the MAD test is more appropriate for large pools of first digits because this test is not affected by the number of first digits used.

Table 5-9 report findings of the MAD test. The table shows that the aggregate FSD_SCORE for the entire market of listed companies in the UK from 2005 to 2012 is 0.0010, which is similar to that of companies listed in the US, as reported by Amiram et al. (2015). [35] The small aggregate FSD_SCORE falls within the first predetermined range (from 0.000 to 0.004) of conformity suggested by previous studies (Drake and Nigrini, 2000; Nigrini, 2012). The results indicate that distributions of first digits closely conform to Benford's Law. As shown in

Figure 5-3, distributions of first digits of UK listed companies perfectly match with the expectations of Benford's Law, suggesting close conformity.

Table 5-11 reports FSD_SCORE by industry. The findings show that the UK market maintains a low FSD_SCORE for each industry, meaning high levels of conformity. In particular, in 81 industries, there are 32 industries with conformity level A (close

[35] In the US, Amiram et al. (2015) report that the aggregate FSD_SCORE of listed companies in US from 2001 to 2011 is 0.0009.

conformity), 32 industries with conformity level B, 9 industries with conformity level C (marginally acceptable conformity), and only 8 industries with conformity level D (non-conformity). The evidence supports the findings above that, in general, first digits of UK listed companies follow Benford's Law at the market level.

In general, the evidence reported in Section 5.4.1.1 and 5.4.1.1 support the Hypothesis H1 that the first digits of financial statement items of UK listed companies conform to Benford's Law, at the firm-specific and at market levels. The results are similar to what are reported by Amiram et al. (2015) using a sample of US data.

Table 5-4: Descriptive statistics

Variables	N	MEAN	STD	MEDIAN	MIN	MAX	P25	P75
$AT_{i,t}$	3635	1,020,420	3,612,198	120,127	276	50,806,224	36,874	530,592
$Sale_{i,t}$	3635	818,674	2,559,972	121,071	0	41,591,430	26,067	549,600
Net income before extraordinary $items_{i,t}$	3635	71,504	403,825	4,677	- 1,425,847	6,893,275	491	28,200
Debt to assets $ratio_{i,t}$	3635	0.315	0.999	0.131	0.000	46.609	0.007	0.355
Market to book $ratio_{i,t}$	3635	4.039	20.544	2.084	0.083	1080.851	1.251	3.566
$FSD\_SCORE_{i,t}$	3635	0.032	0.010	0.031	0.009	0.088	0.025	0.037
$KS_{i,t}$	3635	0.089	0.039	0.082	0.012	0.307	0.061	0.111
$DAC_{i,t}$	3635	0.080	0.128	0.049	0.000	2.776	0.023	0.095
$CSCORE\_RANK_{i,t}$	3635	0.502	0.281	0.501	0.001	0.999	0.263	0.744
$LOSS_{i,t}$	3635	0.153	0.360	0.000	0.000	1.000	0.000	0.000
$FRAUD_{i,t}$	3635	0.102	0.303	0.000	0.000	1.000	0.000	0.000

Note: Table reports the number of observations (N), mean (MEAN), standard deviation (STD), median (MEDIAN), minimum (MIN), maximum (MAX), 25^{th} (P25), and 75^{th} (P75) percentiles of firm characteristics and selected variables. Definitions of variables are in the Appendix.

Table 5-5: Correlations

Variable		1	2	3	4	5	6
$FSD\_SCORE_{i,t}$	1	1.000					
$KS_{i,t}$	2	0.727	1.000				
$DAC_{i,t}$	3	0.127	0.091	1.000			
$CSCORE\_RANK_{i,t}$	4	0.065	0.058	*0.019*	1.000		
$LOSS_{i,t}$	5	0.238	0.197	0.192	0.059	1.000	
$FRAUD_{i,t}$	6	0.061	*0.031*	0.109	*0.042*	0.081	1.000

Note: The table reports the Pearson correlation coefficients between selected variables. The values reported in italic indicate the corresponding coefficients are not significant at 5% level. Definitions of variables are in the Appendix.

Table 5-6: Aggregate conformity to Benford's Law (based on KS values) at the firm-specific level

	Number of firm-year observations	*Percentage*
Conformity	9,130	90.86%
Non-Conformity	918	9.14%
Total	10,048	100.00%

Note: Table reports findings of KS tests for aggregate conformity to Benford's Law of first digits of financial statement items of UK listed companies from 2005 to 2012.

Table 5-7: Conformity to Benford's Law (based on KS values) at the firm-specific level, by year

Year	*Number of firm-year observations*	*Number of conformity*	*Percentage*
2005	1544	1368	88.60%
2006	1535	1397	91.01%
2007	1447	1309	90.46%
2008	1311	1205	91.91%
2009	1182	1084	91.71%
2010	1086	999	91.99%
2011	1009	922	91.38%
2012	934	846	90.58%

Note: Table reports findings of KS tests for conformity to Benford's Law by year of first digits of financial statement items of UK listed companies from 2005 to 2012.

Table 5-8: Conformity to Benford's Law (based on KS values) at the firm-specific level, by industry

Industry	*Number of firm-year observations*	*Number of conformity*	*Percentage*
Aerospace	58	55	95%
Airlines	38	37	97%
Alternative Fuels	74	66	89%
Apparel Retailers	115	103	90%
Auto Parts	56	52	93%
Biotechnology	232	198	85%
Brewers	11	11	100%
Broadcast	250	213	85%
Broadline Retailers	71	67	94%
Building Material and fixtures	171	152	89%
Bus Train and Employment	272	247	91%
Business Support Services	970	915	94%
Clothing and Accessory	111	104	94%
Coal	88	73	83%
Commercial Vehicles and Trucks	32	31	97%
Commodity Chemicals	1	1	100%
Computer Hardware	60	51	85%
Computer Services	307	291	95%
Consumer Electronics	24	22	92%
Containers and Package	75	72	96%
Defense	49	48	98%
Delivery Services	9	9	100%
Diamonds and Gemstones	70	61	87%
Distillers and Vintners	21	20	95%
Diversified Industrials	26	25	96%
Drug Retailers	7	7	100%
Durable Household Products	27	26	96%
Electrical Office Equipment	4	4	100%
Electrical Equipment	194	173	89%
Electronic Equipment	164	151	92%
Exploration and Production	601	511	85%
Farming and Fishing	77	67	87%
Financial Administration	25	24	96%
Fixed Line Telecommunication	101	94	93%
Food Products	187	176	94%
Food Retail - Wholesale	79	73	92%
Forestry	7	5	71%

Industry	*Number of firm-year observations*	*Number of conformity*	*Percentage*
Furnishings	73	73	100%
Gambling	135	117	87%
General Mining	423	355	84%
Gold Mining	230	188	82%
Healthcare Providers	95	90	95%
Heavy Construction	134	123	92%
Home Construction	102	99	97%
Home Improvement Retailers	58	58	100%
Hotels	47	41	87%
Industrial Machinery	294	273	93%
Industrial Suppliers	152	148	97%
Integrated Oil and Gas	19	18	95%
Internet	92	84	91%
Iron and Steel	40	37	93%
Marine Transportation	27	23	85%
Media Agencies	326	304	93%
Medical Equipment	169	155	92%
Medical Supplies	75	72	96%
Mobile Telecommunication	97	88	91%
Nondurable Household Product	31	31	100%
Nonferrous Metals	53	46	87%
Oil Equipment and Services	126	122	97%
Paper	19	17	89%
Personal Products	29	27	93%
Pharmaceuticals	248	208	84%
Platinum and Precious Metal	37	31	84%
Publishing	177	165	93%
Railroads	2	2	100%
Recreational Products	24	19	79%
Recreational Services	160	149	93%
Renewable Energy Equipment	30	26	87%
Restaurants and Bars	200	184	92%
Semiconductors	85	79	93%
Soft Drinks	27	27	100%
Software	686	621	91%
Specialized Consumer Service	44	36	82%
Specialty Chemicals	145	132	91%
Specialty Retailers	203	188	93%

Industry	*Number of firm-year observations*	*Number of conformity*	*Percentage*
Telecommunication Equipment	116	105	91%
Tobacco	18	18	100%
Toys	42	40	95%
Transport Services	155	144	93%
Travel and Tourism	89	85	96%
Waste, Disposal Services	50	47	94%

Note: Table reports findings of KS tests for conformity to Benford's Law by industry (Datastream's level 6 code) of first digits of financial statement items of UK listed companies from 2005 to 2012.

Table 5-10 reports FSD_SCORE by years. When calculating FSD_SCORE separately for each year, the findings show that the UK market maintains a low FSD_SCORE from 2005 to 2012, ranging from 0.0012 to 0.0015.[36] Based on the MAD conformity range values suggested by previous studies (Drake and Nigrini, 2000; Nigrini, 2012), this is evidence that first digits of UK-listed companies closely conform to Benford's Law when tested separately by year. Figure 5-4 helps to visualise deviations of first digits by year.

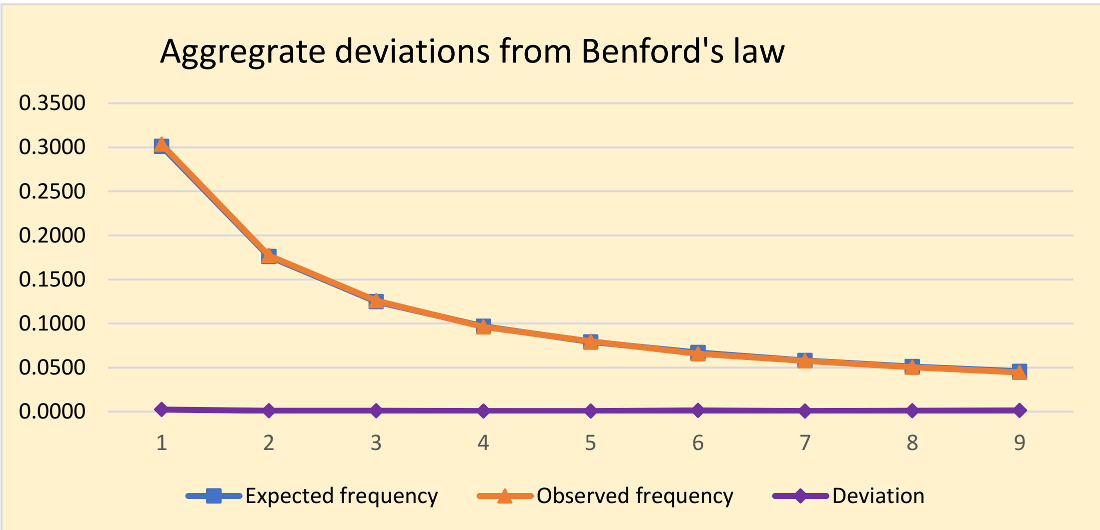
[36] It is noted that the aggregate FSD_SCORE reported in Table 5-9 (0.0010) is calculated based on the whole sample from 2005 to 2012. It means that the pool of first digits to calculate the aggregate FSD_SCORE for the market is larger than the pools of first digits used to calculate FSD_SCORE for each year.

Table 5-9: Aggregate conformity to Benford's Law at the market level

First digit	Number of the first digits	Expected frequency	Observed frequency	Deviation
(a)	(b)	(c)	(d)	(e)
1	218,700	0.3010	0.3033	0.0023
2	127,672	0.1761	0.1771	0.0010
3	90,719	0.1249	0.1258	0.0009
4	69,400	0.0969	0.0963	0.0007
5	57,485	0.0792	0.0797	0.0005
6	47,424	0.0670	0.0658	0.0012
7	41,411	0.0580	0.0574	0.0006
8	36,185	0.0512	0.0502	0.0010
9	32,031	0.0458	0.0444	0.0013
Total	721,027	1.0000	1.0000	0.0094
FSD_SCORE				0.0010

Note: the table reports the aggregate FSD_SCORE of UK listed companies for the period from 2005 to 2012. The table shows the first digits being analysed, expected frequencies of the first digits following Benford's Law, observed (actual) frequencies of the first digits, deviations of the first digits from Benford's Law, where deviations are defined as the absolute values of the observed frequencies minus the expected frequencies. FSD_SCORE is the sum of all deviations divided by nine. Definitions of variables are in the Appendix.

Figure 5-3: Aggregate deviations of the first digits of UK listed companies (2005-2012)



Note: the figure shows the expected and observed (actual) distributions of the first digits of financial statements of UK listed companies (2005-2012). The expected frequency is the theoretical distributions of the first digits following Benford's Law. The observed frequency is the observed (actual) distributions of the first digits in the sample. The deviation is defined as the absolute value of the observed frequency minus the expected frequency.

Table 5-10: FSD_SCORE by year

Year	*Number of first digits*	*Number of firm-year observations*	*FSD_SCORE*
2005	107,950	1,544	0.0012
2006	108,288	1,535	0.0012
2007	103,418	1,447	0.0014
2008	94,830	1,311	0.0015
2009	85,496	1,182	0.0012
2010	78,604	1,086	0.0013
2011	73,720	1,009	0.0014
2012	68,721	934	0.0014

Note: The table reports FSD_SCORE by year of all firms in the research period from 2005 to 2012.

Figure 5-4: Visualisation of FSD_SCORE, by year

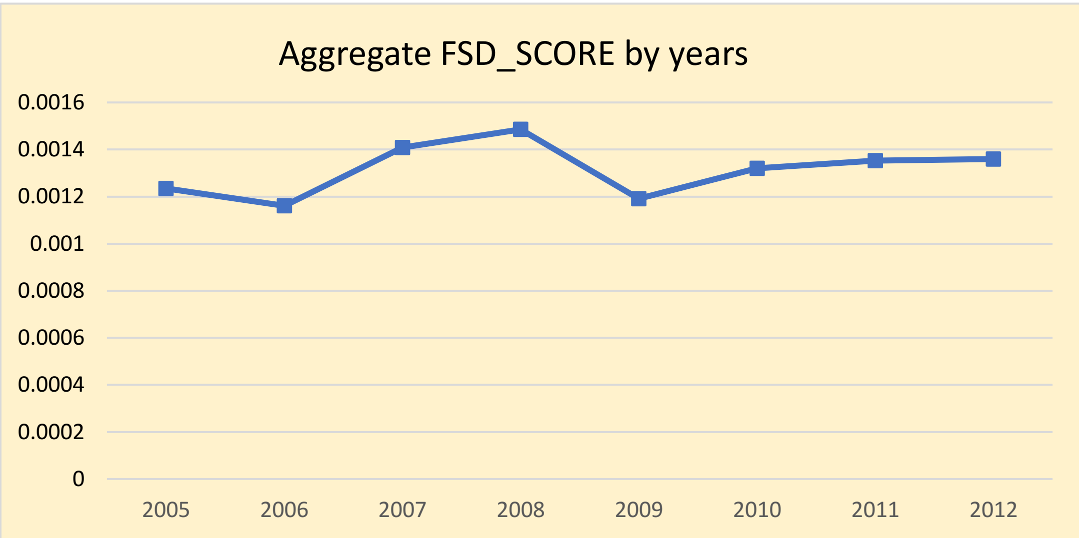


Table 5-11: FSD_SCORE by industry

Industry	Number of first digits	Number of firm-year observations	FSD_SCORE	Conformity level
Aerospace	4,986	58	0.0040	A
Airlines	3,053	38	0.0036	A
Alternative Fuels	4,648	74	0.0042	B
Apparel Retailers	8,629	115	0.0041	B
Auto Parts	3,883	56	0.0085	C
Biotechnology	14,745	232	0.0024	A
Brewers	1,061	11	0.0098	C
Broadcast	16,605	250	0.0029	A
Broadline Retailers	5,506	71	0.0044	B
Building Material and fixtures	12,541	171	0.0041	B
Bus Train and Employment	18,768	272	0.0018	A
Business Support Services	73,930	970	0.0023	A
Clothing and Accessory	7,838	111	0.0028	A
Coal	4,959	88	0.0036	A
Commercial Vehicles and Trucks	2,540	32	0.0039	A
Commodity Chemicals	99	1	0.0269	D
Computer Hardware	4,388	60	0.0075	B
Computer Services	22,192	307	0.0013	A
Consumer Electronics	1,759	24	0.0090	C
Containers and Package	5,920	75	0.0060	B
Defense	4,395	49	0.0043	B
Delivery Services	689	9	0.0148	D
Diamonds and Gemstones	4,408	70	0.0083	C
Distillers and Vintners	1,644	21	0.0063	B
Diversified Industrials	2,356	26	0.0073	B
Drug Retailers	525	7	0.0119	C
Durable Household Products	2,118	27	0.0077	B
Electrical Office Equipment	295	4	0.0122	D
Electrical Equipment	14,159	194	0.0036	A
Electronic Equipment	12,296	164	0.0028	A
Exploration and Production	36,199	601	0.0017	A
Farming and Fishing	5,468	77	0.0067	B
Financial Administration	1,743	25	0.0077	B
Fixed Line Telecommunication	7,546	101	0.0041	B
Food Products	15,172	187	0.0040	A
Food Retail - Wholesale	6,266	79	0.0050	B
Forestry	278	7	0.0142	D

Industry	Number of first digits	Number of firm-year observations	FSD_SCORE	Conformity level
Furnishings	5,461	73	0.0091	C
Gambling	9,422	135	0.0033	A
General Mining	27,627	423	0.0025	A
Gold Mining	14,559	230	0.0019	A
Healthcare Providers	6,998	95	0.0034	A
Heavy Construction	10,225	134	0.0051	B
Home Construction	7,717	102	0.0046	B
Home Improvement Retailers	4,332	58	0.0044	B
Hotels	3,166	47	0.0064	B
Industrial Machinery	22,795	294	0.0026	A
Industrial Suppliers	12,174	152	0.0023	A
Integrated Oil and Gas	1,954	19	0.0086	C
Internet	5,740	92	0.0045	B
Iron and Steel	3,024	40	0.0068	B
Marine Transportation	1,734	27	0.0089	C
Media Agencies	23,652	326	0.0019	A
Medical Equipment	11,564	169	0.0036	A
Medical Supplies	5,364	75	0.0034	A
Mobile Telecommunication	6,260	97	0.0035	A
Nondurable Household Product	2,675	31	0.0031	A
Nonferrous Metals	2,877	53	0.0060	B
Oil Equipment and Services	9,981	126	0.0028	A
Paper	1,690	19	0.0173	D
Personal Products	2,052	29	0.0071	B
Pharmaceuticals	17,794	248	0.0053	B
Platinum and Precious Metal	2,157	37	0.0071	B
Publishing	14,385	177	0.0022	A
Railroads	137	2	0.0286	D
Recreational Products	1,863	24	0.0127	D
Recreational Services	11,206	160	0.0035	A
Renewable Energy Equipment	1,921	30	0.0095	C
Restaurants and Bars	15,198	200	0.0029	A
Semiconductors	6,043	85	0.0057	B
Soft Drinks	2,163	27	0.0143	D
Software	45,406	686	0.0014	A
Specialized Consumer Service	3,088	44	0.0057	B
Specialty Chemicals	10,955	145	0.0028	A

Industry	Number of first digits	Number of firm-year observations	FSD_SCORE	Conformity level
Specialty Retailers	15,777	203	0.0040	B
Telecommunication Equipment	8,407	116	0.0030	A
Tobacco	1,737	18	0.0073	B
Toys	3,084	42	0.0056	B
Transport Services	12,111	155	0.0041	B
Travel and Tourism	7,411	89	0.0051	B
Waste, Disposal Services	3,534	50	0.0042	B

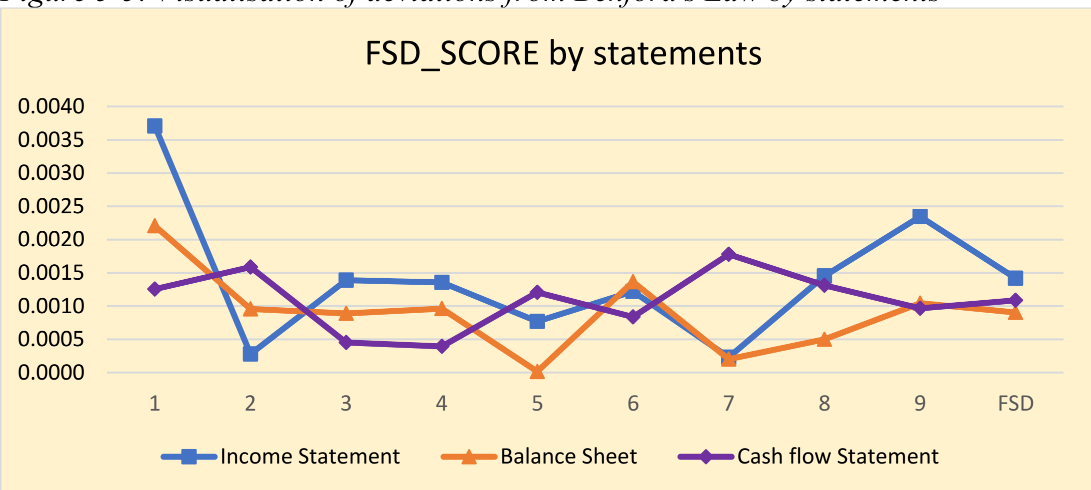
Note: The table reports FSD_SCORE by industry (Datastream's level 6 code) of all firms in the research period from 2005 to 2012. Four conformity levels are based on previous studies (Drake and Nigrini, 2000; Nigrini, 2012): close conformity (A), acceptable conformity (B), marginally acceptable conformity (C), and Nonconformity (D).

5.4.1.2. Conformity to Benford's Law by each component of financial statements

To provide evidence for the hypothesis H2, I analyse deviations from Benford's Law by each component of financial statements, namely income statements, balance sheets, and cash flow statements. Similar to the tests for the whole sample at the market level, I rely on FSD_SCORE, which is based on MAD, calculated for each component of financial statements.

Table 5-12 reports the results of the MAD test for income statements (Panel A), balance sheets (Panel B), and cash flow statements (Panel C). I find that the FSD_SCORE for income statement items, balance sheet items and cash flow items are 0.0014, 0.0009 and 0.0011, respectively. Those small figures also indicate that first digits of separate components of financial statements also closely conform to Benford's Law. Figure 5-5 helps to visualise the deviations of the first digits and FSD_SCORE of each statement. Importantly, I find that FSD_SCORE of income statement items are larger than those of balance sheets and cash flow statements, suggesting that income statements may contain more errors. In general, the findings support the Hypothesis H2 that deviations from Benford's Law of the first digits of income statement items are larger than those of balance sheet items and cash flow items.

Figure 5-5: Visualisation of deviations from Benford's Law by statements



Note: the figure shows the expected and observed (actual) distributions of the first digits of financial statements of UK listed companies (2005-2012), by components of financial statements. The expected frequency is the theoretical distributions of the first digits following Benford's Law.

Table 5-12: Conformity to Benford's Law at the market level, by statements

Panel A: Income statement

First digit	Number of the first digits	Expected frequency	Observed frequency	Deviation
1	52,970	0.3010	0.3047	0.0037
2	30,657	0.1761	0.1764	0.0003
3	21,958	0.1249	0.1263	0.0014
4	16,610	0.0969	0.0956	0.0014
5	13,897	0.0792	0.0799	0.0008
6	11,425	0.0670	0.0657	0.0012
7	10,120	0.0580	0.0582	0.0002
8	8,639	0.0512	0.0497	0.0015
9	7,546	0.0458	0.0434	0.0023
Total	173,822	1.0000	1.0000	0.0127
FSD_SCORE				0.0014

Panel B: Balance sheet

First digit	Number of the first digits	Expected frequency	Observed frequency	Deviation
1	101,811	0.3010	0.3032	0.0022
2	59,444	0.1761	0.1770	0.0010
3	42,247	0.1249	0.1258	0.0009
4	32,215	0.0969	0.0959	0.0010
5	26,590	0.0792	0.0792	0.0000
6	22,019	0.0670	0.0656	0.0014
7	19,404	0.0580	0.0578	0.0002
8	17,007	0.0512	0.0507	0.0005
9	15,013	0.0458	0.0447	0.0010
Total	335,750	1.0000	1.0000	0.0081
FSD_SCORE				0.0009

Panel C: Cash flow statement

First digit	Number of the first digits	Expected frequency	Observed frequency	Deviation
1	63919	0.3010	0.3023	0.0013
2	37571	0.1761	0.1777	0.0016
3	26514	0.1249	0.1254	0.0004
4	20575	0.0969	0.0973	0.0004
5	16998	0.0792	0.0804	0.0012
6	13980	0.0670	0.0661	0.0008
7	11887	0.0580	0.0562	0.0018
8	10539	0.0512	0.0498	0.0013
9	9472	0.0458	0.0448	0.0010
Total	211,455	1.0000	1.0000	0.0098
FSD_SCORE				0.0011

Note: the table reports the aggregate FSD_SCORE of UK listed companies for the period from 2005 to 2012 by income statements (Panel A), balance sheets (Panel B), and cash flow statements (Panel C). The table shows the first digits being analysed, expected frequencies of the first digits following Benford's Law, observed (actual) frequencies of the first digits, deviations of the first digits from Benford's Law, where deviations are defined as the absolute values of the observed frequencies minus the expected frequencies. Definitions of variables are in the Appendix.

5.4.2. Multivariate regression results

Table 5-13 reports findings of Equation 5-11, where independent variables include abnormal accruals (column a), conditional conservatism (column b) and both abnormal accruals and conditional conservatism (column c). Regarding control variables, I find that *KS* is higher for firms with losses in two consecutive years (*LOSS* = 1) and firms with a higher risk of fraud (*FRAUD* = 1). This evidence is consistent with prior studies (e.g., Amiram et al., 2015). I now turn to the key variables of interest. I find that *KS* is positively associated with abnormal accruals (columns a and c), which is a proxy for earnings management. The association is statistically significant. The findings support hypothesis H3 that earnings management is a source of deviations of first digits. This is consistent with the notion that earnings management causes deviations of digits of accounting numbers from Benford's Law (Caneghem, 2002, 2004; Durtschi et al., 2004; Amiram et al., 2015). The reason may be that, when earnings are managed, the first digits of financial statement items deviate from expectations following Benford's Law. Thus, higher abnormal accruals are associated with larger *KS*. In column c, the evidence shows that one unit increase in abnormal accruals is associated with an increase of 0.011028 in *KS*. Given that the mean of *KS* is 0.089 (as reported in Table 5-4) when abnormal accruals increase by one unit, *KS* increases by 12.34% (=0.011028/0.089), which is non-trivial. Thus, the association between *KS* and abnormal accruals is significant in economic terms. The evidence supports the hypothesis H3 that earnings management is a source of deviations of first digits of financial statement items.

Also in Table 5-13, columns (b) and (c), I find that *CSCORE_RANK* leads to an increase in *KS*. The effect is statistically significant at the 1% level. The relationship between *CSCORE_RANK* and *KS* is also significant in economic terms. For example, in column c, I observe that one unit increase in conditional conservatism is associated with an increase of 0.012486 in *KS*, which accounts for 14.02% of *KS* (=0.012486/0.089). In general, the evidence supports the hypothesis H4 that conditional conservatism is a source of first-digit deviations. The findings are supported by previous studies that conditional conservatism introduces biases, which causes first digits to deviate from Benford's Law because it can be manipulated by managers (LaFond and Watts, 2008; Zhang, 2008; Mora and Walker, 2015).

5.4.3. Robustness tests

5.4.3.1. An alternative measure of deviations from Benford's Law

To check whether the findings for hypotheses H3 and H4 are robust, I replace *KS* with *FSD_SCORE* in Equation 5-11. As discussed above, whereas *FSD_SCORE* is calculated based on the mean of absolute differences between actual frequencies and expected frequencies of first digits following Benford's Law, the *KS* value is calculated based on maximum cumulative absolute differences. The two measures, therefore, reinforce each other by capturing a different dimension of the deviation of first digits from Benford's Law. I re-run the Equation 5-11 with FSD_SCORE as the dependent variable.

Table 5-14 reports findings with *FSD_SCORE* as the alternative measure of deviations from Benford's Law. The evidence shows that *FSD_SCORE* is also positively associated with earnings management and conditional conservatism. These relationships are statistically significant at 1% level. In terms of economic significance, in column c, the evidence shows that one unit increase in abnormal accruals is associated with an increase of 0.004604 in *FSD_SCORE*. Given that the mean of *FSD_SCORE* is 0.032 (as reported in Table 5-4) when abnormal accruals increase by one unit, *FSD_SCORE* increases by 14.39% (=0.004604/0.032), which is non-trivial. Also, I observe that one unit increase in conditional conservatism is associated with an increase of 0.004174 in *FSD_SCORE*, which accounts for 13.04% of *KS* (=0.004174/0.032). In general, the evidence is very similar to the main findings reported in Table 5-13 above, supporting hypotheses H3 and H4.

Table 5-13: Determinants of KS values

	(a)		(b)		(c)	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$DCA_{i,t}$	1.2506*	2.40			1.1028*	2.12
$CSCORE\_RANK_{i,t}$			1.2763***	5.33	1.2486***	5.21
$LOSS_{i,t}$	1.6987***	8.71	1.5738***	8.03	1.5230***	7.72
$FRAUD_{i,t}$	-0.0489	-0.30	-0.0689	-0.42	-0.1105	-0.67
Constant	0.0914***	20.27	0.0851***	18.23	0.0848***	18.18
Year fixed effects	Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes	
Observations	3633		3633		3633	
Adjusted R^2	0.0567		0.0626		0.0635	

Note: Column (a) reports findings of the following regressions: $KS_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 LOSS_{i,t} + \beta_3 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$.

Column (b) reports findings of the following regressions: $KS_{i,t} = \alpha + \beta_1 CSCORE\_RANK_{i,t} + \beta_2 LOSS_{i,t} + \beta_3 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$.

Column (c) reports findings of the following regressions: $KS_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 CSCORE\_RANK_{i,t} + \beta_3 LOSS_{i,t} + \beta_4 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$.

All coefficients are multiplied by 100 for easy reading. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 5-14: Determinants of FSD_SCORE

	(a)		(b)		(c)	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**	**Coefficient**	**t-statistic**
$DCA_{i,t}$	0.5098***	3.97			0.4604***	3.61
$CSCORE\_RANK_{i,t}$			0.4289***	7.30	0.4174***	7.10
$LOSS_{i,t}$	0.5184***	10.82	0.4809***	10.01	0.4597***	9.51
$FRAUD_{i,t}$	0.0086	0.21	0.0054	0.14	-0.0120	-0.30
Constant	0.0326***	29.43	0.0305***	26.66	0.0304***	26.61
Year fixed effects	Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes	
Observations	3633		3633		3633	
Adjusted R^2	0.0868		0.0963		0.0993	

Note: Column (a) reports findings of the following regressions: $FSD\_SCORE_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 LOSS_{i,t} + \beta_3 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$.
Column (b) reports findings of the following regressions: $FSD\_SCORE_{i,t} = \alpha + \beta_1 CSCORE\_RANK_{i,t} + \beta_2 LOSS_{i,t} + \beta_3 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$.
Column (c) reports findings of the following regressions: $FSD\_SCORE_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 CSCORE\_RANK_{i,t} + \beta_3 LOSS_{i,t} + \beta_4 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$.
All coefficients are multiplied by 100 for easy reading. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

5.4.3.2. Alternative measures of conditional conservatism

The main measure of firm-year conditional conservatism is $CSCORE\_RANK$, which is based on the timeliness of bad news over good news (*CSCORE*) following Khan and Watts (2009). To check whether the findings are robust, I estimate total conditional conservatism following García Lara et al. (2016), which is also based on GSCORE and CSCORE obtained from Equation 5-10. In particular, I add $GSCORE$ and $CSCORE$ together for each company in each year, and I refer to the new variable as $CONS$. After that, I calculate the average of $CONS$ across years t-2, t-1, and t (denoted $aCONS_{i,t}$); then rank $aCONS_{i,t}$ of all firms for each year; and divide the rank values by N+1, where N is the total observations in each rank group. I refer to the new variable as the annual fractional rank of total conditional conservatism, denoted $CONS\_RANK_{i,t}$. $CONS\_RANK_{i,t}$ also ranges from 0 to 1, and a higher $CONS\_RANK_{i,t}$ indicates higher total conditional conservatism.[37]

I re-run Equation 5-11 where CSCORE_RANK is replaced by CONS_RANK as the measure of conditional conservatism. Table 5-15 and

Table 5-16 report the findings of regressions when KS and KSD_SCORE are used as the dependent variable, respectively. The evidence shows that CONS_RANK has a positive and statistically significant impact on KS and FSD_SCORE. In general, using this alternative measure of conditional conservatism, I find broadly similar evidence with main findings reported above.

[37] The validity test of this measure is provided in Chapter 5, section 5.3.4.

Table 5-15: Alternative measure of conservatism: CONS_RANK and KS

	(a)		(b)	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
DCA			1.1078*	2.13
CONS_RANK	1.2964***	5.43	1.2702***	5.32
LOSS	1.5627***	7.97	1.5116***	7.65
FRAUD	-0.0515	-0.32	-0.0937	-0.57
Constant	0.0849***	18.18	0.0846***	18.13
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Observations	3633		3633	
Adjusted R^2	0.0629		0.0638	

Note: Column (a) reports findings of the following regressions: $KS_{i,t} = \alpha + \beta_1 CONS\_RANK_{i,t} + \beta_2 LOSS_{i,t} + \beta_3 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon.$
Column (b) reports findings of the following regressions: $KS_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 CONS\_RANK_{i,t} + \beta_3 LOSS_{i,t} + \beta_4 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon.$
All coefficients are multiplied by 100 for easy reading. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 5-16: Alternative measure of conservatism: CONS_RANK and FSD_SCORE

	(a)		(b)	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
$DCA_{i,t}$			0.4629***	3.63
$CONS\_RANK_{i,t}$	0.4289***	7.33	0.4179***	7.14
$LOSS_{i,t}$	0.4782***	9.94	0.4569***	9.44
$FRAUD_{i,t}$	0.0115	0.29	-0.0061	-0.15
Constant	0.0305***	26.63	0.0304***	26.57
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Observations	3633		3633	
Adjusted R^2	0.0964		0.0994	

Note: Column (a) reports findings of the following regressions: $FSD\_SCORE_{i,t} = \alpha + \beta_1 CONS\_RANK_{i,t} + \beta_2 LOSS_{i,t} + \beta_3 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon.$
Column (b) reports findings of the following regressions: $FSD\_SCORE_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 CONS\_RANK_{i,t} + \beta_3 LOSS_{i,t} + \beta_4 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon.$
All coefficients are multiplied by 100 for easy reading. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

5.4.3.3. Purposeful-intervention conservatism

I acknowledge that the measure of conditional conservatism (*CSCORE_RANK*) may capture both neutral application/selection of accounting choices and purposeful intervention by management, while H4 predicts that the Benford's-law deviation is more likely to be led by the latter, not the former. To disentangle the effect of the two components of *CSCORE_RANK* on *KS*, I rely on the presence of the Big Four auditors. I argue that Big Four auditors would effectively remove a significant part of the conditional conservatism induced by managers' purposeful intervention. Therefore, I create a dummy which turns on if a firm is audited by one of the Big Four auditors (denoted *BIG4*) and interact it with *CSCORE_RANK*. The model now becomes:

Equation 5-13: Modelling the effect of conservatism-related purposeful intervention by management on deviations from Benford's Law

$$\begin{aligned} Deviations_{i,t} &= \alpha + \beta_1 DAC_{i,t} + \beta_2 CSCORE\_RANK_{i,t} + \beta_3 BIG4_{i,t} \\ &* CSCORE\_RANK_{i,t} + \beta_4 LOSS_{i,t} + \beta_5 FRAUD_{i,t} + \beta_6 BIG4_{i,t} \\ &+ INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon \end{aligned}$$

Where: $Deviations_{i,t}$ can be $KS_{i,t}$ and $FSD\_SCORE_{i,t}$ (used as substitutes). $BIG4_{i,t}$ is a dummy variable with a value of 1 if a firm is audited by a Big Four auditor, and zero otherwise. In this model, the coefficient on *CSCORE_RANK* (β_2) indicates the effect of conditional conservatism on first-digit deviations from Benford's Law when there is an absence of Big Four auditors. There is evidence that Big Four auditors provide better audit quality which helps to mitigate accounting manipulations in financial statements (Becker et al., 1998b; Krishnan, 2003), the coefficient β_2 most likely captures the effect of conservatism on first-digit deviations caused by purposeful intervention by management in the absence of Big Four auditors. Also, the coefficient on the interaction term *BIG4*CSCORE_RANK* (β_3) indicates the incremental effect of conservatism on first-digit deviations when there is a presence of Big Four auditors, that is when purposeful intervention by management is less likely to exist.

Table 5-17 reports the findings of Equation 5-13. The coefficient on *BIG4* standing alone is negative and statistically significant, suggesting that Big Four auditors help to mitigate biases in financial statements, which supports the prior literature that Big Four auditors help reduce earnings management (Becker et al., 1998b; Krishnan, 2003). The table also shows that the coefficient on the interaction term *BIG4*CSCORE_RANK* is negative but not significant. It suggests that conditional conservatism which occurs naturally as a result of selecting and applying accounting policies required by financial reporting standards does not cause financial statements to deviate from the distribution predicted by Benford's Law. Meanwhile, the coefficient on *CSCORE_RANK* is still positive and statistically significant, indicating that conditional conservatism has a positive impact on first-digit deviations from Benford's Law in the absence of Big Four auditors, i.e. when the conservatism is more likely to be the results of purposeful intervention by the managers. The evidence, in general, suggests hypothesis *H4* cannot be rejected.

Table 5-17: Purposeful-intervention conditional conservatism (CSCORE_RANK)

	FSD_SCORE (a)		KS (b)	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
DCA	0.4106**	3.2307	0.9413	1.8096
CSCORE_RANK	0.3743***	3.7201	0.9516*	2.3107
BIG4*CSCORE_RANK	-0.1210	-0.9838	-0.1458	-0.2895
LOSS	0.4429***	9.1972	1.4734***	7.4760
FRAUD	-0.0318	-0.7958	-0.1735	-1.0594
BIG4	-0.1600*	-2.0820	-0.6512*	-2.0705
Constant	0.0319***	24.9805	0.0906***	17.3369
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Observations	3633		3633	
Adjusted R^2	0.1096		0.0698	

Column (a) reports findings of the following regression: $FSD\_SCORE_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 CSCORE\_RANK_{i,t} + \beta_3 BIG4_{i,t} * CSCORE\_RANK_{i,t} + \beta_4 LOSS_{i,t} + \beta_5 FRAUD_{i,t} + \beta_6 BIG4_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$

(b) reports findings of the following regression: $KS_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 CSCORE\_RANK_{i,t} + \beta_3 BIG4_{i,t} * CSCORE\_RANK_{i,t} + \beta_4 LOSS_{i,t} + \beta_5 FRAUD_{i,t} + \beta_6 BIG4_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$

All coefficients are multiplied by 100 for easy reading. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 5-18 reports the findings of Equation 5-13 where the measure of conservatism is CONS_RANK (total conditional conservatism). The evidence also shows that the coefficient on the interaction term *BIG4*CONS_RANK* is negative but not significant while the coefficient on *CSCORE_RANK* is positive and statistically significant. The findings are in line with the notion that conditional conservatism has a positive impact on first-digit deviations from Benford's Law in the absence of Big Four auditors, that is when managers are more likely to affect the choice of conservative accounting policies. The evidence also suggests hypothesis *H4* cannot be rejected.

Table 5-18: Purposeful-intervention total conservatism (CONS_RANK)

	FSD_SCORE (a)		KS (b)	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
$DCA_{i,t}$	0.4110**	3.2343	0.9402	1.8080
$CONS\_RANK_{i,t}$	0.3415***	3.4372	0.9284*	2.2831
$BIG4_{i,t}$*$CONS\_RANK_{i,t}$	-0.0579	-0.4751	-0.0349	-0.0699
$LOSS_{i,t}$	0.4406***	9.1402	1.4624***	7.4123
$FRAUD_{i,t}$	-0.0279	-0.6973	-0.1628	-0.9951
$BIG4_{i,t}$	-0.1973**	-2.6021	-0.7147*	-2.3035
Constant	0.0321***	25.2064	0.0908***	17.4115
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Observations	3633		3633	
Adjusted R^2	0.1099		0.0702	

Column (a) reports findings of the following regression: $FSD\_SCORE_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 CONS\_RANK_{i,t} + \beta_3 BIG4_{i,t} * CONS\_RANK_{i,t} + \beta_4 LOSS_{i,t} + \beta_5 FRAUD_{i,t} + \beta_6 BIG4_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$

(b) reports findings of the following regression: $KS_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 CONS\_RANK_{i,t} + \beta_3 BIG4_{i,t} * CONS\_RANK_{i,t} + \beta_4 LOSS_{i,t} + \beta_5 FRAUD_{i,t} + \beta_6 BIG4_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon$

All coefficients are multiplied by 100 for easy reading. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

5.4.3.4. Unconditional conservatism

The last test was to examine whether there is a relationship between deviations from Benford's Law and unconditional conservatism. As *CSCORE_RANK* is a news-dependent measure, or conditional conservatism, I follow Givoly and Hayn (2000) and Ahmed and Duellman (2013) to measure unconditional conservatism by estimating the difference between skewness of cash flows and skewness of earnings (*SKEWNESS*). Under conservative accounting practice, earnings tend to have a negative skewness because of downwards in book values of assets. The variable *SKEWNESS* is calculated as follows:

Equation 5-14: Skewness of earnings following Givoly and Hayn (2000)

$$SKEWNESS_{i,t} = \frac{\left(CFO_{i,t} - \mu_{CFO,i,t}\right)^3}{\left(\delta_{CFO,i,t}\right)^3} - \frac{\left(NI_{i,t} - \mu_{NI,i,t}\right)^3}{\left(\delta_{NI,i,t}\right)^3}$$

Where: $CFO_{i,t}$ is cash flows from operations of firm *i* in year *t* and $NI_{i,t}$ is net income of firms *i* in year *t*, all scaled by total assets in year *t-1*. $\mu_{CFO,i,t}$ and $\mu_{NI,i,t}$ are the mean of cash flows from operations and net incomes, respectively, of firm *i* over a five-year period from year *t-4* to year *t*. $\delta_{CFO,i,t}$ and $\delta_{NI,i,t}$ are the standard deviations of cash flows from operations and net incomes, respectively, of firm *i* over a five-year period from year *t-4* to year *t*. Similar to *CSCORE_RANK*, I calculated the annual fractional rank of skewness, denoted *SKEWNESS_RANK*, by ranking *SKEWNESS* for all observations by year and then dividing the ranked values by *N+1* (where *N* is total number of observations in each year). A higher *SKEWNESS_RANK* indicates higher conservatism.

Table 5-19 and Table 5-20 report the findings of regressions between deviations from Benford's Law and unconditional conservatism. The coefficients on *SKEWNESS_RANK* are mixed and not significant. In general, I do not find evidence on the effect of unconditional conservatism on deviations of first-digit deviations from Benford's Law.

Table 5-19: SKEWNESS_RANK and KS

	(b)		(c)	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
$DCA_{i,t}$			1.2687*	2.38
$SKEWNESS\_RANK_{i,t}$	0.0081	0.04	0.0209	0.10
$LOSS_{i,t}$	1.8025***	9.14	1.7411***	8.76
$FRAUD_{i,t}$	0.0456	0.28	-0.0011	-0.01
Constant	0.0920***	19.76	0.0914***	19.64
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Observations	3590		3590	
Adjusted R^2	0.0543		0.0556	

Note: Column (a) reports findings of the following regressions: $KS_{i,t} = \alpha + \beta_1 SKEWNESS\_RANK_{i,t} + \beta_2 LOSS_{i,t} + \beta_3 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon.$

Column (b) reports findings of the following regressions: $KS_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 SKEWNESS\_RANK_{i,t} + \beta_3 LOSS_{i,t} + \beta_4 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon.$

All coefficients are multiplied by 100 for easy reading. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

Table 5-20: SKEWNESS_RANK and FSD_SCORE

	(b)		(c)	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
$DCA_{i,t}$			0.5270***	4.04
$SKEWNESS\_RANK_{i,t}$	-0.0402	-0.76	-0.0349	-0.66
$LOSS_{i,t}$	0.5436***	11.26	0.5181***	10.66
$FRAUD_{i,t}$	0.0431	1.07	0.0237	0.58
Constant	0.0331***	29.09	0.0329***	28.93
Year fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Observations	3590		3590	
Adjusted R^2	0.0795		0.0834	

Note: Column (a) reports findings of the following regressions: $FSD\_SCORE_{i,t} = \alpha + \beta_1 SKEWNESS\_RANK_{i,t} + \beta_2 LOSS_{i,t} + \beta_3 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon.$

Column (b) reports findings of the following regressions: $FSD\_SCORE_{i,t} = \alpha + \beta_1 DAC_{i,t} + \beta_2 SKEWNESS\_RANK_{i,t} + \beta_3 LOSS_{i,t} + \beta_4 FRAUD_{i,t} + INDUSTRY\ FIXED\ EFFECTS + YEAR\ FIXED\ EFFECTS + \varepsilon.$

All coefficients are multiplied by 100 for easy reading. Definitions of variables are in the Appendix. *, **, *** are significance at 10%, 5% and 1%, respectively.

5.5. Conclusions

In this research, I apply Benford's Law to study distributions of the first digits of financial statement items of UK listed companies. At the firm-specific level, I find that the percentage of firm-year observations conforming to Benford's Law is 90.86%. At the market level, the evidence shows that the financial statements of all firms closely conform to Benford's Law. The first digits of separate components of financial statements (income statements, balance sheets and cash flow statements) also closely conform to Benford's Law. Deviations of first digits of income statement items are larger than those of balance sheet items and cash flow items, suggesting that income statements contain more errors. Also consistent with the hypothesis, the results indicate that earnings management and conditional conservatism are two sources of deviations of first digits from Benford's Law.

This research makes the following contributions to the literature. First, this research examines the first digits of all items as against what is more common in existing literature in this area. Secondly, it utilised the financial statements of UK listed companies. As compared with previous studies in the UK which also apply Benford's Law (Caneghem, 2002, 2004), as the study demonstrated the use only firm-year observations as against time-series or cross-sectional data. Second, this research uniquely provides an alternative explanation for deviations of digits from Benford's Law. Previous studies argue that digits of accounting numbers deviate from the law of distributions because of an introduction of frauds, errors or biases, such as earnings management (Caneghem, 2004; Amiram et al., 2015). The findings show that conditional conservatism also increases first-digit deviations. The results have implications for practitioners, especially auditors. First, auditors should be more cautious with income statement items, such as revenues and expenses, because the evidence shows that income statement items are more likely to deviate from Benford's Law. Second, auditors should pay more attention to conservatism-related items such as impairment losses and inventory written-off because they can be manipulated by managers.

However, a limitation of the paper is that I mainly employ Datastream's adjusted data, not "as reported" data. I randomly checked 10 randomly-selected firms included in the FTSE 100 index at the end of 2012 by downloading their original financial statements and compare the first digits reported on those statements with my sample. I find a small discrepancy (less than 5%). While the discrepancy is not too worrying, it does suggest a potential problem, and I invite future research to address that more thoroughly.

Appendix 3: Variable definitions for Chapter 5

$CSCORE\_RANK_{i,t}$	Annual factional rank of conditional conservatism, based on Basu (1997) and Khan and Watts (2009).
$CONS\_RANK_{i,t}$	Annual fractional rank of the three-year average of total conditional conservatism (García Lara et al., 2016), where total conditional conservatism is the sum of the timeliness of good news (*GSCORE*) and the asymmetric timeliness of bad news over good news (*CSCORE*) estimated by the model of Khan and Watts (2009), which is based on Basu (1997). I calculate the average of total conditional conservatism across years t-2, t-1, and t (denoted $aCONS_{i,t}$); then rank $aCONS_{i,t}$ of all firms for each year; and divide the rank values by N+1, where N is the total observations in each rank group. I refer to the new variable as the annual fractional rank of total conditional conservatism.
$SKEWNESS\_RANK_{i,t}$	A measure of unconditional conservatism, which is the annual fractional rank of the difference between skewness of cash flows and skewness of earnings (SKEWNESS). Where SKEWNESS is calculated following Givoly and Hayn (2000) and Ahmed and Duellman (2013) as follows:

	$$SKEWNESS_{i,t} = \frac{(CFO_{i,t} - \mu_{CFO,i,t})^3}{(\delta_{CFO,i,t})^3} - \frac{(NI_{i,t} - \mu_{NI,i,t})^3}{(\delta_{NI,i,t})^3}$$ Where: $CFO_{i,t}$ is cash flows from operations of firm *i* in year *t* and $NI_{i,t}$ is net income of firms *i* in year *t*, all scaled by total assets in year *t-1*. $\mu_{CFO,i,t}$ and $\mu_{NI,i,t}$ are the mean of cash flows from operations and net incomes, respectively, of firm *i* over a five-year period from year *t-4* to year *t*. $\delta_{CFO,i,t}$ and $\delta_{NI,i,t}$ are the standard deviations of cash flows from operations and net incomes, respectively, of firm *i* over a five-year period from year *t-4* to year *t*.
$DAC_{i,t}$	$$DAC_{i,t} = \left\| \frac{AC_{i,t}}{A_{i,t-1}} - \left[\hat{\alpha} + \hat{\beta}_1 \left(\frac{1}{A_{i,t-1}} \right) + \hat{\beta}_2 \left(\frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{A_{i,t-1}} \right) + \hat{\beta}_3 \left(\frac{PPE_{i,t}}{A_{i,t-1}} \right) \right] \right\|;$$ Where $\hat{\alpha}, \hat{\beta}_1, \hat{\beta}_2, \hat{\beta}_3$ are estimated from the following equation with at least ten observations for each industry-year (Datastream level-six).

	$\frac{AC_{i,t}}{A_{i,t-1}} = \alpha + \beta_1 \left(\frac{1}{A_{i,t-1}}\right) + \beta_2 \left(\frac{\Delta REV_{i,t}}{A_{i,t-1}}\right) + \beta_3 \left(\frac{PPE_{i,t}}{A_{i,t-1}}\right) + \varepsilon_{i,t}$ Where $AC_{i,t}$ is total accruals which equals to net income before extraordinary items minus net cash flows from operations; $A_{i,t-1}$ is total assets of firm i at the end of year t–1; $\Delta REV_{i,t}$ and $\Delta REC_{i,t}$ are change in sales and change in receivables from year t–1 to year t of firm i, respectively; $PPE_{i,t}$ is gross PPE of firm i at the end of year t.
$FSD\_SCORE_{i,t}$	$FSD\_SCORE_{i,t} = \frac{\sum_{d=1}^{9} \left\| OBSERVED_{d,i,t} - EXPECTED_d \right\|}{9}$ Where: $FSD\_SCORE_{i,t}$ is the mean absolute deviation of the first digits of financial statement items from Benford's Law of firm i in year t; $OBSERVED_{d,i,t}$ is the actual probability of the first digit d of firm i in year t; $EXPECTED_d$ is the expected probability of the first digit d following Benford's Law; and d = 1, 2, …, 9.
$KS_{i,t}$	$KS_{i,t} = \max\{\left\|OD_{1,i,t} - ED_1\right\|, \left\|(OD_{1,i,t} + OD_{2,i,t}) - (ED_1 + ED_2)\right\|, \ldots, \left\|(OD_{1,i,t} + OD_{2,i,t} + \cdots + OD_{9,i,t}) - (ED_1 + ED_2 + \cdots + ED_9)\right\|\}$

	Where $KS_{i,t}$ is maximum cumulative absolute deviation of the first digits of figures reported in financial statements from what are expected by Benford's Law of firm i in year t; $OD_{d,i,t}$ is the cumulative observed probability of the first digit d (d = 1, 2, …, 9) of firm i in year t; ED_d is the expected probability of the first digit d (d = 1, 2, …, 9) as defined by Benford's Law.
$FRAUD_{i,t}$	equal to one if FSCORE is greater than one, zero otherwise; where FSCORE is calculated as follows: $\text{Predicted Value} = -7.893 + 0.790 * \text{ACC\_RSST} + 2.581 * \Delta\text{REC} + 1.191 * \Delta\text{INV} + 1.979 * \text{SOFTASSET} + 0.171 * \Delta\text{CASH} - 0.932 * \Delta\text{ROA} + 1.029 * \text{SEO}$ $\text{Probability} = \frac{e^{\text{Predicted Value}}}{1 + e^{\text{Predicted Value}}}$ $\text{FSCORE} = \frac{\text{Probability}}{0.0037}$ Where: e = 2.71828183; ACC_RSST is change in non-cash net operating assets following Richardson et al. (2005), scaled by total assets at the end of year t-1; ACC_RSST = (chWC + ChNCO + ChFIN)/AT_{t-1};

	where: $ChWC = WC_t - WC_{t-1} = [(ACT_t - CHE_t) - (LCT_t - DLC_t)] - [(ACT_{t-1} - CHE_{t-1}) - (LCT_{t-1} - DLC_{t-1})]$; ACT is current assets, CHE is cash and cash equivalent, LCT is current liabilities, DLC is short term debts and current portions of long term debts. $ChNCO = NCO_t - NCO_{t-1} = [(AT_t - ACT_t - INVST_t) - (LT_t - LCT_t - DLTT_t)] - [(AT_{t-1} - ACT_{t-1} - INVST_{t-1}) - (LT_{t-1} - LCT_{t-1} - DLTT_{t-1})]$; INVST is total investments; LT is total liabilities, DLTT is long term debts. $ChFIN = FIN_t - FIN_{t-1} = [(STINVST_t + LTINVST_t) - (LT_t + LTDEBTC_t + PRESTOCK_t)] - [(STINVST_{t-1} + LTINVST_{t-1}) - (LT_{t-1} + LTDEBTC_{t-1} + PRESTOCK_{t-1})]$; STINVST is short-term investments, LTINVST is long-term investments, LTDEBTC is current portion of long term debts, PRESTOCK is preferred stock. ΔREC is changes in receivables from year t-1 to year t, scaled by total assets at the end of year t-1; ΔINV is changes in inventories from year t-1 to year t, scaled by total assets at the end of year t-1; SOFTASSET is soft assets in year t-1 (total assets minus cash and cash equivalent minus net PPE, scaled by total assets at the end of year t-1); ΔCASH is changes in cash and cash equivalent scaled

	by total assets at the end of year t-1; ΔROA is return on assets in year t minus return on assets in year t-1, where return on assets are equal net income divided by total assets; SEO is actual equity issuance, which is equal one if change in common share capital is greater than 5% and proceed from issuance is greater than 0, zero otherwise.
$LOSS_{i,t}$	equal to one if net incomes before extraordinary items in year t-2 and year t-1 are both negative, zero otherwise.
$BIG4_{i,t}$	Big Four auditor, which is a dummy variable with a value of one if a firm is audited by a Big Four auditor, and zero otherwise.

Chapter 6: CONCLUDING CHAPTER

In most accounting scandals, managers inflated earnings, up to four years, prior to the collapses of companies (e.g., García Lara, Garcia Osma, et al., 2009). Levitt Jr (1998) refers this phenomenon as "the numbers game". Following the accounting scandals in the 2000s and the passage of Sarbanes-Oxley Act (2002) in the US in 2002, a growing number of researchers have focussed on earnings quality (Dechow et al., 2010), developing, validating, and improving models to estimate earnings quality (e.g., Jones, 1991; Dechow et al., 1995; Dechow and Dichev, 2002; Kothari et al., 2005; Roychowdhury, 2006) to provide practitioners with tools which can provide early signals of accounting manipulations at firm levels.

The thesis contributes to the research strand on earnings quality by employing recent methodologies to study the earnings quality of listed companies in the United Kingdom (UK). In the UK, the Financial Reporting Review Panel (FRRP) releases firm specific announcements for investigation of allegations of accounting standards, but the sample is very small. For example, Nguyen (2016) documents that there are only 70 cases of accounting allegations from 01/1995 and 12/2012. The lack of exposed accounting manipulations, which are similar to accounting restatements and AAER in the US, makes studies on earnings quality using recent methodological developments even more relevant. Building on recent research in the field, the thesis offers a new way to study earnings quality by using chief executive officers' personal traits which are more likely to link with accounting manipulations activities. Also, the thesis employs

Benford's Law, which relies on distributional probabilities of first digits of financial statement items (Amiram et al., 2015), to examine biases and sources of biases in financial statements of UK listed companies. Another focus of the thesis is using working history in the banking industry of individual directors on the boards of directors to study accounting conservatism, an aspect of earnings quality.

The thesis has three independent empirical chapters. Section 6.1 briefly introduces the main findings and contributions of each chapter, while Section 6.2 explains the limitations of the thesis and suggests new directions for future research.

6.1. The main findings and contributions of the thesis

In the first empirical chapter, I offer a new way to study earnings quality by focusing on the profile of chief executive officers (CEO). Specifically, I construct a measure of CEO profile, namely PSCORE, which embraces various aspect of CEO characteristics linked to earnings quality, including financial expertise (e.g., Aier et al., 2005), reputation (Milbourn, 2003; Francis et al., 2008; Jian and Lee, 2011), internal power (Dechow et al., 1996; Feng et al., 2011), and age (Huang et al., 2012; Ali and Zhang, 2015). Using a sample of 3,395 firm-year observations of listed companies at the London Stock Exchange from 2005 to 2012, I show that the PSCORE is positively related to three different types of measures of earnings quality: accrual earnings management, measured by abnormal accruals (Jones, 1991; Dechow et al., 1995; Peasnell et al., 2000b); (ii) real earnings management, measured by abnormal cash flows, abnormal production costs, abnormal discretionary expenditures (real earnings management) (Roychowdhury, 2006); (iii) financial statement errors, measured by deviations of first digits of figures reported in financial statements from what are expected by Benford's Law (Amiram et al., 2015; Nigrini, 2015). Further analysis indicates that the positive associations between PSCORE and proxies for earnings quality are more pronounced when CEOs have higher equity-based compensation incentives. The results suggest that PSCORE could signal the quality of earnings reported in financial statements.

This study makes some significant contributions to the literature. The chapter introduces a new way to study earnings quality, by looking at the curriculum vitae of CEOs which are publicly available. It is more likely that PSCORE could help to overcome limitations of model-based approaches which require time-series or cross-sectional data and other problems associated with empirical models such as poor specifications. Also, the chapter suggests that PSCORE can signal poor earnings quality in individual firms, regardless of whether it results from accruals manipulations, restructuring of actual business transactions, or errors. Misstated financial statements, regardless of causes, may have an impact on the "true" picture of the financial performance of companies. Therefore, the PSCORE can provide practitioners with a tool to assess the quality of earnings, e.g. they can pick up cases when reported earnings may not reflect the fundamental performance of firms because it may contain biases (earnings management) or errors.

In the second empirical chapter, I offer an innovative way to study accounting conservatism by measuring the accumulated banking expertise of individual members on the boards of directors. I measure banking expertise of boards of directors by taking into account the numbers of years and the number of banks an individual director has worked for. Using a sample of UK listed companies, the findings support the hypothesis that banking expertise on the board helps to reduce accounting conservatism, which is documented in recent years as costly for firms. In particular, I find the amount of banking expertise has a negative impact on firm-year accounting conservatism (Basu, 1997; Khan and Watts, 2009; García Lara et al., 2016), and the impact becomes more pronounced for firms with high financial leverage and for firms with high bankruptcy risk. The chapter suggests two explanations for the findings. First, directors with banking expertise would have an information advantage about the market-level demand for accounting conservatism so that they can help non-financial firms avoid excessive conservatism. Second, directors with banking expertise can provide firms with an interpersonal network (e.g., Engelberg et al., 2012) in the banking industry which can act as a private channel for debt contacting, leading to a reduction in demand for accounting conservatism as a debt monitoring mechanism.

The chapter makes significant contributions to the literature. The study complements the work of Erkens et al. (2014) and Bonetti et al. (2017) by focusing on the role of the link between banks and non-financial firms on corporate practices, e.g. accounting conservatism. While previous studies examine how the presence of affiliated bankers on the board (Erkens et al., 2014) or non-affiliated bankers on the board (Bonetti et al., 2017) affect accounting conservatism, this chapter considers working history in the banking industry of individual directors. That is because not only the presence of a banker affects accounting conservatism, but life-time working experience in the banking industry can make a difference. Also, the findings could be more generalised compared with the previous studies because there is no restriction in the sample selection, e.g. there is no requirement for existence of a lending contract between affiliated banks and firms.

In the third empirical chapter, I apply Benford's Law, a law of distributions of first digits (Nigrini, 1996; Amiram et al., 2015; Nigrini, 2015), to study earnings quality in the context of UK. I find that the first digits of UK listed companies conform to Benford's Law at firm-specific and market levels. The findings indicate that income statements exhibit higher deviations of first digits of financial statements from Benford's Law than those of the balance sheets and cash flow statements. The evidence suggests that income statements contain more biases, e.g. earnings management, or errors. Also, I find that earnings management and conditional conservatism are two explanations for deviations. The relationship between deviations of first digits from Benford's Law and conditional conservatism exists only when there is an absence of a Big-Four auditor. The evidence implies that conservatism-related purposeful intervention by management causes biases in financial statements, which are more likely to exist in the absence of Big-Four auditor, and this causes the deviations of first digits.

The chapter contributes to the existing literature in several ways. This is the first study to apply Benford's Law in analysing the first digits of all items in the financial statements of UK listed companies. The approach applying Benford's Law on all financial statement items (Erkens et al., 2014) overcomes the limitations of previous studies (Caneghem, 2002, 2004) which focus on only an individual item in financial statements such as earnings before tax. The approach has at least three major advantages because (i) it gives a chance to detect errors or fraud in assets, liabilities, incomes, expenses and cash flows, (ii) it makes errors and fraud are more likely to be detected due to double-entry accounting system, and (iii) it can flag up errors or frauds in accounts which do not directly affect net income. Also, the paper adds to the findings of Caneghem (2002) and Caneghem (2004) by showing that earnings management is a source of deviations from Benford's Law. However, as explained above, while Caneghem (2002) and Caneghem (2004) rely on one item in financial statements (pre-tax income), the chapter uses a recent methodology (Amiram et al., 2015; Nigrini, 2015) which relies on first digits of all items reported in financial statements. Next, the chapter is the first study which provides an alternative explanation for deviations of first digits. Previous studies document that deviations of first digits are linked to earnings management (Carslaw, 1988; Caneghem, 2002, 2004; Amiram et al., 2015), the chapter shows that conditional conservatism is also a source of deviations because it may introduce biases to financial statements, which in turn lead to higher deviations.

6.2. Limitations of the thesis and suggestions for future research

Although the thesis has done a significant amount of work, the thesis has some limitations due to limited time and resources. I will explain the limitations and suggest directions for future research separately for each empirical chapter as follows.

Regarding Chapter 3, the construction of the PSCORE has some limitations. It does not include some CEO characteristics which have been documented in previous studies as being linked to earnings quality. For example, Barua et al. (2010) find that the gender of directors affects earnings management, while Hilary et al. (2016) find that marital status also has an impact. There are other potential candidates for the construction of PSCORE such as facial masculinity (Jia et al., 2014), narcissism (Capalbo et al., 2018), overconfidence (Ahmed and Duellman, 2013), managing style (Bertrand and Schoar, 2003), managerial ability (Demerjian et al., 2013), vocal tone optimism (Davis et al., 2015), origin (Kuang et al., 2014), and personal life behaviours such as having criminal record or using luxury goods (Davidson et al., 2015). Future research might consider developing an even more complicated tool which takes into account more CEO characteristics to study earnings quality.

In addition, another limitation is the construction of the PSCORE relies on the use of an equally-weighted binary variable. Although the simple method is employed in previous research to construct an index (Nguyen, 2016) and is applied in some influential studies (Piotroski, 2000; Mohanram, 2005), there is still room for further improvement. One direction for future research is that it may build a weighted index (Beneish, 1999; Dechow et al., 2011). The weighted index takes into account the possibility that each factor may have different weight on earnings quality. Another direction is that future research should consider constructing a single index based on the component of the principal component analysis. For example, Florackis and Sainani (2018) uses the first component of the principal component analysis to create a single index for chief executive officers' characteristics and study it with cash holdings. Other studies use the principal component analysis to construct a single index for corporate governance (Larcker et al., 2007; Florackis and Ozkan, 2009). A method based on the principal component analysis helps to mitigate potential multicollinearity of individual factors further.

The third limitation of Chapter 3 is that the methodology to validate the PSCORE is not based on exposed earnings manipulation. In this chapter, I use three types of measures for earnings quality, namely accrual earnings management, real earnings management, and deviations of the first digits from Benford's Law. While previous studies document that models to estimate earnings management suffer some limitations such as misspecifications (Holthausen et al., 1995; Fields et al., 2001; Dechow et al., 2010; Ball, 2013), the use of Benford's Law to capture deviations of first digits of financial statements as sources of biases do not differentiate deviations caused by fraudulent activities from those caused by errors (mistakes) in the accounting processes. Therefore, future research using a comprehensive sample of exposed earnings manipulations of UK listed companies to validate the PSCORE is invited.

Turning on Chapter 4, which is about banking expertise of boards of directors and accounting conservatism, there are also some limitations. First, survival bias may exist in the research sample. Because I do not have access to a comprehensive database for information on boards of directors of all companies, I compile data on directors' working history from different sources, which are not available for all companies in the research sample. Dead companies are less likely to disclose information on the board of directors, thus observations with missing data may be deleted during the sample selection procedure. This bias may affect the results. Second, the study does not differentiate banking expertise provided by directors in different roles in firms or expertise gained by from different positions in banks. For example, because CEOs and CFOs have different roles in firms, the levels of banking expertise they contribute to the board may be different. Also, different positions in banks may provide individual directors with varying knowledge on insights how borrowing firms' data are processed, thus they may bring different levels of expertise even when they have a similar working history. I, therefore, invite future research to examine how those concerns affect the relationship between accounting conservatism and banking expertise on the board. Third, there is a chance that the banking expertise on the board may be underestimated. As stated in the sample selection, I mainly rely on the lists of banks provided by the Bank of England to determine whether CEOs have working experience in the banking industry. Directors have worked for some banks, but the names of those banks are not listed on the lists. This bias may significantly affect the results when (i) not-on-the-list banks are big and working in those banks increase directors' experience significantly, and (ii) a director's experience in those banks boost the overall banking expertise of the board significantly. Although it is less likely that all two conditions are met simultaneously, further research to respond to this concern is invited. Similarly, future research should consider eliminating some companies on the list which are not primarily banks because some financial services firms might have a banking licence or a banking segment, although I expect that the number of these companies is very small. Fourth, while the study employes recent methodologies to examine the relationships between accounting conservatism and banking expertise on the board, it is unlikely to mitigate all endogeneity issues. For example, there may be shocks in firms' industry, or even in the banking industry, which cause human capital movement between corporations and banks, leading to changes in levels of banking expertise on the board. Similarly, the choice of directors with banking expertise may be the board's preference, e.g. Renneboog and Zhao (2011) find that it is more likely that CEOs and directors have direct and indirect networks. For example, an appointment of a new CEO with banking expertise is more likely to bring more directors within his banking network on the board, leading to a significant increase in the overall banking expertise of the board but it is not necessarily related to changes in demand for accounting conservatism. Also, this is a source of measurement errors because directors in the same banking network tend to know the same things, thus having them all on board does not necessarily increase the board's banking expertise. Future studies could consider those issues.

Finally, Chapter 5 also have a significant limitation. As explained in the study, I mainly employ Datastream's adjusted data, not "as reported" data, thus the findings should be interpreted with caution. While the discrepancy is not too worrying, it does suggest a potential problem, and I invite future research to address that more thoroughly. Next, while this chapter follows previous studies (Amiram et al., 2015) and uses the first digits of figures of financial statement items, I invite future studies to employ the second digits or the combined first and second digits.

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