University of Sussex

Accrual Accounting, Cash Accounting and the Estimation of Future Cash Flows

by

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The thesis is submitted for the fulfilment of the requirements for the degree of the doctor of philosophy

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Declaration

I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree.

Signature: ………………………………………

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Summary

This study investigates the predictive ability of current and past cash flows with respect to the estimation of future cash flow, and compares this predictive ability with that of current and past earnings. Future cash flow is estimated in this study on the basis of a model hierarchy that initially incorporates aggregated predictors and then their disaggregated components, with the objective of improving on conventional research design with respect to the problematic issues surrounding missing values in source databases, extreme values in the sampled data and variability in fiscal year length. In determining whether the disaggregation of earnings into cash flow, accruals and their components adds to the predictive ability of cash flow, the present thesis also documents out-of-sample accuracy tests for the UK based on initial in-sample estimations, with accruals being computed using both the information in the Statement of Cash Flows and the information that may be derived from Balance Sheet changes.

Using the information in the Statement of Cash Flows, the results of the in-sample estimation indicate that, whilst there is no notable difference between the ability of cash flow and aggregate earnings to predict future cash flow, the disaggregation of earnings into cash flow and accruals improves the prediction. The out-of-sample accuracy tests confirm the standard result that this disaggregated earnings model is a better predictor of future cash flow. In contrast, this thesis shows that, when using information in the Balance Sheet, by way of changes from one period to the next, the results of both the in-sample estimation and the out-of-sample accuracy tests show that disaggregated earnings is unable to outperform aggregate earnings in predicting future cash flow. Nevertheless, when the total accrual is further disaggregated into its deferral and accrual components, in-sample estimation reveals additional improvement in predictive ability, using each of the two sources of information to compute total accruals (the Statement of Cash Flows and Balance Sheet changes), although this is less evident with the out-of-sample tests.

Whilst further analysis indicates that disaggregation is more informative when the firm size is large, the magnitude of accruals is low and the firm reports a positive *CFO* and *EBIT*, the thesis shows that the ability of the estimation models to predict future cash flow differs across industries in the UK, and that the findings are generally sensitive to the effect of database choice, the fiscal year length, and the identification and treatment of unrecorded data.

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Dedication

To my parents, my wife and my son, Amin

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Chapter 1

Overview

1.1. Introduction

From a policy perspective, the present study is motivated by the exposure draft of the *Conceptual Framework for Financial Reporting*, which was jointly issued in May 2008 by the IASB and the FASB, and which reconfirms the standard setters' view that a key aim of financial reporting is to provide helpful information in predicting future cash flows. The aim of the present research is to contribute to our understanding of the predictive ability of current and past cash flows and earnings in this context. Given the conflicting evidence in the recent published empirical papers in this area, which is discussed more extensively in the next chapter, one aim of the thesis is to reassess whether the disaggregation of earnings into cash flow and accruals, and their components, adds to the predictive ability of current cash flow, and in so doing the thesis demonstrates how the definition of accruals might be reconsidered in order to ensure full articulation between financial statements, and how the nature of the source data might influence the outcome.

1.2. Intended contributions

The first part of the present study considers in detail the way in which the information in the Statement of Cash Flows may be used to compute total accruals, making comparisons with prior studies in this area, including the initial work of Barth et al (2001). In addition to using the Statement of Cash Flows information to compute total accruals, the current research study shows how a full reconciliation with the Balance Sheet changes method may be drawn up, thus taking into consideration the wider set of accrual components that are identifiable amongst the detailed accounting information available in published financial statements.

The thesis also places considerable emphasis on issues relating to research design and sampling. With regard to research design, an important aspect is whether in-sample estimations should be interpreted as prediction tests, or whether instead a *prediction model* should only be referred to as such if it is tested using out-of-sample accuracy tests. In this respect, many prior studies, such as Barth et al (2001), investigated the association between earnings components and future performance measures using an in-sample design, and it is only recent studies that have begun to examine the predictive ability of current cash flows, earnings and earnings components using out-of-sample prediction tests, albeit with restricted testing (Lev et al, 2009; Brochet et al, 2009; and Habib, 2010). The present study addresses this issue, and extends cash flow prediction research by documenting both in-sample estimations and out-of-sample prediction tests, using multiple methods in the latter case.

The study focuses to begin with on the operating results available in published financial statements. The initial findings from in-sample estimation indicate that there is little difference between operating cash flow and aggregate earnings as estimators of the future cash flow of UK companies, whilst the disaggregation of earnings into cash flow and accruals improves the prediction, but that the disaggregation of earnings into cash flow and accruals improves the estimation significantly. Out-of-sample accuracy tests confirm these findings, providing robust evidence that the disaggregated earnings model is indeed a better predictor of future cash flow. When the total accrual is further disaggregated into its individual accrual components, using information both from the Statement of Cash Flows and in the form of Balance Sheet changes to compute total accruals, in-sample estimation reveals further improvement in the association with future cash flow, but in this case there is little improvement in predictive ability when out-of-sample accuracy tests are conducted. Thus, although this study is able to conclude that out-of-sample testing in the UK supports the generally-held view that accruals-based accounting is superior to cash flow accounting in predicting future cash flows, the more detailed findings do not support the standard setter's position that accrual components are important predictors of future cash flows. The latter is therefore still an open question. As mentioned, in addition to out-of-sample testing, other methodological contributions of the current study relates to aspects of sampling in accounting research, particularly how they may influence the inclusion or exclusion of data points in predictions. The first of these is concerned with the validity of the accounting numbers taken from commercial databases, including the articulation of the financial statements from which such databases are constructed and the nature of values that are unrecorded, missing or zero. In this respect, the present study addresses some of the limitations of accounting databases examined by Lara et al (2006) and Alves et al (2007) who demonstrated that employing different databases can lead to different results for the same estimations. Instead of contrasting databases, this thesis explores the benefits of drawing on more than one database to improve the quality of the final sample. The findings show that commercial sources of accounting data are not perfect alternatives, because of differences in firm coverage and accounting definition across databases, although the number of useable observations may be extended to some extent by reconciling these differences across databases. More importantly, however, the study indicates a far greater increase in useable observations by investigating the true nature of unrecorded and zero data points. By backfilling missing accounting numbers with the help of appropriate accounting identities, the number of firm-year observations may be increased noticeably.

A second aspect of sampling relates to the effect of influential observations on the estimations, and the available methods of controlling for extreme values (such as simple trimming, measuring outlier distance effects, multivariate filtering over panels, and studentised residuals). It is well known that the choice of method of extreme value detection can affect the regression results significantly, and it is possible that the inconclusive evidence on the estimation of cash flow may be attributed to this problem (Wilson, 1997). Accordingly, the present study involves a detailed comparison of alternative ways of dealing with outliers, identifying which is most appropriate for the analysis as a whole.

The third sampling issue focuses on a specific feature of accounting data that arises in the case of a change of fiscal year-end, which is acceptable in some jurisdictions (e.g. the UK) but not in others, leading to differences in the accounting period duration. The thesis reports on systematic effects that are attributable to these reporting period durations, with the findings regarding the effect of the change of fiscal year-end showing also that there can be a statistically significant difference between yearly and weekly reporting.

1.3. Research Methods

As noted above, the thesis is concerned with how the disaggregation process improves the prediction of future cash flows. This is based on a model hierarchy that focuses first on aggregated predictors and then on the disaggregated components, as follows:

(i) a cash flow only model

(ii) an aggregate earnings model

(iii) a disaggregated earnings model (cash flow from operations and aggregate accruals); and

(iv) the full disaggregation model (cash flow from operations and accruals components).

The *cash flow only* model captures the predictive ability of current and past cash flows with respect to future cash flows, and the *aggregate earnings* model tests the predictive ability of current and past earnings with respect to future cash flows. It is evident that these two models only test for the differential predictive ability of cash flow and earnings. However, by allowing for the accounting relationship between these two variables captured in the accounting identity *EBIT* = *CFO* + *TACC,* the third model that is fitted here is based on these two main components of *disaggregated earnings*, i.e. cash flow from operations *CFO* and the total accrual *TACC*. By then decomposing the total accrual into its components, so that future cash flow is expressed as a function of the current cash flow plus any accruals and deferrals, the fourth model is referred to as the *full disaggregation model*.

The analysis allows for variation in prediction horizons (one-year-ahead, two-year-ahead and three-year-ahead) and in the lags of aggregate cash flows, earnings and earnings components (up to five years). The four research models are evaluated using both in-sample estimations and out-of-sample predictions tests, applying Vuong's (1989) likelihood ratio test of differences in the explanatory power of the examined models. With regard to the out-of-sample predictions, the estimated parameters are provided by the in-sample estimation holdout samples. There are several methods of making out-of-sample prediction tests (see Gujarati, 2004), and the current study employs the mean adjusted R^2 from regressions of actual values on the predicted values, the mean and median error and absolute error, and Theil's U-statistic, which are then compared with other recent studies (e.g. Lev et al, 2009; Brochet et al, 2009).

1.4. Structure of the Thesis

The next chapter, Chapter 2, begins with an overview of accrual-based accounting, cash-based accounting and the estimation of future cash flows. In addition, Chapter 2 explains the developments of the relevant standards, starting with the content and form of the Statement of Funds Flow and then assessing the purposes and format of the Statement of Cash Flows. The chapter makes a comparison of *FRS* 1 with *IAS* 7 and reviews direct and indirect methods of reporting cash flows from operating activities. Furthermore, the chapter describes the different calculations of total accruals used in previous studies and introduces a more comprehensive measure of the net accrual (i.e. all operating accruals less operating deferrals) which is subsequently used in the second part the thesis. Finally, empirical evidence on cash flow estimation from recent accounting– based research is considered more extensively.

Chapter 3 presents the design of the current research. The chapter begins by explaining prediction horizons and the number of lags of predictor variables which will apply in the current study. Then, the chapter develops the four research models outlined above: the cash flow model, the aggregate earnings model, the disaggregated earnings model (cash flow with aggregate accruals) and the full disaggregation model (cash flow and accruals components). In addition, the chapter describes evaluative measures including in-sample goodness-of-fit criteria and out-of-sample predictions tests, together with diagnostic tests regarding heteroscedasticity, multicollinearity and autocorrelation.

Chapter 4 outlines the key features of the data and definitions of the accounting variables used in this study and provides a discussion of fundamental sampling issues in accounting research whose impact on research design and outcomes are investigated here. With respect to database validity, the chapter demonstrates firm coverage differentiation in source databases, and also examines the nature of accounting values that are unrecorded, missing or zero. The chapter also considers the impact of changes of fiscal year length and the identification of observations which may have undue influence on the estimations. Finally, the chapter includes a number of illustrative comparisons of published financial statements with data in commercial databases, highlighting differences between the information that is published in financial statements and the data that is offered in commercial databases. Chapter 4 concludes with the sampling process and the sample specifications employed in this study.

Chapter 5 presents the preliminary results of the study including in-sample and out-of-sample predictions, and Chapter 6 extends the initial results, investigating whether the preliminary results are sensitive to alternative dependent variables, further control variable and econometric model choice. Further control variables include firm size, magnitude of accruals effects, positive and negative cash flows from operations, positive and negative operating income, industry effects and the effect of mergers and acquisitions. Econometric model choice includes panel data regression.

Chapter 7 examines the effect of sampling issues in accounting research (introduced in Chapter 4) on the estimations on the primary findings.

The thesis concludes in Chapter 8 with a summary of the findings, then outlines the intended contributions of the thesis to the literature, and indicates the limitations of the study. In addition, the chapter provides some suggestions about future research in this area.

Chapter 2

Background

2.1. Introduction

This chapter begins with an overview of the standard setter's perspective on accrual-based and cash-based accounting, and the implications for forecasting future cash flows. Section 2.3 then describes the historical development of the relevant standards in the UK, starting with the Funds Flow Statement and how this led to its reformatting in the form of the Statement of Cash Flows. Section 2.4 then examines the direct and indirect methods of reporting cash flows from operating activities and discuses recent points of view about the importance of reporting on cash flows from operating activities using the direct method. Section 2.5 develops an analytical approach to understanding the underlying accounting, by presenting the cash flow and accruals identity and explaining the computation of total accruals. Building on this understanding of the relevant accounting framework, Section 2.6 then reviews the empirical evidence on future cash flow estimation. Section 2.7 presents a final summary of this chapter.

2.2. The Standard Setter's Perspective on Accrual-Based and Cash-Based Accounting, and the Implications for Forecasting Future Cash Flows

Under accrual accounting, financial transactions and events are recorded when they occur, without considering the timing of their cash receipts or cash payments. In contrast, under cash accounting, financial transactions and events are recorded when the cash is received or paid. The difference between accrual accounting and cash accounting is therefore one of timing differences which lead to both accruals (where cash flows will occur in future periods) and deferrals (where cash flows occur in the current period but the income effects are deferred to the future). Consequently, given that accounting theory supposes that accruals and deferrals mitigate the timing problems of cash accounting, by matching costs and revenues in the appropriate period, the prediction of future cash flow should be improved if these matching and timing differences can be properly identified.

The relationship between accrual-based financial reporting and the prediction of future cash flows has long been a contentious issue, among both practitioners and researchers, and has important policy implications. Nevertheless, the importance of accrual accounting in cash flow prediction is emphasized by the International Accounting Standard Board (IASB), the Accounting Standard Board (ASB) and the Financial Accounting Standard Board (FASB) in defining the usefulness of financial statements.[1] For instance, the exposure draft of the *Conceptual Framework for Financial Reporting*, jointly issued in May 2008 by the IASB and the FASB, calls attention to the role of accrual accounting in this context as follows:

> *… financial performance* [is] *measured by accrual accounting* [which] *provides a better basis for assessing cash flow prospects than information solely about the entity's current cash receipts and payments … financial reporting should provide information to help present and potential investors and creditors and others to assess the amounts, timing, and uncertainty of the entity's future cash inflows and outflows.*

The general assumption here is that investors need information about future cash flow because the current value of their holding may be estimated as the present value of the future cash flows that will be created by the firm in which they invest. In fact, such prediction plays an important part not only in security valuation but also more generally

[1] Note that the IASB replaced the earlier International Accounting Standards Committee (IASC), and the ASB replaced the earlier Accounting Standard Committee (ASC)

in capital budgeting analysis and dividend policy formulation (for example, see Penman, 2009, 2010). Moreover, as the power of a firm to generate cash flow is reflected in the market value of its equity, it follows that the prediction of future cash flow helps to predict future stock returns and not just current investment values.

In a similar vein, International Accounting Standard *IAS* 1: *Presentation of Financial Statements* makes reference to the wider use of accounting information in predicting future cash flows, asserting unequivocally that financial statement information:

> *...assists users of financial statements in predicting the entity's future cash flows* (Paragraph 9)

In expounding the benefits of the publication of a Cash Flow Statement, *IAS* 7: *Statement of Cash Flows* also refers to the role of financial statements in prediction, and more specifically that historical cash flow information:

> *...is often used as an indicator of the amount, timing and certainty of future cash flows* (Paragraph 5)

Elsewhere, however, less trust seems to be placed in historical cash flow information alone - see for example the UK Financial Reporting Standard *FRS* 1: *Cash Flow Statements*, which was last revised in 1996, which states that:

> *Although cash flow statements show information about the reporting entity's cash flows in the reporting period, it provides incomplete information for assessing future cash flows. Some cash flows result from transactions that took place in an earlier period and some cash flows are expected to result in further cash flows in a future period. Accordingly, cash flow statements should normally be used in conjunction with profit and loss accounts and balance sheets when making an assessment of future cash flows.* (Paragraph 4, Appendix 3)

With regard to the calculation of cash flow, *IAS* 7 refers to the more questionable role of the indirect method in predicting future cash flows, as follows:

> [The cash flow statement] *provides information which may be useful in estimating future cash flows and which is not available under the indirect method* (Paragraph 19)

Likewise, the CFA Institute, in its monograph entitled *A Comprehensive Business Reporting Model* (2007), also emphasises a preference for the direct cash flow method:

> [The cash flow statement] *should be prepared using the direct method only …….the indirect method does not provide the needed information or enable investors to generate it from the data, then companies must be required to use the direct method* [Paragraph 9] ….. *the articulation between the balance sheet and the income statement is almost always obscured* (Paragraph D page 22)

In spite of the FASB, ASB and IASB standpoints on the usefulness of accrual-based financial statement information in cash flow prediction, it should be recognised nevertheless that accounting manipulation, or even unintentional errors in accounting estimates, may lead to a decrease in the usefulness of accrual accounting in predicting future cash flows (Brochet et al, 2009). That is to say, although accrual accounting mitigates the timing and matching problems inherent in cash accounting through the creation of accruals and deferrals, as pointed out earlier, the general expectation is that cash flow accounting is more readily verifiable and therefore is less vulnerable to manipulation than accrual accounting.

Building on these arguments, this thesis considers the current state of cash flow prediction research and then proposes some methodological improvements that may be taken into account, which are tested on a large sample of accounting data from UK companies. Beforehand, however, a brief historical review of the development of cash flow reporting is provided, to allow the reader to more fully appreciate the requirements placed on the UK companies that form the sample tested later in the thesis.

2.3. The Development of the Relevant Standards

2.3.1. History

As noted earlier, accounting standard setters emphasise that financial reporting should provide informative information to users in predicting future cash flows. In the UK, when such information was initially solicited under *SSAP* 10 (1975), firms were required to prepare a *Statement of Source and Application of Funds*, which reported changes in financial position by focusing strictly on short-term working capital, i.e. current accruals and deferrals of costs and revenues. The same approach had already taken in US GAAP in *APB Opinion* 19 (1963), under the title of the *Statement of Changes in Financial Position*. Table 2.1 shows the standard format of this statement, divided into two sections: sources of funds and uses of funds.

Table 2.1
Standard Format of the Statement of Changes in Financial Position

Sources of Resources (transaction credits)
1. Increases to the "fund balance" accounts a. From net income b. From other sources
2. Other sources of resources
3. Decrease, if any, in the fund balance for the period
Uses of Resources (transaction debits)
1. Decreases to the "fund balance" accounts a. From net losses b. From other sources
c. Other uses of resources
Increase, if any, in the fund balance for the period

Source: Wolk and Tearney (1997, p.381)

The sources of funds include increases in liabilities and equities and decreases in assets, and the uses of funds include decreases in liabilities and equities and increases in assets.

The main problem with this earlier financial statement was its flexibility on the definition of cash, as most firms defined funds as net working capital, the same drawback being evident both in *APB* 19 in the USA and *SSAP* 10 in the UK. A new standard was issued both in the USA and in the UK, with the aim of requiring firms to concentrate on changes in cash (and near cash) instead of changes in working capital, thus moving from an accruals-based statement to a cash-based statement. The motivation was discussed in the new standard in the UK, *FRS* 1, as follows:

> *.. funds flow data based on movements in working capital can obscure movements relevant to the liquidity and solvency of an entity…*

Table 2.2 summarises the history of the relevant standards in the UK. The next section will present the objectives of the Statement of Cash Flows and will compare across accounting regimes.

Table 2.2
History of the Relevant Standards in the UK

1975	*Statement of Standard Accounting Practice* 10*: Statements of Source and Application of Funds (SSAP* 10*)* - issued by the Institute of Chartered Accountants in England and Wales.
1991	*Financial Reporting Standard* 1*: Cash Flow Statements (FRS* 1) replaces *Statements of Source and Application of Funds* – issued by the Accounting Standards Board
1996	Revised *FRS* 1: *Cash Flow Statements*
1997	Effective date of revised *FRS* 1 : 23 March 1997

2.3.2. Purposes of Cash Flow Information

In referring to the importance and usefulness of cash flow information, the pronouncements of the FASB, the IASB and the ASB all contain statements that give a clear indication of the motivation for requiring such disclosures. For instance, the UK

Financial Reporting Standard *FRS* 1: *Cash Flow Statements*, which was last revised in 1996, states that:

> *A cash flow statement has increasingly come to be recognised as a useful addition to the balance sheet and profit and loss account in their portrayal of financial position, performance and financial adaptability. Historical cash flow information gives an indication of the relation between profitability and cash generating addition, analysts and other users of financial information often, formally or informally, develop models to assess and compare the present value of the future cash flows of entities. Historical cash flow information could be useful to check the accuracy of past assessments and indicate the relationship between the entity's activities and its receipts and payments...* (Paragraphs 2 and 3 of Appendix 3)

Also in *FRS* 1, in paragraph 5 of Appendix 3, the advantages of the Cash Flow Statement are discussed terms which may be summarised as follows:

- Funds flow data does not provide new information, as it is just two balance sheet changes, whereas the Statement of Cash Flows presents additional data which may be not disclosed in a Funds Flow Statement.
- The change in working capital does not provide relevant information for assessment of the liquidity and solvency of a firm, and may conceal important changes in cash, for instance, a significant increase (decrease) in cash may be masked by an increase (decrease) in stocks and debtors; a decrease in working capital does not necessarily mean that there is a cash shortage and bankruptcy risk.
- Cash flow is more understandable than changes in working capital.
- Cash flow may be used directly in business valuation models, and therefore may be more relevant than funds flow data.

Elsewhere, at the International Accounting Standards Board, *IAS* 7: *Statement of Cash Flows* states that:

> *A Statement of Cash Flows, when used in conjunction with the rest of the financial statements, provides information that enables users to evaluate the changes in net assets of an entity……* [historical cash flow information] *is useful in checking the accuracy of past assessments of future cash flows and in examining the relationship between profitability and net cash flow and the impact of changing prices.* (Paragraphs 4 and 5)

Finally, in the USA, the FASB indicates in paragraph 4 of *FAS* 95: *Statement of Cash Flows* that the purpose is as follows:

> *…..to provide relevant information about the cash receipts and cash payments of an enterprise during a period*. (Paragraph 4)

also emphasising that:

> ….[cash flow information] *if used with related disclosures and information in the other financial statements, should help investors, creditors, and others to (a)assess the enterprise's ability to generate positive future net cash flows; (b) assess the enterprise's ability to meet its obligations, its ability to pay dividends, and its needs for external financing; (c) assess the reasons for differences between net income and associated cash receipts and payments; and (d) assess the effects on an enterprise's financial position of both its cash and noncash investing and financing transactions during the period.* (Paragraph 5)

Given the above-mentioned viewpoints on the subject, which are similar to a great extent, it can be concluded that the standard setters are generally of the opinion that:

- The Statement of Cash Flows provides new information to help users to measure of financial performance, specifically to:
    - evaluate the changes in net assets;
    - predict future cash flows;
    - assess the quality of earnings;
    - increase comparability of financial statements;
    - investigate the relationship between accrual accounting (earnings), cash accounting and changes in prices; and
    - assess flexibility, liquidity and solvency.

- The Statement of Cash Flows should be used in conjunction with other financial statements, such as the Balance Sheet and Income Statement.

In spite of the similarities between standard setters in the purposes of the Statement of Cash Flows, the next section will discuss differences in the design of the Statement of Cash Flows.

2.3.3. Format of the Statement of Cash Flows

Whilst the previous section indicates that different accounting regimes have similar objectives, there are differences in the formats of their Statement of Cash Flows. The current research uses UK data, and hence this section compares the *FRS* 1 (1996) format of the *Statement of Cash Flows* with the IASB and FASB formats. *FRS* 1 suggests the following standard headings:

> *…..operating activities, returns on investments and servicing of finance, taxation, capital expenditure and financial investment, acquisition and disposal, equity dividends paid, management of liquid resources and financing*….. (Paragraph 13)

but these are not mandatory; in fact, *FRS* 1 (1996) follows the exposure draft *FRED* 10[2] which allows firms to select a format for the Statement of Cash Flows.

The ASB indicates that the first six headings should be reported in order and that the last two headings (management of liquid resources and financing) could be merged and presented under one heading with subtitles. Operating cash flows can be presented by either the direct method or the indirect method, which in the latter case is calculated by adjustment to the operating profit reported in the profit and loss account.

In contrast, *IAS* 7 requires firms to present the Statement of Cash Flows as follows:

> *The Statement of Cash Flows shall report cash flows during the period classified by operating, investing and financing activities* (Paragraph 10)

The FASB, in a similar vein, requires firms in *FAS* 95 to report their cash receipts and cash payments in the following way:

> *A Statement of Cash Flows shall classify cash receipts and cash payments as resulting from investing, financing, or operating activities*. (Paragraph 14)

In addition to differences in the format of the classification of the Statement of Cash Flows, Appendix 2 of *FRS* 1 outlines differences between *FRS* 1 and other standards, including differences in the definition of cash. *FRS* 1 defines cash flow as:

> *increase or decrease in an amount of cash and cash as cash in hand and deposits repayable on demand less overdrafts* (Paragraph 6)

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[2] Financial Reporting Exposure Draft

IAS 7 specifies cash flows as a change in cash and cash equivalents and defines cash as:

> *… cash on hand and demand deposits" and cash equivalents as …..short-term, highly liquid investments that are readily convertible to known amounts of cash and which are subject to an insignificant risk of changes in value* (Paragraph 6)

FAS 95 identifies cash equivalents as:

> *….. Short-term, highly liquid investments that are both: a. readily convertible to known amounts of cash b. So near their maturity that they present insignificant risk of changes in value because of changes in interest rates* (Paragraph 6)

The definition of cash in *FRS* 1 is close to the definition of cash in *IAS* 7. The differences are related to the classification of the components of cash flows from operations and preparing net cash flows from operations, which will be discussed in the next section.

2.4. Direct and Indirect Methods of Reporting Cash Flows from Operating Activities

According to *FRS* 1, cash flows from operations are those generated by operating and trading activities. Cash flows with respect to provisions are also included in the cash flows from operations. In addition, dividends received from equity accounted firms are considered as the cash flows from operations where the results are included as part of operating profits. *FRS* 1 allows firms to present operating cash flows using either the direct or indirect method, but the preference is for the indirect method, which is the most common method of presenting cash flows from operating activities in practice.

Under the indirect method, operating cash flow is calculated by adjusting the operating profit reported in the profit and loss accounts for any non-cash items in the income statement. *FRS* 1 provides an illustrative format for the reconciliation of operating profit to net cash inflow from operating activities (see Table 2.3).

Table 2.3
Reconciliation of Operating Profit to Net Cash Inflow from Operating Activities (*FRS* 1 Format)

Operating profit	xx
Depreciation charges	xx
Increase in stocks	xx
Increase in debtors	xx
Increase in creditors	xx
Net cash from operating activities	xx

With regard to the direct method, there is no illustration under *FRS* 1, but there is under *IAS* 7. Here, the indirect method starts with the reported profit before tax. In fact, in practice, UK firms have used different starting points to calculate cash flows from operating activities; for instance, before 2005 they used operating profit, and since then some of them have used operating profit before tax and others net income as a starting point in the reconciliation. Under the direct method, the operating cash flow is shown as the gross cash receipts less the gross cash payments. The illustrative format in *IAS* 7 refers to this subtotal as 'cash generated from operations' (see Table 2.4).

Table 2.4
Cash Flows from Operating Activities (*IAS* 7 Format)

Cash receipts from the sale of goods and services	xx
Cash payments to suppliers	xx
Cash payments to and on behalf of employees	xx
Cash generated from operations	**xx**
Interest paid	xx
Income taxes paid	xx
Net cash from operating activities	**xx**

Whilst the IASB recommends that firms report operating cash flows under the direct method, under *FRS* 1 firms have the choice to use the direct method or the indirect method, although the ASB prefers the indirect method. The main advantages of the indirect method over the direct method are that the cost of implementing it is lower and that it indicates the difference between earnings and cash flow from operations. The main advantage of the direct method is that it is more easily understandable by users who wish to know how cash flow has been generated, and it allows a better comparison.

In theory, the results of using either the direct or the indirect method to compute cash flows from operating activities should be the same. However, there is an argument with respect to the greater usefulness of the direct method. As mentioned in the previous section, the discussion in *IAS* 7 suggests that the indirect method does not provide the necessary disaggregated information required to predict future cash flows, and the CFA Institute (2007) calls for the disclosure of the direct cash flow computation, again to facilitate the prediction of future cash flows.

Two recent studies that have investigated the role of the direct method in predicting future cash flows and earnings have been motivated by the FASB, IASB and CFA Institute comments discussed above (Orpurt and Zang, 2009, and Arthur et al, 2010).

Orpurt and Zang (2009) investigate the predictive ability of the direct method of cash flow disclosure in predicting both future cash flow and future earnings, extending Barth et al (2001) and Cheng and Hollie (2008). Regarding the FASB, IASB and CFA institute's comments with respect to the usefulness of the direct method of cash flow information to users, these authors point out that computing cash flow using this method is still not necessarily reliable. They provide evidence of the articulation errors that may occur when the Balance Sheet and Income Statement are used to compute the cash flow of US companies using the direct method, by comparison with the direct cash flow published by small numbers of these companies. They also examine the effect of adding these articulation errors to models of future cash flows. Using the published cash flow, they find that adding articulation errors improves the predictive ability of models and conclude that the direct method of cash flow statements enhances the prediction of future cash flows.

Using annual Australian data, Arthur et al (2010) investigate the ability of the decomposition of cash flow from operations to predict future earnings, again using the direct method. They argue that disaggregated cash flows with accruals provide helpful information in predicting future earnings, and partition the components of cash flows into core and non-core cash flows components - they use the classifications suggested in *IAS* 7 and consider cash generated from operations as the core operating cash flows. They conclude that the disclosure of the components of the direct method cash flow from operations is informative with regard to the prediction of future earnings.

With regard to the UK, however, it should be noted that there is no information in commercial databases at present regarding the use of the direct method by UK firms. Therefore, this study is restricted to Statement of Cash Flows data based on the indirect method.

2.5. The Cash Flow and Accruals Identity and the Computation of Total Accruals

In empirical accounting research, the most common definition of accruals (*ACC*) derives from the indirect approach, in the form of the change in non-cash working capital less depreciation and amortisation expense, i.e.:

$$ACC = [(\Delta CA - \Delta Cash)] - [\Delta CL - \Delta STD - \Delta TAXP - \Delta DIV] - DEPAM$$

where:

ΔCA = change in current assets

$\Delta Cash$	=	change in cash and short investments
ΔCL	=	change in current liabilities
ΔSTD	=	change in short term debt
$\Delta TAXP$	=	change in income taxes payable
ΔDIV	=	change in dividend payable
$DEPAM$	=	depreciation and amortization expenses

Then cash flow from operations *CFO* is calculated as follows:

$$CFO = EBIT - ACC$$

The above concept of accruals is close to the notion of operating accruals defined in *IAS* 7 paragraph 20, which is widely used in the existing literature (e.g. Sloan 1996, Chan et al 2006, Bergstresser and Philippon 2006, Soares and Stark 2011 and Govendir et al 2011).

The second method that is common in empirical accounting research simply takes *CFO* from the Statement of Cash Flows and calculates accruals as follows:

$$ACC = EBIT - CFO$$

This leads to the following disaggregation of the individual accrual components:

$$ACC = \Delta AR + \Delta INV - \Delta AP - DEPAM + OTHER$$

where:

ΔAR	=	change in accounts receivable
ΔINV	=	change in inventory
ΔAP	=	change in accounts payable
$DEPAM$	=	depreciation and amortization expenses
$OTHER$	=	$EARN - (CFO + \Delta AR + \Delta INV - \Delta AP - DEPAM)$

The above calculation of accruals is also used widely in the literature, e.g. Barth et al (2001), Al-Attar and Hussain (2004), Brochet et al (2009) and Lev et al (2009).

Richardson et al (2005) have made it clear that this definition of accruals ignores changes in non-current operating assets and liabilities and non-cash financial assets and liabilities, and in so doing they have introduced a more comprehensive measure of accruals - their ‘total accrual’ is the change in working capital, *plus* the change in net non-current operating assets, *plus* the change in non-cash financial assets. Like Richardson et al, the current study recognises the need for a more comprehensive measure of the net accrual (i.e. all operating accruals less operating deferrals) but argues for a different determination of this, specifically the change in working capital, *plus* the change in non-current operating receivables, *less* the change in non-current operating payables, *less* depreciation and amortization expenses. This is subsequently referred to here as *operating accruals*, and is calculated based on the indirect method of balance sheet changes, an approach which assumes that the long-term receivable and long-term payable items in accounting databases are related to operating activities, and is thus consistent with *FRS* 1 and *IAS* 7. The total accrual based on this approach may be determined as:

$$TACC =$$

$$[(\Delta CA - \Delta Cash) + \Delta LTR] - [(\Delta CL - \Delta STD - \Delta TAXP - \Delta DIV) + \Delta LTOL] - DEPAM$$

where:

ΔCA	=	change in current assets
$\Delta Cash$	=	change in cash and short investments
ΔLTR	=	change in long-term receivables
$\Delta \mathrm{CL}$	=	change in current liabilities
ΔSTD	=	change in short term debt
$\Delta TAXP$	=	change in income taxes payable
ΔDIV	=	change in dividend payable
$\Delta LTOL$	=	change in long-term operating liabilities
$DEPAM$	=	depreciation and amortization expenses

By disaggregating the individual components of the total accrual further, the above may be restated as:

$$TACC =$$

$$(\Delta TAR + \Delta INV + \Delta PREP + \Delta OCA) + \Delta LTR - (\Delta TAP + \Delta OCL) - \Delta LTOL - DEPAM$$

Where the disaggregated components of the operating current asset change (ΔCA – $\Delta Cash$) are:

ΔTAR = change in trade accounts receivable
ΔINV = change in inventories
$\Delta PREP$ = change in prepayments
ΔOCA = change in other current assets

the disaggregated components of operating current liability change (ΔCL – ΔSTD – $\Delta TAXP$ – ΔDIV) are:

ΔTAP = change in trade accounts payable
ΔOCL = change in other current liabilities

2.6. Empirical Evidence on Accounting-based Cash Flow Estimation

As mentioned earlier, most prior studies have investigated the association between earnings components and future performance measures (e.g. Barth et al 2001) and some have examined the predictive ability of earnings and its components to predict future cash flows, using out-of-sample prediction tests (e.g. Lev et al 2009, Brochet et al 2009). Studies of the role of cash flow accounting and accrual accounting in predicting future cash flows have yielded remarkably different results. Some researchers have reached the conclusion that current earnings and the components of earnings are better predictors of future cash flow than current cash flow (e.g. Dechow et al, 1998; Barth, et al, 2001).[3] In contrast, as first indicated in Barth et al (2001), others have reached the opposite conclusion whereby current cash flow is the better predictor of future cash

[3] See also Al-Attar and Hussain (2004), who show that earnings and the components of earnings is a better predictor of one-period-ahead cash flow than current cash flow, and Brochet, Nam and Ronen (2009) who indicate that accruals is a better predictor than current cash flow in predicting future cash flow.

flow, citing the studies of Bowen, Burgstahler and Daley (1986), Percy and Stokes (1992) and Finger (1994).

Ten years on, the empirical evidence with respect to the predictive ability of accruals remains inconclusive, due – among other things – to differences in samples and methodologies.[4] Below, in reviewing previous studies in order to highlight the relevant developments in research design and sampling, we concentrate primarily on research that is restricted to the use of accounting information to predict future cash flows, consistent with the aims of this thesis.

Modelling the Accrual Process

The seminal paper by Dechow et al (1998) is recognised for its development of a theoretical model to explain the relationship between earnings, cash flows and current accruals (specifically, changes in inventory, accounts receivable and accounts payable). They examine the predictive ability of current earnings and current operating cash flows and propose that current earnings are better than current cash flows as a predictor of future cash flows. Their modelling provides evidence on; "(i) *the relative ability of earnings and operating cash flows to predict future operating cash flows ; and* (ii) *firms' time series properties of operating cash flows, accruals and earnings*." (Dechow et al, 1998, p.1).

[4] Brochet, Nam and Ronen (2009), in their summary of the main findings of empirical studies that assess the role of earnings components in predicting future cash flows, highlight other research design differences: (a) some investigate the association of earnings components with finite measures of future cash flow, and others predict (or investigate the association of earnings components with) the market value of equity; (b) some utilize cross-sectional regression and others firm-specific regressions.

Using a large sample and annual data for years 1963-1992, they test the following models:

(1) $CFO_{t+j} = CFO_{t-k}$

(2) $CFO_{t+j} = EARN_{t-k}$

where:

t denote the year, and

j ranges from 1 to 3 (denoting a forecast for the following year or two or three years ahead), and

the lagged operator *k* ranges from 1 to 3.

Using firm-specific estimations, they report the average mean standard deviation of prediction error. Their findings may be summarised as follows:

- The prediction error in the cash flow estimation when using aggregate earnings (1.60) is less than when using current cash flow (1.89). Therefore, they conclude that current earnings alone are better than current cash flows from operations in predicting future operating cash flows.
- Performing firm-specific regressions of future cash flows on aggregate current earnings and current cash flows, both have incremental information.
- The predictive ability of aggregate earnings relative to cash flow differs with firms' operating cash cycles and earnings are better than cash flows as a predictor when the firms' operating cash cycles are increased.

Dechow et al (1998) do not examine the predictive ability of the accruals components; this is subsequently investigated by Barth et al (2001).

Disaggregating Earnings into Cash Flow and Accrual Components

The highly cited study by Barth et al (2001) extends Dechow et al (1998) by disaggregating earnings into cash flow and accrual components. Barth et al add several lags of aggregate earnings and cash flow as predictor variables, and, in contrast to Dechow et al (1998), who focused on working capital accruals, consider the effect of the long-term accruals (using depreciation and amortisation expenses as proxies in the empirical test) in predicting future cash flows.

Barth et al define *EARN* as income before extraordinary items and discontinued operations, *CFO* as net cash flow from operating activities less the effect of the extraordinary items and discontinued operations reported on the Statement of Cash Flows, and ‘total accruals’ as *EARN* minus *CFO*. They also specify the accrual components as the changes in accounts receivable, inventories and accounts payable, depreciation and amortisation and other accruals. Their variables are deflated by the average total assets.

They employ three hierarchical research models with increasing disaggregation of earnings. Their first model captures the predictive ability of current and past earnings with respect to future cash flows as follows:

$$(1)\ CFO_{i,\,t+1} = EARN_{i,\,t-k}$$

where

the lagged operator k ranges from 0 to 6.

The second model tests the predictive ability of current and past cash flow and aggregate accruals as follows:

$$(2)\ CFO_{i,\,t+1} = CFO_{i,\,t-k} + Accruals_{i,\,t-k}$$

The third model examines the predictive ability of current cash flow and accrual component of earnings as follows:

$$(3)\ CFO_{i,\,t+1} = CFO_{i,\,t} + \Delta AR_{i,\,t} + \Delta INV_{i,\,t} + \Delta AP_{i,\,t} + DEPR_{i,\,t} + AMORT_{i,\,t} + OTHER_{i,\,t}$$

The main contention of Barth et al (2001) is that the ability of the last model to predict future cash flows is better than that of the other models, and they predict that the sign of the weights of current cash flow, change in accounts receivable and change in inventories are positive and the sign of the weight of change in accounts payable is negative. They also assert that, consistent with Feltham and Ohlson (1996), future cash flows are positively related to depreciation and amortisation.

In addition to adjusted R^2, Barth et al's use Vuong's (1989) test to compare models, and an F-test of differences in coefficients of the full disaggregation. Their findings are considered to be consistent with FASB's point of view that accrual accounting is superior to cash flow accounting, which is contrary to the implications of Dechow et al (1998), and may be summarised as follows.

- The predictive ability of current cash flow (Adjusted R^2 0.24) to predict future cash flows is greater than that of the aggregated earnings (Adjusted R^2 0.15).
- Disaggregating earnings into current cash flows from operations and aggregate accruals (Adjusted R^2 0.27) enhances the ability to predict future cash flows compared to aggregate earnings (Adjusted R^2 0.15).
- Disaggregating earnings into current cash flows from operations and the components of accruals (Adjusted R^2 0.35) further increases the ability to predict future cash flows compared to disaggregating earnings into current cash flows from operations and aggregate accruals (Adjusted R^2 0.27).

- The accrual components, including depreciation and amortisation, are significant in predicting future cash flows with the predicted sign and have incremental information to current cash flow, whilst aggregate earnings and aggregate accruals mask the relevant information.
- Inconsistent with other studies (e.g. MacDonald 1999a, 1999b), depreciation and amortisation have a significant ability to predict future cash flows.
- The ability of the disaggregated current earnings (Adjusted R^2 0.27) to predict future cash flows is more than that of current aggregate earnings and up to six years of lagged aggregate earnings (Adjusted R^2 0.19).
- Partitioning aggregate earnings based on operating cash cycles masks important information with respect to predicting future cash flows, this is inconsistent with Dechow et al's (1998) finding that the predictive ability of earnings for future cash flows varies with the firm's operating cash cycle.
- Barth et al's findings are robust to further control variables such as prediction for several years in the future, operating cash cycle and industry effects.
- Barth et al's conclusions support the FASB's point of view that the earnings components are important to the prediction of future cash flows.

Barth et al use US data and Compustat database, whereas the empirical work for this thesis is based on cash flow reporting by UK companies. In this context, it is also important therefore to appreciate prior research using UK data that tests the Barth et al models.

Replicating Barth et al (2001) Using UK Data

Al-Attar and Hussain (2004) investigate the ability of current accounting data such as earnings, cash flows and accruals to predict future cash flows. They replicate and extend Barth et al's (2001) work using panel methods to control for firm-specific fixed effects and time trends in the cash flow information. Using the Statement of Cash Flow information and annual UK data for years 1991-2000, they employ three research models as follows:

(1) $CFO_{i,\, t+j} = EARN_{i,\, t}$

(2) $CFO_{i,\, t+j} = \text{CFO}_{i,t} + Accruals_{i,\, t}$

(3) $CFO_{i,\, t+j} = CFO_{i,\, t} + \Delta AR_{i,\, t} + \Delta INV_{i,\, t} + \Delta AP_{i,\, t} + DEP_{i,\, t} + OTHER_{i,\, t}$

where

j ranges from 1 to 3

Al-Attar and Hussain define *EARN* as after-tax profits, adjusted for items that do not relate to the normal trading activities of the company, *CFO* as net cash flow from operating activities minus cash from non-operating activities and total accruals as *EARN* minus *CFO*. Their variables are deflated by the number of ordinary shares outstanding.

Al-Attar and Hussain's findings support the results of Barth et al (2001), and the signs of the derived weights of variables under investigation are consistent with the expectations of Barth et al. They also document that disaggregating earnings into current cash flows from operations and aggregate accruals enhances the ability to predict future cash flows (Adjusted R^2 78.1%) compared to aggregate earnings (Adjusted R^2 69.8%). In addition, they find that decomposing earnings into cash flow and components of accruals (Adjusted R^2 80.7%) enhances the predictive ability of earnings to predict future cash flows.

Al-Attar and Hussain conclude that their findings are consistent with the standard setter’s point of view, that is, earnings and its components are better than current cash flow as predictors of future cash flows. It should be noted however that these initial studies in the UK and US by Dechow et al (1998), Barth et al (2001) and Al-Attar and Hussain (2004) have a particular shortcoming with regard to the predictive ability that is claimed as they do not employ out-of-sample accuracy tests. In contrast, both in-sample estimations and out-of-sample tests are used by the studies reviewed below, by Finger (1994), Kim and Kross (2005), Yader (2007), Brochet et al (2009) and Lev et al (2009).

Out-of-Sample Estimation

The first research paper that considered the estimation of future cash flow with both in-sample estimation and out-of-sample prediction testing, by Finger (1994), predated the theoretical framework outlined above linking the accounting variables involved. The study simply examined how current cash flow and earnings might predict future cash flow (and earnings). Using annual US data and firm-specific regressions, Finger (1994) was also innovative in estimating cash flow up to eight years ahead, arguing that prior studies had used short horizons.

Finger’s in-sample estimation and out-of-sample prediction tests indicate that current cash flow is a better predictor of future cash flows than earnings for short horizons (one to two years ahead) but that the predictive ability of current cash flow and earnings are similar in the case of longer-term predictions (four to eight years ahead). With regard to current earnings as a predictor, the out-of-sample prediction tests provide no evidence on the ability of earnings to estimate either future earnings or cash flow and therefore reject the FASB point of view that earnings are better than current cash flow as a predictor of future cash flow.

Reassessing Dechow et al (1998) with Out-of-Sample Tests

Using a large sample and annual US data, Kim and Kross (2005) investigate the association between earnings and next year operating cash flows over 28 years (1972-2001). Consistent with Dechow et al (1998), they employ out-of-sample tests to assess the accuracy of prediction of the following models:

(1) $CFO_{i,t+1} = CFO_{i,t} + EARN_{i,t}$

(2) $CFO_{i,t+1} = CFO_{i,t}$

(3) $CFO_{i,t+1} = EARN_{i,t}$

Kim and Kross document positive coefficients for both cash flows and earnings for all examined periods. They also report the average coefficient and t-statistics for earnings (0.43, t=20.39) and cash flows (0.23, t=13.33) when using the first model. Their reported coefficients lie between coefficients reported by Dechow et al and Barth et al (i.e. 0.07:0.38 on *CFO*, and 0.45:0.22 on *EARN*, respectively). In addition, they report that the coefficients on *EARN* increased over the examined period (from 0.32 to 0.54), as they also do on *CFO* (from 0.22 to 0.26). Accordingly, they conclude that the contribution of earnings to predicting future cash flows for one-year-ahead is increasing.

Kim and Kross (2005) calculate annual R^2 when using the cash flow only model of up to 46.9% and when using the earnings only model of up to 52%. They report incremental explanatory power of cash flow decreasing over the period from 4.5% to 2.5%, and earnings increasing from 4.4% to 8.5%, and note therefore that, in addition to a higher coefficient level, the explanatory power of earnings with respect to future cash flows is also increasing. They also document that Theil's U-statistic decreases when using the earnings only model (from 0.76 to 0.68) over the examined period, confirming an improvement in the prediction over time.

Accordingly, Kim and Kross's in-sample estimation and out-of-sample prediction tests confirm that current earnings outperform current cash flow in predicting one-year-ahead future cash flows, that the association between earnings and next year operating cash flows increases over the time period and out-of-sample prediction tests indicate that the prediction accuracy of aggregate earnings increase over the time period.

It should be noted that Kim and Kross restrict their models to those introduced by Dechow et al (1998) and do not examine the predictive ability of earnings components. The next study, in addition to using both in-sample estimations and out-of-sample tests, builds on the model refinement first introduced in Barth et al (2001), and also adds adding firm growth to prediction models.

Reassessing Barth et al (2001) Using with Out-of-Sample Tests

Yader (2007) investigates the incremental predictive ability of accrual models for future cash flows, following Barth et al (2001). Using cash flow information and annual US data for years 1989-2005, Yader tests for the predictive ability of current cash flow plus the change in accounts receivables, the change in inventory, the change in accounts payables, and (unlike previous work) the latter variable includes all accrued expenses, except accrued income taxes which is included in the model as a separate variable. The out-of-sample predictions confirm the Barth et al results, showing a higher association for the accrual-based model (Adjusted R^2 64.0%).

Brochet et al (2009) also study the value of disaggregated accruals in predicting future cash flows, on a quarterly basis, using out-of-sample methods. They define *EARN* as income before extraordinary items and discontinued operations, *CFO* as cash flow from operations and total accruals as *EARN* minus *CFO* minus extraordinary item and discontinued operations that affect cash flows[5]. The models as follows:

(1) Cash flow model (as the benchmark)

$$CFO_{i,t} = CFO_{i,\,t-1}$$

(2) Earnings model

$$CFO_{i,t} = EARN_{i,\,t-1}$$

(3) Cash flow with aggregate accruals model

$$CFO_{i,\,t} = CFO_{i,\,t-1} + ACC_{i,\,t-1}$$

(4) Cash flow with accrual components model

$$CFO_{i,\,t} = CFO_{i,\,t-1} + \Delta AR_{i,\,t-1} + \Delta INV_{i,\,t-1} + \Delta AP_{i,\,t-1} + DEP\ AMORT_{i,\,t-1} + OTHER_{i,\,t-1}$$

Using firm–specific regressions, Brochet et al find, as shown in Table 2.5 below, that the ability of the past earnings (mean Adjusted R^2 8.94%) to predict one-quarter-ahead cash flows is greater than that of the past cash flow (mean Adjusted R^2 8.09%), and disaggregating earnings into cash flows and aggregate accruals enhances the predictive ability of their model (mean Adjusted R^2 12.69%), the mean coefficient of past cash flow doubling from 0.1842 to 0.3644.

[5] Compustat Quarterly data item numbers (8), (108) and (78) respectively, scaled by Total Assets (44)

Table 2.5
Brochet et al's (2009) One-Quarter-Ahead Prediction Results

	Mean coefficient			
	CFO	*EARN*	*CFO&ACC*	*CFO&ACC* components
N	16,549	16,549	16,549	12,327
Intercept	0.0190	0.190	0.0174	0.0094
CFO	0.1842		0.3644	0.3355
EARN		0.3017		
ACC			0.2664	
Δ*AR*				0.1908
Δ*INV*				0.4567
Δ*AP*				-0.4567
DEPAMORT				0.0264
OTHER				0.2832
Adj.R^2	8.09%	8.94%	12.69%	19.20%

The next table, Table 2.6, reports their firm–specific absolute prediction errors. The table shows that the mean absolute prediction errors of the aggregate accrual model are lower than for other models when future cash flow is predicted one-, two- and four-quarter-ahead, but not one to eight- quarter-ahead.

Table 2.6
Brochet et al's (2009) Absolute Prediction Errors

	Means				Medians			
Prediction horizons	*CFO*	*EARN*	*CFO&ACC*	*CFO&ACC* components	*CFO*	*EARN*	*CFO&ACC*	*CFO&ACC* components
CFO_{t+1}	2.12	2.11	2.08	2.21	1.33	1.31	1.28	1.33
$CFO_{t+1, t+2}$	1.64	1.62	1.59	1.65	1.04	1.02	1.00	1.02
$CFO_{t+1, t+4}$	1.31	1.28	1.25	1.26	0.86	0.84	0.80	0.79
$CFO_{t+1, t+8}$	1.10	1.06	1.04	1.00	0.73	0.68	0.66	0.63

Although Brochet et al, with out-of-sample testing, appear to confirm the ability of accruals to predict future cash flows, the statistical evidence above does not reveal substantial differences, and suggests that this is still an open question.

Aligning Cash Flow and Earnings

Lev et al (2009) consider two versions of cash flows (cash flow from operations and free cash flows) and align these with two similar levels of earnings (operating earnings and net income), employing both in-sample estimations and out-of-sample predictions tests, although their main test is out-of-sample accuracy tests. They also argue that, as most issues in accounting and reporting require estimates in the financial statements, especially due to the move to the fair value accounting, the quality of the accounting data involved is a fundamental issue. They equate quality with the usefulness of accruals in predicting cash flows and earnings, and extend prior research design to five hierarchical models with increasing disaggregation, as follows:

(1) Current cash flow only model (as the benchmark)

$$CFO_{i,\, t+j} = CFO_{i,\, t}$$

where j ranges from 1, 2, 1 through 2 and 1 through 3

(2) Net income only model

$$CFO_{i,\, t+j} = NI_{i,\, t}$$

(3) Cash flows with the change in working capital (excluding inventory) model

$$CFO_{i,\, t+j} = CFO_{i,\, t} + (\Delta WC - \Delta INV)_{i,\, t}$$

(4) Cash flows with the change in working capital (excluding inventory) and other accruals model

$$CFO_{i,\, t+j} = CFO_{i,\, t} + (\Delta WC - \Delta INV)_{i,\, t} + OTHER_{i,\, t}$$

(5) Cash flows with the change in working capital (excluding inventory), the change in inventory, depreciation and amortisation, deferred taxes, and other accruals model

$$CFO_{i,\, t+j} = CFO_{i,\, t} + (\Delta WC - \Delta INV)_{i,\, t} + \Delta INV_{i,\, t} + DEPAMORT_{i,\, t} + DT_{i,\, t} + OTHER_{i,\, t}$$

Table 2.7 indicates Lev et al's distributional statistics.

Table 2.7
Lev et al's (2009) Distributional Statistics

Variables	Mean	SD
Net income	0.017	0.149
CFO	0.066	0.129
Operating income	0.070	0.146

Note that whilst CFO and operating income are substantially greater on average than Net Income, the standard deviation of *CFO* is marginally lower than net income and operating income. The result is in contrast with the accounting theory and supposes that accruals and deferrals mitigate the timing problems of cash accounting, therefore the variability of earnings should be less than cash flow.

They report that their in-sample regressions results are consistent with Barth et al (2001). According to their non-tabulated in-sample estimations, the change in working capital (excluding inventory) is highly significant across all industries and the changes in inventory and depreciation and amortisation are also significant in most industries, whilst, deferred taxes, and other accruals are not significant in half of the industries they study.

Table 2.8 contains the summary statistics for the out-of-sample prediction errors, including the mean absolute prediction error (MAER) and mean error (MER) from the pooled sample, the mean adjusted R^2 from regressions of actual values on the predicted values and the mean of Theil's U-statistic. The table indicates that the MAER, MER and Theil's U-statistic of model 1 (cash flow only: 0.056, 0.001 and 0.58 respectively) are lower than those of model 2 (net income only: 0.062, 0.003 and 0.64) and the mean adjusted R^2 of model 1(0.46) is higher than model 2 (0.37). These results are true for all prediction horizons. Therefore, Lev et al's conclusion is that the cash flow model is a better predictor than the net income model, which is inconsistent with Kim and Kross

(2005) who report that earnings outperforms cash flow in predicting one-year-ahead cash flow.

Table 2.8

Lev et al's (2009) Out-of-Sample Accuracy Tests

Prediction model	Out-of-sample accuracy tests			
	MAER	MER	R^2	Theil's U
CFO $_{t+1}$**:**				
Model 1 – *CFO* only	0.056	0.001	0.46	0.58
Model 2 – Net income	0.062	0.003	0.37	0.64
Model 3 – *CFO* and Δ*WC**	0.054	0.001	0.50	0.56
Model 4 – *CFO* , Δ*WC** and *OTHER*	0.054	0.002	0.50	0.57
Model 5 – Full disaggregation	0.055	0.002	0.49	0.57
CFO $_{t+2}$**:**				
Model 1 – *CFO* only	0.062	0.001	0.33	0.65
Model 2 – Net income	0.065	0.004	0.26	0.68
Model 3 – *CFO* and Δ*WC**	0.061	0.001	0.34	0.64
Model 4 – *CFO* , Δ*WC** and *OTHER*	0.061	0.002	0.34	0.65
Model 5 – Full disaggregation	0.062	0.002	0.34	0.65
CFO $_{t+1, t+2}$**:**				
Model 1 – *CFO* only	0.109	0.000	0.46	0.56
Model 2 – Net income	0.119	0.008	0.36	0.62
Model 3 – *CFO* and Δ*WC**	0.105	0.002	0.50	0.55
Model 4 – *CFO* , Δ*WC** and *OTHER*	0.105	0.003	0.50	0.55
Model 5 – Full disaggregation	0.106	0.003	0.50	0.55
CFO $_{t+1, t+3}$**:**				
Model 1 – *CFO* only	0.173	-0.002	0.44	0.58
Model 2 – Net income	0.189	0.013	0.34	0.64
Model 3 – *CFO* and Δ*WC**	0.169	0.002	0.46	0.57
Model 4 – *CFO* , Δ*WC** and *OTHER*	0.170	0.006	0.47	0.57
Model 5 – Full disaggregation	0.170	0.006	0.46	0.58

Note. Δ*WC** = change in working capital net of inventories

Comparing the out-of-sample accuracy tests across models, the simplest accruals-based model (model 3, incorporating just changes in working capital) is generally the best predictor of future cash flows. The results outlined above lead Lev et al to the ultimate conclusion that neither earnings nor full accrual disaggregation improve the prediction of future cash flows. This finding is again inconsistent with the claim made by Barth et al (2001) and the FASB that earnings components are important to predict future cash flows. Also, it should be noted that the statistical evidence above once again does not reveal substantial differences, and suggests once more that this is still an open question.

Further Out-Of-Sample Prediction Tests

Using US annual data from the Statement of Cash Flows, Lorek and Willinger (2009, 2010) employ the following research models:

(1) $CFO_{i,t+1} = CFO_{i,t}$

(2) $CFO_{i,t+1} = EARN_{i,t}$

(3) $CFO_{i,\,t+1} = CFO_{i,\,t} + \Delta AR_{i,\,t} + \Delta INV_{i,\,t} + \Delta AP_{i,\,t} + DEPR_{i,\,t} + AMORT_{i,\,t} + OTHER_{i,\,t}$

Essentially, in the first paper (Lorek and Willinger, 2009), they follow on from Dechow et al, Barth et al and Kim and Kross, but now retesting out-of-sample cash flow prediction models based on both firm-specific time series estimation and cross-sectional estimation, again with annual Statement of Cash Flow data.

Using cross-sectional analyses and out-of-sample prediction tests (mean absolute percentage error, MABE), they report that the cash flow model (with MABE 0.617) is superior to the earnings model (MABE 0.752). Using time-series estimations, consistent with cross-section analyses, the cash flow model (MABE 0.487) again provides more accurate estimations than the earnings model (MABE 0.515). They also report higher adjusted R^2 for the cash flow model (0.80) than the earnings model (0.55).

In addition, they show that future cash flows can be estimated more accurately for larger firms than for smaller firms, and for firms with shorter rather than longer operating cycles. However, inconsistent the Kim and Cross (2005), who indicate that the association between earnings and future operating cash flows has been increasing over the studied time period, Lorek and Willinger show that the predictive ability of the cash based and earnings based models, has not been increasing over the examined period.

The second paper (Lorek and Willinger, 2010) reports mean absolute deflated forecast error (MADFE) for one-step-ahead cash flow prediction and one-thru-five-steps-ahead cash flow prediction. Panel A of Table 2.9 reveals that full disaggregation gives more accurate pooled cash flow prediction (0.115) than the earnings only model, with two (0.177) and six (0.167) lags when using cross-sectional analysis. This result is consistent with the in-sample estimation performed by Barth et al (2001).

In addition, when using time series analyses, whilst all models provides a better prediction, the aggregate earning model with two lags has the lowest prediction error (0.048).

Table 2.9
Lorek and Willinger's (2010) Mean Absolute Deflated Forecast Error of Pooled Sample

Panel A: One-Step-Ahead Cash Flow Prediction

Prediction model	In-sample estimations adjusted R^2	MADFE of Pooled sample	
		Cross-sectional	Time-series
Aggregate earnings with two lags	0.812	.177	.048
Aggregate earnings with four lags			.063
Aggregate earnings with six lags	0.815	.167	
Disaggregated earnings with six lags	0.933	.115	.058

Panel B: One-through-Five-Step-Ahead Cash Flow Prediction

Prediction model	MADFE of Pooled sample	
	Cross-sectional	Time-series
Aggregate earnings with two lags	.131	.049
Aggregate earnings with four lags		.062
Aggregate earnings with six lags	.089	
Disaggregated earnings with six lags	.087	.058

Panel B of Table 2.9 indicates that, similar to one-year-ahead prediction, cash flow prediction model based on time-series approach performs better than cross-sectional prediction, and the earnings only model with two lags has the lowest prediction error (0.049). Accordingly, Lorek and Willinger find that the predictive ability of the cash flow estimation model is enhanced when time series estimation is employed. As a result, they conclude that the firm-specific predicting procedures to be able to forecast more accurate out-of-sample predictions for future cash flow than the cross-sectional procedures.

Habib (2010) also compares time-series and cross-sectional approaches, using Australian data. The models in this case are as follows:

(1) $CFO_{i,t+1} = CFO_{i,t}$

(2) $CFO_{i,t+1} = EARN_{i,t}$

Table 2.10 shows the distributional statistics, with the standard deviation of *CFO* lower than that of *EARN*, consistent with Lev et al (2009).

Table 2.10
Habib's (2010) Distributional Statistics

Variables	Mean	SD
CFO	-0.0383	0.2370
EARN	-0.0900	0.2864

Based on the cross-sectional analysis, Table 2.11 shows that Habib's cash flow model is better than his earnings model in predicting cash flow, both in-sample and out-of-sample.

Table 2.11
Habib's (2010) Results

Panel A: In-sample Estimations

Model	Coefficient	Adjusted R^2
Cash flow model	0.82	48%
Earnings model	0.62	40%

Panel B: Out-of- Sample Tests, Cross-Sectional Estimation

	Theil's U-statistic of pooled sample		
Model	One –year-ahead	Two–years-ahead	Three –years-ahead
Cash flow model	0.0387	0.0424	0.0628
Earnings model	0.0954	0.0506	0.0689

Comparing cross-sectional and time series (unreported) approaches, Habib (2010) observes that the cross-sectional approach improves upon the time series approach for both cash flow based model and earnings based model in predicting future cash flows, a result is inconsistent with that obtained by Lorek and Willinger (2010) who find that the time series approach leads to more accurate estimation of future cash flows.

Distinguishing Core and Non-Core Cash Flow Components

Chenge and Hollie (2008) investigate the ability of cash flow components to predict future cash flows, extending Barth et al (2001). They propose that the components of cash flow are partitioned into core and non-core cash flow items. Chenge and Hollie identify cash flows from sales, cost of goods sold and operating and administrative expenses as operating cash flows or core cash flows and cash flows from interest, taxes and other as non-operating cash flows or non-core cash flows.

Using the combination of the Income Statement and the Statement of Cash Flow information and annual US data for years 1988-2004, they develop their research models as follows.

(1) Aggregate cash flow model

$$CFO_{i,t+1} = CFO_{i,t}$$

(2) Disaggregated cash flow model (core and non-core cash flow components)

$$CFO_{i,t+1} = C\_SALES_{i,t} + C\_COGS_{i,t} + C\_OE_{i,t} + C\_INT_{i,t} + C\_TAX_{i,t} + C\_OTHER_{i,t}$$

(3) Aggregate cash flows with disaggregated accruals model

$$CFO_{i,\,t+1} = CFO_{i,\,t} + \Delta AR_{i,\,t} + \Delta INV_{i,\,t} + \Delta AP_{i,\,t} + DEPR_{i,\,t} + AMORT_{i,\,t} + OTHER_{i,\,t}$$

(4) Aggregate accruals with cash flow components model

$$CFO_{i,t+1} = C\_SALES_{i,t} + C\_COGS_{i,t} + C\_OE_{i,t} + C\_INT_{i,t} + C\_TAX_{i,t} + C\_OTHER_{i,t} + TACC_{i,t}$$

Chenge and Hollie (2008) report means for *EARN*, *CFO* and *TACC* of 0.012, 0.059 and -0.047 respectively and standard deviations of 0.139, 0.124 and 0.113 respectively, whilst Barth et al (2001) have calculated means for *EARN*, *CFO* and *TACC* of 0.04, 0.08 and -0.04 respectively and a uniform standard deviation (0.08) for *EARN*, *CFO* and *TACC*.

They report that disaggregating cash flows increase adjusted R^2 from 31.7% (aggregate cash flow model) to 34.2% (cash flow components model). In addition, they also find that the adjusted R^2 is increased from 38.5% (model 3) to 39.8% (model 4) when cash flows are disaggregated. Chenge and Hollie reach the conclusion that disaggregating cash flows into core and non-core cash flow components enhances the predictive ability of the cash flow prediction models. In contrast with in-sample estimations, their out-of-sample predictions tests indicate that the aggregate cash flow model has lower prediction error than other models.

Net Distributions to Owners as an Indicator of Future Cash Flow

Extending Dechow, Richardson, and Sloan (2008) who study the persistence of the components of cash and introduce net distributions to owners as an indicator of future cash flow, Francis (2010) hypothesises that "*firms with the largest net distributions to shareholders generate the most accurate out-of-sample cash flow forecasts*".

The study employs two research models across portfolios which are partitioned based on the magnitude of net distributions to owners: the first model captures the predictive ability of current free cash flow with respect to future free cash flow and the second model tests the predictive ability of current operating cash flow in relation to future operating cash flow. Consistent with Lorek and Willinger (2010) who report that firm-specific estimation outperforms cross-sectional estimation, Francis's main analysis is firm-specific estimations, and similar to existing studies Francis uses the median absolute percentage error (MDAPE) to measure prediction errors.

The empirical result is consistent with Dechow, Richardson, and Sloan (2008), in that the accuracy of out-of-sample estimations of future cash flows increases with the amount of the net cash distributions to owners. Francis (2010) reports the sensitivity of the predictive ability of cash flow estimation models to firm size and concludes that larger firms can generate more accurate cash flow predictions than small firms.

Predicting Future Cash Flows across Accounting Regimes

Atwood et al (2011) examine the association between current accounting earnings and future earnings and future cash flows, across firms reporting under *IFRS*, the United States GAAP and firms reporting under non-US domestic accounting standards (DAS).

They develop two empirical models. The first estimation equation captures the predictive ability of current earnings with respect to future earnings and the second tests the association between current earnings with respect to future cash flows. They control the sensitivity of the estimation models to reporting regime effect, country effect and positive and negative earnings firms.

Atwood et al obtain data from Compustat Global Industrial/Commercial file. They prepare three samples based on reporting regime, firms reporting under *IFRS*, under US GAAP and non-US firms.

Atwood et al describe a positive association between current and future earnings and find that losses are less persistent than profits among three samples. They also document that current reported earnings are positively associated with future cash flows across three samples and that there is no difference in the association between current earnings and future cash flows when control to positive and negative earnings among three samples. They conclude that US GAAP is superior with respect to the estimation of future cash flows.

Table 2.12 indicates a summary of research studies on the future cash flow estimation from accounting based researches as discussed in this section.

2.7. Summary

This chapter starts by showing how the standard setter's perspective on accrual-based and cash-based accounting presumes the greater usefulness of the former in the prediction of future cash flows. This was followed by a summary of the empirical evidence from accounting-based studies on future cash flow estimation which have explored these policy implications. Given that the Statement of Cash Flows is expected to provide information to help users to measure of financial performance, there seems to be general agreement across different accounting regimes on cash flow reporting, which is now required under *IFRS* and most national accounting standards. Even so, there are differences in the formats of the Statement of Cash Flows, which reflect the direct and indirect methods of cash flow computation and their related disclosures.

This study builds on an extensive literature which has contributed to our understanding regarding the predictive ability of current and past cash flows and earnings with respect to future cash flows, and the main aim of the present thesis is to consider ways of improving research design. Most related studies examine the association between cash flow, earnings and earnings components with respect to the future cash flows (for example Barth et al, 2001). More recent studies investigate the predictive ability of cash flows, earnings and earnings components using out of sample accuracy tests, with US data (see Lev et al, 2009 and Brochet et al, 2009). In determining whether the disaggregation of earnings into cash flow, accruals and their components adds to the predictive ability of cash flow, the thesis documents both in-sample estimations and out-of-sample accuracy tests using the UK firm information. The study also considers two sources to compute total accruals using the information in the Statement of Cash Flows and the Balance Sheet changes.

With respect to which models are better predictors of future cash flows, the empirical studies published to date report conflicting results and appear to provide inconclusive evidence, with disparate results that appear to be affected by the following factors:

- differences in model specification and variable definition
- contrasting results from in-sample estimations and out-of-sample predictions
- inconclusive comparisons between cross-sectional and firm-specific regressions

In addition, it will be seen that other research design issues may also potentially influence these results, particularly

- possible limitations of using data from commercial databases
- the methods used to detect extreme values
- the length of the reporting period

Given the ongoing interest amongst accounting researchers in investigating the predictive ability of cash flow, earnings and their components, consideration of the above limitations of research to date on this issue has provided strong motivation for the study carried out for this thesis.

Chapter 3 will present the details of the design of the research including models and their evaluative measures.

Table 2.12

A Summary of Accounting-Based Studies into Future Cash Flow Estimation

Research Study	**Tested Period**	**Data**	**Dependent Variables**	**Independent Variables**	**Main Results**
Finger (1994)	1935-1987	50 US firms, Compustat	Future earnings Future cash flows	*EARN*[6] and *CFO*[7]	*CFO* is a better predictor of future cash flows than earnings for short horizons; *CFO* and *EARN* have similar ability to predict future cash flows for long-term horizons; no evidence that *EARN* outperforms *CFO* in predicting future cash flows.
Dechow et al (1998)	1963-1992	22,776 firm-years,Compustat	Future cash flows	*EARN*[8] and *CFO*[9]	Current earnings alone are better than current cash flows from operations in predicting future operating cash flows.
Barth et al (2001)	1987-1996	10,164 firm-years,Compustat	Future cash flows	*EARN*[10], *CFO*[11], *TACC*[12], ΔAR[13], ΔINV[14], ΔAP[15], *DEP*[16], *AMORT*[17] and Other Accruals[18]	Decomposing earnings into *CFO* and the components of accruals has further information with respect to future cash flows.

[6] Net income before extraordinary items
[7] Cash flows from operations
[8] Earnings before extraordinary items and discontinued operations
[9] Cash flows from operations which is calculated as operating income before depreciation minus interest minus taxes minus changes in non-cash working capital
[10] Income before extraordinary items and discontinued operations(#18)
[11] CFO is calculated as net cash flow from operating activities (#308) less the accrual portion of extraordinary items and discontinued operations reported on the statement of cash flows(#124)
[12] $TACC = EARN - CFO$
[13] Change in accounts receivable per the statement of cash flows(#302)
[14] Change in inventories per the statement of cash flows(#303)
[15] Change in accounts payable per the statement of cash flows(#304)
[16] Depreciation expense(#103)
[17] Amortization expense(#65)

Research Study	Tested Period	Data	Dependent Variables	Independent Variables	Main Results
Al-Attar and Hussain (2004)	1991-2000	7,191 firm-years,Datastream	Future cash flows	*EARN*[19], *CFO*[20], AGGACC[21], Δ*AR*[22], Δ*INV*[23], Δ*AP*[24], *DEP*[25], Other Accrual[26]	Using fixed-effects regression model supports OLS regression models. Findings consistent with Barth et al (2001).
Kim and Kross (2005)	1972-2001	100,266 firm-years,Compustat	Future cash flows	*EARN*[27], *CFO*[28], *ACC*[29], Δ*WC*[30], *DEP* [31]	The association between earnings and next year *CFO* and the prediction accuracy of aggregate earnings increased over the studied time period.
Yader (2007)	1989-2005	53,045 firm-years,Compustat	Future cash flows	*CFO*[32], Δ*AR*[33], Δ*INV*[34], Δ*AP*[35], ΔA*ccIT*[36] and Δ*Sales*[37]	A higher association between the accrual based models with future cash flows. A lower absolute mean prediction error when adding the change in sales to accrual based models.

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18 *Earn* – (*CFO* + Δ*AR* + Δ*INV* - Δ*AP* - *DEP* - *AMORT*)
19 After tax profit adjusted for items which do not relate to the normal trading activities of the company (175)
20 *CFO* (1015) is obtained net cash flow from operating activities (1009) minus net cash flow from non-operating activities(1014)
21 *AGGACC* = *EARN* - *CFO*
22 Increase in total debtors and equivalent during the year(448)
23 Change in stock, net of advances on work in progress, where applicable(445)
24 The increase or decrease in creditors during the year (417)
25 Depreciation on tangible assets (402)
26 *Earn* – (*CFO*+ Δ*AR* + Δ*INV* - Δ*AP* - *DEP*)
27 *EARN* = *CFO* +*ACC*
28 *CFO* = income before depreciation (#13) – interest expense (#15) + interest revenue (#62) – tax expense (#16)- Δ*WC*
29 *ACC*= Δ*WC* - *DEP*
30 Δ*WC*= Δ*AR* (Δ#2) + Δ*INV* (Δ#3) + Δ*OCA* (Δ#68) – Δ*AP* (Δ#70) – Δ*TP* (Δ#71) – Δ*OCL* (Δ#72) – Δ*DEFTAX* (Δ#74)
31 Depreciation and amortization (#14)
32 Cash flows from operations
33 Change in accounts receivable
34 Change in inventory
35 Change in accounts payable and accrued expenses

Research Study	**Tested Period**	**Data**	**Dependent Variables**	**Independent Variables**	**Main Results**
Chenge and Hollie (2008)	1988-2004	29,090 firm-years,Compustat	Future cash flows	*EARN*[38], *CFO*[39], *ACC*[40], ΔAR[41], ΔINV[42], ΔAP[43], *DEP*[44], *AMORT*[45], Other Accruals[46], *C_SALES*[47], *C_COGS*[48], *C_OE*[49], *C_INT*[50], *C_TAX*[51] and *C_OTHER*[52]	Disaggregating cash flows into core and non-core cash flow components enhance the predictive ability of the cash flow prediction models. Using out-of-sample predictions, the aggregate cash flow model has lower prediction error.
Lorek and Willinger (2009)	1990-2004	1,174 firms	Future cash flows	*EARN* and *CFO*	The cash flow based model is a better predictor of future cash flows than the earnings based model.

[36] Change in accrued income tax
[37] Change in sales
[38] Income before extraordinary items and discontinued operations(#18)
[39] Net cash flow from operating activities (#308)
[40] *ACC = EARN - CFO*
[41] Change in accounts receivable per the Statement of Cash Flows (#302)
[42] Change in inventories per the statement of cash flows(#303)
[43] Change in accounts payable per the statement of cash flows(#304)
[44] Depreciation expense(#103)
[45] Amortization expense(#65)
[46] $Earn - (CFO + \Delta AR + \Delta INV - \Delta AP - DEP - AMORT)$
[47] Cash flow from sales = sales (#12) - Change in accounts receivable per the Statement of Cash Flows (#302)
[48] Cash flow from cost of goods sold = Cost of goods sold (#41) – Change in inventory (#303) – Change in accounts payables (#304)
[49] Cash flow from operating and administrative expense = Sales (#12) – Cost of goods sold (#41) – Operating income before depreciation (#13) Change in working capital excluding changes in accounts receivable, inventory, tax payable and interest payable
[50] Interest payments (#315)
[51] Tax payments (#317)
[52] *C_OTHER*= *CFO* (#308) – all other cash flow components

Research Study	Tested Period	Data	Dependent Variables	Independent Variables	Main Results
Brochet et al (2009)	1987-2006	16,594, firm-quarters, CRSP and Compustat	Future cash flows Free cash flows Market value of equity	*MKTCAP*[53], *EARN*[54], *CFO*[55], *ACC*[56], Δ*AR*[57], Δ*INV*[58], Δ*AP*[59], *DEPAMORT*[60] and *OTHER*[61]	Accruals outperform current cash flows in predicting quarterly future cash flows.
Lev et al (2009)	1988-2005	41,124, firm-years,Compustat	Future cash flows, Free cash flows, Operating income, Net income	NI[62], *CFO*[63], *FCF*[64], *OI*[65], Δ*WC**[66], Δ*AR*[67], Δ*INV*[68], Δ*AP*[69], *D&A*[70], *CAPEX*[71], *DT*[72], *EST*[73], *EST**[74]	In-sample regressions results consistent with Barth et al (2001). Using out-of-sample predictions, the accounting estimates are less informative to investors.

[53] *MKTCAP* = Price × shares outstanding at the end of fiscal quarter
[54] Income before extraordinary items and discontinued operations(#8)
[55] Cash flow from operations (#308)
[56] *ACC= EARN – CFO*
[57] Change in accounts receivable from previous quarter (Data #103 if available, Δ data37 otherwise)
[58] Change in inventories from previous quarter (Data #104 if available, Δ data38 otherwise)
[59] Change in accounts payables from previous quarter (Data #105 if available, Δ data46 otherwise)
[60] Depreciation and amortization (#77)
[61] *OTHER= ACC* – (Δ*AR* + Δ*INV* – Δ*AP* – *DEPAMORT*)
[62] Income before extraordinary items (#18)
[63] *CFO* is calculated as net cash flow from operating activities (#308) less the accrual portion of extraordinary items and discontinued operations reported on the statement of cash flows(#124)
[64] *FCF= CFO – CAPEX*
[65] Operating income after depreciation (#178)
[66] Δ*WC**= Δ*WC* – Δ*INV* per the statement of cash flows
[67] Change in accounts receivable per the statement of cash flows (#302)
[68] Change in inventories per the statement of cash flows (#303)
[69] Change in accounts payable and accrued liabilities per the statement of cash flows (#304)
[70] Depreciation and amortizations per the statement of cash flows (#125)
[71] Capital expenditures per the statement of cash flows (#128)

Research Study	**Tested Period**	**Data**	**Dependent Variables**	**Independent Variables**	**Main Results**
Orpurt and Zang (2009)	1989-2002	39,255, firm-years, CRSP and Compustat	Future operating cash flows Future earnings	*EARN*[75], *CFO*[76], *ACC*[77], *Dis_Int*[78], *Dis_Other*[79], *Dis_Tax*[80], *Est_other*[81], *Est_Sales*[82], *Est_Supem*[83], *Sales_Err*[84], *Supem_Err*[85]	The direct method of cash flow statements enhances the prediction of future cash flows and earnings
Lorek and Willinger (2010)	1988–2005	19,998, firm-years, Compustat	Future cash flows	*EARN*[86], *CFO*[87], ΔAR[88], ΔINV[89], ΔAP[90], *DEP*[91], *AMORT*[92], Other Accruals[93]	The predictive ability of the cash flow model is enhanced when time series estimation is employed. The firm-specific predicting methods forecast more accurate out-of-sample predictions than the cross-sectional procedures.

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72 Deferred taxes per the statement of cash flows (#126)
73 Estimates = $CFO - NI - \Delta WC^*$
74 Net estimates = $CFO - NI - \Delta WC^* - \Delta INV - D\&A - DT$
75 Income before extraordinary items and discontinued operations
76 Net cash flow from operations
77 $ACC = EARN - CFO$
78 Disclosed cash interest payments
79 *Dis_Other* = *CFO* – *Dis_Sales* – *Dis_Supem* – *Dis_Int* – *Dis_Tax*
80 Disclosed cash tax payment
81 *Est_Other* = *Est_Sales* – *Est_Supem* – *Dis_Int* – *Dis_Tax*
82 The articulated estimate of cash received from customers
83 The articulated estimate of cash paid to suppliers and employees
84 The articulated errors for cash received from customers
85 The articulated errors for cash paid to suppliers and employees
86 Income before extraordinary items and discontinued operations (#18)
87 *CFO* = net cash flow from operating activities (#308) - the accrual portion of extraordinary items and discontinued operations reported on the statement of cash flows(#124)
88 Change in accounts receivable (#2)
89 Change in inventories (#3)
90 Change in accounts payable (#70)
91 Depreciation expense(#14)

Research Study	Tested Period	Data	Dependent Variables	Independent Variables	Main Results
Francis (2010)	1989- 2008	17,568, firm-years, Compustat	Future cash flows Free cash flow	*CFO*[94], *FCF*[95]	The accuracy of out-of-sample estimations of future cash flows increases with the amount of the net cash distributions to owners.
Arthur et al (2010)	1992-2005	3,672, firm-years, Australian data	Future earnings	Earnings[96], *CFO*[97], *Accruals*[98], *CORE_RECEIPTS*[99], *CORE_PAYMENTS*[100], *TAX*[101], *INTPAID*[102], *INTREC*[103], *DIV*[104], *OTHER_RECEIPTS*, *OTHER_PAYMENTS* , ΔAR, ΔINV, ΔAP, *DEP*, *AMORT*, *OTHERACC*	The predictive ability of the cash flow components model is higher than that of an aggregate cash flow model. The disclosure of the components of cash flows from operations is informative to prediction of future earnings.

92 Amortization expense(#65)

93 $Earn - (CFO + \Delta AR + \Delta INV - \Delta AP - DEP - AMORT)$

94 Compustat data items 308-124+311

95 Compustat data items 308-124

96 After tax operating income before extraordinary items

97 Net cash flows from operations

98 $Accruals = EARN - CFO$

99 Cash collected from customers

100 Cash paid to suppliers

101 Income tax paid

102 Interest paid

103 Interest received

104 Dividend Received

Research Study	Tested Period	Data	Dependent Variables	Independent Variables	Main Results
Atwood et al (2011)	2002-2008	58,832 firm-years observations from 33 countries	Future cash flows Future earnings	*EARN*[105], *CFO*[106]	The US GAAP is superior with respect to the estimation of future cash flows.
Habib (2010)	1992-2007	12,263, firm-years	Future cash flows	*EARN*[107], *CFO*[108]	The cash flow based model is a better predictor of future cash flows than is the earnings based model. The cross-sectional approach improves upon the time series approach in predicting future cash flows.

[105] Net income before extraordinary items (#32)
[106] Cash flows from operations
[107] Net profit after tax , but before abnormal items
[108] Cash flows from operations

Chapter 3

Research Design

3.1. Introduction

Chapter 2 reviewed the background to the present study, which aims to investigate research design in assessing whether the disaggregation of cash flow, accruals and earnings into their components may increase the predictability of cash flow.

The models described in this thesis forecast future cash flows for one, two and three years ahead, using a predictor that includes current reported values and past values for up to five years. Prior research has similarly employed several lags in predictor variables; for example, Barth et al (2001) use up to six years of past data. Although most of the earlier prior studies on this topic predicted future cash flow just one-year-ahead, recent research has produced longer-term forecasts; for example, Lev et al (2009) predict future annual cash flow in year t+1 and in year t+2.[109] It should be noted in this context that the empirical accounting data relating to the Statement of Cash Flow have been available only since 1991 in the UK. Nevertheless, this allows for sufficient periods that span up to the maximum of nine years which is required for five lags of the predictor variables and a three-years-ahead forecast.

The present chapter discusses the research design of these forecasting models, and starts in Section 3.2 by outlining the four-model hierarchy used in the research study. Section 3.3 then proceeds to discuss in-sample estimation and out-of-sample accuracy tests, whilst Section 3.4 summarises the diagnostic tests that are employed to

[109] Note that Lev et al (2009) also forecast cash flow for periods greater than one year, i.e. through t+2 (two years' cash flow) and through t+3 (three years' cash flow). In addition, using quarterly data, Brochet et al (2009) predict future cash flows not only in quarter t+1 but also in aggregate through t+2 (i.e a forecast of the next six months' cash flow), through t+4 (one year's cash flow) and through t+8 (two years' cash flow).

detect and evaluate heteroscedasticity, multicollinearity and autocorrelation in the data. Section 3.5 provides a final summary of this chapter

3.2. Research Models

As mentioned earlier the standard setters emphasise that a key aim of financial reporting is to provide helpful information in predicting future cash flows. The general assumption in this thesis is that investors need information about future cash flow because the current value of their investment is estimated as the present value of the future cash flows that will be created by the firm. The power of a firm to generate cash flow is reflected in the market value of its equity, so the prediction of future cash flow helps to predict future stock returns. For this reason the prediction of cash flow is an important subject in accounting research.

This study investigates the application of operating accounting information to predict future cash flow, because the ability of firms to generate cash flow from operating activities is more important than obtaining cash flow directly from investors and creditors, and operating activities are more regular and continuous than investing and financing activities. Therefore, unlike many studies, this study focuses on the operating accounting information available in published financial statements instead of investing and financing accounting information, such as earning before interest and tax (EBIT) and cash flow generated from operations, operating assets and liabilities.

As discussed earlier although accrual accounting mitigates the timing and matching problems in cash accounting through the creation of accruals and deferrals and the standard setters emphasise on the usefulness of accrual-based financial statement information in cash flow prediction, it should be noted that accounting manipulation, or even unintentional errors in accounting estimates, may lead to a decrease in the usefulness of accrual accounting in predicting future cash flows (Brochet et al, 2009). In contrast, the general expectation is that cash flow accounting is more verifiable and therefore is less vulnerable to manipulation than accrual accounting.

Building on these arguments, this thesis addresses the predictive ability of current and past cash flows and earnings in predicting future cash flows, whether the disaggregation of earnings into cash flow and accruals, and their components, adds to the predictive ability of current cash flow and concentrates on methodological improvements that should be consider in cash flow forecasting.

The study reported in this thesis is based on a model hierarchy that focuses first on aggregated predictors and then on their disaggregated components. Accordingly, the following research models and objectives are employed:

(i) the cash flow model, predicting future cash flow from current and past cash flow;

(ii) the earnings model, predicting future cash flow from current and past earnings;

(iii) the disaggregated earnings model, predicting future cash flow from current and past cash flow and accruals; and

(iv) the full disaggregation model, predicting future cash flow from current and past cash flow and the components of accruals.

These models are described in greater detail below.

3.2.1. The Cash Flow Model

The first estimation equation captures the predictive ability of current and past cash flows with respect to future cash flows one, two and three-years-ahead, as follows:

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \varepsilon_{i,t} \qquad (3.1)$$

where:

i and *t* denote the firm and year,

j ranges from 1 to 3 (denoting a forecast for the following year or for two years or three years ahead), and

the lagged operator *k* ranges from *K*=0 up to *K*=5.

When *K*=0, the model includes only the current cash flow as a predictor, and the expanded model allows for the addition of up to five prior year cash flows in the estimation as lagged variables. It may be noted that, where one is a plausible value of β1, and *K*=0, cash flow follows a random walk, as the change in cash flow CFO_{t+1} – CFO_t is governed only by white noise $\varepsilon_{i,t}$ with periodic drift if and when β0 is nonzero.

Essentially, this model is equivalent to the base estimator in Kim and Kross (2005), Yader (2007), Chenge and Hollie (2008), Brochet et al (2009) and Lev et al (2009).

It may be noted that although some authors, such as Brochet et al (2009), allow for seasonality in firm-level time series, the study presented here focuses solely on annualised data, and treats (1) as the naïve model against which further estimations are compared.

3.2.2. The Earnings Model

The second estimation may be characterised as 'the earnings model', which simply permits a test of the predictive ability of current and past earnings with respect to future cash flows in one, two and three-years-ahead, i.e.

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} EBIT_{i,t-k} + \varepsilon_{i,t} \tag{3.2}$$

By comparison with (3.1), earnings calculated under accrual and deferral accounting are expected to be more forward-looking than cash flow, and likely therefore to reduce prediction error. Prior research suggests that lags in earnings would also add to the prediction, capturing longer term policies; therefore, the effects of current and up to five past earnings releases are examined here, with the aim of this study being to focus on earnings disaggregation, as elaborated below. It is worth noting that (3.2) is equivalent to the base estimator in Barth et al (2001), Al-Attar and Hussain (2004) and Lorek and Willinger (2010).

3.2.3. The Disaggregated Earnings Model

Clearly, model 3.1 and model 3.2 only test for the differential predictive ability of cash flow and earnings. However, by allowing for the accounting relationship between these two variables, which is captured in the accounting identity *EBIT* = *CFO* + *TACC*, the present study tests whether this first level decomposition adds to the predictive ability of cash flow and reduces prediction errors, given the separation of the forward-looking accrual component of current earnings.

Accordingly, the third model is fitted here disaggregates earnings into two main components, cash flow from operations *CFO* and total accruals *TACC*, as follows:

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 2_{t-k} TACC_{i,t-k} + \varepsilon_{i,t} \quad (3.3)$$

The expectation with this model is that earnings is not an unbiased predictor, and that accruals, even in aggregate, will add to the predictive ability of current cash flow with respect to both short-term and the long-term cash flows. Nevertheless, whilst the net total accrual may inform us about the direction of cash flow changes, it is evident that short-term and long-term accruals and deferrals are combined in *TACC*, and these differing components of the net accrual may be expected to have differing consequences for future cash flow. Therefore, in the final model, total accruals will be disaggregated in order to attempt to separate out these differing effects.

3.2.4. The Full Disaggregation Model

An early study by Barth et al (2001) decomposes accruals into six main components, including the changes in accounts receivable, inventories and accounts payable, together with depreciation, amortisation and other accruals. They confirm that future cash flow is indeed a function of current cash flow and the components of accruals. That is, the accrual components are significant in predicting future cash flows incremental to current cash flow, whereas aggregate accruals mask the relevant information. In this thesis, this kind of model is referred to as the full disaggregation model, and is employed to investigate whether the disaggregation of accruals adds to the ability of current cash flows and earnings to predict future cash flows.

As the current research relies upon two sources of information to compute total accruals (the Statement of Cash Flows and the Balance Sheet changes), the full disaggregation model takes into account two sets of predictor variables, as described below:

Using the Information from Statement of Cash Flows

In the following design, the total accrual is disaggregated into its five accounting components:

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 2(1)_{t-k} \Delta AR_{i,t-k} + \sum_{k}^{K} \beta 2(2)_{t-k} \Delta INV_{i,t-k} + \sum_{k}^{K} \beta 2(3)_{t-k} \Delta AP_{i,t-k} + \sum_{k}^{K} \beta 2(4)_{t-k} DEPAM_{i,t-k} + \sum_{k}^{K} \beta 2(5)_{t-k} Other_{i,t-k} + \varepsilon_{i,t} \quad (3.4a)$$

where:

ΔAR	=	change in accounts receivable
ΔINV	=	change in inventories
ΔAP	=	change in accounts payable
$DEPAM$	=	depreciation of tangible assets and amortisation of intangible assets
$Other$	=	$EARN - (CFO + \Delta AR + \Delta INV - \Delta AP - DEPAM)$

In empirical accounting research, 'accrual' is used as an abbreviation for the terms of accrual and deferral, whilst they have opposite accounting features. An accrual occurs before cash is received or paid out. A deferral occurs after cash is received or paid out. There are also accruals and deferrals for incomes and expenses. Accrued income and accrued expenses are recognized in the Income Statement before the related cash is received or paid out, and the cash flow will occur in a future period or periods. In contrast, deferred incomes and deferred expenses are recorded as an asset or liability after the cash is received or paid out; hence, the cash flow occurs in the current period but the income effects are deferred to the future. For instance, an example of accrued income is the Balance Sheet line item 'accounts receivable', deferred expense 'prepayments', accrued expense 'accounts payable', and deferred income 'cash received in advance from customers'.

The expectation in (3.4a) is that the signs of the coefficients for the variables under investigation will be consistent with predictions that are informed by the nature of the specified financial statement line items, including asset deferrals which will lead to future cash inflows (+), liability accruals which will lead to future cash outflows (-), and depreciation and amortisation which match prior investment to future benefits (+). In other words, the expected sign is positive on ΔAR, ΔINV and *DEPAM,* and negative on ΔAP.

Using the Balance Sheet Changes Method of Accrual Computation

In the following model, the total accrual is disaggregated into eleven accounting components, which are as follows:

$$
\begin{aligned}
CFO_{i,t+j} = {} & \\
& \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 2(1)_{t-k} \Delta TAR_{i,t-k} + \sum_{k}^{K} \beta 2(2)_{t-k} \Delta INV_{i,t-k} + \\
& \sum_{k}^{K} \beta 2(3)_{t-k} \Delta PREP_{i,t-k} + \sum_{k}^{K} \beta 2(4)_{t-k} \Delta OCA_{i,t-k} + \sum_{k}^{K} \beta 2(5)_{t-k} \Delta LTR_{i,t-k} + \\
& \sum_{k}^{K} \beta 2(6)_{t-k} \Delta TAP_{i,t-k} + \sum_{k}^{K} \beta 2(7)_{t-k} \Delta OCL_{i,t-k} + \sum_{k}^{K} \beta 2(10)_{t-k} \Delta LTOL_{i,t-k} + \\
& \sum_{k}^{K} \beta 2(11)_{t-k} DEPAM_{i,t-k} + \varepsilon_{i,t}
\end{aligned}
\qquad (3.4b)
$$

where:

ΔTAR	=	change in trade accounts receivable
ΔINV	=	change in inventories
$\Delta PREP$	=	change in prepayments
ΔOCA	=	change in other current assets
ΔLTR	=	change in long-term receivables
ΔTAP	=	change in trade accounts payable
ΔOCL	=	change in other current liabilities
$\Delta LTOL$	=	change in long-term operating liabilities
$DEPAM$	=	depreciation of tangible assets and amortisation of intangible assets

The rationale underlying the expectation regarding the signs of the coefficients for the variables in (3.4b) is consistent with (3.4a), with an expected positive sign on current asset and long term receivable increases ΔTAR, ΔINV, $\Delta PREP$, ΔOCA and ΔLTR as well as on *DEPAM*, and an expected negative sign on current and long-term operating liability increases ΔTAP, ΔOCL, and $\Delta LTOL$.

Table 3.1

A Summary of Research Models Using Information from the Statement of Cash Flows

Research models	**Equations**
The Cash Flow Model	$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \varepsilon_{i,t}$
The Earnings Model	$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} EBIT_{i,t-k} + \varepsilon_{i,t}$
The Disaggregated Earnings Model	$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 1_{t-k} TACC_{i,t-k} + \varepsilon_{i,t}$
The Full Disaggregation Model	$CFO_{i,t+j} =$ $\beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 2(1)_{t-k} \Delta AR_{i,t-k} + \sum_{k}^{K} \beta 2(2)_{t-k} \Delta INV_{i,t-k} +$ $\sum_{k}^{K} \beta 2(3)_{t-k} \Delta AP_{i,t-k} + \sum_{k}^{K} \beta 2(4)_{t-k} DEPAM_{i,t-k} + \sum_{k}^{K} \beta 2(5)_{t-k} Other_{i,t-k} + \varepsilon_{i,t}$

Table 3.2

A Summary of Research Models Using the Balance Sheet Changes Method of Accrual Computation

Research models	Equations
The Cash Flow Model	$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \varepsilon_{i,t}$
The Earnings Model	$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} EBIT_{i,t-k} + \varepsilon_{i,t}$
The Disaggregated Earnings Model	$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 1_{t-k} TACC_{i,t-k} + \varepsilon_{i,t}$
The Full Disaggregation Model	$CFO_{i,t+j} =$ $\beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 2(1)_{t-k} \Delta TAR_{i,t-k} + \sum_{k}^{K} \beta 2(2)_{t-k} \Delta INV_{i,t-k} + \sum_{k}^{K} \beta 2(3)_{t-k} \Delta PREP_{i,t-k} +$ $\sum_{k}^{K} \beta 2(4)_{t-k} \Delta OCA_{i,t-k} + \sum_{k}^{K} \beta 2(5)_{t-k} \Delta LTR_{i,t-k} + \sum_{k}^{K} \beta 2(6)_{t-k} \Delta TAP_{i,t-k} + \sum_{k}^{K} \beta 2(7)_{t-k} \Delta OCL_{i,t-k} +$ $\sum_{k}^{K} \beta 2(10)_{t-k} \Delta LTOL_{i,t-k} + \sum_{k}^{K} \beta 2(11)_{t-k} DEPAM_{i,t-k} + \varepsilon_{i,t}$

3.3. In-Sample and Out-of-Sample Estimation

Gujarati (2004) distinguishes between in-sample estimations and out-of-sample predictions as follows:

> *In-sample forecasting essentially tells us how the chosen model fits the data in a given sample. Out-of-sample forecasting is concerned with determining how a fitted model forecasts future values of the regressand, given the values of the regressors.*

The study for this thesis adopts a research design that is based on initial in-sample estimation, followed by out-of-sample validation. A number of recent papers have included out-of-sample results, although none have used UK data in predicting future cash flows. Kim and Kross (2005), Yoder (2007) and Lev et al (2009) use cross-sectional regression in this context, and Finger (1994) and Brochet et al (2009) use firm-specific regression estimation, whilst Habib (2010) and Lorek and Willinger (2009 and 2010) report on out-of-sample predictions comparing both cross-sectional and firm-specific time series estimation.

3.3.1. In-Sample Goodness-of-Fit

As Wooldridge (2004) notes, forecasting models require a measure of goodness-of-fit within the sample used to obtain the parameter estimates. This is usually the adjusted R^2, which is reported widely in the existing research literature, and here an F-test and Voung's likelihood ratio test are also used. The computation of these statistics is explained in greater detail below.

Adjusted R^2

In order to determine the goodness of fit of regression models, the present research study reports adjusted R^2 as an in-sample measure of the degree of association between future operating cash flow and the current cash flow, the current earnings or the disaggregation of earnings into cash flow, accruals and their components. The adjusted R^2 is computed as follows:

$$\overleftarrow{R}= 1- \frac{RSS/(n-k)}{TSS(n-1)} \qquad (3.5)$$

where:

RSS = Residual sum of squares

TSS = Total sum of squares

n = Number of observations

k = Number of independent variables plus intercept

It is worth noting that, in least squares regression, R^2 increases weakly with the number of regressors used in the model. Thus, R^2 cannot be used alone as a meaningful comparison of models with different numbers of independent variables; an F-test should be carried out on the residual sum of squares, as discussed below.

F- Statistic

As noted, whilst the model with the highest adjusted R^2 amongst other models should be selected as the best model, adding a variable to a model may increase adjusted R^2 without reducing the residual sum of squares (Gujarati, 2004). The following F-test is therefore recommended when adding a variable to a regression model:

$$F= \frac{(R^2_{new}-R^2_{old})/m}{1-R^2_{new}/(n-k)} \qquad (3.6)$$

where:

m = the number of new regressors
n = the number of observations
k = the number of parameters in the new model, Gujarati (2004, p.263)

A significant F-statistic indicates that the added variable increases explanatory power, and is used to compare nested models. A different approach is required to test non-nested models, as discussed in the next section.

Voung's (1989) Likelihood Ratio test

According to Gujarati (2004), there are two main approaches to testing non-nested models, broadly characterised as the 'discriminating' approach and the 'discerning' approach, which are defined as follows:

> (1) *the discrimination approach, where given two or more competing models, one chooses a model based on some criteria of goodness of fit* [such as the adjusted R^2], *and* (2) *the discerning approach where, in investigating one model, we take into account information provided by other models*.

In fact, there are several of the latter tests of model selection in the econometrics literature, such as the Davidson-MacKinnon J-test, Cox's test, and the Mizon-Richard test (see Gujarati, 2004: p. 536). It should be noted that, to select the best model in this case, each of these tests will consider the attributes of opponent models. Accounting research into cash flow prediction has used Voung's Likelihood Ratio test for model selection (e.g. Dechow 1994 and Barth et al 2001). Davidson-MacKinnon's J-test is sometimes suggested to overcome problems in the non-nested F testing method, (see Gujarati, 2004, P.533); however, Dechow (1994) has noted that when the explanatory power of variables is incremental, the J-test may not be powerful and cannot make a distinction between the competing models. Hence, Voung's test is a more powerful test than the J-test.

In investigating the role of accounting accruals in the measurement of firm performance, and in order to compare competing models, Dechow (1994) explained Voung's Likelihood Ratio test of non-nested model selection as follows:

> [Voung's (1989)] *has provided a likelihood ratio test for model selection to test the null hypothesis that the two models are equally close to explaining the 'true data generating process' against the alternative that one model is closer to the 'true data generating process'. Therefore, the Voung test allows rejection of cash flows in favour of earnings in situations where ambiguous results would otherwise be obtained.*

With the Voung test, a model is superior to another model when the log likelihood is higher than the log likelihood for the model(s) considered. Following Dechow (1994), the Likelihood Ratio test is computed as follows:

- First, the differences in log-likelihoods between the two models is calculated as:

$$LR = \log [L (M_a)] - \log [L (M_b)] \qquad (3.7)$$

- In a second step, the variance of LR, ω^2 is estimated by the following equation:

$$\omega^2 = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{1}{2}\log(\sigma_b^2) - \frac{1}{2}\log(\sigma_a^2) + \frac{1}{2}\frac{(e_{bi})^2}{e_b^2} - \frac{1}{2}\frac{(e_{ai})^2}{e_a^2}\right) - \left(\frac{1}{n}\text{LR}\right)^2 \qquad (3.8)$$

where:

e = estimated residuals under either model

σ^2 = the estimated residual variance

- Finally, based on the following equation, Voung's Z-statistic is calculated as:

$$Z = \frac{1}{\sqrt{n}} \frac{LR}{\omega_n} \tag{3.9}$$

This Z-statistic can be interpreted such that, if it is significantly positive, model *b* has higher explanatory power with respect to model *a*. If the Z-statistic is significantly negative, it indicates that model *a* should be selected, and a non-significant Z-statistic implies that there is no difference in explanatory power between the two models. Accordingly, this thesis employs Voung's (1989) Likelihood Ratio test to identify the explanatory power of the four cash flow prediction models that have been introduced above.

3.3.2. Out-of-Sample Prediction

As mentioned earlier, several recent studies mention that in-sample estimation should not be treated as a prediction test, and that prediction models should be tested using out-of-sample accuracy tests. These studies include Finger (1994), Kim and Kross (2005), Yader (2007), Brochet et al (2009), Lev et al (2009) and Habib (2010), each of which examines predictive ability with respect to future cash flows using out-of-sample accuracy tests.

In-sample estimation, which is measured by adjusted R^2, tells us how the selected model explains variations in the dependent variable given the regressor variables in the model, and using the data in a given sample. Out-of-sample predictions test the accuracy of models using estimated parameters provided by the in-sample estimation using data in a holdout sample. To put it another way, Wooldridge (2004) refers to:

> "…*forecasting models that are based on a part of the sample that was not used in obtaining parameter estimates*." (Wooldridge, 2004, p.799)

Along the same lines, in an accounting application, Brochet et al (2009) argue that:

> "*In-sample predictions assume that parameters are stable through time and use data not available at the time of the predictions to estimate them.*"

Many summary statistics are to be found in out-of-sample testing, and prediction studies in accounting research include a wide range of such statistics. In general, these forecasting accuracy measures include the mean error (MER), the mean squared error (MSE), the mean absolute error (MAER), the mean percentage error (MPE), the mean absolute percentage error (MAPE), the median error (MDER), the median absolute error (MDAER), the median percentage error (MDAPE) and the median absolute percentage error (MDAPE), as well as the use of *deflated* forecast errors such as the mean absolute deflated forecast errors (MADFE). Each of these measures is intended to assess the estimating model in terms of both its variation and unbiasedness, and taking the square root of will transform the measure into one that has the same units as the quantities estimated, with the most prominent being the root mean squared error (RMSE), also known as the standard error. In addition, the mean adjusted R^2 and the Wilcoxon Z-statistic are also set out in statistics texts as standard tests in this context (as in Gujarati, 2004). Table 3.3 indicates which of these measures are in used accounting studies that predict future cash flows.

Table 3.3
A Summary of Forecast Error Methods Used in Cash Flow Prediction Studies

Forecast Error Statistics	**Studies**
Mean adjusted R^2 from regressions of actual values on the predicted values	Lev et al (2009)
Mean error (MER)	Lev et al (2009)
Mean absolute error (MAER)	Lev et al (2009), Yoder (2007), Brochet et al (2009)
Mean absolute percentage error (MAPE)	Finger (1994), Lorek and Willinger (2010)
Median absolute error (MDAER)	Brochet et al (2009), Yoder (2007)
Mean squared error (MSE)	Finger (1994)
Mean absolute deflated forecast error (MADFE)	Lorek and Willinger (2010)
Median absolute deflated forecast error (MDADFE)	Francis (2010)
Theil's U-statistic	Kim and Cross (2005), Lev et al (2009),
Wilcoxon's Z-statistic	Francis (2010)

Following Lev et al (2009) and Brochet et al (2009), the current study calculates the mean adjusted R^2 from regressions of actual values on predicted values, the mean and median error, the mean and median absolute error and Theil's U-statistic.

The following example illustrates the basic steps taken to calculate the predicted values of future cash flows and the prediction error (the difference between the actual *CFO* and the estimated *CFO* for each firm-year), using the 'Cash Flow Only' model and a prediction for 1993 to exemplify this.

1. To obtain estimated coefficients, a cross-sectional regression model is estimated for each industry-year with the following equation:

   $$CFO\ (1992) = \beta 0 + \beta 1 CFO\ (1991) + \varepsilon$$

2. Using the estimated coefficients β0 and β1 obtained in step1, the estimated *CFO* for 1993 is calculated for each firm-year on the basis of the following equation:

   $$\text{Estimated } CFO\ (1993) = \beta 0 + \beta 1 CFO\ (1992)$$

3. The prediction error for each firm is computed as:

   $$\text{Prediction Error (1993)} = \text{Actual } CFO\ (1993) - \text{Estimated } CFO\ (1993)$$

The summary statistics used in this thesis based on this approach are described below.

The mean adjusted R^2

The mean adjusted R^2 reported in this thesis is the average of the yearly adjusted R^2s from yearly regressions of actual values of future cash flows with respect to predicted values of future cash flows (i.e. Actual $CFO_{t+1} = \alpha + \beta$ Estimated CFO_{t+1} + residual).

The mean and median prediction errors and absolute prediction errors

As discussed previously, first the predicted values of future cash flows are calculated, then the prediction error for each firm-year is calculated as Actual value of CFO_{t+1} *less* Estimated value of CFO_{t+1}. The mean and median of annual prediction errors are then calculated using the estimated value of *CFO* for each firm-year. Finally, when comparing models, the model with the lower mean and median of annual prediction error is identified as the best fitting prediction model. By ignoring the sign in the error, the mean and median *absolute* prediction errors are used to measure how close forecasts or predictions are to the eventual outcomes.

Theil's U-statistic

Following Kim and Cross (2005) and Lev et al (2009), Theil's U-statistic, the mean of annual U-statistics, is calculated as follows:

$$\text{U-statistic} = \sqrt{\frac{\sum (Actual - Forecast)^2}{\sum (Actual)^2}} \qquad (3.10)$$

The value of the U-statistic lies between zero and 1, where zero is the perfect fit. Therefore, the model with the lowest U-statistic is the best prediction model.

3.4. Diagnostic Tests

Consistent with accounting empirical studies, this thesis uses annual pooled data, which is a combination of both time-series and cross-section, and applies ordinary least squares (OLS) regression. The usual assumptions underlying OLS regression apply also to the analysis using accounting data, including linearity of the model, normality of the prediction error, homogeneity of variance across individual observations and groups of observations (homoscedasticity), no correlation between predictor variables (no multicollinearity) and that there are no errors in variables. The research described in this thesis has to consider these conditions and ensure that the data have met the assumptions of the regression analysis. Accordingly, the current study employs the following diagnostic tests.

3.4.1. Heteroscedasticity Tests

As data may be subject to time series error terms or cross-section error terms (or both), homogeneity of variance is an important assumption of OLS regression that must be tested. When the variance of the residuals is not equal across observations, this heteroscedasticity problem should be rectified. To mitigate this problem, it is usual to deflate variables by a size factor such as the number of outstanding shares, the market value of equity or total assets, either at the end of the fiscal year or on average during the year.

White's (1980) standard error test and the Breusch-Pagan test may be used to detect heteroscedasticity. In a recent investigation of the methods used in accounting studies to calculate standard errors, Gow et al (2010) suggest that allowing for standard errors clustered by firm and time is likely to be robust to both time-series and cross-section dependence.

To test heteroscedasticity, the current study, following Barth et al (2001), Lev et al (2009) and Brochet et al (2009), scales all variables by the average value of total assets across firms in the dataset.

3.4.2. Multicollinearity Test

Multicollinearity is high correlation among two or more independent variables. This issue leads to unstable coefficients and inflated standard errors for the coefficients. Several methods to detect multicollinearity are well documented in the econometrics literature, although there is no failsafe method that works effectively in any conditions.

To detect multicollinearity, the variance inflation factor (VIF) should be calculated after running a regression. A high VIF indicates a high level of multicollinearity, with a VIF more than the cut-off point of 10 indicating a need for further investigation. The other rule suggested in the econometrics literature is to estimate pair-wise correlation between independent variables employed in each research model, relying on a correlation coefficient between independent variables that is more than 0.80 as an indicator that there is a serious problem (Gujarati, 2004, p.359).

With regard to multicollinearity, as Gujarati (2004) notes if the aim of the regression analysis is prediction, multicollinearity is often not treated as a serious issue, and the highest R^2 is interpreted as indicating the best estimation *per se*. Nevertheless, in addition to estimating pair-wise correlation between independent variables, to tackle the issue of multicollinearity, the current study also takes into consideration the variance inflation factor (VIF).

3.4.3. Autocorrelation Test

Autocorrelation is an issue in time-series data, when the error terms are not independent. The Durbin-Watson test is performed to detect serial correlation defined as the D-W statistic falling between 0 and 4. When equal to 2, the D-W statistic indicates that there is no first-order autocorrelation; if less than 2, there is positive serial correlation; if more than 2, there is negative serial correlation. The Arellano-Bond test (1981) for autocorrelation is used with panel data with cross-section and time-series structure, as employed in this thesis, and is also reported here in the context of OLS.[110] This study uses the Arellano–Bond test to detect autocorrelation.

3.5. Summary

In this chapter, prediction horizons and the number of lags of predictor variables are specified. Then, the chapter describes the development of four research models: a cash flow model; an aggregate earnings model; a disaggregated earnings model (cash flow with aggregate accruals) and a full disaggregation model (cash flow with accruals components) which are tested in Chapter 5.

In addition, the chapter outlines the criteria for comparison of research models including in-sample estimations and out-of-sample predictions.

Furthermore, the chapter describes diagnostic tests that are performed in Chapter 5 to test the equality of the variance of the residuals, identify correlation between independent variables and detect serial correlation.

Chapter 4 will focus on the data and the sample; beginning with describing the key features of the data and variable definitions and provides a discussion of sampling

[110] Roodman, D. 2006. How to do xtabond2: An introduction to "Difference" and "System" GMM in Stata. Working Paper 103. Center for Global Development, Washington

issues in accounting research, then presenting the sampling process. Chapter 5 will present the preliminary empirical results of the research: descriptive statistics and model estimation, including in-sample estimations and out-of-sample accuracy tests.

Chapter 4

Data and Sample

4.1. Introduction

This chapter is structured as follows. Section 4.2 outlines the key features of the data used in this study. Section 4.3 presents the definition of variables and describes the two approaches to cash flow analysis used in the thesis, using either Cash Flow Statement information to calculate accruals, or alternatively the Balance Sheet changes method. Section 4.4 provides a more detailed discussion with relation to (a) the validation of data including firm coverage differentiation, (b) the nature of values that are unrecorded, missing or zero, (c) the effect of influential observations on the estimations, and (d) the impact of changes in fiscal year length, plus a comparison between the information in commercial databases and the source information in published financial statements. Section 4.5 specifies the sampling process and the sample specifications. Section 4.6 concludes with a summary.

4.2. The Dataset

The source data for this study has been obtained from the most common UK provider, Thomson One Banker[111], using its *Extel Financial* platform (EX) and the *Worldscope* platform (WS) where it is feasible to enhance the useable data by substituting WS data for items missing in Extel. The Extel Financial database provides 'as reported' data whereas Worldscope asserts that it offers 'standardised data'; the difference between the two is related to both disclosure and presentation, with Worldscope claiming to enhance

[111] Thomson One Banker (T1B) is an Internet-based analytics tool.T1B offers several datasets, including accounting and market data, principally Thomson Financial (TF), Worldscope (WS), DataStream (DS), and Extel Financial (EX).

the international comparability of its accounting data across countries and industries (Alves et al, 2007).

Extel provides more detailed financial statement data and covers more firm years in the examined period than Worldscope. For these two reasons, which will be explained in detail in the following sections, Extel is used as the main source of data raw financial statement variables, and Worldscope is the supplementary source that is used to improve the sample. More precisely, Extel is used initially to download the research variables, and Wordscope is then employed to complete missing data, along with recourse to individual company annual reports where this is required to resolve ambiguities. The initial sample available through *Extel* includes reported accounting data for 1,183 listed firms in the UK, including new listings and delistings during the examined period. Consistent with prior studies, this sample already excludes firm-year observations with ICB Industry code 8000 (financials) because their activities are different from other firms and their financial statements are structured differently as well.[112]

For the present study, the period examined covers 18 years from 1991 to 2008. Earlier data are not examined because the Statement of Cash Flows data was mandated by the ASB[113] in September 1991. In order to calculate at least one year forward and one lag, the final sample includes firm-year data for the 16 years from 1992 to 2007.

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[112] ICB code is the merger of the industrial classification of the Financial Times Stock Exchange (FTSE) and Dow Jones, has been formed from four hierarchical levels (industry, super sector, sector and subsector levels). In the first level, industry ICB, companies are divided in to 9 categories, including 0001 oil and gas, 1000 Basic Materials, 2000 Industrials, 3000 Consumer Goods, 4000 Healthcare, 5000 Consumer Services, 6000 Telecommunications, 7000 Utilities, 8000 Financials and 9000 Technology.

[113] The effective date of FRS 1 *Cash Flow* Statements was September 1991

4.3. Definition of Variables

With regard to the accounting variables that are collected for the study, the position of Collins and Hribar (2002) is adopted, following their recommendation to use Statement of Cash Flows information to calculate accruals rather than relying solely on Balance Sheet changes. For this reason, and in order to make comparisons with previous studies in this area, e.g. Barth et al (2001), Lev et al (2009) and Brochet et al (2009), the present thesis first reviews the way in which the information in the Statement of Cash Flows may be used to compute total accruals, and how this leads to the variable definitions employed in this study.

In addition to using the Statement of Cash Flows method to compute total accruals, a full reconciliation with the Balance Sheet changes method may be drawn up; thus the research approach takes account of the wider set of accrual components that are identifiable amongst the detailed accounting information that is available in published financial statements, such as the contribution to *total accruals* from long-term receivables and payables which are related to operating activities.

The research described in this thesis uses cash flows from operating activities as the dependent variable and other accounting based data as independent variables to predict future cash flows. As noted previously, consistent with previous studies such as Barth et al (2001), Lev et al (2009) and Brochet et al (2009), all variables are deflated by the average total assets.

4.3.1. Using Information from the Statement of Cash Flows

In Chapter 2, it was explained how accruals *TACC* are defined as the earnings before interest and taxation *EBIT* reported in the Income Statement *less* the operating cash flow *CFO* reported in the Statement of Cash Flows, as follows:

$$TACC = EBIT - CFO \tag{4.1}$$

Furthermore, the individual components of the total accrual may be defined in turn as:

$$TACC = \Delta AR + \Delta INV - \Delta AP - DEPAM + OTHER \tag{4.2}$$

where:

ΔAR	=	change in accounts receivable
ΔINV	=	change in inventory
ΔAP	=	change in accounts payable
$DEPAM$	=	depreciation and amortisation expenses and thus
$OTHER$	=	$EARN - (CFO + \Delta AR + \Delta INV - \Delta AP - DEPAM)$

Table 4.1 summarizes these research variables and the relevant items on the Extel database and their definitions when using the Statement of Cash Flows method to compute total accruals. The variables and their definitions may be summarised as follows:

<u>Earnings before Interest and Tax (*EBIT*)</u>

Most prior research, using the Compustat database for US firms, employ Net Income before Extraordinary Items and Discontinued Operations[114] as *EARN* (e.g., Barth et al 2001; Lev et al 2009; Brochet et al 2009). In contrast, Al-Attar and Hussain (2004), in analysing UK data from the Datastream database, use "…*after-tax profits, adjusted for*

[114] income before extraordinary items (#18)

items that do not relate to the normal trading activities of the company" as *EARN*[115]. In the present study, *EBIT* is defined as earnings before interest and tax and is calculated as sales[116] minus total trading expenses[117].

Cash Flows from Operating Activities (*CFO*)

Reported *CFO* differs from the *CFO* presented by the Extel and Worldscope databases; (this point will be discussed in more detail in the next section) thus, using different databases leads to different amounts of future cash flows. In addition, prior studies (e.g., Barth et al 2001; Lev et al 2009) using US data and Compustat database define *CFO*[118] as cash flow from operations adjusted for the effect of extraordinary items and discontinued operations on the Statement of Cash Flows. Furthermore, Al-Attar and Hussain (2004), using UK data from Datastream database define *CFO*[119] as the difference between net cash flow from operating activities and net cash flow from non-operating activities.

Using The Statement of Cash Flows data, the present study defines *CFO*[120] as cash flows generated from operating activities adjusted for the effect of discontinued operations items on the Statement of Cash Flows. Therefore, this study does not consider tax paid and interest received in computing *CFO*.

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[115] Earnings (175) = after-tax profit, adjusted for items which do not relate to the normal trading activities of the company.

[116] Sales = EX. Sales

[117] EX. Trading Expenses = EX. Trading Ex Cost of Goods Sold + EX. Trading Exp Selling and General + EX. Trading Exp MiscByFormat1

[118] *CFO* = cash flow from operations (#308) less the accrual portion of extraordinary items and discontinued operations reported on the Statement of Cash Flows (#124)

[119] Operating cash flows = net cash flow from operating activities – net cash flow from non-operating activities (1015 = 1009–1014).

[120] *CFO* = EX. CF Operating Inflows – Ex. CF Operating Disc Ops

Total Accrual (*TACC*)

Collins and Hribar (2002) evaluate the methods of computing total accruals (the Balance Sheet changes method and the Statement of Cash Flows method) and study the errors introduced by the Balance Sheet changes method in estimating accruals. They suggest using the Statement of Cash Flows data instead of the Balance Sheet changes data. Thus, this study utilizes the method which takes *CFO* from the Statement of Cash Flows, as discussed above, and calculates total accruals as earnings before interest and tax less cash flow from operations.

As discussed in Chapter 2, this computation of total accruals is consistent with Barth et al (2001), Lev et al (2009) and Brochet et al (2009).

Change in Accounts Receivable (Δ*AR*)

Change in accounts receivable per the Statement of Cash Flows is characterized as debtors decrease (increase) and relates to adjustment to operating cash flows that show any changes in accounts receivable.

Change in Inventories (Δ*INV*)

Change in inventories per the Statement of Cash Flows is defined as stock decrease (increase) and concerns to adjustment to operating cash flows to indicate any changes in inventories.

Change in Accounts Payable (ΔAP)

Change in accounts payable per the Statement of Cash Flows is classified as creditor increase (decrease) and represents adjustment to operating cash flows to reveal any changes in accounts payable.

Depreciation and Amortisation Expenses (*DEPAM*)

Depreciation and amortisation expenses per the Statement of Cash Flows are identified as depreciation of tangible assets and amortisation of intangible assets relate to adjustment for depreciation & amortisation expenses to arrive at the cash flow from operating activities.

Other Accrual (*OTHER*)

Other accrual is calculated using the above mentioned variables by the following equation:

Other accruals = $TACC - (\Delta AR + \Delta INV - \Delta AP - DEPAM)$

Table 4 -1

Definitions of Variables – Using Information from the Statement of Cash Flows

The Research Variables Name	Extel Financial Item Name	Definition[121]
Earnings before Interest and Tax (*EBIT*)	EX. Sales *Less* EX. Trading Expenses	**Sales revenue** represents turnover net of VAT and other sales taxes and duties. **Trading expenses** relates to the total trading expenses of the company including cost of goods sold, selling and general and other Trading expenses that cannot be reliably categorized by function.
Cash Flows from Operating Activities (*CFO*)	EX. CF Operating Inflows *less* EX.CF Operating Disc Trading Flow *Less* EX.CF Operating Disc Ops After Tax	**Operating inflows** represents cash inflows generated from operations. **Discontinued trading inflow** includes receipts from discontinued operating activities before tax. **Discontinued operating inflow after tax** payments for discontinued operations shown after tax outflows.
Total Operating Accrual (*TACC*)		Total Operating Accrual, is obtained as *EBIT* less *CFO*
Change in Accounts Receivable (ΔAR)	EX.CF Operating Debt or Dec Inc	**Debtor decrease (increase)** relates to adjustment to operating cash flows that indicate any change in debtors.
Change in Inventory (ΔINV)	EX. CF Operating Stock Dec Inc	**Stock decrease (increase)** concerns to adjustment to operating cash flows to show any change in stocks.
Change in Accounts Payable (ΔAP)	EX. CF Operating Credit or Inc Dec	**Creditor increase (decrease)** represents adjustment to operating cash flows to reveal any increase in creditors.
Depreciation and Amortisation Expenses (*DEPAM*)	EX. CF Operating Depreciation And Amort	**Depreciation & amortisation** relates to adjustment for depreciation & amortisation provisions to arrive at the cash flow from operating activities. Includes amortisation of intangibles.
Other Accruals (*OTHER*)		$TACC - (\Delta AR + \Delta INV - \Delta AP - DEPAM)$

[121] The source of definitions is the Thomson One Banker- Extel Financial database, adapted for this table

4.3.2. Using the Balance Sheet Changes Method of Accrual Computation

As discussed earlier in Chapter 2 (Section 2.5), according to this approach, total accrual is calculated by using the Balance Sheet changes. Therefore, total accrual is computed as the change in working capital, *plus* the change in non-current operating receivables, *less* the change in non-current operating payables, *less* depreciation and amortisation expenses. Then, cash flow from operations *CFO* is calculated as follows:

$$CFO = EBIT - TACC \tag{4.3}$$

Table 4.2 summarises the research variables with their relevant items on the Extel database and their definitions when using the *Balance Sheet changes* method to compute total accruals. The variables and their definitions may be summarised as follows:

Earnings before Interest and Tax (*EBIT*)

In the present study, *EBIT* is identified as earnings before interest and tax which is calculated by sales minus total trading expenses.

Cash Flows from Operating Activities (*CFO*)

As mentioned above, cash flow from operations *CFO* is calculated as *EBIT* less total accruals.

Total Accrual and Components of Accrual (*TACC*)

As noted above, the approach described in this thesis accepts a comprehensive measure of the net accrual (i.e. all operating accruals less operating deferrals) and calculates it as the change in working capital, *plus* the change in non-current operating receivables (ΔLTR), *less* the change in non-current operating payables ($\Delta LTOL$), *less* depreciation and amortisation expenses. This is referred to as operating accruals. This approach assumes that the long-term receivables (ΔLTR) and long-term payables ($\Delta LTOL$) items in accounting databases are related to operating activities. The total accrual based on this approach may be determined as:

$$TACC = (\Delta TAR + \Delta INV + \Delta PREP + \Delta OCA) - (\Delta TAP + \Delta OCL) + \Delta LTR - \Delta LTOL - DEPAM \quad (4.4)$$

Change in Trade Accounts Receivable (ΔTAR)

Change in trade accounts receivable is defined as:

> *Trade debtors* [represents] *amounts owed to the company from the sale of goods or services on credit.* (Thomson One Banker –Extel)

Change in inventories (ΔINV)

Change in inventories is identified as:

> *Stocks* [relates to] *the total of all types of stock* (*inventory*). *Includes*: (i) *Raw materials;* (ii) *Work in progress;* (iii) *Finished goods and goods for resale (excluding fixed assets;* (iv) *Payments made and received in advance.* (Thomson One Banker –Extel)

Change in Prepayments ($\Delta PREP$)

Change in prepayments includes other prepayments and pension prepayments which are characterised as:

> *Other prepayments* [represents] *expenses paid and income received in advance. Pension prepayments* [relates to] *prepayments for pensions.* (Thomson One Banker –Extel)

Change in Other Current Assets (Δ*OCA*)

Other current assets is calculated by total current assets which is adjusted by the accounts are related to taxations (other tax recoverable, other certificates of tax deposit, other act recoverable and deferred tax) less trade accounts receivable, inventories and prepayments.

Change in Long-Term Receivables (Δ*LTR*)

Change in long-term receivables is characterised as:

> *Long term debtors* [represents] *long term receivables due from companies other than those classified as associated co investment.* (Thomson One Banker –Extel)

Change in Trade Accounts Payable (Δ*TAP*)

Change in trade accounts payable is identified as:

> *Trade creditors* [involves] *amounts owed for the purchase of goods or services on credit. Includes: Amounts due to suppliers etc relating to normal business operations. Excludes: Trade creditors specified as being attributable to the life business of an insurance company.* (Thomson One Banker –Extel)

Change in Other Current Liabilities (Δ*OCL*)

Change in other current liabilities is calculated by creditors less trade accounts payable, dividends and tax payables.

Change in Long-Term Operating Liabilities (Δ*LTOL*)

Change in long-term operating liabilities includes non-current provisions, provisions for future pension liabilities and other long-term operating liabilities.

Depreciation and Amortisation Expenses (*DEPAM*)

Include depreciation of tangible assets and amortisation of intangible assets per the Income Statement.

Table 4.2

Definitions of Variables – Using the Balance Sheet Changes Method of Accrual Computation

The Research Variables	Extel Item Name	Definition
Trade Accounts Receivables (*TAR*)	EX. Current Assets Trade Debtors	**Trade debtors** [represents] amounts owed to the company from the sale of goods or services on credit, Includes: amounts due from customers relating to normal business operations. Excludes: trade debtors specified as being attributable to the life business of an insurance company (see life trade debtors).
Inventories (*INV*)	EX. Current Assets Stocks	**Stocks** [relates to] the total of all types of stock (inventory). Includes: (i) Raw materials; (ii) Work in progress; (iii) Finished goods and goods for resale (excluding fixed assets; (iv) Payments made and received in advance
Prepayments (*PREP*)	EX. Current Assets Other Prepayments EX. Current Assets Pension Prepayments	**Other prepayments** [represents] expenses paid and income received in advance This will include deferrable expenses (such as marketing costs) incurred in the gaining of insurance business and pension prepayments. Includes: Prepaid expenses and accrued income. Excludes: Accruals. **Pension prepayments** [relates to] prepayments for pensions. Excludes: (1) Prepaid expenses and accrued income except for pensions.
Other Current Assets (*OCA*)	EX. Current Assets less above items	Total current assets after excluding taxation less above items.
Long Term Receivables (*LTR*)	EX. Finance Assets LT Debtors	**Long term debtors** [represents] long term receivables due from companies other than those classified as Associated co investment. Includes: (1) Long term receivables. (2) Trade (and other) debtors. Excludes: (1) Receivables from trade investments (2) Current asset receivables due after a year.

Table 4.2 Continued

The Research Variables Name	Extel Item Name	Definition
Trade Accounts Payable (*TAP*)	EX. Creditors Trade Creditors	**Trade creditors** [involves] amounts owed for the purchase of goods or services on credit. Includes: Amounts due to suppliers etc relating to normal business operations. Excludes: Trade creditors specified as being attributable to the life business of an insurance company.
Other Current Liabilities (*OCL*)	EX. Creditors Less: EX. Creditors Trade Creditors EX. Creditors Tax Due EX. Creditors Dividends Due	**Creditors** [represents] the total of creditors [including] Trade creditors, Bills of exchange, Due to market & clients , Due to agents etc, Due to policyholders, Due to insurance companies, Due to reinsurance companies, Accrued interest, Other accruals etc, Current provisions, Fixed asset payables, Deferred consideration, Trading investments – short, Tax due , Short term government grants, Dividends due, Items in transit, Notes in circulation, Reinsurance deposits , Intra-group payables and U&O creditors.
Long Term Operating Liabilities (*LTOL*)	EX. Deferred Liabilities EX. Other Liabilities EX. Other LT Liabilities Less: EX. Deferred Tax	Long Term Liabilities after excluding deferred tax.

Table 4.2 Continued

The Research Variables Name	Extel Item Name	Definition
Earnings before Interest and Tax (*EBIT*)	EX. Sales Less: EX. Trading Expenses	**Sales revenue** represents turnover net of VAT and other sales taxes and duties. Excludes turnover known to be inclusive of sales taxes which cannot be shown separately. **Trading expenses** relates to the total trading expenses of the company including cost of goods sold , selling and general and U&O by format 1 (the total of all components of trading expenses that cannot be reliably categorised by function).
Cash Flows from Operating Activities (*CFO*)		$CFO = EBIT - TACC$
Accruals		$TACC = (\Delta TAR + \Delta INV + \Delta PREP + \Delta OCA) - (\Delta TAP + \Delta OCL) + \Delta LTR - \Delta LTOL - DEPAM$
ΔTAR		Change in trade accounts receivable
ΔINV		Change in inventories
$\Delta PREP$		Change in prepayments
ΔOCA		Change in other current assets
ΔLTR		Change in long-term receivables
ΔTAP		Change in trade accounts payable
ΔOCL		Change in other current liabilities
$\Delta LTOL$		Change in other long-term operating liabilities
$DEPAM$		Depreciation of tangible assets and amortisation of intangible assets per Income Statements

The source of definitions of variable is the Thomson One Banker- Extel Financial.

4.4. The Validity of Database Information

As mentioned in Chapter 1, the thesis investigates the validity of the accounting data and databases by examining key aspects of research design that influence the inclusion or exclusion of data points in the estimated predictions. These key aspects are:

- The firm coverage differentiation between two databases.
- The nature of values that are unrecorded, missing or zero.
- The effects of influential observations on the estimations, comparing the methods of controlling for extreme values.
- The specific feature of accounting data that arises in the case of a change of fiscal year length.
- The Comparison of published financial statements with data in commercial databases.

4.4.1. Firm Coverage

As noted earlier, the present study takes into account the data structure of the most common UK provider, *Thomson One Banker*, and particularly the *Extel Financial* platform and substituting missing values using the Worldscope platform. The study investigates the firm coverage between two databases, Extel Financial platform and Worldscope platform. Table 4.3 summarises the downloaded data as values and unrecorded and allows a comparison between the enhanced dataset and Extel Financial and Worldscope platforms by firm coverage. The table is prepared using the total assets variable, a value that is always included for any period in which a financial report has been entered in the database.

Table 4.3
Firm Coverage by Databases - Sample of UK Firms 1991-2008

	Extel	Worldscope	Enhanced dataset (all sources)
Downloaded data with non missing total asset	**13,131**	**12,454**	**13,135**
In both databases	12,281	12,281	12,281
In one database only	850	173	854
Downloaded as 'N/A'	**8,163**	**8,840**	**8,159**
Total	**21,294**	**21,294**	**21,294**
Note. Downloaded data (1,183 firms x 18 years = 21,294 firm-years)			

The table shows how the enhanced set of available accounting data is constructed using all observations in both Extel and Worldscope, including 854 firm-years reported in only the Extel database. The number of firm-years in which there was no financial report, i.e. the years within the 18-year window which were before the stock listing or after the stock delisting, is 8,159.

Table 4.4 presents downloaded data as values by year. It is evident that there are differences between two databases and the Extel Financial platform provides more firm-years observations in the examined periods.

Table 4.4
Number of Observations by Year - Sample of UK Firms 1991-2008

	Extel	Worldscope	Difference
1991	347	325	22
1992	371	333	38
1993	407	342	65
1994	457	355	102
1995	487	371	116
1996	511	466	45
1997	565	518	47
1998	612	539	73
1999	658	576	82
2000	703	655	48
2001	759	727	32
2002	865	832	33
2003	921	908	13
2004	1001	997	4
2005	1075	1074	1
2006	1121	1129	-8
2007	1142	1150	-8
2008	1129	1157	-28
	13,131	12,454	677

Prior research reported that financial datasets are not perfect substitutes (Alves et al 2007). In addition, the effects of database choice on accounting research have been examined recently by Lara et al (2006), by regressing book value of shareholders' equity and earnings on the market value of the company using EU data from seven sources for the period 1990–99. Lara et al conclude that much of the variation is attributable to differences in firm coverage across databases. Alves et al (2007) have also been made a comparison of the number of UK firms among four commercial databases[122] through three platforms[123] according to either net income or total assets for a period between 1970 and 2004. Alves et al document that not only there are differences concerning coverage of firms among the databases, but the coverage of firms varies across platforms for the same databases (see Appendix 3). Alves et al also document differences in the coverage of firms across time periods.

The above discussion indicates that the Extel database which is used in the thesis as the source of data provides better coverage of the accounting data for the UK–listed firms compared with the Worldscope database.

The effects of database choice on the estimations, testing the prediction models using the Worldscope database and comparing with the Extel database, will be presented in Chapter 7.

4.4.2. Unrecorded Data : Missing or Zero

The current study considers the nature of values that are reported in downloads as not applicable or unrecorded, missing or zero. Table 4.5 compares the nature of values for

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[122] Worldscope (WS), Extel Financial (EX), Thomson Financial (TF) and Datastream Company Accounts Historical Archive (DSA)

[123] Datastream (DS), Thomson ONE Banker (T1B) and Company Analysis (CA)

some accounting variables between the Worldscope and the Extel Financial databases, downloading data for 18 years 1991 to 2008. Some firm year observations have value in one database, whilst in the other database they are reported as missing or zero. For instance, the number of firm year observations concerning the accounting variables, Cash, Inventories, Current assets and Sales are reported as #N/A in the Worldscope database 1133, 606, 943 and 772 respectively, whilst they are valued in the Extel Financial database.

Table 4.5 demonstrates a potential drawback in accounting research based on commercial databases. Lara et al (2006) and Alves et al (2007) who have demonstrated that employing different databases can lead to different results for the same estimations. There is no any prior study to try to identify the unrecorded data, missing or zero. These cases can be retrieved by referring to primary documents, i.e. the annual reports published by the company. In addition, these items may be obtained directly from the available data, by backfilling via the appropriate accounting identity. Therefore, these results provide evidence of missing values that can be easily reconstructed from accounting identities or retrieved from the source documents. The current research improves the quality of the final sample by using more than one database as well as source documents and deduction.

The effect of unrecorded data on the research models, testing the research models without identifying the nature of unrecorded data, will present in Chapter 7.

Table 4.5
Values that are Unrecorded, Missing or Zero

Cash		Worldscope				*Enhanced dataset*
		Value	#N/A	Zero	Total	*Total*
Extel Financial	Value	11,570	1,133	16	12,719	*12,279*
	#N/A	114	8,096	360	8,570	*8,159*
	Zero	0	1	4	5	*856*
	Total	11,684	9,230	380	21,294	*21,294*

Inventory		Worldscope				*Enhanced dataset*
		Value	#N/A	Zero	Total	*Total*
Extel Financial	Value	9,697	606	22	10,325	*10,324*
	#N/A	143	8,264	2,560	10,967	*8,159*
	Zero	0	2	0	2	*2,811*
	Total	9,840	8,872	2,582	21,294	*21,294*

Current Assets		Worldscope				*Enhanced dataset*
		Value	#N/A	Zero	Total	*Total*
Extel Financial	Value	12,183	943	1	13,127	*13,127*
	#N/A	157	8,003	6	8,166	*8,159*
	Zero	0	1	0	1	*8*
	Total	12,340	8,947	7	21,294	*21,294*

Sales		Worldscope				*Enhanced dataset*
		Value	#N/A	Zero	Total	*Total*
Extel Financial	Value	11,567	772	24	12,363	12,354
	#N/A	192	8,020	35	8,247	8,159
	Zero	13	55	616	684	781
	Total	11,772	8,847	675	21,294	*21,294*

4.4.3. Extreme Values

This section explores the effects of influential observations on the estimations, and the available methods of controlling for extreme values. The identification of influential observations, which can have a marked impact on modelling, enhances the generalisation of the estimations. By influential observations, in both dependent and independent variables, the present research refers here both to outliers and high leverage values respectively (see Wilson, 1997 and Hadi, 2006, for a more detailed discussion).

The two most common methods of reducing the influence of extreme values in prior research are to replace the upper and lower 1% of each empirical distribution with the respective values of the 2nd and 98th percentiles (winsorising) or to exclude the upper and lower 1% altogether (trimming, or truncation). For example, Brochet et al (2009) winsorise "*the independent variables at 1% and 99% of their quarterly distributions"*, whereas Dechow et al (1998) exclude *1% of the observations with the largest and smallest values of earnings, accruals, cash flows, and sales"*.

Wilson (1997), in an article examining distortion effects and extreme observations in empirical research, compares the above-mentioned approaches with Cook's distance and conclude that the choice of method of dealing with influential observations can lead to substantially different results. In this vein, Barth et al (2001) also include a distance measure, and exclude "*observations with sales less than $10 million, share price less than $1, EARN or CFO in the extreme upper and lower 1 percent of their respective distributions, and studentized residuals greater than 3 in absolute value"*. Consistent with Barth et al (2001), Lev et al (2009) exclude "*observations with market value of equity or sales of less than $10 million, or with share prices below $1, to eliminate economically marginal firms,*[and delete] *observations with studentized residuals greater than 3 or less than -3*".

Christodoulou and Bradbury (2010) investigate sampling methods which are robust to extreme values. They argue that winsorising and truncation as outlier control methods are an inappropriate way to prepare a robust estimation sample, especially in the context of firm-year accounting data which follows a panel structure together with heterogeneous financial year ends. Accordingly, they use a multivariate filter which appears to be superior to the above-mentioned methods in weighting out influential panels.

The present study compares the impact of four outlier identification methods: Trimming, Cook's Distance, Studentised Residuals and Multivariate Filter. Cook's Distance is calculated by running the study's OLS regression models and measuring "*the aggregate change in the estimated coefficients when each observation is left out of the estimation*". Observations are ranked according to their impact on the regression model, and those with greater than the suggested 4/n[124] and 1% [125]cut-off are considered to be extreme values and removed. Hadi's Multivariate Filter measures influential observations, again based on both dependent and independent variables, and influential firm panels are then identified at the 1% and 5% level of statistical significance and removed.

Table 4.6 shows the results of these removal methods. For truncation, for each model fit, the excluded observations are the upper and lower 1% of each variable incorporated in the estimation. Cook's Distance, Studentised Residuals and Hadi's Multivariate Filter are also computed for each model separately. Each outlier method is computed by using two different cut-off points which have employed in the previous studies.

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[124] This cut-off point is suggested by Stata (see Stata Base Reference Manual Release 11 for a more detailed discussion)
[125] This cut-off point is used by Wilson (1997)

Table 4.6 shows that the full sample contains 6,832 firm-year observations. As expected, the choice of outlier removal methods leads to different numbers of firm-year observations; for example, for the cash flow autoregression in model (1):

- trimming the dependent and independent variable for the 1% extremes reduces N by 193 observations to 6,639 and for the 2% extremes reduces N by 380 observations to 6,452;
- using Studentised Residuals at |SR|>2 reduces N by 326 observations to 6,506 and at |SR|>3 reduces N by 123 observations to 6,709;
- using Cook's Distance at 4/n reduces N by 368 observations to 6,464 and at reduces N by 1 observations to 6,831; and
- using Hadi's Multivariate Filter at 1% reduces N by 76 to 6,756 and at 5% reduces N by 102 observations to 6,730.

The advantage of the Studentised Residuals at |SR|>2 is the achievement of a higher adjusted R^2 and increases the t-statistics. The main drawback of other methods, however, is more evident in model (4), where the increased number of variables leads to the discarding of far more observations (trimming -543 and -1,021, Studentised Residuals -347 and -116, distance -427 and -2, multivariate filter -369 and -486), potentially limiting the generalisation to the population as a whole of any inferences drawn from these samples.

Table 4.6
Outlier Removal Methods

	Full sample	Robustness Check	Simple Trimming 1%	Simple Trimming 2%	Studentized Residuals |SR|>2	Studentized Residuals |SR|> 3	Measuring Outlier Distance Effects Cook's D > 4/N	Measuring Outlier Distance Effects Cook's D > 1	Hadi's Multivariate Filtering 1% level	Hadi's Multivariate Filtering 5% level
1. Cash Flow Only Model										
N	6832	6831	6639	6452	6506	6709	6464	6831	6756	6730
Extreme values			***193***	***380***	***326***	***123***	***368***	***1***	***76***	***102***
Adjusted R^2	0.4814	0.7067	0.4024	0.4029	0.6239	0.5557	0.5756	0.4933	0.4740	0.4811
Intercept	0.0421	0.0318	0.0477	0.0477	0.0369	0.0393	0.7184	0.0395	0.0408	0.0405
CFO_t	0.6748	0.7430	0.6296	0.6298	0.7084	0.6908	0.0348	0.6946	0.6810	0.6859
t-stat	(79.63)	(128.32)	(66.86)	(65.98)	(103.87)	(91.60)	(93.64)	(81.55)	(78.02)	(79.00)
2. Earnings Only Model										
N	6832	6831	6642	6453	6525	6737	6473	6831	6760	6731
Extreme values			***190***	***379***	***307***	***95***	***359***	***1***	***72***	***101***
Adjusted R^2	0.4624	0.6334	0.3653	0.3489	0.5774	0.5269	0.5134	0.4548	0.4387	0.4395
Intercept	0.0564	0.0505	0.0620	0.0621	0.0539	0.0551	0.0512	0.0577	0.0569	0.0562
$EBIT_t$	0.7605	0.7971	0.6950	0.6956	0.7730	0.7676	0.7928	0.7462	0.7451	0.7532
t-stat	(76.64)	(108.64)	(61.83)	(58.81)	(94.42)	(86.63)	(82.64)	(75.49)	(72.70)	(72.65)
3. Disaggregate Earnings										
N	6832	6830	6548	6283	6468	6725	6429	6830	6713	6684
Extreme values			***284***	***549***	***364***	***107***	***403***	***2***	***119***	***148***
Adjusted R^2	0.5343	0.7268	0.4649	0.4634	0.6585	0.5948	0.6264	0.5435	0.5284	0.5288
Intercept	0.0375	0.0296	0.0400	0.0398	0.0333	0.0346	0.0308	0.0376	0.0364	0.0356
CFO_t	0.8085	0.8436	0.7653	0.7606	0.8257	0.8222	0.8393	0.8090	0.8089	0.8135
t-stat	(86.46)	(130.47)	(73.21)	(71.22)	(109.19)	(97.72)	(100.43)	(88.66)	(84.58)	(84.26)
$TACC_t$	0.4013	0.3398	0.3204	0.2999	0.3678	0.3922	0.3639	0.4073	0.3845	0.3760
t-stat	(27.89)	(33.57)	(20.06)	(18.38)	(31.43)	(30.45)	(27.32)	(28.52)	(25.31)	(25.47)

Table 4.6 Continued

	Predictions Signs	Full sample	Robustness check	Simple Trimming 1%	Simple Trimming 2%	Studentised Residuals |SR|>2	Studentised Residuals |SR|> 3	Measuring Outlier Distance Effects Cook's D > 4/N	Measuring Outlier Distance Effects Cook's D > 1	Hadi's Multivariate Filtering 1% level	Hadi's Multivariate Filtering 5% level
4. Full disaggregation											
N		6832	6830	6289	5811	6485	6716	6405	6830	6463	6346
Extreme values				***543***	***1021***	***347***	***116***	***427***	***2***	***369***	***486***
Adjusted R^2		0.5672	0.7506	0.5179	0.5175	0.6998	0.6341	0.6660	0.5803	0.5877	0.6035
Intercept		0.0211	0.0094	0.0205	0.0222	0.0139	0.0155	0.0116	0.0165	0.0130	0.0119
CFO_t	+	0.8068	0.8411	0.7287	0.7128	0.8272	0.8077	0.8284	0.8154	0.8150	0.8243
t-stat		(86.90)	(133.63)	(74.45)	(71.61)	(111.99)	(98.70)	(102.74)	(90.57)	(86.56)	(88.39)
ΔAR_t	+	0.0126	0.1838	-0.0119	0.0676	0.1081	0.1299	0.0339	0.0093	-0.177	-0.0277
t-stat		(0.26)	(5.60)	(-.20)	(1.09)	(2.63)	(3.10)	(0.61)	(0.20)	(-0.25)	(-0.38)
ΔINV_t	+	0.2159	0.3539	0.1778	0.2590	0.3113	0.3507	0.2327	0.2780	0.1445	0.1289
t-stat		(4.13)	(10.00)	(2.74)	(3.84)	(7.08)	(7.85)	(4.09)	(5.49)	(1.94)	(1.70)
ΔAP_t	-	-0.6934	-0.6840	-0.5711	-0.5398	-0.7037	-0.6918	-0.6670	-0.7032	-0.6739	-0.6376
t-stat		(-31.88)	(-46.48)	(-23.67)	(-20.82)	(-43.23)	(-38.01)	(-35.42)	(-33.41)	(-29.59)	(-28.09)
$DEPAM_t$	+	-0.0564	0.0852	0.1911	0.1944	0.0284	0.05612	0.0743	0.0175	0.1032	0.0982
t-stat		(-2.36)	(4.61)	(6.08)	(5.93)	(1.5)	(2.49)	(3.23)	(0.66)	(3.65)	(3.54)
$OTHER_t$	?	0.3354	0.4044	0.2701	0.3099	0.3792	0.3879	0.3343	0.3421	0.2924	0.2780
t-stat		(13.55)	(24.16)	(8.91)	(10.11)	(17.79)	(17.93)	(11.91)	(14.29)	(7.28)	(7.54)

4.4.4. Fiscal Year Length

In addition to influential observations (outliers and high leverage data points) which have been investigated in the previous section, the present study also considers the impact of another type of ‘unusual’ observation, attributable specifically to changes in fiscal year-end leading in turn to differences in accounting period duration, which are an acceptable business practice in some jurisdictions (e.g. the UK) but not in others. For example, in Christodoulou and Bradbury (2010), which explores this issue in depth, the possibility of year-end change is described as follows:

> *Companies listed in the UK that wish to change their financial year-end must abide by the UK company act that allows unrestricted changes in the accounting year-end when shortening the accounting reference period, but does not allow the extension of the period for more than 18 months or for changes more than once in a period of 5 years (Companies House 2007, GBA3). The Company Act also allows the unrestricted oscillation of year-end dates by seven days (i.e., resulting in periods of 51 to 53 weeks) otherwise the firm must file for formal permission to change its accounting reference data*

Table 4.7 shows the accounting period duration for the observations in the dataset. The usual calendar year report is for 365 days, and 366 days in leap years. Some firms report for 52 weeks (364 days), and their pattern is to do so for three or four accounting periods then report for 53 weeks (371 days) in the following reporting period. The other durations relate mainly to changes of reporting date.

Although it is usual to exclude some ‘unusual’ observations by outlier removal methods because they are extreme values, samples may still include ‘unusual’ observations because they relate to a period longer or shorter than twelve months. Whilst, the table obviously shows how, after annualising earnings and cash flow from operations, observations from nonstandard reporting periods are not determined to be unusual by the outlier removal methods, accordingly the sample still includes these unusual observations.

Table 4.7
Fiscal Year Length

	Number of Firm - Year Observations			
	The Statement of Cash Flows Information		The Balance Sheet Changes Method	
Number of days	Full Sample	Final Sample	Full Sample	Final Sample
90- 200	10	4	11	5
201-300	31	16	33	20
301-363	51	32	52	30
364	1,061	894	1,067	891
365	4,958	4,121	4,979	4,162
366	2,017	1,172	2,024	1,198
367-370	39	32	39	33
371	223	180	223	181
372-400	13	7	13	7
401-500	42	23	42	22
501-607	17	4	17	4
Total	8,462	6,485	8,500	6,553

Christodoulou and Bradbury (2010) cite that Ferguson et al (2006) exclude firms with fiscal period length less or more than twelve-months and Gore et al (2007) take in to account firms with fiscal period length between 350 to 380 days.

In the present study to mitigate the effect of these kinds of observations, all applied variables related to income statement and cash flow statement annualised by dividing amount to reported period durations in days and multiplying by 365 days, thus all period durations and their respective variables regarding to income statement and cash flow statement fields convert to one year. This process is called annualising data. For example if sales are reported over 100 days, the study assumes that the same value of sales will continue for the remaining 265 days. That is, if the sale is reported £1 over 100 days, multiplying by 3.65 estimates that the firm would have achieved £3.65 over 365 days.

4.4.5. Comparison of Published Financial Statements with Data in Commercial Databases

As noted in previous section, prior research reported that financial datasets are not perfect substitutes, not only as coverage of firms and accounting items varies across the databases, but because there are differences in the way each database defines and constructs key variables (Alves et al, 2007). Alves et al compare the properties of items from the Worldscope accounting data with corresponding items from the Extel Financial and the Datastream Company Accounts Archive and report some differences. For instance, the mean and median Worldscope values for operating cash flow are 25 percent lower than the Extel Financial values.

This section investigates the effect of using accounting data from different databases on empirical accounting research and particularly focuses on the content and the nature of accounting data. For this reason, it considers the data structure of the most common UK provider, Thomson One Banker, the Extel financial and the Worldscope platforms. As discussed earlier, the Extel financial database provides ‘as reported’ data and the Worldscope database asserts that it offers ‘standardised data; differences relate to disclosure and presentation, in order to enhance the international comparability of the accounting data for listed firms around the world from different countries and industries (Alves et al, 2007). On the other hand, there are many variations in annual reports such as the format of financial statements and the definition of accounting items.

The present study makes a bridge between financial statements and commercial databases and compares and illustrates differences across reported accounting data with considered databases. In this respect, first, using financial statements (Balance Sheet, Income Statement and Statement of Cash Flows) for *Tesco, Vodafone and British Telecommunications* (BT) as the case studies, this part of the study compares between the financial statements published by selected companies with the accounting data presented by the Extel and the Worldscope databases (see Appendix 1).

To perform the comparison, all items related to Balance Sheet, Income Statement and Statement of Cash Flows regarding *Tesco*, *Vodafone* and *BT* for fiscal year 2008 from both databases are downloaded and checked with deduction and other procedures. Then, the published financial statements items are tracked to their respective items in both databases.

The following findings show some differences between items in the published financial statements and their relevant data items in the examined databases (see Table 4.8). For example:

- Considering deferred taxes-debit as an asset, Extel reports total current assets and total assets consistent with published financial statements, whilst Worldscope reports net deferred taxes as a liability (deferred taxes- credit *less* deferred taxes- debit).
- Worldscope reports cost of sales in two items, cost of goods sold and depreciation and amortisation expenses, while Extel reports cost of sales as a whole. Likewise, Extel reports this item in a separate field for some firms and Worldscope classifies in a different way, such as cost of sales of *BT* (see Table 4.8).
- *Tesco*'s reported operating cash flow is £3,343 million for the financial year ending in February 2008, whilst the Worldscope database gives a figure of £3,559 million and the Extel financial database gives a figure of £4,099 million which is related to cash generated from operations.
- *Vodafone*'s reported operating cash flow is £10,474 million for the financial year ending March 2008, whilst the Worldscope Database gives a figure of

£10,312 million and the Extel financial Database gives a figure of £13,289 million which is related to cash generated from operations.

- *British Telecommunication*'s reported operating cash flow is £5,486 million for the financial year ending March 2008, whilst the Worldscope Database gives a figure of £4,757 million and the Extel financial database gives a figure of £5,187 million which is related to cash generated from operations.

It is clear that using different datasets can lead to different results. Therefore, researchers should consider the content and nature of accounting data, when collecting data.

In addition to comparing these databases, to find an appropriate and clear structure of data to apply in the balance sheet changes approach, using the Extel Financial database, Appendix 2 contains a framework for reclassifying Balance Sheet items.

Table 4.8
Example Comparisons of Published Financial Statements with Information in Commercial Databases

Financial statements (£m)	**2008**	**Extel**	**2008**	**Worlscope**	**2008**
Tesco, year ended 23 February 2008					
Total current assets	6,300	EX. Current Assets	6,300	WS. Current Assets	5,955
Total assets	30,164	EX. Total Assets	30,164	WS. Total Assets	30,060
Cost of sales	43,668	EX. Trading Ex Cost Of Goods Sold	43,668	WS. Cost Of Goods Sold	42,692
				WS.DepreciationDeplAmortExpense	976
Profit before tax	2,803	EX. Profit Before Tax	2,803	WS. Income Bef Income Taxes	2,728
Cash generated from operations	4,099				
Interest paid	(410)				
Corporation tax paid	(346)				
Net cash from operating activities	3,343	EX. CF Operating Inflows	4,099	WS. Net Cash Flow Operating	3,559
Vodafone, year ended 31 March 2008					
Total assets	127,270	EX. Total Assets	127,270	WS. Total Assets	126,834
Cost of sales	21,890	EX. Trading Ex Cost Of Goods Sold	21,890	WS. Cost Of Goods Sold	15,981
				WS.DepreciationDeplAmortExpense	5,909
Profit before tax	9,001	EX. Profit Before Tax	9,001	WS. Income Bef Income Taxes	6,167
Cash generated from operations	13,289				
Corporation tax paid	(2,815)				
Net cash from operating activities	10,474	EX. CF Operating Inflows	13,289	WS. Net Cash Flow Operating	10,312
BT, year ended 31 March 2008					
Operating costs	18,697	EX. Trading Ex Cost Of Goods Sold	0	WS. Cost Of Goods Sold	8,871
		EX. Trading Exp Selling	0	WS.Depreciation Depl Amort Expense	3,214
		EX. Trading Exp MiscByFormat1	18,168	WS. Selling General Admin Expense	6,083
Cash generated from operations	5,187				
Income taxes paid	(222)				
Income tax repayment for prior years	521				
Net cash from operating activities	5,486	EX. CF Operating Inflows	5,187	WS. Net Cash Flow Operating CF Stmt	4,757

4.5. Sampling Process

The criteria as mentioned above lead to a final sample for the two approaches to cash flow analysis used in the thesis, using either Cash Flow Statement information to calculate accruals, or alternatively the Balance Sheet changes method. Panel A of Table 4.9 indicates the process of sample selection. Panel B of Table 4.9 presents the number of firm year observations by ICBI (Industrial Classification Benchmark Industry) code and Panel C of the table shows the number of firm year observations by GICS (Global Industry Classification Standard)[126]. The most of firm-year observations are taken place in the four industries.

The full sample covers the period 1991-2008, earlier years are excluded as accounting data regarding the Statement of Cash Flows is available from 1991 only. The sample used in estimations starts in fiscal year 1992, as the data for fiscal year 1991 are required to deflate variables by average total assets, and ends in 2007 as one–year–ahead predictions are evaluated in the present study. Panel D of Table 4.8 classifies firm-year observations according to fiscal years.

[126] The GICS is an industry taxonomy developed by Morgan Stanley Capital International (MSCI), and Standard & Poor's (S&P) for use by the global financial community. The GICS structure consists of 10 sectors, 24 industry groups, 68 industries and 154 sub-industries into which S&P has categorized all major public companies. The system is similar to ICB (Industry Classification Benchmark), a classification structure maintained by Dow Jones Indexes and FTSE Group. GICS is used as a basis for S&P and MSCI financial market indexes in which each company is assigned to a sub-industry, and to a corresponding industry, industry group and sector, according to the definition of its principal business activity. "GICS" is a registered trademark of McGraw-Hill and is currently assigned to S&P.

Table 4.9
Sample Specification

Panel A: Sampling Process

	Number of Firm - Year Observations	
	The Statement of Cash Flows Information	The Balance Sheet Changes Method
Downloaded as values	13,135	13,135
Less: Observations with missing values of *CFO*	(95)	-
Less: Incomplete series, i.e. interrupted	(836)	(786)
Less: Sales < £10 millions	(3,734)	(3,840)
Less: Negative depreciations	(8)	(9)
Full sample	8,462	8,500
Less: Scaling variables by average total assets	(857)	(863)
Less : Calculation lagged variables	(773)	(779)
Less: Extreme values	(347)	(305)
Final sample	6,485	6,553

Note: Downloaded data from Extel Financial database (1,183 UK non-financial firms x 18 years = 21,294 firm-years, 1991-2008). Excluding extreme values with studentised residuals greater than 2 which is computed by estimating full disaggregation model (the model uses more predictor with compared to other models).

Panel B: Sample Size, by Industry Classification Benchmark

		Number of Firm - Year Observations			
		The Statement of Cash Flows Information		The Balance Sheet Changes Method	
Code	Name	Full Sample	Final Sample	Full Sample	Final Sample
0001	Oil and Gas	270	195	270	197
1000	Basic Materials	437	338	442	341
2000	Industries	3,285	2,609	3,296	2,618
3000	Consumer Goods	1,001	804	1,001	802
4000	Health Care	361	252	361	255
5000	Consumer Services	1,986	1,500	2,007	1,523
6000	Telecommunications	123	84	123	87
7000	Utilities	178	142	178	145
9000	Technology	821	561	822	585
Total		8,462	6,485	8,500	6,553

Note. Industry Classification Benchmark from Thomson, based on FTSE and Dow Jones standard classifications

Panel C: Sample Size, by GICS (Global Industry Classification Standard)

Code	Name	Number of Firm - Year Observations			
		The Statement of Cash Flows Information		The Balance Sheet Changes Method	
		Full Sample	Final Sample	Full Sample	Final Sample
10	Energy	355	251	355	252
15	Materials	616	490	621	495
20	Industrials	2,491	1991	2,511	2,004
25	Consumer Discretionary	2,218	1721	2,228	1,735
30	Consumer Staples	481	385	481	387
35	Health Care	296	202	296	205
40	Financials	7	1	7	1
45	Information Technology	1,070	761	1,072	779
50	Telecommunication Services	108	82	108	82
55	Utilities	182	145	182	149
Total		7,824	6,029	7,861	6,089

Panel D: Sample Size, by Year

	Number of Firm - Year Observations			
	The Statement of Cash Flows Information		The Balance Sheet Changes Method	
	Full Sample	Final Sample	Full Sample	Final Sample
1991	260		276	
1992	280	234	282	259
1993	304	265	304	268
1994	328	281	328	278
1995	345	313	346	313
1996	374	319	375	331
1997	399	349	400	359
1998	413	373	414	375
1999	435	379	437	388
2000	457	408	460	412
2001	482	415	483	425
2002	507	451	508	451
2003	541	473	545	459
2004	593	490	594	478
2005	633	541	632	553
2006	672	585	673	582
2007	706	609	708	622
2008	733		735	
Total	8,462	6,485	8,500	6,553

4.6. Summary

This chapter describes the choice of dataset and the process of data collection for the research. In addition, the chapter specifies the variables and their definitions. Furthermore, to improve the quality of data for the study, the chapter discuses the validity of the accounting data and database and examines some key aspects of research design that influence the inclusion or exclusion of data points in the predictions, such as firm coverage, the nature of unrecorded data, missing or zero, methods of controlling for extreme values, the case of a change of fiscal year-end. The chapter compares reported financial statement figures with offering data in commercial databases, and provides evidence that using different datasets can lead to different findings. Indeed, it is suggested here as a result that researchers might place more emphasis on the content of accounting data bases and the nature of the items reported in these datasets, when putting together accounting-based firm-year panels for analysis.

Using the data specified in this chapter, Chapter 5 will present the results of empirical tests based on the arguments of this chapter and Chapter 3.

Chapter 5

Preliminary Results

5.1. Introduction

This chapter outlines the results of the initial analysis, including the descriptive statistics, in-sample model estimations and out-of-sample accuracy tests for the two approaches to cash flow analysis used in the thesis, using either Cash Flow Statement information to calculate accruals, or alternatively the Balance Sheet changes method. Section 5.2 provides the distributional statistics and correlation analyses for the variables employed in the present study. Section 5.3 contains the preliminary results of the model estimations using holdout samples, and the tests of predictive accuracy. Section 5.4 is a summary of the chapter.

5.2. Descriptive Statistics

This section contains descriptive statistics (distributional statistics and correlation analyses) and provides evidence concerning the assumptions of OLS regression, which have been discussed in the Section 3.5 of Chapter 3 (diagnostic tests).Tables 5.1 and 5.2 present distributional statistics and Table 5.3 reports correlation analyses.

5.2.1. Distributional Statistics

Using Information from the Statement of Cash Flows

Panel A of Table 5.1 indicates distributional statistics for the full sample before excluding extreme values and Panel B of Table 5.1 indicates distributional statistics after extreme values are excluded.

Table 5.1
Distributional Statistics – Using Information from the Statement of Cash Flows

Panel A: Full Sample, before Excluding Extreme Values (N = 7,605)

Variables[127]	Mean	S.D.	0.25	Median	0.75	Min	Max
$EBIT_t$ [128]	0.100	0.116	0.053	0.096	0.146	-1.081	1.883
CFO_t [129]	0.134	0.132	0.071	0.125	0.192	-0.880	2.113
$TACC_t$ [130]	-0.033	0.086	-0.067	-0.031	0.002	-1.687	0.800
ΔAR_t [131]	-0.017	0.069	-0.035	-0.008	0.007	-0.674	0.790
ΔINV_t [132]	-0.007	0.040	-0.014	-0.001	0.002	-0.371	0.569
ΔAP_t [133]	0.015	0.071	-0.010	0.008	0.035	-1.435	0.713
$DEPAM_t$ [134]	0.048	0.045	0.026	0.041	0.059	-0.332	1.664
$OTHER_t$ [135]	0.053	0.169	-0.013	0.033	0.111	-2.264	1.577
Note. Full Sample after Scaling variables by average total assets							

Panel B: Final Sample, after Excluding Extreme Values (N = 6,485)

Variables	Mean	S.D.	0.25	Median	0.75	Min	Max
$EBIT_t$	0.103	0.097	0.056	0.097	0.146	-0.550	1.049
CFO_t	0.137	0.112	0.076	0.128	0.192	-0.813	1.731
$TACC_t$	-0.034	0.075	-0.067	-0.032	-0.001	-0.1606	0.722
ΔAR_t	-0.017	0.063	-0.034	-0.009	0.005	-1.035	0.691
ΔINV_t	-0.007	0.037	-0.014	-0.001	0.002	-0.364	0.569
ΔAP_t	0.015	0.062	-0.009	0.008	0.035	-1.435	0.611
$DEPAM_t$	0.048	0.038	0.027	0.042	0.059	0.000	1.467
$OTHER_t$	0.053	0.153	-0.010	0.033	0.107	-1.539	1.577

Panel B of Table 5.1 demonstrates that the mean and median values of $EBIT_t$ (0.103 and 0.097) and CFO_t (0.137 and 0.128) are positive and the mean and median value of accruals (-0.034 and -0.032) are negative. Note that the average value of accruals is computed as the average value of EBIT less the average value of CFO [TACC = 0.103 – 0.137 = -0.034]. It is evident that the average values of EBIT are lower than the average CFO which indicates that earnings include non-cash expenses

[127] All variables deflated by the average of total assets. Variable definitions with respective Extel Financial item name are as follows:
[128] *EBIT* = Sales (EX. Sales) minus Total Operating Expenses (EX.TradingExpenses).
[129] *CFO* = Cash generated by operations (EX.CFOperatingInflows) adjusted by discontinued operations (EX.CFOperatingDiscTradingFlow and EX.CFOperatingDiscOpsAfterTax).
[130] *TACC* = Total Operating Accrual, is obtained as *EBIT* less *CFO*
[131] ΔAR = Change in Accounts Receivable per the Statement of Cash Flow (EX.CFOperatingDebtorDecInc).
[132] ΔINV = change in Inventory per the Statement of Cash Flow (EX.CFOperatingStockDecInc)
[133] ΔAP = Change in Accounts Payable per the Statement of Cash Flow (EX.CFOperatingCreditorIncDec)
[134] *DEPAM* = Depreciation and Amortisation per the Statement of Cash Flow.
[135] $OTHER = TACC – (\Delta AR + \Delta INV – \Delta AP – DEPAM)$

such as depreciation and amortisation. In contrast CFO is calculated by adjusting the earnings by the non-cash items in the income statement. TACC includes current accruals and long term accruals and the table indicates that the mean value of current accruals are smaller than the mean value of long term accruals; therefore, TACC is affected by depreciation and amortisation as a proxy for long term accruals. These results are consistent with Dechow et al (1998), Barth et al (2001) and Kim and Kross (2005). Accordingly, the conclusion can be drawn is that the characteristics of the UK data are consistent with accounting information has used in prior studies.. The means of *EBIT* and *CFO* (0.103, and 0.137) are greater than Barth et al's means of *EARN* and *CFO* (0.04 and 0.08) and the mean of *TACC* (-0.034) is lower than Barth et al's mean of accruals (-0.04).

Barth et al (2001) report negative and similar mean and median for accruals (-0.04) which is due to including mean and median depreciation (0.05 and 0.04 respectively) and amortisation (0.01 and 0.00 respectively) in computing accruals. Kim and Kross (2005) also report negative mean and median for accruals, -0.024 and -0.033 respectively. In contrast, Richardson et al (2005) document positive mean and median for accruals, 0.052 and 0.039 respectively, due to their more comprehensive definition of accruals (the change in non-cash working capital *plus* the change in net non-current operating assets *plus* the change in net financial assets) which is not used in this study.

Panel B of Table 5.1 indicates that the variability of *CFO* (0.112) is greater than *EBIT* (0.097), providing initial evidence that accrual accounting reduces variability in mitigating the timing and matching problems in cash accounting through the creation of both accruals and deferrals. Barth et al (2001) report the identical standard deviation to both *CFO* and *EARN* (0.08), whilst Kim and Kross (2005) report greater standard deviation for *CFO* (0.171) than *EARN* (0.152) and Brochet et al (2009) achieve a similar result to Kim and Kross. In contrast, Lev et al (2009) report lower standard deviation for *CFO* (0.129) than net income (0.149).

The mean and (median) of the components of accruals, change in accounts receivable, change in inventory, change in accounts payable, depreciation and amortisation and other are -0.017 (-0.009), -0.007 (-0.001), 0.015 (0.008), 0.048 (0.042), 0.053 (0.033) respectively, with standard deviation of 0.063, 0.037, 0.062, 0.038 and 0.153.

The mean of short term accruals including change in accounts receivable, change in inventory and change in accounts payable [-0.017 + (-0.007) – 0.015] is smaller than the mean of long term accruals including depreciation and amortisation (0.048). Thus, total accrual is affected by long term accruals.

Consistent with Barth et al (2001) depreciation and amortisation as a long term accrual is less variable than current accruals, change in accounts receivable, change in inventory and change in accounts payable.

Using the Balance Sheet changes method of Accrual Computation

Panel A of Table 5.2 indicates distributional statistics for the full sample, before excluding extreme values and Panel B of Table 5.2 indicates distributional statistics after extreme values are excluded.

Table 5.2
Distributional Statistics - Using the Balance Sheet Changes Method of Accrual Computation

Panel A: Full Sample, before Excluding Extreme Values (N = 7,637)

Variables[136]	Mean	S.D.	0.25	Median	0.75	Min	Max
$EBIT_t$[137]	0.100	0.116	0.053	0.096	0.146	-1.081	1.883
CFO_t[138]	0.147	0.154	0.075	0.139	0.212	-1.642	2.291
$TACC_t$[139]	-0.046	0.121	-0.091	-0.041	0.002	-1.691	1.859
ΔTAR_t	0.023	0.086	-0.006	0.009	0.042	-0.947	0.908
ΔINV_t	0.009	0.055	-0.003	0.002	0.020	-0.569	0.700
$\Delta PREP_t$	0.003	0.023	-0.001	0.001	0.007	-0.423	0.511
ΔOCA_t	-0.003	0.064	-0.004	0.000	0.007	-1.269	1.301
ΔLTR_t	0.000	0.008	0.000	0.000	0.000	-0.193	0.300
ΔTAP_t	0.014	0.065	-0.007	0.006	0.028	-1.129	0.914
ΔOCL_t	0.013	0.075	-0.007	0.008	0.032	-1.162	1.168
$\Delta LTOL_t$	0.004	0.066	-0.004	0.000	0.008	-1.746	1.013
$DEPAM_t$	0.048	0.044	0.026	0.041	0.059	0.000	1.664

Panel B of Table 5.2 demonstrates that the mean and median values of $EBIT_t$ (0.104 and 0.098) and CFO_t (0.149 and 0.141) are positive and the mean and median value of accruals (-0.045 and -0.041) are negative. These results also reflect the fact that *EBIT* includes non-cash expenses such as depreciation and amortisation, but *CFO* is computed by adjusting the earnings by the non-cash activities in the income statement.

The means of *EBIT*, *CFO* and *TACC* (0.104, 0.149 and -0.045), when using the balance sheet changes method are greater than means of *EBIT*, *CFO* and *TACC* (0.103, 0.137 and -0.034), when using the Statement of Cash Flow information.

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[136] All variables deflated by the average of total assets. Variable definitions with respective Extel Financial item name are as follows:

[137] *EBIT* = Sales (EX. Sales) minus Total Operating Expenses (EX.TradingExpenses).

[138] $CFO = EBIT - TACC$

[139] $TACC = (\Delta TAR + \Delta INV + \Delta PREP + \Delta OCA) + \Delta LTR - (\Delta TAP + \Delta OCL) - \Delta LTOL - DEPAM$

Panel B: Final Sample, after Excluding Extreme Values (N= 6,553)

Variables	Mean	S.D.	0.25	Median	0.75	Min	Max
$EBIT_t$	0.104	0.101	0.056	0.098	0.147	-1.081	1.049
CFO_t	0.149	0.133	0.078	0.141	0.212	-1.642	1.670
$TACC_t$	-0.045	0.108	-0.088	-0.041	0.001	-1.545	1.547
ΔTAR_t	0.024	0.083	-0.005	0.009	0.042	-0.947	0.868
ΔINV_t	0.009	0.053	-0.003	0.002	0.020	-0.569	0.700
$\Delta PREP_t$	0.003	0.022	-0.001	0.001	0.006	-0.423	0.341
ΔOCA_t	-0.004	0.062	-0.004	0.000	0.006	-1.269	1.041
ΔLTR_t	0.000	0.008	0.000	0.000	0.000	-0.193	0.300
ΔTAP_t	0.015	0.062	-0.006	0.006	0.028	-1.129	0.914
ΔOCL_t	0.012	0.072	-0.007	0.007	0.029	-1.162	1.168
$\Delta LTOL_t$	0.004	0.056	-0.005	0.000	0.007	-1.746	0.731
$DEPAM_t$	0.048	0.038	0.027	0.042	0.059	0.000	1.467

The mean of short term accruals including change in trade accounts receivable, change in inventory, change in prepayments, change in other current assets, change in trade accounts payable and change in other current liabilities [0.024 + 0.009 + 0.003 + (-0.004) – 0.015 – 0.012] is smaller than the mean of long term accruals including change in long term payables and depreciation and amortisation (0.004 + 0.048). Therefore, total accrual is affected by long term accruals, trade accounts receivable, trade accounts payable and other current liabilities.

Panel B of Table 5.2 indicates that the variability of *CFO* (0.133) is greater than *EBIT* (0.101). As noted earlier, this indicates that accrual accounting reduces variability in mitigating the timing and matching problems in cash accounting through the creation of both accruals and deferrals. The variability of *EBIT*, *CFO* and *TACC* (0.101, 0.133 and 0.108 respectively) when using the balance sheet changes method, are greater than *EBIT*, *CFO* and *TACC* (0.097, 0.112 and 0.075 respectively) when using the Statement of Cash Flow information. This is due to non-cash activities because the statement of cash flows does not consider accruals regarding non-cash transactions (see also Collins and Hribar, 2002).

5.2.2. Correlation Analyses

Table 5.3 presents Pearson and Spearman correlation for employed variables in the research models. Panel A and B of Table 5.3 contain the results of correlation analyses performed using the Statement of Cash Flow information and the Balance Sheet changes method respectively.

Using Information from the Statement of Cash Flow

Panel A of Table 5.3 shows that *EBIT* is significantly and positively correlated with *CFO* and *TACC*. Total accrual is significantly and negatively correlated with *CFO*. These results are consistent with Barth et al (2001). The change in accounts receivable ΔAR, the change in inventory ΔINV and the depreciation and amortisation *DEPAM* are negatively correlated with *EBIT*; in contrast, the change in accounts payable ΔAP is significantly and positively correlated with *EBIT*. The change in inventory ΔINV, the change in accounts payable ΔAP, the depreciation and amortisation *DEPAM* are significantly and positively correlated with *CFO*, whilst the change in accounts receivable ΔAR is insignificantly correlated with *CFO*.

As noted in Section 3.4.2, when a correlation coefficient between independent variables is more than 0.80, it indicates that there is a multicollinearity issue. The correlation coefficient between the change in accounts receivable ΔAR and other accruals is high (-0.858 and -0.821 for Pearson and Spearman, respectively) which may leads to multicollinearity in the regression. Nevertheless, the coefficients of the change in accounts receivable ΔAR and other accruals are statistically significant; thus, the high multicollinearity is not treated as a serious issue. Likewise, as pointed out earlier, if the aim of the analyses is prediction, multicollinearity may be given less weight, and the highest R2 may be interpreted directly as indicating the best prediction.The other highest correlation is between *EBIT* and *CFO* (0.753 and 0.726 for Pearson and Spearman, respectively). This is similar to previous studies and is not a serious problem.

Table 5.3
Pearson and Spearman Correlations
Pearson (Spearman) Correlations Above (Below) the Diagonal, the Sample of UK Firms, 1991-2008

Panel A: Final Sample - Using Information from the Statement of Cash Flows

Variables	$EBIT_t$	CFO_t	$TACC_t$	ΔAR_t	ΔINV_t	ΔAP_t	$DEPAM_t$	$OTHER_t$
$EBIT_t$		0.753	0.173	-0.234	-0.188	0.144	-0.042	0.275
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CFO_t	0.726		-0.518	-0.024	0.083	0.231	0.313	-0.112
	(0.000)		(0.000)	(0.049)	(0.000)	(0.000)	(0.000)	(0.000)
$TACC_t$	-0.120	-0.499		-0.341	-0.370	-0.158	-0.523	0.525
	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ΔAR_t	-0.244	0.002	-0.326		0.162	-0.627	0.056	-0.858
	(0.000)	(0.905)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)
ΔINV_t	-0.189	0.056	-0.322	0.217		-0.302	0.073	-0.596
	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
ΔAP_t	0.183	0.220	-0.132	-0.548	-0.294		-0.049	0.647
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)
$DEPAM_t$	0.059	0.330	-0.473	0.050	0.065	-0.049		-0.069
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)
$OTHER_t$	0.276	-0.099	0.507	-0.821	-0.561	0.575	-0.072	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

<u>Using the Balance Sheet changes Method of Accrual Computation</u>

Panel B of Table 5.3 shows that *EBIT* is significantly and positively correlated with *CFO* and *TACC*. *CFO* is significantly and negatively correlated with *TACC*. These results are consistent with correlation coefficients when using the Statement of Cash Flow information.

The ΔTAR, ΔINV, $\Delta PREP$, ΔOCA, ΔTAP and ΔOCL are significantly and positively correlated with *EBIT*; in contrast, the *DEPAM* is significantly and negatively correlated with *EBIT*. The coefficients on ΔLTR and $\Delta LTOL$ are not statistically significant.

The ΔTAR, ΔINV and ΔOCA are significantly and negatively correlated with *CFO*, whilst ΔTAP, ΔOCL, $\Delta LTOL$ and *DEPAM* are significantly and positively correlated with *CFO*. The coefficient on $\Delta PREP$ and ΔLTR are not statistically significant.

When using the Balance Sheet changes method, the correlation coefficients are all less than 0.80; hence, there is not a multicollinearity issue in the research data.

Panel B: Final Sample - Using the Balance Sheet Changes Method of Accrual Computation

Variables	$EBIT_t$	CFO_t	$TACC_t$	ΔTAR_t	ΔINV_t	$\Delta PREP_t$	ΔOCA_t	ΔLTR_t	ΔTAP_t	ΔOCL_t	$\Delta LTOL_t$	$DEPAM_t$
$EBIT_t$		0.608	0.177	0.173	0.194	0.129	0.042	-0.005	0.103	0.086	0.013	-0.061
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.712)	(0.000)	(0.000)	(0.297)	(0.000)
CFO_t	0.599		-0.674	-0.076	-0.160	-0.017	-0.085	-0.006	0.038	0.238	0.410	0.28
	(0.000)		(0.000)	(0.000)	(0.000)	(0.173)	(0.000)	(0.622)	(0.000)	(0.000)	(0.000)	(0.000)
$TACC_t$	0.160	-0.601		0.256	0.379	0.140	0.144	0.003	0.049	-0.215	-0.497	-0.377
	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.789)	(0.000)	(0.000)	(0.000)	(0.000)
ΔTAR_t	0.218	-0.070	0.307		0.206	0.191	-0.335	-0.007	0.652	0.122	0.035	-0.033
	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.570)	(0.000)	(0.000)	(0.005)	(0.008)
ΔINV_t	0.224	-0.113	0.361	0.314		0.080	0.045	-0.006	0.342	0.150	0.075	-0.071
	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.605)	(0.000)	(0.000)	(0.000)	(0.000)
$\Delta PREP_t$	0.136	-0.008	0.135	0.248	0.155		-0.153	-0.048	0.171	0.107	-0.019	-0.010
	(0.000)	(0.509)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.127)	(0.441)
ΔOCA_t	0.091	-0.043	0.139	0.074	0.118	0.010		-0.040	-0.238	0.413	0.046	0.004
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.434)		(0.001)	(0.000)	(0.000)	(0.000)	(0.764)
ΔLTR_t	0.001	0.015	-0.009	0.012	0.006	-0.037	-0.027		-0.011	0.017	0.051	-0.011
	(0.931)	(0.213)	(0.451)	(0.000)	(0.627)	(0.003)	(0.031)		(0.370)	(0.167)	(0.000)	(0.382)
ΔTAP_t	0.161	0.061	0.055	0.548	0.416	0.236	0.112	0.015		-0.082	0.025	-0.045
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.225)		(0.000)	(0.046)	(0.000)
ΔOCL_t	0.147	0.206	-0.138	0.335	0.212	0.164	0.257	0.042	0.172		0.065	-0.016
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)		(0.000)	(0.209)
$\Delta LTOL_t$	0.024	0.248	-0.297	0.083	0.090	0.040	0.085	0.063	0.072	0.139		0.008
	(0.050)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)		(0.519)
$DEPAM_t$	0.055	0.299	-0.390	-0.029	-0.060	0.024	-0.015	-0.026	-0.030	-0.024	0.011	
	(0.000)	(0.000)	(0.000)	(0.021)	(0.000)	(0.057)	(0.239)	(0.033)	(0.015)	(0.052)	(0.395)	

5.3. Model Estimation

As noted earlier, this thesis tests the following research models in predicting future cash flows: the cash flow model; the earnings model; the disaggregated earnings model; and the full disaggregation model as discussed in Section 3.3. Likewise, both in-sample estimations and out-of-sample predictions are used to test the research models, as discussed in Section 3.4. The reader will recall that the current study takes into account two sources of information to compute total accruals (the Statement of Cash Flows and the Balance Sheet changes) and predicted future cash flows across the three prediction horizons, in one-year-ahead (t+1), second-year-ahead (t+2) and third-year-ahead (t+3), using current and up to five lags of predictor variables. This section presents the results of testing the abovementioned research models.

5.3.1. Models Using Information from Statement of Cash Flows

5.3.1.1. In-Sample Estimations Tests

For comparison purposes and consistent with the previous studies (e.g. Barth et al, 2001; Al-Attar and Hussain, 2004), the research models of this study are evaluated using in-sample estimations, which are measured by the adjusted R-squared calculated in OLS regression. In addition, to select the best model, the present research considers Voung's test for the explanatory power of research models. Table 5.4 presents the summary of the results of the in-sample estimations for the research models across several prediction horizons and up to five lagged predictors which are discussed in detail below.

Cash Flow Model

The first model of the research models, the cash flow model, captures the predictive ability of current and past aggregate cash flow with respect to future cash flow. Regression summary statistics from this model are presented in Panel A of Table 5.4 across prediction horizons and up to five lagged predictors.

Panel A of the Table 5.5 shows that CFO_{t} (0.6921 with a t-statistic of 95.78) is significant at the 1% level to predict one-year-ahead cash flows (CFO_{t+1}) and 58.59% of the future cash flow variations are explained by the CFO_{t}.

In addition, Panel B and C of the Table 5.5 show that CFO_{t} is significant at the 1% level to predict second-year-ahead cash flows (CFO_{t+2}) and third -year-ahead cash flows (CFO_{t+3}).

Furthermore, the results indicate that up to five years lags of cash flow from operations increase the adjusted R^2s from 58.59% to 64.48% in predicting one-year-ahead cash flows. The results are true in predicting two-year-ahead (the adjusted R^2s from 44.35% to 51.76%) and three-year-ahead (the adjusted R^2s from 37.04% to 44.48%) cash flows.

Aggregate Earnings Model

The second research model assesses the predictive ability of current and past earnings with respect to future cash flows. Regression summary statistics from this model are presented in Table 5.4 across prediction horizons and up to five lagged predictors. Consistent with prior studies, the aggregate earnings are significant in predicting future cash flows. Panel A of Table 5.6 show that $EBIT_{t}$ explains 55.73% of variation in predicting one-year-ahead cash flows (*CFO* $_{t+1}$) when the coefficient of *EBIT* is 0.7770 with a t-statistic of 90.35.

In addition, Panel B and C of the Table 5.6 present that *EBIT* $_t$ is significant at the 1% level to predict second-year-ahead cash flows (*CFO* $_{t+2}$) and third -year-ahead cash flows (*CFO* $_{t+3}$), and up to three years lags of *EBIT* from operations increase the adjusted R^2s from 55.73% to 58.0% in predicting one-year-ahead cash flows. The results accurately predict two-year-ahead (the adjusted R^2s from 41.77% to 43.95%) and three-year-ahead (the adjusted R^2s from 32.78% to 34.95%) cash flows. These findings are inconsistent with Barth et al (2001) who report that "*up to six lag of earnings are significant in predicting next period cash flow*".

<u>The Comparison of CFO and EBIT Models</u>

As discussed earlier, *CFO* and *EBIT* are significantly and positively correlated with future cash flows. The comparison of testing the current aggregate *EBIT* and the current *CFO* models in predicting one-year-ahead cash flow demonstrates that the adjusted R^2 for the *CFO* only model (58.59%) is higher than that for the *EBIT* only model (55.73%).

This finding is consistent with Barth et al (2001) who report adjusted R^2s of 24% for the *CFO* only model and 15% for the *EBIT* only model. Habib (2010) also documents a higher coefficient for *CFO* (0.82) than the *EARN* (0.62) and a higher adjusted R^2 for the *CFO* model (48%) than *EARN* model (40%). Nevertheless, Kim and Kross (2005) report the average annual R^2 when using the cash flow only model (from 12.9% to 46.9%) and earnings only model (from 12.8% to 52.%) and note that the explanatory power of earnings with respect to future cash flows has been increasing.

Panel B of the Table 5.4 demonstrates that Voung's test for cash flow only model versus earnings only model is insignificant for all prediction horizons, meaning that there is no difference between the explanatory powers of these two models.

As a result, although the *CFO* only model has a higher adjusted R^2 than *EBIT* only model, according to Voung's test, the explanatory power of these two models is similar.

<u>*Disaggregated Earnings Model*</u>

Table 5.7 indicates summary statistics from estimating the model, which disaggregates earnings into cash flow and aggregate accrual, across prediction horizons. As discussed in the previous section, *CFO* is significantly and positively correlated with future cash flows and *TACC* is significantly and negatively correlated with future cash flows.

Based on Panel A of Table 5.7, the regression of one-year-ahead future cash flows on the current cash flow with aggregate accruals for the entire sample demonstrates that CFO_t (0.8336 with a t-statistic of 107.77) and $TACC_t$ (0.4090 with a t-statistic of 35.32) are significant to predict next year cash flows (CFO_{t+1}) and 65.27% of future cash flow variation is explained by this model. The results suggest that *CFO* and *TACC* provide a better explanation of the variation of future cash flows.

In addition, the coefficient of *CFO* (0.8336) is more than that of *TACC* (0.4090). Thus, *CFO* has more effect in explaining future cash flows than *TACC*. This result also indicates that aggregate total accruals have incremental information content in predicting future cash flows and the aggregate *TACC* adds to ability of *CFO* in predicting future cash flow by increasing the coefficient of *CFO* in cash flow model from 0.6921 to 0.8336 in the disaggregated earnings model and reducing intercept from

0.0395 in the cash flow model to 0.0339 in the disaggregated earnings model. As a result, these findings provide evidence that accrual accounting improves cash flow predictions and is better predictor of future cash flow than cash accounting. These results are consistent with Barth et al (2001) who document that aggregate accruals adds significantly to ability of *CFO* in predicting future cash flows.Furthermore, Panel B and C of Table 5.7 show that CFO_t and $TACC_t$ are significant at the 1% level to predict second-year-ahead cash flows (CFO_{t+2}) and third-year-ahead cash flows (CFO_{t+3}).

The results also indicates that up to four years lags of *CFO* and *TACC* increase the adjusted R^2s from 65.27% to 68.91% in predicting one-year-ahead cash flows. Most lags of *CFO* and *TACC* are insignificant when more than three lags are used in estimation models.

Comparison of the Disaggregated Earnings Model with CFO and EBIT Models

The comparison of the adjusted R^2 of the disaggregated earnings model (65.27%) with *CFO* (58.59%) and *EBIT* (55.73%) models for one-year-ahead prediction of future cash flows, demonstrates that disaggregating earnings into cash flow and aggregate accruals adds to predictive ability of the model. Decomposing earnings also increases the coefficient of *CFO* from 0.6921 in the cash flow model to 0.8336 in the disaggregated earnings model and reduces the intercept from 0.0395 in the cash flow model to 0.0339 in the disaggregated earnings model. Testing the equality of the *CFO* and *TACC* coefficients indicates that when *TACC* is added as variable increases the explanatory power the model. Accordingly, *CFO* and *TACC* provide a better explanation of the variation of future cash flows. Thus, the conclusion to be drawn is that the aggregate accrual is incremental to CFO_t to predict future cash flows. These results are consistent with Barth et al (2001) who document that disaggregating earnings increases the adjusted R^2 of their *CFO* model from 24% to 27% in disaggregated earnings model for one-year-ahead prediction of future cash flows.

Panel B of Table 5.4 shows the results of Voung's test, which implies that the explanatory power of the disaggregated earnings model is higher than both the *CFO* only model and aggregate earnings model. These results are true for all prediction horizons.

As a result, according to the adjusted R^2 and Voung's test the disaggregated earnings model is a better predictor of future cash flows than the *CFO* only model and aggregate earnings model.

Full Disaggregation Model (Cash Flow with Accruals components)

Table 5.8 indicates summary statistics from estimating the model, which disaggregates earnings into cash flow and accrual components, across the prediction horizons.

The results show that disaggregating earnings into current cash flows from operations and the current components of accruals (Adj.R^2 69.98%) for one-year-ahead prediction of future cash flows further increases ability to predict future cash flows compared to disaggregating earnings into current cash flows from operations and aggregate accruals (Adj.R^2 65.27%). The results are true for two-year-ahead and three-year-ahead prediction of future cash flows.

In addition, the table demonstrates that the accrual components, with the exception of depreciation and amortisation, are significant in predicting future cash flows with the predicted sign. Inconsistent with Barth et al (2001) depreciation and amortisation are not significant predictor of future cash flows. Nevertheless, in the prediction of future cash flows for two-years-ahead and three-years-ahead, depreciation and amortisation are significant predictors of future cash flows with the predicted sign. These results are consistent with Al-Attar and Hussain (2004).

Furthermore, although the adjusted R^2 of this model in predicting future cash flows for all prediction horizons (when adding lags of variables to the model) increases compared to disaggregating earnings into current cash flows from operations and aggregate accruals, most of the accrual components are not significant predictors of future cash flows.

Panel B of Table 5.4 demonstrates the result of Voung's test, which shows that the explanatory power of the full disaggregation model is higher than other models in one-year-ahead prediction of future cash flows.

As a result, according to the adjusted R^2 and Voung's test the full disaggregation model is a better predictor of future cash flows than other models.

5.3.1.2. Out-of-Sample Prediction Tests

As discussed earlier, out-of-sample predictions tests examine the accuracy of models to measure prediction errors, using estimated parameters provided by in-sample estimation and the data in a holdout sample, Gujarati (2004). There are several methods to estimate out-of-sample tests; the current research study employs the mean adjusted R^2 from annual regressions of actual values on the predicted values, the mean and median prediction errors, the mean and median absolute prediction errors and the mean Theil's U-statistic as out-of-sample tests. Table 5.9 demonstrates the results of out-of-sample prediction tests of research models.

Cash Flow Model vs. Aggregate Earnings Model

Table 5.9 indicates that the mean adjusted R^2 from annual regressions of actual values on the predicted values for the cash flow model (0.421) is higher than for the aggregate earnings model (0.417), and the mean (0.054) and median (0.039) absolute prediction errors and the mean Theil's U-statistic (0.456) for cash flow model are smaller than the mean (0.056) and median (0.041) absolute prediction errors and the mean Theil's U-statistic (0.459) aggregate earnings model for one-year-ahead predictions of cash flow. These findings are true for two-year-ahead and three-year-ahead prediction horizons.

These findings are consistent with Lev et al (2009), who report a higher mean adjusted R^2 (0.46) for their cash flow model than their current net income model (0.37). They also document that the mean error (0.001), the absolute mean error (0.056) and the mean Theil's U-statistic (0.58) of cash flow model are smaller than the mean error (0.003), the absolute mean error (0.062) and the mean Theil's U-statistic (0.64) of their current net income model.

The result is inconsistent with Kim and Kross (2005). Using Theil's U statistic, they conclude that current earnings outperform current cash flow in predicting one-year-ahead future cash flows.

Brochet et al (2009) report smaller mean and median absolute prediction errors for earnings only model, (mean 2.18, median 1.31) than cash flow only model , (mean 2.19, median 1.34), and conclude that accruals outperforms current cash flows in estimating future cash flows.

The results of the in-sample estimations indicate that there is no difference between the explanatory powers of the cash flow and aggregate earnings models in predicting future cash flows. In contrast, the results of the out-of-sample accuracy tests provide evidence that the cash flow model is a better predictor of future cash flow than the earnings model. As a result the findings of the out-of-sample accuracy tests are inconsistent with the in-sample estimations.

Disaggregated Earnings Model vs. Cash Flow and Aggregate Earnings Models

Table 5.9 reveals that the mean adjusted R^2 (0.462) for the disaggregated earnings model is higher than that for *CFO* only (0.421) and aggregate earnings (0.417) models in predicting one-year-ahead cash flows from operations. In addition, the mean (0.053) and median (0.038) absolute prediction errors and the mean Theil's U-statistic (0.445) for the disaggregated earnings model are smaller than those for the cash flow only and aggregate earnings models in predicting one-year-ahead cash flows from operations. These results are true for two-year-ahead and three-year-ahead prediction of cash flows from operations.

Brochet et al (2009) report smaller mean and median absolute prediction errors for their disaggregated earnings model, current cash flows and aggregate accruals, (mean 2.16, median 1.29) than their cash flow only model, (mean 2.19, median 1.34). They report that these results are true for all prediction horizons.

These results are consistent with the in-sample estimations showing that disaggregating earnings into current cash flows from operations and aggregate accruals (Adj. R^2 65.27%) enhances the ability to predict future cash flows compared to aggregate earnings (Adj. R^2 58.59%). Thus, the conclusion is that disaggregating earnings provides more accurate estimation of cash flows from operations.

Full Disaggregation Model (Cash Flow with Accruals Components)

This model examines the contribution of decomposing earnings into cash flow and disaggregated accruals to the prediction of future cash flows. Table 5.9 indicates that the mean adjusted R^2 (0.397) of this model is smaller than that of other models for all prediction horizons. In addition, the mean and median absolute prediction errors and the mean Theil's U-statistic for this model are higher than those for model1, model 2 and model 3 for all prediction horizons. Accordingly, the full disaggregation model does not improve the accuracy of cash flow predictions across prediction horizons.

This is consistent with Brochet et al's (2009) findings that disaggregating accruals does not improve the prediction accuracy of future cash flows. The result is also inconsistent with the in-sample estimations result that disaggregating earnings into current cash flows from operations and the components of accruals (Adj. R^2 69.98%) further increases the ability to predict future cash flows compared to disaggregating earnings into current cash flows from operations and aggregate accruals (Adj. R^2 65.27%).

The conclusion is that disaggregating accruals does not improve the prediction accuracy of future cash flows and prediction models should be tested by out-of-sample prediction tests.

5.3.1.3. The Results of Diagnostic Tests

The present research study uses annual pooled data, a combination of time-series and cross- sectional data, and applies ordinary least squares (OLS) regression. Accordingly, the study employs diagnostic tests to check employed data in order to meet the assumptions of OLS regression.

Heteroscedasticity

An important assumption of OLS regression is the homogeneity of variance; problems arise when the variance of the residuals is not equal across observations. To mitigate the heteroscedasticity problem previous studies deflated variables by the number of outstanding shares, market value of equity and total assets at the end of fiscal year or their average. The present study, following Barth et al (2001), Lev et al (2009) and Brochet et al (2009), scales all variables by the average of total assets.

Multicollinearity

As noted earlier, multicollinearity exists when there is high correlation among two or more independent variables, and leads to unstable coefficients and inflated standard errors for the coefficients. Gujarati (2004) suggests that if the correlation coefficient between independent variables is more than 0.80, multicollinearity is a serious problem and further investigation is required.

Table 5.3 reports that the correlation coefficient between the change in accounts receivable ΔAR and other accruals is high (-0.858 and -0.821 for Pearson and Spearman, respectively) which suggests multicollinearity. Gujarati (2004) also mentions that:

> *....if the sole purposes of regression analysis is prediction or forecasting, then multicollinearity is not a serious problem because the higher the R^2, the better the prediction (Gujarati, 2004, p.369).*

The other method commonly used in the econometric literature to detect multicollinearity effects is the variance inflation factor (VIF). A high VIF indicates high multicollinearity; if the values of VIF for variables are more than 10, the data should be investigated further for multicollinearity. In this study, the computed VIF for two research variables with high negative Pearson correlation, change in accounts receivable and other accruals, were 14.15 and 22.45 respectively.

When the other accruals variable is dropped, the mean of VIF decreases (from 7.84 to 1.47) and the adjusted R^2 is reduced (from 69.98% to 68.52%). Other variables remained significant, but the sign of the change in accounts receivable and change in inventory appear with signs opposite to those predicted. As a result it is determined that this component of the research suffers from multicollinearity. Nevertheless, as mentioned earlier, Gujarati (2004) notes that if the aim of the analyses is prediction, multicollinearity can be disregarded as a serious issue, and the highest R2 interpreted directly as the best prediction. This approach has been followed in this thesis.

Autocorrelation

To detect serial correlation, which occurs when the error terms are not independent in time-series data, most previous researches performed a Durbin-Watson test. The current study uses the Arellano-Bond test (1981) [140] to detect autocorrelation. The results of the Arellano-Bond test (1981) for the four research models are as follows:

Model1 – cash flow model, AR (1): z = - 6.15 pr > z = 0.000

Model2 – aggregate earnings model, AR (1): z = 29.53 pr > z = 0.000

Model3 – disaggregated earnings model, AR (1): z = 2.09 pr > z = 0.0362

Model4 – full disaggregation model, AR (1): z = 4.20 pr > z = 0.000

[140] Roodman, D. 2006. How to do xtabond2: An introduction to “Difference” and “System” GMM in Stata. Working Paper 103. Center for Global Development, Washington.

These results show that there is no serious autocorrelation issue in models 1, 2 and 4, but model 3 suffers serial correlation. It indicates that the error terms are correlated and the OLS assumption is violated.

5.3.2. Models Using Balance Sheet Changes Method of Accrual Computation

5.3.2.1. In-Sample Estimations Tests

Table 5.10 presents the results of the in-sample estimations (OLS regressions and Voung's test) for the research models when using the Balance Sheet changes method across prediction horizons and up to five lagged predictors. Highlights from the table are presented and discussed below.

Cash Flow Model

Regression summary statistics from the cash flow model are presented in Table 5.11 across prediction horizons and up to five lagged predictors. Panel A of Table 5.11 shows that CFO_{t} (0.4240 with a t-statistic of 48.25) is a significant predictor ($p < 0.01$) of one-year-ahead cash flows (CFO_{t+1}) and 26.21% of the future cash flow variations are explained by the CFO_{t}.

In addition, Panel B and C of Table 5.11show that CFO_{t} is significant at the 1% level to predict second-year-ahead cash flows (CFO_{t+2}) and third-year-ahead cash flows (CFO_{t+3}).

Furthermore, the results indicate that up to three years lags of cash flow from operations increase the adjusted R^2s from 26.21% to 36.44% in predicting one-year-ahead cash flows. The results also are true in predicting two-year-ahead (adjusted R^2s from 18.89% to 28.42%) and three-year-ahead (adjusted R^2s from 17.11% to 26.18%) cash flows.

Aggregate Earnings Model

Regression summary statistics from the aggregated earnings model are presented in Table 5.12 across prediction horizons and up to five lagged predictors. Consistent with prior studies, the aggregate earnings are significant in predicting future cash flows. Panel A of Table 5.12 shows that $EBIT_t$ explains 41.74% of variation in predicting one-year-ahead cash flows (CFO_{t+1}) when the coefficient of *EBIT* is 0.7129 with a t-statistic of 68.52.

In addition, Panels B and C of the Table 5.12 present that $EBIT_t$ is significant at the 1% level to predict second-year-ahead cash flow (CFO_{t+2}) and third-year-ahead cash flows (CFO_{t+3}).

Furthermore, the results indicate that up to three years lags of *EBIT* from operations increase the adjusted R^2s from 41.74% to 42.98% in predicting one-year-ahead cash flows. The results accurately predict two-years-ahead cash flows (adjusted R^2s from 31.03% to 33.06%) and three-years-ahead cash flows up to two lagged predictors (adjusted R^2s from 23.82% to 25.07%). In predicting two-year-ahead cash flows, the first lag of *EBIT* is not significant when using more than one lag of *EBIT*. This result is inconsistent with Barth et al (2001) who report that "*up to six lag of earnings are significant in predicting next period cash flow*".

Comparison of CFO and EBIT Models

The comparison of the current aggregate *EBIT* and the current *CFO* models in predicting one-year-ahead cash flow demonstrates that the adjusted R^2 for the *EBIT* only model (41.74%) is higher than that for the *CFO* only model (26.21%).

This result is inconsistent with Barth et al (2001) who report the adjusted R^2 for a *CFO* only model of 24% and an *EBIT* only model 15%. As noted earlier, Habib (2010) report a higher coefficient for *CFO* (0.82) than *EARN* (0.62) and a higher adjusted R^2 for his *CFO* model (48%) than *EARN* model (40%). This result is also consistent with Kim and Kross (2005), who report an average annual R^2 when using the cash flow only model (from 12.9% to 46.9%) and earnings only model (from 12.8% to 52.%) and note that the explanatory power of earnings with respect to future cash flows has been increasing.

Panel B of the Table 5.10 presents the result of Voung's test, which indicates that the explanatory power of the aggregate earnings model is greater than the cash flow that of only model across all prediction horizons.

As a result, the *EBIT* only model is a better predictor in predicting future cash flows than the *CFO* model.

Disaggregated Earnings Model

Table 5.13 contains summary statistics from estimating the disaggregated earnings model, across prediction horizons. As noted earlier, *CFO* is significantly and positively correlated with future cash flows and *TACC* is significantly and negatively correlated with future cash flows.

The regression of one-year-ahead future cash flows on the current cash flow with aggregate accruals for the entire sample demonstrates that CFO_t (0.7427 with a t-statistic of 71.65) and $TACC_t$ (0.5861 with a t-statistic of 45.61) are significant predictors of next year cash flows (CFO_{t+1}) and 43.99% of future cash flow variation is explained by this model. In addition, the coefficient of *CFO* (0.7427) is more than *TACC* (0.5861). Thus, *CFO* has more effect in explaining future cash flows.

Furthermore, Panel B and C of table 5.13 show that CFO_t and $TACC_t$ are significant predictors (at the 1% level) of second-year-ahead cash flows (CFO_{t+2}) and third-year-ahead cash flows (CFO_{t+3}).

The results also indicate that up to three years lags of *CFO* and *TACC* increase the adjusted R^2s from 43.99% to 47.31% in predicting one-year-ahead cash flows. Likewise, the adjusted R^2s are raised from 32.48% to 36.45% in predicting two-year-ahead cash flows when using three years lags of *CFO* and *TACC*. Similarly, the adjusted R^2s increases from 26.05% to 29.69% in predicting three-years-ahead cash flows when using two years lags of *CFO* and *TACC*.

Comparison of the Disaggregated Earnings Model with CFO and EBIT Models

The comparison of the adjusted R^2 of the disaggregated earnings model (43.99%) with *CFO* (26.21%) and *EBIT* (41.74%) models for one-year-ahead prediction of future cash flows, demonstrates that disaggregating earnings into cash flow and aggregate accruals adds to predictive ability of the model. This result is true for the second-year-ahead and third-year-ahead prediction of future cash flows.

Decomposing earnings also increases the coefficient of *CFO* from 0.4240 in the cash flow model to 0.7427 in the disaggregated earnings model. Thus, the conclusion is that the aggregate accrual is incremental to *CFO* $_t$ to predict future cash flows. The results are consistent with Barth et al (2001) who document that disaggregating earnings increases the adjusted R^2 of their *CFO* model from 24% to 27% in disaggregated earnings model for one-year-ahead prediction of future cash flows.

Panel B of the Table 5.10 shows the results of Voung's test, which indicates that the explanatory power of the disaggregated earnings model is higher than that of the cash flow only model whilst there is no difference between the explanatory power of the disaggregated earnings model and aggregate earnings model at a 1% significant level. This result is true for all prediction horizons

Full Disaggregation Model (Cash Flow with Accruals components)

Table 5.14 contains summary statistics from estimating the full disaggregation model (which disaggregates earnings into cash flow and accrual components) across the prediction horizons.

The results show that disaggregating earnings into current cash flows from operations and the current components of accruals (Adj.R^2 53.48%) for one-year-ahead prediction of future cash flows further increases the ability to predict future cash flows compared to disaggregating earnings into current cash flows from operations and aggregate accruals (Adj.R^2 43.99%). The results are true for two-year-ahead and three-year-ahead cash flows.

In addition, the table demonstrates that the accrual components are significant in predicting future cash flows with the predicted sign. The finding remains true for two-year-ahead and three-year-ahead cash flows.

Although the adjusted R^2 of this model in predicting future cash flows for all prediction horizons (when adding lags of variable to the model) increases compared to disaggregating earnings into current cash flows from operations and aggregate accruals, most of the accrual components are not significant to predictors of future cash flows.

Panel B of the Table 5.10 demonstrates the result of Voung's test. The explanatory power of the full disaggregation model is higher than that of other models in one-year-ahead prediction of future cash flows.

5.3.2.2. Out- of - Sample Prediction Tests

Table 5.15 demonstrates the results of out-of-sample prediction tests by research models across prediction horizons.

Cash Flow Model vs. Aggregate Earnings Model

Table 5.15 indicates that the mean adjusted R^2 from annual regressions of actual values on the predicted values for the cash flow model (0.238) is smaller than that of the aggregate earnings model (0.319) and the mean (0.071) and median (0.054) absolute prediction errors and the mean Theil's U-statistic (0.522) for cash flow model are higher than the mean (0.067) and median (0.050) absolute prediction errors and the mean Theil's U-statistic (0.495) aggregate earnings model for one-year-ahead cash flow. This is true for two-year-ahead and three-year-ahead prediction horizons. Consistent with in-sample estimations, these results confirm that the aggregate earnings model is a better predictor of future cash flows.

This result is inconsistent with Lev et al (2009), who report a higher mean adjusted R^2 (0.46) for their cash flow model than their current net income model (0.37).

They also document that the mean error (0.001), the absolute mean error (0.056) and the mean Theil's U-statistic (0.58) of their cash flow model are smaller than the mean error (0.003), the absolute mean error (0.062) and the mean Theil's U-statistic (0.64) of their current net income model.

The results from the current research are consistent with Kim and Kross (2005). Using Theil's U statistic, they conclude that current earnings outperform current cash flow in predicting one-year-ahead future cash flows.

Disaggregated Earnings Model vs. Cash Flow and Aggregate Earnings Models

Table 5.15 reveals that the mean adjusted R^2 (0.334) for the disaggregated earnings model is higher than those for the cash flow only (0.238) and aggregate earnings (0.319) models in predicting one-year-ahead cash flows from operations.

In addition, the mean (0.066) and median (0.050) absolute prediction errors and the mean Theil's U-statistic (0.492) for the disaggregated earnings model are marginally smaller than those for the cash flow only and aggregate earnings models in predicting one-year-ahead cash flows from operations. These results are not true for two-year-ahead and three-year-ahead prediction of cash flows from operations.

These results are consistent with the outcome of in-sample estimations showing that there is no difference between the explanatory powers of disaggregated earnings and aggregate earnings.

Full Disaggregation Model (Cash Flow with Accruals Components)

Table 5.15 indicates that the mean adjusted R^2 of the full disaggregation model is smaller than those of other models for all prediction horizons. In addition, the mean and median absolute prediction errors and the mean Theil's U-statistic for this model are higher than those for model1, model 2 and model 3 for all prediction horizons. Accordingly, the full disaggregation model does not improve the accuracy of cash flow predictions across prediction horizons. This result is consistent with Brochet et al (2009), who show that disaggregating accruals does not improve prediction accuracy of future cash flows. In contrast, the result is inconsistent with the in-sample estimations result that disaggregating earnings into current cash flows from operations and the components of accruals further increases the ability to predict future cash flows compared to disaggregating earnings into current cash flows from operations and aggregate accruals.

5.3.2.3. The Results of Diagnostic Tests

The following diagnostic tests are applied in order to meet the assumptions of OLS regression.

Heteroscedasticity

As noted previously, to mitigate the heteroscedasticity problem, the present study scaled all variables by the average of total assets.

Multicollinearity

Panel B of Table 5.3 shows that the correlation coefficients between independent variables are less than 0.80, thus, there is no multicollinearity issue. The variance inflation factor (VIF) tests also confirm that there is no multicollinearity issue.

Autocorrelation

As noted earlier, this study uses the Arellano-Bond test (1981) [141] to detect autocorrelation. The result of the Arellano-Bond test (1981) for research model are as follows:

Model1 – cash flow model, AR (1): z = 4.14 pr > z = 0.000

Model2 – aggregate earnings model, AR (1): z = 16.81 pr > z = 0.000

Model3 – disaggregated earnings model, AR (1): z = 7.09 pr > z = 0.000

Model4 – full disaggregation model, AR (1): z = 3.06 pr > z = 0.002

These results show that there is no autocorrelation.

5.4. Summary

This chapter discusses the preliminary results of the research including descriptive statistics and model estimation, in-sample estimations and out-of-sample accuracy tests, for the two approaches to compute accruals, using either Cash Flow Statement information, or alternatively the Balance Sheet changes method.

When using the Statement of Cash Flows information, the adjusted R2 of the cash flow model is higher than the aggregate earnings model, whilst Voung's test of these models indicates that there is no difference in explanatory power between them. Disaggregating earnings into cash flows from operations and aggregate accruals enhances the ability of the estimation model to predict future cash flows compared to the aggregate earnings model. In addition, Voung's test of these models confirms that the explanatory power of the disaggregated earnings model is greater than that the

[141] Roodman, D. 2006. How to do xtabond2: An introduction to " Difference" and "System" GMM in Stata. Working Paper 103. Center for Global Development, Washington.

aggregate earnings model and the cash flow model. In addition, disaggregating earnings into cash flows from operations and the accruals components further increases the ability to predict future cash flows compared to disaggregating earnings into cash flows from operations and aggregate accruals. This result is also confirmed by Voung's test. The accrual components, with the exception of depreciation and amortisation, are significant predictors of future cash flows with the predicted sign. Whilst, the depreciation and amortisation variable is significant in predicting two and three-year-ahead cash flows. These results are consistent with Al-Attar and Hussain (2004). The result of out-of-sample accuracy tests demonstrate that the cash flows model marginally outperforms the aggregate earnings model in estimating future cash flows for all prediction horizons and disaggregating earnings into cash flows from operations and aggregate accruals improves accuracy of estimating future cash flows; this finding is consistent with the study by Brochet et al (2009) and provides evidence regarding the standard setter's point of view that earnings components are important predictors of future cash flows and confirm that accrual accounting is superior to cash accounting. Although the in-sample estimations suggest further improvement when the total accrual is disaggregated into its accrual components but the out-of-sample tests do not provide evidence of a significant improvement in the second stage of disaggregation.

When using the Balance Sheet changes method, the results of the in-sample estimation (the adjusted R2 and Voung's test) of the cash flow model with the aggregate earnings model indicate that the ability of the aggregate earnings model to predict future cash flows is greater than that of the cash flow model. The results of out-of-sample accuracy tests also confirm that the aggregate earnings model outperforms the cash flow only model in estimating future cash flows for all prediction horizons. This result is the opposite of the finding produced when using the Statement of Cash Flows information.

These findings support that that accrual accounting is superior to cash accounting. In addition, the adjusted R2 of the disaggregated earnings model indicates that disaggregating earnings into cash flow and aggregate accruals enhance the ability of the prediction model to predict future cash flows compared to the aggregate earnings model, whilst this result is not confirmed by Voung's test, which confirms that there is no difference between the explanatory power of the disaggregated earnings model and the aggregate earnings model. The results of out-of-sample accuracy tests indicate that there is not considerable difference between the aggregate earnings model and disaggregated earnings model. Consistent with in-sample estimation, the results of out-of-sample accuracy tests confirm that disaggregating earnings into cash flow from operations and aggregate accruals do not improve the accuracy of estimating future cash flows. Disaggregating earnings into cash flow from operations and the accruals components further increases the ability to predict future cash flows over disaggregating earnings into cash flows from operations and aggregate accruals. This result is confirmed by Voung's test. The accrual components are significant predictors of future cash flows with the predicted sign. Out-of-sample accuracy tests indicated that further disaggregation of accruals do not improve the accuracy of estimating future cash flows.

In brief, these results reinforce the standard setters' point of view that accrual accounting is superior to cash accounting in predicting future cash flows.

Chapter 6 will investigate whether the initial results are sensitive to alternative approaches, further control variables and econometric model choice. Chapter 7 also will present whether the primary results are sensitive to the effect of the sampling issues in accounting research.

Table 5.4
Summary of the Result of In-Sample Estimations, Using Information from the Statement of Cash Flows

Panel A: Adjusted R^2 for the Research Models, Prediction Horizons and up to Five Lagged Predictors

	Current year only	Current and One Lag	Current and Two Lags	Current and Three Lags	Current and Four Lags	Current and Five Lags
Model 1- Cash Flow:						
One- year-ahead	0.5859	0.6141	0.6318	0.6372	0.6408	0.6448
Two-year-ahead	0.4435	0.4558	0.4781	0.4977	0.5144	0.5176
Three-year-ahead	0.3704	0.3928	0.4215	0.4434	0.4441	0.4448
Model 2- Aggregate Earnings						
One- year-ahead	0.5573	0.5614	0.5644	0.5802	0.5748	0.5569
Two-year-ahead	0.4177	0.4118	0.4235	0.4395	0.4323	0.4237
Three-year-ahead	0.3278	0.3259	0.3401	0.3495	0.3470	0.3457
Model 3- Disaggregated Earnings (Cash Flow with Aggregate Accruals)						
One- year-ahead	0.6527	0.6621	0.6751	0.6883	0.6891	0.6879
Two-year-ahead	0.4909	0.4974	0.5159	0.5376	0.5435	0.5448
Three-year-ahead	0.3998	0.4096	0.4367	0.4605	0.4659	0.4693
Model 4- Full Disaggregation (Cash Flow with Accruals components)						
One- year-ahead	0.6998	0.7018	0.7044			
Two-year-ahead	0.5355	0.5282	0.5428			
Three-year-ahead	0.4298	0.4334	0.4536			

Panel B: Vuong's Test

	Prediction Horizons		
	One- year-ahead	Two-year-ahead	Three-year -ahead
Model 2 (Earnings only) > Model 1 (Cash Flow only)	-0.70	-1.40	-1.81
Model 3 (Disaggregated Earnings) > Model 1 (Cash Flow only)	5.00	3.56	2.77
Model 4 (Full Disaggregation) > Model 1 (Cash Flow only)	6.70	5.73	3.89
Model 3 (Disaggregated Earnings) > Model 2 (Earnings only)	3.42	5.04	4.19
Model 4 (Full Disaggregation) > Model 2 (Earnings only)	5.01	7.15	5.74
Model 4 (Full Disaggregation) > Model 3 (Disaggregated Earnings)	5.49	4.70	3.17

Table 5.5
Regression of Future *CFO* on Current and Past Aggregate *CFO*

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \varepsilon_{i,t}$$

Panel A: One- year-ahead Prediction.

	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0395		.0310		.0276		.0251		.0222		.0196	
CFO_{t}	.6921	95.78 ***	.5482	54.31 ***	.5608	51.18 ***	.5672	48.18 ***	.5596	44.98 ***	.5490	40.89 ***
CFO_{t-1}			.1990	23.15 ***	.1058	9.13 ***	.1009	7.92 ***	.1197	8.73 ***	.1136	7.75 ***
CFO_{t-2}					.1014	10.48 ***	.0798	7.03 ***	.0675	5.27 ***	.0938	6.44 ***
CFO_{t-3}							.0320	3.10 ***	.0225	1.81 *	.0127	0.90
CFO_{t-4}									.0251	2.35 **	.0017	0.13
CFO_{t-5}											..0339	3.06 ***
Adj. R^2	0.5859		0.6141		0.6318		0.6372		0.6408		0.6448	
N	6485		5823		5210		4621		4111		3631	
(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%												

Panel B: Two- year-ahead Prediction

Variables	Current year only			Current and One Lag			Current and Two Lags			Current and Three Lags			Current and Four Lags			Current and Five Lags		
	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Intercept	.0563			.0509			.0450			.0389			.0318			.0300		
CFO_t	.5523	68.25	***	.4033	34.96	***	.4015	32.19	***	.4259	31.37	***	.4057	28.41	***	.4159	27.22	***
CFO_{t-1}				.1836	16.74	***	.1299	9.61	***	.1149	7.57	***	.1584	9.70	***	.1542	8.78	***
CFO_{t-2}							.0916	7.79	***	.0746	5.37	***	.0589	3.81	***	.0435	2.63	***
CFO_{t-3}										.0424	3.40	***	.0175	1.19		.0176	1.10	
CFO_{t-4}													.0521	4.15	***	.0114	0.77	
CFO_{t-5}																.0563	4.43	***
Adj. R^2	0.4435			0.4558			0.4781			0.4977			0.5144			0.5176		
N	5845			5210			4637			4108			3618			3172		

Panel C: Three- year-ahead Prediction.

Variables	Current year only			Current and One Lag			Current and Two Lags			Current and Three Lags			Current and Four Lags			Current and Five Lags		
	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Intercept	.0653			.0570			.0483			.0399			.0364			.0346		
CFO_t	.4771	55.36	***	.3472	28.22	***	.3587	26.18	***	.3841	25.79	***	.3806	23.86	***	.3964	23.18	***
CFO_{t-1}				.1820	15.00	***	.1380	9.34	***	.1036	6.30	***	.0982	5.56	***	.1019	5.36	***
CFO_{t-2}							.0842	6.50	***	.0524	3.44	***	.0471	2.80	***	.0368	2.02	**
CFO_{t-3}										.0851	6.51	***	.0459	2.92	***	.0328	1.85	*
CFO_{t-4}													.0671	4.91	***	.0613	3.73	***
CFO_{t-5}																.0146	1.02	
Adj. R^2	0.3704			0.3928			0.4215			0.4434			0.4441			0.4448		
N	5210			4630			4109			3614			3166			2765		

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Table 5.6
Regression of Future *CFO* on Current and Past Aggregate *EBIT*

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} EBIT_{i,t-k} + \varepsilon_{i,t}$$

Panel A: One- year-ahead Prediction

	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0540		.0533		.0501		.0472		.0452		.0435	
EBIT $_t$	.7770	90.35 ***	.7397	47.86 ***	.7432	44.87 ***	.7808	44.13 ***	.7763	40.61 ***	.7501	35.09 ***
EBIT $_{t-1}$			.0346	2.36 ***	(.0474)	(2.46) **	(.0628)	(3.03) ***	(.0516)	(2.23) **	(.0674)	(2.46) **
EBIT $_{t-2}$					.1071	7.75 ***	.0283	1.46	.0363	1.69 *	.1189	4.66 ***
EBIT $_{t-3}$							.0839	5.60 ***	.0436	2.11 **	.0267	1.12
EBIT $_{t-4}$									.0413	2.62 ***	(.0128)	(0.57)
EBIT $_{t-5}$											.0365	2.12 **
Adj. R^2	0.5573		0.5614		0.5644		0.5802		0.5748		0.5569	
N	6485		5823		5210		4621		4111		3631	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Panel B: Two- year-ahead Prediction

Variables	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0696		.0680		.0630		.0581		.0560		.0534	
EBIT $_t$	.6095	64.76 ***	.5392	32.55 ***	.5485	31.45 ***	.5940	31.26 ***	.5864	26.47 ***	.5718	23.21 ***
EBIT $_{t-1}$			.0812	5.22 ***	(.0105)	(0.48)	(.0277)	(1.15)	(.0091)	(0.33)	.0324	1.03
EBIT $_{t-2}$					.1239	7.43 ***	.0896	4.03 ***	.0735	2.96 ***	.0403	1.45
EBIT $_{t-3}$							.0448	2.59 ***	(.0014)	(0.06)	.0366	1.40
EBIT $_{t-4}$									.0545	2.94 ***	(.0189)	(0.73)
EBIT $_{t-5}$											.0588	2.96 ***
Adj. R^2	0.4177		0.4118		0.4235		0.4395		0.4323		0.4237	
N	5845		5210		4637		4108		3618		3172	

Panel C: Three- year-ahead Prediction

Variables	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0782		.0750		.0694		.0635		.0603		.0580	
EBIT $_t$	0.5138	50.41 ***	.4223	22.90 ***	.4361	21.84 ***	.4925	22.24 ***	.5110	20.89 ***	.5101	19.22 ***
EBIT $_{t-1}$			.1141	6.36 ***	.0539	2.24 ***	.0335	1.27	.0002	0.01	.0266	0.81
EBIT $_{t-2}$					0.876	4.80 ***	.0033	0.13	.0391	1.44	.0122	0.41
EBIT $_{t-3}$							.0861	4.37 ***	.0113	2.92	.0190	0.65
EBIT $_{t-4}$									.0730	4.91 ***	.0121	0.41
EBIT $_{t-5}$											.0680	3.00 ***
Adj. R^2	0.3278		0.3259		0.3401		0.3495		0.3470		0.3457	
N	5210		4630		4109		3614		3166		2765	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Table 5.7
Regression of Future *CFO* on Current and Past *CFO* and Accruals

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 2_{t-k} TACC_{i,t-k} + \varepsilon_{i,t}$$

Panel A: One- year-ahead Prediction.

	Current year only			Current and One Lag			Current and Two Lags			Current and Three Lags			Current and Four Lags			Current and Five Lags		
Variables	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Intercept	.0339			.0300			.0260			.0230			.0201			.0162		
CFO_t	.8336	107.77	***	.7983	56.77	***	.7954	53.46	***	.8300	52.41	***	.8331	48.12	***	.8063	43.64	***
CFO_{t-1}				.0287	2.15	**	(.0247)	(1.39)		(.0442)	(2.31)	**	(.0534)	(2.54)	**	(.0749)	(3.13)	***
CFO_{t-2}							.0723	5.70	***	.0212	(1.20)		.0452	2.32	***	.1124	4.99	***
CFO_{t-3}										.0522	3.82	***	.0161	0.86		.0194	0.92	
CFO_{t-4}													.0273	1.94	**	(.0310)	(1.58)	
CFO_{t-5}																.0410	2.72	***
$TACC_t$	.4090	35.32	***	.4400	27.58	***	.4275	24.96	***	.4802	26.17	***	.4839	24.35	***	.4604	21.37	***
$TACC_{t-1}$				(.1429)	(9.41)	***	(.1066)	(6.04)	***	(.1256)	(6.63)	***	(.1445)	(6.83)	***	(.1652)	(6.66)	***
$TACC_{t-2}$							(.0648)	(4.52)	***	(.0899)	(5.02)	***	(.0507)	(2.58)	***	(.0138)	(0.59)	
$TACC_{t-3}$										(.0155)	(1.01)		(.0448)	(2.31)	**	(.0329)	(1.49)	
$TACC_{t-4}$													(.0275)	(1.74)	*	(.0805)	(3.95)	***
$TACC_{t-5}$																(.0163)	(0.96)	
Adj. R^2	0.6527			0.6621			0.6751			0.6883			0.6891			0.6879		
N	6485			5823			5210			4621			4111			3631		

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Panel B: Two- year-ahead Prediction

Variables	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0528		.0488		.0421		.0355		.0303		.0277	
CFO $_t$	.6575	73.43 ***	.5992	37.08 ***	.6040	35.79 ***	.6299	35.01 ***	.6040	29.33 ***	.5911	26.11 ***
CFO $_{t-1}$			.0628	4.14 ***	(.0064)	(0.30)	(.0047)	(0.20)	.0203	0.77	.0523	1.77 *
CFO $_{t-2}$					.0971	5.99 ***	.0621	2.89	.0698	2.97 ***	.0352	1.35
CFO $_{t-3}$							.0405	2.45 **	(.0163)	(0.71)	.0227	0.92
CFO $_{t-4}$									.0581	3.35 ***	(.0199)	(0.82)
CFO $_{t-5}$											.0619	3.38 ***
TACC $_t$	.3144	23.37 ***	.3403	19.29 ***	.3512	18.86 ***	.3828	18.30 ***	.3467	14.60 ***	.3210	12.20 ***
TACC $_{t-1}$			(.1061)	(6.18) ***	(.1375)	(6.43) ***	(.1281)	(5.46) ***	(.1177)	(4.43) ***	(.0619)	(2.09) *
TACC $_{t-2}$					(.0211)	(1.16)	(.0610)	(2.74) ***	(.0252)	(1.02)	(.0412)	(1.52)
TACC $_{t-3}$							(.0297)	(1.60)	(.0713)	(3.04) ***	(.0319)	(1.25)
TACC $_{t-4}$									(.0277)	(1.41)	(.0812)	(3.24) ***
TACC $_{t-5}$											(.0267)	(1.28)
Adj. R^2	0.4909		0.4947		0.5159		0.5376		0.5435		0.5448	
N	5845		5210		4637		4108		3618		3172	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Panel C: Three- year-ahead Prediction

Variables	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0624		.0562		.0472		.0384		.0347		.0324	
CFO_{t}	.5570	56.92 ***	.4732	26.14 ***	.4957	25.51 ***	.5240	24.97 ***	.5389	23.51 ***	.5481	22.23 ***
CFO_{t-1}			.10177	5.78 ***	.0407	1.73 **	.0389	1.54	.0057	0.21	.0285	0.92
CFO_{t-2}					.0837	4.71 ***	-.0029	-0.12	.0336	1.30	.0033	0.12
CFO_{t-3}							.0970	5.20 ***	.0262	1.01	.0264	0.94
CFO_{t-4}									.0639	3.27 ***	.0230	0.82
CFO_{t-5}											.0467	2.20 **
$TACC_{t}$	.2354	16.00 ***	.2163	10.93 ***	.2257	10.58 ***	.2420	10.06 ***	.2776	10.52 ***	.2758	9.66 ***
$TACC_{t-1}$			(.0606)	(3.07) ***	(.0967)	(4.00) ***	(.0627)	(2.37)	(.0849)	(2.95) ***	(.0591)	(1.80) *
$TACC_{t-2}$					(.0128)	(0.65)	(.0947)	(3.81) ***	(.0559)	(2.07)	(.0862)	(2.92) ***
$TACC_{t-3}$							(.0118)	(0.56)	(.0569)	(2.15) **	(.0496)	(1.70) *
$TACC_{t-4}$									(.0385)	(1.75) *	(.0794)	(2.73) ***
$TACC_{t-5}$											.0284	1.19
Adj. R^2	0.3998		0.4096		0.4367		0.4605		0.4659		0.4693	
N	5210		4630		4109		3614		3166		2765	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Table 5.8
Regression of Future *CFO* on Current and Past *CFO* and Components of Accruals

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 2(1)_{t-k} \Delta AR_{i,t-k} + \sum_{k}^{K} \beta 2(2)_{t-k} \Delta INV_{i,t-k} + \sum_{k}^{K} \beta 2(3)_{t-k} \Delta AP_{i,t-k} + \sum_{k}^{K} \beta 2(4)_{t-k} DEPAMORT_{i,t-k} + \sum_{k}^{K} \beta 2(5)_{t-k} Other_{i,t-k} + \varepsilon_{i,t}$$

Panel A: One- year-ahead Prediction

Variables	Current year only		Current and One Lag		Current and Two Lags	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0139		.0118		.0127	
CFO_{t}	.8272	111.99 ***	.8196	60.59 ***	.8132	55.65 ***
CFO_{t-1}			(.0012)	(0.10)	(.0466)	(2.62) ***
CFO_{t-2}					.0660	(5.09) ***
ΔAR_{t}	.1081	2.63 ***	-.0435	(0.91)	(.0636)	(1.27)
ΔAR_{t-1}			(.0649)	(1.56)	.0642	1.53
ΔAR_{t-2}					(.0228)	(0.58)
ΔINV_{t}	.3113	6.93 ***	.1255	2.54 **	.1305	2.53 **
ΔINV_{t-1}			(.0465)	(1.07)	.0656	1.50
ΔINV_{t-2}					(.0551)	(1.32)
ΔAP_{t}	(.7037)	(43.23) ***	(.7213)	(35.67) ***	(.6714)	(29.35) ***
ΔAP_{t-1}			.0658	3.46 ***	.0805	3.55 ***
ΔAP_{t-2}					.0244	1.29
$DEPAM_{t}$	.0284	1.45	.0303	0.69	.0524	1.17
$DEPAM_{t-1}$			.0850	1.99 **	.0789	1.46
$DEPAM_{t-2}$					(.0770)	(1.87) *
$Other_{t}$	.3792	17.79 ***	.3063	12.20 ***	.2947	11.13 ***
$Other_{t-1}$			(.0670)	(3.04) ***	(.0120)	(0.54)
$Other_{t-2}$					(.0313)	(1.51)
Adj. R^2	0.6998		0.7018		0.7044	
N	6485		5823		5210	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Panel B: Two- year-ahead Prediction

	Current year only			Current and One Lag			Current and Two Lags		
Variables	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Intercept	.0288			.0306			.0271		
CFO_t	.6518	74.32	***	.6256	38.26	***	.6220	35.85	***
CFO_{t-1}				.0345	2.22	**	(.0110)	(0.50)	
CFO_{t-2}							.0769	(4.70)	***
ΔAR_t	.1220	2.77	***	.1789	3.56	***	(.2104)	(4.09)	***
ΔAR_{t-1}				(.0142)	(0.30)		(.0492)	(0.91)	
ΔAR_{t-2}							(.0128)	(0.24)	
ΔINV_t	.2505	5.27	***	.2443	4.62	***	.2450	4.51	***
ΔINV_{t-1}				(.0364)	(0.72)		(.0688)	(1.22)	
ΔINV_{t-2}							(.0430)	(0.75)	
ΔAP_t	(.5145)	(26.07)	***	(.5337)	(22.09)	***	(.5059)	(18.85)	***
ΔAP_{t-1}				.0333	1.47		.0644	2.32	**
ΔAP_{t-2}							(.0307)	(1.32)	
$DEPAM_t$	.1743	6.79	***	.1302	2.67	***	.1082	2.14	**
$DEPAM_{t-1}$				.0054	0.11		.0541	0.83	
$DEPAM_{t-2}$							(.0402)	(0.77)	
$Other_t$	.3196	14.22	***	.3386	13.23	***	.3534	13.52	***
$Other_{t-1}$				(.0424)	(1.70)	*	(.0742)	(2.60)	***
$Other_{t-2}$							(.0131)	(0.45)	
Adj. R^2	0.5355			0.5282			0.5428		
N	5845			5210			4637		

Panel C: Three- year-ahead Prediction

	Current year only			Current and One Lag			Current and Two Lags		
Variables	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Intercept	.0440			.0420			.0357		
CFO_t	.5476	50.69	***	.4863	26.95	***	.5033	25.82	***
CFO_{t-1}				.0861	4.89	***	.0391	1.64	
CFO_{t-2}							.0667	3.71	***
ΔAR_t	.2249	3.96	***	.1340	2.19	**	.1363	2.10	*
ΔAR_{t-1}				.0038	0.06		(.1298)	(1.80)	
ΔAR_{t-2}							.0601	1.04	
ΔINV_t	.2264	3.77	***	.1425	2.26	**	.1132	1.68	
ΔINV_{t-1}				(.0084)	(0.14)		(.1613)	(2.18)	**
ΔINV_{t-2}							.0919	1.48	
ΔAP_t	(.3482)	(14.77)	***	(.3673)	(13.85)	***	(.3587)	(11.84)	***
ΔAP_{t-1}				(.0163)	(0.66)		.0168	0.56	
ΔAP_{t-2}							(.0249)	(0.99)	
$DEPAM_t$	.1746	5.27	***	.1869	3.25	***	.0967	1.61	
$DEPAM_{t-1}$				(.0459)	(0.81)		.0152	0.21	
$DEPAM_{t-2}$							.0269	0.44	
$Other_t$	.2745	9.46	***	.2237	7.12	***	.2244	6.73	***
$Other_{t-1}$				(.0121)	(0.38)		(.0978)	(2.55)	**
$Other_{t-2}$							.0441	1.40	
Adj. R^2	0.3679			0.4334			0.4536		
N	5407			4630			4109		

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Table 5.9

Out-of-Sample Estimations Using Information from the Statement of Cash Flows

		Mean Adj.R^2 [142]	Prediction Errors[143]		Absolute[20] Prediction Errors		Mean Theil's U [144]
			Mean	Median	Mean	Median	
One –year-ahead (*CFO* $_{t+1}$):							
Model 1	Cash Flow only	0.421	-0.001	-0.002	0.054	0.039	0.456
Model 2	Aggregate Earnings	0.417	0.001	-0.002	0.056	0.041	0.459
Model 3	Disaggregated Earnings	0.462	0.000	-0.002	0.053	0.038	0.445
Model 4	Full Disaggregation	0.397	-0.002	-0.001	0.057	0.039	0.556
Two-year-ahead (*CFO* $_{t+2}$):							
Model 1	*CFO* only	0.346	-0.001	-0.003	0.055	0.041	0.466
Model 2	Aggregate Earnings	0.338	0.000	-0.003	0.057	0.043	0.465
Model 3	Disaggregated Earnings	0.371	-0.001	-0.002	0.055	0.041	0.459
Model 4	Full Disaggregation	0.239	-0.001	-0.001	0.067	0.041	0.893
Three-year-ahead (*CFO* $_{t+3}$):							
Model 1	*CFO* only	0.309	-0.001	-0.003	0.055	0.043	0.457
Model 2	Aggregate Earnings	0.294	0.000	-0.002	0.056	0.043	0.463
Model 3	Disaggregated Earnings	0.334	0.000	-0.002	0.054	0.041	0.453
Model 4	Full Disaggregation	0.211	0.000	-0.001	0.066	0.042	0.836

[142] The mean Adj.R^2 was obtained per yearly regressions of actual values of future *CFO* on predicted values of *CFO*. Predicted values were calculated by using estimated coefficients computed by estimating cross-sectional regression for each industry-year and actual values of *CFO* related to last year.

[143] The mean and median of predictions errors and the mean and median of absolute prediction errors, computed by actual values of future *CFO* minus predicted future *CFO*.

[144] Following Lev et al (2009), the mean Theil's U-statistic was calculated as the square root of ∑ (actual values future *CFO* – predicted future *CFO*) $^2 / \sum$ (actual values future *CFO*) ^{2}.

Table 5.10

Summary of Results of In-Sample Estimations, Using the Balance Sheet Changes Method of Accrual Computation

Panel A: Adjusted R^2 for the Research Models, Prediction Horizons and up to Five Lagged Predictors

	Current year only	Current and One Lag	Current and Two Lags	Current and Three Lags	Current and Four Lags	Current and Five Lags
Model 1- Cash Flow:						
One-year-ahead	0.2621	0.3312	0.3426	0.3644	0.3595	0.3465
Two-year-ahead	0.1889	0.2499	0.2798	0.2842	0.2786	0.2666
Three-year-ahead	0.1711	0.2312	0.2513	0.2618	0.2386	0.2379
Model 2- Aggregate Earnings						
One-year-ahead	0.4174	0.4193	0.4127	0.4289	0.4215	0.3909
Two-year-ahead	0.3103	0.3124	0.3161	0.3306	0.3058	0.2931
Three-year-ahead	0.2382	0.2368	0.2507	0.2490	0.2245	0.2412
Model 3- Disaggregated Earnings (Cash Flow with Aggregate Accruals)						
One-year-ahead	0.4399	0.4497	0.4482	0.4731	0.4679	0.4450
Two-year-ahead	0.3248	0.3363	0.3506	0.3645	0.3443	0.3347
Three-year-ahead	0.2605	0.2740	0.2908	0.2969	0.2706	0.2822
Model 4- Full Disaggregation(Cash Flow with Accruals components)						
One-year-ahead	0.5348	0.5386	0.5333			
Two-year-ahead	0.4060	0.4084	0.4203			
Three-year-ahead	0.3141	0.3217	0.3319			

Panel B: Vuong's Z-statistic

	Prediction Horizons		
	One-year-ahead	Two-year-ahead	Three-year-ahead
Model 2 (Earnings only) > Model 1 (Cash Flow only)	4.02	4.20	2.57
Model 3 (Disaggregated Earnings) > Model 1 (Cash Flow only)	6.39	5.79	4.74
Model 4 (Full Disaggregation) > Model 1 (Cash Flow only)	11.12	8.07	6.10
Model 3 (Disaggregated Earnings) > Model 2 (Earnings only)	1.86	2.04	2.22
Model 4 (Full Disaggregation) > Model 2 (Earnings only)	4.75	6.97	5.93
Model 4 (Full Disaggregation) > Model 3 (Disaggregated Earnings)	5.55	6.43	4.38

Table 5.11

Regression of Future *CFO* on Current and Past Aggregate *CFO*

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \varepsilon_{i,t}$$

Panel A: One-year-ahead Prediction

	Current year only			Current and One Lag			Current and Two Lags			Current and Three Lags			Current and Four Lags			Current and Five Lags		
Variables	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Intercept	.0842			.0632			.0560			.0473			.0443			.0408		
CFO_t	.4240	48.25	***	.3416	36.07	***	.3080	29.42	***	.2983	27.13	***	.2784	22.94	***	.2611	20.01	***
CFO_{t-1}				.2110	23.97	***	.1538	15.67	***	.1456	13.44	***	.1369	11.42	***	.1135	8.52	***
CFO_{t-2}							.1338	14.59	***	.0952	9.23	***	.1031	8.69	***	.1224	9.12	***
CFO_{t-3}										.1026	10.18	***	.1003	8.60	***	.0999	7.20	***
CFO_{t-4}													.0388	3.52	***	.0420	3.26	***
CFO_{t-5}																.0305	2.57	***
Adj. R^2	0.2621			0.3312			0.3426			0.3644			0.3595			0.3465		
N	6553			5885			5263			4678			4149			3668		

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Panel B: Two-year-ahead Prediction

	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0952		.0761		.0650		.0607		.0530		.0501	
CFO $_t$	.3381	37.04 ***	.2496	24.89 ***	.2259	20.43 ***	.2222	18.52 ***	.1905	14.25 ***	.1857	12.59 ***
CFO $_{t-1}$			.2080	21.70 ***	.1512	13.96 ***	.1272	10.31 ***	.1372	9.96 ***	.1311	8.39 ***
CFO $_{t-2}$					.1470	14.30 ***	.1335	11.06 ***	.1373	9.62 ***	.1254	7.95 ***
CFO $_{t-3}$							.0653	5.67 ***	.0652	4.89 ***	.0729	4.60 ***
CFO $_{t-4}$									.0534	4.33 ***	.0427	2.98 ***
CFO $_{t-5}$											.0360	2.78 ***
Adj. R^2	0.1889		0.2499		0.2798		0.2842		0.2786		0.2666	
N	5885		5260		4674		4148		3666		3223	

Panel C: Three-year-ahead Prediction

	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0991		.0801		.0700		.0613		.0610		.0571	
CFO $_t$	.3074	32.98 ***	.2300	21.75 ***	.2046	16.52 ***	.1908	14.25 ***	.1759	11.50 ***	.1780	10.43 ***
CFO $_{t-1}$			.1987	19.32 ***	.1719	14.29 ***	.1631	11.59 ***	.1468	9.32 ***	.1480	8.16 ***
CFO $_{t-2}$					.1155	10.29 ***	.0932	7.10 ***	.0974	6.25 ***	.1039	6.02 ***
CFO $_{t-3}$							.0837	6.91 ***	.0597	4.17 ***	.0625	3.68 ***
CFO $_{t-4}$									.0458	3.52 ***	.0440	2.88 ***
CFO $_{t-5}$											.0055	0.41
Adj. R^2	0.1711		0.2312		0.2513		0.2618		0.2386		0.2379	
N	5267		4681		4152		3657		3226		2810	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Table 5.12
Regression of Future *CFO* on Current and Past Aggregate *EBIT*

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} EBIT_{i,t-k} + \varepsilon_{i,t}$$

Panel A: One-year-ahead Prediction

	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0733		.0724		.0708		.0659		.0657		.0654	
EBIT $_t$	.7129	68.52 ***	.6546	37.38 ***	.6481	34.50 ***	.6822	33.58 ***	.7001	30.09 ***	.6860	26.48 ***
EBIT $_{t-1}$			.0624	3.80 ***	(.0395)	(1.75)	(.0456)	(1.82) **	(.0780)	(2.85) **	(.1000)	(3.01)
EBIT $_{t-2}$					.1268	7.52 ***	.0425	1.77 **	.0526	2.00	.0746	2.35 **
EBIT $_{t-3}$							.0977	5.24 ***	.0627	2.41 **	.0727	2.42 ***
EBIT $_{t-4}$									.0498	2.56 ***	.0018	0.07
EBIT $_{t-5}$											.0452	2.05 ***
Adj. R^2	0.4174		0.4193		0.4127		0.4298		0.4215		0.3909	
N	6553		5885		5263		4678		4149		3668	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Panel B: Two-year-ahead Prediction

	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0865		.0845		.0801		.0759		.0733		.0718	
$EBIT_t$	.5781	51.46 ***	.4848	24.80 ***	.5062	24.45 ***	.5350	23.60 ***	.5230	19.27 ***	.4934	16.38 ***
$EBIT_{t-1}$			.1133	6.09 ***	(.0035)	(0.13)	(.0002)	(0.01)	.0149	0.44	.0742	1.89 *
$EBIT_{t-2}$					.1299	6.43 ***	.0755	2.76 ***	.0605	1.87 *	.0391	1.05
$EBIT_{t-3}$							.0668	3.19 ***	.0033	0.11	.0120	0.36
$EBIT_{t-4}$									.0844	3.61 ***	.0081	0.24
$EBIT_{t-5}$											.0702	2.83 ***
Adj. R^2	0.3103		0.3124		0.3161		0.3306		0.3058		0.2931	
N	5885		5260		4674		4148		3666		3223	

Panel C: Three-year-ahead Prediction

	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0954		.0930		.0875		.0814		.0824		.0760	
$EBIT_t$	.4880	40.60 ***	.3707	17.08 ***	.3934	16.70 ***	.4237	15.80 ***	.4349	13.77 ***	.5231	14.77 ***
$EBIT_{t-1}$			.1355	6.46 ***	.0600	2.12 **	.0229	0.70	(.0221)	(0.58)	(.0622)	(1.39)
$EBIT_{t-2}$					.0875	4.93 ***	.0118	0.38	.0782	2.31 **	.0465	1.19
$EBIT_{t-3}$							.1356	5.68 ***	.0199	0.58	.0452	1.19
$EBIT_{t-4}$									.0703	2.75 ***	.0314	0.85
$EBIT_{t-5}$											.0529	1.87 **
Adj. R^2	0.2382		0.2368		0.2507		0.2490		0.2245		0.2412	
N	5267		4681		4152		3657		3226		2810	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Table 5.13

Regression of Future *CFO* on Current and Past *CFO* and Accruals

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 1_{t-k} TACC_{i,t-k} + \varepsilon_{i,t}$$

Panel A: One-year-ahead Prediction

	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0632		.0569		.0519		.0433		.0416		.0381	
CFO $_t$	.7427	71.65 ***	.6875	39.85 ***	.6795	36.84 ***	.7087	35.89 ***	.7287	31.89 ***	.7141	28.31 ***
CFO $_{t-1}$			.0666	4.14 ***	(.0263)	(1.19)	(.0345)	(1.42)	(.0710)	(2.66) **	(.1063)	(3.27) ***
CFO $_{t-2}$					.1225	7.40 ***	.0466	2.00 **	.0495	1.94 *	.0818	2.62 ***
CFO $_{t-3}$							.0978	5.38 ***	.0863	3.43 ***	.0979	3.33 ***
CFO $_{t-4}$									.0335	1.75 *	(.0086)	(0.32)
CFO $_{t-5}$											.0275	1.28
TACC $_t$	.5861	45.61 ***	.5436	29.09 ***	.5482	27.46 ***	.5853	27.48 ***	.6097	25.71 ***	.6020	22.83 ***
TACC $_{t-1}$			(.0350)	(1.97) **	(.1073)	(4.63) ***	(.1133)	(4.45) ***	(.1303)	(4.74) ***	(.1480)	(4.56) ***
TACC $_{t-2}$					.0323	1.78	(.0274)	(1.13)	(.0179)	(0.67)	(.0014)	(0.05)
TACC $_{t-3}$							.0039	0.20	(.0114)	(0.44)	.0020	0.07
TACC $_{t-4}$									(.0209)	(1.04)	(.0575)	(2.06) **
TACC $_{t-5}$											(.0310)	(1.35)
Adj. R^2	0.4399		0.4497		0.4482		0.4731		0.4679		0.4450	
N	6553		5885		5263		4678		4149		3668	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Panel B: Two- year-ahead Prediction

	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0785		.0710		.0620		.0572		.0518		.0490	
CFO_{t}	.6003	53.8 ***	.5017	25.78 ***	.5199	25.39 ***	.5514	24.51 ***	.5241	19.41 ***	.5016	16.74 ***
CFO_{t-1}			.1282	6.93 ***	.0137	0.53	(.0015)	(0.05)	.0183	0.55	.0667	1.69 *
CFO_{t-2}					.1363	6.82 ***	.1024	3.77 ***	.0929	2.89 ***	.0662	1.78 *
CFO_{t-3}							.0576	2.76 ***	.0139	0.47	.0239	0.72
CFO_{t-4}									.0698	3.01 ***	.0202	0.62
CFO_{t-5}											.0510	2.07 **
$TACC_{t}$	.4820	34.42 ***	.4048	19.42 ***	.4256	19.35 ***	.4677	19.52 ***	.4549	16.21 ***	.4450	14.26 ***
$TACC_{t-1}$			.0221	1.11	(.0723)	(2.70) ***	(.0675)	(2.32) **	(.0488)	(1.45)	.0167	0.043
$TACC_{t-2}$					.0286	1.33	8.23	0.00	(.0148)	(0.45)	(.0265)	(0.72)
$TACC_{t-3}$							.0050	0.23	(.0490)	(1.61)	(.0524)	(1.54)
$TACC_{t-4}$									.0120	0.49	(.0424)	(1.26)
$TACC_{t-5}$											(.0114)	(0.44)
Adj. R^2	0.3248		0.3363		0.3506		0.3645		0.3443		3347	
N	5885		5260		4674		4148		3666		3223	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Panel C: Three-year-ahead Prediction

	Current year only		Current and One Lag		Current and Two Lags		Current and Three Lags		Current and Four Lags		Current and Five Lags	
Variables	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0857		.0768		.0682		.0593		.0600		.0548	
CFO $_t$	.5144	42.77 ***	.3900	18.15 ***	.4089	17.43 ***	.4334	16.27 ***	.4431	13.98 ***	.5192	14.64 ***
CFO $_{t-1}$			.1558	7.50 ***	.0931	3.31 ***	.0527	1.62	.0029	0.08	(.0324)	(0.72)
CFO $_{t-2}$					.0992	4.61 ***	.0251	0.83	.0848	2.51 **	.0587	1.49
CFO $_{t-3}$							.1237	5.26 ***	.0355	1.05	.0557	1.48
CFO $_{t-4}$									.0494	1.95 *	.0440	1.20
CFO $_{t-5}$											.0147	0.52
TACC $_t$	.3749	25.26 ***	.2639	11.54 ***	.2973	12.06 ***	.3206	11.61 ***	.3415	10.59 ***	.4346	11.86 ***
TACC $_{t-1}$			.0336	1.52	(.0189)	(0.66)	(.0582)	(1.77) *	(.0901)	(2.37) **	(.1205)	(2.74) ***
TACC $_{t-2}$					.0179	0.79	(.0513)	(1.66) *	.0046	0.13	(.0328)	(0.83)
TACC $_{t-3}$							.0585	2.33 **	(.0266)	(0.77)	(.0048)	(0.13)
TACC $_{t-4}$									(.0011)	(0.04)	(.0028)	(0.08)
TACC $_{t-5}$											(.0010)	(0.03)
Adj. R^2	0.2605		0.2740		0.2908		0.2969		0.2706		0.2822	
N	5267		4681		4152		3657		3226		2810	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

Table 5.14
Regression of Future *CFO* on Current and Past *CFO* and Components of Accruals

$$CFO_{i,t+j} = \beta 0 + \sum_{k}^{K} \beta 1_{t-k} CFO_{i,t-k} + \sum_{k}^{K} \beta 2(1)_{t-k} \Delta TAR_{i,t-k} + \sum_{k}^{K} \beta 2(2)_{t-k} \Delta INV_{i,t-k} + \sum_{k}^{K} \beta 2(3)_{t-k} \Delta PREP_{i,t-k} + \sum_{k}^{K} \beta 2(4)_{t-k} \Delta OCA_{i,t-k} + \sum_{k}^{K} \beta 2(5)_{t-k} \Delta LTR_{i,t-k} + \sum_{k}^{K} \beta 2(6)_{t-k} \Delta TAP_{i,t-k} + \sum_{k}^{K} \beta 2(7)_{t-k} \Delta OCL_{i,t-k} + \sum_{k}^{K} \beta 2(10)_{t-k} \Delta LTOL_{i,t-k} + \sum_{k}^{K} \beta 2(11)_{t-k} DEPAM_{i,t-k} + \varepsilon_{i,t}$$

Panel A: One-year-ahead Prediction

Variables	Current year only		Current and One Lag		Current and Two Lags	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0278		.0223		.0241	
CFO_t	.7629	78.69 ***	.7157	44.03 ***	.7042	40.48 ***
CFO_{t-1}			.0587	3.85 ***	(.0204)	(0.98)
CFO_{t-2}					.0992	6.32 ***
ΔTAR_t	.7795	43.48 ***	.7249	32.33 ***	.7234	29.20 ***
ΔTAR_{t-1}			.0168	0.76	(.0405)	(1.52)
ΔTAR_{t-2}					.0416	1.81 *
ΔINV_t	.5227	25.62 ***	.5154	20.27 ***	.5346	19.67 ***
ΔINV_{t-1}			(.0155)	(0.64)	(.0641)	(2.20) **
ΔINV_{t-2}					(.0048)	(0.19)
$\Delta PREP_t$	.7308	16.22 ***	.6517	12.95 ***	.7171	13.24 ***
$\Delta PREP_{t-1}$			.1897	4.05 ***	.0707	1.32
$\Delta PREP_{t-2}$					.1966	3.95 ***
ΔOCA_t	.7895	39.04 ***	.7119	26.85 ***	.8046	23.34 ***
ΔOCA_{t-1}			.0232	1.01	(.0313)	(1.09)
ΔOCA_{t-2}					.0718	3.07 ***
ΔLTR_t	.7234	6.02 ***	.7394	6.04 ***	.8155	6.47 ***
ΔLTR_{t-1}			.3915	3.06 ***	.2313	1.75 *
ΔLTR_{t-2}					.0746	0.49
ΔTAP_t	(.8333)	(36.09) ***	(.7982)	(28.71) ***	(.8178)	(26.24) ***
ΔTAP_{t-1}			(.0470)	(1.76) *	.0190	0.60
ΔTAP_{t-2}					(.0452)	(1.63)
ΔOCL_t	(.8025)	(43.59) ***	(.7474)	(31.64) ***	(.7191)	(27.82) ***
ΔOCL_{t-1}			.0005	0.02	.0700	2.58 ***
ΔOCL_{t-2}					(.0964)	(4.19) ***
$\Delta LTOL_t$	(.7478)	(39.11) ***	(.7111)	(31.12) ***	(.7074)	(29.13) ***
$\Delta LTOL_{t-1}$			(.1604)	(7.14) ***	(.0902)	(3.41) ***
$\Delta LTOL_{t-2}$					(.1533)	(6.53) ***
$DEPAM_t$	.1497	5.69 ***	.1396	2.31 **	.1563	2.39 **
$DEPAM_{t-1}$			.0874	1.52	.1578	2.17 **
$DEPAM_{t-2}$					(.1351)	(3.43) ***
Adj. R^2	0.5348		0.5386		0.5342	
N	6553		5883		5333	

(***) significant at the level of 1%, (**) significant at the level of 5%,
(*) significant at the level of 10%

Panel B: Two-year-ahead Prediction

Variables	Current year only			Current and One Lag			Current and Two Lags		
	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Intercept	.0429			.0479			.0407		
CFO_t	.6166	56.74	***	.5210	27.54	***	.5359	26.88	***
CFO_{t-1}				.1223	6.78	***	.0252	1.01	
CFO_{t-2}							.1196	6.12	***
ΔTAR_t	.5399	26.40	***	.4757	18.28	***	.4606	16.29	***
ΔTAR_{t-1}				.0379	1.47		(.0356)	(1.13)	
ΔTAR_{t-2}							.0312	1.16	
ΔINV_t	.4375	18.50	***	.3978	13.59	***	.4110	13.12	***
ΔINV_{t-1}				.0266	0.97		(.0423)	(1.26)	
ΔINV_{t-2}							.0253	0.90	
$\Delta PREP_t$	.7005	14.36	***	.6015	10.64	***	.6545	11.14	***
$\Delta PREP_{t-1}$				.2540	4.67	***	.1241	2.05	**
$\Delta PREP_{t-2}$							.0636	1.05	
ΔOCA_t	.5314	24.59	***	.4356	14.87	***	.4573	12.17	***
ΔOCA_{t-1}				.0652	2.50	**	(.0356)	(1.05)	
ΔOCA_{t-2}							.0741	2.70	***
ΔLTR_t	.9802	7.24	***	.8215	5.89	***	.8982	6.36	***
ΔLTR_{t-1}				.0833	0.51		.0877	0.54	
ΔLTR_{t-2}							.3133	1.53	
ΔTAP_t	(.5977)	(22.82)	***	(.5494)	(17.25)	***	(.4960)	(14.12)	***
ΔTAP_{t-1}				(.0760)	(2.45)	***	(.0006)	(0.02)	
ΔTAP_{t-2}							(.0432)	(1.38)	
ΔOCL_t	(.5392)	(26.22)	***	(.4621)	(17.20)	***	(.4642)	(15.85)	***
ΔOCL_{t-1}				(.1027)	(3.97)	***	.0109	0.34	
ΔOCL_{t-2}							(.1089)	(3.98)	***
$\Delta LTOL_t$	(.7375)	(34.95)	***	(.6534)	(25.31)	***	(.6866)	(25.05)	***
$\Delta LTOL_{t-1}$				(.1927)	(7.39)	***	(.1158)	(3.73)	***
$\Delta LTOL_{t-2}$							(.1769)	(6.10)	***
$DEPAM_t$	.2415	7.34	***	.2546	3.80	***	.2117	3.03	***
$DEPAM_{t-1}$				(.1640)	(2.56)	**	(.0037)	(0.04)	
$DEPAM_{t-2}$							(.0794)	(1.09)	
Adj. R^2	0.4060			0.4084			0.4203		
N	5885			5260			4674		

(***) significant at the level of 1%, (**) significant at the level of 5%,
(*) significant at the level of 10%

Panel C: Three-year-ahead Prediction

Variables	Current year only			Current and One Lag			Current and Two Lags		
	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Intercept	.0629			.0559			.0485		
CFO_t	.5240	43.99	***	.4028	19.02	***	.4129	17.66	***
CFO_{t-1}				.1550	7.53	***	.0974	3.50	***
CFO_{t-2}							.0924	4.29	***
ΔTAR_t	.4019	17.86	***	.2981	10.24	***	.3200	9.90	***
ΔTAR_{t-1}				.0448	1.60		(.0055)	(0.16)	
ΔTAR_{t-2}							.0625	2.11	**
ΔINV_t	.3444	13.81	***	.2590	8.21	***	.2961	8.50	***
ΔINV_{t-1}				.0411	1.40		(.0196)	(0.54)	
ΔINV_{t-2}							.0781	2.53	**
$\Delta PREP_t$	.5703	10.23	***	.3835	6.14	***	.4196	6.31	***
$\Delta PREP_{t-1}$				.0973	1.50		.0524	0.69	
$\Delta PREP_{t-2}$							.1879	2.70	***
ΔOCA_t	.4474	18.90	***	.3115	9.41	***	.3319	7.74	***
ΔOCA_{t-1}				.0915	3.20	***	.0201	0.54	
ΔOCA_{t-2}							.0340	1.13	
ΔLTR_t	.3021	1.78	*	.2792	1.64		.3462	2.01	**
ΔLTR_{t-1}				.1657	0.79		.1585	0.73	
ΔLTR_{t-2}							1.377	0.40	
ΔTAP_t	(.4477)	(15.78)	***	(.3455)	(10.00)	***	(.3794)	(9.75)	***
ΔTAP_{t-1}				(.0696)	(2.12)	**	(.0269)	(0.69)	
ΔTAP_{t-2}							(.0315)	(0.91)	
ΔOCL_t	(.4831)	(21.24)	***	(.3360)	(11.29)	***	(.3317)	(10.00)	***
ΔOCL_{t-1}				(.1330)	(4.63)	***	(.0943)	(2.64)	***
ΔOCL_{t-2}							(.0955)	(3.22)	***
$\Delta LTOL_t$	(.5504)	(23.36)	***	(.4417)	(15.19)	***	(.4566)	(14.32)	***
$\Delta LTOL_{t-1}$				(.1794)	(5.98)	***	(.1213)	(3.44)	***
$\Delta LTOL_{t-2}$							(.0869)	(2.71)	***
$DEPAM_t$	.1128	3.51	***	.2513	3.21	***	.1331	1.67	*
$DEPAM_{t-1}$				(.0758)	(0.98)		.0197	0.19	
$DEPAM_{t-2}$							.0337	0.39	
Adj. R^2	0.3141			0.3217			0.3319		
N	5267			4681			4152		

(***) significant at the level of 1%, (**) significant at the level of 5%,
(*) significant at the level of 10%

Table 5.15

Summary of Out-of-Sample Estimations of *CFO*, Using the Balance Sheet Changes Method of Accrual Computation

		Mean Adj.R^2	Prediction Errors		Absolute[20] Prediction Errors		Mean Theil's U
			Mean	Median	Mean	Median	
One –year-ahead (*CFO* $_{t+1}$):							
Model 1	Cash Flow only	0.238	-0.002	-0.003	0.071	0.054	0.522
Model 2	Aggregate Earnings	0.319	0.001	-0.002	0.067	0.050	0.495
Model 3	Disaggregated Earnings	0.334	0.000	-0.002	0.066	0.050	0.492
Model 4	Full Disaggregation	0.213	-0.001	-0.002	0.077	0.051	0.670
Two-year-ahead (*CFO* $_{t+2}$):							
Model 1	*CFO* only	0.192	0.000	-0.004	0.070	0.054	0.518
Model 2	Aggregate Earnings	0.273	0.001	-0.004	0.066	0.051	0.489
Model 3	Disaggregated Earnings	0.278	0.001	-0.003	0.066	0.051	0.491
Model 4	Full Disaggregation	0.138	0.001	-0.002	0.080	0.054	0.780
Three-year-ahead (*CFO* $_{t+3}$):							
Model 1	*CFO* only	0.176	0.001	-0.004	0.069	0.055	0.508
Model 2	Aggregate Earnings	0.229	0.001	-0.004	0.067	0.053	0.488
Model 3	Disaggregated Earnings	0.234	0.001	-0.003	0.067	0.052	0.491
Model 4	Full Disaggregation	0.101	-0.003	-0.002	0.086	0.055	0.890

Chapter 6

Additional Analyses

6.1. Introduction

This chapter investigates whether the preliminary results of the current study are robust with respect to alternative dependent variables, further control variables and econometric model choice. Section 6.2 outlines the estimation of operating income. Section 6.3 provides evidence as to firm size effect on the research models. Section 6.4 reviews the effects of magnitude of accruals. Section 6.5 presents the effects of adding both firm size and absolute magnitude of accruals to research models. The effect of positive or negative cash flow from operations and operating income are discussed in Sections 6.6 and 6.7. Sections 6.8 and 6.9 discuss industry effects and the effect of mergers and acquisitions on the estimations. The result of using panel data regression methods are presented in Section 6.10.

6.2. Estimation of Operating Income

The current study investigates whether the initial results are robust to the choice of an alternative dependent variable estimated future operating income. The current research defines operating income as earnings before interest and tax (*EBIT*).

Using out-of-sample accuracy tests, Lev et al (2009) predict future operating income. Table 6.1 contains summary statistics for the out-of-sample prediction tests of Lev et al's five research models, including the mean absolute prediction error (MAER) and mean error (MER) from the pooled sample, the mean adjusted R^2 from regressions of actual values on the predicted values and the mean of Theil's U-statistic.

Table 6.1
Lev et al's (2009) Out-of-Sample Accuracy Tests in Predicting Future Operating Income

	Out-of-sample accuracy tests			
Prediction model	MAER	MER	R^2	Theil's U
CFO $_{t+1}$**:**				
Model 1 – *CFO* only	0.061	0.002	0.45	0.59
Model 2 – Net income	0.057	0.002	0.52	0.56
Model 3 – *CFO* and Δ*WC**[145]	0.058	0.001	0.51	0.56
Model 4 – *CFO* , Δ*WC** and *EST*	0.054	0.002	0.58	0.53
Model 5 – Full disaggregation	0.054	0.001	0.58	0.53
CFO $_{t+2}$**:**				
Model 1 – *CFO* only	0.070	0.001	0.30	0.70
Model 2 – Net income	0.070	0.005	0.32	0.70
Model 3 – *CFO* and Δ*WC**	0.069	0.002	0.33	0.69
Model 4 – *CFO* , Δ*WC** and *EST*	0.067	0.003	0.37	0.68
Model 5 – Full disaggregation	0.068	0.003	0.36	0.69
CFO $_{t+1,\, t+2}$**:**				
Model 1 – *CFO* only	0.137	-0.004	0.40	0.64
Model 2 – Net income	0.133	0.005	0.45	0.62
Model 3 – *CFO* and Δ*WC**	0.132	-0.002	0.45	0.61
Model 4 – *CFO* , Δ*WC** and *EST*	0.126	0.002	0.51	0.59
Model 5 – Full disaggregation	0.126	0.002	0.50	0.59
CFO $_{t+1,\, t+3}$**:**				
Model 1 – *CFO* only	0.253	-0.021	0.30	0.72
Model 2 – Net income	0.257	0.000	0.31	0.74
Model 3 – *CFO* and Δ*WC**	0.249	-0.014	0.33	0.71
Model 4 – *CFO* , Δ*WC** and *EST*	0.247	-0.003	0.36	0.71
Model 5 – Full disaggregation	0.250	-0.003	0.35	0.72

Lev et al's out-of-sample accuracy tests indicate that the MAER, MER and Theil's U-statistic of model 1 (0.061, 0.002 and 0.59 respectively) are higher than those of model 2 (0.57, 0.002 and 0.56) and the mean adjusted R^2 of model 1(0.45) is lower than model 2 (0.52) in predicting one-year-ahead operating income. Therefore, model 2 (earnings) performs better than model 1 (cash flows) in predicting one-year-ahead operating income; whilst model 1 (cash flows) improves upon model 2 (earnings) in predicting operating income for two-year-ahead and aggregate next three years. They also report that model 3(*CFO*, Δ*WC*[162] and other accruals) outperforms other models in

[145] Working capital items excluding inventories

predicting operating income for all prediction horizons. However, Lev et al's out-of-sample tests confirm that further desegregations do not improve the prediction of operating income. These results lead Lev et al to the ultimate conclusion that their earnings model is a better predictor of future operating income than the cash flow only model, and that model 3 (*CFO*, ΔWC and other accruals) improves the prediction of operating income.

In-Sample Estimations

Panel A of Table 6.2 summarises key findings of the current research, showing the adjusted R^2 by research models, prediction horizons and up to five lagged predictors in predicting future operating income. The table shows that the aggregate earnings model (with adjusted R^2 80.6%) is a better predictor than the cash flow only model (with adjusted R^2 50.2%) in predicting one-year-ahead operating income. Likewise, disaggregating earnings into cash flows and aggregated accruals and accruals components marginally improves the prediction of operating income. Adding several lags of predictor variables does not improve the prediction of operating income. The results are true to two and three-year-ahead.

Panel B of Table 6.2 demonstrates the result of Voung's test, which shows that the explanatory power of the cash flow model is lower than that of other models in predicting one-year-ahead operating income. These findings are true to two and three-year-ahead.

Panel B also demonstrates that Voung's test for the aggregate earnings model versus the disaggregated earnings model and full disaggregation model is insignificant for all prediction horizons, meaning that there is no difference between the explanatory powers of these three models.

As a result, according to the adjusted R^2 and Voung's test, the aggregate earnings model is a better predictor of future operating income than the other models.

Table 6.2
Summary of In-Sample Estimations of Future *EBIT*

Panel A: The Adjusted R^2 by the research models, prediction horizons and up to five lagged predictors

	Current	Current and One Lag	Current and Two Lags	Current and Three Lags	Current and Four Lags	Current and Five Lags
Model 1- Cash Flow:						
One- year-ahead	0.5021	0.5131	0.4877	0.5236	0.5292	0.5109
Two-year-ahead	0.3767	0.3744	0.3880	0.3881	0.3804	0.3799
Three-year-ahead	0.2562	0.2620	0.2692	0.2929	0.2946	0.2917
Model 2- Aggregate Earnings:						
One- year-ahead	0.8065	0.8009	0.7923	0.8108	0.8101	0.7957
Two-year-ahead	0.5642	0.5587	0.5682	0.5712	0.5650	0.5811
Three-year-ahead	0.4081	0.3930	0.3994	0.4177	0.4308	0.4292
Model 3- Disaggregated Earnings						
One- year-ahead	0.8100	0.8054	0.7953	0.8140	0.8126	0.7993
Two-year-ahead	0.5704	0.5651	0.5742	0.5761	0.5685	0.5850
Three-year-ahead	0.4132	0.3972	0.4023	0.4201	0.4334	0.4336
Model 4- Full Disaggregation						
One- year-ahead	0.8109	0.8080	0.8019			
Two-year-ahead	0.5707	0.5691	0.5811			
Three-year-ahead	0.4169	0.4094	0.4160			

Panel B: The Vuong's Z-statistic by the research models and prediction horizons

	Prediction Horizons		
	One- year-ahead	Two-year-ahead	Three-year-ahead
Model 2 > Model1	12.16	7.98	4.39
Model 3 > Model1	12.22	9.12	5.15
Model 4 > Model1	12.13	9.12	4.97
Model 3 > Model2	1.55	1.63	0.911
Model 4 > Model2	1.55	1.71	1.54
Model 4 > Model3	1.02	0.563	0.978

Panel C: Summary of Regression of the Future *EBIT* on the Current *CFO*, Current *EBIT* and Its Components

			Intercept	CFO_t	$EBIT_t$	$TACC_t$	ΔAR_t	ΔINV_t	ΔAP_t	$DEPAM_t$	$OTHER_t$	Adj.R2
One –year-ahead (*EBIT* $_{t+1}$): N = 6554												
Model 1	Cash Flow only	Coeff.	.0267	.5517								0.5021
		t-stat		81.30 ***								
Model 2	Aggregate Earnings	Coeff.	.0173		.8210							0.8065
		t-stat			165.24 ***							
Model 3	Disaggregated Earnings	Coeff.	.0141	.8298		.7600						0.8100
		t-stat		166.43 ***		103.04 ***						
Model 4	Full Disaggregation	Coeff.	.0172	.8303			.6857	.6976	(.7484)	(.8210)	.7196	0.8109
		t-stat		162.72 ***			26.73 ***	25.40 ***	(66.57) ***	(58.73) ***	54.97 ***	
Second-year-ahead (*EBIT* $_{t+2}$): N = 5852												
Model 1	Cash Flow only	Coeff.	.0418	.4353								0.3767
		t-stat		59.48 ***								
Model 2	Aggregate Earnings	Coeff.	.0370		.6247							0.5642
		t-stat			87.04 ***							
Model 3	Disaggregated Earnings	Coeff.	.0330	.6351		.5505						0.5704
		t-stat		88.03 ***		51.37 ***						
Model 4	Full Disaggregation	Coeff.	.0345	.6378			.5866	.5489	(.5461)	(.5828)	.5552	0.5707
		t-stat		86.16 ***			15.90 ***	14.01	(34.78) ***	(29.44) ***	28.80 ***	
Third-year-ahead (*EBIT* $_{t+3}$): N = 5233												
Model 1	Cash Flow only	Coeff.	.0551	.3218								0.2562
		t-stat		42.46 ***								
Model 2	Aggregate Earnings	Coeff.	.0481		.5010							0.4081
		t-stat			60.06 ***							
Model 3	Disaggregated Earnings	Coeff.	.0449	.5090		.4431						0.4132
		t-stat		60.70 ***		37.43 ***						
Model 4	Full Disaggregation	Coeff.	.0479	.5180			.5242	.4594	(.4236)	(.5136)	.4512	0.4169
		t-stat		60.14 ***			12.09 ***	10.02 ***	(23.87) ***	(27.22) ***	20.20 ***	

Out-of-Sample Predictions

Table 6.3 shows the results of the out-of-sample accuracy tests in predicting operating income, indicating that the MAER, MER and Theil's U-statistic of the cash flow model (0.049, 0.000 and 0.519 respectively) are higher than those of the aggregate earnings model (0.041, 0.001 and 0.427) and the mean adjusted R^2 of aggregate earnings model (0.5394) is higher than that of the cash flow model (0.3626) in predicting one-year-ahead operating income. Therefore, consistent with in-sample estimation results and Lev et al (2009), the aggregate earnings model performs better than the cash flow model in predicting one-year-ahead operating income. However, out-of-sample tests confirm that further desegregations do not improve the prediction of operating income. These findings are true in predicting operating income for two-year-ahead and three-year-ahead.

As a result, both the in-sample estimation and the out-of-sample accuracy tests confirm that the aggregate earnings model is a better predictor of future operating income than the cash flow only, disaggregated earnings and full disaggregation models. Accordingly, the findings confirm that accrual accounting improves earning predictions and is better predictor of future earnings than cash accounting; however, the conclusions do not support the standard setter's point of view that the earnings components are important to prediction.

Table 6.3
Out-of-Sample Accuracy Tests of the Prediction of Future *EBIT*

		Mean Adj.R^2	Prediction Errors		Absolute Prediction Errors		Mean Theil's U
			Mean	Median	Mean	Median	
One –year-ahead (*EBIT* $_{t+1}$):							
Model 1	Cash Flow only	0.3626	0.000	-0.001	0.049	0.048	0.519
Model 2	Aggregate Earnings	0.5394	0.001	0.001	0.041	0.027	0.427
Model 3	Disaggregated Earnings	0.5398	0.000	0.000	0.041	0.026	0.465
Model 4	Full Disaggregation	0.4410	0.001	0.000	0.045	0.027	0.586
Second-year-ahead (EBIT $_{t+2}$):							
Model 1	Cash Flow only	0.2668	-0.002	-0.003	0.047	0.035	0.514
Model 2	Aggregate Earnings	0.4186	0.000	0.000	0.043	0.030	0.471
Model 3	Disaggregated Earnings	0.4195	-0.001	-0.001	0.043	0.030	0.475
Model 4	Full Disaggregation	0.2873	0.001	-0.001	0.051	0.032	0.773
Third-year-ahead (*EBIT* $_{t+3}$):							
Model 1	Cash Flow only	0.2158	-0.001	-0.003	0.036	0.036	0.523
Model 2	Aggregate Earnings	0.3455	0.000	-0.001	0.044	0.032	0.482
Model 3	Disaggregated Earnings	0.3354	0.000	-0.001	0.044	0.033	0.487
Model 4	Full Disaggregation	0.2001	0.001	-0.001	0.055	0.035	0.962

6.3. Firm Size

The current study examines whether the initial results are sensitive to the effect of firm size as a further control variable. Firm size is an important and useful characteristic that can to explain the variability in the prediction of future cash flows across firms documented in previous studies. Kim and Kross (2005) and Lorek and Willinger (2009) note that large firms are diversified and have stable growth but their growth is slow; in contrast, small firms are growth firms and their risk is higher than large firms. Francis (2010) mentions that the prediction of future cash flows" *is a function of firm growth as well as a function of firm size*." Francis also emphasises that size is a proxy for a firm's stability and documents that her results are robust to firm size. Computing mean absolute deflated forecast error (MADFE), Lorek and Willinger (2010) report more accurate cash flow prediction in one-year-ahead for the largest firms in the quintile than for the smallest firms. They conclude that the prediction of future cash flows is highly sensitive to firm size.

Firm size is measured by different ways in published studies: for example, Kim and Kross (2005) measure the firm size based on total assets at the end of each fiscal year and Lorek and Willinger (2010) divide their sample into quintiles based on the average total assets. Francis (2010) partitions the sample into four subsamples based on annual sales.

Accordingly, the current study hypothesises that the ability to predict future cash flows is greater for large firms than for smaller firms. The current research classifies firms by size based on the log of total assets at the end of each fiscal year. The final sample is divided into four quartiles, then OLS regression is performed and Theil's U-statistic is calculated for these subsamples. Regressions summary statistics of the disaggregated earnings model are presented in Table 6.4 across subsamples and Table

6.5 presents Theil's U-statistic of one-year-ahead cash flow predictions for the disaggregated earnings model. Table 6.4 indicates that the adjusted R^2 squared of regressions involving large firms (68.2% for quartile 4) is higher than small firms (63.9% for quartile 1). Table 6.5 reveals that Theil's U-statistic of one-year-ahead cash flow predictions for the largest firms (0.335) is lower than the corresponding Theil's U-statistic for the largest firms (0.592). Accordingly, one-year-ahead cash flow predictions for the largest firms are more accurate than those for the smallest firms. The above evidence shows that the prediction of future cash flows is highly sensitive to firm size. These results are consistent with Lorek and Willinger (2009 and 2010); whilst Kim and Kross (2005) report that firm size does not strongly affect their results.

Table 6.4:
Regressions of Future *CFO* on Current *CFO* and Aggregate Accruals

	Quartile 1			Quartile 2			Quartile 3			Quartile 4		
Variables	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
Intercept	.0357			.0406			.0258			.0269		
CFO_t	.8050	47.85	***	.8052	55.89	***	.8996	53.93	***	.8508	58.33	***
$TACC_t$	.4402	19.07	***	.4225	18.44	***	.4394	17.21	***	.2533	11.00	***
Adj. R^2	0.6394			0.6616			0.6542			0.6825		
N	1330			1638			1748			1789		

Table 6.5
Theil's U-Statistic of One-Year-Ahead Cash Flow Predictions for the Disaggregated Model

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Disaggregated Earnings	0.592	0.457	0.445	0.335

6.4. Magnitude of Accruals Effects

As noted earlier, accounting theory hypothesises that accruals and deferrals mitigate the timing problems of cash accounting by matching costs and revenues in the appropriate period (Dechow, 1994; Dechow et al, 1998). Additionally, although accrual accounting mitigates the timing and matching problems in cash accounting through the creation of accruals and deferrals, it is supposed that cash flow accounting is more reliable and less vulnerable to manipulation than accrual accounting, because the quality of accruals is affected by managerial decisions. Dechow and Dichev (2002) report a negative correlation between the quality of accruals and the magnitude of total accruals. Dechow (1994) hypothesises that when the magnitude of aggregate accruals is large, earnings outperforms cash flows in assessment of firm performance. Partitioning total sample into five samples based on the absolute magnitude of aggregate accruals, Dechow (1994) report a similar association between earnings, cash flows and stock return, when the absolute magnitude of aggregate accruals is small. Nevertheless, when the absolute magnitude of aggregate accruals is high, Dechow (1994) find a stronger association between earnings, and stock return than cash flows and stock return.

The current study investigates the effect on the preliminary results of using the absolute magnitude of aggregate accruals as a further control variable. To do this, this study divides the final sample into five groups based on the absolute magnitude of aggregate accruals. Hence, quintile 1 contains firm-year observations with a small absolute magnitude of aggregate accruals and quintile 5 includes firm-year observations with a large absolute magnitude of aggregate accruals; OLS regression is then repeated for these subsamples. Table 6.6 shows regressions summary statistics across subsamples when predicting one-year-ahead cash flows.

Table 6.6
Effect of the Absolute Magnitude of Aggregate Accruals in Predicting One-Year-Ahead *CFO*

	Preliminary Results		Quintile 1		Quintile 5	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
N	6,485		1,309		1,202	
Model 1- Cash Flow:						
Intercept	.0395		.0267		.0590	
CFO_t	.6921	95.78 ***	.8268	49.28 ***	.5763	35.22 ***
Adj. R^2	0.5859		0.6498		0.5079	
Model 2-Aggregate Earnings:						
Intercept	.0540		.0281		.0937	
$EBIT_t$	.7770	90.35 ***	.8304	49.62 ***	.7182	34.50 ***
Adj. R^2	0.5573		0.6530		0.4975	
Model 3- Disaggregated: Earnings:						
Intercept	.0540		.0274		.0504	
CFO_t	.8336	107.77 ***	.8314	49.68 ***	.8335	45.94 ***
$TACC_t$	.4090	35.32 ***	.5858	3.82 ***	.4572	21.91 ***
Adj. R^2	0.6527		0.6534		0.6483	
Model 4- Full Disaggregation:						
Intercept	.0139		.0154		.0231	
CFO_t	.8275	111.99 ***	.8299	50.27 ***	.8222	50.93 ***
ΔAR_t	.1081	2.63 ***	.1389	0.85	.1020	1.31
ΔINV_t	.3113	6.93 ***	.4165	2.41 **	.3177	3.89 ***
ΔAP_t	(.7037)	(43.23) ***	(.6799)	(4.50) ***	(.7461)	(26.08) ***
$DEPAM_t$	.0284	1.45	(.1568)	(0.93)	(.0061)	(0.19)
$Other_t$	.3792	17.79 ***	.4029	2.66 ***	.3939	10.13 ***
Adj. R^2	0.6998		0.6735		0.7350	

Table 6.6 indicates that the adjusted R-squareds obtained for quintile 1 (models with the smallest absolute magnitude of aggregate accruals) are higher than the adjusted R-squareds of quintile 5 (models with the largest absolute magnitude of aggregate accruals) for models 1, 2 and 3. Whilst, the adjusted R-squareds obtained for quintile 1 is lower than the adjusted R-squareds of quintile 5. The association tests presented above shows that the prediction of future cash flows leads to different result for the various levels of aggregate accruals.

6.5. Adding Firm Size and Absolute Magnitude of Accruals to Research models

The effect of both firm size (the log of total assets at the end of each fiscal year) and absolute magnitude of accruals on the initial results in the regression models is also tested by adding them as control variables to research models. Table 6.7 presents the summary of regression estimations in this respect. The table reveals that these variables are not significant in the cash flow model, whilst they are significant in the aggregate earnings, disaggregated earnings and full disaggregation models.

Table 6.7
Firm Size and Absolute Magnitude of Accruals as Control Variables

	Preliminary Results		Adding control variables	
	Coeff.	t-stat	Coeff.	t-stat
N	6,485		6,485	
Model 1- Cash Flow:				
Intercept	.0395		.0333	
CFO_t	.6921	95.78 ***	.6947	93.41 ***
ABSTACC			.0003	0.89
Firm Size			(.0235)	(1.61)
Adj. R^2	0.5859		0.5860	
Model 2-Aggregate Earnings:				
Intercept	.0540		(.0157)	
$EBIT_t$	.7770	90.35 ***	.7887	96.37 ***
ABSTACC			.3699	26.56 ***
Firm Size			.0024	5.90 ***
Adj. R^2	0.5573		0.6007	
Model 3- Disaggregated Earnings:				
Intercept	.0540		.0022	
CFO_t	.8336	107.77 ***	.8315	108.59 ***
$TACC_t$	.4090	35.32 ***	.4622	37.61 ***
ABSTACC			.1695	11.97 ***
Firm Size			.0012	3.24 ***
Adj. R^2	0.6527		0.6601	
Model 4- Full Disaggregation:				
Intercept	.0139		(.0131)	
CFO_t	.8275	111.99 ***	.8263	111.88 ***
ΔAR_t	.1081	2.63 ***	.1203	2.92 ***
ΔINV_t	.3113	6.93 ***	.3275	7.43 ***
ΔAP_t	(.7037)	(43.23) ***	(.7124)	(43.17) ***
$DEPAM_t$	.0284	1.45	(.0022)	(0.10)
$Other_t$	.3792	17.79 ***	.3906	18.17 ***
ABSTACC			.0478	3.37 ***
Firm Size			.0013	3.70 ***
Adj. R^2	0.6998		0.7007	
(***) significant at the level of 1%,(**) significant at the level of 5%,(*) significant at the level of 10%				

6.6. Positive and Negative *CFO*

The current study considers the effect of positive and negative cash flows from operation on the initial results. Habib (2010), reporting a high correlation between negative earnings and negative *CFO* (0.69), argues that losses are transitory and firms reporting losses should be expected to report negative *CFO*. Therefore, negative *CFO* creates high prediction errors and less predictable *CFO*. He documents that his earnings-based estimation model outperforms the cash flow-based estimation model in predicting one-year-ahead *CFO* for those firms which reported negative *CFO*. Habib also reports the opposite result for those firms which reported positive *CFO*.

Accordingly, the current research hypothesises that the predictive ability of future cash flows is greater for positive *CFO* than that of negative *CFO*. The Pearson correlation between negative *EBIT* and negative *CFO* is 65.4% and the Pearson correlation between positive *EBIT* and positive *CFO* is 76.6%. Table 6.8 shows that 6.7% of the sample is firm year observations with negative *CFO*.

Table 6.8
Number of Firm-Year Observations Based on Positive and Negative *CFO*

	Firm-year observations
Positive *CFO*	6,051
Negative *CFO*	434
	6,485

In order to examine the effect of positive and negative *CFO* on the primary results, the current research classifies firms based on the positive and negative *CFO* at the end of each fiscal year. The researcher divides the final sample into two groups, positive *CFO* and negative *CFO*, and then performs a statistical analysis on these subsets. Table 6.9 shows the summary of in-sample estimations and out-of-sample tests of the effect of positive and negative *CFO*. Panel A of Table 6.9 indicates that most of the coefficients are significant for firms which have positive *CFO*. In the full disaggregation model ΔAR_t is significant at the 10% level and $DEPAM_t$ consistent with the preliminary results is not significant. ΔAR_t and $DEPAM_t$ are not significant for firms which have negative *CFO*. The adjusted R^2 and the coefficients of negative *CFO* firms are lower than positive *CFO* firms. Panel B of Table 6.9 shows that firms with positive *CFO* have better ability to predict future cash flows than firms with negative *CFO*. As a result, the predictive ability of future cash flows is enhanced for positive *CFO* over that of negative *CFO*.

Table 6.9
Effect of *CFO* Sign

Panel A : The In-Sample Estimations by the Research Models in Predicting One-Year-Ahead Cash Flows

	Preliminary Results		Positive *CFO*		Negative *CFO*	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
N	6,485		6,051		434	
Model 1- Cash Flow:						
Intercept	.0395		.0302		.0467	
CFO_t	.6921	95.78 ***	.7425	91.61 ***	.4774	8.84 ***
Adj. R^2	0.5859		0.5811		0.1513	
Model 2-Aggregate Earnings:						
Intercept	.0540		.0302		.0259	
$EBIT_t$	.7770	90.35 ***	.7425	81.08 ***	.5750	18.48 ***
Adj. R^2	0.5573		0.5207		0.4403	
Model 3-Disaggregated Earning:						
Intercept	.0540		.0263		.0342	
CFO_t	.8336	107.77 ***	.8658	100.84 ***	.6614	14.64 ***
$TACC_t$	.4090	35.32 ***	.3743	30.23 ***	.5325	15.26 ***
Adj. R^2	0.6527		0.6360		0.4478	
Model 4- Full Disaggregation:						
Intercept	.0139		.0112		.0188	
CFO_t	.8275	111.99 ***	.8418	100.77 ***	.7236	16.49 ***
ΔAR_t	.1081	2.63 ***	.0973	1.93 *	.1296	1.40
ΔINV_t	.3113	6.93 ***	.2945	5.65 ***	.3521	3.24 ***
ΔAP_t	(.7037)	(43.23) ***	(.6755)	37.11 ***	(.7508)	(16.69) ***
$DEPAM_t$	.0284	1.45	.0297	1.36	(.1375)	(1.58)
$Other_t$	.3792	17.79 ***	.3625	14.33 ***	.4053	7.58 ***
Adj. R^2	0.6998		0.6793		0.5191	
(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%						

Panel B : Theil's U-Statistic

	Preliminary Results	Positive *CFO*
Model 1-Cash Flow	0.456	0.432
Model 2-Aggregate Earnings	0.459	0.429
Model 3-Disaggregated Earnings	0.445	0.421
Model 4-Full Disaggregation	0.556	0.521

The effect of positive and negative *CFO* on the initial results in the regression models is also tested by adding the signs (positive or negative) of *CFO* as a dummy variable. Panel C of Table 6.9 presents the summary of regression estimations, when using dummy variables to capture the signs (positive or negative) of *CFO*.

Panel C: Using Dummy Variables to Capture the Signs (Positive or Negative) of *CFO*

	Preliminary Results		Positive *CFO*	
	Coeff.	t-stat	Coeff.	t-stat
N	6,485		6,485	
Model 1- Cash Flow:				
Intercept	.0395		.0302	
CFO_t	.6921	95.78 ***	.7285	87.78 ***
*DUM*1			.0325	8.75 ***
Adj. R^2	0.5859		0.5907	
Model 2-Aggregate Earnings:				
Intercept	.0540		.0585	
$EBIT_t$	.7770	90.35 ***	.7515	82.24 ***
*DUM*1			(.0283)	(7.97) ***
Adj. R^2	0.5573		0.5615	
Model 3- Disaggregated Earnings:				
Intercept	.0540		.0280	
CFO_t	.8336	107.77 ***	.8622	101.32 ***
$TACC_t$	.4090	35.32 ***	.4047	35.08 ***
*DUM*1			.0269	7.89 ***
Adj. R^2	0.6527		0.6559	
Model 4- Full Disaggregation:				
Intercept	.0139			
CFO_t	.8275	111.99 ***	.8396	102.47 ***
ΔAR_t	.1081	2.63 ***	.0997	2.42 **
ΔINV_t	.3113	6.93 ***	.3037	6.90 ***
ΔAP_t	(.7037)	(43.23) ***	(.6994)	(42.87) ***
$DEPAM_t$	.0284	1.45	.0187	0.95
$Other_t$	.3792	17.79 ***	.3724	17.41 ***
*DUM*1			.0113	3.48 ***
Adj. R^2	0.6998		0.7003	
(***) significant at the level of 1%,(**) significant at the level of 5%, (*) significant at the level of 10%				

CFO is converted into a dummy variable and coded 1and 0, 1 >= positive *CFO*, 0 = negative *CFO*. Then dummy variables are created: DUM1 = positive *CFO*, and

DUM2 = negative *CFO*. The table reveals that the explanatory power of models marginally increases when *CFO* has positive sign. Additionally, when the sign of the *CFO* is positive, it adds to the ability of *CFO* to predict future cash flows for one-year-ahead.

6.7. Positive and Negative *EBIT*

The current study also investigates whether the primary results are robust to the effect of firm profitability as a further control variable. The expectation is that firm profitability is useful in explaining the variability in the prediction of future cash flows across firms which are documented in previous studies. As mentioned above, negative earnings are not permanent and those firms which report negative earnings are to be expected to report negative *CFO*. Accordingly, negative *CFO* creates high prediction errors and less predictable *CFO*. Hence, this study hypothesises that the predictive ability of future cash flows is enhanced for positive *EBIT* compared with negative *EBIT*. Table 6.10 shows that 8.2% of the sample is firm year observations with negative *EBIT*.

Table 6.10
Number of Firm-Year Observations Based on Positive and Negative *EBIT*

	Firm-year observations
Positive *EBIT*	5,953
Negative *EBIT*	532
	6,485

In order to examine the effect of positive and negative *EBIT* on the initial results, the current research classifies firms based on the positive and negative *EBIT* at the end of each fiscal year. The researcher divides final sample into two groups, positive *EBIT* and negative *EBIT*, then performs a statistical analysis on these subsets. Table 6.11 shows the summary of estimations of the effect of *EBIT* sign (positive and negative).

Table 6.11

Effect of *EBIT* Sign

Panel A: The In-Sample Estimations by the Research Models in Predicting One-Year-Ahead Cash Flows

	Preliminary Results			Positive *EBIT*			Negative *EBIT*		
	Coeff.	t-stat		Coeff.	t-stat		Coeff.	t-stat	
N	6,485			5,953			532		
Model 1- Cash Flow:									
Intercept	.0395			.0435			.0118		
CFO_t	.6921	95.78	***	.6825	87.20	***	.4631	15.25	***
Adj. R^2	0.5859			0.5609			0.3038		
Model 2-Aggregate Earnings:									
Intercept	.0540			.0454			.0609		
$EBIT_t$	.7770	90.35	***	.8356	79.88	***	.6363	14.99	***
Adj. R^2	0.5573			0.5173			0.2964		
Model 3- Disaggregated Earnings:									
Intercept	.0540			.0290			.0431		
CFO_t	.8336	107.77	***	.8652	93.44	***	.7170	17.73	***
$TACC_t$	.4090	35.32	***	.4285	31.66	***	.4101	8.81	***
Adj. R^2	0.6527			0.6241			0.3918		
Model 4- Full Disaggregation:									
Intercept	.0139			.0121					
CFO_t	.8275	111.99	***	.8429	94.84	***	.7583	19.45	***
ΔAR_t	.1081	2.63	***	.0797	1.63		.1552	1.55	
ΔINV_t	.3113	6.93	***	.2777	5.55	***	.3888	3.14	***
ΔAP_t	(.7037)	(43.23)	***	(.7235)	(40.32)	***	(.6233)	(10.67)	***
$DEPAM_t$	.0284	1.45		.0116	0.53		.0036	0.05	
$Other_t$	.3792	17.79	***	.3696	14.91	***	.3944	6.13	***
Adj. R^2	0.6998			0.6735			0.4674		
(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%									

Panel A of Table 6.11 indicates that most coefficients are significant for firms which have positive *EBIT*, but in the full disaggregation model ΔAR_t and $DEPAM_t$ are not significant. ΔAR_t and $DEPAM_t$ are not significant for firms which have negative *EBIT*. The adjusted R2 and the coefficients of negative *EBIT* firms are lower than positive *EBIT* firms.

Panel B: Theil's U-Statistic

	Preliminary Results	Positive *EBIT*
Model 1-Cash Flow	0.456	0.419
Model 2-Aggregate Earnings	0.459	0.432
Model 3-Disaggregated Earnings	0.445	0.416
Model 4-Full Disaggregation	0.556	0.519

Panel B of Table 6.11 shows that firms with positive *EBIT* have better ability to predict future cash flows than firms with negative *EBIT*. As a result, the predictive ability of future cash flows is greater for positive *EBIT* than that of negative *EBIT*.

The effect of positive and negative *EBIT* on the primary results in the regression models are further tested by adding the signs (positive or negative) of *EBIT* as a dummy variable. Panel C of Table 6.11 presents the summary of regression estimations when using dummy variables to capture the signs (positive or negative) of *EBIT*.

Panel C: Using Dummy Variables to Capture the Signs (Positive or Negative) of *EBIT*

	Preliminary Results			Positive *EBIT*		
	Coeff.	t-stat		Coeff.	t-stat	
N	6,485			6,485		
Model 1- Cash Flow:						
Intercept	.0395			.0467		
CFO_t	.6921	95.78	***	.6611	86.25	***
*DUM*1				(.0353)	(11.29)	***
Adj. R^2	0.5859			0.5938		
Model 2-Aggregate Earnings:						
Intercept	.0540			.0474		
$EBIT_t$	.7770	90.35	***	.8191	79.99	***
*DUM*1				.0272	7.49	***
Adj. R^2	0.5573			0.5610		
Model 3- Disaggregated Earnings:						
Intercept	.0540			.0307		
CFO_t	.8336	107.77	***	.8544	93.53	***
$TACC_t$	.4090	35.32	***	.4340	33.46	***
*DUM*1				.0138	4.27	***
Adj. R^2	0.6527			0.6536		
Model 4- Full Disaggregation:						
Intercept	.0139			.0128		
CFO_t	.8275	111.99	***	.8354	96.28	***
ΔAR_t	.1081	2.63	***	.1155	2.79	**
ΔINV_t	.3113	6.93	***	.3164	7.18	***
ΔAP_t	(.7037)	(43.23)	***	(.7125)	(41.94)	***
$DEPAM_t$	.0284	1.45		.0160	0.78	
$Other_t$	.3792	17.79	***	.3872	17.79	***
*DUM*1				.0054	1.80	*
Adj. R^2	0.6998			0.6999		

(***) significant at the level of 1%,(**) significant at the level of 5%,(*) significant at the level of 10%

EBIT is coded 1and 0, 1 >= positive *EBIT*, 0 = negative *EBIT*. Then dummy variables are created: DUM1 = positive *EBIT*, and DUM2 = negative *EBIT*. The table reveals that the adjusted R^2 of the models increases marginally when *EBIT* has positive sign. Additionally, the dummy variable is significant at the level of 10% in the full disaggregation model.

6.8. Industry Effects

Using Theil's U-statistic, the study examines whether the prediction of future cash flows differs across industries, because their activities and accounting practices are different. These differences lead to different sort and levels of accruals and deferrals. For example, industrial firms invest more in fixed assets and inventories and have high accounts receivable than retail firms, whilst the accounts payable of retailer firms are higher than their accounts receivable. The current research classifies firms into nine groups according to the Industry Classification Benchmark (ICB) code from Thomson, based on FTSE and Dow Jones standard classifications. Table 6.12 demonstrates the result of Theil's U-statistic across industries in predicting one-year-ahead cash flows.

Table 6.12
Theil's U-Statistic - Predicting *CFO* across Industries

Code	Name	N	Cash Flow Model	Aggregate Earnings Model	Disaggregated Earnings Model	Full Disaggregation Model
	Full Sample	6,485	0.456	0.459	0.445	0.556
0001	Oil and Gas	195	0.433	0.440	0.461	0.929
1000	Basic Materials	338	0.416	0.401	0.424	0.460
2000	Industries	2,609	0.444	0.444	0.424	0.399
3000	Consumer Goods	804	0.464	0.477	0.449	0.467
4000	Health Care	252	0.453	0.473	0.489	0.604
5000	Consumer Services	1,500	0.423	0.459	0.421	0.418
6000	Telecommunications	84	0.518	0.405	0.542	1.19
7000	Utilities	142	0.287	0.257	0.301	1.16
9000	Technology	561	0.580	0.570	0.570	0.590

The table shows that the cash flow model is a better predictor of one-year-ahead cash flow for Oil and Gas, Consumer Goods and Health Care industries, whilst for Basic Materials and Telecommunications industries the aggregate earnings model is a better predictor. Additionally, the disaggregated earnings model is an appropriate model for the Consumer Goods industry. It is evident that the proper model for predicting one-year-ahead cash flows in Industries and Consumer Services is the full disaggregation model.

6.9. The Effects of Mergers and Acquisitions

Collins and Hribar (2002) report that three transactions in particular (acquisitions, divestitures and foreign currency translations) lead to serious errors in the estimation of accruals. To mitigate the effect of these transactions, they exclude observations with absolute discontinued operations and foreign currency translations more than $10,000.

Similarly, Finger (1994) drops from her analysis any observations with 50% or more increase or 33% or more decrease in total assets to eliminate the impact of the merger or divestiture.

Lev et al (2009) investigate the effects of mergers and acquisitions. They use the ratio of discontinued operations on net income as a proxy for the acquisitions and divestitures effects and the ratio of foreign currency translation on net income foreign currency as a proxy for foreign currency translations effects. Lev et al consider an absolute value of these ratios of 10% as the cut-off point. They report that their findings are consistent with their main results.

Following Lev et al and based on the data available from Extel, this study investigates the sensitivity of the initial results to the effects of discontinued operations.

To achieve this goal, the study computes the ratio of discontinued operations income on net income from the Income Statement; then excludes observations with absolute values of the ratio of more than 10% as the significant effects of discontinued operations. Using the same sampling process and controlling for the mergers and acquisitions effects reduces the research sample from 6,485 to 6,265 firm-years observations.

Table 6.13 presents the summary of regression estimations and Theil's U-statistic respectively.

Table 6.13
Effect of Mergers and Acquisitions
Panel A: In-Sample Estimations

N= 6,265	The Cash Flow Model		The Aggregate Earnings Model		The Disaggregated Earnings Model		The Full Disaggregation model	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0398		.0552		.0345		.0147	
CFO_t	.6944	94.73 ***			.8300	105.95 ***	.8232	109.74 ***
$EBIT_t$			.7717	88.50 ***				
$TACC_t$					.3994	33.94 ***		
ΔAR_t							.1039	2.39 **
ΔINV_t							.3073	6.63 ***
ΔAP_t							(.6889)	(40.28) ***
$DEPAM_t$							.0275	1.40
$Other_t$							.3747	16.56 ***
Adj. R^2	0.5889		0.5556		0.6527		0.6977	
(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%								

Panel B: Theil's U-statistic

	Theil's U-statistic
The Cash Flow Model	0.451
The Aggregate Earnings Model	0.455
The Disaggregated Earnings Model	0.446
The Full Disaggregation model	0.546

The above tables indicate that the ability of the disaggregated earnings model to predict future cash flows is higher than that of the other models. These findings are consistent with those reported in the primary results except the change in accounts receivable which is significant at the 5% level.

6.10. Panel Data Regressions

As mentioned in Chapter 4, the current study pooled data across firms and years. This section tests whether the preliminary results, using OLS regression, are sensitive to panel data regression methods. Baltagi (2005) notes some of the advantages and disadvantages of using panel data, which are listed by Hsiao (2003) and Klevmarken (1989) as follows:

The advantages of using panel data

(i) *Controlling for individual heterogeneity*;

(ii) *Panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency*;

(iii) *Panel data are better able to study the dynamics of adjustment*;

(iv) *Panel data are better able to identify and measure effects that are simply not detectable in pure cross-section or pure time-series data*; and

(v) *Panel data models allow us to construct and test more complicated behavioural models than purely cross-section or time-series data...*, (Baltagi, 2005, pp. 4-7).

The disadvantages of using panel data

(i) *Design and data collection problems*;

(ii) *Distortions of measurement errors*;

(iii) *Selectivity problems*;

(iv) *Short time series dimension*; and

(v) *Cross-section dependence* (Baltagi, 2005, pp. 4-7).

The OLS regression is performed under the assumption that intercept and coefficients remain constant across firms, whilst there are systematic differences among firms. These firm-specific variations can be controlled using an econometric method called the fixed effects estimator or the within estimator. When the individual-level effects are correlated with the independent variables, they are known as fixed effects. This method allows variations to the intercept across firms, whilst the coefficients remain constant across firms. Firm-specific differences may be tested using the F statistic of the null hypothesis that there are no individual-specific effects.

The random effects estimator is another econometric method for panel data. This method assumes that the individual-level effects are not correlated with the independent variables. When the random effects assumption is satisfied, the random effects model is more efficient than the fixed effects model and should be used.

Hausman's test is used to evaluate whether a fixed effects or random effects model is appropriate. When the test is rejected, the random effects model is biased and the correct estimation model is the fixed effects model.

In the context of the prediction of future cash flows, Al-Attar and Hussain (2004) employ a fixed effects estimator and compared with OLS estimation of their research models. They report that using the fixed effects method enhances the ability of their research models to predict future cash flows.

Table 6.14 presents summary results of estimations, using a fixed effects model of future cash flows for various prediction horizons. The table also shows the results of F-tests and Hausman's test. The results of these tests indicate that there are variations in the intercepts and the individual-level effects are correlated with the independent variables, confirming the use of the fixed effects model.

Table 6.14 reveals that the adjusted R^2s of the fixed effects model are similar to the adjusted R^2s of OLS regression for all research models in predicting one-year-ahead cash flows. All predictor variables are significant with predicted signs except ΔAR_t which is significant at the 5% level when using the fixed effects model. $DEPAM_t$ is not significant when using either the fixed effects model or OLS regression. Consistent with OLS regression, the cash flow only model is a better predictor of future cash flow than the aggregate earnings model and disaggregating earnings adds to the predictive ability of *CFO* and increases the adjusted R^2. The full disaggregation model further improves the ability of the model to predict one-year-ahead cash flows.

In contrast, the adjusted R^2s of the fixed effects models are lower than the adjusted R^2s of OLS regression for all research models in predicting two-year-ahead and three-year-ahead cash flows. This result clashes with those of Al-Attar and Hussain (2004), who report that the adjusted R^2 of their fixed effects model is higher than the adjusted R^2 of OLS regression.

In both approaches the coefficients are statistically significant, but the coefficient and t-statistic of the fixed effects model are lower than the coefficient and t-statistic of OLS regression.

As a result, table 6.14 indicates that the full disaggregation model is a better predictor of future cash flows than other models. These findings are consistent with those reported in Chapter 5 except the change in accounts receivable which is significant at the 5% level.

Table 6.14
Fixed Effects Model

		N		Intercept	*CFO* $_t$	*EBIT* $_t$	*TACC* $_t$	ΔAR_t	ΔINV_t	ΔAP_t	*DEPAM* $_t$	*OTHER* $_t$	Adj.R^2	F-test	Hausman's test
One –year-ahead (*CFO* $_{t+1}$):															
Model 1	Cash Flow only	6,485	Coeff.	.0728	.4492								0.5859	2.79	572.43
			t-stat		45.63										
			P>|t|		***										
Model 2	Aggregate Earnings	6,485	Coeff.	.0693		.6292							0.5574	5.15	69.41
			t-stat			55.87									
						***									
Model 3	Disaggregated Earnings	6,485	Coeff.	.0572	.6784		.4718						0.6369	2.81	487.24
			t-stat		60.01		33.56								
			P>|t|		***		***								
Model 4	Full Disaggregation	6,485	Coeff.	.0358	.6810			.0990	.3012	(.6543)	(.0112)	.3616	0.6966	2.03	307.30
			t-stat		60.70			2.15	6.08	(35.32)	(0.37)	14.74			
			P>|t|		***			**	***	***		***			
Second-year-ahead (*CFO* $_{t+2}$):															
Model 1	Cash Flow only	5826	Coeff.	.1026	.2228								0.3916	4.18	757.07
			t-stat		17.22										
			P>|t|		***										
Model 2	Aggregate Earnings	5826	Coeff.	.0961		.3585							0.3402	5.88	73.88
			t-stat			23.70									
			P>|t|			***									
Model 3	Disaggregated Earnings	5826	Coeff.	.0929	.3712		.3177						0.3739	4.17	809.35
			t-stat		23.78		16.19								
			P>|t|		***		***								
Model 4	Full Disaggregation	5826	Coeff.	.0775	.3684			.1470	.2073	(.3616)	.0016	.2643	0.4550	3.15	486.46
			t-stat		23.01			2.22	2.91	(13.80)	0.03	7.46			
			P>|t|		***			**	***	***		***			
(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%															

Table 6.14 Continued

		N		Intercept	*CFO* t	EBIT t	*TACC* t	Δ*AR* t	Δ*INV* t	Δ*AP* t	*DEPAM* t	*OTHER* t	Adj.R^2	F-test	Hausman's test
Third-year-ahead (*CFO* t+3):															
Model 1	Cash Flow only	5211	Coeff.	.1167	.1140								0.2791	4.99	234.74
			t-stat		7.97										
			P>|t|		***										
Model 2	Aggregate Earnings	5211	Coeff.	.1121		.1961							0.2688	5.37	264.31
			t-stat			11.55									
			P>|t|			***									
Model 3	Disaggregated Earnings	5211	Coeff.	.1113	.1995		.1850						0.2802	4.58	326.24
			t-stat		11.39		8.35								
			P>|t|		***		***								
Model 4	Full Disaggregation	5211	Coeff.	.1073	.1984			.1799	.1661	(.1853)	(.1053)	.1849	0.3030	4.32	303.30
			t-stat		10.99			2.37	2.04	(6.33)	(1.76)	4.55			
			P>|t|		***			**	**	***	*	***			
(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%															

Chapter 7

Sampling Issues

7.1. Introduction

This chapter examines the sensitivity of the preliminary findings to some aspects of sampling issues in accounting research. Sections 7.2 and 7.3 discuss the effect of change in fiscal year end and the effect of unrecorded data respectively. Section 7.4 presents the effects of database choice.

7.2.The Effect of Change in Fiscal Year End

In Chapter 4, the accounting period duration has been introduced for the observations in the dataset (see Table 4.7). As noted earlier, the usual calendar year report is for 365 days, and 366 days in leap years. Some firms report for 52 weeks (364 days), and their pattern is to do so for four or five accounting periods and then report for 53 weeks (371 days) in the following reporting period. Table 7.1 shows four examples for this sort of reporting. The other durations relate mainly to changes of reporting date.

The effect of fiscal year length in the regression models is tested by adding period duration as a dummy variable. Period duration is coded 1 and 0, 1 = weekly reporting, 0 = yearly. Table 7.2 presents the summary of regression estimations. The table reveals that the adjusted R^2 of models marginally increases when the dummy variable for period duration is added to models. Additionally, the dummy variable is significant at the 1% level for the research models. Hence, it can be observed that there is a statistically significant difference between yearly and weekly reporting.

Table 7.1
Examples of Reporting Yearly or Weekly

Year	Mothercare Fiscal Year End	Mothercare Period Duration	Tesco Fiscal Year End	Tesco Period Duration	API Group Fiscal Year End	API Group Period Duration	Trinity Mirror Fiscal Year End	Trinity Mirror Period Duration
1989	01/04/1989	364	25/02/1989	364	30/09/1989	364	30/12/1989	364
1990	31/03/1990	364	24/02/1990	364	29/09/1990	364	29/12/1990	364
1991	30/03/1991	364	23/02/1991	364	28/09/1991	364	28/12/1991	364
1992	28/03/1992	364	29/02/1992	371	03/10/1992	371	26/12/1992	364
1993	27/03/1993	364	27/02/1993	364	02/10/1993	364	25/12/1993	364
1994	02/04/1994	371	26/02/1994	364	01/10/1994	364	31/12/1994	371
1995	01/04/1995	364	25/02/1995	364	30/09/1995	364	30/12/1995	364
1996	30/03/1996	364	24/02/1996	364	28/09/1996	364	29/12/1996	365
1997	29/03/1997	364	22/02/1997	364	04/10/1997	371	28/12/1997	364
1998	28/03/1998	364	28/02/1998	371	03/10/1998	364	27/12/1998	364
1999	27/03/1999	364	27/02/1999	364	03/10/1999	365	02/01/2000	371
2000	01/04/2000	371	26/02/2000	364	30/09/2000	363	31/12/2000	364
2001	31/03/2001	364	24/02/2001	364	30/09/2001	365	30/12/2001	364
2002	30/03/2002	364	23/02/2002	364	30/09/2002	365	29/12/2002	364
2003	29/03/2003	364	22/02/2003	364	30/09/2003	365	28/12/2003	364
2004	27/03/2004	364	28/02/2004	371	30/09/2004	366	02/01/2005	371
2005	26/03/2005	364	26/02/2005	364	30/09/2005	365	01/01/2006	364
2006	01/04/2006	371	25/02/2006	364	30/09/2006	365	31/12/2006	364
2007	31/03/2007	364	24/02/2007	364			30/12/2007	364
2008	29/03/2008	364	23/02/2008	364	31/03/2008	548	28/12/2008	364

Table 7.2
Summary of Regression Estimations Reporting Yearly or Weekly

N= 6,485	The Cash Flow Model Coeff.	The Cash Flow Model t-stat	The Aggregate Earnings Model Coeff.	The Aggregate Earnings Model t-stat	The Disaggregated Earnings Model Coeff.	The Disaggregated Earnings Model t-stat	The Full Disaggregation model Coeff.	The Full Disaggregation model t-stat
Intercept	.0385		.0514		.0326		.0126	
CFO_t	.6893	95.0 ***			.8306	107.3 ***	.8239	111.4 ***
$EBIT_t$			.7731	90.1 ***				
$TACC_t$					.4107	35.5 ***		
ΔAR_t							.1056	2.5 ***
ΔINV_t							.3126	7.1 ***
ΔAP_t							(.7039)	(43.3) ***
$DEPAM_t$							.0273	1.4
$Other_t$							.3798	17.8 ***
DUM	.0083	3.8 ***	.0177	7.9 ***	.0103	5.1 ***	.0105	5.6 ***
Adj. R^2	0.5868		0.5614		0.6541		0.7012	

(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%

7.3.The Effect of Unrecorded Data, Missing or Zero

The nature of values reported in downloads as not applicable or unrecorded, missing or zero introduced in Chapter 4. As mentioned earlier, identifying unrecorded data improves the quality and quantity of the final sample. This section describes the examination of the effect of using directly downloaded data in the regression models without further investigation on the nature of missing data. Table 7.3 presents the comparison of the downloaded data from the Extel and Worldscope databases and enhanced data by the research variables, using the cash flow information. It is evident that identifying the unrecorded data increases the number of firm-year observations.

Table 7.3
Comparison of Downloaded Data and Enhanced Data

	Downloaded Data						Enhanced Data	
	Extel			Worldscope				
Variables	Value	#N/A	Zero	Value	#N/A	Zero	Value	Zero
Sales	12363	8247	684	11750	8870	674	12357	778
Trading Expenses	13138	8155	1	12175	9099	20	13127	8
CFO	13047	8237	10	11264	10020	10	13047	11
Δ*AR*	12827	8467	0	11642	9643	9	12827	231
Δ*INV*	10151	11143	0	9264	11973	57	10148	2910
Δ*AP*	12833	8460	1	11600	9684	10	12833	225
DEPAM	12715	8577	2	11896	9160	238	12713	345

Table 7.4 presents a summary of regression by research models and Table 7.5 shows the Theil's U-statistic. Table 7.4 reveals that the number of firm-year observations decreases from 6,485 to 5,762. The depreciation and amortisation variable is significant at the 5% level, whilst this variable is not significant in the initial findings.

Table 7.4
In-Sample Regression Estimations, before Correcting Seemingly Missing Data or False Zeroes

N=	The Cash Flow Model		The Aggregate Earnings Model		The Disaggregated Earnings Model		The Full Disaggregation model	
5,762	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0396		.0540		.0338		.0139	
CFO t	.6837	90.0 ***			.8240	97.7 ***	.8185	102.2 ***
EBIT t			.7748	81.5 ***				
TACC t					.3834	30.3 ***		
Δ*AR* t							.1610	3.6 ***
Δ*INV* t							.3251	6.8 ***
Δ*AP* t							(.7032)	(40.6) ***
DEPAM t							.0474	2.3 **
Other t							.3913	16.5 ***
Adj. R^2	0.5844		0.5358		0.6416		0.6940	
(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%								

Table 7.5
Theil's U-Statistic – Out-of-Sample Results before Correcting Seemingly Missing Data or False Zeroes

	Preliminary Results	The effect of unrecorded
Model 1-Cash Flow	0.456	0.442
Model 2-Aggregate Earnings	0.459	0.453
Model 3-Disaggregated Earnings	0.445	0.436
Model 4-Full Disaggregation	0.556	0.540

7.4.The Effects of Database Choice

As mentioned earlier, prior studies reported that commercial accounting databases are not perfect alternatives. There are dissimilarity in the coverage of firms and accounting items also differs across the databases, because there are differences in the definition of the key variables (Alves et al, 2007).This section documents the effect of using Worldscope database, without identifying the nature of missing data, and compares with the initial findings using Extel database.

Table 7.6 indicates distributional statistics after extreme values are excluded. The table reveals that the number of firm-year observations is reduced from 6,485 to 4,973.The table indicates that the mean and median values of $EBIT_t$ (0.098 and 0.093),

CFO_t (0.100 and 0.095) and $TACC_t$ (-0.002 and -0.001), when using the Worldscope database, are lower than the mean and median value of $EBIT_t$ (0.103 and 0.097), CFO_t (0.137 and 0.128) and $TACC_t$ (-0.034 and -0.032) when using the Extel database. The standard deviation of $EBIT_t$ and CFO_t are similar (0.096) when using the Worldscope database, whilst, the standard deviation of $EBIT_t$ (0.097) is lower than CFO_t (0.112) when using the Extel database. There are also differences in the range of variables.

Table 7.6
Distributional Statistics Based on the Worldscope Only (N = 4,973)

Variables	Mean	S.D.	0.25	Median	0.75	Min	Max
$EBIT_t$	0.098	0.096	0.053	0.093	0.140	-0.521	1.241
CFO_t	0.100	0.097	0.050	0.095	0.146	-0.802	1.654
$TACC_t$	-0.002	0.084	-0.039	-0.001	0.034	-1.529	1.136
ΔAR_t	-0.015	0.057	-0.031	-0.009	0.006	-0.994	0.482
ΔINV_t	-0.008	0.039	-0.016	-0.002	0.003	-0.373	0.300
ΔAP_t	0.013	0.056	-0.010	0.007	0.031	-0.641	0.543
$DEPAM_t$	0.050	0.039	0.029	0.043	0.060	0.000	1.467
$OTHER_t$	0.083	0.152	0.017	0.067	0.139	-1.013	1.534

Table 7.7 reports the result of regression in predicting one-year-ahead cash flow, using the Worldscope database. As noted earlier, the table reveals that the number of firm-year observations is reduced from 6,485 to 4,973 and the adjusted R^2 of the research models are lower than when using the Extel database, for example the adjusted R^2 of the cash flow, aggregate earnings, disaggregated earnings and full disaggregation models are 58.5%, 55.7%, 65.2% and 69.9% , respectively. Whilst, when using the Worldscope database, the adjusted R^2 of the cash flow, aggregate earnings, disaggregated earnings and full disaggregation models are 49.2%, 34.7%, 52.8% and 59.4, respectively. Unlike the preliminary findings, the sign of the ΔAR and ΔINV are negative, *DEPAM* is significant and ΔINV is not significant.

Using Worldscope as an alternative database, in addition to reduce firm-year observations, produces different results compared to the initial findings. To sum up, the above evidence indicates that commercial accounting databases are not perfect alternatives. These results are consistent with Aleves et al (2007) and Lara et al (2006).

Table 7.7
Summary of Regression Estimations, before Correcting Seemingly Data or False Zeroes, Using the Worldscope Database

	The Cash Flow Model		The Aggregate Earnings Model		The Disaggregated Earnings Model		The Full Disaggregation model	
N= 4,973	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Intercept	.0363		.0463		.0286		.0105	
CFO $_t$[146]	.6032	69.4 ***			.6844	73.3 ***	.6970	74.7 ***
EBIT $_t$[147]			.5129	51.4 ***				
TACC $_t$[148]					.2140	19.6 ***		
ΔAR_t[149]							(.1836)	(5.6) ***
ΔINV_t[150]							(.0506)	(1.3)
ΔAP_t[151]							(.5594)	(28.7) ***
DEPAM $_t$[152]							.1519	7.1 ***
Other $_t$[153]							.1564	10.1 ***
Adj. R^2	0.4923		0.3476		0.5289		0.5948	
(***) significant at the level of 1%, (**) significant at the level of 5%, (*) significant at the level of 10%								

[146] *CFO* = Cash flows from operations (WS.NetCashFlowOperatingCFStmt).
[147] *EBIT* = Sales (WS.Sales) minus Total Operating Expenses (WS.TotalOperatingExpenses).
[148] *TACC* = Total Operating Accrual, is obtained as *EBIT* less *CFO*
[149] ΔAR = Change in Accounts Receivable per the Statement of Cash Flow (WS.AccountsReceivableIncDecCFStmt).
[150] ΔINV = change in Inventory per the Statement of Cash Flow (WS.InventoryIncDecCFStmt)
[151] ΔAP = Change in Accounts Payable per the Statement of Cash Flow (WS.AccountsPayableIncDecCFStmt)
[152] *DEPAM* = Depreciation and Amortisation per the Statement of Cash Flow (WS.DepreciationDeplAmortCFStmt).
[153] $OTHER = TACC - (\Delta AR + \Delta INV - \Delta AP - DEPAM)$

Chapter 8

Summary and Conclusions

This chapter starts with a brief review of the thesis (Section 8.1), then the main findings of the thesis and conclusions are summarised Section 8.2. Sections 8.3 and 8.4 outline the contributions of the thesis to the literature and limitations of the study respectively. Section 8.5 provides some suggestions about future research in this area.

8.1 Summary

Given that cash flow prediction is considered to have a vital role in security valuation and more generally in capital budgeting analysis and dividend policy formulation, therefore the general supposition of this thesis is that cash flow forecasting is fundamental to financial decision-making in general(for example, see Penman, 2009 and 2010). It follows therefore that, this thesis has implications for finance as well as accounting. However, the empirical work reported here does not extend to the share pricing implications. The general assumption in this context is that investors need information about future cash flow because the current value of their holding may be estimated as the present value of the future cash flows that will be created by the firm in which they invest. As the power of a firm to generate cash flow is reflected in the market value of its equity, it follows that the prediction of future cash flow helps to predict future stock returns and not just current investment values. It is for this reason that the prediction of cash flow has remained a central theme of accounting research, with the identifiable policy implications that have introduced in Chapter 2. Whilst this thesis concentrates on methodological improvements that should be taken into account in cash flow forecasting, further work should explore the pricing implications.

The Chapter 2 starts with references to the importance of accrual accounting and the implications for the estimation of future cash flows. In addition, the chapter describes the development of the relevant standards and provides a discussion concerning the direct and indirect methods of reporting cash flows from operating activities, and presents evidence on the importance of reporting on cash flows from operating activities using the direct method. Furthermore, the chapter describes the development of an analytical approach to understanding the underlying accounting by presenting the cash flow and accruals identity and explaining the computation of total accruals. Finally the Chapter 2 reviews the empirical evidence on future cash flow estimation, beginning with a study with a theoretical framework to link the accounting variables involved (Dechow et al, 1998). Then, the chapter considers a highly cited study which extended Dechow et al's model by disaggregating earnings into cash flow and accrual components (Barth et al, 2001). Chapter 2 proceeds to discuss other studies which extended Barth et al's work in different ways.

Chapter 3 discusses the research design of these forecasting models, and outlines the four-model hierarchy used in the research study:

(i) the cash flow model, predicting future cash flow from current and past cash flow;

(ii) the earnings model, predicting future cash flow from current and past earnings;

(iii) the disaggregated earnings model, predicting future cash flow from current and past cash flow and accruals; and

(iv) the full disaggregation model, predicting future cash flow from current and past cash flow and the components of accruals.

Chapter 3 discusses in-sample estimation and out-of-sample accuracy tests and gives an overview of the relevant diagnostic tests.

In Chapter 4 the key features of the data used in this study are outlined, including the definitions of variables and description of the two approaches to cash flow analysis employed in this thesis: using Cash Flow Statement information to calculate accruals or the Balance Sheet changes method. Additionally, Chapter 4 provides a more detailed discussion with relation to (a) the validation of data including firm coverage differentiation, (b) the nature of unrecorded data, missing or zero, (c) the effect of influential observations on the estimations, and (d) the impact of changes in fiscal year length. The chapter also includes a comparison between the information in commercial databases and the source information in published financial statements and details the sampling process and the sample specifications.

Chapter 5 outlines the preliminary results of the research including the descriptive statistics (distributional statistics and correlation analyses) and model estimations.

Chapter 6 describes further analyses of the robustness of the initial findings of the thesis to the use of a substitute dependent variable, further control variables and econometric model choice.

Chapter 7 indicates the effect of sampling issues in accounting research on the primary results.

8.2 Main Findings

As noted previously, total accrual is computed using information from the Statement of Cash Flows and the Balance Sheet changes. Hence, the findings of this study are presented based on these methods of accrual computation.

Using Information from the Statement of Cash Flows

Comparing the adjusted R^2 of the cash flow model with the aggregate earnings model confirms that the ability of the cash flow model to predict future cash flows is greater than that of the aggregate earnings model, whilst Voung's test of these models indicates that there is no difference in explanatory power between them.

- The adjusted R^2 of the disaggregated earnings model indicates that disaggregating earnings into cash flows from operations and aggregate accruals enhances the ability of the estimation model to predict future cash flows compared to the aggregate earnings model. In addition, Voung's test of these models confirms that the explanatory power of the disaggregated earnings model is greater than that the aggregate earnings model and the cash flow model.

- Disaggregating earnings into cash flows from operations and the components of accruals further increases the ability to predict future cash flows compared to disaggregating earnings into cash flows from operations and aggregate accruals. This result is confirmed by Voung's test.

- The accrual components, with the exception of depreciation and amortisation, are significant predictors of future cash flows with the predicted sign. Whilst, the depreciation and amortisation variable is significant in predicting two and three-year-ahead cash flows.

- The result of out-of-sample accuracy tests demonstrate that the cash flows model marginally outperforms the aggregate earnings model in estimating future cash flows for all prediction horizons.

- Disaggregating earnings into cash flows from operations and aggregate accruals improves accuracy of estimating future cash flows; this finding is consistent with the standard setter's point of view that earnings components are important predictors of future cash flows.

- The results of out-of-sample accuracy tests demonstrate that accrual components do not improve the prediction of future cash flows.

Conclusion: The results of the in-sample estimation indicate that, whilst there is not notable difference between the ability of cash flow and aggregate earnings to predict future cash flows, the disaggregation of earnings into cash flow and accruals improves the prediction. The out-of-sample accuracy tests confirm that the disaggregated earnings model is a better predictor of future cash flow. The in-sample estimations also suggest further improvement when the total accrual is disaggregated into its accrual components. However, the out-of-sample tests do not provide evidence of a significant improvement in the second stage of disaggregation.

Using the Balance Sheet changes Method of Accrual Computation

1. Comparing the adjusted R^2 and Voung's test of the cash flow model with the aggregate earnings model confirm that the ability of the aggregate earnings model to predict future cash flows is greater than that of the cash flow model. This result is the opposite of the finding produced when using the Statement of Cash Flows information.

2. The adjusted R^2 of the disaggregated earnings model indicates that disaggregating earnings into cash flow and aggregate accruals enhance the ability of the prediction model to predict future cash flows compared to the aggregate earnings model. This result is not confirmed by Voung's test, which confirms that there is no difference between the explanatory power of the disaggregated earnings model and the aggregate earnings model.

3. Disaggregating earnings into cash flow from operations and the components of accruals further increases the ability to predict future cash flows over disaggregating earnings into cash flows from operations and aggregate accruals. This result is confirmed by Voung's test.

4. The accrual components are significant predictors of future cash flows with the predicted sign.

5. The results of out-of-sample accuracy tests demonstrate that the aggregate earnings model outperforms the cash flow only model in estimating future cash flows for all prediction horizons.

6. The results of out-of-sample accuracy tests indicate that there is not considerable difference between the aggregate earnings model and disaggregated earnings model. Consistent with in-sample estimation, the results of out-of-sample accuracy tests confirm that disaggregating earnings into cash flow from operations and aggregate accruals do not improve the accuracy of estimating future cash flows.

7. Out-of-sample accuracy tests indicated that further disaggregation of accruals do not improve the accuracy of estimating future cash flows.

Conclusion: The results of both the in-sample estimation and the out-of-sample accuracy tests confirm that the aggregate earnings model outperforms the cash flow model, and disaggregated earnings model (*CFO* and aggregate accruals) in predicting future cash flows. The in-sample estimation also suggested further improvement when the total accrual is disaggregated into its deferral and accrual components. However, the out-of-sample tests do not provide evidence of a significant improvement in the further disaggregation of accruals.

Additional Analyses

1. Comparing the adjusted R^2 and Voung's test of the cash flow model with the aggregate earnings model confirm that the ability of the aggregate earnings model to predict future operating income (*EBIT*) is greater than that of the cash flow model. The findings confirm that there is no difference in the explanatory power of the aggregate earnings model, disaggregated earnings model and full disaggregation

model. The out-of-sample accuracy tests also confirm that the aggregate earnings model is a better predictor of future operating income than other research models.

2. The results of the in-sample estimation indicate that the largest firms have the highest adjusted R^2 and the out-of-sample accuracy tests show that the data from largest firms enable more accurate predictions. As a result the prediction of future cash flows is highly sensitive to size of firm.

3. The firms with low magnitude of aggregate accruals have the highest adjusted R^2 for cash flow model and aggregate earnings model. In contrast, the firms with high magnitude of aggregate accruals have the highest adjusted R^2 for the full disaggregation model. As a result, the various levels accruals lead to different results.

4. Adding firm size and magnitude of aggregate accruals to research models indicate that both of them are significant in predicting future cash flows.

5. The predictive ability of future cash flows is greater for positive *CFO* than that of for negative *CFO*.

6. The predictive ability of future cash flows is greater for positive *EBIT* than that of for negative *EBIT*.

7. Theil’s U-statistic across industries in predicting one-year-ahead cash flows indicates that the accuracy tests of the research models differs across industries.

8. The results of the investigation of the mergers and acquisitions effects are consistent with the findings reported in the initial results.

9. The adjusted R^2 of the fixed effects model is similar to the adjusted R^2 of OLS regression in predicting one-year-ahead cash flows. In contrast, the adjusted R^2 of the fixed effects model is lower than the adjusted R^2 of OLS regression in predicting two-year-ahead and three-year-ahead cash flows. All predictor variables are significant with predicted signs (except ΔAR_t, which is significant at the 5% level when using the fixed effects model). $DEPAM_t$ is not significant when using either the fixed effects model or OLS regression. In both models the coefficients are statistically significant, but the coefficient and t-statistic of the fixed effects model are lower than the coefficient and t-statistic of OLS regression. As a result, the full disaggregation model is a better predictor of future cash flows. These findings are consistent with those reported in Chapter 5 except the change in accounts receivable which is significant at the 5% level.

The Effect of Sampling Issues in Accounting Research on the Estimations

1. Period duration is a significant as dummy variable when added to the research models tested in this research. Hence, there is a statistically significant effect between yearly and weekly reporting.

2. Using data without identifying the nature of unrecorded, missing or zero data not only reduces the number of firm year observations, but leads to different results: for example, *DEPAM* is not significant in the primary findings whilst *DEPAM* is significant at the 5% level.

3. Using Worldscope as an alternative database, in addition to reduce firm-year observations, produces different results compared to the initial findings when using the Extel database. As a result, commercial accounting databases are not perfect alternatives.

8.3 Contributions

This thesis adds to the literature on cash flow in several important respects:

1. The ability of firms to generate cash flow from operating activities is more important than obtaining cash flow directly from investors and creditors, and operating activities are more regular and continuous than investing and financing activities. Therefore, unlike many studies, this study focuses on the operating accounting information available in published financial statements instead of investing and financing accounting information, such as earning before interest and tax (*EBIT*) and cash flow generated from operations, operating assets and liabilities.

2. In addition to using the Statement of Cash Flows method to compute total accruals, this study employs the Balance Sheet changes method, thus considering in the research approach the wider set of accrual components that are identifiable amongst the detailed accounting information available in published financial statements, such as the contribution to *total accruals* from long-term receivables and payables which are related to operating activities.

3. Most prior studies only investigated the association between earnings components and future performance measures using an in-sample design, and it is only the most

recent studies that have examined the predictive ability of current cash flows, earnings and earnings components using out-of-sample prediction tests, although none have used UK data in predicting future cash flows. The present study addresses this issue, and extends cash flow prediction research by documenting both in-sample estimations and out-of-sample predictions tests, using multiple methods in the latter case.

4. Introduce how the validation of the accounting numbers taken from commercial databases by identifying the nature of values reported in downloads as not applicable or unrecorded, missing or zero.

5. Introduce a specific feature of accounting data that arises in the case of a change of fiscal year-end, leading to differences in the accounting period duration; which is addressed in this study by annualising observations in cross section.

6. Demonstrating that commercial accounting databases are not perfect alternatives because of differences in firm coverage and the accounting items across databases.

7. Indicating the impact of outlier identification methods on the estimations.

8. Most studies in this field use data on US firms from the Compustat Annual Industrial and Research Files; the present research adds to the cash flow prediction literature by using data from UK's Extel Financial database.

9. *FRS* 1, issued by the ASB, strongly links cash flow and earnings in predicting future cash flows and emphasises that the Statement of Cash Flows should accompany the Income Statement and Balance Sheet when it is used in predicting future cash flows.

As noted in the previous section, *CFO* and *EBIT* are not solely the best predictors of future cash flows. Hence, the current study provides empirical evidence to support *FRS* 1.

8.4 Limitations

The current study has several limitations. First, the prediction horizons of this study are one, two and three-year-ahead cash flows, so the study does not consider the aggregation level of future cash flows or more than three-year-ahead cash flows. Second, to avoid data mining the study incorporates aggregated predictors of long-term receivables and long-term payables which are related to operating activities. Third, the study includes only firms listed in the UK, so the results of the study may not be generalisable to private firms and firms in other countries.

8.5 Suggestions for Future Research

Further research in the area of this study might address the following ideas:

1. Extending this study to the share pricing implications.
2. The research models developed in this thesis could be further extended by decomposing current cash flow, using the Income Statement and the indirect cash flow information.
3. Extending the research models by disaggregating total accrual into the discretionary and the non-discretionary accruals.
4. Using alternative predicted variables such as the aggregation level of future cash flows, free cash flow and market value of equity as proxies for future cash flow.

5. Considering further control variables such as operating cash flow cycle and macroeconomic factors.
6. Using six-monthly data.

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Appendix 1

A Comparison of Three Companies' Reported Financial Statements with their Worldscope and Extel Databases Entries

Table A.1.1

Example 1: A Comparison of Tesco's Reported Financial Statements with the Worldscope and Extel Databases

Panel A: Tesco's Balance Sheet, 23 February 2008

Reported Financial Statements		**Extel Financial**		**Worldscope**	
Goodwill and Other intangible assets	2,336	EX. Fixed Assets Intangible	2,336	WS. Intangibles	2,336
Property, plant and equipment Investment property	19,787 1.112	EX. Fixed Assets Tangible	20,899	WS. Total Prop Plant Equip Net	19,787
Investments in joint ventures and associates	305	EX. Finance Assets Associate Co	305	WS .Investment In Unconsol Subsidiaries	305
Investment property Other investments Derivative financial instruments	1.112 4 216	EX. Finance Assets Other Investments EX. Finance Assets Derivative financial instruments	4 216	WS. Other Investments	1,332
Deferred tax assets	104	EX. Finance Assets Defer Tax Assets	104	WS. Deferred Taxes Debit	104
Inventories	2,430	EX. Current Assets Stocks	2,430	WS. Total Inventories	2,430
Trade and other receivables	1,311	EX. Current Assets Other Prepayments EX. Current Assets Intra Group Debtors EX. Current Assets Misc Debtors	298 212 801	WS. Total Receivables WS. Other Current Assets **Move to non-current assets**	686 594 31
Derivative financial instruments Short term investment	97 360	EX. Current Assets Current Investments	457	WS. ST Investments	457
Current tax assets Assets classified as held for sale	6 308	EX. Current Assets Other Tax Recoverable EX. Current Assets Held For Resale	6 308	WS. LT Receivables WS. Other Assets **Transfer from other receivables**	333 12 31
Cash and bank balances	1,788	EX. Current Assets Cash And Near Cash	1,788	WS. Cash	1,788
Total current assets	6300	EX. Current Assets	6,300	WS. Current Assets	5955

Panel A: Continued

Reported Financial Statements		**Extel Financial**		**Worldscope**	
Total assets	30,164	EX. Total Assets	30164	WS. Total Assets	30060
Trade and other payables	7,277	EX. Creditors Trade Creditors	3936	WS. Accounts Payable	3936
Derivative financial instruments and other liabilities	443	EX. Creditors Intra Group Payables	116	WS. Other Current Liabilities	3788
		EX. Creditors Misc	2157		
		EX. Creditors Other Accruals	1187		
Current tax liabilities	455	EX. Creditors Tax Due	779	WS. Income Taxes Payable	455
Provisions	4	EX. Creditors Current Provisions	4		
Current Liabilities - Borrowings	2,084	EX. Debt ST Loans	2,084	WS. ST Debt And Cur Port LT Debt	2,084
Non-current Liabilities - Borrowings	5,972	EX. Debt LT Loans	5,972	WS. Total LT Debt	5,972
Derivative financial instruments and other liabilities	322	EX. Other Liab Financial Instrument	322	WS. Provision For Risks And Charges	861
Post-employment benefit obligation	838	EX. Deferred Liab Pension Provisions	838		
Deferred tax liabilities	802	EX. Deferred Tax	802	WS. Deferred Taxes Credit	802
Provisions	23	EX. Deferred Liab Misc Provisions	23	WS. Deferred Taxes Debit	(104)
Other non-current liabilities	42	EX. Other LT Liabilities	42	WS. Other Liabilities	364
Share capital	393	EX. Shareholders Equity Share Capital	393	WS. Common Stock	393
Equity attributable to equity holders of the parent	11,422	EX. Shareholders Equity	11,422	WS. Total Common Equity	11,422
Minority interests	87	EX. Deferred Liab Minority Interest	87	WS. Minority Interest Bal Sht	87

Panel B: Tesco's Income Statement, Year ended 23 February 2008

Reported Financial Statements		Extel Financial		Worldscope	
Revenue	47298	EX. Sales	47298	WS. Sales	47298
Cost of sales	43668	EX. Trading Ex Cost Of Goods Sold	43668	WS. Cost Of Goods Sold WS.DepreciationDeplAmortExpense	42692 976
Administration expenses	1027	EX.TradingExpSellingAndGeneral	1027	WS. Selling General Admin Expense	1027
share of post-tax profits of joint ventures and associates	75	EX. Non Trading Income	75	WS. Equity In Earnings	75
Profit arising on property-related items finance income	188 187	EX. Other Income EX. Interest Income EX. Trading Exp Misc By Format1 EX. Exceptional Charges EX. Pre tax Adjustment Expenses	188 91 (10) (59) (165)	WS. Other Income Expense Net WS. Interest Income WS. Extraordinary Charge Pre tax WS. Extraordinary Credit Pre tax	225 91 77 (136)
Finance cost	(250)	EX. Finance Charges	(250)	WS. Interest Expense On Debt WS. Interest Capitalized	(350) 103
Profit before tax	2803	EX. Profit Before Tax	2803	WS. Income Bef Income Taxes WS. Equity In Earnings	2728 75
Taxation	(673)	EX. Taxation	(673)	WS. Income Taxes	(673)
Minority interest	(6)	EX. After Tax Non Equity Minority Ints	(6)	WS. Minority Interest Income Stmt	(6)
Equity holders of the parent	2124	EX. Net Income	2124	WS. Net Income	2124

Panel C: Tesco's Statement of Cash Flows, Year ended 23 February 2008

Reported Financial Statements		**Extel Financial**		**Worldscope**	
Cash flows from operating activities:					
Profit before tax	2803	EX.CF Operating Profit Before Tax	2803	WS. Income Bef Extra Items CFStmt	2803
Depreciation and amortization	992	EX.CFOperatingDepreciationAndAmort	976	WS.DepreciationDeplAmortCFStmt	976
Increase in inventories	(376)	EX.CFOperatingStockDecInc	(376)	WS. Inventory IncDec CF Stmt	(376)
Increase in trade and other receivables	(71)	EX.CFOperatingDebtorDecInc	(71)	WS.AccountsReceivableIncDecCFStmt	(71)
Increase in trade and other payables	641	EX.CFOperatingCreditorIncDec	641	WS.AccountsPayableIncDecCFStmt	641
Net finance costs	63				
Share of post-tax profits of joint ventures and associates	(75)	EX. CF Operating Associate Co Profit	(75)		
Profit arising on property-related items	(188)				
Net impairment of property , plant and equipment	(10)				
Adjustment for non-cash element of pensions charge	121				
Share-based payments	199				
		EX.CFOperatingMiscNonCashAdjustment	201	WS. Other Cash Flow CF Stmt	(414)
Cash generated from operations	4099	EX. CF Operating Inflows	4099		
Interest paid	(410)	EX. CF Int And Divs Int Paid[154]	(410)		
Corporation tax paid	(346)	EX. CF Taxation[155]	(346)		
Net cash from operating activities	3343			WS. Net Cash Flow Operating CF Stmt	3559
Cash flows from investing activities:					
Purchase of property, plan and equipment and investment property	(3442)	EX. CF Invs Tangible Assets Acqu	(3442)	WS.CapitalExpendituresCFStmt	(3442)
Proceeds from sale of property, plant and equipment	1056	EX. CF InvsTangible Asset Disposal	1056	WS.DisposalOfFixedAssetsCFStmt	1056
Purchase of intangible assets	(158)	EX. CF Invs Intangible Assets Acqu	(158)	WS.AdditionsToOthAssetsCFStmt	(158)

[154] This item is classified under interest and dividend headline.
[155] This item is classified under taxation headline.

Panel C: Continued

Reported Financial Statements		Extel Financial		Worldscope	
Increase in loan to joint ventures Invested in short-term investments	(36) (360)	EX. CF Invs Financial Assets Acqu	(396)	WS.IncreaseInInvestmentCFStmt	(457)
Acquisition of subsidiaries, net of cash acquired Invested in joint ventures and associates	(169) (61)	EX. CF Invs Acquis And Divest	(230)	WS.NetAssetsFrAcquisitionsCFStmt	(169)
Dividends received	88	EX. CF Int And Divs Oth Received[156]	88		
Interest received	128	EX. CF Int And Divs Int Received [157]	128		
Net cash used in investing activities:	(2954)	EX. CF Investments[158]	(3170)	WS. Net Cash Flow Investing CFStmt	(3170)
Cash flows from financing activities:					
Proceeds from issue of ordinary share capital Proceeds from sale of ordinary share capital to minority interests Own shared purchased	138 16 (775)	EX. CF Financing Share Capital Iss	(621)	WS. Sale Or Issuance Of Stock CFStmt WS. Purch Of Com And PfdStkCFStmt	154 (775)
Increase in borrowings Repayment of borrowings New finance leases Repayment of obligations under finance leases	9333 (7593) 119 (32)	EX. CF Financing Debt Issued EX. CF Financing Finance Leases	1740 87	WS. LTDebt Issuance CFStmt WS. LTDebt Reduction CFStmt	9452 (7625)
Dividends pay	(792)	EX. CF Int And Divs Misc Paid[159]	(792)	WS. Cash Dividends CFStmt	(792)
Dividends paid to minority interests	(2)	EX. CF Int And Divs Minority Paid[160]	(2)	WS. Other Financing Uses CFStmt	(2)
Net cash from financing activities	412	EX. CF Financing	1206	WS. Net Cash Flow Financing CFStmt	412
Net increase in cash and cash equivalents	801	EX. CF Cash And Cash Equiv	801	WS.CashAndCashEquivIncDecCFStmt	746
Cash and cash equivalent at beginning of year	1042				
Effect of foreign exchange rate changes	(55)			WS. Exchange Rate Effect CFStmt	(55)
Cash and cash equivalents at the end of year	1788				

[156] This item is classified under interest and dividend headline.
[157] This item is classified under interest and dividend headline.
[158] The differences in the net cash used in investing activities with respective title in the Extel financial and Worldscope arise from interest and dividend received which are classified under interest and dividend headline.
[159] This item is classified under interest and dividend headline.
[160] This item is classified under interest and dividend headline.

Table A.1.2

Example 2: A Comparison of Vodafone's Reported Financial Statements with the Worldscope and Extel Databases

Panel A: Vodafone's Balance Sheet, 31 March 2008

Reported Financial Statements		**Extel Financial**		**Worldscope**	
Goodwill Other intangible assets	51,336 18,995	EX. Fixed Assets Intangible	70,331	WS. Intangibles	70,331
Property, plant and equipment	16,735	EX. Fixed Assets Tangible	16,735	WS. Total Prop Plant Equip Net	16,735
Trade and other receivables Post employment benefits Other investments	1,067 65 7,367	EX. Finance Assets LTDebtors EX. Finance Assets derivative financial instruments EX.TotalAssetsMisc EX. Finance Assets Other Investments EX. Finance Assets Misc	115 831 186 7,138 229	WS.LTReceivable WS. Other Assets WS.DeferredCharges WS. Other Investments	115 121 65 8,198
Investments in joint ventures and associates	22,545	EX. Finance Assets Associate Co	22,545	WS .Investment In Unconsol Subsidiaries	22,545
Deferred tax assets	436	EX. Finance Assets Defer Tax Assets	436	WS. Deferred Taxes Debit	(436)
Inventories	417	EX. Current Assets Stocks	417	WS. Total Inventories	417
Trade and other receivables Taxation Recoverable	6,551 57	EX. Current Assets Other Prepayments EX. Current Assets Trade Debtors EX. Current Assets Intra Group Debtors EX. Current Assets Misc Debtors EX. Current Assets Other Tax Recoverable	2,426 3,549 21 555 57	WS. Total Receivables WS. Other Current Assets	4,182 2,426
Cash and bank balances	1,699	EX. Current Assets Cash And Near Cash	1,699	WS. Cash	1,699
Total current assets	8,724	EX. Current Assets	8,724	WS. Current Assets	8,724
Total assets	127,270	EX. Total Assets	127,270	WS. Total Assets	126,834
Trade and other payables Current tax liabilities Provisions	11,962 5,123 356	EX. Creditors Trade Creditors EX. Creditors Intra Group Payables EX. Creditors Misc EX. Creditors Other Accruals EX. Creditors Tax Due EX. Creditors Current Provisions	2,963 22 813 7498 5,789 356	WS. Accounts Payable WS. Other Current Liabilities WS. Income Taxes Payable	2,963 9,355 5,123

Panel A: Continued

Reported Financial Statements		Extel Financial		Worldscope	
Current Liabilities - Borrowings	4,532	EX. Debt ST Loans	4,532	WS. ST Debt And Cur Port LT Debt	4,532
Non-current Liabilities - Borrowings	22,662	EX. Debt LT Loans	21,677	WS. Total LT Debt	21,677
Post-employment benefit obligation	104	EX. Other Liab Financial Instrument	173	WS. Provision For Risks And Charges	410
Deferred tax liabilities	5,109	EX. Deferred Tax	5,213	WS. Deferred Taxes	4,673
Provisions	306	EX. Deferred Liab Misc Provisions	306	WS. Deferred income	373
Trade andOther Payables	645	EX. Other LT Liabilities	472	WS. Other Liabilities	272
Share capital	4,182	EX. Shareholders Equity Share Capital	4,182	WS. Common Stock	4,182
Equity attributable to equity holders of the parent	73,861	EX. Shareholders Equity	73,861	WS. Total Common Equity	73,861
Minority interests	(1,572)	EX. Deferred Liab Minority Interest	(587)	WS. Minority Interest Bal Sht	(587)

Panel B: Vodafone's Income Statement, Year ended 31 March 2008

Reported Financial Statements		**Extel Financial**		**Worldscope**	
Revenue	35,478	EX. Sales	35,478	WS. Sales	35,478
Cost of sales	(21,890)	EX. Trading Ex Cost Of Goods Sold	(21,890)	WS. Cost Of Goods Sold WS.DepreciationDeplAmortExpense	(15,981) (5,909)
Administration expenses	(6,389)	EX.TradingExpSellingAndGeneral	(6,389)	WS. Selling General Admin Expense	(6,346)
share of result in associated undertakings	2,876	EX. Non Trading Income	2,876		
Other income and expense Non-operating income and expense Investment income	(28) 254 714	EX. Other Income EX. Interest Income EX. Trading Exp Misc By Format1 EX. Exceptional Charges EX. Pre tax Adjustment Expenses	(28) 523 70 (108) 391	WS. Other Income Expense Net WS. Interest Income WS. Extraordinary Charge Pre tax WS. Extraordinary Credit Pre tax	(348) 451 (648) 826
Finance cost	(2,014)	EX. Finance Charges	(1,356)	WS. Interest Expense On Debt WS. Interest Capitalized	(1,356)
Profit before tax	9,001	EX. Profit Before Tax	9,001	WS. Income Bef Income Taxes WS. Equity In Earnings	6,167
Taxation	(2,245)	EX. Taxation	(2,245)	WS. Income Taxes	(2,245)
Minority interest	(96)	EX. After Tax Non Equity Minority Ints	(96)	WS. Minority Interest Income Stmt	(138)
				WS. Equity In Earnings	2,876
Equity holders of the parent	6,660	EX. Net Income	6,660	WS. Net Income	6,660

Panel C: Vodafone's Statement of Cash Flows, Year ended 31 March 2008

Reported Financial Statements		Extel Financial		Worldscope	
Cash flows from operating activities:					
Profit after tax	6,756	EX.CF Operating NetIncome	6,660	WS. Income Bef Extra Items CFStmt	6,756
Depreciation and amortization	5,909	EX.CFOperatingDepreciationAndAmort	5,909	WS.DepreciationDeplAmortCFStmt	5,909
Increase in inventories	(78)	EX.CFOperatingStockDecInc	(78)	WS. Inventory IncDec CF Stmt	(78)
Increase in trade and other receivables	(378)	EX.CFOperatingDebtorDecInc	(378)	WS.AccountsReceivableIncDecCFStmt	(378)
Increase in trade and other payables	460	EX.CFOperatingCreditorIncDec	460	WS.AccountsPayableIncDecCFStmt	460
Net finance costs	2,014				
Share of result in associates undertakings	(2,876)	EX. CF Operating Associate Co Profit	(2,876)		
Other income and expense	28				
Non-operating income and expense	(254)				
Investment income	(714)				
Loss on disposal of property , plant and equipment	70	EX. CF Operating AssetDisposals	70		
Income tax expenses	2,245				
Share-based payments	107				
		EX.CFOperatingMiscNonCashAdjustment	3,522	WS. Other Cash Flow CF Stmt	(2,357)
Cash generated from operations	13,289	EX. CF Operating Inflows	13,289		
		EX. CF Int And Dividends[161]	(3,933)		
Tax paid	(2,815)	EX. CF Taxation[162]	(2,815)		
Net cash from operating activities	10,474			WS. Net Cash Flow Operating CF Stmt	10,312
Cash flows from investing activities:					
Purchase of property, plan and equipment	(3,852)	EX. CF Invs Tangible Assets Acqu	(3,852)	WS.CapitalExpendituresCFStmt	(3,852)
Purchase of investments	39	EX. CF InvsTangible Asset Disposal	39	WS.DisposalOfFixedAssetsCFStmt	39
Purchase of intangible assets	(846)	EX. CF Invs Intangible Assets Acqu	(846)	WS.AdditionsToOthAssetsCFStmt	(846)
Purchase of property, plant and equipment	(96)	EX. CF Invs Financial Assets Acqu	689	WS.IncreaseInInvestmentCFStmt	(96)
Disposal of property, plant and equipment	785			WS.SaleofInInvestmentCFStmt	785
Purchase of interests in subsidiary undertakings and joint ventures , net of cash acquired	(5,957)	EX. CF Invs Acquis And Divest	(5,957)	WS.NetAssetsFrAcquisitionsCFStmt	(5,957)

[161] This item is classified under interest and dividend headline.
[162] This item is classified under taxation headline.

Panel C: Continued

Reported Financial Statements		Extel Financial		Worldscope	
Dividends received from associated undertakings	873				
Dividends received from investments	72	EX. CF Int And Divs Oth Received[163]			
Interest received	438	EX. CF Int And Divs Int Received [164]			
Net cash used in investing activities:	(8,544)	EX. CF Investments[165]	(9,927)	WS. Net Cash Flow Investing CFStmt	(9,927)
Cash flows from financing activities:					
Issue of ordinary share capital and reissue of treasury shares B share capital redemption	310 (7)	EX. CF Financing Share Capital Iss	303	WS. Sale Or Issuance Of Stock CFStmt WS. Purch Of Com And PfdStkCFStmt	310 (7)
Net movement in short term borrowings	(716)	EX. CF Financing STDebtRepaid	(716)	WS. STInvestmentsIncDecCFStmt	(716)
Proceeds from issue of long term borrowings Repayment of borrowings	1,711 (3,847)	EX. CF Financing LTDebtRepaid EX. CF Financing MiscDebtIssued	1,711 (3,847)	WS. LTDebt Issuance CFStmt WS. LTDebt Reduction CFStmt	1,711 (3,847)
Equity dividends pay	(3,658)	EX. CF Int And Divs Misc Paid[166]	(3,658)	WS. Cash Dividends CFStmt	(3,658)
Dividends paid to minority interests	(113)	EX. CF Int And Divs Minority Paid[167]	(113)	WS. Other Financing Uses CFStmt	(113)
Interest paid	(1,545)				
Net cash from financing activities	(7,865)	EX. CF Financing	(2,549)	WS. Net Cash Flow Financing CFStmt	(6,320)
Net increase in cash and cash equivalents	(5,935)	EX. CF Cash And Cash Equiv	(5,935)		
Cash and cash equivalent at beginning of year	7,458				
Effect of foreign exchange rate changes	129			WS. Exchange Rate Effect CFStmt	129
Cash and cash equivalents at the end of year	1,652			WS.CashAndCashEquivIncDecCFStmt	(5,806)

[163] This item is classified under interest and dividend headline.
[164] This item is classified under interest and dividend headline.
[165] The differences in the net cash used in investing activities with respective title in the Extel financial and Worldscope arise from interest and dividend received which are classified under interest and dividend headline.

[166] This item is classified under interest and dividend headline.
[167] This item is classified under interest and dividend headline.

Table A.1.3

Example 1: A Comparison of British Telecommunication's Reported Financial Statements with the Worldscope and Extel Databases

Panel A: British Telecommunication's Balance Sheet, 31 March 2008

Reported Financial Statements		**Extel Financial**		**Worldscope**	
Intangible assets	3,355	EX. Fixed Assets Intangible	3,355	WS. Intangibles	3,355
Property, plant and equipment	15,307	EX. Fixed Assets Tangible	15,307	WS. Total Prop Plant Equip Net	15,307
Trade and other receivables	854	EX. Total Assets Misc	3,741	WS. Other Assets	854
Retirement benefit asset	2,887			WS. Deferred Charges	2,887
Investments	31	EX. Finance Assets Other Investments	15	WS. Other Investments	325
		EX. Finance Assets LT Debtors	16		
Associates and in joint ventures and	85	EX. Finance Assets Associate Co	85	WS .Investment In Unconsol Subsidiaries	101
Derivative financial instruments	310	EX. Other Assets	310		
Inventories	122	EX. Current Assets Stocks	122	WS. Total Inventories	122
Trade and other receivables	4,449	EX. Current Assets Other Prepayments	981	WS. Total Receivables	2,128
		EX. Current Assets Accrued Income	1,340		
		EX. Current Assets Trade Debtors	1,853	WS. Other Current Assets	1,340
		EX. Current Assets Misc Debtors	275	WS. Prepaid Expense IncI Taxes	981
Derivative financial instruments	77	EX. Current Assets Current Investments	78	WS. ST Investments	78
Investments	440				
Cash and bank balances	1,435	EX. Current Assets Cash And Near Cash	1,874	WS. Cash	1,874
Total current assets	6,523	EX. Current Assets	6,523	WS. Current Assets	6,523
Total assets	29,352	EX. Total Assets	29,352	WS. Total Assets	29,352
Trade and other payables	7,591	EX. Creditors Trade Creditors	4,410	WS. Accounts Payable	4,410
Derivative financial instruments	267	EX. Creditors Misc	1,105	WS. Other Current Liabilities	3,529
		EX. Creditors Other Accruals	1,795		
Current tax liabilities	241	EX. Creditors Tax Due	789	WS. Income Taxes Payable	241
Provisions	81	EX. Creditors Current Provisions	81		
Loan and other Borrowings	1,524	EX. Debt ST Loans	1,524	WS. ST Debt And Cur Port LT Debt	1,524
Loan and other Borrowings	9,818	EX. Debt LT Loans	9,818	WS. Total LT Debt	9,818

Panel A: Continued

Reported Financial Statements		Extel Financial		Worldscope	
Derivative financial instruments	805	EX. Other Liab Financial Instrument	805	WS. Deferred Income	71
Retirement benefit obligations	108	EX. Deferred Liab Provisions	373	WS. Provision For Risks And Charges	373
Deferred tax liabilities	2,513	EX. Deferred Tax	2,513	WS. Deferred Taxes	2,513
Provisions	265				
Other payables	707	EX. Other LT Liabilities	707	WS. Other Liabilities	1,441
Share capital	420	EX. Shareholders Equity Share Capital	420	WS. Common Stock	420
Equity attributable to equity holders of the parent	4,989	EX. Shareholders Equity	4,989	WS. Total Common Equity	4,989
Minority interests	23	EX. Deferred Liab Minority Interest	23	WS. Minority Interest Bal Sht	23

Panel B: British Telecommunication's Income Statement, Year ended 31 March 2008

Reported Financial Statements		**Extel Financial**		**Worldscope**	
Revenue	20,704	EX. Sales	20,704	WS. Sales	20,704
Operating costs	(18,697)	EX. Trading Ex Cost Of Goods Sold	0	WS. Cost Of Goods Sold	(8,871)
		EX. Trading Exp Selling And General	0	WS.Depreciation Depl Amort Expense	(3,214)
		EX. Trading Exp MiscByFormat1	(18,168)	WS. Selling General Admin Expense	(6,083)
Other operating income	349	EX. Other Income	359	WS. Other Income Expense Net	778
		EX. Interest Income	65	WS. Interest Income	65
EX. Share of post tax loss of associates and joint ventures	(11)	EX. Non-trading income	(11)		
Finance Income	2,513	EX. Exceptional Charges	(571)	WS. Extraordinary Charge Pre tax	(570)
Profit and disposal of associate	9	EX. Pre tax Adjustment Expenses	420		
Finance expense	(2,891)	EX. Finance Charges	(822)	WS. Interest Expense On Debt	(822)
Profit before tax	1,976	EX. Profit Before Tax	1,976	WS. Income Bef Income Taxes	1,987
Taxation	(238)	EX. Taxation	(238)	WS. Income Taxes	(238)
Minority interest	(1)	EX. After Tax Non Equity Minority Ints	(1)	WS. Minority Interest Income Stmt	(1)
				WS. Equity In Earnings	(11)
Equity holders of the parent	1,737	EX. Net Income	1,737	WS. Net Income	1,737

Panel C: British Telecommunication's Statement of Cash Flows, Year ended 31 March 2008

Reported Financial Statements		Extel Financial		Worldscope	
Cash flows from operating activities:					
Profit before tax	1,976	EX.CF Operating Net Income	1,976	WS. Income Bef Extra Items CFStmt	1,976
Depreciation and amortization	2,889	EX.CF Operating Depreciation AndAmort	2,889	WS.DepreciationDeplAmortCFStmt	2,889
Loss (profit) on sale of associates and non current asset investments	1	EX. CFOperatingAssetDisposals	1		
Increase in inventories	23	EX.CFOperatingStockDecInc	23	WS. Inventory IncDec CF Stmt	23
Increase in trade and other receivables	(498)	EX.CFOperatingDebtorDecInc	(498)	WS.AccountsReceivableIncDecCFStmt	(498)
Increase in trade and other payables	451	EX.CFOperatingCreditorIncDec	451	WS.AccountsPayableIncDecCFStmt	451
(Decrease) increase in provisions and other liabilities	(104)				
Other non cash charges	60				
Net finance expense	378				
Share of losses (profits) of associates and joint ventures	11	EX. CF Operating Associate Co Profit	11		
		EX.CFOperatingMiscNonCashAdjustment	334	WS. Other Cash Flow CF Stmt	(84)
Cash generated from operations	5,187	EX. CF Operating Inflows	5,187		
Income taxes paid	(222)				
Income tax repayment for prior years	521	EX. CF Taxation[168]	(299)		
Net cash from operating activities	5,486			WS. Net Cash Flow Operating CF Stmt	4,757
Cash flows from investing activities:					
Interest received	111	EX. CF Int And Divs Int Received [169]			
Dividends received from associated and joint ventures	2				
Proceeds on disposal of property, plant and equipment	62	EX. CF InvsTangible Asset Disposal	62	WS.DisposalOfFixedAssetsCFStmt	62
Proceeds on disposal of associated and joint ventures	13				
Purchases of non current financial assets	(2)				
Purchases of current financial assets	(4,938)	EX. CF InvsFinancialAssetsAcqu	(160)		
Proceeds on disposal of non current financial assets	1			WS.IncreaseInInvestmentCFStmt	(4,940)

[168] This item is classified under taxation headline.
[169] This item is classified under interest and dividend headline.

Panel C: Continued

Reported Financial Statements		Extel Financial		Worldscope	
Proceeds on disposal of current financial assets Acquisition of subsidiaries, net of cash acquired	4,779 (377)	EX. CF Invs Acquis And Divest	(364)	WS.SaleofInInvestmentCFStmt WS.NetAssetsFrAcquisitionsCFStmt	4,793 (377)
Purchase of property, plan and equipment and computer software	(3,315)	EX. CF Invs Tangible Assets Acqu	(3,315)	WS.CapitalExpendituresCFStmt	(3,315)
Net cash used in investing activities:	(3,664)	EX. CF Investments[170]	(3,777)	WS. Net Cash Flow Investing CFStmt	(3,777)
Cash flows from financing activities:					
Proceeds on issue of treasury shares Repurchase of ordinary shares	85 (1,498)	EX. CF Financing Share Capital Iss	(1,413)	WS. Sale Or Issuance Of Stock CFStmt WS. Purch Of Com And PfdStkCFStmt	85 (1,498)
Net bank loans raised Repayment of borrowings Repayments of finance lease liabilities Net (purchase of) proceeds on issue of commercial paper	3,939 (913) (284) (681)	EX. CF Financing MiscDebtIssued EX. CF Financing FinanceLeases	2,345 (284)	WS. LTDebt Issuance CFStmt WS. LTDebt Reduction CFStmt	3,939 (1,878)
Equity dividends pay	(1,236)	EX. CF Int And Divs Paid[171]		WS. Cash Dividends CFStmt	(1,236)
Interest paid	(842)	EX. CF Int And Divs Paid[172]			
Net cash from financing activities	(1,430)	EX. CF Financing	648	WS. Net Cash Flow Financing CFStmt	(588)
Net increase in cash and cash equivalents	417	EX. CF Cash And Cash Equiv	392	WS.CashAndCashEquivIncDecCFStmt	417
Cash and cash equivalent at beginning of year	757				
Effect of foreign exchange rate changes	25			WS. Exchange Rate Effect CFStmt	25
Cash and cash equivalents at the end of year	1,174				

[170] The differences in the net cash used in investing activities with respective title in the Extel financial and Worldscope arise from interest and dividend received which are classified under interest and dividend headline.

[171] This item is classified under interest and dividend headline.
[172] This item is classified under interest and dividend headline.

Appendix 2

Table A.2.1

Regrouping the Balance Sheet Using Extel Database **2008 (£m)**

The Restructured Balance Sheet	**Tesco**	**Vodafone**	**BT**	**Extel Financial**	**Tesco**	**Vodafone**	**BT**
Assets:							
Cash & ST Investments	2,245	1,699	1,952	EX. Current Assets Cash And Near Cash EX. Current Assets Current Investments	1,788 457	1,699	1,874 78
Trade Accounts Receivables		3,549	1,853	EX. Current Assets Trade Debtors		3,549	1,853
Inventories	2,430	417	122	EX. Current Assets Stocks	2,430	417	122
Prepayments	298	2,426	981	EX. Current Assets Other Prepayments EX. Current Assets Pension Prepayments	298	2,426	981
Tax Recoverable	6	57		EX. Current Assets Other Tax Recoverable	6	57	
Other Current Assets	1,013	576	1,615	EX. Current Assets less other items	1,013	576	1,615
Current Assets	5,992	8,724	6,523	EX. Current Assets	5,992	8,724	6,523
Non-Current Assets classified as Held For Resale	308			EX. Current Assets Held For Resale	308		
Long Term Receivables		115	16	EX. Finance Assets LT Debtors		115	16
Investment In Unconsolidated Subsidiaries	305	22,545	85	EX. Finance Assets Associate Co	305	22,545	85
Other Investments	4	7,138	15	EX. Finance Assets Other Investments	4	7,138	15
Net Plant, Property & Equip	20,899	16,735	15,307	EX. Fixed Assets Tangible	20,899	16,735	15,307
Intangibles	2,336	70,331	3,355	EX. Fixed Assets Intangible	2,336	70,331	3,355
Derivative Financial Instruments	216	831	310	EX. Finance Assets derivative financial instruments	216	831	310
Other Assets		415	3,741	Non-current asset less other items	4	415	3,741
Non-Current Assets	24,068	118,110	22,829	Total assets less Current assets	24,068	118,110	22,829
Total Assets	30,060	126,834	29,352	EX. Total Assets less EX. Finance Assets Defer Tax Assets	30,060	126,834	29,352
Trade Accounts Payable	3,936	2,963	4,410	EX. Creditors Trade Creditors	3,936	2,963	4,410
ST Debt & Current Portion of LT Debt	2,084	4,532	1,524	EX. Debt ST Loans	2,084	4,532	1,524
Income Taxes Payable	779	5,789	789	EX. Creditors Tax Due	779	5,789	789

Table A.2.1: Continued

The Restructured Balance Sheet	**Tesco**	**Vodafone**	**BT**	**Extel Financial**	**Tesco**	**Vodafone**	**BT**
Other Current Liabilities	3,464	8,689	2,981	EX. Creditors Current Provisions, EX. Creditors Other Accruals, EX. Creditors Misc	3,464	8,689	2,981
Current liabilities	10,263	21,973	9,704		10,263	21,973	9,704
Long Term Debt	5,972	21,677	9,818	EX. Debt LT Loans	5,972	21,677	9,818
Non-current Provisions	838	306	373	EX. Deferred Liab Provisions	838	306	373
Deferred Tax	698	4,777	2,513	EX. Deferred Tax	698	4,777	2,513
Derivative Financial Instruments	322	173	805	EX. Other Liab Financial Instrument	322	173	805
Other Long Term Liabilities	65	472	707	EX. Other LT Liabilities	65	472	707
Non-Current liabilities	7,895	27,405	14,216		7,895	27,405	14,216
Total Liabilities	18,158	49,378	23,920		18,158	49,378	23,920
Minority Interest	87	(587)	23	EX. Deferred Liab Minority Interest	87	(587)	23
Total Shareholders Equity	11,815	78,043	5,409	EX. Shareholders Equity, EX. Shareholders Equity Share Capital	11,815	78,043	5,409
Total Shareholders Equity & Liabilities	30,060	126,834	29,352		30,060	126,834	29,352

Appendix 3

Table A.3.1

The Results of the Database Comparison Study by Alves et al (2007)

	Database					
	EXCA[173]	EXT1B[174]	TFT1B[175]	WSDS[176]	WST1B[177]	DSA[178]
Companies listed in the database	5,372	5,460	5,460	6,141	5,460	4,361
Companies with total assets or net income	5,232	5,184	5,460	3,199	3,888	4,361
Percentage of firms retained	97%	95%	100	52%	71%	100%

173 Extel Financial via the Company Analysis platform
174 Extel Financial via the Thomson One Banker platform
175 Thomson Financial via the Thomson One Banker platform
176 Worldscope via the Datastream platform
177 Worldscope via the Thomson One Banker platform
178 Datastream Company Accounts Historical Archive

Appendix 4

Table A.4.1
Distributional Statistics Reported in Prior Work on the Prediction of Future Cash Flows

Panel A: Distributional Statistics of Barth et al (2001), Sample of the US Firms, 1987-1996

Variables	Mean	S.D.	Median
EARN	0.04	0.08	0.04
CFO	0.08	0.08	0.09
ACC	-0.04	0.08	-0.04
Δ*AR*	0.01	0.05	0.01
Δ*INV*	0.01	0.05	0.01
Δ*AP*	0.01	0.04	0.01
DEPR	0.05	0.03	0.04
AMORT	0.01	0.02	0.00
OTHER	-0.01	0.05	-0.01

Panel B: Distributional Statistics of Kim and Kross (2005), Sample of the US Firms, 1972-2001

Variables	Mean	S.D.	Median
EARN	0.007	0.152	0.038
CFO	0.031	0.171	0.064
ACC	-0.024	0.114	-0.033

Panel C: Distributional Statistics of Brochet et al (2009), Sample of the US Firms, the Third Fiscal Quarter in 2002 to the Fourth Quarter in 2006

Variables	Mean	S.D.	Median
EARN	0.0083	0.0467	0.0135
CFO	0.0213	0.0493	0.0240
ACC	-0.0129	0.0521	-0.0115

Appendix 5

Table A.5.1
Detailed Results of Out-of-Sample Estimations, Using Information from the Statement of Cash Flows

Panel A: Mean Adjusted R-Squareds

	Cash Flow only			Aggregate Earnings			Disaggregated Earnings			Full Disaggregation		
	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one- year-ahead	two-year-ahead	three-year-ahead
1993	0.430	0.343	0.394	0.404	0.345	0.397	0.483	0.395	0.436	0.044	-0.004	-0.003
1994	0.511	0.443	0.409	0.485	0.368	0.408	0.542	0.391	0.469	0.517	0.212	0.227
1995	0.418	0.486	0.412	0.475	0.457	0.382	0.499	0.513	0.456	0.431	0.312	0.205
1996	0.512	0.419	0.435	0.519	0.422	0.394	0.545	0.462	0.442	0.399	0.009	0.359
1997	0.455	0.376	0.250	0.482	0.382	0.274	0.530	0.422	0.307	0.490	0.269	0.076
1998	0.408	0.222	0.147	0.494	0.307	0.196	0.483	0.299	0.181	0.539	0.269	0.144
1999	0.391	0.248	0.218	0.352	0.195	0.211	0.424	0.262	0.226	0.360	0.305	0.251
2000	0.324	0.294	0.213	0.275	0.289	0.208	0.316	0.291	0.246	0.350	0.256	0.245
2001	0.351	0.305	0.286	0.371	0.281	0.232	0.383	0.340	0.269	0.317	0.133	0.148
2002	0.419	0.374	0.286	0.381	0.335	0.242	0.428	0.386	0.282	0.379	0.390	0.275
2003	0.457	0.386	0.401	0.430	0.395	0.361	0.492	0.413	0.426	0.504	0.255	0.302
2004	0.456	0.378	0.260	0.405	0.333	0.207	0.465	0.370	0.262	0.386	0.375	0.193
2005	0.384	0.302	0.301	0.360	0.327	0.315	0.407	0.360	0.347	0.289	0.345	0.324
2006	0.428	0.269		0.414	0.300		0.484	0.299		0.509	0.217	
2007	0.373			0.406			0.447			0.445		
Mean	0.421	0.346	0.309	0.417	0.338	0.294	0.462	0.371	0.334	0.397	0.239	0.211

Panel B: Mean of Prediction Errors

	Cash Flow only			Aggregate Earnings			Disaggregated Earnings			Full Disaggregation		
	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one- year-ahead	two-year-ahead	three-year-ahead
1993	-0.003	0.005	0.001	-0.003	0.003	0.002	-0.004	0.004	0.002	-0.003	0.016	0.011
1994	-0.005	-0.005	-0.007	0.013	0.009	0.007	0.002	0.002	0.002	0.000	-0.006	0.002
1995	0.007	0.004	0.005	0.011	0.012	0.008	0.010	0.008	0.005	0.007	0.013	0.013
1996	0.004	0.002	0.001	0.001	0.002	0.001	0.004	0.001	0.003	0.005	0.017	0.004
1997	0.001	0.004	0.001	0.003	0.001	0.002	0.002	0.002	0.001	0.003	-0.001	-0.001
1998	-0.004	-0.002	-0.003	-0.009	-0.005	-0.006	-0.006	-0.004	-0.005	-0.006	-0.002	-0.004
1999	-0.004	-0.002	-0.003	-0.009	-0.005	-0.006	-0.006	-0.004	-0.005	-0.006	-0.002	-0.004
2000	-0.014	-0.009	-0.008	-0.012	-0.010	-0.007	-0.015	-0.012	-0.010	-0.016	-0.011	-0.008
2001	-0.005	-0.005	-0.003	-0.011	-0.009	-0.007	-0.007	-0.008	-0.004	-0.008	-0.017	-0.004
2002	0.001	-0.002	0.000	-0.011	-0.010	-0.006	-0.006	-0.007	-0.004	-0.009	-0.009	-0.008
2003	0.002	0.000	0.000	0.011	0.006	0.006	0.008	0.003	0.004	0.004	0.002	-0.001
2004	0.002	0.000	0.000	0.011	0.006	0.006	0.008	0.003	0.004	0.004	0.002	-0.001
2005	-0.001	0.000	-0.001	0.009	0.006	0.005	0.003	0.003	0.001	-0.001	-0.002	-0.001
2006	0.000	-0.004		0.002	-0.001		-0.001	-0.004		0.000	-0.009	
2007	0.003			0.005			0.004			0.003		
Mean	-0.001	-0.001	-0.001	0.001	0.000	0.000	0.000	-0.001	0.000	-0.002	-0.001	0.000

Panel C: Median Prediction Errors

	Cash Flow only			Aggregate Earnings			Disaggregated Earnings			Full Disaggregation		
	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one- year-ahead	two-year-ahead	three-year-ahead
1993	-0.006	0.007	0.004	-0.003	0.001	0.001	-0.008	0.004	0.008	-0.003	0.007	0.008
1994	0.005	-0.002	-0.009	0.009	0.004	0.006	0.004	0.001	0.000	0.004	-0.001	0.005
1995	0.006	0.000	0.001	0.012	0.009	0.003	0.009	0.005	0.000	0.007	0.009	0.006
1996	0.007	0.000	0.001	0.000	-0.005	-0.002	0.008	-0.004	0.001	0.008	0.007	0.003
1997	-0.004	0.004	-0.008	0.002	0.001	-0.004	0.002	0.004	-0.005	0.003	0.000	-0.008
1998	-0.006	-0.004	-0.002	-0.012	-0.002	-0.003	-0.007	-0.002	-0.002	-0.006	0.001	-0.001
1999	-0.006	-0.004	-0.002	-0.012	-0.002	-0.003	-0.007	-0.002	-0.002	-0.006	0.001	-0.001
2000	-0.016	-0.009	-0.012	-0.010	-0.011	-0.007	-0.014	-0.011	-0.013	-0.012	-0.007	-0.010
2001	-0.003	-0.010	-0.002	-0.014	-0.012	-0.011	-0.006	-0.012	-0.004	-0.006	-0.016	-0.006
2002	0.000	-0.002	-0.002	-0.013	-0.014	-0.008	-0.005	-0.009	-0.002	-0.006	-0.007	-0.005
2003	0.001	-0.005	-0.004	0.004	-0.002	-0.001	0.003	-0.002	0.000	0.003	-0.002	-0.001
2004	0.001	-0.005	-0.004	0.004	-0.002	-0.001	0.003	-0.002	0.000	0.003	-0.002	-0.001
2005	-0.006	-0.007	-0.004	0.001	0.000	0.001	-0.004	0.000	-0.001	-0.003	0.000	-0.002
2006	-0.001	-0.003		-0.002	-0.003		-0.003	-0.002		0.000	-0.003	
2007										0.000		
Mean	-0.002	-0.003	-0.003	-0.002	-0.003	-0.002	-0.002	-0.002	-0.002	-0.001	-0.001	-0.001

Panel D: Mean Absolute Prediction Errors

	Cash Flow only			Aggregate Earnings			Disaggregated Earnings			Full Disaggregation		
	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one- year-ahead	two-year-ahead	three-year-ahead
1993	0.049	0.055	0.049	0.051	0.053	0.049	0.048	0.052	0.048	0.075	0.132	0.142
1994	0.049	0.047	0.055	0.055	0.055	0.053	0.050	0.051	0.052	0.049	0.061	0.060
1995	0.054	0.055	0.053	0.054	0.055	0.055	0.053	0.053	0.052	0.053	0.063	0.063
1996	0.055	0.055	0.050	0.054	0.057	0.052	0.052	0.054	0.049	0.062	0.108	0.054
1997	0.057	0.054	0.058	0.056	0.055	0.057	0.054	0.052	0.056	0.058	0.057	0.064
1998	0.056	0.056	0.056	0.057	0.060	0.057	0.055	0.057	0.056	0.059	0.055	0.057
1999	0.056	0.056	0.056	0.057	0.060	0.057	0.055	0.057	0.056	0.059	0.055	0.057
2000	0.061	0.056	0.057	0.064	0.057	0.057	0.062	0.057	0.056	0.063	0.060	0.057
2001	0.055	0.056	0.056	0.055	0.057	0.060	0.055	0.055	0.058	0.057	0.067	0.065
2002	0.055	0.055	0.055	0.058	0.059	0.056	0.054	0.055	0.055	0.057	0.055	0.058
2003	0.050	0.055	0.056	0.054	0.058	0.058	0.050	0.056	0.057	0.054	0.056	0.063
2004	0.050	0.055	0.056	0.054	0.058	0.058	0.050	0.056	0.057	0.054	0.056	0.063
2005	0.054	0.056	0.057	0.057	0.056	0.057	0.053	0.054	0.055	0.056	0.055	0.056
2006	0.055	0.058		0.055	0.058		0.054	0.057		0.052	0.059	
2007	0.058			0.056			0.054			0.054		
Mean	0.054	0.055	0.055	0.056	0.057	0.056	0.053	0.055	0.054	0.057	0.067	0.066

Panel E: Median Absolute Prediction Errors

	Cash Flow only			Aggregate Earnings			Disaggregated Earnings			Full Disaggregation		
	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one- year-ahead	two-year-ahead	three-year-ahead
1993	0.037	0.039	0.038	0.041	0.038	0.041	0.035	0.036	0.037	0.038	0.040	0.042
1994	0.035	0.035	0.048	0.039	0.043	0.042	0.035	0.039	0.040	0.035	0.040	0.044
1995	0.036	0.046	0.042	0.039	0.044	0.042	0.038	0.041	0.041	0.038	0.044	0.042
1996	0.041	0.040	0.041	0.042	0.044	0.040	0.039	0.042	0.039	0.042	0.048	0.039
1997	0.042	0.042	0.050	0.041	0.045	0.046	0.040	0.040	0.044	0.041	0.039	0.042
1998	0.041	0.043	0.043	0.042	0.045	0.045	0.041	0.043	0.044	0.044	0.041	0.042
1999	0.041	0.043	0.043	0.042	0.045	0.045	0.041	0.043	0.044	0.044	0.041	0.042
2000	0.042	0.043	0.043	0.043	0.043	0.044	0.039	0.041	0.043	0.043	0.044	0.041
2001	0.042	0.046	0.043	0.042	0.045	0.048	0.043	0.043	0.045	0.040	0.046	0.048
2002	0.037	0.041	0.041	0.044	0.044	0.040	0.037	0.044	0.039	0.042	0.042	0.042
2003	0.035	0.041	0.040	0.037	0.042	0.041	0.032	0.040	0.041	0.035	0.040	0.043
2004	0.035	0.041	0.040	0.037	0.042	0.041	0.032	0.040	0.041	0.035	0.040	0.043
2005	0.038	0.038	0.042	0.043	0.041	0.042	0.037	0.037	0.040	0.037	0.037	0.042
2006	0.039	0.041		0.038	0.043		0.037	0.041		0.035	0.038	
2007	0.042			0.038			0.037			0.038		
Mean	0.039	0.041	0.043	0.041	0.043	0.043	0.038	0.041	0.041	0.039	0.041	0.042

Panel F: The Theil's U Statistic

	Cash Flow only			Aggregate Earnings			Disaggregated Earnings			Full Disaggregation		
	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one-year-ahead	two-year-ahead	three-year-ahead	one- year-ahead	two-year-ahead	three-year-ahead
1993	.0408	0.434	0.377	0.419	0.431	0.375	0.391	0.418	0.368	1.437	3.955	4.130
1994	0.399	0.379	0.380	0.419	0.412	0.381	0.387	0.401	0.358	0.416	0.603	0.503
1995	0.417	0.370	0.393	0.399	0.386	0.404	0.399	0.365	0.380	0.439	0.520	0.602
1996	0.387	0.400	0.390	0.375	0.399	0.404	0.372	0.386	0.388	0.484	1.700	0.436
1997	0.404	0.430	0.458	0.396	0.415	0.450	0.378	0.412	0.440	0.437	0.552	0.743
1998	0.470	0.520	0.513	0.430	0.480	0.489	0.439	0.488	0.502	0.415	0.534	0.543
1999	0.458	0.491	0.483	0.470	0.515	0.487	0.448	0.490	0.489	0.512	0.482	0.504
2000	0.539	0.480	0.496	0.570	0.485	0.493	0.566	0.492	0.488	0.561	0.542	0.504
2001	0.479	0.480	0.498	0.462	0.488	0.511	0.468	0.469	0.516	0.547	0.803	0.705
2002	0.492	0.493	0.491	0.517	0.513	0.516	0.504	0.494	0.505	0.556	0.502	0.558
2003	0.474	0.482	0.472	0.488	0.478	0.490	0.464	0.471	0.463	0.471	0.618	0.527
2004	0.447	0.484	0.502	0.481	0.506	0.529	0.455	0.492	0.512	0.527	0.496	0.619
2005	0.471	0.495	0.495	0.485	0.485	0.487	0.465	0.476	0.483	0.613	0.495	0.499
2006	0.485	0.580		0.482	0.521		0.463	0.578		0.454	0.709	
2007	0.512			0.493			0.476			0.485		
Mean	0.456	0.466	0.458	0.459	0.465	0.463	0.445	0.459	0.453	0.557	0.893	0.836