The Persistence of Book-Tax Differences

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February 2014

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Acknowledgements: The authors are grateful for the helpful comments from seminar and conference participants at School of Management, University of Southampton (2012) and British Accounting and Finance Association, Newcastle (2013) and in particular Rahma Addeh and Sarah Lindop.

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Abstract:

Academic researchers and policy activists have used the difference between accounting income and estimated taxable income, commonly referred to as the book-tax difference (BTD) as a proxy of the unobservable level of corporate income tax planning. In drawing any policy implications from observed BTDs, an understanding of the sources of BTDs and their properties is important. In particular, identifying the degree of persistence or representativeness of an observed annual BTD is critical.

To the authors' knowledge, this paper is the first to examine how BTDs and their components e.g. permanent differences, temporary differences and the effect of differences between UK and overseas statutory tax rate behave over time. The necessary data disclosed under IAS 12 Income Taxes (IASB, 2010) has only been systematically publicly disclosed in the UK since 2005.

In summary, the results indicate that the degree of persistence is dependent on the nature of the BTD and that this variation in persistence itself varies by industry group. The most persistence component relates to differences between UK and overseas statutory tax rates with temporary differences being the least persistent, indicative of a non-earnings management motivation. Within industry groupings there is wide variation in the level of persistence. While 59.4% of the sample companies experienced only one change of sign BTD at most in the six year period, the balance of the sample had at least two changes.

The Persistence of Book-Tax Differences

1. Introduction

A recent phenomenon is the increased scrutiny of the level of corporate income tax paid by companies (Whiting, 2006). Companies have often attracted adverse attention because of a perceived discrepancy between the level of accounting profits reported and the associated levels of taxable income and consequentially, the level of corporate income tax payable e.g. UK Uncut (2010) and Public Accounts Committee (2012). In general terms the scrutiny reflects concerns over companies' use of tax avoidance techniques and the perceived consequences on levels of government revenues and increased levels of taxation on other taxpayer groups (The Guardian, 2009; Trade Union Congress, 2009; UK Uncut, 2010; New Statesman, 2011 and Christian Aid, 2012). Hasseldine, Holland & Van der Rijt (2012) show that tax administrations have responded in a number of ways. These include the publication of UK *Tax Gap* statistics by HMRC in 2009 for the first time and the introduction into UK legislation of a *General Anti Avoidance Rule – GAAR* (HMRC 2013). Further afield intergovernmental organisations have published proposals to "combat" tax avoidance e.g. EU (2013) and OECD (2013).

Companies are required to calculate two measures of income on an annual basis. One measure is determined by financial reporting regulations to give accounting or book income while the second uses tax law to produce a figure of taxable income. The degree to which the resulting levels of income correspond depends on the extent of conformity between the two measures (Hanlon, 2005). Any difference between the two levels is commonly referred to as the book-tax difference (BTD). Emphasising the importance of BTDs, "large" US corporations have been required to file with the Internal Revenue Service (IRS) a reconciliation

(Schedule M-3) of taxable income and financial accounting income since 2004 (Boynton & Mills, 2004).

In response to BTDs, there have been calls to require conformity between the two income measures to end "arbitraging" between the two measures i.e. reporting accounting income that is not included in taxable income and to increase the reliability of reported accounting income by removing the greater flexibility available under financial reporting standards compared with tax legislation (Desai, 2005). However, advocates of the current position argue such conformity would lead to a loss of information content by removing this flexibility through which managers can signal private information (Hanlon, Maydew & Shevlin, 2008). These studies examine the persistence of accounting income i.e. the relation between accounting earnings in successive periods.

We examine a different question by focusing for the first time on the persistence of annual BTDs. While BTDs as can arise for a number of reasons including tax planning, a passive interaction between accounting and tax based income definitions and earnings management (Graham, Raedy & Shackelford, 2012), we use IAS 12 Income Taxes (IASB 2010) to examine aggregate and disaggregated BTDS.[1] This allows separate consideration of permanent and temporary differences in the income measures, and the effect on of income being taxable in overseas jurisdictions with statutory tax rates that differ from the UK rate. Using disaggregated measures allows a better understanding of the underlying motivation. The sample comprises a panel of UK quoted non-financial companies over the six year period 2005 – 2010 and comprises 798 company-year observations.

The paper contributes to the literature on corporate tax performance by analysing the dynamic processes which give rise to BTDs in three aspects. Firstly, whether the sign of BTDs i.e. whether accounting income is higher or lower than

estimated taxable income, changes over time or is consistent, affects the validity of using a single (annual) observation as a representative measure of corporate income tax behaviour and the conclusions that can be drawn. This has direct implications when analysing corporate performance in terms of after tax income performance and more widely in terms of judging corporate behaviour with respect to broader societal expectations. Secondly, it provides an insight into corporate behaviour. A positive (negative) serial correlation in BTDs infers companies consistently (temporarily) maintaining the relative levels of accounting and taxable income. Thirdly, to the extent these dynamics vary by company is an indicator of company specific tax behaviour and provides a measure of the extent to which companies deviate from their peers. This can have implications for the effectiveness of regulatory policy with respect to both taxation and accounting.

In summary, the results indicate that the degree of persistence is dependent on the nature of the BTD and that this variation in persistence itself varies by industry group. The most persistence component relates to differences between UK and overseas statutory tax rates with temporary differences being the least persistent indicative of a non-earnings management motivation. Within industry groupings there is wide variation in the level of persistence. While 59.4% of the sample companies experienced only one change of sign BTD at most in the six year period, the balance had at least two changes.

This paper proceeds as follows: Section 2 presents a review of relevant literature and is followed by Section 3 on sample and data, Section 4 explains the research design while Section 5 presents the results of the analysis and Section 6 contains a discussion and the paper's conclusions.

2. Literature review

The concept of persistence is familiar in research examining the quality of accounting earnings where higher (lower) temporal correlation in accounting earnings is interpreted as indicative of higher (lower) quality of earnings (Sloan 1996). This approach has also been used to examine the relative information content of accounting earnings and cash flow by decomposing accounting earnings into cashflows from operations and accounting accruals. Sloan (1996) found a higher persistence between cashflows and next period accounting earnings than with accounting accruals and next period accounting earnings. This lower quality in accounting accruals is attributed to the flexibility and subjectivity involved in their calculation which allows a greater independence between successive values.

Hanlon (2005) and Blaylock, Shevlin & Wilson (2012) examined the information content of BTDs by the extent to which they moderate the relation between current period accruals and next period accounting earnings. BTDs as a summary measure of the comparison between two income measurement systems can provide additional information on earnings persistence beyond that in the accounting earnings figure (Hanlon, 2005). Taxable income may be a more robust measure less liable to management and therefore BTDs may be indicative of the extent of earnings management (Desai, 2005, Abdul Wahab &,Holland, 2012). Hanlon (2005) finds that the relation between accounting accruals and next period accounting earnings is moderated by the level of BTDs with higher BTDs being associated with lower earnings persistence. Raedy, Seidman and Shackelford (2011) use disaggregated BTDs to extend Hanlon (2005) and conclude that investors price all components of the BTD equally irrespective of their differing nature; a result they described as “baffling” given the differing cashflows effects of the various sources of BTDs.

XXX Insert figure 1 about here XXX

In viewing this paper it is useful to consider the processes involved in generating accounting earnings and taxable income measures, this is shown in figure 1. The earnings persistence literature reviewed above concentrates on the information content of current accounting earnings or decomposed accounting earnings in forecasting future accounting earnings. Instead we focus on the persistency of BTDs in their own right.

Although there is limited research on BTDs we are not aware of any which examines their persistence. While Plesko & Weber (2009) examine the time series properties of accounting income and taxable income they do not examine BTDs. Their focus is on the use of accounting data to forecast taxable income in order to estimate marginal corporate income tax rates. Their finding that book and taxable income have similar persistence coefficients is conducive to using accounting income in forecasting future taxable income. Dyreng, Hanlon & Maydew (2008) examine long term tax avoidance and find a weak relation between annual and long term (five and ten years) cash Effective Tax Rates (ETRs) and highlight the significant year to year variation in annual ETRS.[2,3] This variability is reflected in the majority of companies (>73%) not being able to maintain a consistently low ETR at below 20% compared to a mean rate of 30%. Although Chen, Dhaliwal & Trombley (2012) use the concept of consistency in connection with BTDs to extend Hanlon (2005), their focus is on its moderating effect on the relation between accruals and future accounting earnings rather the properties of consistency.

From a tax planning perspective, BTDs can be decomposed into permanent differences (PDs) and temporary differences (TDs) between accounting and taxable income definitions (Dyreng et al., 2008; Donohoe & McGill, 2011; Tang & Firth, 2011). PDs arise in a single year because of differences between the two income

measures in how a transaction is treated (Wilson, 2009). The level of PDs can reflect strategic tax management (Frank, Lynch & Rego, 2009).

The second source of tax planning related BTDs arises because of temporal differences between accounting and taxable income measures resulting in a transaction being included in both accounting and taxable income measures though not simultaneously e.g. relief for qualifying expenditure on plant and machinery, and utilisation of loses (Altshuler, Auerbach, Cooper & Knittel, 2009; Shackelford, Slemrod & Sallee, 2011). Although the ultimate effect of TDs on a period's accounting reported tax expense is almost absent, they affect the tax expense composition (Maydew & Shackelford, 2007) and have a cash flow timing affect. While TDs can represent tax avoidance in the form of tax deferral, Frank et al. (2009) caution that TDs can also arise from non-discretionary differences e.g. differences between non tax deductible accounting deprecation and tax deductible capital allowances. There is second dimension to the persistence of TDs. Although by definition TDs only produce a temporary BTD, if a company can generate net new TDs consistently over time through continual tax planning the effect is more permanent.

BTDs can also arise from earnings management. This is more likely to represent PDs which can imply managerial aggressiveness in financial accounting reporting (Hanlon & Slemrod, 2009). However, companies may be willing to pay corporate income tax on managed earnings as a signal of their credibility (Erickson, Hanlon & Maydew, 2004) and therefore include the managed earnings in both accounting and taxable income measures. Earnings management in the form of accelerating income recognition or deferring expense recognition would not change the composition of the overall tax change even in the unlikely event of a company adjusting (reversing) the effects of accounting earnings management when estimating corporate income tax liability.[4]

A third aspect of tax planning can be identified in the context of *IAS 12 Income Tax* mandated disclosures and BTDs. Taxable income subject to a statutory tax rate (STR) which differs from the rate prevailing in a company's home jurisdiction will give rise to a higher or lower current tax expense than would be the case if the income was only taxable at the domestic STR (Bucovetsky & Haufler, 2008; Devereux, Lockwood & Redoano, 2008). We use the term *Statutory Tax Rate Difference* (STRD) to describe the net overall effect of differences in statutory tax rates and tax base definitions between the UK and other tax jurisdictions in which a firm operates. This measure can provide forward-looking information to shareholders in assessing the consistency of companies' tax management activities (Schmidt, 2006). We also include STRD in our examination of the persistence of BTDs, PDs and TDs.

The ability to generate BTDs or the circumstances that generate them may be firm specific e.g. senior managements' preferences (Dyreng, Hanlon and Maydew, 2010), or industry specific level. The influence of distinctive industry effects on companies' tax charges has been long researched, for example, Harberger (1959) and Grieson, Hamovitch, Levenson & Morgenstern (1977). Industry membership can be relevant because of industry specific tax treatments in credit, incentives and allowance (Omer, Molloy & Ziebart, 1993; Holland, 1998; Kim & Limpaphayom, 1998; McIntyre & Nguyen, 2000). Further differences in industry conditions, for example, risk, competitiveness and asset structure, can explain variations in companies' capital and operating expenditure with consequential variations tax liability (Bradley, Jarrell & Kim, 1984; Kovenock & Phillips, 1997).

In summary, BTDs and their components PDs, TDs and STRDs have potential information content to interested parties. An understanding of the stability and persistency of these items can help shareholders, tax administrations and society more generally, understand the processes underlying companies' tax performance.

3. Sample and data

This paper analyses financial reporting disclosed tax data of a sample of companies listed on the London Stock Exchange for the six year period 2005 to 2010. The sample is restricted to non-financial companies to reduce complexities from variations in financial reporting regulations. Further, companies with extreme effective tax rates (ETRs), i.e. ETRs value outside the range ± 1 were excluded to control for the potential bias of nonrecurring statutory reconciliation items.[5] Such items could be due to effects of unusual activity, for example, business dispositions and asset impairments (Phillips, 2003). Table 1 presents the summary of the sample reconciliation.

XXX Insert Table 1 about here XXX

As the effective tax rate reconciliation notes in the companies' financial statements are not in machine readable form, the required tax data was hand gathered from the tax footnotes of each firm. *IAS 12 Income Tax* requires the disclosure of a company's total corporate income Tax Expense (**TE**), separately identifying the current tax expense (**CTE**) and deferred tax expense (**DTE**). Further, a reconciliation between TE and the notional tax charge, i.e. the corporate income tax liability that would be expected by applying the current (UK) statutory tax rate to the current accounting profit is required.[6] Specifically the reconciliation summaries the effect of, permanent differences (PD) between accounting and taxable income measures, differences between UK and foreign statutory tax rates (STRD) and disclosures the UK Statutory Tax Rate applying during the period.[7] Further, disclosure of (i) *"the amount of deferred tax expense (income) relating to changes in tax rates or the imposition of new taxes"*; and (ii) *"the amount of the benefit arising from a previously unrecognised tax loss, tax credit or temporary*

difference of a prior period that is used to reduce current tax expense [or deferred tax expense]" (IAS 12 para 80, IASB, 2010) enables the effects of such amounts, along with any prior year adjustments, to be removed from the TE to ensure it is free of distorting effects relating to other periods.[8] In turn the separate disclosure of DTE allows the effect of temporary differences (TD) between accounting and taxable income measures to be quantified.

Table 2 presents the distribution of the companies across industry classification (n=798). In the sample, there are more companies in the industrial sector (39.85%), than in consumer services (22.56%) and basic materials (9.77%). The relative distribution of the remaining industries is as follows: consumer goods, technology, oil and gas, health care and utilities.

XXX Insert Table 2 about here XXX

4. Research design

Identification of BTD and components

We use companies' annual accrued corporate income tax charges to estimate BTDs. This involves taking the disclosed pre-tax accounting earnings and estimating taxable income. Hanlon (2003) and Donohoe, McGill and Outslay (2012) summarise limitations in using US accounting date to estimate taxable income. Three major potential sources of error exist: (1) transactions that do not generate permanent or temporary book-tax differences, (2) research and development tax credits, and (3) tax rate differentials between domestic and foreign operations. The first condition holds in a UK/IFRS setting in that conforming differences i.e. items that do not appear in either accounting or taxable income, will escape measurement. However, the incentive for companies to enter into permanent confirming differences is likely to be low for quoted companies facing market expectations for increased reported accounting income (Erickson et al. 2004,

Hanlon & Heitzman, 2010). The information in the IAS 12 tax reconciliation allows the second limitation to be overcome and the third reduced as discussed below. However, the overall conclusion remains that as in all jurisdictions where public access to companies' tax returns is not routinely available, estimates of taxable income using only publically available information will measure underlying taxable income with error. However, in this setting the source of the error can be identified.

We calculate a company's book tax differences (BTDs) as follows by firstly defining BTDs as:

$$BTD = PBT - TP \tag{1}$$

where: PBT = profit before tax and TP = estimated taxable profits. To arrive at TP in the absence of access to a company's confidential tax returns, we effectively gross up the CTE. We define CTE as:

$$CTE = (TP_{uk} * STR_{uk}) + (TP_{os} * STR_{os}) \tag{2}$$

where STR = statutory corporate tax rate, and UK and OS refer to profits taxable in the UK and outside of the UK respectively. Disaggregating TP into UK and overseas taxable profit and rearranging gives:

$$TP_{uk} = TP - TP_{os} \tag{3}$$

Substituting (3) in (2) gives:

$$CTE = TP * STR_{uk} + (STR_{os} - STR_{uk}) * TP_{os} \tag{4}$$

Substituting (4) into (3) and rearranging gives:

$$TP = \frac{CTE}{STR_{uk}} - \frac{(STR_{os} - STR_{uk}) * TP_{os}}{STR_{uk}} \tag{5}$$

The numerator in the second right hand term is the tax effect of TP_{os} being taxed at a rate STR_{os} that differs from STR_{uk}. We define this as the Statutory Rate Differential (STRD):

$$STRD = (STR_{os} - STR_{uk}) * TP_{os} \quad (6)$$

A positive value of STRD represents an overseas statutory rate(s) being higher than the UK rate. Substituting equation (5) into (1) gives:

$$BTD = PBT - \frac{CTE}{STR_{uk}} + \frac{(STR_{os} - STR_{uk}) * TP_{os}}{STR_{uk}} \quad (7)$$

However, in practise we cannot observe equation (6) because the disclosed reconciliation is to the TE, and not CTE, and consequently timing differences are not included. Instead, in reconciling TE and notional tax charge the disclosed $STRD_{disclosed}$ comprises:

$$STRD_{disclosed} = (STR_{os} - STR_{uk}) * (PBT_{os} + PD_{os}) \quad (8)$$

The difference between equation (8) and (5) is that the former excludes TDs. Consequently to the extent that a company has net positive (negative) TDs in jurisdictions with statutory tax rates which differ from the UK's statutory rate, the estimated TP will be under (over) stated by the grossed up value of such TDs. In turn the disaggregated TD is similar affected. The estimated BTD is shown in equation (9) below.

$$BTD_{esttimated} = PBT - \frac{CTE}{STR_{uk}} + \frac{(STR_{os} - STR_{uk}) * (PBT_{os} + PD_{os})}{STR_{uk}} \quad (9)$$

Next the BTD is disaggregated into Temporary (TDs) and Permanent differences (PDs) as follows. We measure TDs as:

$$TD = \frac{DTE}{STR_{uk}} \qquad (10)$$

where DTE is adjusted for non-current items, as discussed above. A positive signed TD represents temporary differences with the net effect of reducing the current year taxable income relative to accounting income and vice versa. Finally, permanent differences are defined as:

$$PD = PBT - TP - TD \qquad (11)$$

A positive signed PD represents an adjustment that decreases taxable income relative to accounting income. PDs capture non-reversing reconciling items that arise from differences between accounting income and taxable income measures.

Data analysis

The data is initially analysed using change of sign to determine the extent to which BTDs and their components vary over time. Subsequently, dynamic panel-data estimation is employed to assess formally the relation between BTDs and their lagged value. To capture heterogeneity in firm specific factors, normally a fixed effects model could be estimated. In this setting of a short time period and large number of companies i.e. "small T and large N", the use of a lagged dependent variable as an independent variable results in biased estimates of the coefficients of the lagged variable (Nickell, 1981). Consequently, in this setting we use the Blundell and Bond (1998) generalised method of moments (GMM) estimator.[9] To remove scale effects present when using accounting data the analysis is conducted on size deflated variables, with book value of closing assets (BVA) acting as the deflator (Shen and Stark, 2011).[10] Descriptive statistics are also reported for variables deflated by profit before tax (PBT), which although having a more intuitive interpretation in linking BTD with pre-tax accounting income, may reflect scale

effects because of possible association between levels of pre-tax accounting income and BTDs.[11] In testing the degree of persistence a one period autoregressive process AR(1). An AR(1) process maximises the number of observations used in estimation thereby leading to more robust estimations and is comparable to models used in time series studies of accounting income and taxable income (Plesko and Weber (2009).[12] The formal model is in turn estimated for BTD and each of its three components, PD, TD and STRD as in (12) below in the context of modelling BTD.

$$\frac{BTD_{it}}{PBT_{it}} = \alpha \frac{BTD_{it-1}}{PBT_{it}} + X'\beta + \varepsilon_{it} \qquad (12)$$

where X' is a vector of year dummies 2006, 2007, 2008, 2009 and 2010.[13] As discussed above, there is evidence of an association between companies' industry classification and their tax status, the above model is also estimated on sub samples formed by industry group.

5. Results

Descriptive statistics for annual BTDs and components are reported in table 3. Taking the sample as a whole, the weighted mean BTD is positive in all years except 2009, i.e. accounting income exceeds taxable income in each of these five years. The excess is in a narrow range of 2% to 4%. The number of companies with a positive BTD is an increasing majority for each of first three years before falling back over the next three years: over the six years the number ranges from to 49% to 70%. The mean un-weighted BTD is positive in the first three years and negative in 2008, 2009 and 2010.

A similar pattern exists with PDs. For each of the first three years the weighted mean 3% is positive i.e. on average PDs increase taxable income relative to

accounting income, before a lower weighted mean in the remaining three years with a minimum, negative value, in 2009. The percentage of companies with positive PDs follows a similar trend to BTDs though closer to 50%.

There is less variation in the weighted mean TD which is 1% in five years and -1% in the remaining year, 2009. On average the effect of TDs is to increase taxable profits relative to accounting profits. The range of the percentage of companies with positive TDs is 50% to 65%. While all companies have PDs and TDs a reduced number have STRDs. The weighted mean is positive in all six years indicating that on average overseas statutory rates are higher than the UK rate. However, at the firm level this holds for only a minority of companies ranging, from 34% in 2005 to 44% in 2008. For the majority, overseas profits are taxed at a lower rate than the UK rate.

To examine the stability of the magnitudes of BTDs and their components, the differences between the unweighted means across years were analysed using ANOVA. The results are reported in the final column of Table 3 indicate no significant differences, suggestive of persistency at the sample level.[14]

XXX Insert Tables 3 and 4 about here XXX

When examined by industry category, there is some evidence of strong industry effect in BTDs, see panel A table 4. The number of companies with positive BTDs ranges from 41% in the *Technology* sector to 94% in *Utilities.* In contrast, several industries lie in what can be considered an "inconclusive" range, with *Oil and gas* with 50% to *Industrials* with 52%. Similar mixed patterns of persistence in certain industries and lack of it in others occurs with PDs and TDs in panels B and C. The STRD component shows the highest level of consistency across industries

with all but two industries, *Consumer Goods* and *Utilities,* having a sizeable minority of companies with positive STRDs.

The above analysis examines BTDs and their components on a sample wide basis and therefore individual firm variation may be lost in aggregation. To examine company level variation, table 5 compares the expected and actual frequency of the sign of BTDs and their components. This is a direct test of consistency of effect. The first row reports the expected and actual frequency of the number of companies whose BTDs are positive in all six years of data, row two shows similar data for companies with five occurrences of positive BTDs (and therefore one year of negative BTD), and so on. Assuming independence across time the expected values are generated using a binomial distribution with the probability of a negative (positive) sign = 0.5. At the extreme position of 6 positive (negative) signed BTDs i.e. no changes in sign, the actual number, 25 (13) is significantly greater than the expected number of 2.1 (2.1) at the 1% level in both cases. In the next case, one "change" of sign i.e. five positive or five negative BTDs, the actual number is greater than expected in both cases, though the difference is only statistically significant in the former case. Overall, 58.7% of companies experience at least five positive (or five negative signed BTDs in the six-year period with the expected level is 29.2%. The three remaining frequency categories have lower than expected frequencies as a corollary to the higher than expected frequencies in the more "extreme" positions.

XXX Insert Table 5 about here XXX

The component PD exhibits a similar level of persistence. Of the 133 companies, 38.3% (51) have at least five positive signed PDs and 20.3% (27) have at least five negative signed PDs in the six-year period compared with an expected 10.9% for each category. The component TD also shows consistency with 39.5% (49)

of companies having at least five positive signed TDs, and 20.2% (25) with at least five negative signed TDs in the six-year period. This compares with an expected rate of 10.9% for five or more positive or negative signed TDs. The component STRD is generally similar to PD in terms of consistency of sign. Of the 78 companies which reported STRDs, 37.2% (29) have at least five positive STRDs while 13 (16.7%) reported at least five negative STRDs compared with an expected percentage of 10.9% in each case. Overall, there is strong evidence of persistence; the null hypothesis of the frequency following a binomial distribution is rejected for BTD and each of its components as indicated by the significant chi-squared goodness of fit tests reported at the foot of table 5.

XXX Insert Table 6 about here XXX

Table 6 summarises a series of time series estimations of the relation between BTDs and its one -period lag, the results are given in columns 1. In columns 2, 3 and 4 similar estimations are reported for PDs, TDs and STRDs respectively. In each of the estimations the diagnostic tests are satisfied: the Hansen test of instrument over-identification is satisfactory with an insignificant test statistic along with insignificant AR (2) errors. For BTD, PD and STRD there is a significant, stable, relation over time with the estimated coefficients on the lagged terms within the range ±1.00. The lagged variable TD is also positive though statistically insignificant. Of the three components, STRDs has the highest level of persistence when measured by the size of the coefficients with TDs being the least. The coefficients for the three components are statistically significantly different from each at the 1% level.

To assess whether the above sample wide results are stable across individual industrial groups, we re-estimate the models on three subsamples of companies.

Although there are eight industrial categories represented in the sample, see table 2, there are insufficient number of observations within some of these categories to estimate each individually. Instead, the sample is disaggregated into the two largest industry categories *Industrials*, and *Consumer Services* with 318 and 180 observations respectively with the remaining categories collapsed into a third group, referred to as *Others* with 300 observations. The results are summarised in Table 7.

XXX Insert Table 7 about here XXX

Each of the four estimated models satisfies the required diagnostic tests with insignificant Hansen test statistic and insignificant AR(2) errors. The coefficient for the lagged BTD variable is statistically significant at the 1% level in all three industry groups and ranges from 0.327 to 0.676, see columns 1, 2 and 3.[15] With each coefficient being statistically significantly different from both zero and each other, this suggests the initial finding of persistence is general to the full sample, rather than being driven by a sub category of observations, and, that the degree of persistence varies by industry group. The source of the persistence varies with PDs exhibiting significance in both *Consumer Services* and *Others* and TDs in *Industrials*. Only for STRD is there significant persistence for in all three industry groups.

6. Discussion and conclusions

This paper reports the results of an initial investigation into the behaviour of BTDs using hand-collected tax reconciliation data drawn from a panel of UK quoted non-financial companies during the period 2005 – 2010.

Overall, the various analyses can be summarised as follows. There is evidence of consistency in the sign of BTDs and their components in a limited number of industry groups (table 4) though in the majority of groups, there is no dominate trend. Within companies, goodness of fits tests are rejected (table 5) indicative of consistency of sign. However, this consistency does not apply to all companies. For example, only 79 companies (59.4%) had either five or more positive or negative BTDs in the sample period (table 5). Further, formal time series models indicate the degree of persistence both varies by type of BTD and across industry. In the context of interpreting the underlying sources of BTDs, STRD has the significantly the highest level of persistence (0.718, table 6) suggesting taxation as important motivating factor. With the majority of companies face a lower overseas statutory rate compared to the UK rate the ability to maintain the STRD effect over time is consistent with an underlying tax motivation. Though the presence of a number of companies consistently facing the reverse relative magnitude of overseas and UK statutory rates indicates non-tax benefits influence location or income recognition decisions.

In the absence of full disclosures on the nature of PDs it is difficult to determine an underlying motivation. However, the observation that on average only 51.5% of PDs were positive over the six year period (average of percentages in table 3 panel B) indicates that a significant number of PDs do not represent simple "add backs" of non-qualifying accounting deductions. A significant proportion of the adjustments are of income recognised for accounting income but which is non-taxable, this would be consistent with "aggressive" financial reporting (Hanlon & Slemrod, 2009).

The relative low persistence of TDs (0.338, table 3) is unexpected if TDs are driven by systematic earnings management over several periods. Instead, the low value is consistent with the effect of new originating differences being offset by the

inevitable reversal of earlier timing differences, a more "mechanical" process. When for example levels of capital expenditure qualifying for capital allowances increase over time (net) TDs would persist though any reduction in expenditure could result in a reversal of effect as appears to be the case in 2009 (see table 3).

In using BTDs to assess a company's taxation behaviour these results imply users of tax disclosures should attempt to determine the nature of the BTD and observe their properties over a number of periods. A similar approach should be adopted in using BTDs as a measure of earnings quality. Further research could investigate the source(s) of cross-sectional variation in the level of persistence although the extent to which this could be done using currently publically disclosed tax related information is an empirical question.

Notes:

[1] Prior to 2005 UK companies were able to provide deferred tax on a partial provisioning method which limited the ability to examine changes over time without access to private information on forecast profits, capital expenditure etc. (Holland and Jackson, 2004).

[2] ETRs and BTDs are related in that ETRs are the after tax equivalent of (before tax) BTDs.

[3] Long run measures *"avoids much of the mismatch of cash taxes and earnings"* (Hanlon and Heitzman 2010), as discussed subsequently we focus on the accrued tax charge and exclude prior year adjustments to minimise this effect.

[4] The treatment would however effect the composition of the total tax expense. i.e. between current and deferred tax charges.

[5] ETR is defined as the ratio of current tax expense relative to the accounting profit before tax. The ETR is the after tax effect of the pre-tax or gross book tax-difference.

[6] IAS 12 allows uses of domestic rate or the weighted average rate of the jurisdictions in which the company operates. In all company year end reconciliations included in the sample the domestic (UK) statutory rate was used.

[7] See footnote 5.

[8] The effect of tax credits for expenditure on e.g. research and development expenditure are also adjusted as they are required to be disclosed.

[9] Estimated using the xtabond2 command in Stata, see Roodman (2009).

[10] While Shen and Stark (2011) examine deflator properties in the context of valuation models such models utilise financial statement based data as in this study and therefore it is reasonable to apply their conclusion in this setting.

[11] The results of the BVA and PBT deflated data are qualitatively the same. When deflating by PBT, the resulting measure has an obvious interpretation in stating the BTD relative to PBT. However, to reduce the effect of any relation between the level of PBT and BTD, the BVA deflator is used (Plesko and Weber 2009).

[12] Untabulated results based on an AR(2) process show qualitatively similar results to those using the AR(1) specification.

[13] The use of time dummies is recommended by Roodman (2009) to assist in meeting the assumption that idiosyncratic disturbances are uncorrelated across observations.

[14] In the absence of homogeneous variances across years, the Welch robustness test is also reported as appropriate.

[15] With two exceptions the difference in regression coefficients between each pair of industry groups is significant at the 1% level for each set of comparison i.e. BTD, PD, TD and STRD, for example, the comparison of β_BTD_$Industrials_{t-1}$ with

β_BTD_C*onsumer_Services*$_{t-1}$ etc. The two exceptions are the insignificant difference between β_PD_*Industrials*$_{t-1}$ and β_PD_*Consumer_Cervices*$_{t-1}$ and the insignificant difference between β_PD_*Industrials*$_{t-1}$ and β_PD_*Others*$_{t-1}$ T-statistics available from authors upon request.

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Figure 1: Accounting and taxation processes

Cash flow from operations	+	Net accruals	=	Pre-tax Accounting earnings	+	Net book tax differences (BTDs)	=	Taxable Income

Table 1: Sample reconciliation

Details	n
Non-financial public listed companies (listed throughout the period)	2490
At least one year of annual report is not available	(462)
At least one of the accounting periods is more than 12 months	(552)
Extreme value of effective tax rates (-1>ETR>1)	(57)
Negative profit before tax	(143)
Unbalance data	(478)
Total sample	798

Table 2: Distribution of sample by industry

Details	Firm-year (n=798)	%
Oil and gas	48	6.01
Basic materials	78	9.77
Industrials	318	39.85
Consumer goods	72	9.02
Health care	18	2.26
Consumer services	180	22.56
Utilities	18	2.26
Technology	66	8.27
Total (133 companies * 6 year ends)	798	100

Note: Based on FT-SE Industry Classifications.

Table 3 BTD: Descriptive statistics by year

	Year	n#	Mean	S.D.	Min	Median	Max	Weighted mean	% >0	Difference in Unweighted means
Panel A: BTD/BVA	2005	133	0.02	0.06	-0.21	0.01	0.43	0.03	56%	(a) 1.037 (5, 792)
	2006	133	0.03	0.08	-0.10	0.01	0.77	0.04	65%	(b) 0.908 (5, 367)
	2007	133	0.03	0.12	-0.13	0.01	1.18	0.04	70%	(c) 0.151 (5, 792)
	2008	133	0.02	0.08	-0.10	0.01	0.72	0.02	58%	
	2009	133	0.01	0.09	-0.12	0.00	0.97	-0.00	49%	
	2010	133	0.02	0.07	-0.09	0.00	0.50	0.02	54%	
Panel B: PD/ BVA	2005	133	0.01	0.07	-0.20	0.00	0.41	0.03	51%	(a) 0.666 (5, 792)
	2006	133	0.02	0.09	-0.10	0.00	0.72	0.03	54%	(b) 0.545 (5, 367)
	2007	133	0.02	0.13	-0.15	0.00	1.33	0.03	57%	(c) 0.183 (5, 792)
	2008	133	0.02	0.07	-0.10	0.00	0.51	0.01	51%	
	2009	133	0.01	0.11	-0.12	0.00	1.12	-0.00	46%	
	2010	133	0.01	0.08	-0.26	0.00	0.68	0.01	50%	
Panel C: TD/ BVA	2005	133	0.01	0.04	-0.28	0.00	0.19	0.01	59%	(a) 0.295 (5, 792)
	2006	133	0.01	0.04	-0.23	0.01	0.12	0.01	65%	(b) 0.355 (5, 368)
	2007	133	0.00	0.04	-0.16	0.00	0.15	0.01	60%	(c) 0.957 (5, 792)
	2008	133	0.01	0.04	-0.19	0.00	0.21	0.01	59%	
	2009	133	0.00	0.03	-0.15	0.00	0.12	-0.00	50%	
	2010	133	0.00	0.05	-0.19	0.00	0.28	0.01	52%	
Panel D: STRD/ BVA	2005	111	0.00	0.01	-0.04	0.00	0.08	0.00	34%	(a) 0.164 (5, 660)
	2006	111	0.00	0.01	-0.02	0.00	0.11	0.00	40%	(b) 0.156 (5, 307)
	2007	111	0.00	0.01	-0.03	0.00	0.07	0.00	40%	(c) 0.342 (5, 660)
	2008	111	0.00	0.01	-0.02	0.00	0.11	-0.00	44%	
	2009	111	0.00	0.01	-0.02	-0.00	0.09	0.00	41%	
	2010	111	0.00	0.01	-0.02	-0.00	0.08	0.00	41%	

(a) ANOVA F test statistic, (b) Welch F test statistic and (c) Levene's test of homogeneity of variance. # Number of companies that report the component at least one time during the period.

Table 3 PBT: Descriptive statistics by year

	Year	n#	Mean	S.D.	Min	Median	Max	Weighted mean	% >0	Difference in Unweighted means
Panel A: BTD/PBT	2005	133	0.13	0.56	-1.49	0.07	2.21	0.25	56%	(a) 2.861** (5, 792)
	2006	133	0.17	0.56	-2.02	0.11	2.27	0.29	65%	(b) 2.086* (5, 366)
	2007	133	0.12	0.68	-5.05	0.12	2.30	0.27	70%	(c) 4.692*** (5, 792)
	2008	133	0.02	0.72	-4.30	0.07	2.74	0.13	68%	
	2009	133	-0.18	1.33	-8.52	-0.04	4.14	-0.05	45%	
	2010	133	0.06	1.06	-3.07	0.05	7.66	0.15	54%	
Panel B: PD/PBT	2005	133	0.06	0.66	-3.26	0.02	3.15	0.21	51%	(a) 0.742 (5, 792)
	2006	133	0.12	0.76	-2.02	0.03	6.43	0.22	54%	(b) 0.776 (5, 365)
	2007	133	0.17	0.91	-5.63	0.04	4.80	0.23	57%	(c) 1.736 (5, 792)
	2008	133	0.09	0.65	-2.58	0.02	4.03	0.08	51%	
	2009	133	-0.02	1.01	-3.96	-0.03	3.82	-0.04	46%	
	2010	133	-0.15	3.41	-36.55	0.00	10.97	0.10	50%	
Panel C: TD/PBT	2005	133	0.07	0.45	-2.96	0.03	3.13	0.05	59%	(a) 1.084 (5, 792)
	2006	133	0.05	0.69	-6.71	0.07	1.24	0.07	65%	(b) 1.597 (5, 361)
	2007	133	-0.05	0.71	-4.47	0.05	0.98	0.04	60%	(c) 2.701** (5, 792)
	2008	133	-0.08	0.74	-6.46	0.04	1.58	0.04	59%	
	2009	133	-0.16	1.29	-6.86	0.00	6.34	-0.02	50%	
	2010	133	0.22	3.04	-5.32	0.00	33.56	0.05	52%	
Panel D: STRD/PBT	2005	111	0.00	0.08	-0.29	0.00	0.50	0.02	34%	(a) 0.446 (5, 660)
	2006	111	0.01	0.08	-0.14	0.00	0.77	0.01	41%	(b) 0.578 (5, 302)
	2007	111	0.01	0.07	-0.26	0.00	0.50	0.01	40%	(c) 0.901 (5, 660)
	2008	111	-0.00	0.04	-0.17	0.00	0.15	-0.00	44%	
	2009	111	-0.01	0.07	-0.39	-0.00	0.30	0.00	41%	
	2010	111	0.01	0.15	-0.24	-0.00	1.45	0.00	41%	

(a) ANOVA F test statistic, (b) Welch F test statistic and (c) Levene's test of homogeneity of variance. *, **, *** respectively indicates significance at 5%, 2.5% and 1% levels (two tailed). Number of companies that report the component at least one time during the period.

Table 4: Descriptive statistics by industry group

	Variable	Industry group	n#	Mean	S.D.	Min	Median	Max	Weighted mean	% >0	Difference in means
Panel A:	BTD	Oil and gas	48	0.01	0.09	-0.21	0.00	0.29	-0.03	50%	(a) 5.387*** (7, 790)
		Basic materials	78	0.06	0.13	-0.20	0.03	0.77	0.04	76%	(b) 5.446*** (7, 134)
		Industrials	318	0.00	0.04	-0.13	0.00	0.20	0.01	52%	(c) 7.878*** (7, 790)
		Consumer goods	72	0.02	0.33	-0.03	0.01	0.18	0.02	75%	
		Health care	18	-0.00	0.03	-0.05	-0.01	0.04	0.02	44%	
		Consumer services	180	0.04	0.14	-0.08	0.01	1.18	0.03	62%	
		Utilities	18	0.02	0.02	-0.03	0.02	0.06	0.02	94%	
		Technology	66	0.01	0.06	-0.07	-0.01	0.36	0.00	41%	
Panel B:	PD	Oil and gas	48	-0.00	0.09	-0.20	-0.02	0.28	-0.04	40%	(a) 3.950*** (7, 790)
		Basic materials	78	0.05	0.13	-0.07	0.02	0.72	0.03	69%	(b) 3.752*** (7, 130)
		Industrials	318	0.00	0.05	-0.06	-0.00	0.30	0.00	43%	(c) 5.739*** (7, 790)
		Consumer goods	72	0.01	0.20	-0.03	0.01	0.07	0.02	67%	
		Health care	18	0.01	0.02	-0.04	0.00	0.05	0.02	50%	
		Consumer services	180	0.03	0.15	-0.09	0.00	1.34	0.02	52%	
		Utilities	18	0.01	0.04	-0.11	0.01	0.07	0.01	78%	
		Technology	66	0.03	0.07	-0.07	0.01	0.35	0.02	58%	
Panel C:	TD	Oil and gas	48	0.02	0.06	-007	-0.00	0.24	0.01	50%	(a) 6.078*** (7, 790)
		Basic materials	78	0.01	0.04	-0.07	0.01	0.28	0.00	64%	(b) 5.195*** (7, 128)
		Industrials	318	0.00	0.04	-2.28	0.00	0.24	0.01	61%	(c) 3.941*** (7, 790)
		Consumer goods	72	0.01	0.02	-0.02	0.01	0.10	0.01	65%	
		Health care	18	-0.01	0.02	-0.03	-0.01	0.03	-0.01	33%	
		Consumer services	180	0.01	0.40	-0.17	0.00	0.21	0.01	62%	
		Utilities	18	0.02	0.03	-0.02	0.01	0.12	0.01	78%	
		Technology	66	-0.02	0.05	-0.22	-0.01	0.11	-0.02	23%	
Panel D:	STRD	Oil and gas	48	-0.00	0.13	-0.04	0.00	0.03	-0.01	35%	(a) 3.265*** (7, 658)
		Basic materials	78	0.00	0.02	-0.01	-0.00	0.11	0.00	40%	(b) 4.201*** (7, 73)
		Industrials	252	-0.00	0.01	-0.02	-0.00	0.02	-0.00	34%	(c) 7.005*** (7, 658)
		Consumer goods	72	0.00	0.00	-0.00	0.00	0.01	0.00	60%	
		Health care	18	0.00	0.00	-0.00	0.00	0.01	0.00	44%	
		Consumer services	132	0.00	0.02	-0.01	0.00	0.11	0.00	46%	
		Utilities	6	-0.00	0.00	-0.00	-0.00	0.00	0.00	50%	
		Technology	60	-0.00	0.01	-0.01	-0.00	0.03	-0.00	30%	

(a) ANOVA F test statistic, (b) Welch F test statistic and (c) Levene's test of homogeneity of variance. *, **, *** respectively indicates significance at 5%, 2.5% and

1% levels (two tailed).# Number of companies that report the component at least one time during the period.

Table 5: Consistency of sign

	BTD/BVA		PD/BVA		TD/BVA		STRD/BVA	
actual (expected)	N	cum %	n	cum %	N	cum %	N	cum %
6 +ve	25*** (2.1)	18.8% (1.6%)	25*** (2.1)	18.8% (1.6%)	23*** (2.0)	18.5% (1.6%)	14*** (1.5)	17.9% (1.6%)
5 +ve	26** (12.5)	38.3% (10.9%)	26** (12.5)	38.3% (10.9%)	26*** (12.2)	39.5% (10.9%)	15 (9.0)	37.2% (10.9%)
4 +ve	24 (31.2)	56.4% (34.4%)	24 (31.2)	56.4% (34.4%)	23 (30.5)	58.1% (34.4%)	14** (22.5)	55.1% (34.4%)
3 +ve	13*** (41.6)	66.2% (65.7%)	13*** (41.6)	66.2% (65.7%)	12*** (40.6)	67.7% (65.6%)	12*** (30.0)	70.5% (65.6%)
2 +ve	18* (31.2)	79.7% (89.1%)	18* (31.2)	79.7% (89.1%)	15** (30.5)	79.8% (89.1%)	10*** (22.5)	83.3% (89.1%)
1 +ve	14 (12.5)	90.2% (98.5%)	14 (12.5)	90.2% (98.5%)	12 (12.2)	89.5% (98.4%)	5 (9.0)	89.7% (98.4%)
0 +ve	13*** (2.1)	100.0% (100.0%)	13*** (2.1)	100.0% (100.0%)	13*** (2.0)	100.0% (100.0%)	8*** (1.5)	100.0% (100.0%)
Number of companies[a]	133		133		124		78	
Chi-squared goodness of fit test[b]		*273.44 *** (6)*		*204.26*** (6)*		*141.040*** (6)*		*623.689*** (6)*

*, ** and *** are univariate test of difference between actual number and expected number, significant at 5, 2.5 and 1% level respectively (two tailed).

[a] Number of companies that report the component throughout the six year period.

[b] *** statistically significant at 1% level (null hypothesis – the observed frequency distribution is identical to the expected frequency distribution assuming a binomial distribution).

Table 6: Time series regression results

Dependent variable (DV):	1	2	3	4
	BTD/BVA	PD/BVA	TD/BVA	STRD/BVA
Independent variable $= DV_{t-1}$	0.604 (10.01***)	0.581 (13.89***)	0.338 (1.55)	0.718 (15.63***)
Year dummies	✓	✓	✓	✓
F-statistic	26.27 (6,133)***	39.33 (6,133)****	7.14 (6,124)***	60.59 (6,78)***
Number of observations	665	665	620	390
Number of groups	133	133	124	78
Number of instruments	19	19	19	19
Arellano-Bond test (AR1)	-1.59	-1.32**	-1.95	-1.06
Arellano-Bond test (AR2)	1.08	1.11	1.47	-0.46
Hansen χ^2 (12)	19.52	17.12	18.29	12.41

1. Blundell and Bond (1998) DPD two step system GMM estimator.
2. Bracketed figures represent t –statistics (Windmeijer corrected standard errors).
3. ***, **, and * significant at 5, 2.5 and 1% respectively.

Table 7: Time series regression results by Industry category

Panel A	1	2	3	4	5	6
	Industrials	Consumer services	Others	Industrials	Consumer services	Others
Dependent variable (DV):	BTD/BVA	BTD/BVA	BTD/BVA	PD/BVA	PD/BVA	PD/BVA
Independent variable = DV_{t-1}	0.327 (3.51***)	0.676 (30.52***)	0.552 (3.14***	0.580 (1.75)	0.607 (27.83***)	0.543 (2.96***)
Year dummies	✓	✓	✓	✓	✓	✓
F-statistic	4.73 (6,52***)	1552.80 (6,30****)	16.13 (6,50***)	4.95 (6,53***)	515.75 (6,30****)	11.16 (6,50***)
Number of observations	260	150	250	265	150	250
Number of groups	52	30	50	53	30	50
Number of instruments	19	19	19	19	19	19
Arellano-Bond test (AR1)	-2.89***	-1.10	-1.65	-1.80	-1.06	-1.66
Arellano-Bond test (AR2)	-0.41	1.02	0.51	0.83	1.04	0.90
Hansen χ^2 (12)	10.98	18.94	16.69	14.30	11.53	18.69
Panel B	Industrials	Consumer services	Others	Industrials	Consumer services	Others
Dependent variable (DV):	TD/BVA	BD/BVA	TD/BVA	STRD/BVA	STRD/BVA	STRD/BVA
Independent variable = DV_{t-1}	0.772 (4.67***)	-0.012 (-0.09)	0.283 (1.31)	0.457 (2.68**)	0.651 (44.53***)	0.785 (19.63***)
Year dummies	✓	✓	✓	✓	✓	✓
F-statistic	13.64 (6,48***)	7.48 (6,28***)	0.77 (6, 48)	3.76 (6,32***)	520.63 (6,12***)	146.32 (6,34***)
Number of observations	240	140	240	160	60	170
Number of groups	48	28	48	32	12	34
Number of instruments	19	19	19	19	19	19
Arellano-Bond test (AR1)	-2.85***	-1.21	-2.64	-2.23	-1.08	-0.18
Arellano-Bond test (AR2)	-0.71	0.80	1.52	0.35	1.02	-1.31
Hansen χ^2 (12)	14.88	14.67	20.39	18.30	9.82	73.88

1. Blundell and Bond (1998) DPD two step system GMM estimator.
2. Bracketed figures represent t –statistics (Windmeijer corrected standard errors).
3. *, **, *** and *** significant at 5, 2.5 and 1% respectively.