Impact of an accounting environment on cash flow prediction

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Abstract

This study investigates the impact of an accounting environment on the performance of cash flow prediction models. It is hypothesized that the cash flow model by Barth, Cram, and Nelson [Acc. Rev. 76 (2001) 27] performs well in countries where the accruals are used mainly to correct cash flows to better reflect current profitability of the firm, i.e., in countries with high information content of accruals. The results suggest that the model performs consistently across countries, except in Germany. As hypothesized, the impacts of the explanatory variables are similar in market-oriented countries with separated financial accounting and taxation, with strong shareholder protection and legislation based on common-law origin, i.e., in countries with high quality of accruals. By contrast, the impacts are different in countries with low quality of accruals. The results imply that the cash flow prediction model by Barth et al. [Acc. Rev. 76 (2001) 27] can be used in different kinds of accounting environments. However, the exact parameter values are dependent on the accounting environment.

Keywords: Accruals; Cash flow; Earnings; Cash flow prediction

1. Introduction

This study examines cash flow prediction from the multinational perspective. While the main objective of financial reporting is to provide information to interest groups of firms regarding future cash flows, differences in legal systems, shareholder protection, capital market orientation and relationship between financial reporting rules and taxation across countries may substantially affect the ability to predict cash flows (see Ball, Kothari,
& Robin, 2000). On the other hand, as a result of the ongoing worldwide harmonization of accounting practices, financial reporting may satisfy the objective well enough to enable accurate cash flow prediction independent of the accounting environment.

While the impact of the accounting environment on cash flow prediction is still an open question, it has important implications for globally operating investors and creditors and also for multinational companies, which, regardless of the accounting environment, are in continuous need of accurate cash flow predictions. These predictions have several important areas of application such as equity valuation. In addition, the results have important implications for researchers applying cash prediction models.

To empirically investigate the predictability of cash flows in different kinds of accounting environments, the cash flow prediction model by Barth et al. (2001) (hereafter BCN) is applied in two kinds of accounting environments. The first group consists of the USA, the UK, and Canada representing countries with high informativeness of earnings and accruals, i.e., market-oriented countries with strong shareholder protection, legislation based on common-law origin and separated financial accounting and taxation. The second group consists of France, Germany, and Japan representing bank-oriented countries with common financial accounting and taxation, with low shareholder protection and legislation based on code-law origin. Consequently, in the second group the information content of earnings and accruals is low.

The BCN cash flow prediction model is based on the fact that earnings can be disaggregated into cash flow and the components of accruals. Using this model rather than the model by Dechow, Kothari, and Watts (1998), for example, is advantageous because of the higher information content of disaggregated earnings compared to aggregated earnings. The information obtained via delayed cash flows is related to past transactions, whereas disaggregating earnings also provides information on future operating and investment activities (see BCN, 2001). The performance of disaggregated earnings in the prediction, however, depends on the information content of earnings and accruals. It is therefore hypothesized that the BCN cash flow model performs well in countries where the accruals are used mainly to correct cash flows to better reflect current profitability of the firm. The performance of the model in different accounting environments is an empirical question since it is impossible to predict the exact impact of the earnings management on the performance of the cash flow prediction model.

This paper contributes to the existing literature by investigating the impact of the accounting environment on the performance of the cash flow prediction models. As pointed out by BCN (2001), the primary objective of financial reporting is to provide information useful to interest groups (such as investors and creditors) of a firm when assessing the amount and timing of the prospective cash flows. While the previous studies by BCN (2001) and Dechow et al. (1998) show that cash flow prediction models perform well in the US environment, where the primary objective of financial reporting is well achieved in practice, the models may not perform so well in other accounting environments. The multinational perspective

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of this study makes it possible to examine the impact of the accounting environment, which is a particularly relevant research issue in assessing the general reliability and robustness of cash flow prediction models.

The rest of the paper is organized as follows. The following section discusses the effects of accounting environment of the cash flow prediction. The data used in the empirical analyses are described in Section 3. Section 4 describes the methodology. Section 5 presents the results of the empirical tests and Section 6 summarizes and concludes.

2. Accounting environment and the performance of cash flow prediction models

The research on cash flow prediction has concentrated on the usefulness of accrual earnings measures and cash flow measures as predictors of future cash flows. The results of early studies on this topic are mixed. Greenburg, Johnson, and Ramesh (1986), Murdoch and Krause (1989), Lorek and Willinger (1996), and Dechow et al. (1998) find that accrual earnings are better predictors of future cash flow than cash flows. By contrast, Bowen, Burgstahler, and Daley (1986) find that cash flow is a better predictor than accrual earnings. Furthermore, McBeth (1993) states that the predictive ability depends on the time period and Finger (1994) reports that both earnings and cash flows perform equally well in cash flow prediction.

A possible reason for the mixed results is that neither aggregate earnings nor cash flows is an unbiased predictor of future cash flows as shown by BCN (2001). In addition, the bias depends on current accruals. Therefore, the mixed results of earlier studies may stem from different sample periods with time varying biases in prediction. Moreover, the model developed by BCN (2001) implies that the predictive ability of accrual earnings can be improved by decomposing it into accrual components. The empirical evidence of that study supports the proposed model with the finding that, in addition to current cash flow, change in accounts receivable, change in accounts payable, change in inventory, depreciation, amortization, and other accruals have incremental predictive ability for future cash flows. Moreover, a comparison with the aggregated earnings model shows that the model based on the decomposition of accruals is superior in the prediction of future cash flows. Based on these findings, this study applies the model proposed by BCN (2001).

The effect of an accounting environment on the information content of accruals is discussed in Section 2.2 to form hypothesis on the effects of an accounting environment on the cash flow prediction. The information content of earnings and its components is particularly relevant since the model by BCN (2001) uses both, cash flows and accruals, to predict future cash flows. Therefore, the information content of accruals affects the performance of the model.

2.1. Cash flow prediction model

It is assumed in the cash flow prediction model of BCN (2001) that sales, \( S_t \), follows a random walk, \( S_t = S_{t-1} + \varepsilon_t \), where \( t \) denotes the time period. The error term \( \varepsilon_t \sim \)
Earnings are modeled as a constant proportion of sales, i.e., \( \text{EARN}_t = \pi S_t \) and \( 0 < \pi < 1 \). Under these assumptions BCN (2001) show that expected cash flow at time period \( t \) is given by

\[
E_t[\text{CF}_{t+1}] = \text{CF}_t + \left[ 1 - \frac{(1-\beta)\gamma_1\gamma_2(1-\pi)}{\alpha} \right] \Delta \text{AR}_t + (1-\beta)\Delta \text{INV}_t - \Delta \text{AP}_t,
\]

where \( \text{CF}_{t+1} \) denotes the cash flow of a firm at time \( t+1 \), and \( \Delta \text{AR}_t, \Delta \text{AP}_t, \) and \( \Delta \text{INV}_t \) denote changes in accounts receivable, in accounts payable, and in inventory respectively. \( \alpha \) represents the constant proportion \( (0 < \alpha < 1) \) of accounts receivable, \( \text{AR}_t \), to sales, i.e., \( \text{AR}_t = \alpha S_t \) and \( \beta \) determines the constant proportion \( (0 < \beta < 1) \) of accounts payable, \( \text{AP}_t \), to purchases or production, i.e., \( \text{AP}_t = \beta P_t \). The parameters \( \gamma_1 (\gamma_1 > 0) \) and \( \gamma_2 (\gamma_2 < 1) \) reflect the inventory policy of the firm. Eq. (1) shows that the expected cash flow at time \( t+1 \) is given by the cash flow at time \( t \) adjusted for the components of accruals.

### 2.2. Effects of institutional factors on accounting environments

The use of accruals has contradictory effects on information content of earnings. The main purpose in using accrual accounting instead of cash flow accounting is that accrual accounting matches revenues and expenses better than pure cash flow accounting (see, e.g., Cheng, Liu, & Schaefer, 1996; Dechow, 1994). Therefore, the use of accrual accounting should improve the assessment of a firm’s current financial performance as well as improving predictions regarding its future performance, including future cash flows. On the other hand, the possibility of managing earnings by using accruals may reduce the information content of the earnings. This occurs if the accruals are used to manage earnings for other purposes than adjusting cash flows to better reflect the current profitability of a firm. For example, managers may have incentives to manipulate accruals if their reward systems are based on the accounting performance (see, e.g., DeAngelo, 1988; Healy, 1985; McNichols & Wilson, 1988).\(^5\)

The use of accruals to improve earnings to better reflect the current profitability of a firm increases informativeness while the possibility of using the accruals incorrectly reduces the informativeness of the earnings. For example, if the accounting practices allow to capitalizing or immediately expensing R&D expenditures an outsider is unable to detect the reason for the particular practice that is actually used. However, shareholders are protected against misleading practices in several ways that force managers to use correct practices (see, e.g., Holmström, 1979; Jensen & Meckling, 1976). The level of this shareholder protection helping investors to rely on the accounting practices varies across countries as La Porta, Lopez-de-Silanes, Schleifer, and Vishny (1998) shows.

The information content of the earnings across countries is also affected by other institutional and cultural factors. These factors include, legal systems, capital market orientation

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\(^4\) It is straightforward to show that if sales are allowed to change at a constant rate, an additional term which is (only) a function of that change and the parameters \( \pi, \beta, \gamma_1, \) and \( \gamma_2 \) will appear in the model.

\(^5\) Even though the reward systems are based on stock price performance, e.g., stock options, managers may have incentive to manipulate earnings to mislead investors in their valuation processes.
and relationship between financial reporting rules and taxation (see Ball et al., 2000). First, the extent of political influence on both standard setting and enforcement, i.e., the legal system, is the most fundamental institutional variable causing differences in accounting income across countries as suggested by Ball et al. (2000). Ball et al. (2000) classify countries into two groups based on the origin of legal system. In code-law countries setting and enforcement occur under codified law, in which the role of governmental processes is vital, while in common-law countries the role of the market is more important (see David & Brierley, 1985 for a survey). The fundamental difference causing this classification is the institutional need for accounting information. In code-law countries the stakeholders’ need comes first, while in common-law countries the shareholders’ point of view is more important. Ball et al. (2000) hypothesize, and find evidence supporting the hypothesis, that demand for timely incorporation of true economic income in accounting income is lower in code-law countries than in common-law countries.

In the code-law countries, governments, shareholders, debt holders, employees, and managers are stakeholders among whom the accounting income is distributed. Therefore, the demand for the accounting income is influenced by the payout preferences of different stakeholders and the role of different institutions, especially public, instead of individual shareholders is important in law setting and enforcement. A common demand for these groups is that the volatility of the income that can be distributed among stakeholders should be low (see Healy, 1985). Therefore, there exists a common incentive to reduce volatility of income in code-law countries. Volatility can be reduced by using accruals at the expense of the informativeness of the income figures. Moreover, since the stakeholders frequently have representation in corporate governance, e.g., board memberships, the need for timely information in the form of published financial statements is low as the stakeholders possess inside information (Guethner & Young, 2000).

By contrast, in the shareholder model common-law arises from individual action in the private sector. This means that laws evolve by becoming commonly accepted in practice. As a consequence, accounting rules are mainly determined by the disclosure needs of shareholders and other investors that need a fair view of the income statement and balance sheet of a firm. Moreover, since the different shareholders are not able to have representatives in corporate governance the role of financial statements in resolving information asymmetry between managers and shareholders is important. According to Ball et al. (2000), common-law is originated in England and it is now found, for example, in the UK, the US, and Canada.

The difference between the code-law and the common-law classes is not straightforward and in practice the classes overlap. Moreover, the increased importance of shareholder ownership in former code-law countries cause the difference to be not necessarily the same over time. However, the classification between code-law and common-law countries is clear in some countries and the empirical evidence by Ball et al. (2000), supports the hypothesis that the differences occur in accounting information due to legal system.

The second factor affecting the need and form of accounting information is whether the country is bank or market oriented (see, e.g., Ali & Hwang, 2000). In a bank-oriented country the traditional providers of finance are financial institutions instead of private investors. Firms usually have very close ties to just one bank and all the capital needs are raised from this particular bank. Therefore, the bank has direct access to company information. Consequently, the need for published financial statements is low as the firms do not have to access
the market to raise capital. However, in market-oriented countries the main provider of the capital is capital market. Therefore, firms have to provide reliable and timely information in the form of public financial statements in order to attract investors who do not have direct access to company specific information. Thus, it can be expected that earnings and accruals will have lower information content in bank-oriented countries.

Third, in some countries financial and tax reporting are closely related, i.e., reported income affects taxes paid for that fiscal year (see Alford, Jones, Leftwich, & Zmijewski, 1993). Under this kind of legislation firms have an incentive to reduce earnings to avoid taxes. In consequence, financial accounting information may be less informative in countries with a close relationship between accounting and taxation compared to firms operating in countries with separated financial accounting and taxation.

To summarize, the informativeness of earnings and accruals is higher in countries with strong shareholder protection, whose legislation is based on common-law, and which are market oriented with separated financial accounting and taxation. By contrast, the informativeness of earnings and accruals is low in bank-oriented countries with common financial accounting and taxation, with low shareholder protection and legislation based on code-law. The above classification is supported by the empirical evidence of Leuz, Nanda, and Wysocki (2003), for example, who find that the magnitude of earnings management is higher in countries with low investor protection. Moreover, Ali and Hwang (2000), Ball et al. (2000), Fan and Wong (2001), and Hung (2001) find that the institutional factors discussed above explain differences in the price-earnings association across countries.

The cash flow prediction model applied in this study uses both cash flows and accruals to predict future cash flows. The use of the model is motivated by use of accrual accounting instead of cash flow accounting, since accrual accounting matches revenues and expenses better than pure cash flow accounting (see, e.g., Cheng et al., 1996; Dechow, 1994). However, institutional factors affecting the accounting practices and the use of accruals is likely to affect the performance of the model. It is therefore hypothesized that the cash flow model by BCN (2001) performs well in countries where the accruals are used mainly to correct cash flows to better reflect the current profitability of the firm, i.e., in market-oriented countries with separated financial accounting and taxation, with strong shareholder protection and legislation based on common-law. Moreover, the effects of accruals in the prediction will vary across countries.

The performance of the model in different accounting environments, however, is an empirical question since it is impossible to predict the exact impact of earnings management on the performance of the cash flow prediction model. Differences exist, but it is not known whether the differences are large enough to impair the performance of the model. However, since the previous literature shows that there are differences in the usage of accruals in countries with low shareholder protection, legislation based on code-law, and that are bank oriented with common financial accounting and taxation, it can be hypothesized that the effect of accruals in the prediction will vary across countries.

To investigate these issues, the performance of the cash flow prediction model by BCN (2001) is investigated in different accounting environments. Moreover, the role of accruals in the prediction is investigated in two groups of countries. Based on Ball et al. (2000), Bartov, Goldberg, and Kim (2001), and Hung (2001) Canada, the UK, and the USA are selected to present countries with high quality of accruals, while France, Germany, and Japan represent
Table 1
Institutional characteristics of the sample countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Use of accruals</th>
<th>Investor protection</th>
<th>Legal system</th>
<th>Importance of equity market</th>
<th>Tax-book conformity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>0.82</td>
<td>5</td>
<td>CM</td>
<td>23.3</td>
<td>0</td>
</tr>
<tr>
<td>UK</td>
<td>0.82</td>
<td>5</td>
<td>CM</td>
<td>25.0</td>
<td>0</td>
</tr>
<tr>
<td>US</td>
<td>0.86</td>
<td>5</td>
<td>CM</td>
<td>23.3</td>
<td>0</td>
</tr>
<tr>
<td>France</td>
<td>0.64</td>
<td>3</td>
<td>CD</td>
<td>9.3</td>
<td>1</td>
</tr>
<tr>
<td>Germany</td>
<td>0.41</td>
<td>1</td>
<td>CD</td>
<td>5.0</td>
<td>1</td>
</tr>
<tr>
<td>Japan</td>
<td>0.55</td>
<td>4</td>
<td>CD</td>
<td>16.8</td>
<td>1</td>
</tr>
</tbody>
</table>

Definitions: Use of accruals is accrual index by Hung (2001) having values between 0 and 1. A higher value indicates higher use of accrual accounting. Investor protection is antidirector rights index having values between 0 and 5 by La Porta et al. (1998) indicating how easily shareholders can exercise their voting rights. A higher value indicates better protection. Legal system indicates whether country’s legal origin is common-law (CM) or code-law (CD) based on La Porta et al. (1998). Importance of equity market by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997) indicates the importance of equity market. A higher value indicates a greater importance. Tax-book conformity by Hung (2001) indicates convergence between tax reporting and financial accounting. It equals 1 for countries with high tax-book conformity and 0 for countries with low conformity.

countries with low quality of accruals. The classification is supported by the empirical evidence on the classification of countries based on institutional factors affecting the quality of earnings by Leuz et al. (2003). Moreover, classification of international financial reporting practices by Nobes (1983, 1998) and Doupnik and Salter (1993) supports this classification.

Table 1 reports statistics on the use of accruals and the institutional factors in these countries. The statistics show that countries clearly belong to different categories. All the statistics are very close for Canada, the UK and the USA. However, some variation in statistics occurs within Germany, France, and Japan even though they clearly belong to the same category. This is in line with the financial reporting practice classifications. For example Doupnik and Salter (1993) report that Canada, the UK, and the US are classified as micro-based countries and France, Germany, and Japan are macro-based countries.

3. Data

The data used in the study are retrieved from the publicly available Worldscope database for the years 1992–2000. The data are based on the use of national GAAP. Based on the selection presented in Section 2, the sample consists of listed firms from the following six industrial countries: Canada, France, Germany, Japan, the United Kingdom, and the United States. The variables used are defined as follows: Cash flow (CF) is the cash flow from operating activities and Earnings (EARN) is income before extraordinary items. Change in accounts receivable (ΔAR), change in inventory (ΔINV), and change in accounts payable (ΔAP) are recovered from the cash flow statement. Depreciation and amortization (DEPR) includes both, depreciation and amortization, since for a large number of firms amortization is not available separately in the database. Other accruals (OTHER) are defined as EARN − (CF + ΔAR + ΔINV − ΔAP − DEPR) and accruals (ACC) is defined as the difference between EARN and CF. Following Sloan (1996) and BCN (2001), all variables are deflated.
Table 2
Descriptive statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Canada</th>
<th>France</th>
<th>Germany</th>
<th>Japan</th>
<th>UK</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CF</td>
<td>0.087</td>
<td>0.068</td>
<td>0.077</td>
<td>0.050</td>
<td>0.098</td>
<td>0.072</td>
</tr>
<tr>
<td>EARN</td>
<td>0.026</td>
<td>0.026</td>
<td>0.032</td>
<td>0.012</td>
<td>0.068</td>
<td>0.023</td>
</tr>
<tr>
<td>ACC</td>
<td>−0.061</td>
<td>−0.042</td>
<td>−0.045</td>
<td>−0.038</td>
<td>−0.030</td>
<td>−0.049</td>
</tr>
<tr>
<td>ΔAR</td>
<td>0.014</td>
<td>0.018</td>
<td>0.015</td>
<td>0.003</td>
<td>0.017</td>
<td>0.018</td>
</tr>
<tr>
<td>ΔINV</td>
<td>0.010</td>
<td>0.007</td>
<td>0.009</td>
<td>0.001</td>
<td>0.009</td>
<td>0.011</td>
</tr>
<tr>
<td>ΔAP</td>
<td>0.009</td>
<td>0.013</td>
<td>0.010</td>
<td>0.002</td>
<td>0.012</td>
<td>0.008</td>
</tr>
<tr>
<td>DEPR</td>
<td>0.053</td>
<td>0.054</td>
<td>0.059</td>
<td>0.037</td>
<td>0.041</td>
<td>0.056</td>
</tr>
<tr>
<td>OTHER</td>
<td>−0.023</td>
<td>−0.010</td>
<td>−0.009</td>
<td>−0.004</td>
<td>−0.003</td>
<td>−0.017</td>
</tr>
<tr>
<td>Panel B: standard deviation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CF</td>
<td>0.099</td>
<td>0.114</td>
<td>0.092</td>
<td>0.048</td>
<td>0.093</td>
<td>0.126</td>
</tr>
<tr>
<td>EARN</td>
<td>0.124</td>
<td>0.101</td>
<td>0.064</td>
<td>0.033</td>
<td>0.085</td>
<td>0.147</td>
</tr>
<tr>
<td>ACC</td>
<td>0.134</td>
<td>0.085</td>
<td>0.093</td>
<td>0.045</td>
<td>0.080</td>
<td>0.120</td>
</tr>
<tr>
<td>ΔAR</td>
<td>0.049</td>
<td>0.059</td>
<td>0.057</td>
<td>0.031</td>
<td>0.057</td>
<td>0.065</td>
</tr>
<tr>
<td>ΔINV</td>
<td>0.042</td>
<td>0.037</td>
<td>0.060</td>
<td>0.020</td>
<td>0.043</td>
<td>0.048</td>
</tr>
<tr>
<td>ΔAP</td>
<td>0.036</td>
<td>0.039</td>
<td>0.035</td>
<td>0.023</td>
<td>0.056</td>
<td>0.043</td>
</tr>
<tr>
<td>DEPR</td>
<td>0.037</td>
<td>0.036</td>
<td>0.033</td>
<td>0.023</td>
<td>0.030</td>
<td>0.037</td>
</tr>
<tr>
<td>OTHER</td>
<td>0.092</td>
<td>0.067</td>
<td>0.079</td>
<td>0.026</td>
<td>0.047</td>
<td>0.087</td>
</tr>
</tbody>
</table>

Notes. The variables are defined as follows: CF: cash flow from operating activities; EARN: income before extraordinary items; ACC: operating accruals, defined as EARN minus CF; ΔAR: change in accounts receivable; ΔINV: change in inventory; ΔAP: change in accounts payable; DEPR: depreciation and amortization expense; OTHER: all other accruals, defined as EARN − (CF + ΔAR + ΔINV − ΔAP − DEPR). All variables are deflated by the year end book value of total assets.

by year end total assets. The definitions of variables are similar to those of BCN (2001) but amortization and depreciation are not separated in this study.

Firms belonging to the financial services industry (SIC codes 6000–6999) are excluded from the sample since the models used are developed for industrial companies. The sample also excludes observations with sales less than the equivalent of 10 million US dollars and share price less than 1 US dollar. The currencies are converted using the year end exchange rates. The sample also excludes observations if any of the variables used in the analyses have a missing observation. Furthermore, a firm should have at least two consecutive years of data.

Table 2 presents descriptive statistics for each of the variables used in the estimation of the models. Consistent with earlier studies with the US data (e.g., BCN, 2001; Sloan, 1996), means of CF and EARN are positive and the mean of ACC is negative. The reason for the negative ACC is that EARN includes depreciation and amortization but CF excludes investments to depreciable and amortizable assets. The means of ΔAR, ΔINV, ΔAP, and DEPR are positive while the mean of OTHER is negative. The signs of the means of the variables are consistent across countries. The economic situation in Japan during the sample period is revealed by low CF and EARN values. As Table 2 shows, the number of

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6 It is the cash flow from operating activities. Consequently, it excludes the capital investments, i.e., investments to depreciable and amortizable assets. Since earnings number contains the depreciations and amortizations, the difference between the earnings and cash flows is negative on average.
observations varies considerably across countries. The smallest country sample (France) includes 265 firm-year observations while the largest (US) has 15,366 observations.

4. Methodology

To investigate the usefulness of model (1) in predicting future cash flows the following one way fixed effects equation is estimated separately for each country:

\[
\text{CF}_{i,t+1} = \alpha^0 + \sum_{k=92}^{98} \alpha_k D_{\text{year}}^k + \alpha_1 \text{CF}_{i,t} + \alpha_2 \Delta \text{AR}_{i,t} + \alpha_3 \Delta \text{INV}_{i,t} + \alpha_5 \Delta \text{AP}_{i,t} + \alpha_6 \text{DEPR}_{i,t} + \alpha_7 \text{OTHER}_{i,t} + \epsilon_{i,t}
\]

where dummy \( D_{\text{year}}^k \) has a value of one at year \( k \) and otherwise zero. \( \text{CF}_{i,t} \) denotes cash flow for firm \( i \) at time \( t \), \( \Delta \text{AR} \), \( \Delta \text{INV} \), and \( \Delta \text{AP} \) denote changes in accounts receivable, in inventory, and in accounts payable respectively and \( \text{DEPR}_{i,t} \) denotes depreciation and \( \text{OTHER}_{i,t} \) the other accruals. No dummy variable is used for the last year (1999) to avoid the dummy variable trap.

Eq. (2) allows intercepts to vary over years. The equality of intercepts over time is tested using the \( F \)-test (see, e.g., Baltagi, 1995) and the estimation is performed with yearly dummies if the \( F \)-test rejects the equality of intercepts over time. With respect to possible multicollinearity, the analysis of variance inflation factors (VIF) indicates that the multicollinearity problem is not present in the regression analysis of Eq. (2) nor in the case of other regressions performed in this study (see, e.g., Judge, Hill, Griffiths, Lütkepohl, & Lee, 1988, pp. 868–871). The Newey and West (1987) autocorrelation and heteroskedasticity consistent covariance matrix is used to take into account the autocorrelation and heteroskedasticity of the error terms. Based on the theory presented in Section 2, the coefficients of \( \text{CF}_{i,t} \), \( \Delta \text{AR} \), \( \Delta \text{INV} \), and \( \Delta \text{AP} \) are expected to be positive and negative for \( \Delta \text{AP} \).

To investigate the country effects on the parameters, the following fixed effects equation is estimated:

\[
\text{CF}_{i,t+1} = \alpha^0 + \sum_{k=92}^{98} \alpha_k D_{\text{year}}^k + \sum_{l=1}^{6} \alpha_l D_{\text{country}}^l + \sum_{l=1}^{6} \alpha_l^0 D_{\text{CF}}^l \text{CF}_{i,t} + \sum_{l=1}^{6} \alpha_l^1 D_{\text{AR}}^l \Delta \text{AR}_{i,t} + \sum_{l=1}^{6} \alpha_l^2 D_{\text{INV}}^l \Delta \text{INV}_{i,t} + \sum_{l=1}^{6} \alpha_l^3 D_{\text{AP}}^l \Delta \text{AP}_{i,t} + \sum_{l=1}^{6} \alpha_l^4 D_{\text{DEPR}}^l \text{DEPR}_{i,t} + \sum_{l=1}^{6} \alpha_l^5 D_{\text{OTHER}}^l \text{OTHER}_{i,t} + \epsilon_{i,t}
\]

where, \( D_{\text{year}}^k \) and \( D_{\text{country}}^l \) are year and country dummies and other variables are defined as above. \( D_{\text{CF}}^l \), \( D_{\text{AR}}^l \), \( D_{\text{INV}}^l \), \( D_{\text{AP}}^l \), \( D_{\text{DEPR}}^l \), and \( D_{\text{OTHER}}^l \) are the country dummy variables for \( \text{CF}_{i,t} \), \( \Delta \text{AR}_{i,t} \), \( \Delta \text{AP}_{i,t} \), \( \Delta \text{INV}_{i,t} \), \( \text{DEPR}_{i,t} \), and \( \text{OTHER}_{i,t} \). Eq. (3) allows for time and country effects in the intercept and country effects in the slope coefficients. No dummy
variable is used for the last year (1999) to avoid the dummy variable trap. To test whether variables have the same effect of the cash flow prediction in different countries the equality of slope coefficients within two groups of countries is investigated using $F$-test.

5. Results

Table 3 presents the results of explaining future cash flows with current cash flow and the components of accruals, i.e., the estimation results of Eq. (2). The results with yearly dummies are reported if $F$-test rejects the equality of intercepts over time, otherwise the results without dummies are reported. The $F$-test for the equality of intercept over time rejects equality in five out of six countries at the five per cent significance level, suggesting that the specification of the one way fixed effect model allowing yearly variation is adequate in these countries. The explanatory power of the model is fairly stable across countries, except in Germany, suggesting that the predictive ability of the model is similar in all countries but Germany. The highest explanatory power is observed in the UK (0.425) and the lowest in Germany (0.160).

Regarding the USA, the results are consistent with the findings of BCN (2001) from the same country. Even though the sample period and the data source of this study differ from their study, the values of the coefficients are similar to their results. Moreover, the explanatory power is 0.361, which is close to the 0.35 reported by BCN (2001). In general, the estimation results are consistent across countries. The coefficients are significant, with some exceptions, and they have the expected signs. Some insignificant components of accruals are observed in France and Germany, both having two to four insignificant coefficients. One reason may be that the number of observations is rather low in these countries. The performance of the model seems to be lowest in Germany among the countries investigated, as the explanatory power is lower than in other countries and there are several insignificant coefficients. This is accordance with the statistics in Table 1, where Germany has the lowest investor protection and importance of equity markets among the countries investigated.

The estimation results of Eq. (3), i.e., the investigation of the consistency of coefficients in two groups of countries, are reported in Table 4. In Panel A, the time and country effects on the intercept and basic regression statistics are reported. Based on the $F$-test, the model is estimated allowing yearly variation in the intercept, but no dummies for the countries are specified in the final estimation.

However, the main interest is to investigate the equality of the coefficients within similar countries based on institutional factors. The results of the $F$-test are reported in Panel B. Regarding the sample with high quality of accruals, the results indicate that the equality of coefficients is not rejected in these countries. This indicates that the model performs similarly in Canada, the UK and the US as hypothesized. With respect to countries with lower quality of accruals the results indicate that the effects of CF, ΔAP, DEPR, and OTHER on the prediction are not the same across these countries, while the equality of effect of ΔAR and ΔINV are not rejected. These results suggest that the accruals have a different kind of effect.

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7 As pointed out by an anonymous referee, a possible reason for the different kind of effect of OTHER variable in the second group of countries is that the reserves are used differently in those countries. For example, in Germany and Japan reserves are used extensively.
Table 3
Current cash flow and components of accruals in explaining future cash flows

<table>
<thead>
<tr>
<th>Variable</th>
<th>Canada</th>
<th>France</th>
<th>Germany</th>
<th>Japan</th>
<th>UK</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.003 (0.716)</td>
<td>0.009 (0.525)</td>
<td>-0.011 (0.377)</td>
<td>0.011 (0.000)</td>
<td>0.003 (0.391)</td>
<td>0.000 (0.924)</td>
</tr>
<tr>
<td>CF</td>
<td>0.620 (0.000)</td>
<td>0.767 (0.000)</td>
<td>0.237 (0.066)</td>
<td>0.596 (0.000)</td>
<td>0.632 (0.000)</td>
<td>0.623 (0.000)</td>
</tr>
<tr>
<td>ΔAR</td>
<td>0.281 (0.002)</td>
<td>0.723 (0.000)</td>
<td>0.285 (0.103)</td>
<td>0.600 (0.000)</td>
<td>0.318 (0.000)</td>
<td>0.411 (0.000)</td>
</tr>
<tr>
<td>ΔINV</td>
<td>0.288 (0.003)</td>
<td>0.281 (0.140)</td>
<td>0.187 (0.268)</td>
<td>0.328 (0.000)</td>
<td>0.459 (0.000)</td>
<td>0.264 (0.000)</td>
</tr>
<tr>
<td>ΔAP</td>
<td>-0.626 (0.000)</td>
<td>-1.222 (0.000)</td>
<td>-0.335 (0.145)</td>
<td>-0.785 (0.000)</td>
<td>-0.540 (0.000)</td>
<td>-0.535 (0.000)</td>
</tr>
<tr>
<td>DEPR</td>
<td>0.465 (0.000)</td>
<td>0.152 (0.562)</td>
<td>0.916 (0.000)</td>
<td>0.388 (0.000)</td>
<td>0.424 (0.000)</td>
<td>0.346 (0.000)</td>
</tr>
<tr>
<td>OTHER</td>
<td>0.111 (0.019)</td>
<td>0.633 (0.000)</td>
<td>0.146 (0.248)</td>
<td>0.347 (0.000)</td>
<td>0.068 (0.017)</td>
<td>0.135 (0.000)</td>
</tr>
<tr>
<td>F-statistics</td>
<td>7.89</td>
<td>0.94</td>
<td>3.62</td>
<td>4.18</td>
<td>10.21</td>
<td>6.27</td>
</tr>
<tr>
<td>Probability</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.409</td>
<td>0.376</td>
<td>0.160</td>
<td>0.379</td>
<td>0.425</td>
<td>0.361</td>
</tr>
<tr>
<td>No. of observations</td>
<td>689</td>
<td>265</td>
<td>356</td>
<td>1906</td>
<td>2448</td>
<td>15366</td>
</tr>
</tbody>
</table>

Notes. The estimated model is as follows: $CF_{i,t+1} = \alpha^0 + \sum_{k=2}^{98} \alpha^k D^k_{t-i} + \alpha^1 CF_{i,t} + \alpha^2 \Delta AR_{i,t} + \alpha^3 \Delta INV_{i,t} + \alpha^4 \Delta AP_{i,t} + \alpha^5 DEPR_{i,t} + \alpha^6 OTHER_{i,t} + \epsilon_{i,t}$, where dummy $D^k_{t-i}$ has a value of one at year $k$ and otherwise zero. $CF_{i,t}$ denotes cash flow for firm $i$ at time $t$, $\Delta AR_{i,t}$, $\Delta INV_{i,t}$, and $\Delta AP_{i,t}$ denote changes in accounts receivable, inventory, and accounts payable respectively and $DEPR_{i,t}$ denotes depreciation and $OTHER_{i,t}$ the other accruals. P-values of the $t$-statistics are in parentheses. $F$-statistics: test for fixed effects, i.e., equality of intercepts over time. The results with yearly dummies are reported if the $F$-test rejects the equality of intercepts over time. The Newey and West (1987) autocorrelation and heteroskedasticity consistent covariance matrix is used.
Table 4
Consistency of the prediction model coefficients in similar accounting environments

<table>
<thead>
<tr>
<th>Variable</th>
<th>H₀: all coefficients are equal</th>
<th>Coefficient</th>
<th>Probability of t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panel A: time and country effects on the intercept and basic regression statistics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept: year</td>
<td>5.25</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Intercept: country</td>
<td>0.99</td>
<td>0.425</td>
<td></td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.353</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of observations</td>
<td>21581</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H₀: Canada = UK = US</td>
<td>H₀: France = Germany = Japan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistics</td>
<td>Probability</td>
<td>F-statistics</td>
<td>Probability</td>
</tr>
<tr>
<td>CF</td>
<td>0.31</td>
<td>0.732</td>
<td>6.33</td>
</tr>
<tr>
<td>ΔAR</td>
<td>1.18</td>
<td>0.307</td>
<td>2.07</td>
</tr>
<tr>
<td>ΔINV</td>
<td>2.45</td>
<td>0.086</td>
<td>0.34</td>
</tr>
<tr>
<td>ΔAP</td>
<td>0.29</td>
<td>0.745</td>
<td>2.76</td>
</tr>
<tr>
<td>DEPR</td>
<td>2.80</td>
<td>0.061</td>
<td>0.34</td>
</tr>
<tr>
<td>OTHER</td>
<td>0.79</td>
<td>0.453</td>
<td>4.58</td>
</tr>
</tbody>
</table>

Note. The estimated model is as follows: $CF_{i,t} + \Delta 1 = \alpha_0 + \sum_{k=1}^{98} \alpha_k D_{year}^k + \sum_{l=1}^{6} \alpha_l D_{country}^l + \sum_{l=1}^{6} \gamma_l D_{CF}^l + \sum_{l=1}^{6} \gamma_l D_{Delta1AR}^l + \sum_{l=1}^{6} \gamma_l D_{Delta1INV}^l + \sum_{l=1}^{6} \gamma_l D_{Delta1AP}^l + \sum_{l=1}^{6} \gamma_l D_{DEPR}^l + \sum_{l=1}^{6} \gamma_l D_{OTHER}^l$, where, $D_{year}^k$ and $D_{country}^l$ are year and country dummies and other variables are defined as in Table 3. $D_{CF}^l$, $D_{Delta1AR}^l$, $D_{Delta1INV}^l$, $D_{Delta1AP}^l$, $D_{DEPR}^l$, and $D_{OTHER}^l$ are the country dummy variables for $CF_{i,t}$, $Delta1AR_{i,t}$, $Delta1INV_{i,t}$, $Delta1AP_{i,t}$, $DEPR_{i,t}$, and $OTHER_{i,t}$. The estimation results reported are based on the model having yearly effects on intercept and country effects in the variables that have country variation based on the F-statistics. The Newey and West (1987) autocorrelation and heteroskedasticity consistent covariance matrix is used.

6. Summary and conclusions

This study investigates the impact of accounting environment on the performance of the cash flow prediction models. It is hypothesized that the cash flow model by BCN (2001) performs well in countries where the accruals are used mainly to correct cash flows to better reflect current profitability of the firm, i.e., in countries with high information content of accruals.

Effect on the prediction within these countries as hypothesized. In general the results suggest that the model performs consistently across countries, except in Germany, and the impacts of the explanatory variables are the same in countries with strong shareholder protection, legislation based on common-law, and that are market orientated with separated financial accounting and taxation, i.e., in countries with high quality of accruals. The adoption of the IAS standards from the beginning of 2005 is likely to improve the quality of accounting information of French and German listed companies and harmonize the information content of accounting information in those countries. This probably has an effect on the cash flow prediction in those countries.
To empirically investigate these issues, the cash flow prediction model by BCN (2001) is applied in two kinds of accounting environments. The first group consists of the USA, the UK, and Canada, representing countries with high informativeness of earnings and accruals, i.e., market-oriented countries with strong shareholder protection, legislation based on common-law and separated financial accounting and taxation. The second group consists of France, Germany, and Japan, representing bank-oriented countries with common financial accounting and taxation, with low shareholder protection and legislation based on code-law. Consequently, in the second group the information content of earnings and accruals is low.

The results suggest that the model performs consistently across countries, except in Germany. The impacts of the explanatory variables are similar in market-oriented countries with separated financial accounting and taxation, with strong shareholder protection and legislation based on common-law, i.e., in countries with high quality of accruals. By contrast, the impacts are different in countries with low quality of accruals. The results imply that the cash flow prediction model by BCN (2001) can be used in different kinds of accounting environments. However, the exact parameter values are dependent on the accounting environment.

Acknowledgements

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References


