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The prediction of future operating cash flows using accrual-based and cash-based accounting information: Empirical evidence from Vietnam

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C H R O N I C L E

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A B S T R A C T

This research was conducted for assessing the predictive ability of future cash flows from operating activities by using accounting earnings and cash flows information in the past. Data were collected from the firms listed on Ho Chi Minh Stock Exchange (HOSE) from 2009 to 2018, including the sample of 242 non-financial listed companies. Three statistical methods approaches were employed to address econometric issues and to improve the accuracy of the regression coefficients based on Ordinary Least Squares (OLS), Random Effects Model (REM), and Fixed Effects Model (FEM). The findings showed that earnings and cash flows and aggregated accruals had remarkable ability to forecast future cash flows and the model of operating cash flows combined with aggregated accruals had the most effective prediction ability for companies listed on Ho Chi Minh Stock Exchange.

1. Introduction

Cash flow to businesses is as important as blood circulation in the human body. The prediction of cash flow informs the performance assessment and decisions of both investors and business managers. Researches on cash flow forecasting, which determines the favourable predictive factors of future cash flow, is therefore scientifically critical. From a practical perspective, good forecasts contribute significantly to various daily decisions by human being in general, and state management agencies and firms in particular (Block, 1999; Call et al., 2009). Pae and Yoon (2012) showed the results of a financial expert survey and confirmed the importance of cash flow forecasts to business valuation. Statistics also shows the statement made by 80% of credit officers in the United States that future cash flow plans must be certainly included in loan applications (Fulmer et al., 1991; Waddell, et al., 1994). The benefits of cash flow forecasts to lessen the "distortion" of accrual based accounting information. From the perspective of scientific researches, cash flow prediction has been discussed in the Accounting Standards of different countries and a variety of studies (Barth et al., 2001; Mooi, 2007; Farshadfar et al., 2008; Ebaid, 2011; Anh, 2010). However, Accounting Standards only include judgments with regards to the factors that should be used in cash flow forecasts without justifying them specifically. Vietnamese Accounting Standard No. 24 (VAS 24) assumes the cash flows from operating activities, when combined with other information, enable users to predict future cash flows, while the U.S. Accounting Standards believe that those who are interested in future cash flows often based themselves on accounting earnings rather than past cash flows. On the other hand, most of the authors of cash flow forecast studies have not yet agreed on the ranking of factors by prediction powers. Some scholars argued that past earnings were more powerful than past cash flows in the prediction of future cash flows (Largay & Stickney, 1980; Greenberg et al., 1986; Wilson, 1986; Murdoch &

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Krause, 1989, 1990; Pae & Yoon, 2012; Dechow et al., 2008; Ebaib, 2011), while the others believe the contrary, discussing that historical cash flows are more useful than historical earnings (Bowen et al., 1986; Barth et al., 2001; Stammerjohan & Nasiripour, 2001; Farshadfar et al., 2008). Some authors support the argument that no significant difference is found in terms of prediction powers of historical earnings and cash flows (Arnold et al., 1991; McBeth, 1993; Pfeiffer et al., 1998). Furthermore, the majority of studies of future cash flow from business operations are conducted in countries with developed capital markets, for instance the United States (Barth et al., 2001; Dechow et al., 1998; Finger, 1994; Greenberg et al., 1986; Murdoch & Krause, 1989, 1990; Stammerjohan & Nasiripour, 2001), Australia (Farshadfar et al., 2008; Percy & Stokes, 1992), England (Al-Attar & Hussain, 2004). Up to date, there are a few studies in developing countries, where the commodity market is small-sized such as Egypt (Ebaid, 2011) and Vietnam (Anh, 2013). In addition, most of studies used data prior to 2010 to predict cash flows. To demonstrate, the study of Barth et al. (2001) covers the period from 1987 to 1996 and Greenberg et al. (1986) from 1963 to 1982. Moreover, Ebaid (2011) used data from 1999 to 2007. Due to the scarcity of studies using data beyond 2010, the research of cash flow prediction has not been updated lately. Therefore, this paper fills the gap by using accrual-based and cash-based accounting information from business operations, which is highly important to determine factors stated in Vietnamese Accounting Standards and U.S. Accounting Standards to predict future operating cash flows of Vietnamese listed firms. It also adds empirical evidence to researches on the same topic in the context of Vietnam - a developing country in Asia with a newly opened stock market, where the forecast of cash flows has not been fully recognized; the determinants to forecast operating cash flows have not been fully assessed; experiences of chief accountants are the major sources to forecasts; and forecast methods applied to cash flows are simple and have not been seriously considered.

The remainder of the paper is structured as follows: In Section 2, Literature Review; the next section demonstrates Research Hypotheses; Section 4, presents the Research Methodology; Results and Discussion about the relationship between working capital management and firm's financial performance are presented in Section 5. Finally, the conclusion and recommendations are explained in Section 6.

2. Literature Review

Studies on the forecast of future operating cash flows of listed companies started with researches by Bowen et al. (1986), Greenberg et al. (1986) in the United States, Habib (2010) in Australia, Austin and Andrew (1989) in New Zealand. Since then, the topic has been conducted in other countries including Vietnam (Anh, 2013). These studies are diverse in terms of forecasting factors, data and research methodology as follows:

2.1 Factors in cash flow predictability

The factors employed in cash flow prediction are categorized into groups, including (i) historical earnings; (ii) historical operating cash flows; (iii) combination of historical cash flows and aggregated accruals; (iv) combination of cash flows and disaggregated accruals; and (v) cash flow ratios.

(i) Historical earnings as a predictor of future cash flows

The Financial Accounting Standard Board (FASB) has mentioned forecast operating cash flows since 1978 in which also emphasized was on the stronger interest of investors in historical earnings than historical cash flows in order to predict future cash flows. Nonetheless, FASB did not present empirical evidences to confirm this statement. Since then, researchers have continuously searched for evidences. Historical earnings is considered as a prominent factor used in forecasting future cash flows by various authors such as McBeth (1993), Ali (1994), Finger (1994), Supriyadi (1998), Quirin et al. (1999), Barth et al. (2001), Stammerjohan & Nasiripour (2001), Jordan and Waldron (2001), Al-Attar and Hussain (2004), Mooi (2007), Zhao et al. (2007) and Anh (2013). The value included in a forecasting model can be the normal earnings with one-year lag, two-year lag, thee-year lag or four-year lag (Stammerjohan et al., 2000/2001). Some authors used transformed earnings instead of normal earnings. The transformed earnings are calculated by dividing the original earnings by total assets (Stammerjohan et al., 2000/2001; Farshadfar, 2008; Ebaid, 2011) to minimize the firm-size effects on research results; or dividing the normal earnings by average share value (Murdoch et al., 1989/1990); or dividing the normal earnings by outstanding share numbers (Barth et al., 2001; Zhao, 2007). The authors confirmed the predictability of historical earnings to future cash flows, using either normal or transformed earnings. However, the authors have not agreed whether the earnings model is better than other forecast models to predict cash flows (Stammerjohan et al., 2000/2001; Seng, 2006; Ebaid, 2011; Farshadfar et al., 2008).

(ii) Historical operating cash flow as a predictor of future cash flows

Different research scholars acknowledge the predictability of historical cash flows to future cash flows. The historical

operating cash flows used as a predictor can be the cash flow lagging one year (Barth et al., 2001; Ebaid, 2011) or lagging several years (Barth et al., 2001; Mooi, 2007). Based on empirical evidences, the authors agreed on the predictability of historical operating cash flows to future cash flows. Moreover, some researchers compared the predictability of historical cash flows or other forecasting factors, but they did not agree on the best forecasting model.

(iii) Combination of past operating cash flows and aggregated accruals

The empirical evidences indicate the benefits of combined cash flows and aggregated accruals of earnings in the prediction of future cash flows (Barth et al., 2001; Al-Altar, 2003; Ebaid, 2011). However, they did not have consensus on the best forecasting model.

(iv) Combination of historical operating cash flows and disaggregated accruals

Disaggregated accruals consist of depreciation, change of accounts receivable, change of prepaid expenses, change of inventory, and change of accounts payable. There is a common agreement among most of studies that the forecasting model, using disaggregated accruals as predictors is useful to cash flow prediction, and this model is more powerful than the models, which use solely past earnings or past cash flows (Barth et al., 2001; Al-Altar, 2003; Ebaid, 2011). However, disagreed with this statement, some researchers stated that the inclusion of disaggregated accruals into the cash flow model did not raise the predictability power and the model, using historical cash flows to predict future cash flows, was the best choice.

(v) Cash flow ratios as a predictor of future cash flows

Up to date, cash flow ratios have been used as predictors in some studies in countries such as Thailand. However, it came to the conclusion that the cash flow ratios are not useful to predict cash flows in listed Thai companies during the research period (1994 - 2002). The research admitted the results were affected by the economic crisis in Thailand during this time. Therefore, other researches are needed in new context to verify this statement.

Data and research methods of forecasting cash flows

The researches mainly use data extracted from the financial statements of non-financial listed firms rather than financial listed companies due to the absence of aggregated accruals data such as inventory and receivables in financial statement (Ebaid, 2011). In addition, several studies (Barth et al., 2001; Ebaid, 2011; Farshadfar et al., 2008; Jordan & Wallace, 2007) classified non-financial listed companies into industry groups. For example, Jordan and Wallace (2007) only studied cash flow forecasts in the U.S. oil industry. Besides, a number of authors (Stammerjohan & Nasiripour, 2001; Mooi, 2007; Ebaid, 2011; Anh, 2013) used pooled data. In terms of time series, the first study of cash flow forecasts by Greenberg et al. (1986) employed a 20-year data set (1963 - 1982) in the United States. Afterwards, Al-Altar (2004) used a 10-year data set (1991 - 2000) in the UK; etc. Regarding to the methodology, after formulating the cash flow forecasting equations (the dependent variable is operating cash flow and the independent variables are past earnings, past cash flows, disaggregated accruals, cash flow ratios, etc.), most of the authors give regressions results using Ordinary Least Squares (OLS) (Barth et al., 2001; Mooi, 2007; Ebaid, 2011), while others used Fixed Effect Model (FEM), Random Effect Model (REM) and Step-wise Regression to improve the confidence of research results. In addition, the majority of authors relied on the coefficient of determination (denoted by R^2) obtained from the regression analysis to find the best predictive model. Accordingly, the model with higher R^2 provides more accurate prediction (Barth et al., 2001; Mooi, 2007; Ebaid, 2011)

3. Research Hypotheses

3.1. Predictability of historical earnings on forecasting operating cash flows

The relationship between cash flow and earning has been confirmed in both Accounting Standards and empirical studies of various scholars. According to the Vietnamese Accounting Standard No. 24, Cash Flow Statements prepared by the indirect method are accounting before tax earnings adjusted for non-cash items to generate operating cash flows (such as fixed asset depreciation, provisions, etc.), change of inventory, receivables, payables and other items, of which cash flows from investment activities generate cash effects. A large number of scholars support the importance of earnings and the relationship between earnings and cash flows. Kim and Kross (2005) found a weakening relationship between earnings and stock prices over time, and a significantly increasing relationship between current earnings and future operating cash flows over time and investors tend to be interested in both earnings and cash flows because a profitable company needs to have enough cash to pay dividends. Therefore, earnings and cash flows are two important inputs to decisions of business managers. Other scholars, including Murdoch and Krause (1990), Finger (1994),

Dechow et al. (1998), Barth et al. (2001) and Ebaid (2011) investigated the predictability power of earnings in cash flow forecasting. They all agreed that earnings could be used to predict future operating cash flows (Barth & et al., 2001; Ebaid, 2011; Anh, 2013). Nonetheless, the predictive power differed across studies due to the diversity in research data as well as time series. Therefore, the following hypothesis is employed in this research:

H_1: Past earnings are significant in predicting future operating cash flows of non-financial companies listed on the Ho Chi Minh Stock Exchange.

3.2. The possibility to use past operating cash flows in the forecast of future operating cash flows

The International Accounting Standard Board (IASB) IAS 7 "Cash Flow Statement" identifies that past cash flows are often used as a predictor of amounts, timing and uncertainty of future cash flows. Malaysian Accounting Standard (MASB, FRS 107, 2010) states cash flow statements are useful to accounting information users to assess the predictability on cash flows as well as the timing and uncertainty of predicted cash flows in companies. The empirical studies also explored the predictive ability of historical cash flows (Greenberg et al., 1986; Bowen et al., 1986; Finger, 1994; McBeth, 1993; Quirin et al., 1999; Barth et al., 2001; Anh, 2013), which all suggested that historical cash flows possessed significant explanatory power in predicting future cash flows. Similar to earnings, the predictive power of *past* cash flows varied among studies. Therefore, the following hypothesis is employed in this research:

H_2: Historical operating cash flows are significant in predicting future operating cash flows of non-financial companies listed on the Ho Chi Minh Stock Exchange.

3.3. Aggregated accruals in the forecast of future operating cash flows

Various researchers (Dechow, 1994; Dechow & Dichev, 2002; Dechow et al., 2008) have disaggregated earnings into two components, which are the cash component in earnings (i.e., revenue and expenses actually collected and paid in cash) and the accrual component in earnings (i.e., revenue and expenses pending to receipt and payment). Thus, the accruals and cash flows are interrelated and the use of accruals to predict future cash flows is valid. Barth et al. (2001), Al-Attar and Hussain (2004), and Ebaid (2011), studied simultaneously the effects of cash flow and accrual components in the forecast of future cash flows, instead of solely either cash flows or earnings as previous studies. These studies confirmed the predictive power of accruals on future cash flows, though the predictive ability of historical cash flows, in conjunction with accruals, differed across studies. Therefore, the following hypothesis is employed in this research:

H_3: Historical operating cash flows combined with aggregated accruals are significant in predicting future operating cash flows of non-financial companies listed on the Ho Chi Minh City Stock Exchange.

3.4. Disaggregated accruals in the forecast of future operating cash flows

Wilson (1986) and Lorek and Willinger (1996) showed the outperformance of the research models using additional variables from the company's financial statements rather than earnings or cash flows only. Jordan et al. (2007) indicated that the best cash flow predictor was not solely cash flow or accruals, but probably the combination of them. Some empirical studies worldwide adopted disaggregated accruals as predictors (Barth et al., 2001; Jordan et al., 2007). They confirmed the disaggregated accruals possessed a predictive power on future cash flows. However, the forecasting ability of historical cash flow models with disaggregated accruals varied among studies. Therefore, the following hypothesis is employed in this research:

H_4: Historical operating cash flows combined with disaggregated accruals are significant in predicting future operating cash flows of non-financial companies listed on the Ho Chi Minh Stock Exchange.

3.5. Cash flow ratios in the forecast of future operating cash flows

Cash flow ratios are better measurement of the operating performance than other financial ratios derived from Income Statement and Balance Sheet, because the effects of other non-cash items such as depreciation of tangible assets could be eliminated from cash flow ratios (Kelly & O'connor, 1997; Plewa & Friedlob, 1995). Therefore, the financial performance of a business is correctly assessed. These studies shed a light on new research on the use of cash flow ratios to predict future operating cash flows. Researches on the predictability of cash flow ratios on future cash flows have not been found in Vietnam, therefore the study of predictive power of cash flow ratios in Vietnam will better inform decisions of investors. Therefore, the following hypothesis is employed in this research:

H_5: Historical cash flow ratios are significant in predicting future operating cash flows of non-financial companies listed on the Ho Chi Minh Stock Exchange.

3.6. Comparing predictability in forecasting models

It has been observed that researchers around the world have tried to find empirical evidence to prove the predictability of accounting information on future operating cash flows. Their conclusions, however, are not consistent when it comes to the selection of the best forecasting model, probably due to divergence of research context, methods, among others. Following the idea of previous researchers, the sixth hypothesis is included in the study with the expectation to fill the knowledge gap of operating cash flow prediction in non-financial listed companies given the research context of Vietnam.

H_6: The model that combines operating cash flows and disaggregated accruals best predicts operating cash flow of non-financial companies listed on Ho Chi Minh Stock Exchange.

4. Research Methodology

4.1. Data Collection

The research uses accounting data from financial reports of companies listed on Ho Chi Minh Stock Exchange (HOSE). There are 384 companies listed on HOSE in 2018, including 90 financial companies and 294 non-financial firms. Since financial companies are subject to a special accounting regime, which is different from that in non-financial businesses, only non-financial companies are included in the sample to achieve data consistency. The sampling method was adopted by a large number of scholars (Ebaid, 2011; Stammerjohan & Nassiripour, 2001, Farshadfar et al., 2008; Mooi, 2007). In addition, the non-financial companies selected for the research sample should be listed on HOSE in at least five consecutive years between 2009 and 2018, financial year ending by December 31 with available operating cash flows and earnings. Consequently, the data sample was composed of 242 non-financial companies listed on HOSE.

4.2. Research Models

Learning the models of cash flow prediction employed by other authors, the predictability on future operating cash flows, using accounting information, is assessed for non-financial companies listed on the Hochiminh City Stock Exchange of Vietnam by the specific models as follows:

(i) Prediction of cash flows from operating using historical earnings (Earnings Model)

$$CFO_t = \beta_0 + \beta_1 EARN_{t-1} + \varepsilon, \quad (1)$$
$$CFO_t = \beta_0 + \beta_1 EARN_{t-1} + \beta_2 EARN_{t-2} + \varepsilon, \quad (2)$$
$$CFO_t = \beta_0 + \beta_1 EARN_{t-1} + \beta_2 EARN_{t-2} + \beta_3 EARN_{t-3} + \varepsilon. \quad (3)$$

(ii) Prediction of cash flows from operating using historical Operating Cash Flows (Operating Cash Flows Model)

$$CFO_t = \alpha_0 + \alpha_1 CFO_{t-1} + \mu, \quad (4)$$
$$CFO_t = \alpha_0 + \alpha_1 CFO_{t-1} + \alpha_2 CFO_{t-2} + \mu, \quad (5)$$
$$CFO_t = \alpha_0 + \alpha_1 CFO_{t-1} + \alpha_2 CFO_{t-2} + \alpha_3 CFO_{t-3} + \mu. \quad (6)$$

(iii) Prediction of cash flows from operating using historical Operating cash flows combined with aggregated accruals

$$CFO_t = \lambda_0 + \lambda_1 CFO_{t-1} + \lambda_2 ACR_{t-1} + \varepsilon, \quad (7)$$
$$CFO_t = \lambda_0 + \lambda_1 CFO_{t-1} + \lambda_2 CFO_{t-2} + \lambda_3 ACR_{t-1} + \lambda_4 ACR_{t-2} + \varepsilon, \quad (8)$$
$$CFO_t = \lambda_0 + \lambda_1 CFO_{t-1} + \lambda_2 CFO_{t-2} + \lambda_3 CFO_{t-3} + \lambda_4 ACR_{t-1} + \lambda_5 ACR_{t-2} + \lambda_6 ACR_{t-3} + \varepsilon. \quad (9)$$

(iv) Prediction of cash flows from operating using historical operating cash flows combined with disaggregated accruals

$$CFO_t = e_0 + e_1 CFO_{t-1} + e_2 \Delta AR_{t-1} + e_3 \Delta AP_{t-1} + e_4 \Delta INV_{t-1} + e_5 \Delta OTH_{t-1} + e_6 DPRM_{t-1} + \rho, \quad (10)$$
$$CFO_t = e_0 + e_1 CFO_{t-1} + e_2 CFO_{t-2} + e_3 \Delta AR_{t-1} + e_4 \Delta AR_{t-2} + e_5 \Delta AP_{t-1} + e_6 \Delta AP_{t-2} e_7 \Delta INV_{t-1} + e_8 \Delta INV_{t-2} + e_9 \Delta OTH_{t-1} + e_{10} \Delta OTH_{t-2} + e_{11} DPRM_{t-1} + e_{12} DPRM_{t-2} + \rho, \quad (11)$$
$$CFOt = e_0 + e_1 CFO_{t-1} + e_2 CFO_{t-2} + e_3 CFO_{t-3} + e_4 \Delta AR_{t-1} + e_5 \Delta AR_{t-2} + e_6 \Delta AR_{t-3} + e_7 \Delta AP_{t-1} + e_8 \Delta AP_{t-2} + e_9 \Delta AP_{t-3} + e_{10} \Delta INV_{t-1} + e_{11} \Delta INV_{t-2} + e_{12} \Delta INV_{t-3} + e_{13} DPRM_{t-1} + e_{14} DPRM_{t-2} + e_{15} DPRM_{t-3} + e_{16} \Delta OTH_{t-1} + e_{17} \Delta OTH_{t-2} + e_{18} \Delta OTH_{t-3} + \rho. \quad (12)$$

(v) Prediction of cash flows from operating using historical cash flows ratios (Cash flows ratios models)

$$CFO_t = \beta_0 + \beta_i\, CFR1_{t-1} + \beta_i\, CFR2_{t-1} + \beta_i\, CFR3_{t-1} + \beta_i\, CFR4_{t-1} + \beta_i\, CFR5_{t-1} + \beta_i \quad CFR6_{t-1} + \beta_i\, CFR7_{t-1} + \beta_i\, CFR8_{t-1} + \beta_i\, CFR9_{t-1} + \varepsilon, \tag{13}$$

$$CFO_t = \beta_0 + \beta_1\, CFR1_{t-1} + \beta_2\, CFR2_{t-1} + \beta_3\, CFR3_{t-1} + \beta_4\, CFR4_{t-1} + \beta_5 CFR5_{t-1} + \beta_6\, CFR6_{t-1} + \beta_7\, CFR7_{t-1} + \beta_8\, CFR8_{t-1} + \beta_9\, CFR9_{t-1} + \beta_{10} CFR1_{t-2} + \beta_{11}\, CFR2_{t-2} + \beta_{12}\, CFR3_{t-2} + \beta_{13}\, CFR4_{t-2} + \beta_{14}\, CFR5_{t-2} + \beta_{15}\, CFR6_{t-2} + \beta_{16}\, CFR7_{t-2} + \beta_{17}\, CFR8_{t-2} + \beta_{18}\, CFR9_{t-2} + \varepsilon. \tag{14}$$

Variable Measurements

Research data collected directly from financial statements are presented in Table 1.

Table 1
Measurement of Dependent and Independent Variables

Code	Variables	Measurements
CFO_t CFO_{t-1} CFO_{t-2} CFO_{t-3}	Operating cash flows corresponding to year t (forecast year) and year t-1 (one year prior to the forecast year), year t-2 (two years prior to the forecast year), year t-3 (three years prior to the forecast year)	Value of "Net cash flow from operating activities" is taken from item coded 20 on Cash Flow Statement.
$EARN_{t-1}$ $EARN_{t-2}$ $EARN_{t-3}$	Earnings of year t-1 (one year prior to the forecast year), year t-2 (two years prior to the forecast year), year t-3 (three years prior to the forecast year)	Value of "Net earning from business activities" is taken from item coded 30 on Income Statement.
ACR_{t-1} ACR_{t-2} ACR_{t-3}	Total value of aggregated accruals of year t-1 (one year prior to the forecast year), year t-2 (two years prior to the forecast year), year t-3 (three years prior to the forecast year)	Differences between value of "Earnings from business activities" is taken from item coded 30 on Income Statement and the value of "Net cash flow from operating activities" taken from item coded 20 on Cash Flow Statement.
ΔAR_{t-1} ΔAR_{t-2} ΔAR_{t-3}	Change of accounts receivable in year t-1 (one year prior to the forecast year), year t-2 (two years prior to the forecast year), year t-3 (three years prior to the forecast year)	The value is taken directly from item coded 09 "Change of receivables" on Cash Flow Statement.
ΔAP_{t-1} ΔAP_{t-2} ΔAP_{t-3}	Change of accounts payables in year t-1 (one year prior to the forecast year), year t-2 (two years prior to the forecast year), year t-3 (three years prior to the forecast year)	The value is taken directly from item coded 11 "Change of payables" on Cash Flow Statement.
ΔINV_{t-1} ΔINV_{t-2} ΔINV_{t-3}	Change of inventory in year t-1 (one year prior to the forecast year), year t-2 (two years prior to the forecast year), year t-3 (three years prior to the forecast year)	The value is taken directly from item coded 10 "Change of inventory" on Cash Flow Statement.
$DPRM_{t-1}$ $DPRM_{t-2}$ $DPRM_{t-3}$	Depreciation of tangible fixed assets and intangible fixed assets in year t-1 (one year prior to the forecast year), year t-2 (two years prior to the forecast year), year t-3 (three years prior to the forecast year)	The value is taken directly from item coded 02 "Depreciation expenses" on Cash Flow Statement.
ΔOTH_{t-1} ΔOTH_{t-2} ΔOTH_{t-3}	Change of other prepaid expenses in year t-1 (one year prior to the forecast year), year t-2 (two years prior to the forecast year), year t-3 (three years prior to the forecast year)	The value is taken directly from item coded 12 "Change of prepaid expenses" on Cash Flow Statement.
CFR1	Cash readiness for main business activities	Net cash flow from operating activitiesPayment for fixed assets and other long term assets + Dividend payment + Principal repayment *where:* *Principal repayment is taken from code 34 "Principal repayment" on the Cash Flow Statement.* *Payment for fixed assets and other long-term assets: taken from item coded 21 "Payment for procurement and construction of fixed assets and other long-term assets" on Cash Flow Statement.* *Dividend payment: taken from item coded 36 "Dividend and profit payment to shareholders" on Cash Flow Statement.*
CFR2	Cash readiness for loan repayment	Principal repaymentNet cash flow from operating activities
CFR3	Cash readiness for dividend payment	Dividend paymentNet cash flow from operating activities
CFR4	Cash readiness for investment	Payment for fixed assets and other long-term assetsNet cash flow from operating activities
CFR5	Ratio of Liabilities to Cash flow	Average LiabilitiesNet cash flow from operating activities
CFR6	Ratio of Depreciation to Cash flow	DepreciationNet cash flow from operating activities
CFR7	Ratio of Cash flow to Net revenue	Net cash flow from operating activitiesNet revenue *where:* *The value of Net revenue is taken from item coded 03 "Net revenue from sales of goods and services" on Income Statement.*
CFR8	Ratio of Cash flow to Earning	Net cash flow from operating activitiesNet earnings
CFR9	Ratio of Cash flow to Total assets	Net cash flow from operating activitiesTotal assets *where*: Total assets balance is calculated by dividing the sum of total assets (code 270 in Balance Sheet) at the beginning and at the end of the period by 2.

4.3 Research Design

Three common estimation methods applied to mixed data, including Ordinary Least Squares (OLS), Random Effects Model (REM) and Fixed Effects Model (FEM). These approaches are currently adopted by researchers in Vietnam such as Chuong and Quynh (2015) and Duong and Hung (2014). These estimations use OLS, FEM, REM to examine sensitivity and variation of variables structure in the models. Therefore, OLS, FEM, REM regressions are performed by using STATA 12 software in this study to estimate the models. Having the OLS, FEM, and REM regression results, it is followed by test to select the suitable model among OLS, FEM and REM. In the Hausman test, the null hypothesis is that REM is suitable against the alternative hypothesis in favour of FEM. If the p-value in Hausman test is less than 0.1 (10%), the null hypothesis is rejected and FEM is selected to discuss the results. Otherwise, REM is opted. Given the chosen model, additional tests are made to examine the model suitability and check the regression assumptions such as constant errors variance, independent residuals and autocorrelation. The F-statistic value obtained from model estimation is used to test suitability (i.e., the model is suitable if Prob (F-statistic) value is less than 0.1). The hypothesis of homoscedasticity is checked by Breusch-Pagan-Godfrey test. Breusch-Pagan-Godfrey test sets the null hypothesis of constant variance against the alternative hypothesis that variances are not constant. In case the F-statistic value resulted from the test is less than 0.1, it is concluded variances change in the model. To detect the presence of autocorrelation, the Durbin - Watson (DW) statistic is used. If 1<DW <3, the model has no autocorrelation; if 0<DW<1, the model has a positive autocorrelation; and if 3<DW <4, the model has a negative autocorrelation (Trong & Ngoc, 2013). The model defects discovered from test results are corrected followed by discussions on research results. Then, conclusions are drawn from the discussion of assumptions. Like previous studies, the preditability value of each model is measured by the R^2 coefficient. Accordingly, a higher R^2 value implies higher predictive power in the model.

5. Results and Discussion

5.1. Descriptive Statistics

Table 2
Descriptive Statistics of research variables (*Unit: VND 1,000,000)*

Variables	Mean	Median	Max	Min	Standard Errors
$EARN_{t-1}$	175,000	42,900	12,300,000	(412,000)	694,000
$EARN_{t-2}$	162,000	47,200	7,350,000	(246,000)	507,000
$EARN_{t-3}$	129,000	39,800	5,340,000	(481,000)	379,000
CFO_t	143,000	24,200	14,600,000	(3,050,000)	924,000
CFO_{t-1}	96,200	18,800	11,500,000	(3,050,000)	724,000
CFO_{t-2}	74,300	15,200	9,800,000	(2,790,000)	568,000
CFO_{t-3}	61,800	13,300	7,230,000	(2,200,000)	410,000
ACR_{t-1}	92,600	21,600	5,710,000	(2,110,000)	425,000
ACR_{t-2}	101,000	27,000	3,180,000	(2,110,000)	396,000
ACR_{t-3}	77,100	20,600	3,180,000	(1,840,000)	349,000
ΔAP_{t-1}	52,600	0	8,680,000	(2,550,000)	422,000
ΔAP_{t-2}	53,600	0	8,680,000	(845,000)	400,000
ΔAP_{t-3}	33,600	0	3,840,000	(845,000)	253,000
ΔAR_{t-1}	43,700	0	4,410,000	(1,480,000)	256,000
ΔAR_{t-2}	50,800	721	4,410,000	(1,310,000)	250,000
ΔAR_{t-3}	48,300	0	4,410,000	(632,000)	239,000
ΔINV_{t-1}	64,400	0	7,010,000	(1,160,000)	347,000
ΔINV_{t-2}	61,500	21	4,360,000	(1,180,000)	256,000
ΔINV_{t-3}	42,900	0	1,740,000	(1,180,000)	174,000
ΔOTH_{t-1}	1,500	0	477,000	(1,080,000)	50,900
ΔOTH_{t-2}	5,300	0	676,000	(455,000)	42,800
ΔOTH_{t-3}	4,710	0	676,000	(225,000)	38,500
$DPRM_{t-1}$	49,900	11,800	3,090,000	0	182,000
$DPRM_{t-2}$	41,500	9,680	2,800,000	0	147,000
$DPRM_{t-3}$	33,900	8,150	1,730,000	0	114,000

Table 2 shows the positive values of earnings (EARN), operating cash flows (CFO), aggregate accruals (ACR), indicating positive earnings and net operating cash flows in most of non-financial companies listed on HOSE in the period from 2009 to 2018. The observed positive values of disaggregated accruals (ΔAP, ΔAR, ΔINV, ΔOTH and DPRM) mean that non-financial companies listed on HOSE have higher year-end receivables, payables, inventory, prepaid expenses, and fixed asset depreciation against the year-beginning values.

5.2 Discussions

The Hausman's test results show that the FEM regression is the most suitable for all cash flow forecasting models for non-financial companies listed on HOSE. Specifically, the FEM regression results of cash flow forecasting models are presented in the following tables:

Regression results of earnings model

The relationship between future operating cash flows and historical earnings (with one-year lag, two-year lag and three-year lag) is shown in Table 3:

Table 3
Summary of FEM regression results of earnings model

Variables	One-year lag	Two-year lag	Three-year lag
$EARN_{t-1}$	0.708268***	1.037564***	0.841508***
$EARN_{t-2}$		0.832427***	1.072893***
$EARN_{t-3}$			0.699031***
Prob (F- Statistic)	0.00000	0.00000	0.00000
DW	2.03	1.83	1.88
Adjusted R^2	0.773219	0.792889	0.813363

**Significant at 0.1 level. ** Significant at 0.05 level. Significant at 0.01 level.*

The Prob (F-statistic) value from the FEM regression indicates that earnings models have predictive ability on firm's future cash flows. The Adjusted - R^2 coefficients in these earnings models are 0.77, 0.79 and 0.81, respectively, further show that earnings with one-year lag, two-year lag and three-year lag explain 77%, 79% and 81%, respectively, of the variation in future operating cash flows. FEM regression results for three detailed earnings models (with the independent variables lagging one year, two years and three years) indicate that these models have predictive ability on future cash flows This result is shared by various authors who studied the cash flow prediction by earnings such as Barth et al. (2001), Ebaid (2011), Chong (2012) and Anh (2013). In addition, the longer lag in predictors of these models results in stronger predictive power (from 77% to 81%), meaning that the model with a three-year lag has higher predictive ability than the models with one-year lag or two-year lag. As a result, the first research hypothesis (H_1) is accepted.

Regression results of the cash flow model

The relationship between future operating cash flows and historical operating cash flows (with one-year lag, two-year lag and three-year lag) is shown in Table 4:

Table 4
Summary of FEM regression results of the cash flow model

Variables	One-year lag	Two-year lag	Three-year lag
CFO_{t-1}	0.497463***	0.493368***	0.515405***
CFO_{t-2}		0.411615***	0.337359***
CFO_{t-3}			0.260078***
Prob (F- Statistic)	0.00000	0.00000	0.00000
DW	2.613703	2.695733	2.648768
Adjusted R^2	0.764312	0.789254	0.796054

**Significant at 0.1 level. ** Significant at 0.05 level. Significant at 0.01 level.*

FEM regression results show all cash flow models (with one-year lag, two-year lag and three-year lag) are capable of predicting future cash flows. Predictability of historical cash flow models (with one-year lag, two-year lag and three-year lag) on future cash flows are 76%, 78% and 79%, respectively. This conclusion concurs with the authors of previous studies in the same topic such as Greenberg et al. (1986), Bowen et al. (1986), Mc Beth (1993), Barth et al. (2001), Chotkunakitti (2005) and Anh (2013). Predictability of FEM regression models increases from 76% to 79% (shown by the Adjusted R^2 coefficient). In addition, the longer lag in predictors in these models results in stronger predictive values (from 76% to 79%), meaning that the model with a three-year lag has higher predictive ability than the models with one-year lag or two-year lag. Thus, the second research hypothesis (H2) is accepted.

FEM regression results of the cash flow model combined with aggregated accruals

The relationship between future operating cash flows and historical operating cash flows combined with aggregated accruals (with one-year lag, two-year lag and three-year lag) is shown in Table 5. The table shows FEM regression results of three prediction models (with one-year lag, two-year lag and three-year lag in the predictors) are capable of predicting future operating cash flows. This conclusion is similar to previous studies such as Barth et al. (2001), Ebaid (2011), among others. The Adjusted - R^2 in these models are 0.82, 0.82 and 0.87, respectively, supporting the increasing explanatory value of future cash flow variations from 82% to 87% in cases of longer lag in predictors. The results in this study coincide with what was found by Barth et al. (2001) in terms of both the significance of predictors and the effect direction of predictors on future operating cash flows. Thus, the third research hypothesis is accepted.

Table 5
Summary of FEM regression results in the model of cash flows combined with aggregated accruals

Variables	One-year lag	Two-year lag	Three-year lag
CFO_{t-1}	0.187462**	0.192402**	0.080905
CFO_{t-2}		0.029462	0.415047***
CFO_{t-3}			0.763306***
ACR_{t-1}	0.903857***	0.879525***	1.001574***
ACR_{t-2}		0.095209	0.16145**
ACR_{t-3}			1.106636***
Prob (F- Statistic)	0.0000	0.000000	0.000000
DW	2.418038	2.434564	2.737023
Adjusted R^2	0.828346	0.828309	0.875557

**Significant at 0.1 level. ** Significant at 0.05 level. Significant at 0.01 level.*

FEM regression results of the cash flow model combined with disaggregated accruals

The relationship between future operating cash flows and historical operating cash flows combined with the disaggregated accruals (with one-year lag, two-year lag and three-year lag) is shown in Table 6:

Table 6
Summary of FEM regression results of the cash flow model combined with the disaggregated accruals

Variables	One-year lag	Two-year lag	Three-year lag
CFO_{t-1}	0.06368	0.067608	-0.105004
CFO_{t-2}		-0.278544***	-0.206533***
CFO_{t-3}			-0.106958
ΔAP_{t-1}	-0.724623***	-0.763389***	-0.706308***
ΔAPt-2		0.079242	-0.113543
ΔAP_{t-3}			0.018948
ΔAR_{t-1}	0.877728***	0.751735***	0.803101***
ΔAR_{t-2}		-0.190873***	0.095524
ΔAR_{t-3}			0.244711
ΔINV_{t-1}	0.969675***	0.856248***	0.871865***
ΔINV_{t-2}		0.581657***	0.889791***
ΔINV_{t-3}			0.474898***
ΔOTH_{t-1}	-0.449346	-0.926885**	-1.148572**
ΔOTH_{t-2}		0.440919	0.353376
ΔOTH_{t-3}			-0.32586
$DPRM_{t-1}$	2.492599***	1.552724***	0.321975
$DPRM_{t-2}$		1.097229***	0.780995**
DPRM t-3			1.647527***
Prob (F- Statistic)	0.0000	0.0000	0.0000
DW	2.484538	2.548625	2.501873
Adjusted R^2	0.883925	0.922246	0.93063

**Significant at 0.1 level. ** Significant at 0.05 level. Significant at 0.01 level.*

Table 6 shows FEM regression results of three detailed prediction models (with one-year lag, two-year lag and three-year lag in the predictors). Particularly, disaggregated accruals are capable of predicting future operating cash flows. This conclusion is similar to prior studies such as Barth et al. (2001) and Ebaid (2011), among others. Moreover, the model predictability is stronger if the lagging period of forecast variables is longer (the model predictive value increases from 88% to 93%). Thus, the fourth research hypothesis (H4) is accepted.

FEM regression results of the cash flow ratio model

The relationship between future operating cash flows and cash flow ratios (with one-year lag and two-year lag) is shown in Table 7. FEM regression results show the predictivity of the cash flow ratio model. However, the predictive values lower than those in the previously presented earning models and cash flow models (the highest predictability is 51.8% in the cash flow ratio model with two-year lagging predictors). Thus, the fifth research hypothesis (H_5) is accepted.

Table 7
Summary of FEM regression results of the cash flow ratio model

Variables	One-year lag	Two-year lag
$CFR1_{t-1}$	0.000343	0.000225
$CFR2_{t-1}$	-0.000016	-0.000098**
$CFR3_{t-1}$	-0.000389	0.000180
$CFR4_{t-1}$	0.000601*	0.001132***
$CFR5_{t-1}$	-0.000150*	-0.000414***
$CFR6_{t-1}$	0.002356*	0.005206***
$CFR7_{t-1}$	-0.000567	-0.000538
$CFR8_{t-1}$	-0.000072	-0.000023
$CFR9_{t-1}$	-0.039756*	-0.055162**
$CFR1_{t-2}$		0.000223
$CFR2_{t-2}$		0.000060
$CFR3_{t-2}$		0.001788
$CFR4_{t-2}$		-0.008647***
$CFR5_{t-2}$		-0.000131
$CFR6_{t-2}$		-0.005951**
$CFR7_{t-2}$		-0.001585
$CFR8_{t-2}$		-0.000340
$CFR9_{t-2}$		-0.053952**
Prob(F- Statistic)	0.000000	0.000000
Adjusted R^2	0.333233	0.518494

**Significant at 0.1 level. ** Significant at 0.05 level. Significant at 0.01 level.*

Evaluation of predictability in cash flow forecasting models

A summary of Adjusted - R^2 coefficients in the models is presented in Table 8.

Table 8
Adjusted R^2 values in prediction models

No.	Forecasting Model	Adjusted R^2 value
1	Earnings model (with one-year lag)	0.773219
2	Earnings model (with two-year lag)	0.792889
3	Earnings model (with three-year lag)	0.813363
4	Cash flow model (with one-year lag)	0.764312
5	Cash flow model (with two-year lag)	0.789254
6	Cash flow model (with three-year lag)	0.796054
7	Aggregated accrual model (with one-year lag)	0.828346
8	Aggregated accrual model (with two-year lag)	0.828309
9	Aggregated accrual model (with three-year lag)	0.875557
10	Disaggregated accrual model (with one-year lag)	0.883925
11	Disaggregated accrual model (with two-year lag)	0.922246
12	Disaggregated accrual model (with three-year lag)	0.930630
13	Cash flow ratio model (with one-year lag)	0.333233
14	Cash flow ratio model (with two-year lag)	0.518494

As shown in Table 8, the models with longer-lagging independent variables are more predictive. The models with independent variables lagging three years indicate higher predictivity than those with independent variables lagging one or two years. This conclusion is consistent with the statement given by different researchers such as Barth et al. (2001), Chong (2012), etc. Barth et al. (2001) found the R^2 coefficient increased from 27% to 35% in the regression model of cash flow and accruals when the lag of independent variables is longer. Therefore, the sixth research hypothesis (H_6) is accepted.

6. Conclusion and Recommendations

6.1 Conclusion

The regression results of five cash flow forecasting models (historical earnings, historical cash flows, aggregated accruals, disaggregated accruals, and cash flow ratios) point out the highest Adjusted R^2 coefficient in the model of cash flows and disaggregated accruals. Therefore, this model outperforms the remaining ones in terms of predictability.

The historical cash flows combined with disaggregated accruals explain 88% to 93% of changes in future net operating cash flow. The results support the conclusion by Barth et al. (2001) and Ebaid (2011). The earnings model generates improved predictive values rather than the cash flow model. This empirical result is in favour of Greenberg et al. (1986), Barth et al. (2001), Ebaid (2011), and Anh (2013), and inconsistent with the observations by other researchers such as Mooi (2007).

6.2. Recommendations

From the research results, the research team proposed some recommendations to the Vietnam as follows:
Firstly, to the business: Results of this empirical research highlight the significance of accounting information on future cash flow forecasts with the predictive ability range between 51% and 93%. Business managers are recommended, therefore, to leverage the cash flow forecasting method introduced in this study in addition to traditional forecasting methods to better inform the decision-making. To mandate the forecast as a prior action to decision making, firms are encouraged to create a forecast team, in which specialists should be collaborative, connective and interactive. In addition, companies should foster professional skills for the staff in charge of cash flow forecasting. Besides, they need to create a positive work environment, closely coordinate accountants and forecasters to share detailed accounting data in order to make the cash flow prediction. Secondly, to the Ministry of Finance: It is suggested that Ministry of Finance in Vietnam request businesses to supplement cash flows ratios to the "Financial ratios" section in the Note to Financial Statements to inform a broad range of accounting data users. It is shown in the study that the explanatory values of cash flow ratios such as Cash flow from operating activities/Total assets, Payment for fixed assets/Cash flow from operating activities; Depreciation of fixed assets/Cash flow from operating activities are as high as 51% to future cash flows. The disclosure of cash flow ratios is not only useful to the policy development of state management agencies, but also the understanding of investors with regards to financial performance of enterprises is necessary. Moreover, accounting policies and regimes should be introduced to regulate earnings management techniques in companies in the preparation of financial statements in order to improve the accuracy of cash flow forecasts. The forecasts of operating cash flow will be accurate if they are sourced from accurate earning data. More efforts from the Ministry of Finance are encouraged to promulgate Accounting Standards and corporate accounting regime, which respect the nature rather than the form of business operations, to reduce the managerial discretion in processing complicated transactions. In addition, the Ministry of Finance is suggested to create opportunity for listed companies to make cash flow forecasts. In Vietnam, the forecast of cash flows is not fully backed by an enabling environment. In accordance with the Circular No. 52/2012/TT-BTC, guiding the disclosure of information on securities market, the Ministry of Finance does not require and encourage listed firms to disclose a pro forma cash flow statement. Therefore, businesses do not voluntarily create their pro forma cash flows, thus both businesses and investors are affected due to a lack of information. Companies with poor business performance in the U.S show the willingness to publish cash flow forecasts because their positive prediction of cash flows was perceived as good signals and investors were more confident in future business prospects and sustainability. Consequently, the forecasts of cash flows are critical to Vietnam to support the efficient investments of investors attributed to better information capture, the improved transparency in the stock market, the strengthened global integration, the enforced international commitments and the realized stock market upgrading solutions.

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