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The Value Relevance of Earnings and the Prediction of One-Year-Ahead Cash Flows

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Abstract

In this paper we examine the validity of using one-year-ahead cash flows prediction tests as a substitute for the value relevance test of earnings. We show theoretically that the R^2 of the cash flows prediction regression is contaminated by the presence of (1) noise in the cash flows and (2) spurious, i.e., value-unrelated, correlation between one-year-ahead cash flows and current earnings. We test if either of the above two factors contribute to the result of Kim and Kross (2005) that the ability of earnings to predict one-year-ahead cash flows has increased over the recent decades, in contrast to the evidence of decreasing value relevance of earnings. We find empirical evidence that both factors contributed to their result and conclude that the cash flows prediction test is a poor substitute for the value relevance test of earnings.

1 Introduction

A recent paper by Kim and Kross (2005) shows that the ability of current earnings to predict one-year-ahead cash flows has significantly increased over recent decades. Combined with the evidence of deteriorating association between earnings and stock returns over the same recent decades provided by Francis and Schipper (1999), Brown et al. (1999), and others, the two sets of results beg for an explanation why the value relevance of earnings and the ability of earnings to predict future cash flows diverge. Kim and Kross (2005) describe it well: "If stock price is the present value of future cash flows, the deterioration in the association between accounting earnings and stock prices implies a growing inability of accounting numbers to forecast future cash flows, but that is not what we find." The surprise implied by this statement stems from the belief that return association tests and cash flow prediction tests, which are the two most prominent tests of the usefulness of earnings in the existing literature, would produce similar results.[1] In this paper we examine why the two types of tests produce divergent results.

The theoretical foundation for value-relevance tests is firmly established in the literature. For example, Kim and Verrecchia (1991) show in a short-window setting that if a significant fraction of investors use certain information in their investment decisions, the information will be impounded into the equilibrium price. Therefore, an association between information and stock price (or its change) can be considered as evidence that the information is used by investors. In a long-window setting, such an association indicates that either the information was used by the market or the

[1] There are numerous return-earnings studies including Ball and Brown (1968). Cash flow prediction studies include Finger (1994), Dechow, Kothari, and Watts (1998), Barth, Cram, and Nelson (2001), and Kelly, Shores, and Tong (2003). Also, see Holthausens and Watts (2001) for a review of the value relevance literature.

information simply reflects the beliefs of the market participants.

In contrast, the theoretical foundation for cash flows prediction tests is rather weak. Investors as well as creditors are clearly concerned about a firm's future cash flows, and this is reflected in the concept statement of the Financial Accounting Standard Board that a primary objective of financial reporting is to provide information to help investors, creditors, and others assess the amount, timing and uncertainty of prospective cash flows (FASB 1978, 37-39). The problem is, however, that "prospective cash flows" are elusive and difficult to pinpoint, because the term literally means *all* prospective flows of cash. A researcher who wants to find a number that represents "prospective cash flows" other than from the market (i.e., from the security price) encounters many problems. First, he has to choose a finite subset of different periods' cash flows among the long cash flows series. Second, if cash flows of multiple years are chosen, he must determine discount rates to assign to cash flows of different years when combining them. Third, observed cash flows of a particular period contain periodic noise that may be correlated across periods. The above three problems are closely interrelated and must be dealt with simultaneously.

For simplicity, most existing studies of cash flows prediction concentrate on a small number of immediate future years' cash flows, and a majority on one-year-ahead cash flows including Kim and Kross (2005). This practice ignores the first problem and bypasses the second problem above, and has been accepted as a practical approach in the literature.[2] In this paper we investigate the prediction of one-year-ahead cash flows by current earnings and, as a result, concentrate on the third problem above. That is, we examine the possibility that one-year-ahead cash flows may be a very noisy proxy for "all prospective cash flows" because they contain significant

[2] A related study is Dechow and Dichev (2002) who consider past, current, and future cash flows, in their definition of earnings quality.

value-irrelevant noise which is correlated with current earnings.

More specifically, the purpose of this paper is to identify factors that contribute to the improved inter-temporal cash flows prediction of earnings over recent decades and to reconcile this finding with decreasing value-relevance of earnings over the same time period by focusing on noise in cash flows (and in earnings). We first develop a theoretical model of stock returns, earnings, and cash flows in which earnings and cash flows each consists of two additive components, value-relevant component and value-irrelevant noise. As a result, all the variances and (contemporaneous and lagged) covariances among returns, earnings, and cash flows also consist of the value-driven portion and the noise-driven portion.

We then express the R^2 of the return-earnings regression and the R^2 of the cash flows prediction regression as the value relevance of earnings contaminated by noise. While the former is depressed by the presence of market noise, the latter is depressed by the presence of noise in cash flows. In addition, the R^2 of the cash flows prediction regression is significantly exaggerated if a large fraction of the covariance between one-year-ahead cash flows and current earnings is driven by value-unrelated reasons.

Our empirical results show that both of the above factors contributed to the observation of Kim and Kross (2005). Based on our results, we conclude that the cash flows prediction test using one-year-ahead cash flows is a poor substitute for the test of value relevance of an accounting variable.[3]

The paper is organized as follows. Section 2 presents the model and section 3 analyzes the differences between the R^2's of the return-earnings regression and the cash flows prediction regression and develops the two hypotheses. In section 4 we

[3] Subramanyam and Venkatachalam (2007) also arrive at a similar conclusion that drawing inferences from using such a finite horizon of future payoff can be problematic. They propose to use *ex post* intrinsic values which are based on dividends.

develop value relevance measures and present empirical results in section 5. Section 6 concludes.

2 A Model of Return, Earnings, and Cash Flows

In order to analyze the differences between the value-relevance test and the cash flows prediction test, we develop a model of return, earnings, and cash flows in which all three variables are noisy measures of the value changes of a firm. We first use an equation that expresses stock returns consisting of two components. The first component reflects the change in the market's assessment of the value of the firm (i.e., in the market's expectation of all future payoffs by the firm) and the second component is unrelated to it. We assume that the two components are additive and independent of each other. That is:

$$R_t = X_t + \delta_t \tag{1}$$

for all t, where R_t is the year t stock return, X_t is value-related return, and δ_t is value-irrelevant return that we call market noise. Given equation (1) and the fact that returns are approximately serially independent, we assume that X_t is serially independent and normally distributed with variance v.

We specify earnings and cash flows in relation to equation (1) as:

$$E_t = \alpha_1 X_t + \alpha_2 X_{t-1} + \varepsilon_t \tag{2}$$

and

$$C_t = \beta_1 X_t + \beta_2 X_{t-1} + \gamma_t, \tag{3}$$

where ε_t and γ_t are normally distributed independently of X_t's and δ_t's. In equations (2) and (3), earnings and cash flows are similarly characterized with different parameters and are each decomposed into three components. The first components, $\alpha_1 X_t$ and $\beta_1 X_t$, respectively for E_t and C_t, are priced in the same year as the value change, and the second components, $\alpha_2 X_{t-1}$ and $\beta_2 X_{t-1}$, are priced in the preceding year.[4] The third components, ε_t and γ_t, are those that are not priced in any year. The three components are mutually independent.

The second component, that is priced in year $t-1$, is due to the fact that earnings and cash flows lack timeliness (Beaver, Lambert, and Morse 1980 and Collins et al. 1994). This lack of timeliness of an accounting measure is inevitable, because unlike stock return earnings and cash flows are recognized only after certain requirements are satisfied. For earnings, revenues are recognized when they are earned and realizable and expenses are recognized when the matching revenues are recognized. For cash flows, the criterion is the receipt and payment of cash. On the contrary, stock price responds to any changes in the expectations of future earnings and cash flows. For example, consider a company that developed a promising new product. Stock price goes up reflecting the market's expectation of increased future earnings and cash flows due to the new product. However, earnings does not increase until the firm begins producing and selling the product. Earnings may even decrease in the current year due to the development costs of the new product that are expensed. Also, cash flows generally reflects the sales even later than earnings when cash is collected for the sales.

While the second terms of Equations (2) and (3) captures the lack of timeliness of earnings and cash flows, the third terms, ε_t and γ_t, represent the components that are never impounded into stock price. We will thus call ε_t and γ_t earnings noise and cash flows noise, respectively. This noise reflects the periodic fluctuations of earnings

[4] Studies including Colins and Kothari (1989) suggest that information about year t earnings begins to arrive to the market in year $t-1$.

and cash flows that are not priced because the fluctuations of different periods cancel each other out. Under the current accounting system, this periodic noise tends to reverse over time. In other words, if earnings (or cash flows) of many consecutive periods are added up, the noise significantly diminishes (Easton, Harris, and Ohlson 1992). While the reversal of the periodic noise automatically gives a degree of negative autocorrelation, it is also possible that the direction of intended (e.g., income management) or unintended (e.g., ones due to applying a certain accounting rules such as a declining-balance depreciation method) periodic noise may persist over multiple years, giving a degree of positive autocorrelation. It is also reasonable to assume that certain noise affects both earnings and cash flows, either in the same year or with a lag. The magnitudes of the noise in earnings and cash flows, ε_t and γ_t, , i.e., $Var(\varepsilon_t)$ and $Var(\gamma_t)$, and their auto- and cross-covariances, $Cov(\varepsilon_t, \varepsilon_{t-1})$, $Cov(\gamma_t, \gamma_{t-1})$, $Cov(\varepsilon_t, \gamma_t)$, $Cov(\varepsilon_t, \gamma_{t-1})$, and $Cov(\gamma_t, \varepsilon_{t-1})$, seem largely an empirical issue and we do not make any assumption about their magnitudes at this point.

3 Value Relevance and Cash Flows Prediction

3.1 The Theoretical Differences

In this section we analyze the differences between the value-relevance test and the cash flows prediction test using the model of section 2. The (theoretical value of the)

R^2 of the contemporaneous return-earnings regression can be written as:

$$\begin{aligned} R^2(R_t, E_t) &= \frac{[Cov(R_t, E_t)]^2}{Var(R_t) \cdot Var(E_t)} \\ &= \frac{(\alpha_1 v)^2}{[v + Var(\delta_t)]\,[(\alpha_1^2 + \alpha_2^2)v + Var(\varepsilon_t)]} \\ &= \frac{v}{v + Var(\delta_t)} \cdot \frac{\alpha_1^2 v}{(\alpha_1^2 + \alpha_2^2)v + Var(\varepsilon_t)} \\ &= \Omega R \cdot \Omega E_{cur}. \end{aligned} \tag{4}$$

The purpose of the regression is to measure the contemporaneous value-relevance of earnings, i.e., how current earnings are related to contemporaneous changes in firms' value (X_t). The R^2 of this regression measures the value-relevance of earnings the R^2 with noise. In the third expression of equation (4) the R^2 is expressed as the product of two terms. The second term, $\frac{\alpha_1^2 v}{(\alpha_1^2+\alpha_2^2)v+Var(\varepsilon_t)}$, is the (contemporaneous) *value-relevance of earnings* or the fraction that is related to contemporaneous return in the variance of earnings, which we denote by ΩE_{cur}. The R^2 measures the value-relevance with noise due to the presence of noise in return. The first term of the third expression of equation (4), $\frac{v}{v+Var(\delta_t)}$, measures how good or how free from noise the dependent variable (return) is as a proxy for value. The two terms above are not separately observable, and the R^2 is a noisy measure of the value-relevance of earnings depressed by $\frac{v}{v+Var(\delta_t)}$.[5]

We now write the R^2 of the cash flows prediction regression and relate it to ΩE_{cur}

[5] The regression coefficient, i.e., the earnings response coefficient, is used as another measure of value-relevance of earnings and can be expressed as $\frac{\alpha_1 v}{(\alpha_1^2+\alpha_2^2)v+Var(\varepsilon_t)}$, which is different from the second term of equation (4) because α_1 is not squared.

as follows:

$$\begin{aligned} R^2(C_{t+1},E_t) &= \frac{[Cov(C_{t+1},E_t)]^2}{Var(C_{t+1})\cdot Var(E_t)} \\ &= \frac{\left[\alpha_1\beta_2 v + Cov(\gamma_{t+1},\varepsilon_t)\right]^2}{\left[\left(\beta_1^2+\beta_2^2\right)v + Var(\gamma_{t+1})\right]\left[(\alpha_1^2+\alpha_2^2)v + Var(\varepsilon_t)\right]} \\ &= \frac{\left[\alpha_1\beta_2 v\right]^2}{\left[(\alpha_1^2+\alpha_2^2)v + Var(\varepsilon_t)\right]\left[\left(\beta_1^2+\beta_2^2\right)v + Var(\gamma_{t+1})\right]} \\ &\qquad \cdot \left[\frac{\alpha_1\beta_2 v + Cov(\gamma_{t+1},\varepsilon_t)}{\alpha_1\beta_2 v}\right]^2 \\ &= \frac{\alpha_1^2 v}{(\alpha_1^2+\alpha_2^2)v + Var(\varepsilon_t)}\cdot\frac{\beta_2^2 v}{\left(\beta_1^2+\beta_2^2\right)v + Var(\gamma_{t+1})} \\ &\qquad \cdot \left[\frac{\alpha_1\beta_2 v + Cov(\gamma_{t+1},\varepsilon_t)}{\alpha_1\beta_2 v}\right]^2 \\ &\equiv \Omega E_{cur}\cdot\Omega C_{lag}\cdot\frac{1}{(\Omega CE)^2}. \end{aligned} \tag{5}$$

The fourth expression of Equation (5) expresses the R^2 of the cash flows prediction regression as the value-relevance of earnings, ΩE_{cur}, multiplied by two factors. The second term, that we denote by $\Omega C_{lag} = \frac{\beta_2^2 v}{\left(\beta_1^2+\beta_2^2\right)v+Var(\gamma_{t+1})} < 1$, again measures how good or how free from noise this alternative dependent variable, lagged cash flows, is as a proxy for current value change.

The third term is present because not only the lagged cash flows is noisy, its relation with earnings is only partly driven by value. The third term of the fourth expression above is the squared inverse of $\frac{\alpha_1\beta_2 v}{\alpha_1\beta_2 v+Cov(\gamma_{t+1},\varepsilon_t)}$ which is the fraction of $Cov(C_{t+1},E_t)$ that is value-driven. We will denote it by ΩCE and call it the authenticity of lagged cash flows (as a proxy for contemporaneous value). As lagged cash flows become more unauthentic, the R^2 of the cash flows prediction regression is exaggerated.

We are interested in testing whether the two factors have been increasing over time to explain the improving cash flow predictions by earnings shown by Kim and Kross (2005).

3.2 The Observed Trends and Hypotheses Development

The analysis of last subsection enables us to track the sources of the discrepancy between the decreasing value relevance of earnings and the increasing ability of earnings to predict one-year-ahead cash flows. This can occur if either or both of the following have occurred. We divide the two factors into the following two hypotheses:

Hypothesis 1: *Lagged cash flows has become less noisy, i.e., ΩC_{lag} has increased, over the recent decades.*

An increase in ΩC_{lag} implies that a greater fraction of the variation in cash flows was priced one year in advance.

Hypothesis 2: *Lagged cash flows has become less authentic, i.e., ΩCE has decreased, over the recent decades.*

A decrease in ΩCE implies that a smaller fraction of the covariation between one-year-ahead cash flows and current earnings was related to current return.

If one or both of Hypotheses 1 and 2 are satisfied so that $\Omega C_{lag} \cdot \frac{1}{(\Omega CE)^2}$ increases, the decreasing value-relevance of earnings and the improving prediction of one-year-ahead cash flows by current earnings can be explained. It is possible for lagged cash flows to become more closely related to current value change while the prediction of one-year-ahead cash flows by current earnings becomes less authentic, if the relationship between one-year-ahead cash flows and current earnings becomes tighter but very spurious, i.e., caused by value-unrelated reasons.

Tests of Hypotheses 1 and 2, if they can be tested, would generate valuable insights into the usefulness of the cash flows prediction tests. A formidable problem in testing the hypotheses, however, is that the related variances and covariances are always observed as the sums of value-driven and noise-driven portions, and there is no easy way to cleanly separate them. The next section is devoted to developing empirical measures of ΩE_{cur}, ΩC_{lag}, and ΩCE in order to test hypotheses 1 and 2.

4 Measures of Value Relevance and Authenticity

4.1 Measuring the Fractions That Are Value-Driven

The value-relevance of a periodic performance measure such as earnings and cash flows has been defined in this paper as the degree to which the measure reflects the firm's value. We first write the variances of earnings and cash flows as:

$$Var(E_t) = \left(\alpha_1^2 + \alpha_2^2\right) v + Var(\varepsilon_t), \qquad Var(C_t) = \left(\beta_1^2 + \beta_2^2\right) v + Var(\gamma_t).$$

The value-relevance of earnings, denoted by ΩE, and the value-relevance of cash flows, denoted by ΩC, are each defined as:

$$\Omega E \equiv \frac{\left(\alpha_1^2 + \alpha_2^2\right) v}{\left(\alpha_1^2 + \alpha_2^2\right) v + Var(\varepsilon_t)}, \qquad \Omega C \equiv \frac{\left(\beta_1^2 + \beta_2^2\right) v}{\left(\beta_1^2 + \beta_2^2\right) v + Var(\gamma_t)}.$$

In the above definition, the value-driven portion comes not only from the timely contemporaneous association, but also from the delayed lagged association between value changes and the performance measure. The definition of value relevance is also similar to the concept of signal-to-noise ratio, which is defined as the value-driven variance divided by the noise-driven variance.[6]

We also define the value-relevance of earnings and cash flows with respect to either the current return or lagged return. For example, the value-relevance of earnings with

[6] There is a one-to-one relation between the the signal-to-noise ratio (SNR) and the value relevance (Ω), which can be written as $SNR = \frac{\Omega}{1-\Omega}$ or, equivalently, as $\Omega = \frac{SNR}{1+SNR}$.

respect to current return, denoted by ΩE_{cur}, is defined by:

$$\Omega E_{cur} \equiv \frac{\alpha_1^2 v}{\left(\alpha_1^2 + \alpha_2^2\right) v + Var(\varepsilon_t)},$$

and the value-relevance of cash flows with respect to one-year lagged return, denoted by ΩC_{lag}, is defined by:

$$\Omega C_{lag} \equiv \frac{\beta_2^2 v}{\left(\beta_1^2 + \beta_2^2\right) v + Var(\gamma_t)}.$$

Though the above definitions of value-relevance are natural, there is usually a problem with measuring them because a firm's value or its change (X_t) is rarely observed separately from market noise (δ_t). The problem is illustrated below in the attempt to compute the value-relevance of earnings and cash flows. Given a sample, we first use the fact that the covariances between return and current or one-year-ahead earnings or cash flows can be measured and take the following simple forms in our model:

$$\begin{aligned} Cov(\Delta P_t, E_t) &= \alpha_1 v, & Cov(\Delta P_t, E_{t+1}) &= \alpha_2 v, \\ Cov(\Delta P_t, C_t) &= \beta_1 v, & Cov(\Delta P_t, C_{t+1}) &= \beta_2 v. \end{aligned} \tag{6}$$

Using equation (6), parameters α_2, β_1, and β_2 can be converted to multiples of α_1:

$$\alpha_2 = \frac{Cov(\Delta P_t, E_{t+1})}{Cov(\Delta P_t, E_t)} \cdot \alpha_1, \quad \beta_1 = \frac{Cov(\Delta P_t, C_t)}{Cov(\Delta P_t, E_t)} \cdot \alpha_1, \quad \beta_2 = \frac{Cov(\Delta P_t, C_{t+1})}{Cov(\Delta P_t, E_t)} \cdot \alpha_1. \tag{7}$$

Equation (7) allows us to write the variances of earnings and cash flows as follows:

$$Var(E_t) = \left[1 + \left(\frac{Cov(\Delta P_t, E_{t+1})}{Cov(\Delta P_t, E_t)}\right)^2\right] \alpha_1^2 v + Var(\varepsilon_t), \tag{8}$$

$$Var(C_t) = \left[\left(\frac{Cov(\Delta P_t, C_t)}{Cov(\Delta P_t, E_t)}\right)^2 + \left(\frac{Cov(\Delta P_t, C_{t+1})}{Cov(\Delta P_t, E_t)}\right)^2\right] \alpha_1^2 v + Var(\gamma_t). \tag{9}$$

We can also express the covariance between one-year-ahead cash flows and current earnings as follows using equation (7):

$$\begin{aligned} Cov(C_{t+1}, E_t) &= \alpha_1 \beta_2 v + Cov(\gamma_{t+1}, \varepsilon_t) \\ &= \frac{Cov(\Delta P_t, C_{t+1})}{Cov(\Delta P_t, E_t)} \cdot \alpha_1^2 v + Cov(\gamma_{t+1}, \varepsilon_t), \end{aligned} \tag{10}$$

The authenticity of the prediction of cash flows with earnings (ΩCE) can be written as:

$$\Omega CE \equiv \frac{\alpha_1 \beta_2 v}{\alpha_1 \beta_2 v + Cov(\gamma_{t+1}, \varepsilon_t)} = \frac{\frac{Cov(\Delta P_t, C_{t+1})}{Cov(\Delta P_t, E_t)} \cdot \alpha_1^2 v}{\frac{Cov(\Delta P_t, C_{t+1})}{Cov(\Delta P_t, E_t)} \cdot \alpha_1^2 v + Cov(\gamma_{t+1}, \varepsilon_t)}. \tag{11}$$

We can similarly define authenticity of the predictions of (one-year ahead) earnings by earnings, earnings by cash flows, and cash flows by cash flows, i.e., ΩEE, ΩEC and ΩCC, which measure how the predictions are related to value.

Equations (8), (9), and (10) indicate that for any given number of equations for variances and covariances of earnings and cash flows and their observed values, we have one more unknowns, namely, $\alpha_1^2 v$, in addition to the variances and covariances of noise in earnings and cash flows. The approach we take in the next subsection to test Hypotheses 1 and 2 is not to impose any strong assumptions about the relations between earnings and cash flows noise in order to increase the number of equations or reduce the number of unknowns. Instead, we investigate their upper bounds.

4.2 Computing Value-Relevance and Authenticity Measures

We seek to obtain a sufficiently tight upper bound for $\alpha_1^2 v$ that would in turn generate sufficiently tight upper bounds for ΩE_{cur}, ΩC_{lag}, and ΩCE in equations (8), (9), and (10). Then, they can be used as reasonable proxies for ΩE_{cur}, ΩC_{lag}, and ΩCE, respectively, in equation (5). An upper bound for $\alpha_1^2 v$ is chosen for each year in the following way.

First, we assume that the value-relevance of return, $\Omega R = \frac{v}{v+Var(\delta_t)}$, stays the same for different years, since the extent of market noise is not observable.[7] Under this assumption, the R^2 of the regression of current earnings on current and lagged returns is proportional to the value-relevance of earnings, ΩE.

Second, we find the maximum R^2 of the above regression among all years and assign $\Omega E = 100\%$ to the year and assign ΩE of other years proportionally to the R^2 of the above regression. By doing this, we ensure that ΩE of any given year does not exceed 100%. This value of ΩE for any given year can be understood as the upper bound for the true ΩE.

Third, once the estimate of ΩE is computed for each year, $\alpha_1^2 v$ can be solved from:

$$\Omega E \equiv \frac{\left[1 + \left(\frac{Cov(\Delta P_t, E_{t+1})}{Cov(\Delta P_t, E_t)}\right)^2\right] \alpha_1^2 v}{Var(E_t)}, \tag{12}$$

which is obtained from equation (8).

Fourth, ΩE_{cur}, ΩC_{lag}, and ΩCE are similarly computed by using equations (8), (9), and (10), respectively.

$$\Omega E_{cur} \equiv \frac{\alpha_1^2 v}{Var(E_t)}. \tag{13}$$

$$\Omega C_{lag} \equiv \frac{Cov(R_t, C_{t+1})^2}{Cov(R_t, E_t)^2} \times \frac{\alpha_1^2 v}{Var(C_{t+1})}. \tag{14}$$

$$\Omega CE = \frac{Cov(R_t, E_t)}{Cov(R_t, C_t)} \times \frac{Cov(R_t, C_{t+1})^2}{Cov(R_t, C_t)^2} \times \frac{\alpha_1^2 v}{Cov(C_{t+1}, E_t)}. \tag{15}$$

[7] Pope and Walker (1999) report that U.K. earnings are more highly associated with returns than are U.S. earnings. Basu (1999) comments that it can be interpreted as more accounting timeliness and/or less market efficiency in U.K. relative to U.S.

5 Data and Empirical Results

5.1 Data

Our sample includes all non-financial firms (excluding firms with SIC 6000s), of which accounting and return data are available from the monthly CRSP and annual COMPUASTAT from 1970 through 2002. We follow the data screening procedure of Kim and Kross (2005). Sample firms should have information on stock returns during the test period, and accounting income, cash flow and asset amount up to next two years. Our analysis is based on the final sample of 98,149 firm/year observations over 33 years after eliminating top and bottom 1% of each year's distribution of earnings, cash flows and returns following Pope and Walker (1999). Following Kim and Kross (2005) and Dechow, Kothari and Watts (1998), we define cash flows such that (numbers in the parentheses are COMPUSTAT annual data items)

$$\begin{aligned} CFO &= Operating\ Income\ before\ Depreciation(\#13) - Interest\ Expense(\#15) \\ &\quad + Interest\ Revenue(\#62) - Taxes(\#16) - \Delta WC, \end{aligned} \tag{16}$$

where ΔWC is the change in accounts receivable (#2), inventory (#3), other current assets (#68) from year $t-1$ to year t, minus change in accounts payable (#70), taxes payable (#71), other current liabilities (#72) and deferred taxes (#74) from year $t-1$ to year t. And $E(Earnings)$ is $CFO + \Delta WC - Depreciation$. All variables are deflated by average assets (#6). Stock return of period t is the compounded return over the 12 months beginning in the fourth month of year t and ending at the third month following the end of fiscal year t.

<< *Table* 1 >>

Table 1 reports simple descriptive statistics. The mean (median) cash flows is 5.01% (6.81%) of average assets while the mean (median) of earnings is 1.70% (3.75%) of average assets. The earnings are much lower than cash flows mainly due to depreciation expenses. Our cash flows and earnings are higher than those reported in Kim and Kross (2005) and lower than those in Barth, Cram, and Nelson (2001). Prior research has a mixed findings in terms of skewness of cash flows. For example, Ball, Kothari, and Robin (2000) and Givoly and Hayn (2000) report that cash flows are left-skewed (median is greater than mean) while Kim and Kross (2005) and Barth et al. (2000) report the opposite. Our sample data has right-skewed cash flows. Mean (median) annual stock returns is 11.53% (4.08%). Our mean returns is equivalent to 11.8% in Ryan and Zarowin (2003) while our median returns is higher than their 3%.

5.2 Empirical Results

While Kim and Kross (2005) report that the earning's predictability of future cash flows has increased over time, most other studies indicate a weakening relationship between earnings and contemporaneous returns over time.

<< *Table* 2 >>

Table 2 reports the inter-temporal changes in the explanatory power of the return regression models and the cash flow forecasting model to replicate findings in prior studies. The second column of Table 2 reports R^2 from the contemporaneous earnings-return regression model (the model 1). The average R^2 over the test period is 6.05%, comparable to 5% in Ryan and Zarowin (2003). Table 2 shows results from reverse regressions following most studies that document the declining contemporaneous returns-earnings association. When the annual R^2s are regressed on the sample year to test for the significance of time trends, the second column of Table 2 shows a statistically insignificant time trend t-statistics with t-value of -0.75.[8] The next two columns of Table 2 report annual R^2s for the regressions of earnings and cash flows on both contemporaneous and lagged returns. The last column of Table 2 reports the annual R^2s from the cash flow prediction model of current earnings. The average R^2 is 25.66%, and the annual R^2s have increased by 1.58 % per year on average. The trend t-statistics (30.56) was significant. Overall, empirical results from our sample data are consistent with those of prior studies. We observe that the predictability of future cash flows by current earnings has increased significantly, but the value relevance of contemporaneous earnings has been weakly decreasing.

<< *Table* 3 >>

Table 3 reports temporal changes in the variance and covariance of earnings, cash flows, and returns as well as temporal changes in the explanatory power of returns-earnings regressions and cash flows-earnings regressions. We split our sample period into two periods, 1970-1986 and 1987-2002, and report the change in the mean value from the earlier period to the later one. Panel A of Table 3 reports changes in the variances and covariances of earnings and cash flows. Most variances and covariances have roughly tripled whereas the covariance between current earnings and future cash flows has increased more, 3.92 times, as reported in the last column of Table 3. Similarly, Panel B of Table 3 reports changes in variances and covariances of return and accounting variables. The variance of returns has increased by 26%, and the covariance between return and contemporaneous accounting variables has increased

[8] This is inconsistent with findings in prior studies such as Ryan and Zarowin (2003) who show a significant decrease.

by over 50%. Francis and Schipper (1999) report a similar increase in the volatility of market returns over time (p. 342). The last row of Panel B of Table 3 reports that the covariance between return and future cash flow has tripled (2.92). Panel C of Table 3 reports the temporal changes in various regression R^2s. Note that $R^2(E_t, R_t)$ shows that the explanatory power of earnings/returns regression has gone down (0.88) while $R^2(C_{t+1}, E_t)$ has more than tripled (3.03).

<< *Table* 4 >>

Table 4 provides the annual values of $\alpha_1^2 v$, ΩE_{cur}, ΩC_{lag}, and ΩCE for each year from 1970 to 2002. First, the results support both hypotheses 1 and 2. The increase in the R^2 of the cash flows prediction regression by current earnings can be attributed to both an increase in ΩC_{lag} and a decrease in ΩCE. The fourth column of Table 4 shows that ΩC_{lag} has significantly increased with t-value 1.78. The seventh column of Table 4 reports that ΩCE has decreased by 0.47 % annually on average, which is significant with t-value -1.84.

Affirmative results on Hypotheses 1 and 2 suggest that the one-year-ahead cash flows prediction test is a poor substitute for the value relevance test of earnings, because it is contaminated by the noise in the future cash flows as well as spurious correlation between cash flows and earnings. Note from equation (5) that:

$$R^2(C_{t+1}, E_t) = \Omega E_{cur} \cdot \Omega C_{lag} \cdot \frac{1}{(\Omega CE)^2}.$$

The average value of ΩC_{lag} for 33 years is only 3.01% which means that only 3.01% of the variance in one-year-ahead cash flows is related to current value change.

The mean value of ΩCE is 12.88%. This means that 87.12% of the covariance between one-year-ahead cash flows and current earnings is driven by value-unrelated factors, which further muddles the interpretation of the cash flows prediction test results. The above results suggest that cash flows prediction tests are a poor substitutes for value-relevance tests.

It is interesting to see that the value-relevance of earnings is in general decreasing, while the value-relevance of cash flows is increasing over time in Table 4. This suggests that the value-relevance gap between the two measures is thus narrowing, but the gap still remains wide.

Another notable findings in Table 4 is that the authenticity of earnings prediction is much greater than that of cash flows prediction. Last four columns of Table 4 shows the results. The columns 5 and 6 of Table 4 report the predicting future earnings by current earnings (ΩEE) and by current cash flows (ΩEC), respectively. The average value of ΩEE and ΩEC are 23.31% and 27.05%, respectively. The columns 7 and 8 of Table 4 report the authenticity of predicting future cash flows by current earnings (ΩCE) and by current cash flows (ΩCC), respectively. The average values of ΩCE and ΩCC are 12.88% and 9.93%, respectively. This shows that earnings prediction results are more closely related to the value-related returns (X_t) than cash flows prediction results.

6 Conclusion

In this paper we have examined the sources of the discrepancy between decreasing value relevance of earnings and increasing ability of earnings to predict one-year-ahead cash flows. Our results cast doubts on the validity of using cash flows prediction models as tests of the value-relevance or usefulness of an accounting number, method, or practice. Simply resorting to the FASB concept statement does not seem adequate because "future cash flows" in the statement means an appropriately discounted sum of all future cash flows without errors, and not cash flows of a particular period or periods which include only a fraction of future cash flows with significant noise. The noise in cash flows (and any periodic performance measure such as earnings) arises from fluctuations of cash flows that even out over multiple periods and thus are not priced. For example, a bird in hand does not count if a bird this year implies one less bird next year. Also, why do we regress to cash flows after having evolved from cash flows to earnings (i.e., the accrual basis accounting) long time ago?

Our analysis is limited in many ways. For example, we concentrate on one-year-ahead cash flows following the current practice in the literature, and do not provide guidance as to how to choose and combine multiple periods' cash flows. In addition, we assume that market efficiency is fixed or held constant during our sample period simply because the market noise is not easily separately observable.

One caveat is that our criticism of the cash flows prediction literature should in no way be construed as a claim that cash flow information is not useful to investors and creditors. Cash flows are in general a good source of information that is complementary to information that can be extracted from earnings (e.g., DeFond and Hung 2003). Moreover, much of the noise in cash flows may be removed by observing the components of cash flows or other information such as footnotes and newspaper articles. We are just cautioning against using cash flows tests as tests of usefulness of accounting information such as earnings without qualifications.

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Table 1
Descriptive Statistics

Variables	Mean	Std. Dev.	Median
C	4.64	13.90	6.82
E	1.41	12.58	3.76
R	14.50	59.81	5.41

The sample includes 100,603 firm observations during 1970 through 2003. C is the cash flow from operations such that C = operating income before depreciation - interest expense + interest revenue – taxes - ΔWC, where ΔWC = changes in accounts receivable, inventory, other current assets from year t-1 to year t, minus changes in accounts payable, taxes payable, other current liabilities and deferred taxes from year t-1 to year t. E is earnings such that E = C + ΔWC - Depreciation. All variables are at percentage, deflated by average assets. R is the compounded monthly return at percentage from the fourth month of the fiscal year through the end of the third month after the fiscal year end.

Table 2

Trends of the R^2 from return and cash flows prediction regressions

(1) Earnings - Return Model : $E_t = \alpha_0 + \alpha_1 R_t + \varepsilon_t$

(2) Earnings - Return Model : $E_t = \alpha_0 + \alpha_1 R_t + \alpha_2 R_{t-1} + \varepsilon_t$

(3) Cash Flow - Return Model : $C_t = \beta_0 + \beta_1 R_t + \beta_2 R_{t-1} + \gamma_t$

(4) Cash Flow Forecasting Model : $C_{t+1} = \delta_0 + \delta_1 E_t + \varphi_t$

	Model 1	Model 2	Model 3	Model 4
1970	5.93	32.88	6.19	6.03
1971	14.76	28.00	7.34	6.21
1972	5.13	18.12	5.13	3.62
1973	1.72	11.32	8.09	1.87
1974	4.79	12.75	7.20	4.74
1975	5.50	13.93	4.74	7.11
1976	4.00	11.26	2.92	5.55
1977	4.98	8.85	2.75	6.39
1978	3.40	9.77	0.34	6.68
1979	4.82	9.22	2.88	7.00
1980	5.42	11.82	2.05	11.77
1981	6.49	16.46	2.17	16.38
1982	4.17	13.53	1.89	20.90
1983	2.01	12.35	0.65	16.64
1984	13.90	20.40	10.53	22.90
1985	12.15	21.60	8.37	24.38
1986	5.67	17.03	4.79	25.79
1987	5.41	9.81	3.57	28.44
1988	9.21	14.20	4.77	29.26
1989	10.21	15.89	7.56	31.20
1990	4.82	13.63	3.70	31.17
1991	0.67	6.79	0.40	36.79
1992	2.80	4.27	2.14	37.56
1993	1.86	5.73	1.20	42.65
1994	7.59	10.21	5.12	45.94
1995	0.40	8.37	2.64	44.31
1996	6.09	6.55	4.28	49.96
1997	5.74	10.62	4.96	49.67
1998	1.20	7.19	3.48	49.27
1999	2.74	4.56	2.17	50.88
2000	8.83	8.25	6.64	52.27
2001	4.86	14.61	7.45	57.35
2002	10.36	14.87	10.71	63.39
2003	2.81	11.64	9.21	63.61
Average R^2	5.60	12.84	4.65	28.17
% point change per year	-0.04	-0.31	0.03	1.93
t-value	-0.69	-3.29	0.58	31.09

The table reports percentage R^2's from the return regression models and the cash forecasting model. Each yearly regression includes observations of which the fiscal year ends during the specific calendar year. C is the cash flow from operations such that C = operating income before depreciation - interest expense + interest revenue – taxes - ΔWC, where ΔWC = changes in accounts receivable, inventory, other current assets from year t-1 to year t, minus changes in accounts payable, taxes payable, other current liabilities and deferred taxes from year t-1 to year t. E is earnings such that E = C + ΔWC - Depreciation. All variables are at percentage, deflated by average assets. R is the compounded monthly return at percentage from the fourth month of the fiscal year through the end of the third month after the fiscal year end. The last two rows report the slope coefficients (% point change per year) and t-values from the trend regression of the model $R^2_t = \theta_0 + \theta_1 Year_t + \sigma_t$.

Table 3
Variance, Covariance and R square over time

Panel A : Earnings and Cash Flows

	1970-1986	1987-2003	Later/Earlier Ratio
$Var(E_t)$	55.96	240.44	4.30
$Var(C_t)$	96.93	261.44	2.70
$Cov(E_{t+1}, E_t)$	42.25	202.30	4.78
$Cov(C_{t+1}, C_t)$	37.27	176.61	4.74
$Cov(E_t, C_t)$	41.74	205.63	4.93
$Cov(E_{t+1}, C_t)$	36.30	183.83	5.06
$Cov(C_{t+1}, E_t)$	28.86	178.08	6.17

Panel B : Stock Returns

	1970-1986	1987-2003	Later/Earlier Ratio
$Var(R_t)$	19.38	40.06	2.07
$Cov(R_t, E_t)$	74.51	101.66	1.36
$Cov(R_t, C_t)$	70.46	78.24	1.11
$Cov(R_t, E_{t+1})$	90.67	129.55	1.43
$Cov(R_t, C_{t+1})$	22.91	43.65	1.91

Panel C : Regression R squares

	1970-1986	1987-2003	Later/Earlier Ratio
$R^2(E_t, R_t)$	6.17	5.03	0.82
$R^2(C_{t+1}, R_t)$	0.97	2.09	2.15
$R^2(E_t, R_t \text{ and } R_{t-1})$	14.58	8.28	0.57
$R^2(C_{t+1}, E_t)$	11.41	44.92	3.94

The table reports the averages of annual variances(Var), covariances(Cov) and regression R squares(R^2) over the earlier 17 years (1970-1986) and the later 17 years (1987-2003). C is the cash flow from operations such that C = operating income before depreciation - interest expense + interest revenue – taxes - ΔWC, where ΔWC = changes in accounts receivable, inventory, other current assets from year t-1 to year t, minus changes in accounts payable, taxes payable, other current liabilities and deferred taxes from year t-1 to year t. E is earnings such that E = C + ΔWC - Depreciation. All variables are at percentage, deflated by average assets. R is the compounded monthly return at percentage from the fourth month of the fiscal year through the end of the third month after the fiscal year end. The last column reports the ratio of later period average over that of earlier period.

Table 4
Trends of Key Value Relevance Measures

				Percent Value-driven			
Year	$\alpha_1^2\nu$	ΩE_{cur}	ΩC_{lag}	ΩEE	ΩEC	ΩCE	ΩCC
1970	6.04	32.71	10.65	61.98	53.85	76.02	26.99
1971	9.27	47.16	0.17	56.16	86.34	11.28	7.25
1972	3.36	18.51	4.28	33.55	23.07	46.77	8.62
1973	0.86	4.46	9.56	15.50	4.03	47.83	2.54
1974	2.95	12.50	0.25	22.99	17.30	8.13	3.79
1975	5.52	19.14	0.26	29.73	21.57	8.35	4.59
1976	5.10	17.34	0.02	23.30	22.22	2.38	1.03
1977	3.09	11.30	0.14	17.20	21.01	4.88	2.25
1978	2.79	9.95	0.48	15.04	46.12	0.47	0.47
1979	2.37	6.70	0.10	12.41	14.82	3.12	1.62
1980	5.08	11.33	0.01	17.07	24.21	1.13	1.16
1981	7.46	14.21	0.43	23.85	36.32	6.13	7.19
1982	10.20	12.51	0.07	24.96	37.75	2.05	2.46
1983	9.75	12.04	1.40	16.88	29.02	0.48	0.48
1984	25.06	23.12	8.37	33.42	37.76	29.07	25.77
1985	36.19	25.12	6.75	39.08	62.08	26.38	34.89
1986	45.93	24.07	1.77	33.50	54.94	12.86	17.56
1987	17.56	11.11	1.95	14.05	16.72	8.74	9.06
1988	34.13	18.37	5.43	23.49	34.95	18.46	23.63
1989	38.10	22.27	3.54	29.66	44.57	15.91	21.13
1990	25.18	15.05	0.92	22.32	37.67	6.65	9.73
1991	11.07	7.87	5.59	10.59	46.09	0.48	0.49
1992	4.90	3.34	0.89	5.82	6.65	2.81	2.77
1993	7.52	4.24	0.62	6.14	12.92	2.48	4.48
1994	24.87	12.08	3.79	16.40	21.03	9.98	11.19
1995	14.91	6.87	3.99	11.94	28.35	0.47	0.49
1996	19.42	8.11	3.37	11.03	13.45	7.40	8.31
1997	27.85	10.55	5.25	14.08	17.96	10.56	12.19
1998	20.95	7.28	0.94	9.57	13.68	3.73	4.97
1999	19.49	6.36	4.97	5.86	7.93	7.88	10.12
2000	43.32	11.68	5.60	15.20	20.61	11.19	14.74
2001	51.48	13.90	8.89	19.90	26.12	14.68	18.40
2002	63.94	19.01	16.45	24.30	26.41	22.21	22.94
2003	78.53	22.98	15.20	19.18	19.68	23.44	22.85
Average	20.12	14.80	3.89	21.65	29.04	13.36	10.18
% changes per year	1.36	-0.31	0.17	-0.69	-0.57	-0.49	0.24
t-value	5.61	-2.05	2.46	-3.63	-1.93	-1.77	1.52

The table reports trends of key value relevance measures at percentage.

$\alpha_1^2\nu = (R^2 / R^2_{\max}) \times Var(E_t) / (1 + Cov(R_t, E_{t+1})^2 / Cov(R_t, E_t)^2)$,

$\Omega E_{cur} = \alpha_1^2\nu / Var(E_t)$,

$\Omega C_{lag} = (Cov(R_t, C_{t+1})^2 / Cov(R_t, E_t)^2) \times \alpha_1^2\nu / Var(C_{t+1})$,

$\Omega EE = (Cov(R_t, E_{t+1}) / Cov(R_t, E_t)) \times \alpha_1^2\nu / Cov(E_t, E_{t+1})$,

$\Omega EC = (Cov(R_t, E_{t+1}) / Cov(R_t, C_t)) \times \alpha_1^2\nu / Cov(E_{t+1}, C_t)$,

$\Omega CE = (Cov(R_t, C_{t+1}) / Cov(R_t, E_t)) \times \alpha_1^2\nu / Cov(C_{t+1}, E_t)$,

$\Omega CC = (Cov(R_t, C_{t+1}) / Cov(R_t, C_t)) \times \alpha_1^2\nu / Cov(C_t, C_{t+1})$,

where R^2 is the R squares from the yearly regression of $E_t = \alpha_0 + \alpha_1 R_t + \alpha_2 R_{t-1} + \varepsilon_t$, and $R^2_{\max}$ is the maximum R^2 from the above yearly regression over 34 years. Var( ) and Cov( ) represent the variance or covariance. C is the cash flow from operations such that C = operating income before depreciation - interest expense + interest revenue – taxes - ΔWC, where ΔWC = changes in accounts receivable, inventory, other current assets from year t-1 to year t, minus changes in accounts payable, taxes payable, other current liabilities and deferred taxes from year t-1 to year t. E is earnings such that E = C + ΔWC - Depreciation. All variables are at percentage, deflated by average assets. R is the compounded monthly return at percentage from the fourth month of the fiscal year through the end of the third month after the fiscal year end. The last two rows report the slope coefficients (% changes per year) and t-values from the trend regression of the model $Measures_t = \theta_0 + \theta_1 Year_t + \sigma_t$.