THE ACCOUNTING REVIEW
Vol. 73, No. 3
July 1998
pp. 373–385

Additional Evidence on the Incremental Information Content of Cash Flows and Accruals: The Impact of Errors in Measuring Market Expectations

Ray J. Pfeiffer, Jr.
Pieter T. Elgers
University of Massachusetts Amherst
May H. Lo
Western New England College
Lynn L. Rees
Texas A&M University

ABSTRACT: This study evaluates the relation between security returns and funds-based earnings components. We document that proxies for market expectations of the components that are based on measures of historical serial- and cross-dependencies are substantially more accurate than random-walk proxies. Moreover, we detect significantly higher valuations of the operating cash flow component of earnings, relative to current accruals, when market expectations are represented using the dependency-based predictions. Such differential valuation is not detectable for random-walk representations. Contrary to results in Ali (1994), we find incremental information in unexpected cash flows over the whole spectrum (moderate and extreme) of unexpected cash flow realizations.

Key Words: *Funds-based components, Valuation, Prediction, Non-linearity.*

Data Availability: *All data are available from public sources.*

The authors gratefully acknowledge research support from the School of Management, University of Massachusetts Amherst.

Submitted January 1997.
Accepted December 1997.

I. INTRODUCTION

Purpose and Findings

Current reporting standards for income measurement and disclosure reflect presumptions that accrual earnings are incrementally informative to investors relative to more primitive constructs (e.g., operating cash flows) and that the reporting of earnings components provides value-relevant information beyond that conveyed by aggregate earnings alone. Prior studies of the security market's valuation of funds-based earnings components consistently indicate that working capital components (operating cash flows and current accruals) have higher valuations than do noncurrent accruals. In contrast, evidence of differential valuations of cash flows and current accruals prior to Ali (1994) has been characterized as weak and inconsistent (e.g., Jennings 1990, 925; Ali 1994, 63).

This weak evidence of valuation differences between operating cash flows and current accruals runs counter to expectations that are based on at least two arguments. First, Dechow et al. (1996, 26) note that cash flows are realized in the current period, while accruals represent future-period cash flows. Consequently, the market's valuation of accruals should impound discounts for futurity and risk. Second, Sloan (1996, 298) reports that cash flows are more persistent than accruals, in the sense that future earnings levels are more highly associated with current levels of operating cash flows than with current levels of aggregate (current and noncurrent) accruals. Together, these studies imply that a dollar of operating cash flows should be more highly valued than a dollar of current accruals, with a difference in magnitude sufficient to compensate for differences in futurity, risk and persistence.

Recent studies have improved the empirical specification of the security returns/earnings components relation by relaxing the assumption that the valuation coefficients be identical for all cases. Ali (1994) uses a piecewise-linear model that allows parameter shifts for firm-years having extreme changes in the earnings components. The estimates from this piecewise model indicate that operating cash flows have higher valuation coefficients than current accruals only when the realized operating cash flow changes are moderate, i.e., below the median absolute change in operating cash flows. On the other hand, Ali (1994) is unable to detect valuation differences for extreme changes in operating cash flows, and attributes this finding to an inverse relation between the persistence and the extremity of changes in earnings components.

Prior studies of the market's valuation of unexpected changes in annual earnings components generally use random-walk (no change) predictions as proxies for market expectations of the earnings components (e.g. Rayburn 1986; Bowen et al. 1987; Ali 1994). The present study assesses the impact of the implied measure of market expectations used in relating security returns to changes in earnings components. Our empirical tests address two related issues. First, we assess the extent of auto- and cross-correlations among earnings components and attempt to exploit these historical relations in developing predictions of current period levels of the earnings components.[1] The empirical results show that these historical dependencies are sufficiently stable to enable predictions of funds-based components that are significantly more accurate than random-walk predictions. Moreover, the

[1] Wilson (1986, 1987), in event-studies of the securities market's response to quarterly earnings components, includes prior current accruals, operating cash flows, and other operating variables in equations to predict quarterly current accruals and cash flows, and infers that the market responds more strongly to cash flows relative to accruals. Bernard and Stober (1989), however, assess the generality of this relation over a longer test period, and find no supportive evidence except in the specific two-quarter test period used in Wilson (1986, 1987). Bernard and Stober (1989, 648) suggest that the short-period event-study methodology may provide too short a return window to capture the market's differential valuation of earnings components.

magnitudes and statistical significance of the improvements in predictive accuracy are greatest in cases where the realized changes in the earnings components are "extreme" as defined in Ali (1994).

More accurate predictions of earnings components, however, do not necessarily provide better representations of securities market expectations. For example, Sloan (1996) reports evidence that the market may not fully impound the differential implications of earnings components in predicting future earnings. In addition, Rangan and Sloan (1998) provide evidence that is consistent with the market not fully impounding the implications of the correlation in quarterly earnings that stems from the use of the integral method for interim reporting. For this reason, our second set of tests employ the predicted values of the earnings components to represent security market expectations in assessing the market's valuation of unexpected changes in the components. When the predictions of earnings components that are based on historical auto- and cross-correlations are used to proxy for securities market expectations, estimation of a simple linear model of the securities returns/unexpected earnings components relation shows significant incremental valuation of operating cash flows over current accruals. Moreover, estimation of a piecewise-linear model that incorporates our adjusted measures of expectations of the earnings components indicates that operating cash flows are incrementally valued for extreme as well as for moderate measures of unexpected cash flows. One interpretation of these findings is that Ali's (1994) inability to detect valuation differences with a simple linear model, or to detect differences for extreme operating cash flows with a piecewise-linear model, is due to measurement error in the random-walk proxy for market expectations.

The remaining discussion proceeds as follows. Section II describes the sample selection, research design and empirical results. Section III provides a summary and conclusion.

II. RESEARCH DESIGN AND EMPIRICAL RESULTS

Sample Selection and Measurement of Variables

This study uses all firm-years in the 1997 Compustat CD-ROM active and research databases for which sufficient data are available. Only calendar-year firms are included because of our reliance on intertemporal tests for purposes of assessing statistical significance.[2]

The earnings components are defined as in Ali (1994, 63) in order to facilitate comparisons to the results of that study. Variables used in the empirical analysis are defined as follows (Compustat item numbers and mnemonics are in parentheses):

SAR_{jt} Size-adjusted return; defined as the difference between the realized return on firm j's common stock for the 12 months ended March 31 of year t + 1 and the mean return for all sample firms in the same size decile (where size is defined based on market value of equity (MKVALF) at the start of year t).

E_{jt} Earnings per share; defined as net income before extraordinary items and discontinued operations (#18, EPSPX).

[2] Regression residuals with securities returns as the dependent variable are likely to be cross-correlated in annual cross-sections. For this reason, intertemporal tests treat each annual parameter estimate as a single observation, relying on the assumption of serial rather than cross-sectional independence in securities returns (e.g., Bernard 1987).

$WCFO_{jt}$ Working capital from operations per share; defined as earnings per share plus adjustments for elements of earnings not affecting working capital. Through 1986, $WCFO_{jt}$ is equal to total funds from operations (#110, FOPT). After 1986, $WCFO_{jt}$ is defined as the sum of Compustat data items #106 (ESUBC), #123 (IBC), #124 (XIDOC), #125 (DPC), #126 (TXDC), #213 (SPPIV) and #217 (FOPO).

CFO_{jt} Cash flows from operations per share; defined as $WCFO_{jt}$ minus the change in noncash current assets from operations (change in data items #2 (RECT), #3 (INVT), and #68 (ACO)) plus the change in current liabilities from operations (change in data items #70 (AP), #71 (TXP), and #72 (LCO)).

CA_{jt} Current accruals per share; defined as $WCFO_{jt}$ minus CFO_{jt}.

NCA_{jt} Noncurrent accruals per share; defined as E_{jt} minus $WCFO_{jt}$.

Per share values of each earnings component are computed using common shares used to compute primary earnings per share (#54, CSHPRI). All components are scaled by share price at the start of the earnings year (#199, PRCCF).[3] To mitigate the potential effects of outliers, all firm-years with returns or scaled earnings variables exceeding $|1.0|$ were deleted. This screen resulted in the deletion of approximately five percent of available firm-years, which compares to six percent of cases deleted using the same screen in Ali (1994, 71).

Serial Dependencies and the Prediction of Funds-Based Earnings Components

In order to show empirically the serial relations among the funds-based earnings components for the firms included in our sample, table 1 reports selected auto- and cross-correlations for lags of one and two years. Consistent with prior research (e.g., Dechow 1994, table 2), panel A of table 1 shows that all auto-correlation coefficients are substantially less than one, indicating that the components exhibit strong mean reversion tendencies. This tendency is most pronounced for current accruals and is least pronounced for noncurrent accruals.[4]

Contemporary and lagged cross-correlations are reported in panel B of table 1. Operating cash flows are negatively correlated with both current and noncurrent accruals, consistent with the long-standing argument that accruals mitigate timing problems in cash flows as measures of earnings performance (e.g., Paton and Stevenson 1920, 224 and ff.; Dechow 1994, 7). The serial cross-correlation between each pair of components suggests that current period expectations for a given component that are conditioned on past realizations of each of the three components will be more accurate than random-walk expectations.[5]

The relations in table 1 suggest the potential usefulness of lagged values of the funds-based earnings components in conditioning expectations for the current period. For this reason, the following relation was estimated for each of the components:

$$C_{jt} = \beta_0 + \sum_{i=1}^{N} \beta_i \, CFO_{jt-i} + \sum_{i=1}^{N} \alpha_i \, CA_{jt-i} + \sum_{i=1}^{N} \gamma_i \, NCA_{jt-i} + e_{jt} \quad (1)$$

[3] Qualitatively similar results (not reported herein) are obtained when defining cash from operations as operating income before depreciation, interest and taxes less current accruals, as in Dechow (1994, 16).

[4] The cross-sectional variance in the price-scaled levels of the components (not reported) is reasonably stable over time. A stable variance and an auto-correlation below one imply a mean reversion tendency. Mean-reversion in the levels of earnings components is also consistent with the negative auto-correlations in consecutive *changes* in the earnings components reported in Ali (1994, table 2).

[5] The subsequent analyses will provide tests of this intuition in prediction models that employ all components.

TABLE 1
Auto- and Cross-Correlations Among Funds-Based Earnings Components
(n = 22,839 firm-years, 1980–1996)[a]

Panel A: Auto-Correlations

Earnings Component[b]	*One-Period Lag*		*Two-Period Lag*	
Cash flows (CFO)	CFO_t, CFO_{t-1}	+0.41	CFO_t, CFO_{t-2}	+0.33
Current accruals (CA)	CA_t, CA_{t-1}	+0.10	CA_t, CA_{t-2}	+0.01
Non-current accruals (NCA)	NCA_t, NCA_{t-1}	+0.60	NCA_t, NCA_{t-2}	+0.48

Panel B: Cross-Correlations

Earnings Components	*Contemporaneous*		*One-Period Lag*	
Cash flows and current accruals	CFO_t, CA_t	−0.57	CFO_t, CA_{t-1}	−0.07
			CA_t, CFO_{t-1}	−0.04
Cash flows and noncurrent accruals	CFO_t, NCA_t	−0.48	CFO_t, NCA_{t-1}	−0.41
			NCA_t, CFO_{t-1}	−0.34
Current accruals and noncurrent accruals	CA_t, NCA_t	+0.03	CA_t, NCA_{t-1}	+0.04
			NCA_t, CA_{t-1}	+0.05

[a] All correlations are reported as the average of 17 annual cross-sectional correlations estimated in each year 1980–1996.
[b] CFO_t, CA_t and NCA_t are operating cash flows, current (noncash working capital) accruals, and noncurrent accruals in year t, respectively. All earnings components are scaled by share price measured at the start of the earnings year.

where C_{jt}, the dependent variable, is specified alternatively as operating cash flows (CFO_{jt}), noncash working capital accruals (CA_{jt}) and noncurrent accruals (NCA_{jt}). The number of lags, N, was varied from one to three. Although multiple lags for individual components appeared to be statistically significant in several years, the coefficients varied widely over time, and only the coefficients for the one-period lags were all reliably different from zero based upon intertemporal t-tests.[6] For this reason, table 2 reports the estimation results only for the specification that includes a single lag for each component.[7]

The results in table 2 show that lagged cross-correlations of all three earnings components are incremental to auto-correlations, in association with subsequent levels of each component.[8] For example, the squared values of the one-period auto-correlations that were reported in panel A of table 1 are 0.168, 0.010 and 0.360 for CFO_j, CA_j and NCA_j, respectively. In the associations reported in table 2, the corresponding R^2s are 0.265, 0.035 and 0.366. The percentage improvement from incorporating the lagged cross-correlations are greatest for CFO_j and CA_j, implying that the degree of measurement error in the random-walk expectation differs across components. The significant intertemporal t-values suggest

[6] The apparent statistical significance of multiple lags in various years is based upon t-values in cross-sectional regressions, which are likely to be inflated due to cross-correlations in the regression residuals.
[7] Results over all lags are available upon request.
[8] An exception is the statistically insignificant relation of noncurrent accruals (NCA_t) to lagged cash flows (CFO_{t-1}) shown in panel C of table 2.

TABLE 2
Regression Relations of Funds-Based Earnings Components to One-Period Lagged Values (n = 22,839, years 1980–1996)[a]

Model:[b] $C_{jt} = \beta_0 + \beta_1 CFO_{jt-1} + \beta_2 CA_{jt-1} + \beta_3 NCA_{jt-1} + e_{jt}$

	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$	$\bar{R}^2_{adj}$
Panel A: CFO_{jt} as the Dependent Variable					
Parameter	0.047	0.457	0.281	−0.279	0.265
(t-value)	(7.35)*	(17.91)*	(11.14)*	(−9.23)*	
No. positive[c]	17/17*	17/17*	17/17*	0/17*	
$\sigma(\hat{\beta}_i)$[d]	0.026	0.105	0.104	0.125	
Panel B: CA_{jt} as the Dependent Variable					
Parameter	−0.005	0.155	0.224	0.175	0.035
(t-value)	(−1.04)	(6.58)*	(9.85)*	(5.24)*	
No. positive	8/17	17/17*	17/17*	16/17*	
$\sigma(\hat{\beta}_i)$	0.020	0.097	0.094	0.138	
Panel C: NCA_{jt} as the Dependent Variable					
Parameter	−0.043	0.014	0.065	0.653	0.366
(t-value)	(−21.74)*	(0.80)	(3.06)*	(15.46)*	
No. positive	0/17*	9/17	13/17	17/17*	
$\sigma(\hat{\beta}_i)$	0.008	0.073	0.088	0.174	

* Significant at a probability below 0.01.

[a] All parameter estimates are reported as the averages from 17 annual cross-sectional regressions, estimated in each year 1980–1996. The t-values and standard deviations are measured using the 17 annual observations of each parameter.

[b] C_t is specified alternately as CFO_t, CA_t and NCA_t. CFO_t, CA_t and NCA_t are operating cash flows, current (noncash working capital) accruals, and noncurrent accruals in year t, respectively. All earnings components are scaled by share price measured at the start of the earnings year.

[c] A binomial test is used to test whether the percentage of positive coefficients is significantly different from 50%.

[d] $\sigma(\hat{\beta}_i)$ is the standard deviation of the 17 annual estimates of parameter β_i.

that the parameters of these relationships are reasonably stable over time. If so, the model specifications reported in table 2 may be useful in developing *ex ante* predictions of the components (i.e., predictions that are based upon information that is available before the start of the prediction period).

In order to evaluate the accuracy of predictions of components that are based upon historical dependencies, the models reported in table 2 were re-estimated in each year, 1980 through 1995, using only those observations available from prior years (e.g., the parameters to be used in predicting 1985's components were estimated by pooling all available data from 1980 through 1984). To facilitate comparisons with Ali (1994) the components were aggregated to measure working capital from operations, WCFO (CFO + CA), and earnings, E (CFO + CA + NCA). As in Ali (1994), the absolute values of the changes in earnings (ΔE_t), working capital from operations ($\Delta WCFO_t$), and cash flow from operations (ΔCFO_t) were ranked in each year t; cases below the cross-sectional median were characterized as "moderate" and otherwise as "extreme."

Table 3 provides comparisons of the predictive accuracy between the random-walk and the serial-dependency-based expectations for each of the three earnings components. Without specific knowledge of investors' loss functions associated with prediction errors, it is not possible to identify a "best" measure of predictive accuracy. Thus, we report the mean squared prediction error (MSPE) metric because of its long-standing popularity as a gauge of earnings prediction accuracy (e.g., Elton et al. 1984; Ali et al. 1992). We also report the product-moment correlation of realized and predicted values. In addition, we report the correlation of size-adjusted securities returns and unexpected changes in the components because of its pertinence to the market valuation tests we present in the subsequent section of the paper.

In table 3, the comparisons of predictive accuracy for all cases combined (the first pair of columns) show that the serial-dependency-based predictions are in general significantly more accurate, at probability values below 0.01, than the random-walk predictions.[9] Within the sample partitions based on the extremity of the realized changes in the earnings components, the serial-dependency-based predictions are significantly more accurate for all error metrics except for the MSPE metric for moderate changes. This latter result is not surprising, because the membership of the moderate and extreme groups was determined based upon *ex post* measures of the magnitudes of the random-walk prediction errors.

The correlations of size-adjusted securities returns and unexpected changes in the earnings components reported in table 3 show that all correlations are significantly higher (probability below 0.01) when expectations are based upon serial dependencies. This result supports the view that investor expectations of these components at least partially reflect the historical dependencies upon which our predictions are based.[10]

In general, the results in table 3 demonstrate that the historical auto- and cross-correlations among earnings components are sufficiently stable to enable significant improvements in forecast accuracy beyond that achievable with random-walk expectations. Moreover, predictions of the earnings components that are based upon these historical dependencies appear to be more aligned with security market expectations of these earnings components than are random-walk (no change) predictions. The subsequent section will examine whether the use of predictions of earnings components based on these historical dependencies as proxies for investors' expectations affects inferences about the market's incremental valuation of cash flows from operations.

Predicted Values of Components as Representations of Market Expectations

The previous section developed predictions of each component of earnings based on auto- and cross-correlations among the earnings components. The following tests evaluate whether inferences about the incremental content of earnings components are sensitive to whether component expectations come from a random-walk model or from a model that incorporates the historical auto- and cross-correlation structure in the components. Table 4 provides a replication of Ali's (1994, tables 1 and 3) results, based upon random-walk

[9] An exception is the insignificant difference in the correlation of actual and predicted earnings.

[10] Our tests do not assess whether the market fully impounds the implications of these historical dependencies. Sloan (1996) reports evidence of market mispricing with respect to the cash flow and accrual components of earnings, while Rangan and Sloan (1998) report evidence of market mispricing with regard to the correlation structure in quarterly earnings.

TABLE 3
Comparisons of Prediction Accuracy for Funds-Based Earnings Components Based on Random-Walk and Serial-Dependency Predictions
(n = 22,253, years 1981–1996)[a,b]

	All Cases		*Moderate Changes*[h]		*Extreme Changes*	
Accuracy measure:	*Random Walk*[f]	*Serial Dependency*[g]	*Random Walk*	*Serial Dependency*	*Random Walk*	*Serial Dependency*
Panel A: Predictions of Cash Flows from Operations (CFO_t)						
MSPE*100[c]	3.25	2.12*	0.10‡	0.37	6.39	3.86*
$\rho(CFO_t, E[CFO_t])$[d]	0.44	0.57*	0.86	0.89*	0.30	0.45*
$\rho(SAR_t, UCFO_t)$[e]	0.07	0.17*	0.07	0.24*	0.09	0.17*
Panel B: Predictions of Working Capital from Operations ($WCFO_t$)						
MSPE*100	1.66	1.21*	0.04‡	0.17	3.29	2.25*
$\rho(WCFO_t, E[WCFO_t])$	0.64	0.68*	0.88	0.94*	0.55	0.59*
$\rho(SAR_t, UWCFO_t)$	0.20	0.29*	0.15	0.26*	0.25	0.32*
Panel C: Predictions of Earnings (E_t)						
MSPE*100	2.05	1.30*	0.03‡	0.13	4.06	2.47*
$\rho(E_t, E[E_t])$	0.52	0.52	0.84	0.89*	0.44	0.45
$\rho(SAR_t, UE_t)$	0.21	0.32*	0.19	0.33*	0.25	0.35*

CFO_t, $E[CFO_t]$ = actual and predicted values of cash flow from operations per share in year t (scaled by beginning share price);
$WCFO_t$, $E[WCFO_t]$ = actual and predicted values of working capital from operations per share in year t (scaled by beginning share price);
E_t, $E[E_t]$ = actual and predicted values of earnings before extraordinary items and discontinued operations per share in year t (scaled by beginning share price);
SAR_t = size-adjusted common stock return for the 12 months ended March 31 of year t + 1.

* Serial-dependency-based prediction is more accurate at a probability below 0.01.

‡ Random-walk-based prediction is more accurate at a probability below 0.01.

[a] The predictions of earnings components evaluated in this table are developed from the regression models described in table 2. Because at least one prior year is required for parameter estimation, the first year with available predictions is 1981.

[b] All of the accuracy measures reported in the table are averages of the measures that were computed in each year, 1981–1996. Correspondingly, all tests of differences in accuracy between the random-walk and serial-dependency predictions are based on matched-pair intertemporal t-tests, i.e., on the vector of 16 annual differences in accuracy.

[c] MSPE is the squared difference between the actual and predicted values of each earnings component. Reported numbers are multiplied by 100 to suppress leading zeros.

[d] Pearson correlations between the actual and expected values of each earnings component. The expected value, $E[C_t]$, is the prior year's level (random walk) or the predicted value (serial dependency) of the component.

[e] Pearson correlation between size-adjusted security returns, SAR_t, and unexpected value of the earnings components. Unexpected values are measured as differences from the prior year's level of the component (random walk) or the predicted value of the component (serial dependency).

[f] The random-walk prediction for each earnings component is the level of the component in the prior year.

[g] The serial-dependency predictions for each earnings component are developed by estimating the parameters of the regression models reported in table 2. For purposes of prediction, the parameters are estimated by pooling all firm-years available from 1980 through the year preceding the prediction year.

[h] Extremity of the earnings components is specified as in Ali (1994), i.e., cases below (at or above) the cross-sectional median absolute value of the share-price scaled change in the component in year t are classified as moderate (extreme).

TABLE 4
Relations of Size-Adjusted Security Returns to Changes in Earnings Components
(n = 22,253 firm-years, 1981–1996)

Panel A: Linear Model

Model: $SAR_j = \beta_0 + \beta_1 \Delta E_j + \beta_2 \Delta WCFO_j + \beta_3 \Delta CFO_j + \epsilon_j$

	$\hat{\beta}_0$	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$	$\bar{R}^2_{adj}$
Parameter estimate[a]	−0.030	0.312	0.294	−0.002	0.052
(t-value)[b]	(−9.25)*	(7.45)*	(8.66)*	(−0.08)	
No. positive[c]		16/16*	16/16*	9/16	
$\sigma(\hat{\beta}_i)$[d]		0.167	0.136	0.100	

Panel B: Piecewise-Linear Model

Model: $SAR_j = \alpha_0 + \alpha_1 \Delta E_j + \alpha_2 D^E \Delta E_j + \alpha_3 \Delta WCFO_j + \alpha_4 D^{WC} \Delta WCFO_j + \alpha_5 \Delta CFO_j + \alpha_6 D^{CF} \Delta CFO_j + \mu_j$

	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\alpha}_3$	$\hat{\alpha}_4$	$\hat{\alpha}_5$	$\hat{\alpha}_6$	$(\hat{\alpha}_1 + \hat{\alpha}_2)$	$(\hat{\alpha}_3 + \hat{\alpha}_4)$	$(\hat{\alpha}_5 + \hat{\alpha}_6)$	$\bar{R}^2_{adj}$
Parameter est.	−0.034	2.654	−2.353	1.264	−0.990	0.510	−0.514	0.301	0.275	−0.004	0.065
(t-value)	(−9.73)*	(14.29)*	(−12.48)*	(5.66)*	(−4.59)*	(3.62)*	(−3.53)*	(7.40)*	(8.49)*	(−0.17)	
No. positive		16/16*	0/16*	15/16*	2/16*	13/16	3/16	16/16*	16/16*	8/16	
$\sigma(\hat{\alpha}_i)$		0.743	0.754	0.894	0.862	0.563	0.583	0.163	0.129	0.100	

SAR_j = size-adjusted common stock return for the 12 months ended March 31 of year t + 1;
ΔE_j, $\Delta WCFO_j$, ΔCFO_j = annual change in earnings per share before extraordinary items and discontinued operations, working capital from operations per share, and cash flow from operations per share for year t, respectively. All three variables are scaled by share price at the start of the earnings year;
D^E, D^{WC}, D^{CF} = indicator variables equal to 1 when the absolute values of ΔE, ΔWCFO, and ΔCFO are at or above their annual cross-sectional medians and zero otherwise.

* Significant at a probability below 0.01.
[a] Parameter estimates are the means of 16 parameter estimates obtained in cross-sectional regressions in each year 1981–1996.
[b] The t-values are based upon the means and standard deviations of the 16 annual estimates of each parameter.
[c] A binomial test is used to test whether the percentage of positive coefficients is significantly different from 50%.
[d] $\sigma(\hat{\beta}_i)[\sigma(\hat{\alpha}_i)]$ is the standard deviation of the 16 annual estimates of parameter β_i [α_i].

proxies for security market expectations of the earnings components. Panel A of table 4 shows the result of estimating the following linear model relating security returns and changes in funds-based earnings components:

$$SAR_j = \beta_0 + \beta_1\Delta E_j + \beta_2\Delta WCFO_j + \beta_3\Delta CFO_j + \epsilon_j \tag{2}$$

where SAR_j is the size-adjusted stock return of firm j in year t, and ΔE_j, $\Delta WCFO_j$ and ΔCFO_j represent the contemporaneous changes in earnings, working capital from operations, and cash flow from operations, respectively (time subscripts are omitted). A positive value for β_1 indicates that noncurrent accruals are informative given the information in cash flows and current accruals; a positive value for β_2 indicates that current accruals are more highly valued than noncurrent accruals; and a positive value for β_3 indicates that cash flows are more highly valued than current accruals. The implied market response to changes in these earnings components is β_1 for noncurrent accruals, $(\beta_1 + \beta_2)$ for current accruals, and $(\beta_1 + \beta_2 + \beta_3)$ for cash flows.[11]

The results in table 4 are presented based on separate cross-sectional estimation in each year, 1981 through 1996. The 16 annual estimates of each parameter are treated as individual cases for purposes of statistical inference to avoid potential problems of cross-correlations in regression residuals (Bernard 1987).

The estimation results for the linear model in panel A of table 4 correspond to those in Ali (1994, table 1); i.e., current accruals are valued incrementally to noncurrent accruals ($\hat{\beta}_2$ is significantly positive), but there is no statistically reliable difference between the valuation of current accruals and cash flows ($\hat{\beta}_3$ is not significant).

Following Ali (1994), we next relax the linearity restriction in model (2) by estimating the following piece-wise linear model:

$$\begin{aligned} SAR_j = {} & \alpha_0 + \alpha_1\Delta E_j + \alpha_2 D^E\Delta E_j + \alpha_3\Delta WCFO_j + \alpha_4 D^{WC}\Delta WCFO_j \\ & + \alpha_5\Delta CFO_j + \alpha_6 D^{CF}\Delta CFO_j + \mu_j \end{aligned} \tag{3}$$

where D_j^E (D_j^{WC}, D_j^{CF}) are (0,1) dummy variables with a value of zero when the absolute value of ΔE_j ($\Delta WCFO_j$, ΔCFO_j) is below the cross-sectional median in a given year, and a value of one otherwise. In this formulation, moderate changes in CFO are more highly valued than CA if α_5 significantly exceeds zero, and extreme changes in CFO are more highly valued if $(\alpha_5 + \alpha_6)$ significantly exceeds zero. The estimation results, in panel B of table 4, correspond to those in Ali (1994, table 3): the coefficient on unexpected cash flows is significant when the cash flow change is moderate ($\hat{\alpha}_5 = 0.510$, $t = 3.62$), but is not significant when the cash flow change is extreme ($\hat{\alpha}_5 + \hat{\alpha}_6 = -0.004$, $t = -0.17$).

Table 4 uses realized changes in the earnings components to represent unexpected changes in order to replicate Ali (1994). In contrast, table 5 estimates the same relations, using the serial dependency-based predictions to represent securities market expectations. Panel A provides estimation results for the following linear model:

$$SAR_j = \gamma_0 + \gamma_1 UE_j + \gamma_2 UWCFO_j + \gamma_3 UCFO_j + \epsilon_j \tag{4}$$

where UE_j, $UWCFO_j$, and $UCFO_j$ represent unexpected earnings, working capital from operations and cash flows, respectively, and expectations are measured as the predicted

[11] Jennings (1990) provides an explicit demonstration of these relations.

TABLE 5
Relations of Size-Adjusted Security Returns to Unexpected Earnings Components
(n = 22,253 firm-years, 1981–1996)

Panel A: Linear Model

$$Model:\ SAR_j = \gamma_0 + \gamma_1 UE_j + \gamma_2 UWCFO_j + \gamma_3 UCFO_j + \epsilon_j$$

	$\hat{\gamma}_0$	$\hat{\gamma}_1$	$\hat{\gamma}_2$	$\hat{\gamma}_3$	$\bar{R}^2_{adj}$
Parameter estimate[a]	−0.015	0.689	0.328	0.111	0.115
(t-value)[b]	(−5.01)*	(10.47)*	(6.92)*	(5.91)*	
No. positive[c]		16/16*	15/16*	15/16*	
$\sigma(\hat{\beta}_i)$[d]		0.263	0.190	0.075	

Panel B: Piecewise-Linear Model

$$Model:\ SAR_j = \delta_0 + \delta_1 UE_j + \delta_2 D^E UE_j + \delta_3 UWCFO_j + \delta_4 D^{WC} UWCFO_j + \delta_5 UCFO_j + \delta_6 D^{CF} UCFO_j + \mu_j$$

	$\hat{\delta}_0$	$\hat{\delta}_1$	$\hat{\delta}_2$	$\hat{\delta}_3$	$\hat{\delta}_4$	$\hat{\delta}_5$	$\hat{\delta}_6$	$(\hat{\delta}_1 + \hat{\delta}_2)$	$(\hat{\delta}_3 + \hat{\delta}_4)$	$(\hat{\delta}_5 + \hat{\delta}_6)$	$\bar{R}^2_{adj}$
Parameter est.	−0.020	4.236	−3.573	1.466	−1.163	0.670	−0.583	0.663	0.303	0.088	0.138
(t-value)	(−5.54)*	(8.81)*	(−7.90)*	(6.86)*	(−5.68)*	(5.43)*	(−4.77)*	(10.34)*	(6.50)*	(4.82)*	
No. positive		16/16*	0/16*	14/16*	2/16*	15/16*	2/16*	16/16*	15/16*	14/16*	
$\sigma(\hat{\alpha}_i)$		1.923	1.809	0.855	0.820	0.494	0.489	0.257	0.186	0.073	

SAR_j = size-adjusted common stock return for the 12 months ended March 31 of year t + 1;
UE_j, $UWCFO_j$, $UCFO_j$ = unexpected earnings, unexpected working capital from operations, and unexpected operating cash flows, respectively, where expectations are measured as the predicted values of the earnings components based on the serial dependency models in table 2. All three variables are scaled by share price at the start of the earnings year;
D^E, D^{WC}, D^{CF} = indicator variables equal to 1 when the absolute values of UE, UWCFO, and UCFO are at or above their annual cross-sectional medians and zero otherwise;

* Significant at a probability below 0.01.
[a] Parameter estimates are the means of 16 parameter estimates obtained in cross-sectional regressions in each year 1981–1996.
[b] The t-values are based upon the means and standard deviations of the 16 annual estimates of each parameter.
[c] A binomial test is used to test whether the percentage of positive coefficients is significantly different from 50%.
[d] $\sigma(\hat{\gamma}_i)[\sigma(\hat{\delta}_i)]$ is the standard deviation of the 16 annual estimates of parameter γ_i $[\delta_i]$.

values of the earnings components based on the serial dependency models. The estimation results in panel A of table 5 show that, even in the context of a simple linear model, cash flows appear to be valued more highly than current accruals ($\hat{\gamma}_3$ = 0.111, t = 5.91). Moreover, the predictions of earnings components based on serial dependencies appear to be better representations of securities market expectations. In comparing the estimation results in panel A of tables 4 and 5, the adjusted R^2 of the returns/earnings components relation more than doubles (from 0.052 in panel A of table 4 to 0.115 in panel A of table 5), and the valuation coefficients on each of the earnings components are higher when the random-walk expectation is replaced by predictions that are based upon serial dependencies.

In order to determine whether differentially higher valuations of operating cash flows are detectable over the whole spectrum (moderate and extreme) of unexpected cash flows, panel B of table 5 relaxes the strict linearity assumption in model (4) by estimating the following relation:

$$SAR_j = \delta_0 + \delta_1 UE_j + \delta_2 D^E UE_j + \delta_3 UWCFO_j + \delta_4 D^{WC} UWCFO_j + \delta_5 UCFO_j + \delta_6 D^{CF} UCFO_j + \mu_j \qquad (5)$$

where D_j^E (D_j^{WC}, D_j^{CF}) are (0,1) dummy variables with a value of zero when the absolute value of UE_j ($UWCFO_j$, $UCFO_j$) is below the cross-sectional median in a given year, and a value of one otherwise. The estimation results in panel B of table 5 indicate significantly higher valuations of cash flows relative to current accruals both when unexpected cash flows are moderate ($\hat{\delta}_5$ = 0.670, t = 5.43), and when the unexpected cash flows are extreme ($\hat{\delta}_5 + \hat{\delta}_6$ = 0.088, t = 4.82). This result is in contrast to Ali's (1994) inability to detect differential valuations for extreme changes in cash flows, using a random-walk proxy for securities market expectations.

Overall, the estimation results in tables 4 and 5 indicate that the incremental securities market valuations of cash flows over current accruals that are undetectable with a random-walk proxy for market expectations are significantly positive when expectations are proxied by predictions from historical dependencies among the earnings components. Moreover, the differential positive valuation of cash flows is apparent for both moderate and extreme unexpected changes in cash flows. The higher $\overline{R}^2_{adj}$ values in panels A and B of table 5 suggest that predictions of funds-based earnings components that are based on historical auto- and cross-correlations among the components are better representations of investors' expectations than is the random-walk (no change) prediction that has characterized the previous related research.

III. SUMMARY AND CONCLUSIONS

This study has evaluated the relation among security returns and funds-based earnings components by incorporating the predictive information in historical serial- and cross-correlations among the earnings components. We document substantial improvements in prediction accuracy, relative to random-walk (no change) predictions, for predictions of the components that are based on historical estimates of these linear dependencies. Moreover, we detect significantly higher valuations of the operating cash flow component of earnings, relative to current accruals, when the predictions of components based on past dependencies are used to represent market expectations. Such differential valuation was not detectable for random-walk (no change) representations.

Our results indicate that there is incremental information in unexpected cash flows over the whole spectrum (moderate and extreme) of unexpected cash flow realizations. The lower associations in the tail areas found by Ali (1994) apparently reflect differences in the degree of measurement error in the random-walk expectation model, as well as possible differences in the permanence of extreme observations.

These results are consistent with the joint hypotheses that cash flows have incremental information content (over current accruals), and that market expectations impound, at least in part, the measured correlation structure among historical levels of the earnings components. We find that return regressions with independent variables that incorporate historical correlation structure have more explanatory power than regressions with independent variables that are based upon random-walk expectations. For this reason, we interpret our predictions of earnings components to be more aligned with market expectations than are random-walk predictions. On the other hand, our results do not imply that securities prices fully impound the predictive information in earnings components. Recent evidence by Sloan (1996) of possible mispricing by the market of the cash and accrual components of earnings suggests that the market under- (over-) values the cash (accrual) components of earnings. Future research might endeavor to develop and incorporate adjustments for such mispricing, and thereby provide alternative tests of differential valuation of these earnings components in light of the apparent mispricing.

REFERENCES

Ali, A. 1994. The incremental information content of earnings, working capital from operations, and cash flows. *Journal of Accounting Research* 32 (Spring): 61–74.

———, A. Klein, and J. Rosenfeld. 1992. Analysts' use of information about permanent and transitory components in forecasting annual EPS. *The Accounting Review* 67 (January): 183–98.

Bernard, V. 1987. Cross-sectional dependence and problems of inference in market-based accounting research. *Journal of Accounting Research* 25 (Spring): 1–48.

———, and T. Stober. 1989. The nature and amount of information in cash flows and accruals. *The Accounting Review* 64 (October): 624–652.

Bowen, R., D. Burgstahler, and L. Daley. 1987. The incremental information content of accruals versus cash flows. *The Accounting Review* 62 (October): 723–747.

Dechow, P. 1994. Accounting earnings and cash flows as measures of firm performance: The role of accounting accruals. *Journal of Accounting and Economics* 17 (July): 3–42.

———, J. Sabino, and R. Sloan. 1996. Implications of non-discretionary accruals for earnings management and market-based research. Working paper, University of Pennsylvania.

Elton, E., M. Gruber, and M. Gultekin. 1984. Professional expectations: Accuracy and diagnosis of errors. *Journal of Financial and Quantitative Analysis* 19 (December): 351–363.

Jennings, R. 1990. A note on interpreting incremental information content. *The Accounting Review* 65 (October): 925–932.

Paton, W., and R. Stevenson. 1920. *Principles of Accounting*. New York, NY: The Macmillan Company.

Rangan, S., and R. G. Sloan. 1998. Implications of the integral approach to quarterly reporting for the post-earnings-announcement drift. *The Accounting Review* 73 (July): 353–371.

Rayburn, J. 1986. The association of operating cash flows and accruals with security returns. *Journal of Accounting Research* 24 (Supplement): 112–133.

Sloan, R. 1996. Do stock prices fully reflect information in accruals and cash flows about future earnings? *The Accounting Review* 71 (July): 289–316.

Wilson, G. 1986. The relative information content of accruals and cash flows: Combined evidence at the earnings announcement and annual report release dates. *Journal of Accounting Research* 24 (Supplement): 165–200.

———. 1987. The incremental information content of the accrual and funds components of earnings after controlling for earnings. *The Accounting Review* 62 (April): 293–322.