A Synthesis of Accrual Quality and Abnormal Accrual Models: An Empirical Implementation

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Abstract

Dechow and Dichev's (2002) accrual quality model suggests that the Jones (1991) abnormal accrual model can be improved with the inclusion of past, current, and future operating cash flows. A problem with the empirical implementation of this synthesis is that the augmented accrual model requires *future* operating cash flow information. I propose an equivalent accrual model that is not subject to the "peek ahead" bias and further takes into account the reversal of past accruals. The proposed model improves the explanatory power of the Jones accrual model and makes a difference in inferences about abnormal accruals of firms with accounting restatements and the market mispricing of abnormal accruals.

JEL Classifications: M41

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1. Introduction

This paper examines the implications of Dechow and Dichev's (2002, DD hereafter) accrual quality model for the Jones (1991) accrual model. One of the implications is that the explanatory power of the Jones accrual model greatly improves by adding past, current, and future operating cash flow variables (McNichols, 2002). Considering that the Jones model has been criticized for its lack of power to separate abnormal (unexpected or discretionary) accruals from total accruals (Dechow et al., 1995; Guay et al., 1996; Thomas and Zhang, 2000), a synthesis of the Jones model and the DD model would be helpful for studies requiring a more accurate measure of abnormal accruals. However, in some settings, the implementation of the synthesized model is problematic, because future operating cash flow information is not part of the information set available at the

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time of estimation.[1] I propose a working capital accrual quality model that is similar to DD, but does not require information about future operating cash flows, and apply the alternative working capital accrual quality model to augment the Jones model. The proposed alternative model is not subject to the "peek ahead" bias, so it can be used for a variety of research settings.

I estimate the Jones model, the augmented Jones model with operating cash flows, and the augmented Jones models with operating cash flows and reversal in a firm-specific time-series specification and a cross-sectional specification over the period from 1990 to 2002. In the cross-sectional specification, lagged accruals are used to take into account the reversal of accruals. Empirical tests show that the inclusion of operating cash flows and reversal of accruals significantly increases the explanatory power of the Jones model. As an application, I use these augmented Jones models to examine whether abnormal accruals differ between firms that restated their financial statements and others, and to infer whether the market is rational about the relative persistence of abnormal accruals with respect to one-year-ahead earnings. I find that abnormal accrual models with operating cash flows make a difference in these settings. This study contributes to earnings management literature by suggesting an augmentation of the Jones model with operating cash flows and the reversal of the preceding year's abnormal accruals. The inclusion of operating cash flows and the consideration of the reversal of the preceding year's abnormal accruals are not new to the literature (e.g., Beneish, 1997; Kasznik, 1999). However, this study is based on a working capital accrual model relating to operating cash flows and provides specific guidance on how to augment the Jones model with operating cash flows and the reversal of the preceding year's abnormal accruals.[2]

The remainder of the paper is organized as follows. Section 2 reviews the working capital accrual quality model of DD, and develops working capital accrual quality and abnormal accrual models. Section 3 presents empirical results of comparisons of the relative explanatory power of working capital accrual quality and abnormal accrual models. In Section 4, I apply the augmented Jones accrual models to tests of accounting restatements and market rationality of abnormal accruals. Summary and concluding remarks are reached in Section 5.

2. Model

The Relation between Working Capital Accruals and Operating Cash Flows: A Summary of the Accrual Quality Model in DD

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[1] DD's accrual quality model suffers from the same implementation problem (DD, p. 46).

[2] Implications of Beneish's (1997) analysis are that lagged total accruals and past price performance are useful in detecting GAAP violators. However, his study is not intended to measure abnormal accruals, but to assess the probability of GAAP violation. On the other hand, Kasznik (1999) includes change in operating cash flows as an additional explanatory variable. He includes the change in operating cash flows to account for the negative correlation between accruals and cash flows documented in Dechow (1994). This study includes levels of past and current operating cash flows rather than change in operating cash flows, and the reversal of the preceding year's abnormal accruals rather than total accruals.

Operating cash flows in year t (CF_t) can be decomposed into three components depending on when the cash flow components are recognized in earnings.

$$CF_t = CF_t^{t-1} + CF_t^{t} + CF_t^{t+1}, \quad (1)$$

where CF_t^{τ} denotes an operating cash flow component realized in year t, but recognized as revenues or expenses in year τ. Accrual basis accounting does not recognize the first and last cash flow components as revenues or expenses in year t since they do not meet revenue or expense recognition criteria in Generally Accepted Accounting Principles (GAAP). The difference between estimated and realized cash flows is settled as an adjustment of earnings when cash flows are realized in the next year. Working capital accruals (ACC) recognized in year t are

$$\begin{aligned} ACC_t &= CF_{t-1}^{t} + CF_{t+1}^{t} + \varepsilon_{t+1}^{t} - (CF_t^{t+1} + CF_t^{t-1} + \varepsilon_t^{t-1}) \\ &= CF_{t-1}^{t} - (CF_t^{t+1} + CF_t^{t-1}) + CF_{t+1}^{t} + (\varepsilon_{t+1}^{t} - \varepsilon_t^{t-1}), \end{aligned} \quad (2)$$

where ε_{t+1}^{t} represents the estimation error of working capital accruals recognized in year t for cash flows that will be realized in year $t + 1$. The first component in the first line of equation (2) represents cash flows that are received in the preceding year, but earned this year (CF_{t-1}^{t}). The next two components represent accruals associated with cash flows that will be realized next year along with an estimation error ($CF_{t+1}^{t} + \varepsilon_{t+1}^{t}$). The fourth component represents cash flows that are realized this year, but not earned (CF_t^{t+1}). The last two components represent the reversal and settling-up of accruals recognized in the preceding year ($CF_t^{t-1} + \varepsilon_t^{t-1}$).

In an empirical implementation of equation (2), DD measure working capital accruals as a change in working capital (ΔWC), and measure the quality of accruals as the standard deviation of the residuals of the following firm-specific regression:

$$\Delta WC_t = \alpha_0 + \alpha_1 CF_{t-1} + \alpha_2 CF_t + \alpha_3 CF_{t+1} + \varepsilon_t, \quad (3)$$

where $\alpha_1 > 0$, $\alpha_2 < 0$ and $\alpha_3 > 0$. It is interpreted that the smaller the standard deviation of the residuals in regression (3), the higher the quality of accruals. Note that the lack of readily available information about the components of operating cash flows leads to employing total operating cash flows as a proxy for components of operating cash flows. Due to the measurement errors associated with the use of total operating cash flows as a proxy for operating cash flow components, DD predict and find that the estimated coefficients on operating cash flows and the adjusted R^2 are biased toward zero.

An Alternative Model of Working Capital Accrual Quality

The regression model in equation (3) is intuitive and appealing, however, the empirical implementation is problematic (DD, p. 46):

"The regression approach requires information about *future* cash flows, which reduces the usefulness in many settings (e.g., abnormal return strategies based on quality of earnings)."

In an attempt to overcome this shortcoming, I propose a working capital accrual quality model that does not require information about future operating cash flows so that it can be used for studies requiring a measure of working capital accrual quality that can be estimated with information available at the time of estimation.

By definition, operating earnings in year t ($Earn_t$) are the sum of working capital accruals (ACC_t) and operating cash flows (CF_t) in year t:

$$Earn_t \equiv ACC_t + CF_t = CF_{t-1}^{t} + CF_t^t + CF_{t+1}^t + \varepsilon_{t+1}^t - \varepsilon_t^{t-1} . \quad (4)$$

The corresponding regression model for operating earnings as the dependent variable is

$$Earn_t = \alpha_0 + \alpha_1 CF_{t-1} + \alpha_2 CF_t + \alpha_3 CF_{t+1} + \varepsilon_t , \quad (5)$$

where $\alpha_1 > 0, \alpha_2 > 0$ and $\alpha_3 > 0$.

Converting the level of operating earnings equation (4) into the change in operating earnings form ($\Delta Earn_t \equiv Earn_t - Earn_{t-1}$) yields:

$$\Delta Earn_t = \Delta ACC_t + \Delta CF_t = ACC_t - CF_{t-2}^{t-1} - CF_{t-1}^{t-1} + (CF_t^t + CF_t^{t+1}) - (\varepsilon_t^{t-1} - \varepsilon_{t-1}^{t-2}).$$

Rearranging the above equation yields

$$ACC_t = \Delta Earn_t + CF_{t-2}^{t-1} + CF_{t-1}^{t-1} - (CF_t^t + CF_t^{t+1}) + (\varepsilon_t^{t-1} - \varepsilon_{t-1}^{t-2}). \quad (6)$$

The error terms in equation (6) consist of estimation errors associated with predictions of past and current operating cash flows, but already resolved and reflected in earnings at the time of estimation, whereas the estimation errors in equation (2) are associated with current and future operating cash flows. The regression model corresponding to equation (6) is

$$\Delta WC_t = \beta_0 + \beta_1 \Delta Earn_t + \beta_2 CF_{t-2} + \beta_3 CF_{t-1} + \beta_4 CF_t + \varepsilon_t , \quad (7)$$

where $\beta_1 > 0, \beta_2 > 0, \beta_3 > 0$ and $\beta_4 < 0$.

The regression model in equation (7) is similar to DD, but it does not require information about *future* operating cash flows. The working capital accrual model in equation (6) contains operating cash flows that are realized and recognized in the same year (CF_{t-1}^{t-1} and CF_t^t), while DD's working capital accrual model in equation (2) does not. Note that the working capital accrual model in equation (6) is comparable to the following lagged version of DD's working capital accrual model in equation (2):

$$ACC_{t-1} = CF_{t-2}^{t-1} - (CF_{t-1}^{t} + CF_{t-1}^{t-2}) + CF_{t}^{t-1} + (\varepsilon_{t}^{t-1} - \varepsilon_{t-1}^{t-2}). \quad (8)$$

I further refine the regression model in equation (7) by taking into account the reversal of the estimation error of working capital accruals realized in the preceding year. ε_{t-1}^{t-2} is the accrual estimation error already resolved in the preceding year. I augment the regression model in equation (7) with the reversal of the preceding year's working capital accruals estimation error (ε_{t-1}):

$$\Delta WC_t = \beta_0 + \beta_1 \Delta Earn_t + \beta_2 CF_{t-2} + \beta_3 CF_{t-1} + \beta_4 CF_t + \varepsilon_t - \varepsilon_{t-1}. \quad (9)$$

The quality of working capital accruals is measured by the standard deviation of the estimation error resolved in the current year (ε_t).

Implications for the Jones (1991) Abnormal Accrual Model

McNichols (2002) conjectures a possible link between DD's model of working capital accrual quality and the Jones (1991) abnormal accrual model, and finds that the inclusion of operating cash flows improves the explanatory power of the Jones model. The working capital accrual quality model developed in the preceding section provides an explanation for why these two models are related, and guidance on how to augment the Jones abnormal accrual model with operating cash flows and the reversal of the preceding year's accruals.

The Jones abnormal accrual model estimates abnormal accruals as the residuals in a regression of total accruals (TA_t) on change in sales (ΔSales_t) and the level of gross property, plant, and equipment (PPE_t):

$$TA_t = \beta_0 + \beta_1 \Delta Sales_t + \beta_2 PPE_t + \varepsilon_t. \quad (10)$$

I link working capital accrual quality models (or DD's working capital accrual quality model) to the Jones abnormal accrual model by assuming that operating earnings ($Earn_t$) is proportional to sales, $\text{Earn}_t = \gamma \text{Sales}_t$ or equivalently in the change form $\Delta \text{Earn}_t = \gamma \Delta \text{Sales}_t$.[3] With this added assumption, regression models for total accruals corresponding to the accrual quality regressions (7) and (9) are as follows:

$$TA_t = \beta_0 + \beta_1 \Delta Sales_t + \beta_2 PPE_t + \beta_3 CF_{t-2} + \beta_4 CF_{t-1} + \beta_5 CF_t + \varepsilon_t, \quad (11)$$

$$TA_t = \beta_0 + \beta_1 \Delta Sales_t + \beta_2 PPE_t + \beta_3 CF_{t-2} + \beta_4 CF_{t-1} + \beta_5 CF_t + \varepsilon_t - \varepsilon_{t-1}, \quad (12)$$

[3] The modeling of earnings as a proportion of sales is similar to Barth et al., (2001). They also assume that sales follow a random walk; however, the random walk assumption is not important in this paper. In general, the change in sales will explain the change in operating earnings with error. As long as the errors associated with the change in sales are not systematically correlated with the estimation errors of accruals, the ordering of the standard deviation of the estimation errors of accruals will not be affected. In my sample of Compustat firms, the mean (median) firm-specific Pearson correlation between the change in sales and the change in operating earnings is 0.40 (0.45).

where $\beta_1 > 0, \beta_2 < 0, \beta_3 > 0, \beta_4 > 0$, and $\beta_5 < 0$.

If regression models (11) and (12) are a better specification of total accruals, the Jones model in equation (10), which does not include operating cash flows, will classify accruals explained by past and current operating cash flows ($\beta_2 CF_{t-2} + \beta_3 CF_{t-1} + \beta_4 CF_t$) as abnormal (unexpected). The augmentation of the Jones model with operating cash flows is consistent with Kasznik (1999), but differs in that it includes two years prior operating cash flow variable and is based on the model explaining the relation between operating cash flows and working capital accruals.

Even if the original Jones model is specified as a firm-specific time-series model, it is often cross-sectionally estimated for each industry and year. The cross-sectional adaptation of the Jones model mitigates the stringent data requirements, and allows for industry differences and structural changes over time. In the cross-sectional specification, I use lagged total accruals (TA_{t-1}) to take into account the reversal of accruals:

$$TA_t = \beta_0 + \beta_1 \Delta Sales_t + \beta_2 PPE_t + \beta_3 CF_{t-2} + \beta_4 CF_{t-1} + \beta_5 CF_t + \beta_6 TA_{t-1} + \varepsilon_t \,. \qquad (13)$$

In equation (13), I expect that the coefficient on lagged total accruals (TA_{t-1}) is less than one because reversal reduces the persistence of accruals.

3. Empirical Results

Data and Sample Selection

The sample is drawn from the Compustat annual files over the period 1990 to 2002. The starting year 1990 is chosen because I restrict the sample to the post-1987 period to obtain operating cash flows and the change in working capital directly from the cash flow statement, which will reduce the measurement error of accruals (Hribar and Collins, 2002), and abnormal accrual models require two years prior operating cash flow variables. The final sample used to estimate firm-specific accrual models consists of 27,766 firm-year observations. Table 1 reports descriptive statistics of the sample. The median market value of equity is US$148.78 million. Total accruals (TA_t) are on average negative, and operating cash flows (CF_t) are on average positive. The mean change in working capital (ΔWC_t) is 0.5% of average total assets. It is consistent with a positive change in sales.

Table 1 Description of the Sample Used to Estimate Accrual Models

Variable	Mean	Std. Dev.	Q1	Median	Q3
MV_t	3,075.82	15,214.43	21.45	148.74	1,071.18
TA_t	-0.062	0.124	-0.093	-0.049	-0.010
ΔWC_t	0.008	0.080	-0.019	0.005	0.036
CF_t	0.062	0.152	0.026	0.080	0.133
CF_{t-1}	0.062	0.150	0.025	0.080	0.133

CF_{t-2}	0.062	0.149	0.024	0.080	0.133
$\Delta Earn_t$	0.010	0.106	-0.016	0.008	0.035
$\Delta Sales_t$	0.064	0.280	-0.024	0.041	0.161
PPE_t	0.679	0.467	0.317	0.595	0.991

The sample contains 27,766 firm-year observations (2,180 firms with at least 12 years of consecutive annual data) over the period 1990 to 2002. MV_t is the market value of equity. TA_t is total accruals (Compustat item 123–item 308). TA_t is operating cash flows (Compustat item 308). ΔWC_t is the change in working capital calculated as the negative of the following sum: (Compustat item 302 + item 303 + item 304 + item 305 + item 307). $Earn_t$ is earnings before long-term accruals calculated as the sum of operating cash flows and the change in working capital. $\Delta Earn_t$ denotes the change in operating earnings before long-term accruals. $\Delta Sales_t$ is the change in sales (item 12). PPE_t is property, plant, and equipment (item 7). All variables are scaled by average assets.

Comparison of Working Capital Accrual Quality Models

I estimate firm-specific regressions of working capital accrual quality for 2,180 firms with at least 12 years of consecutive annual data over the period 1990 to 2002. Table 2 reports the estimation results of the three working capital accrual quality models: the DD model, and my alternative models with and without the reversal of the preceding year's estimation errors. Panel A reports the estimation results of the DD model.[4] Consistent with DD, the mean coefficient estimate on current operating cash flows is significantly negative (-0.535), and the mean coefficient estimates on past and future operating cash flows are significantly positive. The mean adjusted R^2 is 0.429. The root of mean squared residuals (*RMSE*), which is my measure of working capital accrual quality,[5] is 0.044. The absolute values of coefficient estimates on operating cash flows and the adjusted R^2 differ from the theoretical value of 1. This is due to the estimation error of operating cash flow components (DD, 2002).

Table 2 Comparison of Accrual Quality Models: Firm-Specific Regressions

$$\Delta WC_t = \alpha_0 + \alpha_1 CF_{t-1} + \alpha_2 CF_t + \alpha_3 CF_{t+1} + \varepsilon_t , \quad (1)$$

$$\Delta WC_t = \beta_0 + \beta_1 \Delta Earn_t + \beta_2 CF_{t-2} + \beta_3 CF_{t-1} + \beta_4 CF_t + \varepsilon_t , \quad (2)$$

$$\Delta WC_t = \beta_0 + \beta_1 \Delta Earn_t + \beta_2 CF_{t-2} + \beta_3 CF_{t-1} + \beta_4 CF_t + \varepsilon_t - \varepsilon_{t-1}, \quad (3)$$

Parameter Estimate		Mean	Standard Deviation	First Quartile	Median	Third Quartile	t-statistics
Panel A Dechow and Dichev's Working Capital Accrual Quality Model (1)							
Intercept		0.017	0.561	-0.003	0.021	0.060	1.43
CF_{t-1}	(+)	0.162	0.258	0.007	0.151	0.308	29.20
CF_t	(–)	-0.535	0.401	-0.792	-0.534	-0.283	-62.27

[4] Since DD's accrual quality model requires information about next year's cash flows, actual estimation was made for the period 1989 to 2001 rather than 1990 to 2002.

[5] To control for differences in the number of independent variables between DD's and my accrual quality models, I use the root of mean squared residual (RMSE) rather than the standard deviation of residuals.

CF_{t+1}	(+)	0.152	1.677	-0.029	0.112	0.268	4.22
Adj. R^2		0.429	0.327	0.184	0.462	0.696	
RMSE		0.044	0.041	0.016	0.030	0.057	
Panel B Alternative Working Capital Accrual Quality Model (2)							
Intercept		0.031	0.179	-0.002	0.024	0.059	8.11
$\Delta Earn_t$	(+)	0.506	0.260	0.391	0.512	0.624	91.09
CF_{t-2}	(+)	0.087	0.223	-0.038	0.078	0.203	18.28
CF_{t-1}	(+)	0.263	0.243	0.111	0.265	0.409	50.57
CF_t	(–)	-0.669	0.507	-0.865	-0.674	-0.485	-61.55
Adj. R^2		0.642	0.268	0.512	0.702	0.845	
RMSE		0.035	0.037	0.012	0.022	0.043	
Panel C Alternative Working Capital Accrual Quality Model with Reversal (3)							
*Intercep*t		0.028	0.128	-0.006	0.021	0.056	10.25
$\Delta Earn_t$	(+)	0.536	0.512	0.293	0.516	0.747	48.85
CF_{t-2}	(+)	0.099	0.393	-0.098	0.087	0.282	11.76
CF_{t-1}	(+)	0.245	0.388	0.050	0.248	0.432	29.46
CF_t	(–)	-0.617	0.501	-0.882	-0.606	-0.340	-57.53
Adj. R^2		0.564	0.458	0.444	0.701	0.846	
RMSE		0.037	0.041	0.012	0.024	0.048	

DD's working capital accrual quality model is intuitive and appealing, but their model requires future operating cash flows, information unavailable at the time of estimation. As an alternative to DD, I consider two alternative working capital accrual quality models. Both models employ change in operating earnings as an additional independent variable. Panel B reports the regression results of change in working capital on change in operating earnings, past and current operating cash flows. The mean coefficient estimate on change in operating earnings is significantly positive (0.506). As predicted, and consistent with DD, the mean coefficient estimate on current operating cash flows is significantly negative (-0.669), and the mean coefficient estimates on lagged operating cash flows are significantly positive. The mean adjusted R^2 and the root of mean squared residuals (*RMSE*) are 0.642 and 0.035, respectively. With respect to the adjusted R^2 and *RMSE*, my alternative working capital accrual quality model with change in operating earnings are superior to those of DD's working capital accrual quality model, supporting that my working capital accrual quality model is less subject to measurement errors associated with operating cash flow components.

Panel C reports the regression results of change in working capital on change in operating earnings, past and current operating cash flows, and the reversal of the preceding year's estimation error.[6] The signs and magnitudes of coefficient estimates are similar to those in Panel B. However, the inclusion of the reversal in addition to

[6] I estimate a model with a first-order moving average error by explicitly imposing a fixed moving average parameter of negative one.

operating cash flows neither increases the adjusted R^2 nor decreases *RMSE*. It appears that the inclusion of the reversal of accruals does not improve the explanatory power of the working capital accrual quality model.

Finally, consistent with the theoretical equivalence of these three models, untabulated correlations are all above 0.8, suggesting that my accrual quality models can be used as an alternative to DD's working capital accrual quality model.

Comparison of Abnormal Accrual Models

In this section, I examine the implications of the working capital accrual quality model for the Jones abnormal accrual model. Panel A of Table 3 reports the regression results of the Jones model. Consistent with Jones, the mean coefficient estimate on change in sales is significantly positive (0.097), and the mean coefficient estimate on the level of gross property, plant, and equipment (*PPE*) is significantly negative (-0.074). The mean adjusted R^2 of the Jones model is 0.130.

Panel B reports the regression results of the augmented Jones model in which operating cash flow variables are added in addition to change in sales and *PPE*. Consistent with McNichols (2002), the inclusion of operating cash flow variables increases the mean adjusted R^2 from 0.130 to 0.546. Since the augmented Jones model requires only past and concurrent operating cash flows information, it can be used as an alternative to the Jones model to infer abnormal accruals at the time of estimation. The increase in the adjusted R^2 suggests that the augmented Jones model better explains total accruals than the original Jones model. The augmented Jones model may increase the power of test for studies requiring a measure of abnormal (or unexpected) accruals.

Panel C reports that the signs of the mean coefficient estimates are the same as those in Panel B. The most notable change is the increase of the adjusted R^2. The mean adjusted R^2 increases from 0.546 to 0.713. It appears that the reversal of the preceding year's abnormal accruals greatly improves the explanatory power of the abnormal accruals model. It is contrasted to the case of working capital accrual quality model, in which the consideration of the reversal does not improve the explanatory power of the accrual quality model (see Panel C of Table 2).

Table 3 Comparison of the Explanatory Power of the Jones and Augmented Jones Abnormal Accrual Models: Firm-Specific Time-Series Specification

The Jones Model:

$$TA_t = \beta_0 + \beta_1 \Delta Sales_t + \beta_2 PPE_t + \varepsilon_t \quad (1)$$

The Augmented Jones Model:

$$TA_t = \beta_0 + \beta_1 \Delta Sales_t + \beta_2 PPE_t + \beta_3 CF_{t-2} + \beta_4 CF_{t-1} + \beta_5 CF_t + \varepsilon_t \quad (2)$$

The Augmented Jones Model with Reversal:

$$TA_t = \beta_0 + \beta_1 \Delta Sales_t + \beta_2 PPE_t + \beta_3 CF_{t-2} + \beta_4 CF_{t-1} + \beta_5 CF_t + \varepsilon_t - \varepsilon_{t-1} \quad (3)$$

Parameter Estimate		Mean	Standard Deviation	First Quartile	Median	Third Quartile	t-statistics
Panel A The Jones Model: Regression (1)							
Intercept		-0.031	0.183	-0.109	-0.022	0.051	-7.92
$\Delta Sales_t$	(+)	0.097	0.291	-0.017	0.075	0.182	15.62
PPE_t	(–)	-0.074	0.812	-0.204	-0.051	0.063	-4.24
$Adj.\ R^2$		0.130	0.255	-0.082	0.076	0.291	
Panel B The Augmented Jones Model: Regression (2)							
Intercept		-0.007	0.301	-0.086	-0.001	0.077	-1.16
$\Delta Sales_t$	(+)	0.113	0.321	0.007	0.082	0.186	16.46
PPE_t	(–)	-0.036	0.706	-0.171	-0.022	0.094	-2.38
CF_{t-2}	(+)	0.052	0.456	-0.125	0.056	0.233	5.37
CF_{t-1}	(+)	0.200	0.492	-0.012	0.167	0.373	18.97
CF_t	(–)	-0.671	0.771	-0.945	-0.709	-0.415	-40.60
$Adj.\ R^2$		0.546	0.367	0.321	0.642	0.849	69.48
Panel C The Augmented Jones Model with Reversal: Regression (3)							
Intercept		-0.004	0.425	-0.110	-0.003	0.083	-0.41
$\Delta Sales_t$	(+)	0.134	0.372	0.001	0.099	0.226	16.78
PPE_t	(–)	-0.036	0.816	-0.196	-0.019	0.117	-2.08
CF_{t-2}	(+)	0.048	0.615	-0.171	0.058	0.277	3.64
CF_{t-1}	(+)	0.194	0.588	-0.052	0.158	0.401	15.45
CF_t	(–)	-0.644	1.023	-0.960	-0.664	-0.325	-29.41
$Adj.\ R^2$		0.713	0.285	0.598	0.793	0.913	116.56

Next, I estimate cross-sectional abnormal accrual models for each industry and year combination. The cross-sectional estimation of abnormal accruals alleviates a long time-series data requirement and takes into account the characteristics of each industry and potential structural changes over time. In the cross-sectional model I use lagged accruals to take into account the reversal of accruals. It is referred to as the augmented Jones model with lagged accruals.

Table 4 reports the estimation results of cross-sectional abnormal accrual models for 562 two-digit SIC and year combinations having at least 20 firms over the period 1990 to 2002. The results are similar to those of firm-specific time-series models. The inclusion of operating cash flows increases the adjusted R^2 from 0.324 to 0.499 in the augmented Jones model, and the inclusion of lagged accruals further increases the adjusted R^2 from 0.499 to 0.571 in the augmented Jones model with lagged accruals.

Table 4 Comparison of the Explanatory Power of the Jones and Augmented Jones Abnormal Accrual Models: Cross-Sectional Specification

The Jones Model:

$$TA_t = \beta_0 + \beta_1 \Delta Sales_t + \beta_2 PPE_t + \varepsilon_t \quad (1)$$

The Augmented Jones Model:

$$TA_t = \beta_0 + \beta_1 \Delta Sales_t + \beta_2 PPE_t + \beta_3 CF_{t-2} + \beta_4 CF_{t-1} + \beta_5 CF_t + \varepsilon_t \quad (2)$$

The Augmented Jones Model with Lagged Accruals:

$$TA_t = \beta_0 + \beta_1 \Delta Sales_t + \beta_2 PPE_t + \beta_3 CF_{t-2} + \beta_4 CF_{t-1} + \beta_5 CF_t + \beta_6 TA_{t-1} + \varepsilon_t \quad (3)$$

Parameter Estimate		Mean	Standard Deviation	First Quartile	Median	Third Quartile	t-statistics
Panel A The Jones Model: Regression (1)							
Intercept		-0.065	0.073	-0.104	-0.058	-0.022	-21.390
$\Delta Sales_t$	(+)	0.093	0.141	0.023	0.090	0.156	15.630
PPE_t	(–)	-0.041	0.090	-0.083	-0.039	0.007	-10.910
$Adj.\ R^2$		0.324	0.174	0.201	0.292	0.422	
Panel B The Augmented Jones Model: Regression (2)							
Intercept		-0.056	0.066	-0.089	-0.054	-0.018	-20.160
$\Delta Sales_t$	(+)	0.100	0.134	0.032	0.098	0.160	17.620
PPE_t	(–)	-0.051	0.085	-0.093	-0.049	-0.008	-14.340
CF_{t-2}	(+)	-0.320	0.412	-0.565	-0.325	-0.078	-18.400
CF_{t-1}	(+)	0.291	0.327	0.116	0.275	0.451	21.080
CF_t	(–)	0.127	0.247	-0.017	0.115	0.247	12.230
$Adj.\ R^2$		0.499	0.184	0.361	0.487	0.628	
Panel C The Augmented Jones Model with Lagged Accruals: Regression (3)							
Intercept		-0.046	0.058	-0.075	-0.043	-0.012	-18.740
$\Delta Sales_t$	(+)	0.079	0.125	0.017	0.074	0.137	14.950
PPE_t	(–)	-0.028	0.078	-0.064	-0.027	0.009	-8.410
CF_{t-2}	(+)	-0.401	0.384	-0.655	-0.404	-0.153	-24.790
CF_{t-1}	(+)	0.468	0.361	0.234	0.455	0.647	30.700
CF_t	(–)	0.033	0.239	-0.103	0.030	0.163	3.290
TA_{t-1}		0.387	0.311	0.217	0.356	0.557	29.510
$Adj.\ R^2$		0.571	0.187	0.432	0.568	0.716	

To summarize, consistent with McNichols (2002), the inclusion of past and concurrent operating cash flow variables significantly improves the explanatory power of the Jones model, and the consideration of the reversal of accruals further improves the explanatory power of the Jones model.

4. Applications of Augmented Accrual Models

In this section, I demonstrate whether the augmented Jones models make a difference in inferences about abnormal accruals of firms with accounting restatements and the market mispricing of abnormal accruals. I use abnormal accruals estimated from cross-sectional abnormal accrual models.

Implications for Abnormal Accruals for Firms with Accounting Restatements

Government Accounting Office (GAO) published a report on financial statement restatements in 2002. The report identifies 919 incidents (845 firms) of financial statement restatements announced between January 1, 1997 and June 30, 2002. These firms restate their financial statements for a variety of reasons, including errors in revenues and expenses. Financial restatements increase the cost of capital (Hribar and Jenkins, 2004), and directors of these firms experience significant labor market penalties (Srinivasan, 2005). It is very likely, all else being equal, that these firms are more likely to be engaged in earnings management than other firms.[7] Employing financial restatement as a proxy for earnings management, I examine whether the magnitude of abnormal accruals differs between firms that restated their financial statements and others.

Panel A of Table 5 reports descriptive statistics of firms that restated their financial statements ("restatement firms") and firms that did not restate their financial statements ("no-restatement firms"). The sample consists of 52,413 firm-years for no-restatement firms and 3,946 firm-years for restatement firms. Abnormal accruals are on average greater for no-restatement firms than restatement firms. The average abnormal accruals of the Jones model are 2% of average total assets for no-restatement firms and 0.9% for restatement firms. The average abnormal accruals of the augmented Jones model are 1.3% of average total assets for no-restatement firms and 0.1% for restatement firms. Restatement firms are on average bigger than no-restatement firms.

Table 5 Abnormal Accruals of Firms with Financial Statement Restatements

Panel A Descriptive Statistics						
	No Restatements (No. of observations = 52,413)			**Restatements** (No. of observations = 3,946)		
	Mean	Standard Deviation	Median	Mean	Standard Deviation	Median
Jones Model						
NAC	-0.090	0.068	-0.082	-0.084	0.068	-0.076
ABNAC	0.020	0.139	0.028	0.009	0.154	0.024

[7] It is very likely that firms who restate their financial statements utilize managerial discretion over accruals allowed under GAAP before they resort to non-GAAP accounting methods, etc. Therefore, restatement firms are more likely to be engaged in earnings management using accruals than no-restatement firms.

Augmented Jones Model						
NAC	-0.084	0.091	-0.073	-0.077	0.089	-0.067
ABNAC	0.013	0.128	0.017	0.001	0.137	0.011
Augmented Jones Model with Lagged Accruals						
NAC	-0.081	0.097	-0.068	-0.076	0.100	-0.062
ABNAC	0.011	0.124	0.012	0.001	0.133	0.009
ROA	-0.065	0.511	0.027	-0.067	0.420	0.028
LOSS	0.359	0.480	0.000	0.339	0.474	0.000
SIZE	4.688	2.392	4.559	5.546	2.265	5.502
DTA	0.484	0.229	0.496	0.504	0.217	0.514
MTB	4.677	59.197	1.817	4.580	25.755	2.210

Panel B Regression Results of Absolute Value of Abnormal Accruals

Variable	**Jones**		**Augmented Jones**		**Augmented Jones with Lagged Accruals**	
	Estimate	t-statistics	Estimate	t-statistics	Estimate	t-statistics
RST	0.003	(1.30)	0.003	(1.92)	0.004	(2.13)
RST × LOSS	0.014	(4.28)	0.006	(2.06)	0.009	(3.05)
LOSS	0.003	(2.58)	0.017	(18.31)	0.021	(22.66)
ROA	-0.064	(-73.62)	-0.051	(-65.48)	-0.047	(-59.30)
SIZE	-0.007	(-36.09)	-0.006	(-36.00)	-0.007	(-38.00)
DTA	0.007	(3.72)	-0.002	(-1.18)	0.004	(2.59)
MTB	0.000	(9.32)	0.000	(6.94)	0.000	(6.25)

Total accruals are decomposed into normal (*NAC*) and abnormal accruals (*ABNAC*) using the Jones Model, the Augmented Jones Model, and the Augmented Jones Model with Lagged Accruals (see Table 3 for details). *ROA* is the return on assets. *SIZE* is the natural log of market value of equity. *DTA* is the ratio of debt to assets. *MTB* is the ratio of market to book value of equity. Firms with non-positive book value of equity are deleted. *RST* is an indicator variable equal to one for firms with accounting restatements identified by Government Accounting Office (GAO, 2002). *LOSS* is an indicator variable equal to one if a firm reports losses. The sample consists of 56,359 firm-years from 1990 to 2002.

To examine whether abnormal accruals differ between restatement firms and no-restatement firms, I regress absolute value of abnormal accruals on an indicator variable, *RST*, which equals one for restatement firms, and other control variables. To control for factors influencing abnormal accruals, I include *Loss*, *ROA*, *SIZE*, *DTA*, and *MTB*: *Loss* is an indicator variable equal to one for firm-years reporting losses; *SIZE* is the natural log of the market value of equity; *DTA* is the ratio of debts to total assets; *MTB* is the ratio of market to book value of equity. I also include year and industry dummies to control for year and industry fixed effects.

Panel B of Table 5 reports regression results of absolute value of abnormal accruals. When the Jones model is used, the coefficient estimate on *RST* is insignificant, indicating that there is no significant difference between restatement firms and no-restatement firms for firm-years reporting profits. However, the coefficient estimate on *RST* is significant for the augmented Jones model and the augmented Jones model with lagged accruals. That is, one may conclude that there is no difference in the magnitude of abnormal accruals between restatement firms and no-restatement firms if the Jones model is employed. The inference based on the Jones model, however, may be misleading, since the Jones model does not control for the effect of operating cash flows on accruals. When earnings management firms differ from non-earnings management firms with respect to operating cash flow performance, the use of the augmented Jones model would alleviate the potential confounding effect of operating cash flows on accruals.

Tests of the Pricing of Abnormal Accruals

Sloan (1996) finds that accruals are on average less persistent than operating cash flows and that the market fails to appreciate fully the lower persistence of the accrual component of earnings with respect to one-year-ahead earnings. Xie (2001) further finds that the mispricing of accruals is mainly due to the abnormal accrual component of earnings. In this section, I employ the Mishkin (1983) and hedge-portfolio tests to examine whether the Jones models augmented with operating cash flows and lagged accruals make a difference in these tests. To ensure that hedge-portfolio trading strategies can be implemented with information available at the time of portfolio formation, I restrict the sample to firms with a December year-end.

First, to examine whether the market rationally prices abnormal accruals with respect to one-year-ahead earnings, I estimate the following forecasting and valuation equations jointly:

$$E_{t+1} = \alpha_0 + \alpha_1 CFO_t + \alpha_2 NAC_t + \alpha_3 ABNAC_t$$
$$SAR_{t+1} = \beta_0 + \beta_1 (E_{t+1} - \alpha_0 - \gamma_1 CFO_t - \gamma_2 NAC_t - \gamma_3 ABNAC_t),$$

where E_{t+1} is earnings for year $t + 1$ and SAR_{t+1} is size-adjusted buy and hold returns for the 12 months from April in year $t + 1$ to March in year $t + 2$. Under the market rationality, the persistence parameters inferred from the valuation equation should equal those from the forecasting equation: $\alpha_1 = \gamma_1$, $\alpha_2 = \gamma_2$, and $\alpha_3 = \gamma_3$.

Panel A of Table 6 reports the Mishkin test results. When the Jones model is used, the forecasting coefficient on abnormal accruals (α_3) is 0.47. The corresponding coefficients for the augmented Jones and augmented Jones with lagged accruals are 0.449 and 0.421, respectively. The forecasting equation suggests that the persistence of abnormal accruals is lower when the augmented Jones and augmented Jones with lagged accruals are used than when the Jones model is used. However, the valuation equation suggests that the persistence of abnormal accruals assessed by the market (γ_3) is greater for the augmented Jones and augmented Jones with lagged accruals than the Jones model (0.729 and 0.704 versus 0.689). The magnitude of the mispricing about abnormal accruals by the market, measured by the difference between γ_3 and α_3, is 0.219 (= 0.689 – 0.47) for the Jones model, whereas it is 0.28 and 0.283 for the augmented Jones model and the augmented Jones model with lagged accruals, respectively. Likelihood Ratio (LR) test statistics suggest that the market misprices abnormal accruals regardless of the employed abnormal accrual models. There is no change in the conclusion that the market overprices (overestimates) the persistence of abnormal accruals; however, it appears that the overpricing becomes more pronounced when the augmented Jones and augmented Jones models with lagged accruals are used.

Next, I run a hedge-portfolio return test to examine whether one can earn higher or lower abnormal returns when the augmented Jones model and the augmented Jones model with lagged accruals are used. Following Beneish and Vargus (2002) and Hanlon (2005), I estimate the following regression each year from 1990 to 2001 after controlling for other factors influencing abnormal returns.

$$SAR_{t+1} = \beta_0 + \beta_1 ABNAC_t^{dec} + \beta_2 SIZE_t^{dec} + \beta_3 BTM_t^{dec} + \beta_4 BETA_t^{dec} + \beta_5 EP_t^{dec} + \varepsilon_t ,$$

where *SIZE* is the natural log of market value of equity; *BTM* is the ratio of book to market value of equity; *BETA* is the slope coefficient from the market model estimated using 60 monthly returns at fiscal year end; *EP* is the ratio of earnings to market value of equity. *ABNAC*, *SIZE*, *BTM*, *BETA*, and *EP* are ranked into deciles and scaled to range from 0 to 1 (denoted by the superscript "*dec*"). This scaling allows the variables' respective coefficients to be interpreted as the return to a zero investment portfolio with a long position in the stocks of the highest decile and a short position in the stocks of the lowest decile (Frankel and Lee, 1998; Hanlon, 2005). Abnormal returns or mispricing of abnormal accruals are consistent with negative coefficient estimates on abnormal accruals (*ABNAC*).

Panel B of Table 6 reports the mean coefficient estimates and t-statistics based on annual regressions from 1990 to 2001. Abnormal accruals trading strategy based on the Jones model yields 7% abnormal returns after controlling for other factors. Abnormal accruals trading strategy based on the augmented Jones model yields 7.2%, which is similar to that for the Jones model. When the augmented Jones model with lagged accruals is used, one-year abnormal returns are 5%, which is lower than that for the Jones model. It appears that the magnitude of abnormal returns is much less when the augmented Jones model with lagged accruals is used than when the Jones model is used.

Table 6 Market Pricing of Abnormal Accruals

Panel A Tests of Market Efficiency with Respect to Next Period's Earnings

$E_{t+1} = \alpha_0 + \alpha_1 CFO_t + \alpha_2 NAC_t + \alpha_3 ABNAC_t$

$SAR_{t+1} = \beta_0 + \beta_1 (E_{t+1} - \alpha_0 - \gamma_1 CFO_t - \gamma_2 NAC_t - \gamma_3 ABNAC_t)$

	Jones		**Augmented Jones**		**Augmented Jones with Lagged Accruals**	
	Estimate	t-statistics	Estimate	t-statistics	Estimate	t-statistics
α_1	0.933	(166.59)	0.902	(155.45)	0.910	(160.10)
α_2	0.642	(37.03)	0.702	(51.51)	0.709	(56.30)
α_3	0.470	(55.87)	0.449	(49.03)	0.421	(44.42)
γ_1	0.973	(28.48)	0.953	(26.95)	0.959	(27.74)
γ_2	0.999	(9.37)	0.865	(10.41)	0.892	(11.61)
γ_3	0.689	(13.26)	0.729	(12.84)	0.704	(12.02)

	LR statistics	p-value	LR statistics	p-value	LR statistics	p-value
$\alpha_1 = \gamma_1$	1.210	0.271	1.880	0.170	1.800	0.179
$\alpha_2 = \gamma_2$	11.000	0.001	3.710	0.054	5.460	0.020
$\alpha_3 = \gamma_3$	17.600	<.0001	24.440	<.0001	23.460	<.0001
$\alpha_1 = \gamma_{1,}$ $\alpha_2 = \gamma_{2,}$ $\alpha_3 = \gamma_3$	26.510	<.0001	27.100	<.0001	27.370	<.0001

Panel B Hedge Portfolio Performance Based on Abnormal Accruals

Variable	**Jones**		**Augmented Jones**		**Augmented Jones with Lagged Accruals**	
	Estimate	t-statistics	Estimate	t-statistics	Estimate	t-statistics
Intercept	0.056	(0.85)	0.060	(0.95)	0.050	(0.79)
$ABNAC^{dec}$	-0.070	(-1.91)	-0.072	(-2.69)	-0.051	(-1.83)
$SIZE^{dec}$	-0.093	(-1.45)	-0.098	(-1.57)	-0.096	(-1.53)
BTM^{dec}	0.097	(1.36)	0.096	(1.38)	0.096	(1.38)
$BETA^{dec}$	0.063	(0.53)	0.063	(0.53)	0.063	(0.53)
EP^{dec}	-0.078	(-0.69)	-0.078	(-0.71)	-0.081	(-0.73)
Adjusted R^2	0.043		0.043		0.042	

SAR is size-adjusted stock returns for 12 months ending three months after fiscal year end. *SIZE* is the natural log of market value of equity. *BTM* is the natural log of the ratio of book to market value of equity. *BETA* is estimated from the market model using 60 monthly returns ending fiscal year end. *EP* is the ratio of earnings to market value of equity. $ABNAC^{dec}$, $SIZE^{dec}$, BTM^{dec}, $BETA^{dec}$, and EP^{dec} are corresponding scaled-decile variables ranging from 0 to 1. The sample consists of 24,341 firm-years with December fiscal year ends from 1990 to 2001.

To summarize, the Mishkin test suggests that the magnitude of mispricing of abnormal accruals is greater when the augmented Jones model or the augmented Jones model with lagged accruals are used; however, the hedge-portfolio test indicates that one cannot earn higher abnormal returns by employing the augmented Jones and augmented Jones with lagged accruals. There is no change in the conclusion that the market misprices abnormal accrual, however, it appears that augmented Jones models make a difference in inferences about the magnitude of market mispricing of abnormal accruals.

5. Summary

A synthesis of the Jones abnormal accrual model and the DD model has a potential to improve the performance of the accrual model; however, it is often criticized due to the "peek ahead" bias of the DD model. This paper addresses a practical implementation issue to ameliorate the "peek ahead" bias of DD accrual quality model. I propose a model that does not require future operating cash flow information and further takes into account the reversal of the preceding year's abnormal accruals. Empirical tests show that the proposed model improves the explanatory power of the Jones abnormal accrual model and makes a difference in inferences about abnormal accruals of firms with accounting restatements and the market mispricing of abnormal accruals.

References

Barth, M.E., Cram, D.P., and K.K. Nelson, 2001, "Accruals and the Prediction of Future Cash Flows", *The Accounting Review* 76, 27–58.

Beneish, M.D., 1997, "Detecting GAAP Violation: Implications for Assessing Earnings Management among Firms with Extreme Financial Performance", *Journal of Accounting and Public Policy* 16, 271–309.

Beneish, M.D. and M. Vargus, 2002, "Insider Trading, Earnings Quality, and Accrual Mispricing", *The Accounting Review* 77, 755–791.

Dechow, P.M., 1994, "Accounting Earnings and Cash Flows as Measures of Firm Performance: The Role of Accounting Accruals", *Journal of Accounting and Economics* 18 (July), 3–42.

Dechow, P.M. and I.D. Dichev, 2002, "The Quality of Accruals and Earnings: The Role of Accrual Estimation Errors", *The Accounting Review* 77 (Supplement), 35–59.

Dechow, P.M., R. Sloan, and A. Sweeney, 1995, "Detecting Earnings Management", *The Accounting Review* 70, 193–225.

Frankel, R. and C.M.C. Lee, 1998, "Accounting Valuation, Market Expectation, and Cross-sectional Stock Returns", *Journal of Accounting and Economics* 25, 283–319.

General Accounting Office, 2002, *Financial Statement Restatements: Trends, Market Impacts, Regulatory Responses, and Remaining Challenges*, Washington DC, GAO-03-138.

Guay, W., S.P. Kothari, and R. Watts, 1996, "A Market-based Evaluation of Discretionary Accrual Models", *Journal of Accounting Research* 34 (Supplement), 83–105.

Hanlon, M., 2005, "The Persistence and Pricing of Earnings, Accruals, and Cash Flows When Firms Have Large Book-Tax Differences", *The Accounting Review* 80, 137–166.

Hribar, P. and D. Collins, 2002, "Errors in Estimating Accruals: Implications for Empirical Research", *Journal of Accounting Research* 40 (March), 105–134.

Hribar, P. and N.T. Jenkins, 2004, "The Effect of Accounting Restatements on Earnings Revisions and the Estimated Cost of Capital", *Review of Accounting Studies* 9, 337–356.

Jones, J.J., 1991, "Earnings Management During Import Relief Investigations", *Journal of Accounting Research* 29(2), 193–228.

Kasznik, R., 1999, "On the Association between Voluntary Disclosure and Earnings Management", *Journal of Accounting Research* 37(1), 57–81.

McNichols, M.F., 2002, "Discussion of The Quality of Accruals and Earnings: The Role of Accrual Estimation Errors", *The Accounting Review* 77 (Supplement), 61-69.

Mishkin, F., 1983, *A Rational Expectations Approach to Macroeconometrics: Testing Policy Effectiveness and Efficient-Markets Models*, (Chicago, IL: University of Chicago Press).

Sloan, R., 1996, "Do Stock Prices Fully Reflect Information in Accruals and Cash Flows About Future Earnings?", *The Accounting Review* 71(3), 289–315.

Srinivasan, S., 2005, "Consequences of Financial Reporting Failure for Outside Directors: Evidence from Accounting Restatements and Audit Committee Members", *Journal of Accounting Research* 43(2), 291–334.

Thomas, J. and X. Zhang, 2000, "Identifying Unexpected Accruals: A Comparison of Current Approaches", *Journal of Accounting and Public Policy* 19(4), 347–376.

Xie, H., 2001, "The Mispricing of Abnormal Accruals", *The Accounting Review* 76 (July), 357–373.