Corporate Liquidity And The Significance Of Earnings Versus Cash Flow

Carol Lancaster, (clancast@richmond.edu), University of Richmond
Jerry L. Stevens, (jstevens@richmond.edu), Joseph A. Jennings Endowed Chair of Business, University of Richmond

Abstract

This paper replicates and extends prior work appearing in this journal on the relationship between liquidity and accrual income versus cash flow. The measure of corporate liquidity is expanded to include both static liquidity (current and quick ratios) and dynamic liquidity (cash conversion cycle). The analysis is also extended to more recent data. Prior conclusions on the insignificance of cash flow from operations in explaining liquidity are revised. Cash flow from operations is significantly related to both the current ratio and the cash conversion cycle and has significant incremental explanatory power relative to accrual income. Statistical significance of cash flow from operations in explaining the quick ratio is sensitive to the sample period and is more difficult to generalize.

I. Introduction

Accrual accounting rules determine the recognition of revenues and expenses in earnings statements, resulting in cash flows being allocated to periods other than those in which they occur. A key issue for the user of accounting data is the extent to which accounting income data based on accrual rules obscures information relative to cash flow data. White, Sondhi, and Fried (1994) suggest that cash flow information is free from many of the drawbacks of accrual concepts and should be more useful than reported income in assessing liquidity and solvency.

Researchers present mixed results in empirical studies of the use of earnings versus cash flows to explain financial performance. Rayburn (1986), Wilson (1986 and 1987), and Bowen, Burgstahler, and Daley (1987) find cash flow data to have incremental information beyond earnings in explaining security returns. Casey and Bartczak (1985) and Gentry, Newbold, and Whitford (1985) do not find differential information in cash-based funds flow over accrual-based income in discriminating between failed and ongoing firms. Wertheim and Robinson (hereafter referred to as W&R, 1991) analyze the relative information provided by changes in accrual earnings and cash flow in explaining changes in a firm's liquidity. They conclude that accrual income measures have more explanatory power than cash flow measures in explaining changes in liquidity.

Readers with comments or questions are encouraged to contact the authors via e-mail.

The purpose of this study is to replicate the W&R study over more recent data and to extend the analysis to include both static and dynamic measures of corporate liquidity. W&R use only the current ratio and the quick ratio as the relevant measures of liquidity and acknowledge the possibility that their conclusions may not hold for other measures. Current ratios and quick ratios are "static" measures of liquidity, based on forced liquidation of assets, and do not measure the ongoing ability of a firm to go from cash back to cash. A better measure of the "dynamic" liquidity of the firm is the cash conversion cycle. Also, other studies such as Bernard and Stober (1989) find that cash flow versus earnings relationships may be time and sample specific. This paper extends the W&R study to more recent data to see if the findings are specific to the sample period.

The remainder of the paper is organized as follows. First, we present differences between traditional static measures of liquidity and dynamic measures of ongoing liquidity. The cash conversion cycle is introduced as an added measure of liquidity for an ongoing concern. Second, the key methods used by W&R are explained in the context of our replication. A key difference from the W&R study is the addition of the cash conversion cycle as an alternative to the current and quick ratios as liquidity measures in the empirical models. Third, empirical results from the replication and extension of the W&R methods are presented. Published findings by W&R are compared to our findings using the same methods over a new time period and with the added measure of liquidity. Conclusions and suggestions for future research appear at the end of the paper.

II. Corporate Liquidity - Beyond Current and Quick Ratios

The Statement of Financial Accounting Concepts No. 5, paragraph 52, of the Financial Accounting Standards Board provides a key motivation for the W&R study. The authors sought empirical validation of the contention that cash flow information helps the assessment of corporate liquidity. W&R (1991, p. 66) note that "... company liquidity, in a general sense, refers to the ability of a company to pay its debts as they become due." The current ratio (current assets divided by current liabilities) and the quick ratio (current assets minus inventory divided by current liabilities) are used to measure liquidity since these measures compare the amount of obligations to the amount or resources available to meet the obligations. W&R recognize that their study offers insights into the relative significance of cash flow and accrual income variables with respect to liquidity, only to the extent that the current ratio and quick ratio are the relevant measures of liquidity.

Corporate liquidity has two distinctly different dimensions. Traditional ratios, such as the current ratio and quick ratio, are designed to measure an ability to meet obligations through the liquidation of assets. This static view of liquidity is based only on balance sheet data for a given point in time. Hager (1976), Kamath (1989), Richards and Laughlin (1980), and Emery (1984) suggest that a dynamic view is needed to capture ongoing liquidity from the firm's operations. Liquidity of an ongoing concern is measured by the firm's ability to cover obligations with cash flows. The cash conversion cycle, first introduced by Gitman (1974) and later refined by Gitman and Sachdeve (1982), is a dynamic measure of the time it takes a firm to go from cash outflow to cash inflow. Lancaster and Stevens (1996), among others, use the cash conversion cycle to measure liquidity in empirical studies of corporate performance.

The cash conversion cycle is measured by the inventory period (365 days / inventory turnover) plus the account receivable period (365 / accounts receivable turnover) minus the account payable period (365 / accounts payable turnover). The W&R study is extended in this paper to include the cash conversion cycle as an alternative measure of corporate liquidity, mak-

ing it possible to compare the use of accrual and cash flow data to explain both static and dynamic liquidity.

III. Research Methods

We employ the same basic methods used in the W&R study. Changes in liquidity are the dependent variables in regression equations and changes in accounting income and cash flow measures are the independent variables. Specific definitions, formulas, and COMPUSTAT data items used for each variable appear in the Appendix. The following notation represents the variables in the empirical models: $CURR_t$ = annual change in the current ratio in period t, $QUIK_t$ = annual change in the quick ratio in period t, CCC_t = annual change in the cash conversion cycle in period t, $IBEI_t$ = annual change in income before extraordinary items in period t, $WCFO_t$ = annual change in working capital from operations in period t, and $CFFO_t$ = annual change in cash flow from operations in period t.

Two main research questions are asked. First, do the variables IBEI, WCFO, and CFFO individually provide information useful in explaining changes in company liquidity? Regression analysis is conducted to test relationships between IBEI, WCFO, and CFFO and liquidity measures over time. Second, do IBEI, WCFO, and CFFO provide incremental information useful in explaining changes in company liquidity? This second question is addressed by testing for the significance of adding a given variable to an existing model. The following empirical models are tested for each of the three different measures of liquidity: (1) (Liquidity Change) $_t = \alpha + \beta\ (IBEI)_t$ + (random error) $_t$, (2) (Liquidity Change) $_t = \alpha + \beta\ (WCFO)_t$ + (random error) $_t$, (3) (Liquidity Change) $_t = \alpha + \beta\ (CFFO)_t$ + (random error) $_t$, (4) (Liquidity Change) $_t = \alpha + \beta_1\ (IBEI)_t + \beta_2\ (WCFO)_t$ + (random error) $_t$, (5) (Liquidity Change) $_t = \alpha + \beta_1\ (IBEI)_t + \beta_2\ (CFFO)_t$ + (random error) $_t$, and (6) (Liquidity Change) $_t = \alpha + \beta_1\ (WCFO)_t + \beta_2\ (CFFO)_t$ + (random error) $_t$.

Student t-statistics on the coefficients in the first three models provide tests for the individual significance of IBEI, WCFO, and CFFO in explaining changes in company liquidity. Models (4) through (6) allow tests for the incremental significance of adding a variable to an existing model. For example, an F-statistic based on the reduction in the residual sum of square errors from model (4) relative to model (1) provides a test of the incremental significance of WCFO in explaining liquidity.

The W&R study uses data from COMPUSTAT over the period from 1975 though 1989 and has a sample of 471 firms with continuous data over this period. More recent data are available for the replication. For the period from 1977 through 1994 our replication results in 417 firms with continuous data. The replication covers most of the period of the W&R study plus more recent observations, making it possible to determine if the W&R findings are robust over time. Both the W&R study and this replication have survivor biases since firms that were dropped from the COMPUSTAT database over the period of analysis are excluded. This limitation in both studies calls for caution in using the results for firms facing potential bankruptcy, merger, or other forms of reorganization that might cause firms to be dropped from the data.

Following W&R, we use a pooled cross-section and time series estimation procedure. Livnat and Zarowin (1990); Bowen, Burgstahler, and Daley (1987); Rayburn (1986); and Wilson (1987) use the same procedure. The pooled cross-section and time series procedure assumes stability in the annual cross-sectional coefficients. We use a dummy variable approach to test for stability of the coefficients and find only marginal significance for instability of the coefficients in only a few of the years of the study. Overall, results from the yearly regressions and the pooled regressions are similar so

only results from the pooled data are presented here.

IV. Individual Significance of IBEI, WCFO, and CFFO in Explaining Liquidity

Table 1 presents regression results published in the W&R study for models (1) through (6) when the current ratio (CURR) and quick ratio (QUIK) are the measures of liquidity. Table 1 also provides results from the replication for models (1) through (6) over more recent periods and with the cash conversion cycle (CCC) as an added measure of liquidity. A comparison of Panel A and B shows that the W&R findings are generally supported by the replication for the IBEI and WCFO variables, but not for the CFFO variable, when the current ratio is used to measure liquidity. Both studies find IBEI and WCFO to have independent statistically significant coefficients but the W&R findings have a higher level of significance. The WCFO variable is significant in the W&R findings even when appearing with IBEI in the same equation, but WCFO is not significant when appearing with IBEI in the replication. A major difference in the findings in Panels A and B is the statistically significant negative relationship between CFFO and the current ratio in the replication. The statistically significant negative coefficients on the CFFO variable is intuitive since a higher current ratio represents higher uses of cash (higher current assets) relative to sources of cash (current liabilities), consistent with lower cash flows from operations.

Results in Panels C and D of Table 1 provide a comparison of the W&R study with replication results when the quick ratio is the measure of liquidity. W&R find IBEI, WCFO, and CFFO all to be individually significant when the quick ratio is the dependent variable. While the signs on the CFFO variable remain negative they are no longer statistically significant in the replication. Difference in the findings suggest that inventory adjustment, the only factor causing the quick ratio to be different from the current ratio, plays a more important role over recent periods of analysis. Lower inventory (a source of cash) improves CFFO while increasing the quick ratio, partially offsetting the negative relationship between CFFO and the static liquidity measure.

Panel E of Table 1 shows regression results for models (1) through (6) when the cash conversion cycle is the liquidity measure. IBEI is no longer statistically significant when the CCC is used rather than static current and quick ratio measures of liquidity. WCFO is significant, except when entered with IBEI, and CFFO is highly significant and negative whenever it appears in a model with the CCC liquidity measure as the dependent variable.

Overall, the results in Table 1 offer important modifications to the W&R study. W&R (1991, p. 69) conclude from their findings that "...annual changes in earnings and working capital from operations are more significantly related to changes in company liquidity than are changes in cash flow, regardless of the measure of company liquidity." This conclusion is modified when the cash conversion cycle is the measure of liquidity. A more appropriate conclusion is that earnings and working capital from operations offer significant relationships with static measures of liquidity (current and quick ratios) and cash flow from operations offers a highly significant relationship with a dynamic liquidity measure (cash conversion cycle).

The replication also shows that the empirical results are sensitive to the sample period. When the sample period is extended cash flow from operation becomes significant even when the static current ratio is the measure of liquidity. Also, since inventory adjustments moderate the relationship between the quick ratio and cash flow from operations, the relationship between cash flow from operations and the quick ratio is sensitive to the period of analysis and is more difficult to generalize.

TABLE 1
Summary of Pooled Regression Results for Associations Between Changes in Accounting Flow and Changes in Liquidity (1977-94)

Panel A: Wertheim and Robinson (1991) Published Results - 1975 through 1989

			Estimated Coefficients (t-Values)		
	Dependent		IBEI	WCFO	CFFO
Model	Variable	Intercept	β_1	β_2	β_3
(1)[1]	CURR	0.053	0.016		
		(8.424)**	(5.258)**		
(2)[2]	CURR	0.048		0.030	
		(7.715)**		(7.333)**	
(3)[3]	CURR	0.054			0.001
		(8.562)**			(0.334)
(4)[4]	CURR	0.049	0.008	0.026	
		(7.725)**	(2.172)*	(5.544)**	
(5)[5]	CURR	0.053	0.017		-0.001
		(8.369)**	(5.254)**		(-0.264)
(6)[6]	CURR	0.049		0.031	-0.002
		(7.737)**		(7.358)**	(-0.693)

Panel B: Replication Results - 1977 through 1994.

			Estimated Coefficients (t-Values)		
	Dependent		IBEI	WCFO	CFFO
Model	Variable	Intercept	β_1	β_2	β_3
(1)[1]	CURR	0.0797	0.0109		
		(8.836)**	(3.126)**		
(2)[2]	CURR	0.0780		0.0144	
		(8.588)**		(2.794)**	
(3)[3]	CURR	0.0856			-0.0089
		(9.352)**			(-2.917)**
(4)[4]	CURR	0.0779	0.0084	0.0098	
		(8.587)**	(2.262)*	(1.776)	
(5)[5]	CURR	0.0846	0.0119		-0.0099
		(9.256)**	(3.416)**		(-3.226)**
(6)[6]	CURR	0.0827		0.0165	-0.0102
		(9.002)**		(3.187)**	(-3.295)**

Panel C: Wertheim and Robinson (1991) Published Results - 1975 through 1989

			Estimated Coefficients (t-Values)		
	Dependent		IBEI	WCFO	CFFO
Model	Variable	Intercept	β_1	β_2	β_3
(1)[1]	QUIK	0.091	0.025		
		(10.256)**	(5.495)**		
(2)[2]	QUIK	0.086		0.041	
		(9.586)**		(7.024)**	
(3)[3]	QUIK	0.089			0.013
		(9.868)**			(3.753)**
(4)[4]	QUIK	0.086	0.013	0.034	
		(9.601)**	(2.593)**	(5.078)**	
(5)[5]	QUIK	0.087	0.023		0.011
		(9.681)**	(5.105)**		(3.156)**
(6)[6]	QUIK	0.082		0.039	0.010
		(9.118)**		(6.567)**	(2.814)**

Table 1 Continued

Panel D: Replication Results - 1977 through 1994

			Estimated Coefficients (t-Values)		
	Dependent		IBEI	WCFO	CFFO
Model	Variable	Intercept	β_1	β_2	β_3
(1)[1]	QUIK	0.1170	0.0145		
		(10.778)**	(3.460)**		
(2)[2]	QUIK	0.1148		0.0186	
		(10.507)**		(2.999)**	
(3)[3]	QUIK	0.1201			-0.0027
		(10.902)**			(-0.725)
(4)[4]	QUIK	0.1147	0.0114	0.0124	
		(10.506)**	(2.540)*	(1.866)	
(5)[5]	QUIK	0.1189	0.0149		-0.0039
		(10.803)**	(3.543)**		(-1.054)
(6)[6]	QUIK	0.1167		0.0194	-0.0041
		(10.552)**		(3.115)**	(-1.110)

Panel E: Results Using the Cash Conversion Cycle to Measure Liquidity - 1977 through 1994.

				Estimated Coefficients (t-Values)	
	Dependent		IBEI	WCFO	CFFO
Model	Variable	Intercept	β_1	β_2	β_3
(1)[1]	CCC	0.0275	0.0028		
		(1.537)	(0.399)		
(2)[2]	CCC	0.0236		0.0200	
		(1.312)		(1.960)*	
(3)[3]	CCC	0.0456			-0.0349
		(2.516)*			(-5.758)**
(4)[4]	CCC	0.0236	-0.0025	0.0213	
		(1.312)	(-0.340)	(1.948)*	
(5)[5]	CCC	0.0451	0.0065		-0.0354
		(2.488)*	(0.943)		(-5.821)**
(6)[6]	CCC	0.0408		0.0278	-0.0369
		(2.240)*		(2.708)**	(-6.054)**

* Indicates significance at the 5% level for a two-tail test.
** Indicates significance at the 1% level for a two-tail test.
[1] Model (1): Dependent Variable = $\beta_0 + \beta_1$ (IBEI) + ε
[2] Model (2): Dependent Variable = $\beta_0 + \beta_1$ WCFO) + ε
[3] Model (3): Dependent Variable = $\beta_0 + \beta_1$ (CFFO) + ε
[4] Model (4): Dependent Variable = $\beta_0 + \beta_1$ (IBEI) + β_2 (WCFO) + ε
[5] Model (5): Dependent Variable = $\beta_0 + \beta_1$ (IBEI) + β_2 (CFFO) + ε
[4] Model (6): Dependent Variable = $\beta_0 + \beta_1$ (WCFO) + β_2 (CFFO) + ε

V. Incremental Significance of IBEI, WCFO, and CFFO in Explaining Liquidity

The incremental significance of IBEI, WCFO, and CFFO is tested using the sum of squared errors from the pooled regression models estimated in Table 1. F-statistics are calculated to measure statistical significance of the increased explanatory power due to adding another variable to the regression model. Table 2 presents the F-statistics for each combination of variables. For example, the first null hypothesis is that IBEI contains no incremental information beyond what WCFO contains in explaining the current ratio. The computed F-statistics for this hypothesis in both the W&R study and the replication are statistically significant at the 5% level, which means the null hypothesis is not supported. W&R find that only cash flow from operations (CFFO) fails to add significant incre-

TABLE 2
F-test Results for Incremental Explanatory Power when the Measure of Liquidity is the Current Ratio

Null Hypothesis	Independent Variable (Model A)[1]	Independent Variable (Model B)[2]	Published F-Statistic by Wertheim and Robinson (1991)	Replication F-Statistic[3]
IBEI contains no incremental explanatory power over that contained in WCFO	WCFO	WCFO, IBEI	4.71*	5.11*
IBEI contains no incremental explanatory power over that contained in CFFO	CFFO	CFFO, IBEI	27.60**	11.66**
WCFO contains no incremental explanatory power over that contained in IBEI	IBEI	IBEI, WCFO	30.74**	3.16
WCFO contains no incremental explanatory power over that contained in CFFO	CFFO	CFFO, WCFO	54.14**	10.15**
CFFO contains no incremental explanatory power over that contained in IBEI	IBEI	IBEI, CFFO	0.07	10.40**
CFFO contains no incremental explanatory power over that contained in WCFO	WCFO	WCFO, CFFO	0.48	10.86**

* Indicates statistical significance at the 5% level.
** Indicates statistical significance at the 1% level.
1 Model A: CURR = b_0 + b_1 (variable *i*) + error term
2 Model B: CURR = b_0 + b_1 (variable *i*) + b_2 (variable *j*) + error term
3 The F- statistic measures the incremental explanatory power of Model B with variable *i* and *j* over the explanatory power of Model A with only variable *i*.

mental explanatory power when the current ratio is the measure of liquidity. In the replication we find that only working capital from operations fails to add incremental explanatory power, and then only when earnings before extraordinary items also appears in the equation. It is also apparent from the lower F-statistics that both IBEI and WCFO provide similar explanatory power with relatively less incremental explanation from one of the variables when the other variable appears in the model.

Table 3 presents results from F-tests for incremental significance when the quick ratio is the measure of liquidity. W&R find that IBEI, WCFO, and CFFO all have significant incremental significance when the quick ratio is used. F-statistics tend to be relatively lower overall in the replication with insignificant incremental explanation from cash flow from operations. Again, this finding could be attributed to differences in inventory adjustments over the different sample periods, introducing a countervailing influence between the quick ratio and CFFO.

Table 4 presents F-statistic results for incremental significance when the cash conversion cycle is the measure of corporate liquidity. Cash flow from operations has the highest F-statistics, suggesting highly significant incremental explanatory power for CFFO. Working capital from operations also has significant F-statistics, but of much lower levels. Income before extraordinary items does not offer significant incremental explanatory information when the cash conversion cycle is the measure of liquidity. The choice of dynamic versus static liquidity measures as the dependent variable clearly makes a difference in conclusions about accrual versus cash flow relationships with cor-

TABLE 3
F-test Results for Incremental Explanatory Power when the Measure of Liquidity is the Quick Ratio

Null Hypothesis	Independent Variable (Model A)[1]	Independent Variable (Model B)[2]	Published F-Statistic by Wertheim and Robinson (1991)	Replication F-Statistic[3]
IBEI contains no incremental explanatory power over that contained in WCFO	WCFO	WCFO, IBEI	6.72**	6.45*
IBEI contains no incremental explanatory power over that contained in CFFO	CFFO	CFFO, IBEI	26.06**	12.55**
WCFO contains no incremental explanatory power over that contained in IBEI	IBEI	IBEI, WCFO	43.12**	3.48*
WCFO contains no incremental explanatory power over that contained in CFFO	CFFO	CFFO, WCFO	25.78**	9.70**
CFFO contains no incremental explanatory power over that contained in IBEI	IBEI	IBEI, CFFO	9.96**	1.13
CFFO contains no incremental explanatory power over that contained in WCFO	WCFO	WCFO, CFFO	7.92**	1.23

* Indicates statistical significance at the 5% level.
** Indicates statistical significance at the 1% level.
1 Model A: QUIK = b_0 + b_1 (variable *i*) + error term
2 Model B: QUIK = b_0 + b_1 (variable *i*) + b_2 (variable *j*) + error term
3 The F- statistic measures the incremental explanatory power of Model B with variable *i* and *j* over the explanatory power of Model A with only variable *i*.

porate liquidity.

VI. Conclusion

This study replicates and extends prior research on the relationship between changes in accounting flow variables and company liquidity. Accounting flow measures include income before extraordinary items (IBEI), working capital from operations (WCFO), and cash flow from operations (CFFO). An important extension in our study is the use of a dynamic measure of liquidity in addition to the current and quick ratios (CURR and QUIK) used in the W&R study. We also extend the replication to include more current data to see if the findings of W&R can be generalized for different periods.

W&R's findings are modified when more recent data are used. First, W&R do not find cash flow from operation to be significant in explaining changes in the current ratio but do find it to be significant in explaining changes in the quick ratio. The replication results reverse this conclusion. Cash flow from operations is significant in explaining changes in the current ratio in the replication but is not significant in explaining changes in the quick ratio. It makes sense that these finding may be sensitive to the sample period if inventory adjustments are more or less pronounced over time. Cash flow from operation has a negative relationship with static

TABLE 4
F-test Results for Incremental Explanatory Power when the Measure of Liquidity is the Cash Conversion Cycle

Null Hypothesis	Independent Variable (Model A)[1]	Independent Variable (Model B)[2]	F-Statistic[3]
IBEI contains no incremental explanatory power over that contained in WCFO	WCFO	WCFO, IBEI	0.13
IBEI contains no incremental explanatory power over that contained in CFFO	CFFO	CFFO, IBEI	0.87
WCFO contains no incremental explanatory power over that contained in IBEI	IBEI	IBEI, WCFO	3.79*
WCFO contains no incremental explanatory power over that contained in CFFO	CFFO	CFFO, WCFO	7.35**
CFFO contains no incremental explanatory power over that contained in IBEI	IBEI	IBEI, CFFO	33.89**
CFFO contains no incremental explanatory power over that contained in WCFO	WCFO	WCFO, CFFO	36.68**

* Indicates statistical significance at the 5% level.
** Indicates statistical significance at the 1% level.
[1] Model A: $CCC = b_0 + b_1$ (variable i) + error term
[2] Model B: $CCC = b_0 + b_1$ (variable i) + b_2 (variable j) + error term[3]
The F- statistic measures the incremental explanatory power of Model B with variable i and j over the explanatory power of Model A with only variable I.

liquidity ratios. Higher current assets (uses of cash) and lower current liabilities (uses of cash) lead to higher current ratios but lower cash flows from operations. The negative relationship between the current ratio and cash flow from operations is partially offset when inventories are taken out of current assets to create the quick ratio. For example, lower inventory reduces both the quick ratio and cash flows from operations. When inventory adjustments take place in a sample period the statistically negative relationship between cash flow from operations and the quick ratio is weakened by the built in positive relationship due to inventory changes. Tests of the incremental significance of cash flow from operations follow the same general pattern found in tests of the significance of cash flow from operations as the only independent variable. Cash flow from operations has incremental significance in explaining the current ratio but not the quick ratio over the replication's sample period.

Introduction of the cash conversion cycle as an alternative measure of liquidity also modifies the conclusions of W&R. Cash flow from operations is highly significant in explaining changes in the cash conversion cycle while income before extraordinary items is insignificant. This same finding holds with respect to incremental significance. Income before extraordinary items does not have significant incremental explanatory power with respect to the cash conversion cycle once cash flow from operations or working capital from operations are given.

W&R conclude that both income before extraordinary items and working capital from operations have more explanatory power than cash flow from operations in explaining changes in liquidity. This study demonstrates that this conclusion is sensitive to the sample period and to the measure of liquidity. Cash flow from operations has significant explanatory power for static forms of liquidity but the significance may be period specific and may vary for the current and quick ratios. For dynamic liquidity, cash flows from operations has more significant explanatory power than income before extraordinary items. The significance of accrual income versus cash flow in explaining liquidity is sensitive to whether static or dynamic liquidity is the objective of the analysis.

VII. Suggestions for Future Research

This replication follows suggestions made by W&R to extend the measures of liquidity in the analysis of accrual income versus cash flow, but there are still a number of areas where future research is needed. First, other measures of accounting flow data should be examined relative to liquidity to see if other measures affect the comparisons. Second, both W&R and our replication use firms in a continuous sample. Relationships between liquidity measures and accrual income versus cash flows may be different for subsets of firms with pending bankruptcy or other firm-specific conditions that would cause them to be dropped from the COMPUSTAT data files. Third, relationships between cash flow and liquidity are especially sensitive to inventory cycles when the quick ratio is the liquidity measure. More attention might be given to inventory adjustment trends and changes that take place in the relationship between cash flows and liquidity for subsets of firms where inventory is a relatively large portion of current assets. Finally, the data are aggregated without controls for differences in industry effects. Added research should test for differences in the relationships between liquidity and measures of accrual income and cash flows for different industries. Industries might be identified where differences in accrual income and cash flows have a more or less pronounced influence on liquidity.

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Appendix
Summary of Formulas and COMPUSTAT Data Items Used in the Calculation of Accounting Flow Variables and Liquidity Measures

Definition and Formula

1. Income Before Extraordinary Items in period$_t$ = IB_t
2. Working Capital From Operations in period $_t$
   = $FOPT_t$ (For firms reporting working capital from operations)
   = $IBC_t + DPC_t + XIDOC_t + TXDC_t + ESUBC_t + SPPIV_t + FOPO_t$
   (For firms reporting a Statement of Cash Flows)
3. Cash Flow From Operations in period $_t$
   = $OANCF_t$ (For firms reporting a Statement of Cash Flows)
   = $WCFO_t + [(LCT_t - DLC_t) - (LCT_{t-1} - DLC_{t-1})] - [(ACT_t - CHE_t) - (ACT_{t-1} - CHE_{t-1})]$
   (For firms reporting working capital)
4. Current Ratio in period $_t$ = $[ACT_t / LCT_t]$
5. Quick Ratio in period $_t$ = $[(CHE_t + RECT_t) / LCT_t]$
6. Cash Conversion Cycle in period $_t$
   = $[INVT_t / (COGS_t / 365)] + [RECT_t / (SALE_t / 365)] - [AP_t / (COGS_t / 365)]$

where:			COMPUSTAT Item No.
IB	=	Income Before Extraordinary Items	18
FOPT	=	Working Capital From Operations	110
IBC	=	Income Before Extraordinary Items (St. of Changes)	123
DPC	=	Depreciation and Amortization (St. of Changes)	125
XIDOC	=	Extraordinary Items and Discontinued Operations	124
TXDC	=	Deferred Taxes	126
ESUBC	=	Equity in Earnings of Unconsolidated Subsidiary	106
SPPIV	=	Gain or Loss from the Sale of Long Term Assets	213
FOPO	=	Funds from Operations - Other	217
OANCF	=	Operating Activities Net Cash Flow	308
LCT	=	Current Liabilities - Total	5
DLC	=	Long Term Debt Listed in Current Liabilities	34
ACT	=	Current Assets - Total	4
CHE	=	Cash and Cash Equivalents	1
RECT	=	Total Current Receivables	2
INVT	=	Inventories - Total	3
COGS	=	Cost of Goods Sold	41
SALE	=	Sales (Net)	12
AP	=	Accounts Payable	70

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