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Hospital Liquidity and Cash Conversion Cycle: A Study of Washington Hospitals

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This Special Issue of the *Journal of Health Care Finance* honors Dr. Louis C. Gapenski for his contributions to the fields of health care finance, public health finance and health administration. In his writing, teaching and mentoring, he served as a role model for all of us.

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Abstract

Liquidity in hospitals is typically measured by the static values of the current ratio, the quick ratio and days-cash-on-hand. There is a growing interest, largely outside of healthcare to use a dynamic measure like the cash conversion cycle. Using data from the State of Washington, we compare these measures. For hospitals in our sample, the average current ratio is 2.06, the average quick ratio is 2.07 and the average days-cash-on-hand is 19 days. The average cash conversion cycle is 64 days, comprised of payments received after 57 days, debts paid after 64 days and inventory used in 91 days. Fixed effects regressions of CCC revealed a positive relationship with the current ratio, no significant relationship with the quick ratio and a negative relationship with days-cash-on-hand. To obtain a comprehensive assessment of the liquidity of a hospital, analysts should consider using both the traditional liquidity ratios as well as the CCC. The traditional liquidity ratios measure the effects of past actions while the CCC, as well as it would appear days-cash-on-hand, reflect the process by which liquidity is changing.

Introduction

The analysis of firm liquidity using a cash conversion cycle (CCC) application has been gaining interest among researchers and practitioners in recent years (Cagle, Campbell, & Jones, 2013; Lin, Lin, Lin & You, 2014). Cash conversion cycle is a technique used to evaluate working capital management. It recognizes the dynamic nature of firm liquidity rather than considering it a static measure. The term cash conversion cycle was first brought forth by Richard and Laughlin (1980), who argued that cash conversion cycle is a better approach to measure a firm's liquidity than the current and quick ratios.

Liquidity measures the ability of a business to meet its cash obligations as they become due and usual liquidity ratios measure the length of a period for converting a hospital's assets into cash or settling its obligations (Gapenski, 2008). In the healthcare finance literature, cash conversion cycle has been defined as the difference in time between the expenditures on patient services and inventory and the collection of revenues from those services (Upadhyay, Sen, and Smith, 2015). Cash conversion cycle is commonly used as a proxy for working capital management. A more descriptive term for working capital management is net working capital, which refers to current assets minus current liabilities (Gapenski and Reiter, 2016). Net working capital represents a circulating capital that assists a hospital in meeting cash demands generated by a patient service delivery cycle (Schilling, 1996). For hospitals, it is imperative that they realize their receivables in a short period of time and are able to settle their liabilities when they are due, to effectively manage this circulating cycle of working capital. Not being able to do so may pose a risk of forming bad debt, poor financial performance, and low profitability for hospitals (Lin et al., 2014).

While cash conversion cycle also measures the liquidity position of hospitals, it is different from other traditional measures of liquidity because it adds a time dimension or flow concept to liquidity (Cagle et al., 2013; Moss and Stine, 1993). Current ratio, quick ratio, and cash on hand measure the static balance sheet values, which present an incomplete picture of the firm's overall ability to manage cash and working capital.

For hospital managers, cash conversion cycle provides an understanding of what must be done to reduce the amount of cash invested in current assets in order to improve the overall liquidity (Gentry, et al., 1990). Cash conversion cycle is the time between cash outflows and cash inflows, so an increase in cash conversion cycle would indicate a worsening of hospital's liquidity while a decrease would indicate an improvement in hospital's liquidity position (Moss and Stine, 1993). However, in the existing healthcare finance body of knowledge, there is a gap in literature that discusses how traditional liquidity measures can affect cash conversion cycle, which is a dynamic measure of liquidity as well as a measure of working capital.

The purpose of this paper is to fill a gap in extant literature as well as be relevant to healthcare managers by studying the relationship between liquidity ratios and cash conversion cycle of hospitals. We have chosen one state (Washington) to control for differences in public and private policies across various states.

Background

This section provides more background on traditional liquidity measures, cash conversion cycle as a liquidity measure, and a comparison of the two types of liquidity measures. Finally, we summarize, synthesize, and develop hypotheses.

Traditional measures of liquidity

Liquidity position of a hospital measures its ability to pay its cash obligations as they are due. Not being able to meet these obligations could result in bankruptcy and financial distress (Garanina and Belova, 2015). The traditional measures of liquidity are current ratio, quick ratio, and days-cash-on-hand (Gapenski and Reiter, 2016). Current ratio measures the dollars of current assets per dollar of current liabilities. For example, a current ratio of 3.7 means there is $3.70 available to pay each dollar of current liabilities. Quick ratio measures the dollar of current assets less inventories per dollar of current assets. For instance, a quick ratio of 3 would indicate that there is $3.00 available to pay each dollar of current liabilities without taking inventories into consideration. This ratio is also known as the acid test ratio because it makes the current ratio a more stringent measure by removing inventories, which are the least liquid of current assets. Days-cash-on-hand is the number of days an organization can continue to pay its cash obligations with no new source of cash being available. High values of current ratio, quick ratio, and days-cash-on-hand imply high liquidity of organizations (Gapenski and Reiter, 2016). High liquidity of hospitals is viewed favorably (McCue, 1991).

Cash Conversion Cycle

A dynamic measure of liquidity is the cash conversion cycle (CCC). Cash conversion cycle is composed of days in accounts receivable (A/R), days in accounts payable (A/P), and days in inventory. The main distinction between cash conversion cycle and traditional measures of liquidity is illustrated in the approach by Richard and Laughlin (1980), whereby; liquidity is measured from the perspective of a firm being a going concern using CCC. The values used to measure current ratio and quick ratio (current assets and current liabilities) are mainly derived from the balance sheet, while the values used to obtain the cash conversion cycle (days in A/R, days in A/P, and days inventory) are mainly derived from the income statement and are measured over a specific duration of time (Gapenski and Reiter, 2016).

Traditional Liquidity Measures vs. CCC

Analyzing liquidity by using only current and quick ratios may be misleading (Lin et al., 2014). Firms may have high values of traditional liquidity measures making it appear that their liquidity position is good, but their cash conversion cycle may be longer (Lin et al., 2014). Cash conversion cycles are expected to be shorter for better liquidity positions (Nobanee, Abdullatif, and AlHajjar, 2011). Cash conversion cycles indicators may better reflect actual short-term debt paying ability. However, some items such as interest, wage, and tax are not included in CCC but they are considered under current and quick ratios. Therefore, evaluating both the traditional liquidity measures as well as the CCC are important for a comprehensive analysis of liquidity.

In hospitals, a shorter cash conversion cycle has been associated with higher profitability margins, as measured by both operating and total margins (Upadhyay, Sen, & Smith, 2014). Given the desirability of shorter CCC's, studies have indicated that a firm's goal should be to shorten the CCC as much as possible without jeopardizing operations (Ebben and Johnson, 2011). In order to shorten the CCC, the traditional liquidity measures should be lowered. However, the traditional liquidity measures (current ratio, quick ratio, and days-cash-on-hand) are expected to be higher in values for better liquidity of hospitals (Gapenski and Reiter, 2016). Firms that have higher values of traditional liquidity measures may have management policies regarding larger commitment towards cash and non-cash investments leading to longer CCC (Garanina and Belova, 2015).

Studies in non-healthcare settings have found that firms that have policies that result in longer CCCs, in other words, less liquidity, would result in larger values for current and quick ratios, indicating greater liquidity. This may sound conflicting because an improved liquidity position of a firm means a lower CCC as well as a lower value of traditional liquidity measure (Cagle et al., 2013). The conflict may be resolved by noting that current and quick ratios are static measurements derived from the balance sheet. However, CCC that has a flow concept to it, is derived from values coming from the income statement, making it a dynamic measurement (Moss and Stine, 1993). Researchers have advised firms to put an emphasis on using CCC as a measurement of liquidity as compared to static indicators of insolvency (Lin et al., 2014).

In summary, the major goal of hospital management is to invest available resources in a way to reap greatest economic benefits. Therefore, there needs to be a right combination of resources invested in working capital and the amount of resources deployed in capital investments (Schilling, 1996). An optimum liquidity position is obtained by striking a balance between keeping static liquidity measures on the lower side so that a shorter cash conversion cycle can be achieved. Researchers have expressed a difficulty in finding an exact cut point between good liquidity ratios and bad ones (Cagle et al., 2013). However, they have made it clear that having an optimum liquidity ratio while maintaining an efficient working capital shows that the inflows of cash is matched with the outflows of cash (Richard and Laughlin, 1980). To the best of our knowledge, this is one of the first papers in healthcare finance literature that evaluates a relationship between traditional liquidity measures that are static and CCC, a dynamic measure of liquidity. Our paper has two primary goals: i) to emphasize the importance of measuring CCC as hospitals' liquidity indicator, and ii) demonstrate how changes in traditional liquidity indicators (current ratio, quick ratio, and days-cash-on-hand) can affect the length of CCC. Our paper's goals are relevant to hospital managers in recognizing the 'necessity' of CCC approach towards liquidity analysis and using it as a key performance metric in financial statements.

Against the aforementioned background, we expect to see a positive relationship between traditional liquidity ratios and CCC. Therefore, we hypothesize negative relationships:

H1: Higher (better) values of the current ratio will be associated with longer (worse) CCC.
H2: Higher (better) values of the quick ratio will be associated with longer (worse) CCC.
H3: Longer (better) values of days-cash-on-hand will be associated with longer (worse) CCC.

Methods

Data and Sample

Data for this study is obtained from publically available financial data provided by the department of health, State of Washington and Medicare Cost reports. Our sample contained 98 hospitals across the state of Washington. Financial data for these 98 hospitals from 2007-2013 were used in our analyses. Datasets used included the income statement, balance sheet and financial ratios, both from Washington state hospitals' financial statements as well as the cost reports. There was less than 5% data missing and the missing data appeared to be random, therefore no attempt was made to either remove hospitals or impute values for missing data. After removing one duplicate observation, we were left with a total of 735 hospital year observations. Panel data at the hospital level was used for analyses purposes.

Dependent Variable

Our dependent variable was CCC. It is calculated as days in accounts receivable plus inventory less days in accounts payable. The three components of CCC used in its formula are individually used as measures of liquidity.

Independent Variables

Our independent variables were traditional liquidity ratios. The liquidity ratios that we considered in this paper were 1) current ratio, 2) quick ratio, and 3) days-cash-on-hand. Current ratio was calculated as the ratio of current assets over current liabilities. Quick ratio was measured as a difference between current assets and inventories divided by the current liabilities. Days-cash-on-hand is calculated as cash plus short term investments divided by total expenses less depreciation, per day.

Control Variables

We controlled for hospital size by employing total assets and natural log of net patient service revenue as our control variables. Control variables used in our analyses draw from the model used by Moss and Stine (1993) that suggests that larger firms may tend to have more cash and higher liquidity than smaller firms. One might usually be concerned about the prospect of facing multicolinearity in a model that incorporates multiple measures representing the same concept. To the extent that multicolinearity is observed between these two measures, the coefficients will be unbiased and the standard errors will be inflated, meaning that a statistically significant relationship might not be observed. In this case, the significance of any relationships between the control variables and the dependent variables is not of particular concern. The key concern is the relationship between the liquidity ratios and CCC. The precision of the statistical significance of the control variables may be sacrificed for precision of the estimate of the liquidity ratios.

Analytic Approach

This study used a fixed effects regression approach for analysis of the longitudinal data spanning 8 years. Hospital fixed effects accounts for any unobserved factors that may influence hospital's policies regarding paying their vendors, collecting obligations from payers and patients, and how long to hold their inventories. A fixed effects model assists in studying the cause of change in CCC within hospitals while omitting their time invariant characteristics (Allison, 2005). A fixed effects methodology also properly shows the effectiveness of having smaller liquidity ratios on average length of CCC (Wooldridge, 2012). Our empirical models were as follows:

1. $CCC_{it} = B_0 + b_1$ current ratio $_{it} + b_2$ total assets $_{it} + b_3$ net patient service revenue$_{it} + v_i + u_{it}$

2. $CCC_{it} = B_0 + b_1$ quick ratio $_{it} + b_2$ total assets $_{it} + b_3$ net patient service revenue$_{it} + v_i + u_{it}$

3. $CCC_{it} = B_0 + b_1$ days-cash-on-hand$_{it} + b_2$ total assets$_{it} + b_3$ net patient service revenue$_{it} + v_i + u_{it}$

Subscripts i and t refer to i^{th} hospital in the t^{th} year. The values of v_i and u_{it} refer to the error components of the models. Robust standard errors were used to cluster the standard errors that come from repeat observations of the same hospital.

Results

Table 1 presents descriptive statistics on the sample of 98 hospitals in state of Washington. The average CCC for all hospitals is 83 days (SD = 178 days). The median CCC is 64 days. On average, hospitals in our sample collect payments after 57 days (SD = 28 days), and pay their outstanding debts in 64 days (SD = 72 days). Hospitals take an average of 91 days (SD = 159 days) to use inventory. For hospitals in our sample, the average current ratio is 2.06, quick ratio is 2.07, and days-cash-on-hand is 19.3 days. Hospital size was measured by total assets with median of approximately $68 million, and the net patient revenues were at a median of $67 million during this time period. While there is some uniformity in the accounts receivable outcomes across hospitals, with a coefficient of variation (mean divided by standard deviation) of less than 2, there is substantial variation in other measures.

Table 2 presents results from the fixed effects regression models between current ratio and CCC. Results suggest that a current ratio 10 points higher than average is associated with a 2.6 days longer cash conversion cycle. This result was found statistically significant at the 95% confidence level and is consistent with hypothesis 1. The model of association between the quick ratio and CCC is presented in table 3. Although the relationship between quick ratio and CCC was also positive, it was not significantly different from zero. The relationship between days-cash-on-hand and CCC, as presented in Table 4, exhibited an unexpected negative relationship and was statistically significant.

Table 1. Descriptive statistics, State of Washington Hospitals, 2007-2013 (N=641)

	Median	Mean	Standard Deviation
Dependent variable-Working Capital Management			
Cash Conversion Cycle	64.0	83.2	178.0
Days Accounts Receivable	53.5	57.3	27.7
Days Inventory	65.6	91.4	158.4
Days Accounts Payable	52.4	64.6	71.6
Independent variables- Liquidity ratios			
Current Ratio	2.1	2.1	87.8
Quick Ratio	2.1	2.1	88.6
Days-cash-on-hand	19.3	47.7	96.9
Control Variables			
Total assets (‘000)	$68,600	$196,000	$291,000
Net patient service revenue (‘000)	$67,800	$164,000	$209,000

Table 2. Fixed Effects Regression results: Cash Conversion Cycle and Current ratio

	Coefficient	S.E.	t-stat
Current ratio	0.26**	0.01	18.8
Total assets	-3.4e-07	2.7e-07	-1.3
Net patient service revenue	6.2e-07	4.9e-07	1.3
2008	-19.7	9.7	-2.0
2009	-10.0	21.2	-0.4
2010	-13.4	20.0	-0.7
2011	-17.0	20.7	-0.8
2012	-25.5	18.4	-1.4
2013	23.4	27.2	0.9
Constant	58.7	33.5	1.8
Adjusted R-Squared	0.65		

**significant at the 95% level, p<0.05

Hospital size as measured by total assets was found to have negative non-significant relationships across all models. Net patient service revenue was found to have non-significant positive relationships across all models. While these two measures of the same general concept of “size”, they have potentially very different meanings with regards to liquidity. However, the precision of the statistical significance of these measures was sacrificed for precision of the liquidity measures. At least one of the year-indicator variables exhibited a t-statistic in excess of an absolute value of greater than 1.0. Despite the non-significant associations, the t-statistics in excess of an absolute value greater than 1.0 indicate that the explanatory power of the model increased due to inclusion of the these control variables.

Table 3. Fixed Effects Regression Results: Cash Conversion Cycle and Quick ratio

	Coefficient	S.E.	t-stat
Quick ratio	2.5	3.0	0.8
Total assets	-3.5e-07	3.2e-07	-1.1
Net patient service revenue	6.2e-07	4.8e-07	1.3
2008	-25.6	12.3	-2.1
2009	-25.5	14.6	-1.8
2010	-25.5	18.2	-1.4
2011	-29.3	18.5	-1.6
2012	-29.1	18.5	-1.6
2013	9.9	26.0	0.4
Constant	44.2	30.7	1.4
Adjusted R-Squared	0.37		

Table 4. Fixed Effects Regression Results: Cash Conversion Cycle and Days-cash-on-hand

	Coefficient	S.E.	t-stat
Days-cash-on-hand	-0.41**	0.14	-3.0
Total assets	-2.0e-07	1.8e-07	-1.2
Net patient service revenue	4.8e-07	3.7e-07	1.3
2008	-18.3	9.2	-2.0
2009	-6.2	19.3	-0.3
2010	-5.6	20.5	-0.3
2011	-12.8	22.1	-0.6
2012	-20.6	19.4	-1.1
2013	27.2	29.9	0.9
Constant	70.0	31.6	2.2
Adjusted R-Squared	0.65		

**significant at the 95% level, $p<0.05$

Discussion

In the most recent years of available data for State of Washington hospitals, generally reported liquidity ratios and the components of the CCC exhibit values that are generally in-line with expectations (Gapenski and Reiter, 2016). Mean Current and Quick ratios of 2.1, days-cash-on-hand of 48 days, days A/R of 64, days inventory of 66 and days A/P of 52 are all consistent values for the hospital industry. That stated, the variation around these mean values is substantial. We hypothesized that there would be a positive correlation between the CCC and liquidity ratios, and this was confirmed for the comparison of CCC with the current ratio. Having a higher current ratio (better static liquidity) is associated with a longer CCC (worse dynamic liquidity). However, despite mean and median values of the quick ratio that are nearly identical to the current ratio, the relationship between CCC and the quick ratio, while still positive, was not statistically significantly different from zero.

Interestingly, the relationship between CCC to days-cash-on-hand was statistically significantly negative, counter to hypothesis 3. Having a longer days-cash-on-hand (better static liquidity) is actually associated with a shorter CCC (better dynamic liquidity). While we have characterized days-cash-on-hand as a static liquidity measure along with the current ratio and quick ratio, by its construction as a value measured in days and empirically, it is consistent with the values provided by CCC.

Each of the fixed effects regressions, particularly the current ratio and days-cash-on-hand regressions, exhibited a high level of model fit with adjusted R-squares of 0.65, suggesting that the results might not just be noise.

To obtain a comprehensive assessment of the liquidity of a hospital, analysts should consider using both the traditional liquidity ratios as well as the CCC. The traditional liquidity ratios measure the effects of past actions while the CCC, as well as it would appear days-cash-on-hand, reflect the process by which liquidity is changing.

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