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Liquidity, Level of Working Capital Investment, and Performance in an Emerging Economy

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Abstract

Th research investigates the relationship between current ratio, the level of investment in working capital, and profitability of firms in Bangladesh for the years 1998-2014, employing non-financial firms listed on the Dhaka Stock Exchange (DSE) for analysis. Results show that the more profitable companies tend to be able to better maintain their level of investments in current assets. Quantile regression points to a non-linear relationship between profit performance and working capital. We conclude that firms with better profitability maintain a healthier level of investment in working capital assets, wheres firms with inadequate investment in current assets have no meaningful relationship with performance. If the latter firms get an injection of working capital, then they may be able to move to a state where they can generate reasonable profits. The paper presents a general argument against tweaking working capital levels and recommends focusing on other functions of the business to increase profitability and value.

Key Words: Liquidity; Current Ratio; Working Capital; Quantile Regression; Generalized Method of Moments

JEL Classifications: F23; G30; G31; M21

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1. Introduction

The general feeling among practitioners and analysts is that firms overinvest in current assets. In a working capital management report by Ernst and Young (2011) based on 1000 prominent U.S. companies, the aggregate amount of over-investment in net working capital is estimated to have been between $330 billion and $590 billion in 2011. Aktas et al. (2015) estimate that the unnecessary portion of net working capital is about 4.5% of the aggregate sales. If too little and too much are bad, then there is likely to be a happy middle that is ideal or optimum for a firm. Baños-Caballero et al. (2012, 2014) and Mun and Jang (2015) find that there is indeed an inverted U-shape relationship between a firm's value (and profitability) and working capital level. An optimum policy can help maintain a level of working capital in which firms can avoid an excessive investment in current assets and also increase profitability.

While it seems logical, it is still difficult to show what exactly an ideal level is. A legitimate question thus arises: Do more profitable companies have more efficient levels of working capital (lean or a level with an ideal cushion), or is it the other way around? This question has been raised by Deloof (2003) and reiterated by others (e.g., Baños-Caballero, García-Teruel, and Martínez-Solano 2014, Knauer and Wöhrmann 2013). A poorly performing firm may simply be forced into a situation where it cannot maintain a desirable level of working capital. Lazaridis and Tryfonidis (2006) also phrase their conclusion, stating that operating performance dictates to some extent how working capital is managed.

The purpose of this research is to closely examine the relationship between profitability and working capital. We view current ratio as an integrated measure of working capital, because it captures investment in liquid assets, such as cash and bank balances and other current assets. Note that the current ratio is current assets divided by current liabilities, and current assets include cash, inventory, accounts receivables, and other short-term assets. Therefore, the ratio aggregates various components of net working capital. Lingstadås and Berg (2016) also use the current ratio as a variable representing working capital in their model. We recognize that cash the conversion cycle is a commonly used specification for measuring working capital, but the issue of endogeneity is unavoidable and has been recognized by others like Lingstadås and Berg (2016). It is not surprising that we see a co-integrating causal relationship among the relevant variables in the model (Alom 2018). The measure for net working capital may be negative sometimes and is often a problematic issue, especially if it is necessary to convert data into log.

The current ratio is also a measure of liquidity since it expresses investment in current assets as a ratio of current liabilities, implying the presence or absence of a cushion during times of financial distress. Therefore, the discussion also applies to the relationship between liquidity and profit performance. A high current ratio results from

relatively large investment in working capital (current) assets relative to current liabilities. A current ratio of 1.5, for example, implies that investment in current assets is 1.5 times current liabilities. When the investment in current assets is a ratio of sales, as often is the case (24%, according to Aktas et al. 2015), net working capital can be closely estimated from the firm's current ratio. Investments in inventory and receivables are also not completely independent of each other. If payables are taken as a given depending on the operations, then the current ratio can work as a substitute for net working capital. Current ratio (CR) is (cash + inventory + receivables) divided by current liabilities, and net working capital (NWC) is (cash + inventory + receivables) minus current liabilities. In that sense, current ratio, a relative value, is a better measure of working capital, because it captures the status of net working capital in a comprehensive way, leaving nothing out.

Baños-Caballero et al. (2012, 2014), Mun and Jang (2015), and Afrifa (2016) provide evidence of a non-linear relationship. If the relationship is indeed non-linear, then general normality assumptions may no longer be valid. One common practice is to use a specification that incorporates non-linearity using either log transformation or including a squared term for a variable, as done by Baños-Caballero et al. (2012, 2014).

A relatively new tool to understand a non-linear relationship is quantile regression (Kocherginsky et al. 2005; Koenker and Bassett 2005). We shall apply this approach to test the relationship between liquidity as measured by the current ratio and performance. This will give us an especially strong tool to test non-linearity in this relationship, because this model is more robust in the presence of likely heteroskedasticity and non-linearity in a relationship.

We also want to examine the directionality of the potential association between profitability and working capital as measured by the current ratio. It is reasonable to expect that a weak current ratio will result in missing opportunities and low profitability, but it may also be true that a firm with low or negative profit is experiencing operational stress that will result in a low current ratio. A relatively high current ratio should represent a relatively strong working capital position. That a large number of companies have relatively low investment in working capital (current ratios below 1 or substantially less than that) may not be policy dictated, but rather dictated by the state of their current business and the practices in the industry. Naturally, firms poorly managing their working capital position and working with low current ratio will incur operational difficulties that should show up in their profitability. On the other side, a firm having significant difficulty generating revenue probably will also have difficulty maintaining a healthy working capital position and a healthy current ratio. In Bangladesh, the absence of an active and established bond market forces firms to rely more on short-term debt (resulting in high current liabilities), which may contribute to low current ratio.

In brief, the purpose of this paper is to do the following:

1. Examine the relationship between profitability and working capital in Bangladesh. We do this through the Generalized Method of Moments (GMM) regression and Quantile regression (QR). We use the current ratio as a comprehensive measure of working capital as opposed to the cash conversion cycle (CCC). Just as endogeneity is a problem with CCC, the same can be said about the current ratio, which directs us toward the GMM regression, the preferred regression model in the presence of endogeneity, omitted variables, and heteroskedasticity.

2. Examine if the current ratio maintained by a firm is affected by its profitability. We look at the directionality of the relation by employing the Dumitrescu Hurlin (DH) causality. We also swap the profitability with the current ratio, making it the dependent variable and profitability the independent variable in the GMM estimation. We also cluster the companies in four groups to identify at what clusters does profitability tend to influence the level of the current ratio the most.

3. Examine the non-linearity of the relationship through the quantile regression.

In the process of examining the relationship between working capital and profitability, we review various studies on working capital and liquidity management. Market capitalization in Bangladesh relative to GDP is much smaller relative to that of other South Asian countries. In 2015, market capitalization to GDP was about 41% in Indonesia, 94% in Thailand, and 140% in Malaysia (World Economic Forum 2016). In Bangladesh, the market capitalization to GDP is just 18% (The Daily Star 2019). In 2015, corporate bond market capitalization to GDP was about 40% for Thailand and about 15% for the Philippines (World Economic Forum 2016), while it is very negligible for Bangladesh.

2. Literature Review

Studies have looked into the relationship of the individual components of working capital (i.e., receivables, inventory, and payables) and profitability or value. The level of working capital is likely dictated to a great extent by industry practices and varies by industry (Weinraub and Visscher 1998, Hill et al. 2010). Lazaridis and Tryfonidis (2006) focus on CCC and suggest that keeping different components of working capital (accounts receivables, accounts payables, inventory) at an optimal level contributes to profitability. Kroes and Manikas (2014) use the cash operating cycle as a measure of working capital and find that managing receivables and inventory may result in a better valuation of a firm. Garcia-Teruel and Martinez-Solano (2007), Gill et al. (2010),

Knauer and Wöhrmann (2013), Shin and Soenen (1998), Deloof (2003), and Yazdanfar (2013) report similar reports.

Lengthening the time of accounts payable mathematically lowers the cash conversion cycle, which is a desirable goal. Most executives probably will agree with Van Horne and Wachowicz (2005) that it is better not to focus on the length of the payment period as they have very little control over it. García-Teruel and Martínez-Solano (2007), Deloof (2003), and Lazaridis and Tryfonidis (2006) indicate that lengthening the accounts payable period could be associated negatively with profits. From a liquidity viewpoint as measured by the current ratio, lengthening the accounts payable period increases the amount of accounts payable and reduces liquidity. If shortening CCC is associated with better performance, as indicated by Enqvist et al. (2014), Jose et al. (1996), and Lazaridis and Tryfonidis (2006), then a longer payment period should be associated with better performance. However, while a positive relationship has been reported by Lazaridis and Tryfonidis (2006), no association is found by García-Teruel and Martínez-Solano (2007), and a negative relationship is a result by Enqvist et al. (2014). A negative relationship is consistent with the arguments made by Ng et al. (1999), Wilners (2000), and Kasozi (2017), whereby discounts from early payment may more than offset the benefit of supplier financing.

The reported literature results send conflicting messages. Blinder and Maccini (1991) argue that firms benefit from larger inventories as they lower supply costs, lower purchase costs, result in less price fluctuations, and offer better management of stock-outs. The ability to maintain more stable prices of products also leads to better customer relations (Schiff and Lieber 1974), but there are costs associated with maintaining a high level of inventory. A high level of inventory must be financed, which increases interest cost (Kieschnick et al. 2013) and is associated with increased expenses in terms of rent, utilities, security, and insurance (Kim and Chung 1990). This may also impair the credit rating of the firm. Furthermore, as Deloof (2003) points out, large investment in inventory and accounts receivable may result in sacrificing some value-creating opportunities.

Conflicting arguments have similarly been made about the other components of working capital. Researchers have directed significant attention to accounts receivable, especially the impact of trade credit, and accounts payable. Even though extending trade credit has to be financed at a cost, the benefits may outweigh the cost. It is easy to associate trade credit with increased sales revenue (Brennan et al. 1988, Peterson and Rajan 1997). Emery (1987) rightly points out that, in times of low demand, it helps to improve sales and that the return from trade credit is likely to be higher than the return from money market investment. Moreover, customers can verify product quality before they make a payment, which is a way to reduce asymmetric information and result in greater trust-based customer relationship (Lee and Stowe 1993; Ng et al. 1999; Wilner 2000).

Aside from endogeneity issues, cash conversion cycle studies leave out the cash component of working capital and its value in profitability and value. In recent years, some authors have justifiably placed greater focus on cash flows, rather than the level amount or ratios involving net working capital. Kieschnick et al. (2013) show that the incremental dollar held in cash is a better investment than an investment in non-cash net working capital. De Almeida and Eid (2014) support that argument. Fazzari and Peterson (1993) emphasize the role of working capital as both a source and a use of funds and note that highly liquid firms are able to smooth fixed investments relative to fluctuations in cash flows, which has also been recognized by others (Deloof 2003; Filbeck and Krueger 2005; Hill et al. 2010). Afrifa (2016) and Afrifa and Tingbani (2018) argue that firms with limited cash flow should limit investment in accounts receivable and inventory.

3. Research Methodology

3.1 The Data and Source of the Data

There is no database yet available in Bangladesh. Thus, we collect data from various sources, primarily from the annual reports submitted to the Dhaka Stock Exchange (DSE). We also access the websites of the sample companies as well as LankBangla Financial Portal, which has a databank of annual reports of many of the listed companies in Bangladesh.

We use annual data from Bangladesh that cover a period from 1998 to 2014 and rely on the current ratio to measure relative investment in working capital. The number of companies listed on the Dhaka Stock Exchange recently hit around 350, including financial firms and banks and some government-owned companies. Our goal is to build a database of as many companies as possible. Starting in 1998, we build a panel dataset consisting of 66 companies for 16 years: 7 of them belong to the food sector, 17 in the pharmaceutical chemical sector, 18 in the textile sector, and the rest in fuel and power, construction, and miscellaneous sectors. Financial sector companies are excluded since they are structurally very different from the others and rely extensively in borrowed capital. Other firms discarded from the initial dataset are government-owned firms or those with missing information.

3.2 The Variables

The variables used in our model specifications are Return on Assets (ROA), Current Ratio (CR), Total Debt to Total Asset (TD), Firm Size (FS), and a control variable FUNDAG described later in this section. Table 1 lists the descriptive statistics. Return on Assets (ROA) is widely used as a dependent variable in the working capital and liquidity literature. This paper defines it as (Net Income/Total Assets). Natural log

of Total Assets (FS) is used extensively as a control variable (e.g., Lingstadås and Berg 2016, Garcia-Teruel et al. 2007, Hill et al. 2010), which assumes that performance depends on firm size, a widely observed phenomenon. Total Debt Ratio, measured as Total Debt/Total Assets, has been used by many authors, including Aktas et al. (2015), Lingstadås and Berg (2016), in varying forms. However, this variable is critical in the context of emerging economies, where a lack of access to capital forces firms to rely more on short-term bank financing. Differences between larger and smaller emerging economies in debt-capital structure have been documented by Booth et al. (2001). Ding et al. (2013) report in their dataset from China that 40% of the firm-year observations have negative working capital. Reliance on short-term loans, bank overdrafts, and other current liabilities is also reportedly high in Vietnam (Tran 2017). Normally, a high debt ratio negatively impacts profitability and value as it places added constraints on business operations. However, evidence of a positive relationship also appears, theorizing that firms benefit from leverage, and also because profitable firms are able to attract more debt capital (Peterson and Rajan 1997). For this reason, we do not pre-specify the relationship between the debt ratio and profitability.

As for working capital, studies have used inventory, accounts receivable, and accounts payable as independent variables. Another common specification is using the cash conversion cycle (CCC) or Net Trade Cycle (NTC). Sometimes, Net working Capital (NWC), computed as sum of cash, accounts receivable (AR), and inventory (INV), minus accounts payable (AP). Both CCC and NWC are composite variables, where CCC is AR + INV – AP and NWC is Cash + AR + INV – AP. Using AR, INV, and AP as mutually independent variables ignores the structural dependence, and the GMM method thus becomes necessary. CCC and NWC measure the composite effect on profitability, but the exclusion of a liquid cash balance takes out an important element of working capital, as the importance of investment in cash balance has been demonstrated by Kieschnick et al. (2013), De Almeida and Eid (2014), Afrifa (2016), and Afrifa and Tingbani (2018). Current Ratio (CR), obtained by dividing current assets by current liabilities, is a different transformation of the same variables, (Cash + AR + Inventory)/AP makes the model more parsimonious, and it is certainly worthwhile testing if this captures the relationship between profitability and working capital. CR will be high when net working capital is positive, and CR will be below 1 when net working capital is negative.

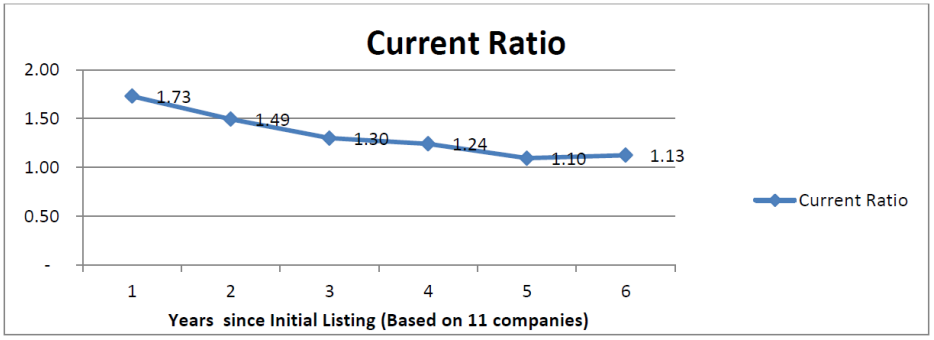
Table 1. Descriptive Statistics

	CR	FS	FUNDAG	TD	ROA
Mean	1.362035	20.32202	0.047042	0.373227	0.043170
Median	1.176428	20.30528	0.005917	0.348929	0.030760
Maximum	7.457085	25.04234	1.000000	1.826625	0.479176
Minimum	0.029440	17.09908	0.000000	0.000000	-0.695661
Std. Dev.	0.781205	1.101022	0.161104	0.268311	0.076852
Skewness	2.460603	0.247325	5.329600	0.614217	-0.893369
Kurtosis	12.94503	3.909347	31.32278	3.359375	18.09792
Jarque-Bera	4232.315	36.83593	31480.57	56.31310	7945.422
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	1054	1054	1054	1054	1054

Jarque-Bera statistics and the zero p-values provide evidence that the distributions of all variables display significant departures from the normal distribution. We take first differences of the variables to obtain stationarity, which is a required condition for running time series regressions.

It is also good that the fluctuation in net working capital and current ratios resulting from external funding should be controlled. We do this by creating a variable named age of latest funding (X_4: FUNDAG), defined as $X_4 = 1/Z^2$, where Z is the number of years since the last major funding, with the value being 1 in the year of funding. In Figure 1 below, we see the pattern of CR trailing off after the IPO. Here, recent funding is associated with a high current ratio, which declines toward a low value (close to zero) quite quickly. This formulation of X_4 can also be found in Alom (2015).

Figure 1. Trend of Current Ratio since Listing (No Additional External Funding)



3.3 The Model

3.3.1 The GMM Specification

In a panel dataset, the basic GMM equation is specified as :

$$y_{i,t} = \alpha_i + \beta_{1i}x_{1i,t} + \beta_{2i}x_{2i,t} + \cdots + \beta_{ki}x_{ki,t} + \delta_{it} + \varepsilon_{i,t}, \quad (1)$$

for t = 1,…..,T; i = 1, …, N, k = 1,….., K,

where T refers to the number of observations over time, N refers to the number of firms (66) in the panel, and K refers to the number of regression variables (four in our case). Moreover, $\boldsymbol{\delta_{it}}$ corrects for endogeneity in the variables.

For the purpose of this paper, we have balanced panel data and can restate the above equation as:

$$y_{i,t} = \alpha_i + \beta_{1i}x_{1i,t} + \beta_{2i}x_{2i,t} + \beta_{3i}x_{3i,t} + \beta_{4i}x_{4i,t} + \delta_{it} + \varepsilon_{i,t}, \quad (2)$$

for t = 1,…..,14; i = 1, …, 66, k = 1,….., 4, y = ROA, x_1 = CR, x_2 = FS, x_3 = TD, and x_4 = FUNDAG.

Equation 2 above examines if ROA is influenced by the current ratio and the other independent variables. In order to examine if firms with better performance maintain a better CR, we rewrite the equation as:

$$y_{i,t} = \alpha_i + \beta_{1i}x_{1i,t} + \beta_{2i}x_{2i,t} + \beta_{3i}x_{3i,t} + \beta_{4i}x_{4i,t} + \delta_{it} + \varepsilon_{i,t}, \quad (3)$$

for t = 1,…..,14; i = 1, …, 66, k = 1,….., 4, y = CR, x_1 = ROA, x_2 = FS, x_3 = TD, and x_4 = FUNDAG.

We employ the Pairwise Dumitrescu Hurlin (DH) causality test (2012) to investigate short-run dynamic relationships, but do not report the detailed results for sake of space; instead, we summarize the results here, which indicate a strong short-run cointegrating bidirectional relationship between current ratio (CR) and return on assets (ROA) as is postulated in this paper. While it is bidirectional, the results indicate that, in the short run, a change in ROA will have a greater impact on liquidity on a DH causality basis than the other way around. The DH causality indicates a strong bidirectional relationship between total debt (TD) and current ratio (CR). A firm's ability to tap into long-term debt allows it to reduce its reliance on short-term debt and maintain better liquidity. We find that firm size (FS) DH causes total debt, but total debt does not cause Firm Size (FS).

3.3.2 The Quantile Regression Specification

The quantile estimates are robust to heteroskedasticty and are asymptotically consistent and efficient. The model can also be applied when the relationship is not strictly monotonic. The regression equations remain the same as above. In the quantile regression, there will be a beta estimate for each quantile of the dependent variable (arranged in ascending order). In a classical regression, the error is computed from the conditional mean, but in a quantile regression, the error is computed from the conditional quantile value at the particular quantile.

Quantile regression minimizes $\sum_i q|ei| + \sum_i (1-q)|ei|$, which is a sum that asymmetrically penalizes $q|e_i|$ for under-prediction and $(1\text{-}q)|e_i|$ for over-prediction. Linear programming is used to carry out the minimization process. The estimates provided are robust and allow us to differentiate the effect of the independent variables in greater detail. In the expanded form we can restate the above equation as:

$$y_{i,j,t} = \alpha_i + \beta_{1ij} x_{1ij,t} + \beta_{2ij} x_{2ij,t} + \beta_{3ij} x_{3ij,t} + \beta_{4ij} x_{4ij,t} + \delta_{ijt} + \varepsilon_{ij,t}, \quad (4)$$

for t = 1,⋯,14; i = 1,⋯, 66, k = 1,⋯, 4, y = ROA, x_1 = CR, x_2 = FS, x_3 = TD, x_4 = FUNDAG, and j are the quantile locations.

In order to examine if firms with better performance maintain a better current ratio, we rewrite the equation as:

$$y_{i,j,t} = \alpha_i + \beta_{1ij} x_{1ij,t} + \beta_{2ij} x_{2ij,t} + \beta_{3ij} x_{3ij,t} + \beta_{4ij} x_{4ij,t} + \delta_{ijt} + \varepsilon_{ij,t}, \quad (5)$$

for t = 1, ⋯,14; i = 1,⋯, 66, k = 1,⋯, 4, y = CR, x_1 = ROA, x_2 = FS, x_3 = TD, x_4 = FUNDAG, and j are the quantile locations.

If we specify 10 quantiles, then we will be able to generate nine slope estimates for each independent variable with the associated confidence intervals. We also will be able to make statements on whether the dependent variable is uniformly affected through the range of data, or whether the data respond differently for different values of explanatory variables. Firms in the lowest current ratio quantiles suffer from poor creditworthiness and have limited access to external financing. Firms in the top quantiles have greater creditworthiness and, as a result, better access to external financing.

We shall compare the quantile estimates with GMM estimates. Next, we compare the quantile estimates with four subsets of GMM estimates. If the relationship is indeed concave, then the slope coefficients should be different for different subsets if the relationship pattern changes over the observation range.

3.3.4 Expected Signs of Coefficients (ROA Dependent)

For the coefficient estimates of equation 2, the expected signs are negative for Total Debt (TD) and positive for Return on Asset (ROA). While high total debt to total assets represents higher leverage and should have a positive relationship with return on equity, it should have a negative relationship with ROA, because part of the asset return will be eroded by the interest payment. Therefore, the coefficient should have a negative sign. As for the current ratio being a predictor of ROA, the presence of an optimal level suggests a negative sign at very high and very low current ratios, and we should see that given the clusters we created and also through quantile regression. We cannot pre-specify what the average slope is, since, theoretically, both negative and positive signs can emerge. The literature consistently provides evidence of a positive relationship between size and ROA, and we expect the same positive sign. The variable X_4 is a control variable, and a specification is not necessary.

3.3.5 Expected Signs of Coefficients (CR Dependent)

With current ratio as the dependent variable in equation (3), the expected signs are negative for Total Debt (TD) and positive for Return on Asset (ROA). As for ROA being a predictor of CR, a positive sign should be associated with high ROA, because firms with better profitability should be able to maintain a healthier current ratio. We expect negative coefficients for the total debt variable as high total debt will impinge the ability of a firm to rely on increased short-term financing.

4. Regression Results and Findings

We used EViews software to generate our estimates. First, we derive the GMM estimates for the complete data et. We take ROA as the dependent variable to see the effect of the current ratio on profitability and then place the current ratio as the dependent variable and ROA as the independent variable. The estimates are shown below.

4.1 GMM Estimates (Complete Dataset)

The GMM estimates based on the complete dataset are as follows:

ROA= -0.02 + 0.003 FS - 0.029 FUNDAG - 0.07 TD + 0.006 CR (6)
(0.74) (1.84) (1.95) (-7.07)** (2.40)*

CR= 1.79 + 0.03 FS + 0.56 FUNDAG – 1.50 TD + 1.01 ROA (7)
(4.53)** (1.35) (2.86)** (-12.12)** (2.40)*

The figures in parenthesis are t values. One asterisk indicates significance at the 5% level, and two asterisks indicate significance at the 1% level. The bidirectional relationship between ROA and CR is evident and significant, and the coefficient signs are consistent with our expectations.

4.2 GMM Estimates for Subsets

We classify the sample into four subsets as follows:
Group 1 - Poor: Current Ratio 1.1 or less,
Group 2 - Marginal: Current Ratio between 1.1 and 1.3,
Group 3 - Better than Marginal: Current Ratio between 1.3 and 1.5, and
Group 4 - Reasonable to high: Current Ratio above 1.5.

The classification is somewhat arbitrary, and its purpose is to test if the estimates of the subsets significantly vary from the estimates based on the complete set and if the effects are different for different subsets. We use a classification scheme that one can relate to in Bangladesh in terms of the characterization of liquidity and current asset investment and also make sure that there are at least eight firms in each group. This allows us to test if performance is affected at extreme ends as suggested in textbooks and the literature. This clustering process is a simpler version of hierarchical cluster analysis employed by Solis and Tseng (2018). Assuming investment in current assets may not be negative, the current ratio cannot be less than zero. The current ratio has no limit on the upper side in group 4, and overinvestment in working capital assets will be reflected in this group. However, from a cursory look at the data, we do not find any sustained high current ratios to suggest sustained over-investment.

The GMM estimates for the data subsets are provided in Table 2 and Table 3 below. In Table 2 the current ratio is specified as the dependent variable. In Table 3, return on assets (ROA) is specified as the dependent variable.

Table 2. GMM Regression Estimate with CR as Dependent Variable (1998-2014)

Variables	Coefficients and t-values (Current Ratio 1.1 or less)	Coefficients and t-values (Current Ratio between 1.1 and 1.3)	Coefficients and t-values (Current Ratio between 1.3 and 1.5)	Coefficients and t-values (Current Ratio above 1.5)
Constant	1.93 (t = 3.20)	0.50 (t = 1.28)	1.01 (t = 2.03)**	4.15 (t = 4.63)*
ROA	0.14 (t = .29)	0.31 (t = 1.82)*	0.80 (t = 2.24)**	2.49 (t = 3.49)**
Firm Size	-0.04 (t = 1.34)	0.03 (t = 1.63)	0.05 (t = 2.28)**	-0.07 (t= 1.84)**
Total Debt	-0.38 (t=4.43)**	-0.05 (t=0.50)	-1.02 (t=4.10)**	-1.47 (t=4.62)**
Fundag	0.74 (t = 2.52)**	0.61 (t = 2.82)**	0.42 (t = 2.38)**	-0.94(t = 2.67)**

Note: * indicates significance at the 5% level, and ** indicates significance at the 1% level.

The coefficient signs are consistent to our expectation throughout, and the positive association between ROA and the current ratio is much more clearly defined in the high CR groups. The firms with higher earnings maintain a stronger current ratio. The total debt ratio is negative as expected and fairly strong statistically except for the second

group (Current Ratio between 1.1 and 1.3). The relationship between Firm Size and Current Ratio is significant only for the two relatively high current ratio groups, suggesting that bigger firms are better able to maintain healthier current ratios and smaller firms have difficulty maintaining that ratio, perhaps due to inadequate resources available to them. The estimates provided in Table 3 are presented with ROA as the dependent variable for the same dataset.

Table 3. GMM Regression Estimate with ROA as Dependent Variable (1998-2014)

Variables	Coefficients and t-values (Current Ratio 1.1 or less)	Coefficients and t-values (Current Ratio between 1.1 and 1.3)	Coefficients and t-values (Current Ratio between 1.3 and 1.5)	Coefficients and t-values (Current Ratio above 1.5)
Constant	-0.163 (t = 3.02)	-0.0079 (t = 0.50)	0.1834 (t = 3.02)**	0.1546(t = 3.33)*
CR	0.004 (t =.79)	0.0028 (t = .40)	0.0122 (t = 2.01)**	0.0035 (t = 1.10)
Firm Size	0.0102(t=3.76)**	0.0022 (t = 2.37)**	-0.0046 (t = 1.53)	-0.0038(t=1.90)*
Total Debt	-0.024 (t=2.38)**	-0.0173 (t =1.44)	-0.1073 (t=4.68)**	-0.71 (t =2.92)**
Fundag	-0.0238(t= 1.53)**	0.011 (t = 0.91)	-0.021 (t = 1.36)	-0.008 (t = 0.42)

Note: * indicates significance at the 5% level, and ** indicates significance at the 1% level.

The results in Table 3 present a different picture. Firm size shows a positive effect on ROA for the first two groups of firms. The coefficients of the fourth group are negative and marginally significant. Total debt, as expected, has negative coefficients and are significant, reflecting the over-reliance on borrowed capital in the country. The impact of CR on ROA is insignificant except for firms belonging in the current ratio group between 1.3 and 1.5, and it is marginally significant at the 5% level. Therefore, in Bangladesh, support is weak at best for the hypothesis that higher investment in working capital assets. We find very little evidence that efforts to manage investment in working capital will bear much fruit. This does not suggest that a firm will not find avenues of improvement in its activities, but fine tuning probably is not justified. If we contrast this with Table 2, then we see that firms that are more profitable invest relatively higher amounts into working capital assets as a multiple of current liabilities. This is more supportive of the argument that current ratios, and implicitly working capital level, are shaped more by profitability and not supportive of the argument that tweaking the current ratio may improve profitability. Taking Tables 2 and 3 together, we conclude that firms with extremely low investment in working capital assets relative to current liabilities struggle with profitability, and that also firms with low profitability struggle to maintain a healthy level of investment in working capital assets. For this group, the right prescription is a significant investment in working capital assets to get out of this group.

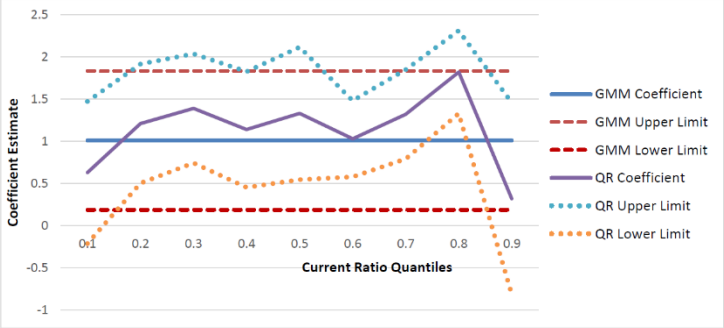
4.3 Quantile Regression Estimates and Confidence Intervals

In the preceding section we find a non-linear relationship (the slopes are different at different levels), but no evidence of a U-shape relationship. A U-shape may be

prevalent and observed in larger economies, and our data are simply unable to unearth that. Quantile regression, developed by Koenker and Bassett (1978, 1982), is better equipped to detect non-linearity. We look at the coefficient estimates of equation 4 along with the corresponding confidence interval at the 95% confidence interval. These are shown in Figures 2, 3, and 4, and the quantile values of current ratios are 0.69, 0.91, 1.03, 1.12, 1.21, 1.35, 1.55, 1.91, and 2.60. If a confidence interval at a particular quantile does not include zero, then a significantly positive relationship will be indicated with coefficient estimates remaining above zero, and a negative relationship will be shown with the confidence interval remaining below zero.

In Figure 2 below the estimated coefficients of the ROA variable along with their confidence bands are plotted on top of the GMM coefficient estimate and the confidence interval. The current ratio is the dependent variable.

Figure 2. Current Ratio as Dependent of ROA



The GMM coefficient and its confidence interval obtained from the estimate provided in Equation (6) show that ROA is positively associated with the current ratio. The quantile coefficient values fall mostly within the GMM confidence band. Ignoring the most extreme quantiles, one might detect a slight increasing tendency in the coefficient values. Only at the 8th quantile does the QR coefficient hit the upper confidence interval band of the GMM estimate. Thus, the strongest relationship is found, not surprisingly, when CR is between 1.55 and 1.91, both with GMM estimate and quantile estimates. The quantile estimates generally fall above the GMM estimate except below the quantile 0.2 (CR = 0.91) and above the quantile 0.8 (CR = 1.91). We suspect that the samples in the higher quantiles consist primarily of incidences of sudden inflow of liquid assets, and the time taken into fully deploying the fund is not fully captured by the variable specified as X_4.

We now examine the relationship between the current ratio and total debt to assets ratio. A low current ratio in Bangladesh implies relatively high reliance on short-term funding sources (and resulting in low proportionate investment in working capital assets)

and is a possible reflection of a lack of access to long-term capital. Firms unable to use long-term sources to fund their permanent assets will rely on short-term sources and have a low current ratio. The confidence interval for Total Debt to Total Assets is shown in Figure 3 with CR as the dependent variable.

Figure 3. Current Ratio as Dependent of Coefficient Confidence Interval of Total Debt to Assets

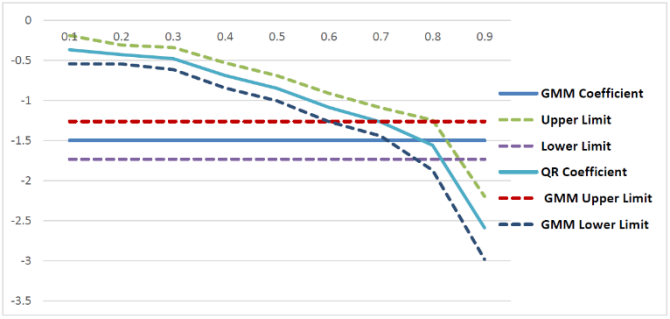
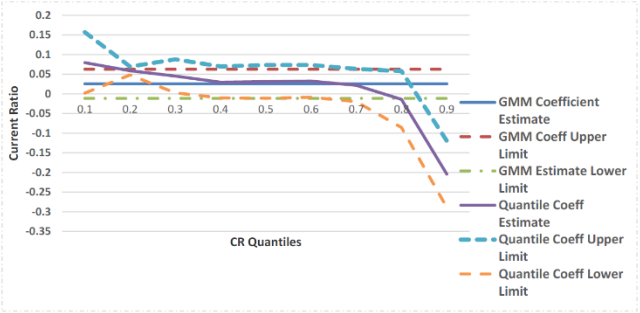


Figure 3 provides a very convincing case for using quantile regression, asthe GMM-based coefficient does not bring out the variation in the relationship quite clearly. The coefficient is negative in both the GMM estimate and quantile estimates. However, for firms with a very low current ratio, quantile regression indicates that the coefficients are significantly less negative than the coefficient estimates for high current ratio firms, and the slopes actually are significantly more negative for firms with a current ratio in quantile 0.8 (current ratio 1.55) and above. Clearly, the negative relationship is much more pronounced for firms that maintain a larger investment in working capital assets.

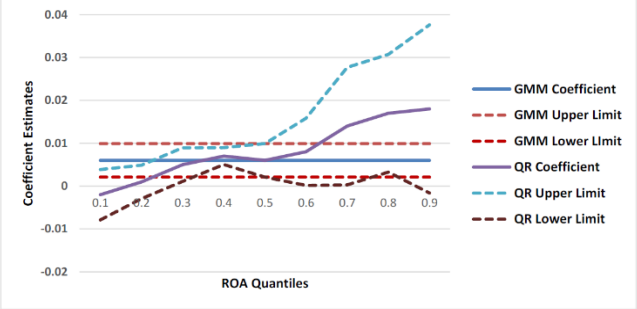
If we take a look at the relationship between firm size and current ratio for various quantiles of CR in Figure 4, we do not find any noticeable difference in estimates generated by quantile regression and GMM regression. The estimates are not statistically significant, and hence no variability in current ratio can be attributed to firm size.

Figure 4. Current Ratio as Dependent of Firm Size Coefficient Confidence Intervals



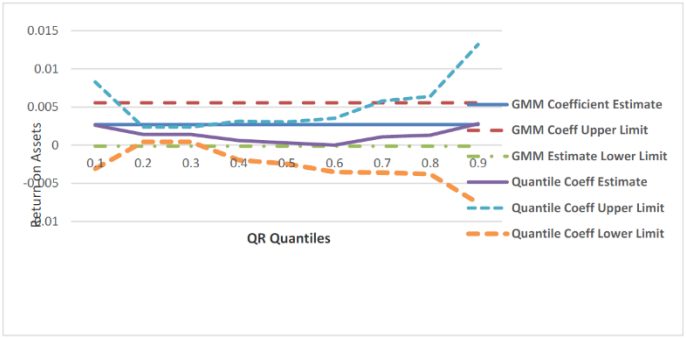
We next take a look at the plots with ROA as the dependent variable and CR as the explanatory variable. Figure 5 shows the CR coefficients at the specified ROA quantiles, and ROA is the dependent variable. (The quantile values are, in decimal form, -0.002, 0.01, 0.017, 0.024, 0.032, 0.041, 0.057, 0.077, and 0.125.) Note that while the GMM estimate of the CR coefficient is statistically significantly positive in Equation (6), the QR estimate confidence intervals rise above the zero slope line only at quantile 0.3. The coefficient itself is negative until quantile 0.2, rises above the upper limit of the GMM coefficient, and becomes significantly higher than the GMM coefficient at about the quantile value of 0.6. Therefore, CR appears to help improve profitability marginally at best only for firms that belong in the 0.06 and higher quantiles (ROA exceeding 0.041), but their coefficients are insignificant or marginally significant. The greater relationship between profitability and large investment in current assets takes place only for the

Figure 5. Return on Assets as Dependent of the Current Ratio



group that is relatively highly profitable (i.e., high ROA quantiles), which is evident in Figure 5, and is not valid for firms with low profitability. Drawing attention to Figure 2 again, the ROA coefficient is mostly flat through all quantiles of current ratios. The current ratio coefficients are larger for profitable firms. The likely explanation is that firms with higher ROA simply make sufficient investment in working capital assets to support their operations. They benefit from the availability of resources and the positive experience they have with the cushion in working capital and profitability. On the left side of the figures, the firms probably lack that beneficial experience and also the resources resulting from not so robust business activities and creditworthiness. These firms probably need something like a "big push" either in talent or an injection of working capital that will move them significantly to the right side of Figure 2. Once they have sustained experience in the profitable experience zone, they will probably not go back to low investment in working capital.

Figure 6. Return on Asset as Dependent of Firm Size Coefficient Confidence Intervals



For the potential effect of firm size on ROA shown in Figure 6 above, we do not see any significant effect on profitability with either of the two approaches when the coefficient confidence intervals include zero. We therefore, conclude in our data that there is no evidence of firm size influencing the profitability of a firm.

Figure 7. ROA as Dependent of Total Debt to Assets' Coefficient Confidence Intervals

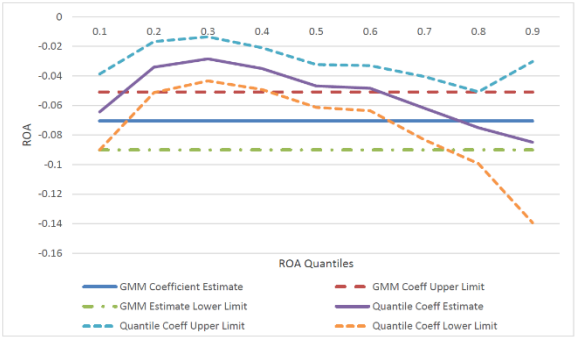


Figure 7 provides an interesting response of Total Debt to Total Asset ratio on Return on Assets. All coefficients are negative, indicating that reliance on debt hurts Return on Assets. The quantile coefficients fall above the confidence interval of the GMM estimate for quite a wide range, from ROA quantile 0.2 to quantile 0.6, implying that the impact of reliance on debt capital on performance is less in this quantile range, and the negative impact increases for higher quantiles as seen by the downward slope of the quantile coefficients as one moves to the right.

We exclude the QR confidence interval figures for the FUNDAG variable, a control variable, as a predictor of Return on Asset and Current Ratio for space constraints and for not being meaningful for the main purpose of this paper.

5. Findings, Summary, and Implications

In Table 2 the explanatory power of ROA keeps significantly increasing with an increasing as one moves to the right. Firms with a stronger proportionate investment in current assets relative to current liabilities show a strong relationship with profit performance. Clearly, a bidirectional relationship is at work, with profitability supporting sustained investment in current assets, and sufficient investment in current assets supporting high profit performance. In our view, what Tables 2 and 3 show us is that once firms attain a stable operating level that generates sustained profits, these firms get comfortable with their working capital and liquidity level. There is hardly any scope of going back and forth to try to find an optimal level. In a competitive business segment, it is not an option for the other firm with a quality inferior to the leading company to tighten credit or require faster payment.

Quantile regression analysis provides additional support for our conclusion. In Figure 2, ROA has a positive coefficient throughout, very stable (around 1) for a vast majority of firms' quantiles (0.2 to 0.7), and not significantly different from zero at both ends. This tells us that for a vast majority of companies, it will make no difference if they maintain a level of investment in current assets that place them between quantile 0.3 and quantile 0.7 (current ratio between 1.03 and 1.91). The strongest association is found when the investment in current assets produces a current ratio between 1.55 and 1.91. According to Figure 2, high performance is associated with high current ratios, provided the firms are already in the high current ratio class. According to Figure 5, low performers have no association between current ratios and profitability. This implies that profitable firms should maintain a stronger current ratio, but as they approach a current ratio of 2, the beneficial association may weaken.

In Table 3, which depicts the impact of the explanatory variables on profitability, tightening trade credit or slim inventory holding will lead to a movement toward the left, but there is no indication of any impact on profitability from such decisions. Firms with a fairly slim investment in current assets cannot expect to improve profitability through working capital management; they have to perform better in terms of production, marketing, and service. This is especially true in times of weakness in the economy when sales may be helped with more attractive trade credits (Brennan et al. 1988, Peterson and Rajan 1997, Emery 1987). Customer loyalty will likely be more important in those times (Lee and Stowe 1993, Ng et al. (1999), Wilner 2000).

When ROA is the dependent variable, the confidence interval at the tenth quantile includes zero, indicating that the link between profitability and investment in current

assets is lost. From quantile 0.2 to 0.6, the coefficient value is just about the same as the GMM estimate and is roughly flat. There is a spike, though not statistically significant at around quantiles 7 and 8, implying that these relatively high current ratios (in the context of Bangladesh) are preferred by profitable firms. This also suggests that firms in the lower quantiles should increase investment in current assets. In Figure 3, the GMM coefficient and quantile regression coefficients of Total Debt to Asset ratio show a significantly negative association with the current ratio. Quantile regression estimates bring forth a glaring distinction in the effects of different levels of creditworthiness of firms on the relative investments that firms make in current assets. The significantly greater negative coefficients for firms with higher creditworthiness imply that they can have relatively lower investment in current assets, presumably because access to longer term debt allows them to work with slimmer investment in current assets.

The main contribution of this paper is in providing evidence that firms with inadequate working capital will struggle to build a dependable and sustainable set of business activities without a strong dose of working capital (Tables 2 and 3) to push them out of their doldrums into sustainable business operations. Seeking optimal working capital is a not an issue for them. The results also indicate that if liquidity is impaired for any reason, then an infusion of working capital will become essential to get them out of the situation in order to survive in the business world. For profitable and successful companies, profitability and investment in working capital are dependent on each other. There may be opportunities to improve management of working capital, but other aspects of the business probably will contribute more to profitability. Overall, our recommendation is not to react too quickly to fluctuations in the working capital levels relative to current liabilities and instead focus on other factors to improve liability.

The data we use have some unique features. The lack of a market for long-term sources of capital, the fact that formal trade credit granting practices are fairly uncommon, and reliance on upfront and advance payments in many cases also make it difficult to generalize the results to other countries. Each developing country seems to have some unique characteristics that may make replication difficult.

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