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Impact of COVID-19 exposure on working capital management: The moderating effect of investment opportunities and government incentives

Augustine Tarkom

A.R. Sanchez Jr. School of Business, Texas A&M International University, 5201 University Boulevard, Laredo, TX 78041, United States of America

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ABSTRACT

This study examines the impact of the COVID-19 pandemic on firms’ working capital management (WCM) covering 2,542 US-publicly traded firms for the period 2019Q1–2021Q2. Proxying WCM as cash conversion cycle (CCC), I find that COVID-19-exposed firms operate with higher levels of CCC. I show that firms with more investment opportunities and firms that receive government incentives (deferred taxes and investment tax credit (DT_ITC)) operate with lower levels of CCC. Overall, I provide evidence of the significant adverse impact of COVID-19 on WCM and show that the effect could be mitigated with an increase in investment opportunities and government incentives.

1. Introduction

The motivation of this paper stems from the point that the COVID-19 pandemic is purported to undermine the working capital management (WCM) of firms. However, empirical evidence about the relation between WCM and COVID-19-exposed firms remains scanty. Ernst and Young reported that various firms struggle to maintain decent control over short-term cash flows and the working capital (WC). More practically, Ernst and Young’s 2019 WC report stated that if the 2000 leading companies in the United States and Europe effectively manage their WC, they can extract up to US$ 1 trillion. Nevertheless, the COVID-19 pandemic, being unique with its challenges, make improvement even more complicated.

PwC reported that US business activities are decelerating as millions exercise social distancing to curtail the spread of COVID-19. As such, firms are either presently facing or foreseeing substantial limitations on cash and WC, involving a probable liquidity upheaval. Following this, Barclays released a report indicating that the COVID-19 pandemic has had an intense effect on businesses, particularly, their cash conversion cycle (CCC). Business Development Company (BDC) also stated that the ability of firms to perceive and reduce their CCC will help keep them afloat. The Department of Defense, further received $500 million for a WC fund to respond to the pandemic as reported by Government Accountability Office.
The independent variable in this study is COVID-19 exposure (COVID\textunderscore Exposure). It is defined as the firm’s exposure to COVID-19, constructed on the proximity of COVID-19 associated words to either positive or negative tone in quarterly-earnings conference calls divided by the number of sentences in the transcript (Almaghrabi, 2021; Hassan et al., 2020). For robustness check, I used negative sentiment related to COVID-19 (Covid\_Neg\_Sentiment) obtained from Hassan et al. (2020). I expect a positive effect of COVID\_Exposure on CCC and WCR.

6 Government Accountability Office (GAO) - https://www.gao.gov/products/gao-21-104590
and COVID_Neg_Sentiment on CCC. To ensure that my results are not spuriously driven, I utilize a similar pandemic outbreak exposure proxy called SARS_Exposure which is measured similarly to the COVID_Exposure measure which is obtained from Hassan et al. (2020). I expect the effect of SARS_Exposure on CCC to be positive but insignificant.

To examine the moderating effect of investment opportunities and COVID_Exposure on CCC, I used Tobin’s Q as a measure of a firm’s investment opportunities (Ujah et al., 2020). Tobin’s Q has been used to explicate several diverse corporate phenomena, such as cross-sectional variations in decisions regarding investment and diversification (Chung and Pruitt, 1994). Ujah et al. (2020) indicated that Tobin’s Q reduces the CCC by an average of 15 days. Therefore, I explored whether Tobin’s Q reduces the effect of COVID_Exposure on CCC. I expect a negative moderating effect. Further, I explored the moderating effect of DT_ITC and COVID_Exposure on CCC. Smith (2020) argued that extending the ITC and production tax credit would allow firms to hire more workers and inject billions into the US economy. Also, Efficio Ltd.’s 2020 report suggested that applying for tax deferrals could help improve CCC. I posit an effective WCM with more DT_ITC. Thus, a negative relation between DT_ITC and CCC is expected. I also expect the negative effect of COVID-19 to be mitigated by the moderation between DT_ITC and COVID_Exposure. I addressed the research questions using the following fixed-effect model:

\[
CCC_{it} = \beta_0 + \beta_1 \text{COVID_Exposure}_{it} + \beta_2 \text{Tobin's Q}_{t-1} + \beta_3 (\text{COVID_Exposure}_{it} \times \text{Tobin's Q}_{t-1}) + \beta_4 \text{DT_ITC}_t + \delta \text{Controls}_{it} + I_t + \mu_u
\]  

(1)

where CCC is defined as 365*(receivables/cogs + inventories/sales - payables/cogs, cogs = cost of goods sold, COVID_Exposure is as defined before, Tobin’s Q is measured as the lag of the ratio of the firm’s market value to its replacement cost of assets, DT_ITC is measured as the ratio of deferred taxes and investment tax credit to total assets, Controls are the set of variables noted to affect CCC. I used ROA (return on assets = net income to total assets), LEV (financial leverage = debt to asset ratio), SIZE (the natural logarithm of firm’s asset), Tangibility (ratio of property plant and equipment to total assets), Profitability (operating income before depreciation and amortization to total assets), Growth (quarter-on-quarter percent change in assets), Capital Exp. (capital expenditure to total

7 Efficio Limited 2020 report link - https://www.efficioconsulting.com/en-us/events/webinar/navigating-the-working-capital-challenges-during-the-covid-19-recovery-phase/.)
### Table 2
Pearson Correlation Matrix.

| Variables       | (1) CCC | (2) WCR | (3) Covid_Exp | (4) Covid_Neg_Sentiment | (5) SARS_Exp | (6) Tobin's Q | (7) DT_TTC | (8) ROA | (9) LEV | (10) SIZE | (11) Tangibility | (12) Profitability | (13) Growth | (14) Capital Exp. | (15) M2B | (16) Growth | (17) Profitability | (18) M2B |
|-----------------|--------|--------|---------------|--------------------------|--------------|--------------|------------|--------|--------|-----------|-------------------|---------------------|------------|-------------------|---------|------------|-------------------|---------|
| (1) CCC         | 1.000  |        |               |                          |              |              |            |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (2) WCR         | 0.862* | 1.000  |               |                          |              |              |            |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (3) Covid_Exp   | 0.074* | 0.045* | 1.000         |                          |              |              |            |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (4) Covid_Neg_Sentiment | 0.070* | 0.058* | 0.842*        | 1.000             |              |              |            |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (5) SARS_Exp    | 0.017  | 0.008  | 0.051*        | 0.034*          | 1.000       |              |            |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (6) Tobin's Q   | -0.013*| -0.049*| 0.029*        | -0.032*        | 0.016*      | 1.000       |            |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (7) DT_TTC      | -0.018*| 0.015* | -0.009        | -0.001         | 0.002       | -0.137*     | 1.000     |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (8) ROA         | -0.132*| -0.150*| -0.026*       | -0.030*        | 0.017*      | 0.051*      | 0.037*    |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (9) LEV         | -0.092 | -0.100*| 0.001         | 0.004         | -0.008      | -0.148*     | 0.067*    |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (10) SIZE       | -0.123*| -0.127*| -0.059*       | -0.068*        | 0.007       | -0.115*     | 0.213*    |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (11) Tangibility| -0.220*| -0.257*| -0.078*       | -0.037*        | -0.003      | -0.267*     | 0.147*    |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (12) Profitability| -0.100*| -0.212*| -0.022*       | -0.043*        | 0.026*      | 0.388*      | -0.251*  |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (13) Growth     | 0.003  | -0.004 | 0.003         | -0.019*        | 0.032*      | 0.188*      | -0.024*  |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (14) Capital Exp.| -0.111*| -0.136*| -0.073*       | -0.057*        | 0.007       | -0.017*     | 0.056*    |        |        |           |                   |                     |            |                   |         |            |                   |        |
| (15) M2B        | -0.046*| -0.069*| 0.008         | -0.027*        | 0.001       | 0.575*      | -0.077*  |        |        |           |                   |                     |            |                   |         |            |                   |        |

This table presents the Pearson correlation matrix of all variables included in the study. Variables retain their definitions as before. * p<.1.

### Table 3
Effect of COVID-19 on Working Capital Management (WCM).

| Variable                  | PreCOVID (1) | COVID (2) | PreCOVID (3) | COVID (4) | PreCOVID (5) | COVID (6) | PreCOVID (7) | COVID (8) |
|---------------------------|--------------|-----------|--------------|-----------|--------------|-----------|--------------|-----------|
| Covid_Exp                 | 0.021 (0.016)| 0.020*** (0.006)| 0.044 (0.028)| 0.052*** (0.011)| 0.009 (0.007)| 0.017*** (0.004)| 0.014 (0.018)| 0.036*** (0.008)|
| Covid_Neg_Sentiment       |              |           |              |           |              |           |              |           |
| ROA                       | 0.384 (0.302)| -0.739*** (0.190)| 0.383** (0.162)| -0.722*** (0.107)| -0.089 (0.097)| -0.604*** (0.107)| -0.090 (0.113)| -0.604*** (0.107)|
| LEV                       | 0.365** (0.153)| 0.313*** (0.085)| 0.371*** (0.086)| 0.308*** (0.085)| 0.133** (0.057)| 0.256*** (0.059)| 0.136** (0.059)| 0.257*** (0.059)|
| SIZE                      | -0.178** (0.085)| -0.037 (0.034)| -0.175*** (0.040)| -0.034 (0.034)| -0.072*** (0.026)| -0.058** (0.026)| -0.070*** (0.026)| -0.059** (0.026)|
| Tangibility               | -0.146 (0.242)| 0.746*** (0.189)| -0.142 (0.162)| 0.737*** (0.189)| -0.103 (0.107)| 0.428*** (0.133)| -0.101 (0.133)| 0.426*** (0.133)|
| Profitability             | -5.502*** (0.530)| -5.807*** (0.255)| -5.521*** (0.255)| -5.789*** (0.255)| -4.990*** (0.255)| -5.318*** (0.255)| -4.919*** (0.255)| -5.322*** (0.255)|
| Growth                    | 0.076 (0.061)| 0.075* (0.043)| 0.073* (0.038)| 0.074* (0.043)| 0.064*** (0.025)| 0.073** (0.025)| 0.063** (0.025)| 0.074** (0.025)|
| Capital Exp.              | -0.166 (0.483)| -0.883*** (0.243)| -0.200 (0.333)| -0.867*** (0.333)| -0.244 (0.161)| -0.263* (0.234)| -0.001 (0.160)| -0.233 (0.160)|
| M2B                       | -0.003* (0.001)| -0.002* (0.001)| -0.003* (0.001)| -0.002* (0.001)| -0.000 (0.001)| -0.000 (0.001)| -0.000 (0.001)| -0.000 (0.001)|
| Constant                  | 1.651*** (0.618)| 0.428 (0.275)| 1.630*** (0.301)| 0.412 (0.273)| 1.816*** (0.199)| 1.548*** (0.192)| 1.806*** (0.192)| 1.562*** (0.191)|

This table presents the results of my main model. I standardized CCC to have a mean (Std.Dev) of 0(1) in all models. The results hold when the raw values are used. Robust standard errors are presented in parentheses. *** p<.01, ** p<.05, * p<.1. †† indicates that a test of equality of coefficients for COVID_Exp of Columns (1) and (2) are significant at p<.05.

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Table 4
Does Investment Opportunities and Government Incentives Moderate the Impact of COVID-19 on WCM?

| Variable                        | PreCOVID | COVID | PreCOVID | COVID | PreCOVID | COVID | PreCOVID | COVID |
|---------------------------------|----------|-------|----------|-------|----------|-------|----------|-------|
|                                 | CCC      | CCC   | CCC      | CCC   | CCC      | CCC   | CCC      | CCC   |
| Covid_Exp                       | 0.029    | 0.031** | 0.036    | 0.027  | 0.023*** | 0.062 | 0.072*** |
|                                | (0.019)  | (0.010) | (0.048)  | (0.018) | (0.007)  | (0.045) | (0.013) |
| Tobin’s Q                      | −0.011   | −0.036***| −0.012   | −0.038***| −0.04   | −0.007***| −0.517***| −0.886***|
|                                | (0.010)  | (0.009) | (0.010)  | (0.009) | (0.009) | (0.009) | (0.012) | (0.012) |
| Tobin’s Q*Covid_Exp            | −0.004   | −0.007**| −0.014   | −0.009**| −0.037  | −0.045**| −0.003** | −0.083**|
|                                | (0.009)  | (0.003) | (0.023)  | (0.007) | (0.023) | (0.023) | (0.023) | (0.023) |
| DT_ITC                          | −0.517***| −0.886***| −0.518***| −0.690***| −0.141  | −0.083**|
|                                | (0.125)  | (0.053) | (0.126)  | (0.045) | (0.164) | (0.041) |
| DT_ITC*Covid_Exp               | −0.037   | −0.049**| −0.203   | −0.011  |
|                                | (0.080)  | (0.023) | (0.095)  | (0.044) |
| DT_ITC*Covid_Neg_Sentiment     | 0.072*** | 0.264***| 0.595*** | 0.299   | 0.908*** |
|                                | (0.168)  | (0.091) | (0.169)  | (0.012) | (0.091) |
| ROA                            | 0.422**  | 0.418**| 0.419    | 0.772***| 0.419    | 1.010***|
|                                | (0.178)  | (0.178) | (0.178)  | (0.204) | (0.195)  |
| LEV                            | 0.395**  | 0.402***| 0.455*** | 0.374***| 0.463*** |
|                                | (0.095)  | (0.094) | (0.168)  | (0.091) | (0.107)  |
| SIZE                           | −0.207***| −0.208***| −0.264***| −0.112***| −0.260***|
|                                | (0.046)  | (0.046) | (0.095)  | (0.037) | (0.012)  |
| Tangibility                     | −0.148   | 0.796***| −0.301   | 0.595***| −0.299   | 0.908***|
|                                | (0.179)  | (0.179) | (0.262)  | (0.261) | (0.091)  |
| Profitability                   | −6.025***| −6.148***| −6.129***| −5.734***| −5.863***| −5.755***| −5.204***|
|                                | (0.284)  | (0.284) | (0.285)  | (0.276) | (0.567)  | (0.242) |
| Growth                         | 0.088**  | 0.090* | 0.086*   | 0.072   | 0.083    | 0.029  |
|                                | (0.042)  | (0.042) | (0.047)  | (0.046) | (0.044)  |
| Capital Exp.                   | −0.169   | −1.010***| −0.086   | −0.820**| −0.125   | −0.636* |
|                                | (0.270)  | (0.268) | (0.367)  | (0.359) | (0.347)  |
| M2B                             | −0.003** | −0.003**| −0.003*  | −0.002* | −0.003*  | −0.002**|
|                                | (0.001)  | (0.001) | (0.001)  | (0.002) | (0.001)  |
| Constant                       | 2.011*** | 0.891***| 2.334*** | 0.989***| 2.305*** | 1.458***|
|                                | (0.351)  | (0.350) | (0.307)  | (0.685) | (0.683)  | (0.094) |
| Observations                    | 9523     | 9467   | 9523     | 9467   | 9523     | 9467   |
| R-squared                      | 0.082    | 0.117  | 0.082    | 0.118  | 0.097    | 0.156  |
| Number of Firms                 | 2278     | 2293   | 2278     | 2293   | 2278     | 2293   |
| Effect                          | Firm     | Yes    | Yes      | Yes    | Yes      | Yes    |
|                                 | Quarter (Qtr) | Firm & Qtr | Firm & Qtr | Firm & Qtr | Firm & Qtr | Firm & Qtr | Firm & Qtr |

This table presents the moderating effect of Tobin’s Q and DT_ITC on the effect of COVID_Exp on CCC. I standardized CCC to have a mean (Std. Dev) of 0(1) in all models. The results hold when the raw values are used. Robust standard errors are presented in parentheses. *** p<.01, ** p<.05, * p<.1.

assets, and M2B (market to book ratio), I_1 = firm effect, T_1 = quarter effect, and \( \mu_B \) = error term. All variables are winsorized at the 1st and 99th percentile to rule out the effect of outliers. A Hausman test was performed for model selection, and a fixed effect with clustered standard errors (firm and quarter) was deemed fit to model the specification in equation (1). Clustered standard errors account for both serial and cross-sectional correlations (Kwon et al., 2007; Petersen, 2009). Other model diagnostics were duly performed.

3. Results and discussion

Panel A of Table 1 presents the summary statistics of all variables. For the sample period, the mean (Std. Dev) of CCC is 425.689 (411.418). The statistics on Covid_Exp is 0.734 (0.985). These statistics show higher levels of CCC and increasing COVID_Exp. Statistics on other variables are expected. Panel B shows a test of means for all variables before and within the COVID-19 period. The mean difference of CCC is significant, indicating a change in WCM for the period under consideration. It is worth noting that the mean of CCC is higher during the COVID-19 period.

Table 2 presents the Pearson correlation matrix. It is evident that COVID_Exp is positively associated with CCC.
Table 3 presents the main results. The results show that an increase in COVID_Exposure is associated with an increase in CCC during the COVID-19 period but has no effect before the COVID-19 period. The result is interpreted to mean that for a unit increase in COVID_Exposure, CCC increases by 0.073, holding constant other variables. The significance is robust across various specifications, including a quantile regression to study the effect at different levels of CCC. These findings suggest that firms are inefficient in managing their WC when exposed to COVID-19.

Table 4 presents the moderating effect of Tobin's q and DT_ITC and COVID_Exposure on CCC. The results indicate that Tobin's q and the moderation between Tobin's q and COVID_Exposure reduce CCC, thus reducing the days cash remain tied up during the COVID-19 period as presented in Columns 1–4. The evidence amplifies when there are negative sentiments related to the pandemic. In Columns 5–8, I present the evidence using DT_ITC and DT_ITC*COVID_Exposure. The evidence suggests that increases in DT_ITC and its moderating effect reduces CCC. The results suggest that firms receiving more DT_ITC have the potential of managing their WC effectively. This implies that government incentives in the form of deferred taxes and investment tax credit can help firms mitigate the impact effect of the pandemic on their WCM. The results are consistent with WCR as the dependent variable (not reported) as well as employing COVID_Neg_Sentiment measures.

Table 5 presents robustness checks on my main results. I modeled the effect of SARS_Exposure on CCC and find positive but insignificant results for both before and within the COVID-19 period. The evidence is presented in Column 4. The evidence holds when I use WCR as a dependent variable presented in Columns 5–8. These findings suggest that firms are inefficient in managing their WC when exposed to COVID-19.

This table presents evidence to robust my main findings. I standardized CCC to have a mean (Std.Dev) of 0(1) in all models. The results hold when the raw values are used. Robust standard errors are presented in parentheses. *** p < .01, ** p < .05, * p < .1.

Main results

Since CCC is standardized, the economic significance of the coefficient of COVID_Exposure is calculated as 8 days = (0.020*411.418)
evidence suggests that the effect of COVID-19 differs considerably having a strong effect on CCC at higher levels (CCC@75%). This implies that firms that keep more inventories and/or delay in collecting their sales during the COVID-19 period will be cash-constrained which will affect their short-term operations. Test of equality of coefficient for COVID_Exposure at the different percentiles was conducted and the coefficients were significantly different from each other. Evidence for PreCOVID is not reported for the quantile regression, but the findings remain unchanged. It is evident that after controlling for potential endogeneity and utilizing different estimation techniques, evidence holds that firms exposed to COVID-19 operate with higher CCC and WCR, and that the impact could be mitigated with investment opportunities and government incentives.

4. Conclusion

The severe conditions presented by the COVID-19 pandemic have considerably rendered firms inefficient in managing the WC. As such, this study assesses the effect of COVID-19 exposure on CCC and the moderating effect of investment opportunities and government incentives. The study is novel in finding evidence that COVID-19-exposed firms operate with higher CCC levels. Furthermore, it asserts that firms with higher investment opportunities and firms that obtain more DT_ITC could operate with lower CCC. The findings contribute to the ongoing discussions on the impact of the pandemic on corporate decisions and outcomes. Future research could explore other government subsidies that could facilitate efficient WCM among exposed firms. Additionally, further studies could examine the speed of adjustment towards WCM during the pandemic.

Author’s Contribution Statement

Augustine Tarkom - being the single and the corresponding author has performed all of the following tasks in completing the research article for publication.
1. Conception of the research idea
2. Designing the research framework
3. Data collection and preparation
4. Data analysis and interpretation
5. Writing the article
6. Revision of the article

Declaration of Competing Interest

None.

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