Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
The impact of COVID-19 economic crisis on the speed of adjustment toward target leverage ratio: An international analysis

Thuy Anh Vo\textsuperscript{a}, Mieszko Mazur\textsuperscript{b,c}, An Thai\textsuperscript{d,*}

\textsuperscript{a} University of Economics, The University of Danang, Viet Nam
\textsuperscript{b} ISEG School of Management, 3 Rue de la Digue, 59000 Lille, France
\textsuperscript{c} LEM-CNRS 9221, 3 rue de la Digue, 59000 Lille, France
\textsuperscript{d} University of Economics, The University of Danang, Viet Nam

ARTICLE INFO

Keywords:
COVID-19
Target leverage ratio
Capital structure
Economic crisis

ABSTRACT

This paper investigates changes in the speed of adjustment toward target leverage ratio under the impact of COVID-19 economic crisis. Using an international sample of publicly listed firms, we find that, on average, firms tend to adjust their capital structure more rapidly in the period following the breakout of COVID-19. Furthermore, we find that firms domiciled in countries in which COVID-19 causes more severe damage, adjust their target leverage quicker than firms domiciled in less severely affected countries. Overall, our study aims at developing a better understanding of the impact of COVID-19 on corporate financing decisions.

1. Introduction

Existing literature suggests that firms pursue target leverage ratios and that they tend to adjust their leverage once it deviates from the target (Huang and Ritter, 2009; Oztetkin and Flannery, 2012). The deviations may be caused by various systematic or idiosyncratic shocks to the firm. Flannery and Rangan (2006) show that when firms are shocked away from their target leverage they eventually converge toward the target in a timely manner. The dynamic properties of targeting behaviour have significant implications for the firm that go beyond decisions on the capital structure choice.

In this paper, we investigate changes in the adjustment toward target leverage ratio under the impact of the COVID-19 economic crisis using a diverse sample of international publicly-listed firms. Worldwide pandemic of COVID-19 created a large macroeconomic shock to firm revenue, operating profit, and the bottom line net income. However, it did not affect all countries equally. Some economies have been affected more than others depending on the rapidity and effectiveness of the government’s response. Moreover, within the same economy some sectors performed significantly better than others, despite the full-blown pandemic. The empirical question we focus on is whether COVID-19 economic crisis affects the speed of adjustment toward the target leverage ratio, and if so to what extent and under which conditions. This question is particularly relevant because capital structure decisions interact with other key decisions in the organization. To the best of our knowledge, this is the first study that explores the speed of convergence toward target leverage in the context of COVID-19.

Using cross-firm cross-country regressions and controlling for firm- and economy-level variables, we show that during the COVID-19 economic crisis, the estimated speed with which the average firm converges to its target leverage is at least several percentage

* Corresponding author.
E-mail addresses: vothuyanh@due.edu.vn (T.A. Vo), m.mazur@ieseg.fr (M. Mazur), anth@due.edu.vn (A. Thai).

https://doi.org/10.1016/j.frl.2021.102157
Received 1 February 2021; Received in revised form 25 March 2021; Accepted 19 May 2021
Available online 25 May 2021
1544-6123/© 2021 Elsevier Inc. All rights reserved.
points higher than during the pre-COVID-19 period. For example, for the market value of leverage, the estimated adjustment speed is 11.29% per quarter during COVID-19 crisis compared to only 5.41% per quarter during times before the pandemic (a twofold difference). Similar results are obtained if leverage is measured at book value. Further, when we split the sample into two disjoin sets based on the severity of the damage caused by COVID-19 to the economy, we find that firms domiciled in countries affected more seriously by COVID-19 move toward their target leverage ratio more rapidly than firms domiciled in countries which are significantly less affected. All estimated effects are statistically significant at the 1% level and are economically meaningful.

Arguably, the speed of convergence toward target leverage, conditional on the severity of the crisis caused by COVID-19, may be driven by several forces. The first one is the accessibility and the price of credit. Government interventions in economies which were affected most by COVID-19 led to substantially cheaper credit as well a greater availability of credit to firms that decided to take on new debt. This implies that firms in economies hit hardest by COVID-19 may have decided to close their leverage gaps quicker as opposed to firms domiciled in economies weakly affected by the pandemic. Another argument is similar to the one developed in Colak et al. (2018). Based on this argumentation, in certain countries we may see quicker adjustments to the target leverage ratios, especially when the benefits of moving faster toward the target leverage zone outweigh any increases in the adjustment costs due to economic uncertainty related to COVID-19. Needless to say, the above does not mean that the firm’s cost of capital after the adjustment becomes lower. Most likely the overall cost of capital will be higher due to the growing economic uncertainty.

Our paper contributes to the literature in the following ways. First and foremost, the study adds to the emerging literature on COVID-19 and corporate finance (Fahlenbrach et al., 2020; Demers et al., 2021; Krieger et al., 2020) by documenting convergence speeds to the target leverage ratios in the context of the COVID-19. Such an analysis is particularly important, as capital structure choices are crucial to other economic decisions in the organization in different stages of firms’ life cycles. Second, we extend the literature on target capital structures (Flannery and Rangan, 2006; Huang and Ritter, 2009; Oztekin and Flannery, 2012) and show that during the COVID-19 economic crisis firms adjust toward leverage targets more quickly than in non-crisis times. Third, we complement the work of Colak et al. (2018) by indicating that uncertainty caused by the COVID-19 economic crisis speeds up the adjustment of leverage. This last observation runs counter to some of the existing findings indicating that uncertainty slows down the adjustment of the capital structure.

The reminder of the paper is organized as follows. Section 2 describes the data and sample. Section 3 presents the methodology. Section 4 reports the results, whereas Section 5 concludes.

### 2. Data sources and sample

The firm-level data are derived from Compustat Global Fundamentals Quarterly for 37,190 publicly listed firms from 81 countries located on five different continents for which complete data are available. Thus, our dataset comprises broad diversity of international corporate finance environments. Economy-wide variables come from the website of World Bank, whereas COVID-19-related measures are extracted from the World Health Organization database. To eliminate outliers, all firm-lever variables are winsorized at the 1% level.

### Table 1

Descriptive statistics

The table reports descriptive statistics for the entire sample of cross-country publicly listed firms between Q1 2011 and Q4 2020 used in the study, as well as the two subsamples including the period of COVID-19 economic crisis between Q1 2020 and Q4 2020 (COVID-19), and the period preceding the crisis (Pre-COVID-19). Variable definitions and the data sources are provided in Appendix A.

| Panel A: Firm-level variables | Variable | Entire sample | Pre-COVID-19 | COVID-19 |
|------------------------------|----------|--------------|--------------|----------|
|                              | Obs.     | Mean         | Std. Dev.    | Obs.     | Mean         | Std. Dev.    | Obs.     | Mean         | Std. Dev. |
| TDM                          | 670,117  | 0.327        | 0.595        | 606,307  | 0.324        | 0.389        | 63,810   | 0.363        | 0.441     |
| TDA                          | 902,628  | 0.251        | 0.196        | 787,967  | 0.261        | 0.176        | 72,192   | 0.260        | 0.199     |
| Size                         | 782,434  | 19.390       | 2.263        | 653,099  | 19.391       | 2.268        | 63,718   | 19.510       | 2.292     |
| Tang                         | 795,518  | 0.882        | 0.178        | 661,069  | 0.881        | 0.179        | 67,698   | 0.886        | 0.173     |
| Profit                       | 820,094  | 0.006        | 0.067        | 679,833  | 0.006        | 0.068        | 71,281   | 0.005        | 0.060     |
| Dep                          | 744,842  | 0.010        | 0.009        | 697,869  | 0.010        | 0.009        | 66,429   | 0.010        | 0.009     |
| MTB                          | 670,121  | 1.426        | 1.602        | 606,311  | 1.426        | 1.593        | 63,810   | 1.430        | 1.688     |
| Book IML                     | 902,628  | 0.225        | 0.092        | 748,155  | 0.226        | 0.091        | 72,192   | 0.234        | 0.091     |
| Market IML                  | 784,686  | 0.245        | 0.189        | 715,431  | 0.241        | 0.186        | 69,255   | 0.283        | 0.222     |
| RD                           | 94,845   | 0.046        | 0.082        | 78,973   | 0.047        | 0.084        | 71,705   | 0.042        | 0.069     |

| Panel B: Macroeconomic variables | Variable | Entire sample | Pre-COVID-19 | COVID-19 |
|----------------------------------|----------|--------------|--------------|----------|
|                                  |          | Mean         | Std. Dev.    | Mean      | Std. Dev.   |
| GGDP                            | 888      | 3.263        | 2.945        |           |
| INF                             | 888      | 3.227        | 3.735        |           |
| DC                              | 855      | 82.603       | 49.661       |           |
| SMC                             | 866      | 68,890       | 122.616      |           |

| Panel C: COVID-19 variables | Variable | COVID-19 | Mean | Std. Dev. |
|-----------------------------|----------|----------|------|-----------|
| Total cases per million     | 303      | 8066.611 | 13,738.570 |
| New cases per million       | 303      | 5407.667 | 10,221.090 |
level on both tails of their distributions. Variable definitions and the data sources are provided in Appendix A. The cross-country distribution of our sample is given in Appendix B.

Descriptive statistics are reported in Table 1. As can be seen, on average, both the book value and the market value of leverage during COVID-19 economic crisis is slightly higher as compared to the pre-COVID-19 period. Similarly, the median leverage across firms in the same industry (both at book and market values) is somewhat higher during the crisis. Moreover, R&D spending drops considerably during the pandemic. All other firm-level variables are qualitatively similar across both time periods.

3. Methodology

Following Flannery and Rangan (2006), Lemmon et al. (2008), Öztekin and Flannery (2012), Çolak et al. (2018) we use the basic partial-adjustment model to estimate how fast a given firm offsets the deviation from the target, expressed as:

\[ DR_{jt} - DR_{jt-1} = \lambda_j \times (DR^*_j - DR_{jt-1}) \]  

(1)

where \( DR^*_j \) is the target leverage of firm \( j \) in country \( t \); \( \lambda_j \) is the speed of adjustment toward the target each quarter for all firms in country \( j \); \( DR_{jt} \) is the debt ratio of the firm \( i \) in country \( j \) at quarter \( t \), which can be measured by market (TDM) or the book leverage (TDA).

The Eq. (1) can be further re-arranged as:

\[ DR_{jt} = \lambda_j \times DR^*_j + (1 - \lambda_j) \times DR_{jt-1} \]  

(2)

The target term of leverage \( DR^*_j \) is unobservable, so the fitted value of Eq. (3) is used as a proxy for the target:

\[ DR^*_j = \beta \times X_{jt-1} + \epsilon_{jt} \]  

(3)

where \( X_{jt} \) is a set of determinants of leverage in quarter \( t \), including firm size (Size), tangibility (Tang), profitability (Profit), depreciation expenses as a measure of firm non-debt tax-shield (Dep), market-to-book ratio as a proxy for firm growth (MTB), industry

Table 2

Adjustment speed toward target leverage

The table reports speeds of adjustment (SOA) to the target leverage ratios obtained by regressing current values of book leverage (TDA) and market leverage (TDM) on the lagged values of TDA and TDM as well as a set of controls including country and time fixed effects. COVID-19 is the period from Q1 through Q4 2020, and Pre-COVID-19 is the period from Q1 2011 through Q4 2019. Variable definitions and data sources are provided in Appendix A. Standard errors are adjusted for heteroskedasticity and are clustered at the country level. Superscripts *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

|                | TDA_{jt} & |       | TDM_{jt} & |
|----------------|-----------|-------|-----------|
|                | Pre-COVID-19 | COVID-19 | Pre-COVID-19 | COVID-19 |
| TDA_{jt-1}     | 0.9601***  | 0.9511*** |             |         |
|                | (0.0019)   | (0.0052) |             |         |
| TDM_{jt-1}     | 0.9439***  | 0.9221*** |             |         |
|                | (0.0046)   | (0.0055) |             |         |
| SOA            | 3.99%      | 4.89%  | 5.61%      | 7.79%   |
| Size_{jt-1}    | 0.0007***  | 0.0016*** | 0.0026***  | 0.0061*** |
|                | (0.0003)   | (0.0003) | (0.0006)   | (0.0005) |
| Tang_{jt-1}    | -0.0036*** | 0.0006  | 0.0011     | 0.0063* |
|                | (0.0006)   | (0.0019) | (0.0018)   | (0.0036) |
| Profit_{jt-1}  | -0.0512*** | -0.0220*** | -0.0679*** | -0.0354 |
|                | (0.0066)   | (0.0050) | (0.0151)   | (0.0249) |
| Dep_{jt-1}     | 0.1755*    | 0.1815*** | 0.2693**   | 0.3132  |
|                | (0.1005)   | (0.0573) | (0.1187)   | (0.2665) |
| MTB_{jt-1}     | -0.0033*** | 0.0004  | -0.0013*** | -0.0013*** |
|                | (0.0001)   | (0.0004) | (0.0002)   | (0.0003) |
| Book IMI_{jt-1}| 0.0218***  | 0.0144** |             |         |
|                | (0.0027)   | (0.0046) |             |         |
| Market IMI_{jt-1}| 0.0151*** | 0.0213*** |             |         |
|                | (0.0034)   | (0.0059) |             |         |
| GDP_{jt-1}     | 0.00002    | 0.0032*** | -0.00002   | -0.0027* |
|                | (0.0002)   | (0.0003) | (0.0004)   | (0.0015) |
| INF_{jt-1}     | -0.0001    | -0.0001 | -0.0004    | 0.0080*** |
|                | (0.0002)   | (0.0001) | (0.0007)   | (0.0004) |
| Constant       | -0.0044    | -0.0193*** | 0.0068    | -0.0350*** |
|                | (0.0041)   | (0.0041) | (0.0107)   | (0.0127) |
| Time fixed effects | Yes     | Yes   | Yes       | Yes     |
| Country fixed effects | Yes   | Yes   | Yes       | Yes     |
| Observations   | 359,259   | 35,931 | 355,355  | 35,489  |
| Adjusted R-squared | 0.9124 | 0.9149 | 0.9139  | 0.8922  |
median leverage (IML), GDP growth (GGDP), and inflation (INF). These control variables are selected based on prior studies, including Harris and Raviv (1991), Titman and Wessels (1988), Frank and Goyal (2009), Baker and Wurgler (2002).

From (2) and (3), we develop the plain partial-adjustment model represented by:

\[ DR_{ij,t} = \lambda_j \beta_j X_{ij,t-1} + (1 - \lambda_j) DR_{ij,t-1} + \lambda_j F_{ij} + \epsilon_{ij,t} \tag{4} \]

By estimating \( \alpha \), we can extract the adjustment speed \( \lambda \) for the quarter \( t \) by subtracting \( \alpha \) from 1.

To see the change in adjustment speed after the breakout of the COVID-19 economic crisis, we estimate Eq. (4) for two subperiods: Q1 2011 – Q4 2019, and Q1 2020 – Q4 2020.

We proxy the severity of the COVID-19 economic crisis by the rate of total COVID-19 cases per million people as well as the rate of new COVID-19 cases per million people for each country in our sample per quarter. At the same time, in each specification we control for the GDP growth and inflation rate. Based on the above indicators, we split the sample into “strongly-affected” by COVID-19, if the country falls into the highest tercile of the distribution of the above COVID-19-related metrics, whereas if the country falls in the lowest tercile, it is classified as “weakly-affected”.

4. Empirical results

4.1. COVID-19 economic crisis and speed of adjustment

Table 2 presents our baseline results. As shown, the adjustment speeds (variable SOA) during the COVID-19 economic crisis are higher as compared to those in the pre-crisis period both for the book (variable TDA) and market values of leverage (TDM). For example, the speed of convergence to the target for the market value of leverage during COVID-19 is 7.79% per quarter as compared to
Table 4
Speed of adjustment toward target leverage. Strongly- versus weakly-affected countries.
Panel A (B) divides the sample into two groups based on the rate of the total (new) cases per million people caused by COVID-19. If the economy falls into the high (low) tercile of the variable distribution, it is classified as strongly (weakly) affected by COVID-19. The time span is Q1 through Q4 2020. Variable definitions and the data sources are provided in Appendix A. Standard errors are adjusted for heteroskedasticity and are clustered at the country level. Superscripts *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

| Panel A | Variables | TDA\(_{i,t-1}\) | TDM\(_{i,t-1}\) |
|---------|------------|-----------------|-----------------|
|         | Strongly-affected | Weakly-affected | Strongly-affected | Weakly-affected |
| TDA\(_{i,t-1}\) | 0.9491*** | 0.9515*** | 0.9159*** | 0.9265*** |
|         | (0.0059) | (0.0120) | (0.0051) | (0.0039) |
| SOA | 5.09% | 4.85% | 8.41% | 7.35% |
|         | (0.0003) | (0.0004) | (0.0005) | (0.0013) |
| Size\(_{i,t-1}\) | 0.0019*** | 0.0004 | 0.0060*** | 0.0052*** |
|         | (0.0030) | (0.0061) | (0.0039) | (0.0076) |
| Tang\(_{i,t-1}\) | 0.0021 | 0.0005 | 0.0030 | 0.0114 |
|         | (0.0030) | (0.0061) | (0.0039) | (0.0076) |
| Profit\(_{i,t-1}\) | 0.0026*** | 0.0056 | -0.0159 | -0.1980*** |
|         | (0.0042) | (0.0156) | (0.0186) | (0.0449) |
| Dep\(_{i,t-1}\) | 0.3011*** | 0.0570 | 0.8504*** | 0.0054 |
|         | (0.0432) | (0.0748) | (0.1271) | (0.1924) |
| MTB\(_{i,t-1}\) | -0.0003 | -0.0008* | -0.0018*** | 0.0009 |
|         | (0.0005) | (0.0003) | (0.0007) | (0.0012) |
| Book IM\(_{i,t-1}\) | 0.0146** | 0.0212 | | |
|         | (0.0068) | (0.0178) | | |

| Market IM\(_{i,t-1}\) | 0.0271*** | 0.0249* |
|         | (0.0041) | (0.0130) |
| GGDP\(_{i,t-1}\) | 0.0047*** | 0.0093* |
|         | (0.0008) | (0.0048) |
| INF\(_{i,t-1}\) | -0.0012*** | 0.0050* |
|         | (0.0002) | (0.0022) |
| Constant | -0.0266*** | -0.0066 |
|         | (0.0053) | (0.0159) |
| Time fixed effects | Yes | Yes |
| Country fixed effects | Yes | Yes |
| Observations | 21,903 | 4,466 |
| Adjusted R-squared | 0.9070 | 0.9422 |

| Panel B | Variables | TDA\(_{i,t-1}\) | TDM\(_{i,t-1}\) |
|---------|------------|-----------------|-----------------|
|         | Strongly-affected | Weakly-affected | Strongly-affected | Weakly-affected |
| TDA\(_{i,t-1}\) | 0.9508*** | 0.9512*** | 0.9169*** | 0.9183*** |
|         | (0.0063) | (0.0081) | (0.0045) | (0.0084) |
| SOA | 4.92% | 4.88% | 8.31% | 8.17% |
|         | (0.0002) | (0.0003) | (0.0005) | (0.0040) |
| Size\(_{i,t-1}\) | 0.0028 | -0.0002 | 0.0026 | 0.0116 |
|         | (0.0032) | (0.0043) | (0.0039) | (0.0072) |
| Tang\(_{i,t-1}\) | 0.0225*** | 0.0436 | -0.0160 | -2.2005** |
|         | (0.0036) | (0.0263) | (0.0186) | (0.0843) |
| Profit\(_{i,t-1}\) | 0.2899*** | 0.1704** | 0.7906*** | 0.1214 |
|         | (0.0436) | (0.0674) | (0.1311) | (0.4025) |
| Dep\(_{i,t-1}\) | -0.0004 | -0.0012*** | -0.0019*** | 0.0006 |
|         | (0.0005) | (0.0003) | (0.0007) | (0.0010) |
| MTB\(_{i,t-1}\) | 0.0126* | 0.0252* | | |
|         | (0.0072) | (0.0137) | | |

| Market IM\(_{i,t-1}\) | 0.0264*** | 0.0168* |
|         | (0.0045) | (0.0092) |
| GGDP\(_{i,t-1}\) | 0.0046*** | 0.0431*** |
|         | (0.0007) | (0.0086) |
| INF\(_{i,t-1}\) | -0.0011*** | 0.0024** |
|         | (0.0002) | (0.0008) |
| Constant | -0.0282*** | 0.1292*** |
|         | (0.0050) | (0.0237) |
| Time fixed effects | Yes | Yes |
| Country fixed effects | Yes | Yes |
| Observations | 21,580 | 4,466 |
| Adjusted R-squared | 0.9070 | 0.9422 | 0.8810 | 0.9205 |
5.61% per quarter in the pre-COVID-19 period (Columns 4 and 3, Table 2). We obtain very similar results when we include in our regressions additional controls such as R&D spending (RD), magnitude of domestic credit available for the private sector (DC), and domestic stock market capitalization (SMC) (see Table 3). This is despite the fact that we lose a large number of observations due to missing values in R&D for many firms in our sample.

To put these numbers into context, the conventional belief is that the annual adjustment speed should lie in the neighbourhood of 8% to 15%. Conversely, Flannery and Rangan (2006) report rapid adjustment speed of a whopping 34.4% during the non-crisis period. Our study finds the mean adjustment speed for the market leverage of 5.61% per quarter (22.44% per year) and book leverage of 3.99% per quarter (15.96% per year) during the non-crisis period (Columns 3 and 1, Table 2). More recent paper by Öztekin and Flannery (2012) finds that the mean adjustment speed is about 21% per year for book leverage for 1991–2006 time period. This number is somewhat higher but similar to the 3.99% per quarter (15.96% per year) reported in our study (Column 1, Table 2).

In the next set of regressions, we split the sample on the basis of the severity of the economic consequences of COVID-19 for the country. We measure the economic impact of COVID-19 by the rate of total COVID-19 cases per million people in the economy as well as by the new cases per million people. We then split the sample along the terciles of these two metrics. We refer to the countries that fall in the high tercile of the distribution of COVID-19 measures as “strongly-affected”, and those in the low tercile as “weakly-affected”. In addition, in all specifications we control for the GDP growth and inflation rate. The results are presented in Table 4. As can be seen in the table, the estimated coefficients corroborate our earlier findings. Panel A shows that firms tend to move to their target leverage quicker, if the economy is more severely affected by COVID-19. The effect is similar for both the book (TDA) and market value of leverage (TDM). We obtain effectively the same results for our second proxy of severity of the COVID-19 economic crisis (Panel B). All the estimated coefficients of interest are statistically significant at the 1% level or higher.

4.2. Robustness test

Following Öztekin and Flannery (2012) and Faulkender et al. (2012) we check the robustness of our results. To this end, we conduct additional tests using the generalized method of moments (GMM) estimator with firm and time fixed effects. As shown in Table 5 the results are qualitatively the same as in our baseline specification. Therefore, the main conclusions of the study remain unchanged.

5. Conclusion

COVID-19 induced unexpected shock to the economies around the world and dramatically increased business uncertainty. In this

| Table 5 | Robustness check. GMM analysis |
|---|---|
| The table reports speeds of adjustment (SOA) to the target leverage ratios obtained by regressing current values of book leverage (TDA) and market leverage (TDM) on the lagged values of TDA and TDM as well as a set of controls using GMM estimator with time and firm fixed effects. COVID-19 is the period from Q1 through Q4 of 2020, and Pre-COVID-19 is the period from Q1 2011 through Q4 2019. Variable definitions and data sources are provided in Appendix A. Standard errors are adjusted for heteroskedasticity and are clustered at the country level. Superscripts *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively. |

| Dependent Variable | TDA_{i,t-1} | COVID-19 | TDM_{i,t-1} | COVID-19 |
|---|---|---|---|---|
| TDA_{i,t-1} | Pre-COVID-19 | 0.9670*** (0.0032) | COVID-19 | 0.9486*** (0.0104) |
| TDM_{i,t-1} | Pre-COVID-19 | 0.9482*** (0.0037) | COVID-19 | 0.9274*** (0.0128) |
| SOA | 3.30% | 5.14% | 5.18% | 7.26% |
| Size_{i,t-1} | 0.0006*** (0.0001) | 0.0007*** (0.0002) | 0.0012*** (0.0002) | 0.0020*** (0.0004) |
| Tang_{i,t-1} | –0.0041*** (0.0009) | –0.0030 | –0.0038*** (0.0014) | –0.0025 |
| Profit_{i,t-1} | –0.0522*** (0.0054) | –0.0194*** (0.0047) | –0.0507*** (0.0104) | 0.0096 |
| Dep_{i,t-1} | 0.1786** (0.0760) | 0.1919*** (0.0647) | 0.1751 | 0.5438*** (0.1331) |
| MTB_{i,t-1} | –0.0002*** (0.0001) | –0.0007** (0.0003) | –0.0013*** (0.0002) | –0.0017*** (0.0005) |
| Book IML_{i,t-1} | 0.0145*** (0.0023) | 0.0240*** (0.0043) | 0.0174*** (0.0035) | 0.0110* (0.0056) |
| Market IML_{i,t-1} | | | | |
| GSGDP_{i,t-1} | –0.0004 | –0.0012** (0.0003) | –0.0005 | –0.0031** (0.0007) |
| INF_{i,t-1} | 0.0001 | 0.0001 | 0.0005 | –0.0016** (0.0003) |
| Time fixed effects | Yes | Yes | Yes | Yes |
| Firm fixed effects | Yes | Yes | Yes | Yes |
| Observations | 359,259 | 35,931 | 355,355 | 35,489 |
study, we seek to examine whether COVID-19 economic crisis has any impact on the firms' speed of adjustment to target leverage ratios, and if so, what is the direction and the magnitude of this impact. Using a large cross-country sample of publicly listed firms, we show that COVID-19 significantly accelerates firms' adjustment toward leverage target and the speed of this adjustment is significantly greater if the firm is domiciled in the economy affected more severely by COVID-19. All documented effects are highly statistically significant and economically meaningful.

This study improves our understanding of the leverage dynamics in response to the perfectly exogenous shock that has adversely affected world economies on an unprecedented scale. A natural extension of our study would be to investigate the potential changes in the cost of capital of firms affected by COVID-19.

CRediT authorship contribution statement

Thuy Anh Vo: Conceptualization, Data curation, Supervision. Mieszko Mazur: Writing – review & editing. An Thai: Methodology, Software, Writing – original draft.

Acknowledgments

We would like to thank the editor, Professor Jonathan Batten, and anonymous reviewers for their valuable feedback on our manuscript. We are grateful to the members of the DUE-UD Teaching and Research Team in Corporate Finance and Asset pricing (TRT-CFAP) for their helpful comments and suggestions. We also would like to thank for Professor Nathan Joseph for his recommendation on our preliminary model.

Appendix A. Variable definitions and sources of data

| Variable | Description | Definition | Source of data |
|----------|-------------|------------|----------------|
| TDA  | Book leverage | Sum of long- and short-term debt divided by the book value of total assets | Compustat Global Fundamentals Quarterly |
| TDM  | Market leverage | The ratio of total debt to the sum of total debt and market capitalization of equity | |
| Size  | Firm size | Logarithmic transformation of the book value of total assets | |
| Tang  | Asset tangibility | Net fixed assets divided by the book value of total assets | |
| Profit | Operating profitability | Earnings before interest, taxes, depreciation, and amortization divided by the book value of total assets | |
| Dep  | Non-debt tax-shields | Depreciation and amortization divided by the book value of total assets | |
| MTB  | Market-to-book ratio | Market capitalization of equity divided by the book value of equity | |
| IML  | Industry median leverage | Median leverage across firms in the same industry | |
| RD  | Research and development | Expenditures and research and development divided by the book value of total assets | |
| GGDP | GDP growth rate | Rate of change in the gross domestic product | WorldBank |
| INF  | Inflation rate | Rate of change in the general price index | |
| DC  | Domestic credit | Amount of domestic credit provided to the private sector divided by the gross domestic product | |
| SMC  | Stock market capitalization | Stock market capitalization divided by the gross domestic product | |

Appendix B. Cross-country distribution of publicly listed firms in the sample

| Count | ISO2 | Country | Number of firms | Perc. | Count | ISO2 | Country | Number of firms | Perc. |
|-------|------|---------|-----------------|-------|-------|------|---------|-----------------|-------|
| 1     | AE   | UAE     | 49              | 0.13% | 42    | KY   | Cayman Islands | 1595             | 4.29% |
| 2     | AT   | Austria | 68              | 0.18% | 43    | KZ   | Kazakhstan      | 23               | 0.06% |
| 3     | AU   | Australia | 1647          | 4.43% | 44    | LK   | Sri Lanka       | 200              | 0.54% |
| 4     | BD   | Bangladesh | 202           | 0.54% | 45    | LT   | Lithuania       | 42               | 0.11% |
| 5     | BE   | Belgium | 119            | 0.32% | 46    | LU   | Luxembourg      | 69               | 0.19% |
| 6     | BG   | Bulgaria | 61             | 0.16% | 47    | LV   | Latvia          | 28               | 0.08% |
| 7     | BH   | Bahrain | 15             | 0.04% | 48    | MA   | Morocco         | 47               | 0.13% |
| 8     | BR   | Brazil  | 311            | 0.84% | 49    | MT   | Malta           | 18               | 0.05% |
| 9     | CA   | Canada  | 1892           | 5.09% | 50    | MU   | Mauritius       | 35               | 0.09% |
| 10    | CH   | Switzerland | 215          | 0.58% | 51    | MX   | Mexico          | 110              | 0.30% |
| 11    | CI   | Cote d'Ivoire | 22            | 0.06% | 52    | MY   | Malaysia        | 842              | 2.26% |
| 12    | CL   | Chile   | 160            | 0.43% | 53    | NG   | Nigeria         | 93               | 0.25% |
| 13    | CN   | China   | 3454           | 9.29% | 54    | NL   | Netherlands     | 188              | 0.51% |
| 14    | CO   | Colombia | 40             | 0.11% | 55    | NO   | Norway          | 246              | 0.66% |
| 15    | CY   | Cyprus  | 74             | 0.20% | 56    | NZ   | New Zealand     | 134              | 0.36% |
| 16    | CZ   | Czech   | 15             | 0.04% | 57    | OM   | Oman            | 64               | 0.17% |
| 17    | DE   | Germany | 660            | 1.77% | 58    | PE   | Peru            | 90               | 0.24% |

(continued on next page)
| Rank | Country | Stock Market | Capital Structure | Country | Stock Market | Capital Structure |
|------|---------|--------------|-------------------|---------|--------------|-------------------|
| 18   | DK Denmark | 132           | 0.35%             | 59 PH Philippines | 169           | 0.45%             |
| 19   | EE Estonia  | 14            | 0.04%             | 60 PK Pakistan    | 340           | 0.91%             |
| 20   | EG Egypt    | 113           | 0.30%             | 61 PL Poland      | 705           | 1.90%             |
| 21   | ES Spain    | 157           | 0.42%             | 62 PS Palestinian Territory | 16       | 0.04%             |
| 22   | FI Finland  | 158           | 0.42%             | 63 PT Portugal    | 51            | 0.14%             |
| 23   | FR France   | 724           | 1.95%             | 64 QA Qatar       | 21            | 0.06%             |
| 24   | GB UK       | 1246          | 3.35%             | 65 RO Romania     | 116           | 0.31%             |
| 25   | GH Ghana    | 10            | 0.03%             | 66 RS Republic of Serbia | 24       | 0.06%             |
| 26   | GR Greece   | 216           | 0.58%             | 67 RU Russia Federation | 267      | 0.72%             |
| 27   | HK Hong Kong | 297          | 0.80%             | 68 SA Saudi Arabia | 128         | 0.34%             |
| 28   | HR Croatia  | 83            | 0.22%             | 69 SE Sweden      | 718           | 1.93%             |
| 29   | HU Hungary  | 29            | 0.08%             | 70 SG Singapore   | 631           | 1.70%             |
| 30   | ID Indonesia| 483           | 1.30%             | 71 SI Slovenia    | 26            | 0.07%             |
| 31   | IE Ireland  | 91            | 0.24%             | 72 TH Thailand    | 600           | 1.61%             |
| 32   | IL Israel   | 456           | 1.23%             | 73 TN Tunisia     | 47            | 0.13%             |
| 33   | IN India    | 3536          | 9.51%             | 74 TR Turkey      | 318           | 0.86%             |
| 34   | IS Iceland  | 15            | 0.04%             | 75 TT Trinidad and Tobago | 12       | 0.03%             |
| 35   | IT Italy    | 392           | 1.05%             | 76 UA Ukraine     | 22            | 0.06%             |
| 36   | JM Jamaica  | 25            | 0.07%             | 77 US United States | 6523       | 17.54%            |
| 37   | JO Jordan   | 101           | 0.27%             | 78 VN Vietnam     | 436           | 1.17%             |
| 38   | JP Japan    | 2838          | 7.63%             | 79 ZA South Africa | 200         | 0.54%             |
| 39   | KE Kenya    | 34            | 0.09%             | 80 ZM Zambia      | 11            | 0.03%             |
| 40   | KR Korea    | 1717          | 4.62%             | 81 ZW Zimbabwe    | 26            | 0.07%             |
| 41   | KW Kuwait   | 88            | 0.24%             |                      |               |                   |

References

Baker, M., Wurgler, J., 2002. Market timing and capital structure. J. Finance 57 (1), 1–32.
Colak, G., Gungoraydinoglu, A., Oztekin, O., 2018. Global leverage adjustments, uncertainty, and country institutional strength. J. Financ. Intermed. 35, 41–56.
Demers, E., Hendrikse, J., Joos, P., Lev, B., 2021. ESG Didn’t Immunize Stocks During the COVID-19 Crisis, But Investments in Intangible Assets Did. 48. Journal of Business Finance & Accounting, pp. 433–462.
Fahlenbrach, R., Rageth, K., Stulz, R.M., 2020. How valuable is financial flexibility when revenue stops? Evidence from the COVID-19 Crisis. NBER Working Papers 27106. National Bureau of Economic Research.
Faulkender, M., Flannery, M.J., Hankins, K.W., Smith, J.M., 2012. Cash flows and leverage adjustments. J Financ. Econ. 103 (3), 632–646.
Flannery, M.J., Rangan, K.P., 2006. Partial adjustment toward target capital structures. J. Financ. Econ. 79 (3), 469–506.
Frank, M.Z., Goyal, V.K., 2009. Capital structure decisions: which factors are reliably important? Financ. Manage. 38 (1), 1–37.
Harris, M., Raviv, A., 1991. The theory of capital structure. J. Finance 46 (1), 297–355.
Huang, R., Ritter, J.R., 2009. Testing theories of capital structure and estimating the speed of adjustment. J. Financ. Quant. Anal. 44, 237–271.
Krieger, K., Mauck, N., Pruitt, S.W., 2020. The impact of the COVID-19 pandemic on dividends. Finance Res. Lett., 101910 p.
Lemmon, M.L., Roberts, M.R., Zender, J.F., 2008. Back to the beginning: persistence and the cross-section of corporate capital structure. J. Finance 63 (4), 1575–1608.
Oztekin, O., Flannery, M.J., 2012. Institutional determinants of capital structure adjustment speeds. J. Financ. Econ. 103 (1), 88–112.
Titman, S., Wessels, R., 1988. The determinants of capital structure choice. J. Finance 43 (1), 1–19.