Readjusting the speed of leverage adjustment during the COVID-19 pandemic?

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Abstract

Purpose – Recognizing the severity of COVID-19 on the US economy, the authors investigate the behavior of US-listed firms towards leverage speed of adjustment (SOA) during the pandemic. While prior evidence (based on an international study) shows that firm leverage increased during the pandemic leading to a higher SOA toward leverage ratios, leverage for US firms during the same period reduced drastically. Yet there is a dearth of empirical studies on the behavior of US-listed firms' SOA during the pandemic. The authors fill this void.

Design/methodology/approach – The study includes US-listed non-financial and non-utility firms for the period 2015Q1-2021Q4, covering a total sample of 45,213 firm-quarter observations. The authors' empirical strategy is based on the generalized method of moments (GMM) and firm-fixed effect methodology, controlling for firm- and quarter-fixed effects.

Findings – Three main findings are established: (1) while the SOA toward book target increased during the pandemic, SOA toward market target increased significantly only for less valued and cash-constrained firms; (2) firms in states most impacted by the pandemic adjusted faster towards target ratio; and (3) while the emergence of the pandemic and the overall firm-level risk increased (decreased) the deviation from book (market) target, firm-level risk partially mediated the effect of the pandemic on how far firms deviated from target ratio.

Practical implications – This study enhances our understanding of leverage adjustment during the crisis and shows that risk avoidance motive and the market value of firms are key determinants of convergence rate during the crisis and further demonstrates that market leverage is more sensitive to market dynamics. As such, caution must be taken when dealing with and interpreting market leverage SOA.

Originality/value – Although prior evidence based on international study provides insights into how firms behave toward their leverage ratios because of the pandemic, little is known about how US firms react to the pandemic in terms of the target ratios, particularly (1) since the USA is one of the severely affected countries and (2) firms in the USA reduced their leverage ratios as against what prior evidence shows. The authors provide evidence to explain how and why US firms reacted toward their SOA during the pandemic.

Keywords COVID-19, Leverage target, Speed of adjustment, Capital structure

Paper type Research paper

1. Introduction

Leverage target has become a significant subject of capital structure studies (Iliev & Welch, 2010) following the seminal work by Fischer, Heinkel, and Zechner (1989). Recent studies (Faulkender, Flannery, Hankins, & Smith, 2012; Flannery & Rangan, 2006; Huang & Ritter, 2009; Leary & Roberts, 2005) agree that firms have a target ratio and are driven to adjust toward their ideal target leverage ratio since deviations affect the value of the firm (Do, Huang, & Ouyang, 2022; Ho, Lu, & Bai, 2021; Öztekin & Flannery, 2012; Vo, Mazur, & Thai, 2021). Various systemic or idiosyncratic shocks to businesses might cause such deviations (Vo *et al.*, 2021). When businesses are shocked away from their target ratio, they ultimately

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approach this target in a timely fashion (Flannery & Rangan, 2006). However, the SOA may depend not only on transaction cost and access to the capital market (Faulkender *et al.*, 2012) but also on economic conditions (Drobetz, Schilling, & Schröder, 2015). Vo *et al.* (2021) posit that a firm's decision to go beyond its capital structure decisions and exhibit leverage-targeting behavior during harsh economic conditions has important implications.

However, an exogenous shock presented by the emergence of COVID-19 has impacted the firm's financing decisions and capital structure. Haque and Varghese (2021) show that financial leverage for US firms decreased [1] during the pandemic and this is driven by (1) the worsening of the growth in corporate cash flow and a rise in asset risk, (2) the desire to roll over the "current proportion of long-term debt" and (3) compared to least affected firms, the most affected firms (by social distancing) did not reduce their leverage. Anecdotal evidence reported by the Federal Reserve and further supported by a report from Deloitte [2] indicated that strong business borrowing before the pandemic led to an increase in total debt but started to reduce some months into 2020. Yet, from an international setting (with a sample including the USA), Vo *et al.* (2021) present an increasing leverage ratio and show that the emergence of the pandemic has increased the firm's speed of leverage adjustment. They argue that the SOA is greater in economies highly hit by the pandemic. With the USA being one of the countries severely hit by the pandemic, important questions remain unanswered. This study revisits and investigates the dynamics of leverage adjustment among US-listed firms in response to the pandemic.

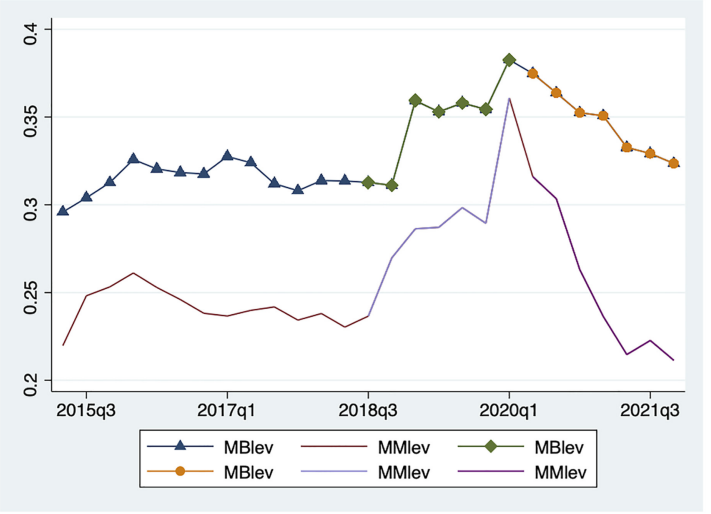
COVID-19's global pandemic wreaked havoc on corporate profitability, assets and bottom-line items. It did not, however, have a proportionately equivalent impact on all economies (Vo *et al.*, 2021). Vo *et al.* (2021) argue that depending on how quickly and effectively the government responds, certain economies have been hit worse than others. Two key findings from their study raise questions that need to be addressed in the context of the US-listed firms. First, the authors find that globally, the leverage ratio has been on the increase during the pandemic period and that the SOA is faster during this period. Second, they find that firms in countries severely hit by the pandemic adjust faster toward their target ratio. While these are interesting and important findings, it is to be acknowledged that although the USA has tasted the sour side of the pandemic, firms situated in the USA behave differently in terms of leverage behavior (see Figure 1) [3]. With the differential attitude of US firms toward leverage ratio, it is important to re-examine whether US firms readjusted their SOA.

In line with their findings and the findings by Haque and Varghese (2021), this study addresses the following questions: Do US firms change their SOA in response to the pandemic? If so, is there a uniform change across both book leverage and market leverage? How sensitive is the SOA to the firm's market value of equity? What is the behavior of firms with non-positive net debt (NPND) (more cash reserves) toward leverage SOA? What is the extent of deviation from the target ratio induced by COVID-19? Does firm-level risk fully or partially mediate the effect of the pandemic on the deviation from the target ratio?

These are particularly essential questions since capital structure decisions, chiefly in times of crisis, affect other critical business decisions. This study advances our understanding stemming from Vo *et al.* (2021) and Haque and Varghese (2021)'s study and helps shed light on the deferring behavior of US firms' SOA toward leverage targets in response to the pandemic.

1.1 Background and predictions

Before the onset of the pandemic, the US economy was on a major growth spurt. In such circumstances, analysts and economists may begin to wonder what could possibly turn things around. Without any possible thought about COVID-19, the only likely trigger for a recession would have been the growth in corporate debt [4]. Corporate debt reached a record



Note(s): MBlev = mean of book leverage, MMlev = mean of market leverage. This graph shows firm leverage over the sample period. Appendix A1 shows the variable definitions
Source(s): Figure by authors

Figure 1.
Leverage ratio over time

high in the early months of 2020. However, the advent of the pandemic changed things around. We saw the country's growth shrinking to 3.5% while corporate debt began to fall (see Figure 1). The change in corporate debt during the pandemic is likely to impact the SOA due to the uncertainty borne by the pandemic.

Several factors related to the COVID-19 pandemic have impacted the ideal level of leverage for firms. For instance, the pandemic-induced strains on corporate cash flows and the tightening of global liquidity constraints have influenced the market valuations of firms as the pandemic spread. Firms with higher cash reserves, lower debt and greater profits have shown more resilience to the pandemic than those with fewer resources (Haque & Varghese, 2021). Furthermore, the value-maximizing level of leverage for firms, particularly those with higher exposure to business risk, may have declined due to reduced growth prospects or increased risks from the COVID-19 shock. Business owners may increase collection efforts in anticipation of defaults and changes to short-term payment plans, which may result in an increase in non-compete litigation, particularly from startups, as laid-off professionals seek new employment opportunities.

The COVID-19 shock's reduction in the book value of equity has immediate consequences on firms' leverage ratios, which increase by approximately 6.7 to 8% points compared to a typical business scenario (Demmou *et al.*, 2021). Additionally, firms that were severely impacted by the drop in demand due to social distancing, particularly those that did not de-lever based on risks from lockdowns, now have actual leverage ratios that significantly exceed their ideal level of leverage (Haque & Varghese, 2021).

Perhaps, the SOA toward a target ratio in the presence of the pandemic might have been driven by many factors, some of which are related to government interventions in the form of both fiscal and monetary stimulus to address the havoc induced by the pandemic. Tarkom (2021) shows that firms that receive government incentives in the form of investment tax credits and deferred taxes are efficient in managing their working capital. This implies that access to credit or liquidity may influence the rate and direction of adjustment toward the

target ratio among US firms during the pandemic. Ho *et al.* (2021) confirm this from an international perspective.

Another important conduit through which the pandemic could alter the SOA is risk avoidance. Prior evidence (Cook & Tang, 2010; Hackbarth, Miao, & Morellec, 2006) suggests that both macroeconomic and firm characteristics are among other determining factors of adjustment costs. Thus, the rising uncertainty, either in the form of liquidity and/or default risk (Ho *et al.*, 2021; Luo, 2021; de Vito & Gómez, 2020), may change the rate of convergence. Additionally, large deviations from the target ratio may expose firms to additional risks. As a result, with the many policies (e.g. social distancing and lockdowns) implemented to curb the spread of the pandemic which induces operational risks (Luo, 2021), drifting too far from target leverage may introduce costly adjustments.

Therefore, firms may be incentivized to adjust toward their target levels to avoid costly adjustments. It is expected that if the motive for convergence rate is due to risk avoidance, then low market valued (risky) firms, low cash holding (constrained) firms, and firms situated in states most affected by the pandemic will have a faster convergence rate than high valued firms, firms with excess cash and firms in the least affect states. The study finds support for these arguments. In line with the idea that practitioners pay much attention to book leverage and that they do not change their capital structure in response to stock price movement (Yin & Ritter, 2020), the convergence rate toward market leverage should be slower compared to that widely reported in the literature. Yin and Ritter argued that the estimated SOA is influenced by both passive (not related to financing choices) and active components (influenced by financing choices).

The authors argue that the upward bias and sensitivity of the estimated SOA towards the market target to the growth in market value drives the higher estimated SOA towards the market leverage target. Therefore, by separating high-valued firms from low-valued firms, differences in the estimated SOA toward market leverage should be expected. This is particularly true since there has been a sharp increase in the market value of firms during the pandemic. Hence, it is expected that the rate of convergence toward the market leverage target will be different for high-valued versus low-valued firms. Therefore, since high-valued firms and firms with excess cash are expected to adjust slowly toward their leverage target, this class of firms may drive the convergence rate for the market target down (Yin & Ritter, 2020). This hypothesis is also supported in this study.

Also, we predict that firms headquartered in states most affected by the pandemic may adjust faster to avoid additional risks stemming from the pandemic. The rationale for this focus is on the basis that fundamental business activities take place in close proximity to the headquarters (Chaney, Sraer, & Thesmar, 2012; Pham, Adrian, Garg, Phang, & Truong, 2021; Pirinsky & Wang, 2006). Thus, if the location of the headquartered firm is exposed to more risk, SOA will be faster to avoid any accumulating risks.

The full sample analysis shows an adjustment speed toward the book (market) leverage target to be 5.2% (9.2%) per quarter. These translate into an annual SOA of 20.8% (36.8%) which are consistent with prior findings. A subsample analysis indicates that the estimated SOA towards book target leverage during the pandemic is higher relative to the pre-pandemic by several percentage points. For instance, the quarterly SOA adjustments toward the book leverage target increased from 3.7% to 7.2% per quarter. However, the estimated SOA toward the market leverage target decreased during the pandemic relative to the pre-pandemic. For instance, the quarterly SOA adjustments toward the market leverage target decreased from a whopping 16.8% to 12.1%. This result supports the findings of Yin and Ritter (2020) who put it simply that "the estimated SOA towards market leverage is slower than you think" but counters the findings from international settings reported by Vo *et al.* (2021).

Second, the evidence shows that the observed low SOA towards the market leverage target is driven by the growth in the market value of firms (Yin & Ritter, 2020). For instance, for low-

valued firms, there is a strikingly high SOA toward market leverage target from the pre-pandemic to the pandemic: 24.1% versus 29.9% per quarter which support the risk avoidance motive. However, for highly valued firms, not only did the SOA not matter before the pandemic, but the estimated SOA towards market leverage target is also only 3%. This can explain why the full sample SOA toward market leverage target is lower during the pandemic relative to the pre-pandemic case. The observed differences in market leverage targets can be attributed to the sensitivity of market leverage to the rise in market valuation during the pandemic.

Additionally, the evidence shows that (1) over-levered firms converge faster during the pandemic (2) low-valued firms relative to high-valued firms with excess cash adjusted faster during the pandemic (3) firms situated in states most affected by the pandemic adjusted faster. Lastly, we show that although the emergence of the pandemic caused a substantial deviation from the target ratio, this deviation is not only attributed to the pandemic but also the overall firm-level risk faced. A mediation analysis subsequently revealed that firm-level risk partially mediated how far the pandemic caused a deviation from target levels.

This paper makes an important contribution to the existing literature on the emerging discourse of COVID-19, corporate finance and capital structure (e.g. Faulkender *et al.*, 2012; Flannery & Rangan, 2006; Krieger, Mauck, & Pruitt, 2021; Öztekin & Flannery, 2012; Tarkom, 2021; Vo *et al.*, 2021) by documenting the (risk avoidance) deferential attitude of US firms towards leverage target SOA. The study extends prior literature's determinant of SOA and suggests that excess cash determines how fast firms adjust towards target ratios in times of pandemic. The study further adds that not only are these changes in leverage SOA attributed to the pandemic but also the firm's overall risk faced during the pandemic. The analysis offers a cautionary tale to the generalization of the SOA since the convergence rate is dependent on the growth in the market value of firms and the risk appetite of firms, suggesting that risk avoidance is core to the convergence rate during the pandemic.

2. Data and leverage model

Firm-level financial data are obtained from Compustat fundamentals quarterly file and COVID-19 and firm-level risk data are obtained from Hassan, Hollander, Lent, Schwedeler, and Tahoun (2020). The data covers US-listed non-financial and non-utility firms. The full sample range from 2015Q1-2021Q4 and covers 45,213 firm-quarter observations with 3,008 unique firms. For even comparison of the *before* and *within* the pandemic effect, two subsamples are formed: (1) "PreCOVID" ranging from 2018Q3-2020Q1 comprising 12,597 firm-quarter observations; and (2) "COVID" ranging from 2020Q2-2021Q4 with 11,259 firm-quarter observations. 2020Q2 is chosen as the beginning of the pandemic to conform with the declaration date (March 11, 2020) of COVID-19 as a global pandemic by WHO.

2.1 Baseline leverage model

This paper aims to examine changes in the SOA as a result of the emergence of COVID-19 and offer possible reasons for such changes, as such, we employ a two-step approach since it offers flexibility and allows for the control of both firm and industry characteristics (An, Li, & Yu, 2015). The first step regresses (book and market) leverage on the determinants of leverage to estimate the (unobservable) target leverage. The target leverage from the first-step is used in the second-step to estimate a partial adjustment model. This approach is considered appropriate for our empirical setting since it will enable us to test the changes in SOA borne by the pandemic and the factors that caused a deviation from the target ratio.

The standard partial-adjustment leverage model often employed in the literature (e.g. Çolak, Gungoraydinoglu, & Öztekin, 2018; Faulkender *et al.*, 2012; Flannery & Rangan, 2006; Lemmon, Roberts, & Zender, 2008; Luo, 2021; Öztekin & Flannery, 2012) is of the form

$$LevR_{i,t} - LevR_{i,t-1} = \lambda\left(LevR^{*}_{i,t} - LevR_{i,t-1}\right) \quad (1)$$

where $LevR_{i,t}$ is the leverage ratio [5] for firm i at quarter t, $LevR_{i,t} - LevR_{i,t-1}$ is the change in leverage ratio, $LevR^{*}_{i,t}$ is firm i's target leverage at quarter t, and $LevR^{*}_{i,t} - LevR_{i,t-1}$ is the deviation from the target ratio. The variable of interest, λ, is the "speed of adjustment" which measures how fast firm i closes the gap between "its target leverage and the beginning period leverage" (Faulkender *et al.*, 2012).

Rearranging Eq. (1) yields

$$LevR_{i,t} = \lambda LevR^{*}_{i,t} + (1-\lambda)\, LevR_{i,t-1} \quad (2)$$

The target ratio is unobservable; hence, it is estimated using a partial adjustment model following the restriction in Eq. (3)

$$LevR^{*}_{i,t} = \beta X_{i,t-1}:$$

$$LevR_{i,t} = \lambda\beta X_{i,t-1} + (1-\lambda) LevR_{i,t-1} + FE_{i,t} + \epsilon_{i,t} \quad (3)$$

where β is the coefficient vector to be estimated at the same time with λ, FE is the fixed effect for firm i at quarter t, and $X_{i,t-1}$ comprise *EBIT/TA* [= (income before extraordinary items plus interest expense plus income taxes)/total assets], *M2B* [=(total liabilities plus equity value)/total assets], *Depreciation* [= (depreciation and amortization)/total assets], *Size* [= natural logarithm of total assets], Tangibility [= net property plant, and equipment/total assets], *R&D/TA* [= research and development expense/total assets; missing values are set to 0], *R&D Dummy* [= 1 if R&D expense is reported, 0 otherwise], *In Median Book Lev* [= without self two-digit industry median of book leverage ratio], *Ind Median Market Lev* [= without self two-digit industry median of market leverage ratio]. To correct for the effect of outliers, all variables are wisorized at the first and the 99th percentile. Following prior literature (e.g. Faulkender *et al.*, 2012), Eq. (3) is estimated using Blundell and Bond's (1998) system generalized method of moments (GMM) after which a fixed effect model is used in estimating Eq. (1). For the baseline partial adjustment model, Eq. (1) is estimated for three samples: Full sample, Pre-COVID and COVID. This separate estimation is essential in determining the change in leverage adjustment for the *full sample* case, *before* and *within* the pandemic period.

3. Results and discussion

3.1 Descriptive statistics

Table 1 reports the descriptive statistics of all the variables. The statistics show that the average book and market leverage is lower during the pandemic. Also, the target ratio for book and market leverage increased during the pandemic relative to the pre-pandemic. Similarly, as the average deviation from the target ratio for book leverage is higher during the pandemic, it marginally increased for the market leverage during the pandemic [6]. Test of means for the Pre-COVID and COVID statistics show that the (key) variables are different from each other.

3.2 Empirical findings

Table 2 Panel A reports the baseline regression using the specification in Eq. (1). For the full sample case, the SOA toward book leverage (*Book Lev)* is 5.2% per quarter (column 1), while the SOA towards market leverage (*Market Lev*) is 9.2% per quarter (column 4). These

	Full sample			PreCOVID			COVID			
	N	Mean	SD	N	Mean	SD	N	Mean	SD	Diff
EBIT/TA	45213	−0.002	0.062	12597	−0.006	0.067	11259	−0.003	0.060	−0.003**
M2B	45213	2.373	1.942	12597	2.263	1.883	11259	2.715	2.394	−0.452***
Depreciation	45213	0.011	0.007	12597	0.011	0.007	11259	0.009	0.007	0.001*
Size	45213	7.268	1.894	12597	7.209	1.932	11259	7.294	1.959	−0.085***
Tangibility	45213	0.254	0.243	12597	0.262	0.246	11259	0.240	0.225	0.022***
R&D/TA	45213	0.014	0.028	12597	0.015	0.030	11259	0.014	0.027	0.001
R&D Dummy	45213	0.449	0.497	12597	0.461	0.498	11259	0.477	0.499	−0.016**
Ind Median Book Lev	45213	0.284	0.133	12597	0.281	0.133	11259	0.274	0.132	0.007**
Ind Median Market Lev	45213	0.212	0.153	12597	0.210	0.152	11259	0.198	0.148	0.011**
Book Lev	45213	0.332	0.243	12597	0.347	0.242	11259	0.239	0.141	0.108***
Book Dev	45213	0.202	0.361	12597	0.202	0.354	11259	0.225	0.340	−0.023***
Book Target	45213	0.530	0.275	12597	0.537	0.267	11259	0.579	0.256	−0.042***
Market Lev	45213	0.259	0.230	12597	0.289	0.248	11259	0.157	0.230	0.132***
Market Dev	45213	0.296	0.369	12597	0.290	0.376	11259	0.292	0.377	−0.002*
Market Target	45213	0.552	0.352	12597	0.559	0.356	11259	0.568	0.368	−0.009**
NPND	45213	0.293	0.455	12597	0.266	0.442	11259	0.309	0.462	−0.043**
Dividend payout	45213	0.944	0.230	12597	0.947	0.224	11259	0.934	0.248	0.0128***
ITC	45213	0.716	0.451	12597	0.711	0.453	11259	0.693	0.461	0.018***
Covid Exposure	45213	0.339	0.858	12597	0.060	0.289	11259	1.296	1.282	−1.236***
Covid Risk	45213	0.0236	0.097	12597	0.002	0.028	11259	0.089	0.173	−0.086***
Ln(RISK)	45213	3.586	1.337	12597	3.471	1.399	11259	3.998	1.121	−0.527***

Note(s): The table reports the descriptive statistics of all the variables. The variables are defined in Appendix Table A1

PreCOVID and COVID samples range between 2018Q3-2020Q1 and 2020Q2-2021Q4 respectively, while the full sample is for the period 2015Q1-2021Q4. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5%, and 10% respectively

Source(s): Table by authors

Table 1.
Descriptive statistics

numbers translate into an annual SOA towards *Book Lev* and *Market Lev* of 20.8% and 36.8%, respectively. This finding is consistent with Faulkender *et al.* (2012) and Öztekin and Flannery (2012) who report an annual SOA towards *Book Lev* to be 21%. The large convergence rate for *Market Lev* reported in this study is also consistent with the findings by Flannery and Rangan (2006) who report an annual convergence rate greater than 30%.

For the subsample analysis, *before* and *within* the pandemic case, the SOA towards *Book Lev* (*Market Lev*) is higher (lower) for *before* and *within* the pandemic, respectively. That is, the SOA towards *Book Lev* increased from 3.7% to 7.2% per quarter (columns 2-3). This also translates into an annual convergence rate of 14.8% and 28.8%, respectively. However, the SOA towards *Market Lev* decreased from 16.8% to 12.1% per quarter (columns 5-6), translating into a whopping annual convergence rate of 67.2% and 48.4%, respectively [7]. The results suggest that the SOA towards book leverage and market leverage is significantly different, particularly in times of crisis. From Figure 2, the higher heterogeneity observed in market leverage changes compared to book leverage explains twice as much SOA towards market leverage.

While the increase in the SOA toward the book target is close and consistent with the findings by Vo *et al.* (2021), the results on adjustments toward the market target contradict their findings. This finding suggests that the attitude of US firms toward market leverage SOA in times of crisis is different from the rest of the world, as found by Vo *et al.* (2021). The results reveal that while the SOA toward the book target continues to increase from

Panel A. Main results						
	Full sample	PreCOVID	COVID	Full sample	PreCOVID	COVID
	(1)	(2)	(3)	(4)	(5)	(6)
Variable	ΔBook lev	ΔBook lev	ΔBook lev	ΔMarket lev	ΔMarket lev	ΔMarket lev
Book Dev	0.052***	0.037***	0.072***			
	(0.002)	(0.005)	(0.005)			
Market Dev				0.092***	0.168***	0.121***
				(0.002)	(0.008)	(0.006)
Constant	−0.007***	0.004***	−0.021***	−0.024***	−0.027***	−0.053***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Observations	45,213	12,597	11,259	45,213	12,597	11,259
R-squared	0.121	0.225	0.208	0.201	0.318	0.301
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B. Speed of adjustment before and within the pandemic without zero-leverage firms				
	PreCOVID	COVID	PreCOVID	COVID
Variable	ΔBook lev	ΔBook lev	ΔMarket lev	ΔMarket lev
Book Dev	0.035***	0.072***		
	(0.005)	(0.005)		
Market Dev			0.195***	0.124***
			(0.008)	(0.006)
Constant	0.006***	−0.022***	−0.034***	−0.054***
	(0.001)	(0.001)	(0.003)	(0.002)
Observations	12,033	11,146	12,033	11,146
R-squared	0.227	0.208	0.329	0.302
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes

Panel C. Excluding healthcare firms				
	PreCOVID	COVID	PreCOVID	COVID
	(1)	(2)	(3)	(4)
Variables	ΔBook lev	ΔBook lev	ΔMarket lev	ΔMarket lev
Book Dev	0.040***	0.070***		
	(0.005)	(0.005)		
Market Dev			0.164***	0.124***
			(0.008)	(0.006)
Constant	0.003**	−0.023***	−0.027***	−0.054***
	(0.001)	(0.001)	(0.002)	(0.002)
Observations	12,204	10,885	12,204	10,885
R-squared	0.228	0.209	0.321	0.300
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes

Panel D. Distress firms (No dividend payout)				
	PreCOVID	COVID	PreCOVID	COVID
	(1)	(2)	(3)	(4)
Variables	ΔBook lev	ΔBook lev	ΔMarket lev	ΔMarket lev
Book Dev	0.120***	0.135***		
	(0.021)	(0.022)		
Market Dev			0.295***	0.354***
			(0.028)	(0.039)

Table 2.
Speed of adjustment before and within pandemic

(*continued*)

Panel D. Distress firms (No dividend payout)				
	PreCOVID	COVID	PreCOVID	COVID
	(1)	(2)	(3)	(4)
Variables	ΔBook lev	ΔBook lev	ΔMarket lev	ΔMarket lev
Constant	−0.001	0.021***	−0.091***	−0.044***
	(0.003)	(0.004)	(0.006)	(0.008)
Observations	722	725	722	725
R-squared	0.379	0.330	0.370	0.437
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes

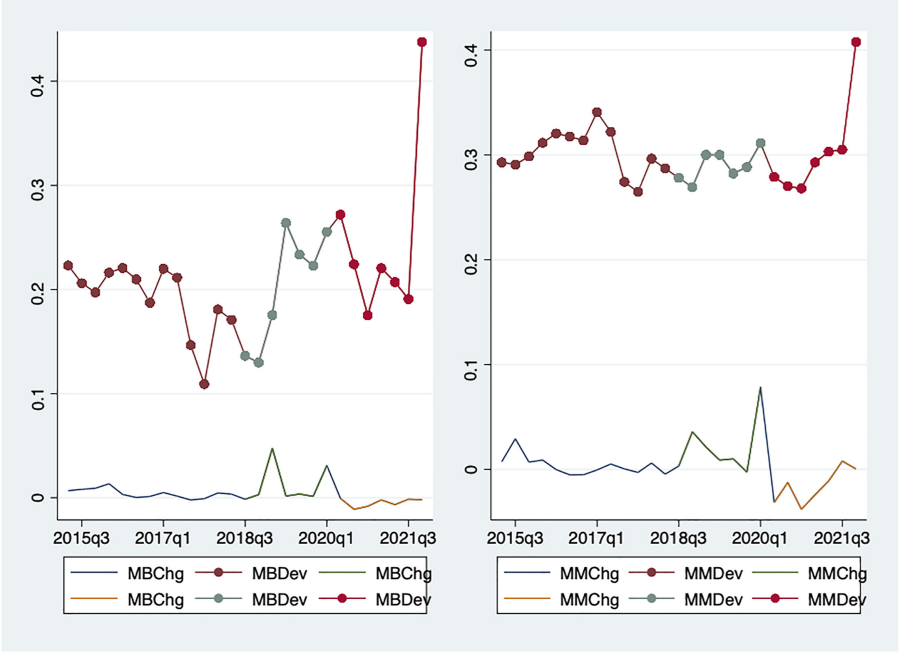
Note(s): Table 2 Panel A reports the baseline regression. Panel B reports evidence using the baseline regression without zero-leveraged firms. Panel C and D report the findings excluding healthcare firms and for distressed firms respectively. Book Dev is defined as the book target ratio minus the book leverage ratio from the previous quarter. Similarly, Market Dev is defined as the market target ratio minus the market leverage from the previous quarter. The target ratio is estimated from Eq. (3). PreCOVID and COVID samples range between 2018Q3-2020Q1 and 2020Q2-2021Q4 respectively. Robust standard errors are presented in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5%, and 10% respectively

$$LevR_{i,t} - LevR_{i,t-1} = \frac{Debt_t}{ATQ_t} - \frac{Debt_{t-1}}{ATQ_{t-1}} = \lambda(LevR^*_{i,t} - LevR_{i,t-1}) + \widetilde{\epsilon}_{i,t}$$

$$LevR_{i,t} - LevR_{i,t-1} = \lambda(LevR^*_{i,t} - LevR_{i,t-1}) + \widetilde{\epsilon}_{i,t}$$

Source(s): Table by authors

Table 2.



Note(s): MBChg = change in book leverage, MBDev = deviation from book leverage target ratio, MMChg = change in market leverage, deviation from market leverage target ratio. Changes are based on differences in time period t−1 to time t

Source(s): Figure by authors

Figure 2.
Time series plot of change in leverage and deviation from target ratio

pre-pandemic to within-pandemic, the SOA towards the market target decreases. The finding is consistent with Yin and Ritter (2020) who show that the estimated SOA towards the market target is lower than the SOA towards the book target. With practitioners focusing on book leverage and that firms do not change their debt in response to stock price changes (Yin & Ritter, 2020), the change in the SOA toward market target found in this study and prior literature remains a puzzle. This is because, from Figure 3, the average market value of equity [8] increased sharply from lower levels pre-pandemic to higher levels within-pandemic. This is also associated with the sharp decline in market leverage.

Panel B report evidence using the baseline regression without zero-leveraged firms. Motivated by Strebulaev and Yang (2013) and Choi and Park (2022), we eliminated firms with zero debt in current liabilities and long-term debt and re-ran our baseline regression. This analysis rules out the effect of firms with zero leverage driving the results. The findings are quantitatively similar to that reported in Panel A except for the SOA for market leverage for the pre-pandemic case. This analysis shows that the results reported in Panel A are not driven by non-zero leveraged holding firms.

Panel C and D report findings by (1) eliminating healthcare firms and (2) examining distressed firms, respectively. This is to show that our results are robust when we exclude healthcare firms and also consider the behavior of distressed firms. Particularly, since healthcare firms received substantial federal government support during the pandemic, their attitude towards leverage adjustment will differ from other firms. Similar arguments hold for distressed firms due to the costly nature of the adjustment. We used dividend payout (Bhagat, Moyen, & Suh, 2005) as a proxy of distress due to the difficulty in paying dividends during the pandemic. Hence, firms that are unable to pay a dividend in a given quarter are considered distressed. Similar to before, we find that excluding healthcare firms from our sample did not alter the basic findings of this study. We find similar evidence when we also exclude firms in the airline industry (no reported). However, we notice that distressed firms strikingly

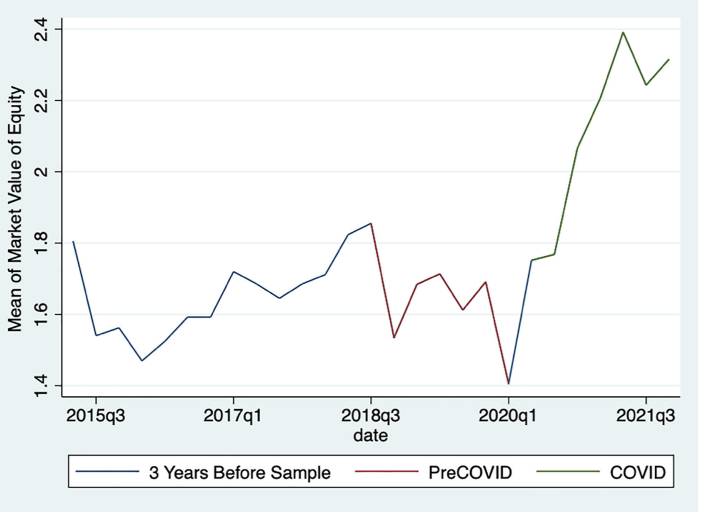


Figure 3.
Time series plot of the market value of equity

Note(s): This figure shows market value (share price times the number of shares outstanding) of firms in the sample over time
Source(s): Figure by authors

adjusted their SOA faster during the pandemic which is consistent with the risk avoidance motive and our predictions.

To ascertain whether these effects vary for firms that receive government support or not, we conduct an additional test by examining the effect of government intervention on the SOA. First, we use investment tax credit (Tarkom, 2021) from the government to moderate the relationship between Book Dev and Market Dev on ΔBook Lev and ΔMarket Lev, respectively. We split the sample based on whether in a given quarter, firms received any government support in the form of investment credit or not. Tarkom (2021) shows that investment tax credit is critical for firms in managing effective working capital during the pandemic. Second, we specifically and randomly identified some firms that received government support during the pandemic. We then modeled the SOA for the identified firms (15 firms were selected, see the notes in Table A2). Our analysis (reported in Table A2 in the Appendix) shows that indeed for firms that received government support during the pandemic, the SOA is faster than those that did not receive any support, offering support to our argument that firms' SOA changes in the face of government intervention.

We will provide details on how the growth in the market value of the firm is sensitive to the estimated SOA towards market leverage in the next section.

3.3 Growth in the market value of firms and the speed of adjustment

The results thus far in conjunction with Figures 1 and 3 show that the SOA towards market leverage is sensitive to the market value of equity which arguably distinguishes book leverage from market leverage. However, to explain this sensitivity of SOA to the market value of equity, important questions regarding the kind of firms that have been driving the leverage binge before and within the pandemic need to be explored. To do this, we created five portfolios based on the market value of firms. That is, we sort all stocks into five quintiles based on the market value of equity. Market value of equity is defined as the stock price times the number of shares outstanding. The first group *top 20* consist of the first 20% most valued firms while the *low 20* refers to the bottom 20% less valued firms. In between these two groups are three different groups following the same logic.

Table 3 reports the statistics for the leverage and asset position of each group. It is evident that while the market value of equity increased during the pandemic period, the low 20 group firms reduced their book and market leverage while the top 20 group firms had a marginal increase in book leverage but a reduction in market leverage. Additionally, it is interesting to note that while all other groups reduced both debts in current liabilities and long-term debt, firms in the top 20 group only reduced debt in current liabilities but increased debt in long-term debt, possibly to invest in technology to support remote work. It is thus not surprising that the top 20 firms hold more than 40% of both short-term and long-term debt. It is therefore expected that the SOA will be different across these groups.

Next, to examine how sensitive the SOA is to the growth in market value, we re-run the baseline model for each group to examine the variation in the SOA. The results are presented in different panels in Table 4. Panel A reports the findings for the low 20 group of firms. While the SOA for book leverage before the pandemic (3.6% per quarter) is similar to the baseline results reported in Tables 2 and it increased (4.2%) within the pandemic period even though the increase is smaller than that reported in Table 2. A more interesting finding is the SOA towards the market target. We find a high SOA during the pandemic for market leverage than for the pre-pandemic case: 29.9% versus 24.1% per quarter. The conversion rates for this group of firms are much higher compared to the baseline results in Table 2.

Similar to Panel A, Panel B report the same analysis but for the case of the next group of firms. Strikingly, the SOA for book leverage increased from 5% to 12.1% during the pre-pandemic to the pandemic, respectively. Similar to the findings for the Rank 1 firms, we find that the SOA during the pandemic period is marginally higher (27.8%) than in the

Rank	Low 20	2	3	4	Top 20	Average	% low 20	% top 20
Full Sample (2015Q1–2021Q4)								
MVE	119.856	586.232	1632.317	4596.022	53615.500	12109.300	0.990	37.954
BLEV	0.319	0.320	0.326	0.346	0.350	0.332	0.962	104.169
MLEV	0.337	0.281	0.253	0.227	0.195	0.259	1.302	87.708
ATQ	404.374	1069.561	2149.258	4500.538	34615.440	8547.399	0.047	52.654
DLCQ	32.803	35.932	64.309	141.255	1491.294	353.100	0.093	40.004
DLTTQ	190.368	453.408	820.113	1624.143	10472.700	2712.016	0.070	59.887
PreCOVID (2018Q3 – 2020Q1)								
MVE	111.223	584.162	1638.420	4585.454	51667.910	11021.240	0.010	41.606
BLEV	0.341	0.336	0.352	0.353	0.357	0.347	0.983	101.631
MLEV	0.381	0.313	0.281	0.242	0.202	0.289	1.317	83.626
ATQ	478.049	1234.984	2367.887	4908.491	35046.540	8308.026	0.058	59.081
DLCQ	40.569	46.871	83.651	179.764	1639.375	376.483	0.108	47.748
DLTTQ	221.392	520.432	937.138	1787.401	10850.380	2705.126	0.082	66.075
COVID (2021Q2 – 2021Q4)								
MVE	122.510	576.166	1650.278	4663.762	66609.920	16769.450	0.007	27.811
BLEV	0.317	0.353	0.357	0.356	0.362	0.349	0.909	101.852
MLEV	0.325	0.300	0.273	0.221	0.183	0.257	1.265	86.042
ATQ	341.114	1067.613	2284.881	4393.959	35342.740	9742.039	0.035	45.103
DLCQ	21.474	37.135	82.328	161.526	1344.231	369.656	0.058	43.696
DLTTQ	143.852	467.338	935.157	1662.529	11518.000	3284.941	0.044	50.611

Note(s): Five portfolios are created based on the market value of firms. We sort all stocks into five quintiles based on the market value of equity. Market value of equity is defined as the stock price times the number of shares outstanding. The top 20 consist of the first 20% most valued firms while the low 20 refers to the bottom 20% less valued firms. In between these two groups are three different groups following the same logic. Table 3 reports the statistics for the leverage and asset position of each group

Source(s): Table by authors

Table 3.
Statistics on each portfolio group

pre-pandemic case (27.2%). The findings indicate that this class of firms tends to adjust faster towards both book and market leverage during the pandemic possibly due to risk avoidance motive.

Panel C reports the findings of the middle class of firms under this analysis. Similar to the results in Panel A and B, the SOA for both book and market leverage is higher during the pandemic relative to the pre-pandemic case. That is the SOA toward the book target increased from 5.5% to 6.8% while the SOA towards the market target is estimated to increase from 15.1% to 18.8%, also suggesting a faster convergence for medium-ranked market-valued firms.

The findings reported in Panel D show the estimated SOA for the group of firms next to the most valued firms. The results are different from the reported findings in Panels A, B and C. The estimated SOA towards book target increased from the pre-pandemic to the pandemic period. However, the case for the market leverage reverted for the estimated SOA during the pandemic period. For instance, while the previous three panels reported that the estimated SOA is higher during the pandemic relative to before the pandemic, we find that in Panel D, the estimated SOA during the pandemic is lower relative to before the pandemic. These findings are consistent with the baseline results reported in Table 2. The findings suggest that the SOA for high-valued firms is slower than less valued firms, supporting the idea that this group of firms has the capacity to pay and thus react differently toward the speed of convergence (Ho *et al.*, 2021).

Finally, the results for the most valued group of firms in this sample are reported in Panel E. Interestingly, the results show that the SOA during the pre- and within-pandemic cases for

Variable	PreCOVID ΔBook lev	COVID ΔBook lev	PreCOVID ΔMarket lev	COVID ΔMarket lev
Panel A Low 20 (Rank 1). This group represent the least 20% valued firms				
Book Dev	0.036***	0.042***		
	(0.011)	(0.011)		
Market Dev			0.241***	0.299***
			(0.018)	(0.018)
Constant	0.024***	0.003	−0.017***	0.035***
	(0.003)	(0.003)	(0.001)	(0.002)
Observations	2,994	2,291	2,994	2,291
R-squared	0.216	0.244	0.352	0.359
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes
Panel B (Rank 2). This group represent the next 20% most valued firms after bottom 20% least valued firms				
Book Dev	0.050***	0.121***		
	(0.012)	(0.012)		
Market Dev			0.272***	0.278***
			(0.020)	(0.018)
Constant	0.012***	−0.007***	−0.036***	−0.074***
	(0.001)	(0.001)	(0.004)	(0.003)
Observations	2,548	2,027	2,548	2,027
R-squared	0.328	0.361	0.385	0.497
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes
Panel C (Rank 3). This represents the third group of most valued firms based on their market values				
Book Dev	0.055***	0.068***		
	(0.012)	(0.014)		
Market Dev			0.151***	0.188***
			(0.017)	(0.018)
Constant	0.002	−0.010***	−0.029***	−0.070***
	(0.002)	(0.002)	(0.005)	(0.005)
Observations	2,365	1,974	2,365	1,974
R-squared	0.304	0.318	0.376	0.414
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes
Panel D (Rank 4). This group represents second group most valued firms next to the top-most valued firms				
Book Dev	0.050***	0.142***		
	(0.014)	(0.013)		
Market Dev			0.100***	0.068***
			(0.016)	(0.012)
Constant	−0.007	−0.050***	−0.029***	−0.042***
	(0.004)	(0.004)	(0.007)	(0.005)
Observations	2,319	2,369	2,319	2,369
R-squared	0.274	0.305	0.343	0.395
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes
Panel E top 20 (Rank 5). This group represents the top 20% most valued firms				
Book Dev	0.011	0.082***		
	(0.010)	(0.010)		
Market Dev			0.019	0.030***
			(0.014)	(0.009)

(*continued*)

Table 4. Growth in the market value of firms and the speed of adjustment

Variable	PreCOVID ΔBook lev	COVID ΔBook lev	PreCOVID ΔMarket lev	COVID ΔMarket lev
Constant	−0.002	−0.071***	−0.005	−0.028***
	(0.009)	(0.008)	(0.008)	(0.005)
Observations	2,371	2,598	2,371	2,598
R-squared	0.271	0.223	0.301	0.288
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes

Note(s): Table 4 displays how sensitive the SOA is to firm's market value. Each panel presents the results from the baseline model for each group in examining the variation in the SOA. PreCOVID and COVID samples range between 2018Q3-2020Q1 and 2020Q2-2021Q4 respectively. Robust standard errors are presented in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5%, and 10% respectively
Source(s): Table by authors

Table 4.

both book and market leverage does not matter. However, the findings indicate that during the pandemic, the SOA toward the book target is higher (8.2%) relative to the SOA for market leverage (3%). The results for this class of firms are interesting and show that for highly valued firms, the SOA matters only in times of crisis. The results also deviate from the extant literature where the estimated SOA for market leverage has consistently been higher than book leverage and support the findings by Yin and Ritter (2020).

The analysis shows how sensitive SOA is to the growth in the market value of equity such that firms that are less valued (risky firms) adjust toward their leverage target much faster than firms that are highly valued (less risky firms). The analysis also offers some explanation as to why the baseline results show that although there is an increasing SOA for both book and market leverage, the SOA for the market increases at a decreasing rate during the pandemic. The results offer insight to the point that less valued firms adjust faster toward their leverage target, especially in times of crisis to prevent drifting too far off their target, since larger deviations expose the firm to more risks and costly adjustments. Thus, the decline in SOA for market leverage during the pandemic can be thought of as being driven by highly valued firms. Hence, a cautionary tale must be exercised when interpreting the SOA since convergence rates differ for larger-sized firms compared to smaller-sized firms. These findings are consistent with DeAngelo, DeAngelo, and Whited (2011) who argue that the SOA is not the same for all firms.

3.4 Speed of adjustment for over-levered and under-levered firms

This section refines the estimation from the baseline model specified in Eq. (1) to adjust for the asymmetry in the SOA between over-levered and under-levered firms. Existing evidence suggests that the speed of leverage convergence is the same for all firms except for DeAngelo *et al.* (2011) who argue otherwise. The pecking order theory posits an asymmetry in the SOA between over-levered and under-levered firms since the cost of funding is higher for over-levered firms (Byoun, 2008; Ho *et al.*, 2021). Faulkender *et al.* (2012) argue that even when the cost of adjustment is the same for over-levered and under-levered firms, the potential benefits may differ and that the value of the firm also decreases with increasing leverage. It is expected that in crisis, over-levered firms may be at risk more and face costly financing relative to under-levered firms. Hence, the SOA is expected to be higher for over-levered firms.

The results are reported in Table 5. Surprisingly, the estimated SOA toward the book target for the pre-pandemic case is higher for under-levered firms: 8.2% versus 1.4% per quarter. However, during the pandemic period, the SOA toward book target is higher for over-levered firms than for under-levered firms: 9.5% versus 5.2% per quarter. On the other

Variable	PreCOVID Over levered	PreCOVID Under levered	COVID Over levered	COVID Under levered	PreCOVID Over levered	PreCOVID Under levered	COVID Over levered	COVID Under levered
	ΔBook lev				ΔMarket lev			
Book Dev	0.014**	0.082***	0.095***	0.052***				
	(0.007)	(0.006)	(0.006)	(0.006)				
Market Dev					0.339***	0.054***	0.310***	0.048***
					(0.013)	(0.007)	(0.012)	(0.005)
Constant	0.016***	−0.017***	−0.025***	−0.020***	−0.061***	−0.014***	−0.110***	−0.027***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.004)	(0.002)	(0.004)	(0.002)
Observations	7,371	5,226	6,722	4,537	7,371	5,226	6,722	4,537
R-squared	0.268	0.314	0.284	0.294	0.411	0.289	0.383	0.366
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note(s): This table refines the estimation from the baseline model specified in Eq. (1) to adjust for the asymmetry in the SOA between over-levered and under-levered firms. The over-levered firms are defined as the leverage higher than the target leverage, and under-levered firms are defined as the leverage lower than the target leverage. PreCOVID and COVID samples range between 2018Q3-2020Q1 and 2020Q2-2021Q4 respectively

Robust standard errors are presented in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5%, and 10% respectively

Source(s): Table by authors

Table 5.
Levered versus unlevered firms and speed of adjustment

hand, the SOA toward the market target is strikingly higher for over-levered firms: 33.9% versus 5.4% per quarter before the pandemic and 31% versus 4.8% per quarter during the pandemic. While Faulkender *et al.* (2012) also report higher SOA for over-levered firms, the striking differences in the rate reported in this study can be attributed to the growth prospects of the firm, the tighter credit requirements and additional risks posed by the pandemic.

3.5 Cash and speed of adjustment

Prior evidence shows that US firms hold more cash and invest less due to uncertainty to prevent the destruction of shareholder wealth (e.g. Pinkowitz, Sturgess, & Williamson, 2013, 2016). If this is the case, then how does this behavior affect leverage SOA? Theories of corporate finance point to the imperative function of liquidity in the reduction of transaction costs (Dang, Moshirian, Wee, & Zhang, 2015; Ho *et al.*, 2021). Faulkender *et al.* cite a firm's incentive to access the capital market as another reason that affects the cost of leverage adjustment. They argue that "cash cow" firms may generate cash in excess of their profitable investment and may choose between paying off their debt, paying dividends, or repurchasing shares. Evidence suggests that the pandemic led to a reduction in dividend payout and an increase in cash holding (Krieger *et al.*, 2021; Tut, 2021). Due to the increasing uncertainty borne by the pandemic and the worsening of cash flow (Haque & Varghese, 2021), firms with more cash fearing increasing adjustment costs from large deviations may want to converge to their optimal levels of leverage target faster.

Table 6 presents the empirical findings for firms with NPND (Strebulaev & Yang, 2013). Strebulaev and Yang (2013) argued that cash can sometimes be viewed as negative debt and defined NPND as firms with the sum of long-term debt plus debt in current liabilities less cash and short-term investment equal to or less than 0. We adopt this measure for this analysis. The findings are presented for the full sample, low-valued and most-valued firms. The results presented in Panel A (full sample) show that firms with more cash adjust faster towards their

Variable	PreCOVID LowCash	PreCOVID HighCash	COVID LowCash	COVID HighCash	PreCOVID LowCash	PreCOVID HighCash	COVID LowCash	COVID HighCash
	ΔBook lev				ΔMarket lev			
Panel A Full sample								
Book Dev	0.010*	0.103***	0.074***	0.084***				
	(0.006)	(0.009)	(0.006)	(0.009)				
Market Dev					0.316***	0.057***	0.298***	0.030***
					(0.012)	(0.008)	(0.010)	(0.006)
Constant	0.015***	−0.070***	−0.009***	−0.056***	−0.060***	−0.013***	−0.109***	−0.015***
	(0.001)	(0.007)	(0.001)	(0.006)	(0.003)	(0.003)	(0.003)	(0.002)
Observations	9,244	3,353	7,776	3,483	9,244	3,353	7,776	3,483
R-squared	0.264	0.329	0.230	0.282	0.389	0.263	0.366	0.303
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B Low 20 (Rank 1) This group represent the least 20% valued firms								
Book Dev	0.007	0.100***	0.042***	0.046***				
	(0.014)	(0.016)	(0.013)	(0.015)				
Market Dev					0.197***	0.497***	0.112***	0.479***
					(0.020)	(0.027)	(0.018)	(0.031)
Constant	0.029***	−0.030***	0.020**	−0.014***	−0.030***	0.107***	−0.026***	0.038***
	(0.008)	(0.005)	(0.008)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)
Observations	1,936	1,058	1,294	997	1,936	1,058	1,294	997
R-squared	0.248	0.386	0.274	0.292	0.443	0.364	0.442	0.360
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel C Top 20 (Rank 5) This group represents the top 20% most valued firms								
Book Dev	−0.002	0.055**	0.071***	0.150***				
	(0.011)	(0.028)	(0.010)	(0.027)				
Market Dev					0.057***	−0.026***	0.127***	−0.028***
					(0.020)	(0.010)	(0.016)	(0.006)
Constant	0.009	−0.078*	−0.052***	−0.207***	−0.028**	0.015***	−0.090***	0.010***
	(0.008)	(0.043)	(0.007)	(0.038)	(0.013)	(0.005)	(0.010)	(0.003)
Observations	1,952	419	2,053	545	1,952	419	2,053	545
R-squared	0.284	0.337	0.201	0.342	0.325	0.285	0.314	0.271
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note(s): Table 6 presents the impact of the cash holdings on the speed of adjustment. LowCash firm is defined as having non-positive net debt equals to 0, otherwise the firm is classified as HighCash. Non-positive net debt (NPND) (Strebulaev & Yang, 2013) is a dummy variable measured as follows: if firms with the sum of long-term debt plus debt in current liabilities less cash and short-term investment equal to or less than 0 than the firm is identified as high cash firm, otherwise it is defined as low cash firm. In Panel A, report finding for the full sample. In Panel B and C report the findings for least 20% valued firms and top 20% valued firms, respectively Pre-COVID and COVID samples range between 2018Q3-2020Q1 and 2020Q2-2021Q4 respectively
Robust standard errors are presented in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5%, and 10% respectively
Source(s): Table by authors

Table 6.
Cash and speed of adjustment

book target than those with less cash. However, firms with less cash are estimated to adjust faster toward market leverage than those with more cash. As discussed above, the behavior exhibited toward the SOA for market leverage is a result of the "size effect".

For instance, in Panel B, we show that low-valued firms with more cash adjusted faster towards both book and market leverage. However, considering the case of highly valued firms (Panel C), we find that the SOA towards the market target is reduced. This could explain

the lower SOA towards market leverage in the full sample case (Panel A). These results are expected since low-valued firms with more cash may want to adjust quickly in times of uncertainty to shirk away from increasing adjustment costs which may not be the case for high-valued firms. These results are also confirmed when we consider non-dividend-paying firms. Unreported results (available upon request) show that firms that did not pay dividends adjusted faster toward their target ratio than dividend-paying firms.

3.6 Speed of adjustment in states most affected by the pandemic

This section analyzes the SOA for firms headquartered in states most severely affected by the pandemic. We match the firm's location with the most affected states by the number of reported cases using the state of its headquartered. Evidence suggests that local stock returns increase during local unfavorable economic circumstances since local risk aversion increases with risk-sharing decreasing (Korniotis & Kumar, 2013). These states are also likely to get government support in times of crisis. Vo *et al.* (2021) find the SOA to be higher for firms situated in countries most affected by the pandemic.

Hence, it is expected that firms headquartered in such states will adjust faster toward their target ratio. To examine this effect, we split the sample into two groups: the top 25 most affected (high cases) and the bottom 25 least affected states (low cases) [9]. Next, we performed the basic analysis on the two groups for both book and market leverage. The results are presented in Table 7. The results confirm prior evidence (Vo *et al.*, 2021) and show that the SOA increases for firms situated in states in terms of higher cases. Quantitively similar results were obtained when we ranked the states in terms of death cases. The results suggest that as the pandemic-related risk in the states in which the firm is headquartered increases, firms tend to adjust towards their target ratio faster to prevent any additional costs of adjustment emanating from deviating more from the target level.

3.7 COVID-19 exposure, firm-level risk and target deviation: a mediation analysis

The previous discussion emphasized that the emergence of the pandemic may potentially increase risk which could cause deviations from the target ratio thereby rendering firms

Variable	Low cases ΔBook lev	High cases ΔBook lev	Low cases ΔMarket lev	High cases ΔMarket lev
Book Dev	0.071***	0.080***		
	(0.005)	(0.012)		
Market Dev			0.116***	0.167***
			(0.006)	(0.018)
Constant	−0.023***	−0.011***	−0.051***	−0.064***
	(0.001)	(0.002)	(0.002)	(0.005)
Observations	9,833	1,426	9,833	1,426
R-squared	0.209	0.203	0.299	0.318
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes

Note(s): Table 7 presents the SOA for firms headquartered in states most severely affected by the pandemic. The sample is split into two groups: the top 25 most affected (high cases) and the bottom 25 least affected states (low cases)
Pre-COVID and COVID samples range between 2018Q3-2020Q1 and 2020Q2-2021Q4, respectively
Robust standard errors are presented in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5%, and 10% respectively
Source(s): Table by authors

Table 7.
Speed of adjustment in the top 25 most affected versus low 25 least affected states

willing to adjust quickly towards their target ratio to avoid costly adjustments as a result of large deviations. This section provides evidence of the degree of increase in firm-level risk brought about by the pandemic. Prior studies show that the COVID-19 shock increases stock market volatility (Baek & Lee, 2021). In this study, we use Hassan *et al.*'s (2020) firm-level risk and Covid-exposure measures [10] to conduct a mediation analysis and examine first, the degree of deviation from the target ratio induced by the exposure to the pandemic.

Second, how the exposure to the pandemic has increased the overall risk faced by the firm. Lastly, whether firm-level risk fully or partially mediates the effect of the pandemic on target deviation. This analysis is to help shed light on (1) the direct effect of the pandemic on target deviations which warrants an increase or decrease in convergence rate and (2) the indirect effect through which the pandemic affects target deviations through firm-level risk. We predict that if exposure to the pandemic has the potential increasing firm risk, then the exposure to the pandemic may (in)directly affect leverage deviations through overall firm risk.

The results are presented in Table 8 Panel A. The findings show that *Ln(RISK)* increase (decrease) book (market) deviations by 0.4% (−0.9%) (columns 1 and 4), respectively. However, an unreported subsample analysis (available upon request) shows that for low-valued firms, exposure to the pandemic caused an increase in both book and market deviation. Yet, for high-valued firms, while there was an increase in book deviation, there was a decline in market deviation. This potentially shows that the reduction in market deviation as reported in Table 8 Panel is driven by highly valued firms.

The results further show that exposure to the pandemic caused an increase in firm-level overall risk by roughly 23~24% (columns 5 and 2). This is suggestive of the increase in SOA to shirk away from the costly nature of adjustments from larger deviations. Additionally, the results (column 3 and 6) shows that firm-level risk *(Ln(RISK))* partially mediates the effect of *Covid Exposure* on how far firms deviate from their optimal level. That is, even though exposure to the pandemic has a significant impact on the overall level of firm risk, the firm risk does not fully absorb the effect of exposure to the pandemic to the deviations from the optimal leverage level.

The significance of this analysis demonstrates that a substantial proportion of the observed increase (decrease) in deviation from book (market) target during the pandemic can be explained partially by overall firm-level risk. This implies that although there is evidence that the pandemic caused a deviation from the target ratio which subsequently affected the SOA, this deviation cannot be solely attributed to the pandemic but also to the overall risk that firms face.

3.8 COVID-19 exposure, risk and SOA

We provide additional evidence on how firms exposed to the pandemic react toward their SOA. To do this, we split the sample into two based on the level of exposure. Firms with exposure values greater than the sample median values are classified as high exposure, otherwise low exposure. As a robustness check, we also use the variable COVID-Risk and split the sample into two following the same step as before. The results for this analysis are reported in Panels B and C of Table 8. Our findings show that firms that exhibited concerns of high exposure or high risk have a higher SOA as compared to low exposure or low risk firms. These findings also confirm our hypothesis that risk-avoidance may induce firms to accelerate how fast they return to their optimal level after deviating from it.

4. Conclusion

The unexpected shock to firms and businesses brought about by the emergence of the COVID-19 pandemic has considerably heightened business risks and changed business decisions, especially regarding their capital structure. In this study, we examined how the

Panel A. Mediation analysis

Variable	(1) Book dev	(2) Ln(RISK)	(3) Book dev	(4) Market dev	(5) Ln(RISK)	(6) Market dev
Covid Exposure	0.004***	0.237***	0.003**	−0.009***	0.231***	−0.007***
	(0.002)	(0.012)	(0.002)	(0.001)	(0.012)	(0.001)
Ln(RISK)			0.004***			−0.006***
			(0.001)			(0.001)
EBIT/TA		−1.119***			−1.052***	
		(0.319)			(0.319)	
M2B		−0.076***			−0.072***	
		(0.013)			(0.013)	
Depreciation		−7.550			−6.355	
		(6.524)			(6.503)	
Size		−0.318***			−0.330***	
		(0.069)			(0.068)	
Tangibility		0.617			0.533	
		(0.386)			(0.385)	
R&D/TA		−2.913**			−2.940**	
		(1.234)			(1.231)	
R&D Dummy		0.077			0.076	
		(0.065)			(0.065)	
Ind Median Book Lev		−4.201				
		(3.796)				
Ind Median Market Lev					−29.123***	
					(5.573)	
Constant	0.221***	7.297***	0.207***	0.304***	12.021***	0.326***
	(0.002)	(1.147)	(0.006)	(0.002)	(1.248)	(0.004)
Observations	11,259	11,259	11,259	11,259	11,259	11,259
R-squared	0.992	0.417	0.992	0.945	0.418	0.945
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes	Yes	Yes

Note(s): In Table 8, we used the Hassan *et al.* (2020)'s firm-level risk, Covid-exposure, and Covid Risk measures to conduct a mediation analysis and examine the degree of deviation from the target ratio induced by the exposure to the pandemic; how the exposure to the pandemic has increased the overall risk faced by the firm; and whether firm-level risk fully or partially mediates the effect of the pandemic on target deviation
The samples range between 2020Q2-2021Q4
Robust standard errors are presented in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5%, and 10% respectively
Source(s): Table by authors

Panel B. COVID exposure and SOA

Variables	Low exposure (1) Book dev	High exposure (2) Book dev	Low exposure (3) Market dev	High exposure (4) Market dev
Book Dev	0.059***	0.078***		
	(0.007)	(0.007)		
Market Dev			0.109***	0.147***
			(0.008)	(0.011)
Constant	−0.021***	−0.018***	−0.049***	−0.059***
	(0.002)	(0.001)	(0.003)	(0.003)

(*continued*)

Table 8.
A mediation analysis using firm-level risk

Panel B. COVID exposure and SOA

Variables	Low exposure (1) Book dev	High exposure (2) Book dev	Low exposure (3) Market dev	High exposure (4) Market dev
Observations	5,864	5,395	5,864	5,395
R-squared	0.336	0.394	0.422	0.441
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes

Note(s): This table report the findings of how different levels of exposure to the pandemic affected the SOA. High Exposure is when the values are higher than the median values, and low exposure is otherwise. The data is based on Hassan *et al.* (2020). Robust standard errors are presented in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5%, and 10% respectively

Source(s): Table by authors

Panel C. COVID risk and SOA

Variables	Low risk (1) Book dev	High risk (2) Book dev	Low risk (3) Market dev	High risk (4) Market dev
Book Dev	0.067***	0.091***		
	(0.006)	(0.009)		
Market Dev			0.126***	0.132***
			(0.007)	(0.013)
Constant	−0.019***	−0.028***	−0.052***	−0.060***
	(0.001)	(0.002)	(0.002)	(0.004)
Observations	7,533	3,726	7,533	3,726
R-squared	0.319	0.510	0.390	0.509
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes

Note(s): This table presents a robustness check to the usage of Covid exposure by using Covid risk measure. High Risk is when the values are higher than the median values, and low risk is otherwise. Again, the data is based on Hassan *et al.* (2020). Robust standard errors are presented in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5% and 10%, respectively

Source(s): Table by authors

Table 8.

COVID-19 pandemic has caused US firms to change their speed of leverage adjustment following a consistent fall in their leverage ratios. The paper further explores the driving factors behind the differences in the observed changes in the speed of leverage adjustment during the pandemic. Lastly, we examine the extent to which the pandemic and firm-level risk have caused deviations from the target ratio thereby causing a change in the SOA.

Using a sample of US-listed non-financial and non-utility firms, we show that the SOA toward book targets increased during the pandemic relative to the pre-pandemic. However, the estimated SOA toward the market target is lower during the pandemic relative to the pre-pandemic. The observed difference is observed to be driven by the growth in market value and risk avoidance motive. Particularly, while low-valued firms tend to adjust strikingly faster toward target (market) leverage during the pandemic, high-valued firms adjust slowly.

Further, the SOA towards book target for firms with more cash (NPDB) is estimated to be higher during the pandemic relative to the pre-pandemic. However, in the case of target market leverage, it is found that firms with low cash tend to adjust faster. Again, a subsample analysis revealed that this effect is driven by highly valued firms. In particular, while low-valued firms with more cash adjusted faster during the pandemic, high-valued firms adjusted slowly. Lastly, an examination of how much deviation from the target ratio can be attributed to the pandemic and firm-level overall risk, a mediation analysis show that not only did the

pandemic alone cause a dramatic deviation from the target ratio which facilitated a faster and/or slower SOA, but also the overall firm-risk. The analysis shows that firm-level risk partially mediated the effect of the pandemic on how far firms deviated from their target ratio.

This study advances our understanding of changes in leverage dynamics (Bajaj, Kashiramka, & Singh, 2021) in response to the emergence of the pandemic and contributes to the literature on the determinant of changes in leverage adjustment. An extension of this study will be to investigate firms' alternative sources of financing and changes in the cost of capital induced by the COVID-19 pandemic. This is important since financing options were limited during the pandemic; thus, there is the likelihood of a differential effect on the SOA. Also, since this study is limited to US-publicly traded firms, it would be interesting to compare the pandemic's impact on SOA for different markets (emerging, advanced, BRICS) since the pandemics' impact varied across regions or markets. Lastly, another crucial area for future research on leverage dynamics during the pandemic is the impact of institutions.

Notes

1. The decline in leverage ratio is presented in Figure 1. It is evident that both book and market leverage prior to the pandemic were increasing. However, the onset of the pandemic can be seen with a decline in both leverage ratios.
2. Financial Stability Report (May 2021). The Federal Reserve and later by Deloitte reported a strong business borrowing which led to an increase in total debt-to-GDP ratio some years before the pandemic but decreased some months into 2020 - https://www.federalreserve.gov/publications/may-2021-borrowing-by-businesses-and-households.htm

   Decoding the drivers of corporate debt and corporations' ability to repay: A look at company-level data (July 15, 2021) - https://www2.deloitte.com/xe/en/insights/economy/issues-by-the-numbers/rising-corporate-debt-after-covid.html
3. Figure 1 show three different patterns. Leverage was fairly stable before 2018q3. However, leverage increased significantly between 2018q3 and 2020q1 as a result of the large corporate borrowing. This is followed by a sharp decline in leverage following the emergence of the pandemic.
4. Deloitte July 2021 Report by Buckley, Barua, and Samaddar - The pandemic has forced corporate debt higher: But is that a bad thing? They discuss the behavior of firm debt before and within the pandemic and the consequences on the US ecocnomy. https://www2.deloitte.com/xe/en/insights/economy/issues-by-the-numbers/rising-corporate-debt-after-covid.html
5. Leverage ratio (LevR) is measure both using book and market leverage. Book leverage is measured as (Debt/ATQ). Market leverage is measured as (Debt/Debt + PRCCQ*CSHOQ), where Debt = DLCQ + DLTTQ. DLCQ, DLTTQ, and ATQ are compustat data items.
6. Book deviation (Dev) is defined as the book target ratio minus the book leverage ratio from the previous quarter. Similarly, Market deviation (Dev) is defined as the market target ratio minus the market leverage from the previous quarter. The target ratio is estimated from Eq. (3).
7. Fisher's Permutation test with a bootstrapping sample of 1000 was performed to test the significance of the differences in the coefficient and the results suggested that the change in the SOA in the two samples (before and within the pandemic) for both the book leverage and the market leverage are significant at 1% level.
8. Market value of equity at quarter t is the product of the close market price at the calendar quarter end times the shares outstanding. (PRCCQand CSHOQ are Compustat variables).
9. States most affected data is retrieved on May 17, 2022 from https://www.nytimes.com/interactive/2021/us/covid-cases.html
10. Firm-level risk and Covid-19 Exposure is a measure of conversations about the overall degree of risk and Covid-19 exposure the firm faces using a textual analysis—by counting the number of synonyms for risk or uncertainty or words related to exposure to the pandemic found in the quarterly earnings conference transcript (Hassan *et al.*, 2020).

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(The Appendix follows overleaf)

Appendix

	Definition
EBIT/TA	(Income before extraordinary items plus interest expense plus income taxes)/total assets
M2B	Market to book ratio= (total liabilities plus equity value)/total assets
Depreciation	(Depreciation and amortization)/total assets
Size	Natural logarithm of total assets
Tangibility	Net property plant, and equipment/total assets
R&D/TA	Research and development expense/total assets; missing values are set to 0
R&D Dummy	If R&D expense is reported, 0 otherwise
Ind Median Book Lev	Without firm self's two-digit industry median of book leverage ratio
Ind Median Market Lev	Without firm self's two-digit industry median of market leverage ratio
Debt	Total debt = Debt in current liabilities + total long-term debt
Market value	Market value = stock price*common shares outstanding
Book Lev	Debt/total asset
Book Dev	Book target ratio minus the book leverage ratio from the previous quarter
Book Target	Target book leverage ratio, estimated by Faulkender *et al.* (2012) model
Market Lev	Debt/(debt + market value)
Market Dev	Market target ratio minus the market leverage from the previous quarter
Market Target	Target market leverage ratio, estimated by Faulkender *et al.* (2012) model
NPND	Firms with the sum of long-term debt plus debt in current liabilities less cash and short-term investment equal to or less than 0
Dividend Payout	Is a dummy variable set to 1 if the firm paid dividend in a given quarter, 0. Otherwise
Investment tax credit	Represents deferred taxes and investment tax credit and it is set to 1 if the firm received the incentive in a given quarter, 0 otherwise
Covid Exposure	Covid-19 Exposure is a measure of conversations about the overall degree of risk and Covid-19 exposure the firm faces using a textual analysis—by counting the number of synonyms for risk or uncertainty or words related to exposure to the pandemic found in the quarterly earnings conference transcript (Hassan *et al.*, 2020)
Covid Risk	See Hassan *et al.* (2020)
Ln (RISK)	The log form of the firm's overall risk. The data is obtained from Hassan *et al.*'s (2020). It is a measure of overall firm-level risk simply counts the frequency of mentions of synonyms for risk or uncertainty and divides by the length of the transcript

Table A1.
Variable description

Source(s): Table by authors

Variables	(2) ΔBook lev	(4) ΔMarket lev
Panel A. Investment tax credit (Government incentive)		
Book Dev	0.069***	
	(0.005)	
ITC*Book Dev	0.007**	
	(0.003)	
Market Dev		0.093***
		(0.007)
ITC*Market Dev		0.061***
		(0.008)
ITC	−0.004	−0.010**
	(0.005)	(0.004)
Constant	−0.019***	−0.052***
	(0.003)	(0.003)
Observations	11,157	11,157
R-squared	0.208	0.305
Firm FE	Yes	Yes
Qtr FE	Yes	Yes

Note(s): This table report findings from using investment tax credit as a moderator to examine the impact on SOA during the pandemic. Robust standard errors are presented in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5%, and 10% respectively

Source(s): Table by authors

Variables	(1) ΔBook lev	(2) ΔBook lev	(3) ΔMarket lev	(4) ΔMarket lev
Panel B. COVID-19 government support				
Book Dev	0.177	0.194***		
	(0.111)	(0.070)		
Market Dev			0.025	0.155*
			(0.118)	(0.085)
Constant	0.275	0.076**	0.026	−0.021**
	(0.170)	(0.035)	(0.037)	(0.010)
Observations	45	66	45	66
R-squared	0.320	0.378	0.437	0.322
Firm FE	Yes	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes	Yes

Note(s): List of companies - Akoustis Technologies, Inc. (AKTS), Allied Esports Entertainment Inc. (AESE), Alphatec Holdings, Inc. (ATEC), Amplify Energy Corp. (AMPY), Ekso Bionics Holdings, Inc. (EKSO), Dynatronics Corporation (DYNT), Ekso Bionics Holdings, Inc. (EKSO), Emmis Communications Corporation (EMMS), EyePoint Pharmaceuticals, Inc. (EYPT), Flux Power Holdings, Inc. (FLUX), Horizon Global Corporation (HZN), iBio, Inc. (IBIO), Jones Soda Co. (JSDA), Lazydays Holdings, Inc. (LAZY), and One Stop Systems, Inc. (OSS)

This table presents findings from randomly sampling firms that received direct Covid-support from the federal government. Robust standard errors are presented in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$ signifies significance at 1%, 5%, and 10% respectively

Source(s): Table by authors

Table A2.
Government incentive, government support, and SOA

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