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Estimating the COVID-19 cash crunch: Global evidence and policy ☆

Antonio De Vito *, Juan-Pedro Gómez

IE Business School, IE University, Spain

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ABSTRACT

In this paper, we investigate how the COVID-19 health crisis could affect the liquidity of listed firms across 26 countries. We stress-test three liquidity ratios for each firm with full and partial operating flexibility in two simulated distress scenarios corresponding to drops in sales of 50% and 75%, respectively. In the most adverse scenario, the average firm with partial operating flexibility would exhaust its cash holdings in about two years. At that point, its current liabilities would increase, on average, by eight times, suggesting that the average firm would have to resort to the debt market to prevent a liquidity crunch. Moreover, about 1/10th of all sample firms would become illiquid within six months. Finally, we study two different fiscal policies, tax deferrals and bridge loans, that governments could implement to mitigate the liquidity risk. Our analysis suggests bridge loans are more cost-effective to prevent a massive cash crunch.

1. Introduction

The outbreak of COVID-19, which likely originated in China in January 2020, has so far infected more than one million humans globally and caused more than 100,000 deaths.[1] The global spread of this virus led the World Health Organization to characterize this infectious disease as a pandemic on March 11, 2020.[2] In addition to the individual tragedies and casualties caused by the disease, the economic risks of the pandemic are not trivial (Bloom et al., 2018). With most countries in some kind of lockdown, consumer demand for products and services has plummeted. The lockdown has also stalled production and service supply chains both nationally and internationally. Together with the human and medical system ramifications, this pandemic is causing significant job losses that will further drive demand downwards, thus leading to a potential global economic recession (Organisation for Economic Co-operation and Development, or OECD, 2020a). Consequently, investors have started to discount

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* Corresponding author at: Department of Accounting and Management Control, IE University, Madrid 28006, Spain.
E-mail addresses: antonio.de.vito@ie.edu (A. De Vito), juanp.gomez@ie.edu (J.-P. Gómez).

[1] See also the COVID-19 map for an update (available at https://coronavirus.jhu.edu/map.html, last accessed April 7, 2020).

[2] See also the WHO Director-General's opening remarks at the media briefing on COVID-19 on March 11, 2020 (available at https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020, last accessed March 23, 2020).

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the liquidity risk in stock prices (Ramelli and Wagner, 2020). In total, about USD 23 trillion in global market value has been destroyed since the outbreak.[3]

A plausible explanation for the market reaction is that prolonged depression of market demand will likely make solvent but cash-constrained firms become illiquid. Indeed, although banks should theoretically be willing to lend to profitable firms, past experience, including that of the 2007–2009 Great Recession (e.g., De Haas and Van Horen, 2013; Becker and Ivashina, 2014), shows that firms and investors are correct to feel, at best, skeptical about this assumption. If policymakers do not intervene swiftly, even temporary shocks could lead to a liquidity crisis with long-lasting damage that the market will rightly discount.

In this paper, we test this assumption by performing several stress tests on the short- and long-term liquidity of 14,245 listed firms across 26 countries. To assess the liquidity risk, we compute three financial ratios: the *cash burn rate* and the *cash flow from operations to current liabilities* measure the short-term liquidity risk, whereas the *cash flow from operations to total debt* measures the long-term liquidity risk. We then stress-test the three ratios by simulating two alternative distress scenarios, which correspond to drops in sales of 50% and 75%, respectively. In our analyses, we assume that firms either have full or partial operating flexibility to adjust to an adverse shock.[4] Our base case scenario is the fiscal year 2018, which is also the last reporting period currently available. In the base case scenario, we find that the average firm has cash holdings for about four years and eight months of annual operating cash flow. However, our results indicate that the average firm with partial operating flexibility would exhaust its cash holdings in about three years if sales were to drop by 50%. This cash burn period would further shrink as demand contracts, and it would last about two years in the high-risk scenario (i.e., a drop in sales of 75%).

Motivated by this evidence, in the next set of analyses, we examine the implications for the financing of short-term liabilities. In the base case scenario, the average firm is able to cover about 66% of its current liabilities using its cash flow from operations. However, if sales were to drop by 50% and 75%, our results indicate that the short-term liabilities of the average firm with partial flexibility would increase substantially, with the increases ranging from 216.01% in the moderate-risk scenario to 779.26% in the high-risk scenario. These results suggest that the contraction in demand due to COVID-19 would also spill over negatively to suppliers. Hence, to prevent a cash crunch at the end of the cash burn period, firms with partial operating flexibility would have to resort to the debt market. Our findings indicate that the debt issuances would range from 30.27% to 53.05% relative to the level of noncurrent liabilities in 2018.[5]

Finally, we evaluate which fiscal measures could be more effective in ameliorating the risk of a COVID-19 cash crunch and preventing a massive number of corporate insolvencies (e.g., Baldwin and Weder di Mauro, 2020; Bénassy-Quéré et al., 2020). To help firms meet liquidity needs in the short term, some European countries, such as Italy and Sweden, have granted tax deferrals, while other countries have provided firms with loans and loan guarantees.[6] Our analyses suggest that tax deferrals appear only marginally effective in helping firms avoid becoming illiquid, whereas bridge loans and loan guarantees seem to be more cost-effective in avoiding a cash crunch.

Our paper connects to two strands of research. First, we draw heavily on the literature that studies the economic effects of pandemics. Most of these studies use simulation techniques to estimate the impacts of pandemics on macroeconomic outcomes (Fan et al., 2018; Fornaro and Wolf, 2020; McKibbin and Fernando, 2020) and to evaluate the effects of policy interventions to curb pandemics (Adda, 2016). To the best of our knowledge, our work is the first to provide a microanalysis of one specific economic risk arising from pandemics, namely, the liquidity risk, and how fiscal policies could mitigate it. Second, our paper relates to the finance and accounting studies that examine the effects of stress tests within banks. These prior works primarily use stress tests to investigate the consequences of banks' sovereign risk exposures (Bischof and Daske, 2013), bank opaqueness (Petrella and Resti, 2013), and banks' accounting discretion during financial crises (Huizinga and Laeven, 2012). We provide a novel perspective on stress tests and emphasize their importance in assessing the liquidity risk of nonfinancial firms.

2. Theoretical framework and empirical strategy

To examine the liquidity of firms during the COVID-19 outbreak of January 2020, we proceed in three steps. In Section 2.1, we use a simple theoretical framework to describe how a contraction in demand affects a firm's cash flow from operations and its current liabilities. In Section 2.2, we introduce three financial ratios used in the accounting literature to measure the liquidity risk (e.g., Bowen et al., 2002) and we link them to our theoretical framework. In Section 2.3, we describe the empirical strategy that will form the basis for the stress tests on the three financial ratios under different distress scenarios.

[3] *The Economist*, "Covid carnage," March 21, 2020.

[4] The assumption of partial operating flexibility is also consistent with anecdotal evidence. The *Financial Times* finds that, although "companies are facing a revenue cliff and they are facing unique challenges", [...], "they are [trying] to keep the workforce paid, keep the firm open, and have the financial resources to weather the storm so they can start growing as quickly as possible afterwards." *Financial Times*, "US companies seek clarity on $454bn lending fund," March 29, 2020.

[5] This result is consistent with anecdotal evidence, which suggests that "the coronavirus outbreak has prompted a general dash for cash [that] companies around the globe [have tried to anticipate] by issuing about USD 244 billion investment-grade corporate bonds in March 2020." *Financial Times*, "Big companies raise record sums from bond market in dash for cash," March 29, 2020.

[6] *Financial Times*, "How major economies are trying to mitigate the coronavirus shock," March 30, 2020.

2.1. Theoretical framework

To illustrate how a contraction in demand (i.e., drop in sales) affects cash flow from operations, we use a hypothetical firm and denote its sales as *Sales* and its cash flow from operations as *CFO*. Let $\partial Sales$ be a marginal variation in sales, such that $\partial Sales/Sales$ corresponds to the percentage change in sales. Appendix A shows that, when sales decrease by a percentage equal to $\partial Sales/Sales$, the dollar change in *CFO* is equal to

$$\partial CFO = \frac{\partial Sales}{Sales} \times \left(\left(Sales - Op.Costs \times E_{Op.Costs} \right) \times (1 - TR) - \Delta CA \times E_{\Delta CA} + \Delta CL \times E_{\Delta CL} \right) \tag{1}$$

where *Op.Costs* denotes the firm's operating costs,[7] *TR* denotes the statutory corporate tax rate, and ΔCA and ΔCL denote the annual variation in current assets (excluding cash holdings) and current liabilities, respectively. Furthermore, $E_{Op.Costs}$, $E_{\Delta CA}$, and $E_{\Delta CL}$, denote the elasticities of the operating costs, change in current assets, and change in current liabilities, respectively, with respect to sales. To be precise, each elasticity term measures the percentage change in the corresponding variable for every percentage change in sales. To clarify, let us assume that $E_{Op.Costs}$, $E_{\Delta CA}$, and $E_{\Delta CL}$ are all equal to zero. In such a case, Eq. (1) would become

$$\partial CFO = \frac{\partial Sales}{Sales} \times Sales \times (1 - TR) = \partial Sales \times (1 - TR)$$

That is, if all the firm's operating costs were fixed and the net working capital were fully independent of sales, for every percentage point decrease in sales, the cash flow from operations would decrease by the same dollar amount as the decrease in sales after taxes. However, as the elasticities grow, the firm is able to scale down production, reduce its operating costs and decrease net working capital if sales decrease, thereby partially offsetting the decrease in cash flow from operations. Hence, the elasticities measure the degree of a firm's operating flexibility to adjust to an adverse shock.

Within this framework, we also estimate the dollar change in current liabilities for a percentage change in sales, $\partial Sales/Sales$, as follows:

$$\partial CL = \frac{\partial Sales}{Sales} \times CL \times E_{CL} \tag{2}$$

where E_{CL} denotes the elasticity of current liabilities with respect to sales. Note that, for E_{CL} equal to zero, current liabilities do not change if sales decrease.

2.2. Three financial ratios to measure liquidity risk

In this section, we introduce three financial ratios to assess the short-term and long-term liquidity risk of listed firms. We then analyze how each financial ratio changes for every percentage change in sales within our theoretical framework. The first ratio is *Cash burn rate*, which measures how long a firm is able to finance its operating costs without further cash contributions from creditors or shareholders. In our context, this ratio indicates how many years it would take for the firm's current cash flow from operations to build up (if positive) or burn through (if negative) its cash holdings. The second financial ratio is *Cash flow from operations to current liabilities ratio*, which estimates the percentage of current liabilities, including short-term debt, covered by annual cash flows from operations, if these are positive, or the expected net growth in current liabilities, if the cash flows are negative. The third ratio is *Cash flow from operations to total debt ratio*, which measures the extent to which the cash flow from operations is sufficient to repay all liabilities, including noncurrent liabilities, if positive, or the percentage increase in noncurrent liabilities that the firm requires to cover its cash needs, if negative. Unlike the previous ratios, *Cash flow from operations to total debt ratio* measures a firm's long-term liquidity risk.

Following our theoretical framework, we define the cash burn rate as $Cash/CFO$, where *Cash* includes the firm's cash holdings and its accounts receivable. The ratio of cash flow from operations to current liabilities is CFO/CL. Finally, the ratio of cash flow from operations to total debt is CFO/TD, where *TD* is equal to the sum of short-term and long-term debt.[8] Consistent with our discussion, when sales drop by a percentage equal to $\partial Sales/Sales$, the three ratios will become

$$Cash\ \ burn\ \ rate = \frac{Cash}{CFO + \partial CFO}$$

$$CFO\ \ to\ \ current\ \ liabilities\ \ ratio = \frac{CFO + \partial CFO}{CL + \partial CL}$$

$$CFO\ \ to\ \ total\ \ debt\ \ ratio = \frac{CFO + \partial CFO}{TD}$$

[7] We focus on the combined operating costs rather than on single cost items (e.g., cost of goods sold, labor costs, etc.) due to the data limitations of Compustat. For example, the data on labor costs have a high proportion of missing observations (about 60% is missing in our sample). For a similar approach, see Banker et al. (2013).

[8] Appendix C provides the detailed definitions.

where ∂CFO is obtained from Eq. (1) and ∂CL is obtained from Eq. (2). All the other variables are defined as above.

To clarify the interpretation of these three ratios, we use the following example. Let us assume a hypothetical firm for which *Cash* equals about USD 40 million, *CFO* about USD 25 million, *CL* about USD 15 million, and *TD* about 50 million, all values as of 2018. The elasticities are such that, if sales decreased by 50%, Eq. (1) predicts that ∂CFO would be equal to USD –40 million, whereas Eq. (2) predicts that ∂CL would be equal to USD –10 million. Hence, after the drop in sales, the cash burn rate would amount to -2.7, the cash flow from operations to current liabilities would be equal to -300%, and the cash flow-to-debt ratio would be about -30%. Thus, the cash flow from operations would become USD –15 million and current liabilities would amount to USD 5 million. The cash burn rate implies that the firm would have about three years before the accumulated cash holdings are exhausted, assuming that no further debt or equity is issued in the meantime. The cash flow from operations to current liabilities implies that, in the fourth year, current liabilities would increase by three times relative to their level in the third year, to a total of USD 20 million (=USD 5 million × (1 + 300%)) if no additional capital were raised. This would pose a liquidity threat to the firm. Alternatively, to avoid a cash crunch, noncurrent liabilities would have to increase by 30% relative to their level in 2018.

2.3. Empirical strategy

To empirically analyze the liquidity risk of listed firms, we stress-test the three financial ratios by simulating two alternative outcomes, corresponding to drops in sales of 50% and 75%, for firms with and without full operating flexibility. We label the two distress scenarios as moderate risk and high risk, respectively. Our empirical examination proceeds as follows. First, we estimate the cash flow from operations (*CFO*) for the fiscal year 2018.[9] Second, we compute the dollar amount of the change in cash flow from operations (∂CFO) in Eq. (1) and current liabilities (∂CL) in Eq. (2) for each distress scenario. To compute the elasticities, we estimate the following regression[10] for each country k in our sample from 2013 to 2018[11]:

$$\ln(y^k_{i,j,t}) = \alpha^k_y + \beta^k_y \ln\left(Sales^k_{i,j,t}\right) + \mu_j + \mu_t + \varepsilon^k_{i,j,t} \tag{3}$$

where $y^k_{i,j,t}$ is, alternatively, operating costs ($y = Op.Costs$), the change in current assets net of cash holdings ($y = \Delta CA$), the change in current liabilities ($y = \Delta CL$), or current liabilities ($y = CL$) for firm i in industry j and year t. To control for inflation, before estimating the regression model, we deflate each variable using the country's yearly deflator from the World Bank. We include industry fixed effects (μ_j) defined at the one-digit Standard Industrial Classification (SIC) code level and year fixed effects (μ_t). For each country k and variable y, β^k_y represents, respectively, $E_{Op.Costs}$, $E_{\Delta CA}$, and $E_{\Delta CL}$ in Eq. (1) and E_{CL} in Eq. (2).[12]

In the last step, we compute the three financial ratios following the theoretical framework in Section 2.2 for the two distress scenarios and for firms with full and partial operating flexibility. Firms are said to have full operating flexibility if they can quickly adjust to an adverse shock by scaling down production, whereas firms exhibit partial operating flexibility if they face frictions in the ability to adjust. We operationalize this using the estimated elasticities per country β^k_y to compute ∂CFO and ∂CL when we assume full operating flexibility, and β^k_y divided by two when we assume partial operating flexibility.[13]

2.4. Data

To examine the liquidity risk of listed firms, we use consolidated firm-level data obtained from the Compustat Global and North America databases for the fiscal year 2018. We start by downloading the accounting data for all firms incorporated and headquartered in one of the 35 OECD countries, plus China. To draw meaningful inferences from our analyses, we require each country to have at least 50 listed firms. This sample requirement excludes 10 of the 35 OECD member countries. We rely on the International Monetary Fund's website to retrieve exchange rates and to convert each variable into US dollars. Furthermore, we collect the corporate tax rates from the KPMG's Corporate Tax Guide 2018. We exclude financial firms (SIC codes 6000–6999) and firms with negative equity, cash holdings, sales, or total assets. These restrictions result in a sample size of 14,245 unique firms across 26 countries in 2018. Note that all the analyses focus only on the fiscal year 2018, which is also the last reporting period currently available. However, for the variables defined in terms of change, such as change in current assets and change in current liabilities, we also use financial information from the fiscal year 2017.[14]

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[9] In our analyses, we implicitly assume that the financial statement remains that of 2018 for each firm.

[10] Banker et al. (2013) employ a similar approach, although their regression model differs slightly from ours, since they focus on cost stickiness.

[11] For each country-level regression, we use all firms available from Compustat's Global and North America databases from 2013 to 2018. However, when the variables are defined in terms of change, such as change in current assets and change in current liabilities, we use accounting data for the fiscal years 2012 to 2018. Moreover, before estimating the regression model, we require each country to have at least 50 observations.

[12] The average β_y across countries ranges from 0.80 for the elasticity of the change in current liabilities to 0.89 for the elasticity of operating costs. The summary statistics of the elasticities are presented in Table A1 of the Internet Appendix.

[13] Our methodology is consistent with recent anecdotal evidence, which suggests that several countries have enacted laws that constrain firms from scaling back production during the outbreak of COVID-19 (e.g., by preventing firms from laying off employees). For an overview of policy responses to the COVID-19 crisis, see also OECD (2020b). Moreover, for a similar approach, see Schivardi (2020).

[14] Table A2 of the Internet Appendix presents the sample distributions by country (Panel A) and by industry (Panel B), the latter defined at the one-digit SIC code level.

Table 1

Summary statistics. This table provides the summary statistics for the main variables used in the empirical tests. Panel A reports the summary statistics for key firm characteristics. Panel B reports the summary statistics for key industry characteristics. The industry is defined at the one-digit SIC code level. Panel C presents comparison statistics between our variable for cash flow from operations (*CFO*) scaled by total assets (*AT*) and the variable for cash flow from operations (*OANCF*) relative to total assets (*AT*) from Compustat. Appendix C provides the variable definitions.

Panel A: Summary statistics – full sample

	Obs.	Mean	Std. dev.	P25	Median	P75
Cash holdings	14,245	0.1680	0.1538	0.0555	0.1238	0.2331
Leverage	14,245	0.2405	0.2649	0.0657	0.1976	0.3374
Gross margin	14,245	0.2962	0.9522	0.1970	0.3165	0.4881
ROA	14,245	0.0116	0.3336	0.0143	0.0487	0.0858
Size	14,245	10.2486	5.1481	6.3312	9.5727	14.1740

Panel B: Summary statistics – by industry

		Agriculture, forestry, and fishing	Mining and construction	Manufacturing	Utilities	Wholesale and retail trade	Services
Cash holdings	Mean	0.1110	0.1382	0.1686	0.1005	0.1448	0.2276
	Median	0.0765	0.1031	0.1312	0.0686	0.1056	0.1708
	Std. dev	0.1029	0.1368	0.1433	0.1124	0.1324	0.1932
Leverage	Mean	0.2526	0.2650	0.2236	0.3302	0.2452	0.2290
	Median	0.2369	0.1912	0.1883	0.3116	0.2001	0.1577
	Std. dev.	0.1831	0.3386	0.2413	0.2454	0.2525	0.3041
Gross Margin	Mean	0.2641	0.0209	0.3037	0.2986	0.2832	0.3841
	Median	0.2658	0.2554	0.3140	0.3233	0.2649	0.3875
	Std. dev.	0.4151	2.1826	0.7173	1.0507	0.5414	0.9034
ROA	Mean	−0.0176	−0.0249	0.0176	0.0312	0.0308	−0.0111
	Median	0.0340	0.0442	0.0484	0.0471	0.0506	0.0531
	Std. dev.	0.4739	0.4421	0.2937	0.1993	0.2581	0.4547
Size	Mean	8.6815	8.8570	10.8419	10.2000	10.7804	8.8880
	Median	8.9194	7.9637	9.9870	9.6025	10.3373	7.9610
	Std. dev.	4.1670	5.0362	5.2209	4.4725	4.8896	5.1195
Obs.		114	993	7,593	1,405	1,457	2,683

Panel C: Comparison statistics between CFO and the variable OANCF from Compustat

	Obs.	Mean	Std. dev.	P25	Median	P75
CFO (our computation)	14,192	0.0407	0.2667	0.0131	0.0645	0.1148
OANCF (Compustat)	14,192	0.0360	0.2189	0.0150	0.0577	0.1003
Difference		0.0046				
t-Stat		1.59				

Descriptive statistics for key firm and industry characteristics are presented in Panels A and B of Table 1. In Panel A, we find that, on average, the sample firms have cash holdings equivalent to 16.8% of their total assets. Further, the mean value of the gross margin (return on assets, *ROA*) is 29.62% (1.16%). The average leverage ratio is about 24.05%. Moreover, the average firm has a logarithm of total assets of 10.2486.

In Panel B, we find that, on average, the manufacturing sector has cash holdings equivalent to 16.86% of the industry's total assets. Furthermore, firms operating in the utilities (manufacturing) sector have, on average, the highest (lowest) leverage ratios. Firms in the agriculture sector as well as those in the mining and construction sector appear less profitable than their counterparts do.

Finally, since we reconstruct the cash flow from operations for each firm in our empirical analyses, we compare *CFO* to the corresponding cash flow from operations from Compustat (*OANCF*).[15] We scale both variables by the total assets in 2018. Panel C of Table 1 presents the summary statistics and the results of the test for the difference in means of the two variables. As expected, the variables are not statistically different from each other, suggesting that our variable closely mirrors that from Compustat.

3. Results

Table 2 presents the base case scenario and the results of the stress tests for the two simulated distress scenarios. We start by analyzing the cash burn rate. In the base case scenario, for the average firm in the sample, we find that cash holdings account for about four years and eight months of annual operating cash flow (column (1) of Panel A).

Next, in Table 2, we focus on the two simulated distress scenarios and allow firms to be either fully flexible (Panels B to C) or partially flexible (Panels D to E) in their response to the shock. Starting with firms with full operating flexibility, in column

[15] Note also that *OANCF* is missing 53 observations. Since different sample sizes could bias our comparison analysis, we require both cash flow variables to be nonmissing. This leaves us with 14,192 unique observations.

Table 2
Stress tests of the cash burn rate, the ratio of cash flow from operations to current liabilities, and the ratio of cash flow from operations to total debt under different distress scenarios and for different levels of operating flexibility.

Panel A: Base case scenario – no sales drop							
Cash burn rate (years)		CFO to current liab. (%)		CFO to total debt (%)		Illiquid firms	
(1) *Mean*	(2) *Median*	(3) *Mean*	(4) *Median*	(5) *Mean*	(6) *Median*	(7) *Number*	(8) *Percentage*
4.71	2.68	66.00	49.00	15.41	12.94	226	1.59
Full operating flexibility							
Panel B: Moderate-risk scenario – 50% sales drop							
Cash burn rate (years)		CFO to current liab. (%)		CFO to total debt (%)		Illiquid firms	
(1) *Mean*	(2) *Median*	(3) *Mean*	(4) *Median*	(5) *Mean*	(6) *Median*	(7) *Number*	(8) *Percentage*
2.41	2.66	4.65	8.79	1.32	2.37	228	1.60
Panel C: High-risk scenario – 75% sales drop							
Cash burn rate (years)		CFO to current liab. (%)		CFO to total debt (%)		Illiquid firms	
(1) *Mean*	(2) *Median*	(3) *Mean*	(4) *Median*	(5) *Mean*	(6) *Median*	(7) *Number*	(8) *Percentage*
−0.19	−1.61	−52.20	−12.79	−5.63	−1.85	287	2.01
Partial operating flexibility							
Panel D: Moderate-risk scenario – 50% sales drop							
Cash burn rate (years)		CFO to current liab. (%)		CFO to total debt (%)		Illiquid firms	
(1) *Mean*	(2) *Median*	(3) *Mean*	(4) *Median*	(5) *Mean*	(6) *Median*	(7) *Number*	(8) *Percentage*
−2.98	−2.10	−216.01	−172.76	−30.27	−24.18	717	5.03
Panel E: High-risk scenario – 75% sales drop							
Cash burn rate (years)		CFO to current liab. (%)		CFO to total debt (%)		Illiquid firms	
(1) *Mean*	(2) *Median*	(3) *Mean*	(4) *Median*	(5) *Mean*	(6) *Median*	(7) *Number*	(8) *Percentage*
−2.15	−1.48	−779.26	−620.40	−53.05	−42.94	1367	9.60

This table presents the base case scenario (Panel A) and the results of the stress tests for the moderate-risk scenario (Panels B and D) and the high-risk scenario (Panels C and E) for different levels of operating flexibility. Appendix C provides the variable definitions.

(1) of Panel B we find that the average firm in the sample would have cash holdings for about two and a half years of annual operating cash flow in its balance sheet if faced with a moderate-risk scenario (i.e., a drop in sales of 50%). On the other hand, in the high-risk scenario (column (1) of Panel C), the cash burn period would last, on average, only two months. However, it is worth pointing out that, in both scenarios, the distribution of the cash burn rate is negatively skewed. Hence, evaluating the cash burn rate at the sample median would result in a burn period of about two and a half (one and a half) years in the moderate-risk (high-risk) scenario.

With respect to firms with partial operating flexibility, we find that the average cash burn rate becomes negative in both distress scenarios. In particular, in column (1) of Panel D of Table 2, we find that the average firm in the sample would burn through its cash holdings in about three years if sales were to drop by 50%. This burn period would further shrink as demand plummeted, and it would last about two years in the high-risk scenario (column (1) of Panel E).

Fig. 1 presents a direct visualization of these tests. We plot the distribution of the cash burn rate for the base case scenario and the distributions of the cash burn rate for the two simulated distress scenarios, both under the assumption of full and partial operating flexibility. Consistent with the previous analyses, we find the distributions of the cash burn rate to be wider for firms with full operating flexibility, with observations in both the negative and positive tails. On the other hand, for firms with partial operating flexibility, we observe that the majority of the observations are concentrated in the negative tail. This finding further suggests that, under partial operating flexibility, the cash burn rate would become negative for most firms if the demand were to contract significantly.

What are the implications for the financing of current liabilities? In the base case scenario, we find that the average firm would be able to cover about 66% of its current liabilities using cash flow from operations (column (3) of Panel A of Table 2). In the moderate-risk scenario, when firms are assumed to have full operating flexibility, they would still be able to cover a portion, albeit smaller, of their current liabilities using cash flow from operations. As shown in column (3) of Panel B in Table 2, the average cash flow from operations would be positive and would amount to about 4 percentage points of current liabilities. On the other hand, in the high-risk scenario, this ratio would decrease and would become negative (column (3) of Panel C).

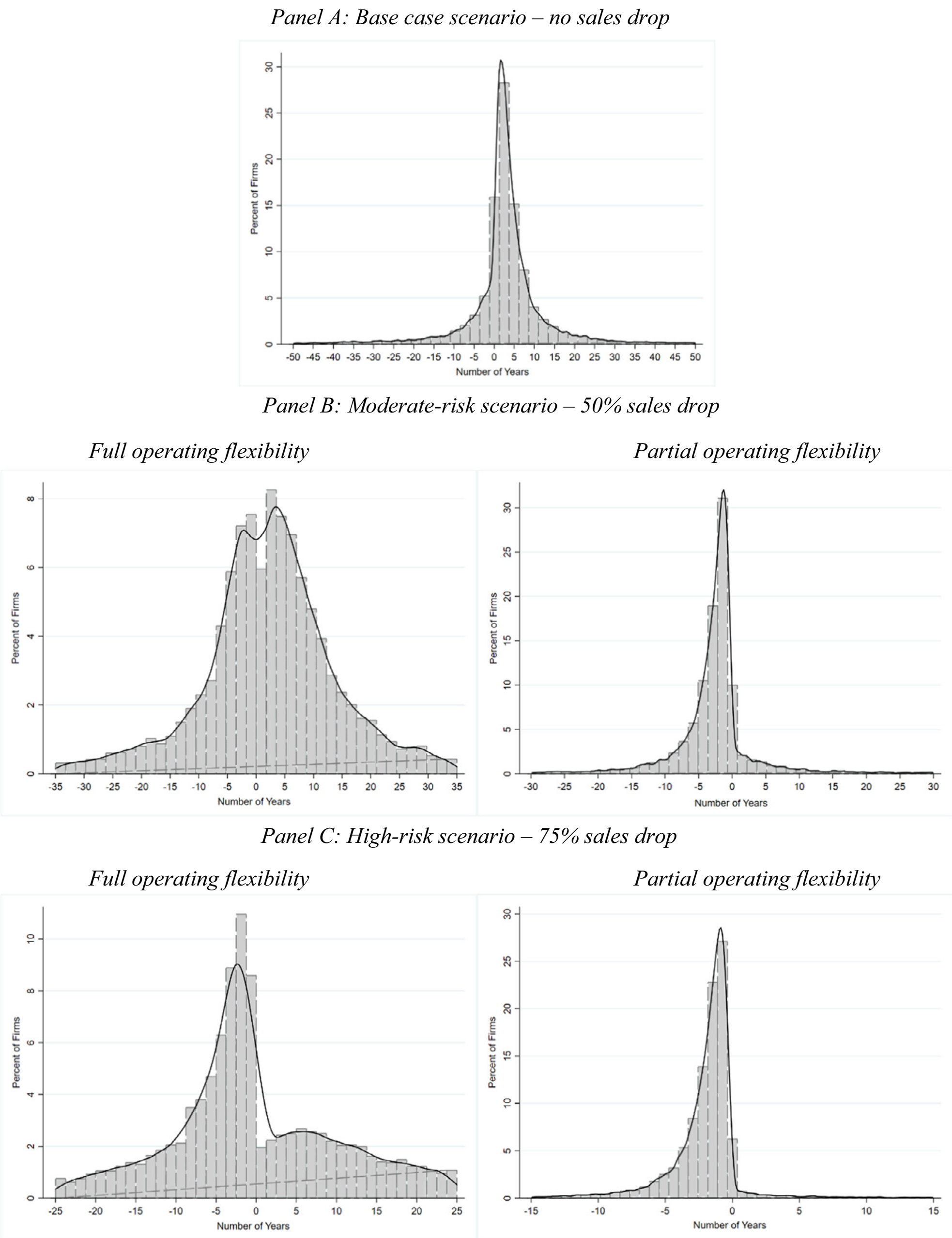

Fig. 1. Distributions of the cash burn rate under different distress scenarios and for different levels of operating flexibility. This figure plots the distribution of the cash burn rate for the base case scenario (Panel A) and for each of the two distress scenarios (Panels B and C). Panels B and C plot the distributions of the cash burn rate allowing firms to respond to the shock with full or partial operating flexibility. Appendix C provides the variable definitions.

The ratio of cash flow from operations to current liabilities appears to be more problematic when firms are assumed to have partial flexibility. In both distress scenarios, we find the ratio to be negative, averaging from −216.01% for the moderate-risk scenario to −779.26% for the high-risk scenario. This result implies a potential spillover effect that would further magnify the impact of a sales drop on the cash burn rate of suppliers. Furthermore, in Fig. 2, we plot the distributions of cash flow from operations to current liabilities. In the base case scenario and in both distress scenarios under the assumption of full operating flexibility, firms are distributed on both sides of the density function. On the other hand, under the assumption of partial operating flexibility, we observe that firms are mostly concentrated on the negative side of the density function, lending further support to our previous analyses.

As argued in Section 2.2, to prevent a cash crunch at the end of the cash burn period, firms with a negative ratio of cash flow to current liabilities would have to increase the noncurrent liabilities relative to their level in 2018. As shown in Table 2,

Fig. 2. Distributions of the ratio of cash flow from operations to current liabilities under different distress scenarios and for different levels of operating flexibility. This figure plots the distribution of the ratio of cash flow from operations to current liabilities for the base case scenario (Panel A) and for each of the two distress scenarios (Panels B and C). Panels B and C plot the distributions of the ratio of cash flow from operations to current liabilities, with firms responding to the shock with full or partial operating flexibility. Appendix C provides the variable definitions.

firms in the base case scenario as well as those in the moderate-risk scenario with full operating flexibility would not need to issue additional debt, since their ratio of cash flow from operations to total debt is positive. However, in the other scenarios, we find that, firms would have to increase noncurrent liabilities by about 5.63 (high-risk scenario with full operating flexibility) to 53% (high-risk scenario with partial operating flexibility) to avoid a cash crunch. These results are also consistent with the distributions of cash flow from operations to total debt in Fig. 3, which are negatively skewed in the high-risk scenario when firms are assumed to have full operating flexibility, and in both distress scenarios when firms are assumed to have partial operating flexibility.

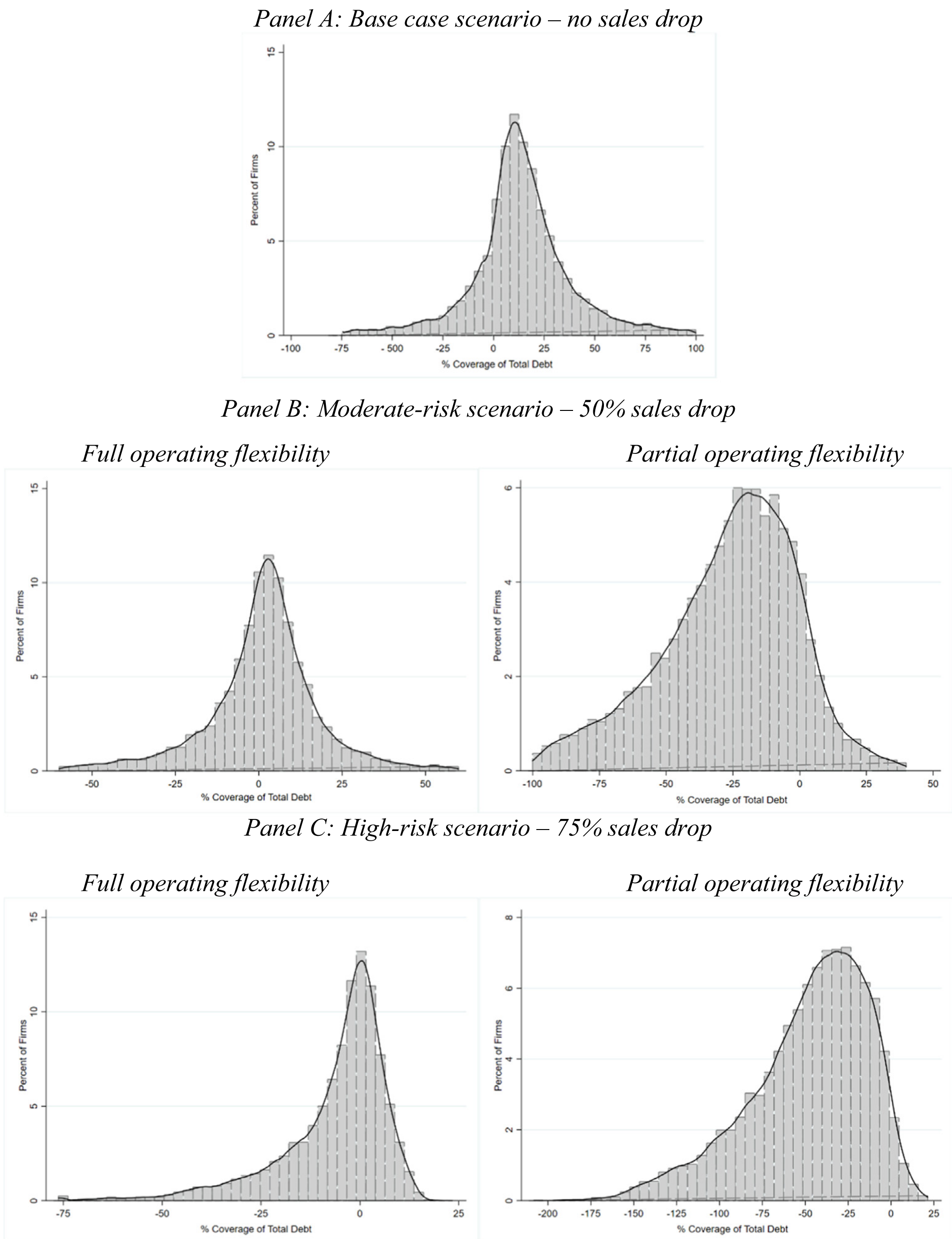

Fig. 3. Distributions of the ratio of cash flow from operations to total debt under different distress scenarios and for different levels of operating flexibility. This figure plots the distributions of the ratio of cash flow from operations to total debt (for 2018) for the base case scenario (Panel A) and for each of the two distress scenarios (Panels B and C). Panels B and C plot the distributions of the ratio of cash flow from operations to total debt, with firms responding to the shock with full or partial operating flexibility. Appendix C provides the variable definitions.

Next, we focus on the most illiquid firms with partial operating flexibility and estimate how many would burn through all their cash holdings in just half a year in each of the two possible distress scenarios. We operationalize this by computing the number of firms whose cash burn rate lies between −0.5 and zero. We label these firms as *illiquid* (i.e., firms with high short-term liquidity risk). In column (7) of Table 2, we find that, on average, 717 and 1367 firms would deplete their cash reserves in half a year in the moderate-risk and high-risk scenarios, respectively.[16]

[16] Table A3 of the Internet Appendix presents the distribution of illiquid firms with partial operating flexibility by country for each of the two distress scenarios and the distribution of illiquid firms for the base case scenario.

Table 3
Differences between illiquid and liquid firms with partial operating flexibility in the high-risk scenario.

Panel A: Difference in means

	(1) Illiquid firms	(2) Liquid firms	(3) *Difference*	(4) *t-Stat*
Cash holdings	0.0725	0.1781	−0.1056***	−33.2849
Leverage	0.4134	0.2221	0.1913***	14.5758
Gross margin	0.0479	0.3226	−0.2747***	−5.2879
ROA	−0.2075	0.0350	−0.1725***	−10.2996
Size	7.6293	10.5273	−2.8981***	−19.1907
Obs.	1,367	12,878		

Panel B: Determinants of illiquidity

	Illiquid			
	(1) *Coefficient*	(2) *Marginal effect*	(3) *Coefficient*	(4) *Marginal effect*
Cash holdings	−9.5433***	−43.09%	−9.2585***	−42.69%
	(0.6143)		(0.6051)	
Leverage	0.4670***	2.11%	0.4687***	2.16%
	(0.1364)		(0.1359)	
Gross margin	−0.0686**	−0.31%	−0.0558*	−0.26%
	(0.0330)		(0.0329)	
ROA	−1.5440***	−6.97%	−1.5193***	−7.01%
	(0.2255)		(0.2200)	
Size	−0.0626***	−0.28%	−0.0674***	−0.31%
	(0.0079)		(0.0079)	
Constant	−1.8869***		−1.4465***	
	(0.1371)		(0.1214)	
Industry fixed effects	Yes		No	
Country fixed effects	Yes		No	
Country – Industry fixed effects	No		Yes	
Obs.	14,245		14,245	
Pseudo-R^2	0.199		0.194	

This table examines the difference between illiquid and liquid firms with partial operating flexibility in the high-risk scenario. Panel A provides the results of univariate analysis, whereas Panel B provides the results of logistic regression examining the determinants of a firm's illiquidity. In Panel B, columns (1) and (3) present the coefficient estimates, whereas columns (2) and (4) present the marginal effects at the means. The model specifications presented in columns (1) and (3) include industry, country, and country–industry fixed effects where indicated. The industry is defined at the one-digit SIC code level. The table reports (in parentheses) heteroskedasticity-robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels (two tailed), respectively. Appendix C provides the variable definitions.

To further analyze the characteristics of these (partially flexible) illiquid firms, we conduct two tests, whose results are shown in Table 3. In Panel A, we present the results of the univariate analysis of key firm characteristics by differentiating between illiquid and liquid firms. The 1367 illiquid firms in the most adverse scenario have a leverage ratio that is, on average, 45% higher than that of the liquid firms. Further, these illiquid firms are smaller, and have, on average, a negative return on assets, in stark contrast with the return on assets of the average liquid firm (i.e., about 3.50%). In sum, these illiquid firms are smaller, less profitable, more levered, and hold a lower percentage of cash relative to total assets compared to their liquid counterparts.[17]

In Panel B of Table 3, we confirm these results by performing a logistic model whose dependent variable (*Illiquid*) is an indicator variable that takes the value of one if the firm is illiquid, and zero otherwise. We use the firm characteristics from the univariate analysis as determinants of short-term liquidity risk. Furthermore, we include industry fixed effects to absorb industry shocks that could affect the probability of a firm becoming illiquid. We include country fixed effects to ensure that unobservable political and economic conditions do not spuriously drive the results.

In line with the univariate analysis, in column (1) of Panel B of Table 3, we find that the likelihood of becoming illiquid within six months is significantly higher when a firm has a higher leverage ratio, whereas it is significantly lower when a firm is larger, and has more cash holdings relative to total assets, a higher gross margin, and a higher return on assets. In terms of economic significance, a one-standard-deviation increase in the leverage ratio is associated with a 0.56% (=2.11% × 0.2649) increase in the probability of becoming illiquid within six months. Relatedly, a one-standard-deviation increase in the cash holdings, size, gross margin, and return on assets is associated with a 6.63%, 1.44%, 0.30%, and 2.33% decrease, respectively, in the probability of becoming illiquid. Importantly, in column (3) of Panel B, we find that the results hold when country–industry fixed effects are included to account for any country–industry-specific factor that could affect the probability of becoming illiquid (e.g., different exposures and durations of exposure of countries and industries to COVID-19).

[17] In untabulated results of univariate analyses, we continue to find that, in the moderate-risk scenario, the most illiquid firms are, on average, less profitable and more levered than their liquid counterparts are. The results are available upon request.

Table 4
Policy intervention: Tax deferrals versus bridge loans.

	Six-month tax deferrals				Bridge loans				Extra money for bridge loans	
	Moderate risk		High risk		Moderate risk		High risk		Moderate risk	High risk
Country	(1) *No. firms*	(2) *Per $1 billion*	(3) *No. firms*	(4) *Per $1 billion*	(5) *No. firms*	(6) *Per $1 billion*	(7) *No. firms*	(8) *Per $1 billion*	(9) *Percent*	(10)
Australia	2	2.30	4	3.98	62	8.31	111	6.98	88.32	93.67
Austria	0	0.00	0	0.00	1	894.39	2	36.93	37.20	97.03
Belgium	1	0.00	0	0.00	1	34.05	4	3.02	100.00	88.87
Canada	0	0.00	0	0.00	27	239.34	40	119.09	100.00	100.00
Chile	0	0.00	0	0.00	2	0.00	5	0.00	100.00	87.44
China	1	0.10	1	0.00	36	0.14	70	0.05	95.89	84.46
Denmark	0	0.00	0	0.00	6	12.79	8	2.38	100.38	86.24
Finland	0	0.00	1	16.58	6	34.97	16	10.40	92.15	96.08
France	0	0.00	0	0.00	6	9.99	14	9.49	99.87	98.68
Germany	0	0.00	1	3.17	17	37.97	36	8.61	58.08	92.45
G. Britain	1	3.54	1	1.22	47	9.53	93	6.44	94.28	94.34
Greece	0	0.00	0	0.00	3	132.23	6	20.18	99.84	75.27
Israel	0	0.00	0	0.00	5	23.23	11	3.70	94.63	93.03
Italy	0	0.00	0	0.00	3	8.21	7	4.79	88.48	95.19
Japan	1	0.00	8	0.00	54	0.00	125	0.00	75.77	87.46
Mexico	0	0.00	2	0.01	3	0.02	9	0.01	66.37	74.54
Netherlands	2	0.01	0	0.00	6	0.00	10	0.00	92.45	96.90
N. Zealand	1	38.36	0	0.00	10	55.49	18	28.57	85.54	85.16
Norway	0	0.00	0	0.00	2	0.64	5	0.46	92.77	87.35
Poland	1	2.32	3	1.02	46	8.92	92	3.06	91.63	90.24
S. Korea	0	0.00	0	0.00	39	0.00	90	0.00	100.00	100.00
Spain	0	0.00	0	0.00	5	50.19	5	9.42	91.00	98.31
Sweden	0	0.00	0	0.00	30	0.88	60	0.27	90.53	83.62
Switzerland	0	0.00	0	0.00	3	1148.86	7	7.47	90.61	90.32
Turkey	0	0.00	0	0.00	14	33.73	30	20.51	90.83	95.09
USA	4	0.35	6	0.29	283	2.66	493	1.63	89.36	93.10
Mean	0.54	1.81	1.04	1.01	27.58	105.64	52.58	11.67	88.69	90.95
Median	0.00	0.00	0.00	0.00	6.00	9.76	15.00	4.24	91.89	92.74
Std. dev.	0.93	7.36	2.01	3.26	54.30	271.47	95.69	23.39	14.34	6.65
Total	14		27		717		1367			

This table compares the absolute number of firms and the number of firms per USD 1 billion invested that would become liquid (cash burn rate lower than −0.5) in the moderate-risk and high-risk scenarios. Firms are assumed to have partial operating flexibility. The policy in columns (1) to (4) consists of a six-month tax deferral; in columns (5) to (8), the government grants a bridge loan to each illiquid firm such that the cash burn rate is adjusted to −0.5. Columns (9) and (10) report the extra cost (in percent) to implement the bridge loan policy relative to the tax deferral. Appendix C provides the variable definitions.

3.1. Policy implications

In the last set of analyses, we examine the policy implications of our results. Specifically, we investigate which fiscal measures could be more effective in ameliorating the risk of a COVID-19 cash crunch. We focus on firms assumed to have partial operating flexibility in the moderate- and high-risk scenarios and analyze two policies: a six-month tax deferral and a direct provision of cash to firms as a lump sum akin to a bridge loan granted by the government. Although both measures mitigate short-term liquidity risk, they work in different directions. In particular, the tax deferral decreases a firm's current taxes, whereas the bridge loan increases a firm's cash holdings.[18] To operationalize this, for each illiquid firm in both distress scenarios, we increase either the denominator of the cash burn rate for the amount of a six-month tax deferral or the numerator for the amount of a bridge loan that would adjust the cash burn rate to −0.5.

Table 4 presents the results. Columns (1) and (3) show the number of firms that a two-quarter tax deferral would prevent from becoming illiquid within six months. In total, a half-a-year tax deferral would prevent only 14 (27) firms from becoming illiquid within six months in the moderate-risk (high-risk) scenario. On the other hand, columns (5) and (7) assume that the government facilitates a bridge loan to the 717 (1367) illiquid firms in the moderate-risk (high-risk) scenario to shore up all their cash burn rates to −0.5. With respect to the costs of each measure, columns (9) and (10) show that the bridge loan is, on average, twice as costly as a six-month tax deferral. Nevertheless, the bridge loan appears to be more cost-effective than a tax deferral. As shown in columns (2) and (4), on average, 1.8 (one) firms would avoid a cash crunch within six months per USD 1 billion of deferred taxes in the moderate-risk (high-risk) scenario. On the other hand, columns (6) and (8) show that a bridge loan to each firm for the amount necessary to prevent a cash crunch within six months would, on average, save 105.64 (11.67) firms per USD 1 billion loan from becoming illiquid within six months in the moderate-risk (high-risk) scenario.

[18] Appendix B shows analytically that, when a firm has a cash burn rate between zero and −1 year, a dollar invested in a cash transfer decreases the cash burn rate (i.e., increases the firm's liquidity) more than a dollar invested in increasing the operating cash flow via tax deferrals.

3.2. Additional evidence

Finally, in Table A4 of the Internet Appendix, we provide additional evidence on which industries could risk a COVID-19 cash crunch. In the base case scenario, for the average firm in the agriculture sector, we find that cash holdings account for about two years of annual operating cash flow, in stark contrast with the cash burn rate of the average firm in the wholesale and retail trade industry (i.e., about six years). Further, for each industry, we find that the cash burn rate is mostly positive under the assumption of full operating flexibility. On the other hand, the ratio becomes negative across all industries in both distress scenarios when we assume partial operating flexibility.

Furthermore, we find that, the average cash flow from operations to current liabilities ratio is negative across all industries in both distress scenarios and under the assumption of partial operating flexibility. As expected, the ratio of cash flow to total debt is also negative across all industries in both distress scenarios when we assume partial operating flexibility. However, while firms in the agriculture, mining and construction, and utilities sectors would need lower cash injections of noncurrent debt, our findings indicate that, firms with partial operating flexibility in the manufacturing, wholesale and retail trade, and services sectors would have to issue larger amounts of debt relative to the level of noncurrent liabilities in 2018 to prevent a cash crunch.

4. Conclusion

In this paper, we examine how the COVID-19 health crisis could affect the liquidity risk of listed firms. To this end, we first collect detailed data on 14,245 listed firms across 26 countries and compute three financial ratios that are widely used in the accounting literature to assess short-term and long-term liquidity risk. Subsequently, we stress-test the three liquidity ratios in two simulated distress scenarios, corresponding to drops in sales of 50% and 75%, respectively. We assume that firms either have full or partial operating flexibility. In the most adverse scenario, and under the assumption of partial operating flexibility, we find that the average firm would exhaust its cash holdings in about two years. At that point, its current liabilities would increase beyond a sustainable level, such that an injection of about 53% of noncurrent debt (relative to the 2018 level) would be needed to prevent a liquidity crunch. Moreover, about 1/10th of all firms would become illiquid within six months.

Furthermore, we study two different fiscal policies, namely, tax deferrals and bridge loans, that governments could implement to mitigate the risk of a COVID-19 cash crunch. Our analyses suggest that bridge loans are more cost-effective in preventing a massive cash crunch within six months after the shock.

Finally, when interpreting our findings, there are several important caveats to keep in mind. First, our analyses focus only on the fiscal year 2018, which is also the last reporting period currently available. Second, the distribution of observations is uneven across countries. Third, while there are important insights on the liquidity risk arising from the COVID-19 pandemic, we acknowledge that there could be cross-country cultural and attitude effects on COVID-19 that our model is unable to capture. Fourth, our analyses are only based on listed firms. Whether the COVID-19 cash crunch is larger and more pressing for unlisted firms is a question we leave for future research.

Appendix A. Theoretical derivation of Eq. (1)

In this appendix, we model how a given percentage drop in sales affects a firm's cash flow from operations. Let us define net income *NI* as

$$NI = Sales - Op.Costs - Depr - Interests - Current\ \ Taxes \tag{A.1}$$

where *Sales* denotes sales, *Op.Costs* denotes operating expenses, *Depr* stands for depreciation and amortization, *Interests* denotes interest payments on debt, and *Current Taxes* denotes current taxes. To estimate funds from operations (*FFO*), *Depr* and *Deferred Taxes* to *NI* are added back, as follows:

$$FFO = NI + Depr + Deferred\ \ Taxes \tag{A.2}$$

To arrive at cash flow from operations (*CFO*), we subtract the change in current assets (ΔCA), net of cash holdings, and add change in current liabilities (ΔCL), as follows:

$$CFO = FFO - \Delta CA + \Delta CL \tag{A.3}$$

Given Eqs. (A.1)–(A.3), the change in cash flow from operations with respect to sales is

$$\frac{\partial CFO}{\partial Sales} = 1 - \frac{\partial Op.Costs}{\partial Sales} - \frac{\partial Current\ \ Taxes}{\partial Sales} - \frac{\partial \Delta CA}{\partial Sales} + \frac{\partial \Delta CL}{\partial Sales} \tag{A.4}$$

where we assume that, in the short run, interest payments and deferred taxes are invariant with respect to sales; that is, a firm neither changes its capital structure nor renegotiates its debt. By multiplying both sides of (A.4) by *Sales*, we can express (A.4) as

$$\frac{\partial CFO}{\frac{\partial Sales}{Sales}} = Sales - Op.Costs \times E_{Op.Costs} - Current\ \ Taxes \times E_{Current\ \ Taxes} - \Delta CA \times E_{\Delta CA} + \Delta CL \times E_{\Delta CL} \tag{A.5}$$

where $E_X = \frac{\partial X/X}{\partial Sales/Sales}$ denotes the elasticity of X with respect to sales, with $X = \{Op.Costs, Current\ \ Taxes, \Delta CA, \Delta CL\}$. In other words, E_X corresponds to the percentage change in each of these variables with respect to a 1% change in sales. The right-hand side of (A.5) can be interpreted as the dollar change in cash flows from operations for a 1% change in sales.

We define current taxes as

$$Current\ \ Taxes = (Sales - Op.Costs - Depr - Interests) \times TR \tag{A.6}$$

where TR is the statutory corporate tax rate. We assume that *Depr* and *Interests* are invariant with respect to sales in the short run. By taking the derivative of (A.6) with respect to sales and multiplying it by *Sales* over *Current Taxes,* we obtain the elasticity of current taxes with respect to sales as follows:

$$E_{Current\ Taxes} = \frac{\partial Current\ \ Taxes/Current\ \ Taxes}{\frac{\partial Sales}{Sales}} = (Sales - Op.Costs \times E_{Op.Costs}) \times \frac{TR}{Current\ \ Taxes} \tag{A.7}$$

By replacing (A.7) into (A.5), we obtain Eq. (1) of the paper, which corresponds to the change in the dollar amount of cash flow from operations with respect to a $\frac{\partial Sales}{Sales}$ percent change in sales.

Appendix B. Theoretical discussion of the benefit of bridge loans versus tax deferrals

In line with our theoretical framework, after a drop in sales, the cash burn rate is defined as follows:

$$CB = \frac{Cash}{CFO + \partial CFO}$$

where *Cash* and *CFO* denote cash holdings plus accounts receivable and annual cash flow from operations, respectively, and ∂CFO denotes the change in *CFO*, as in Eq. (1). Let us now assume that, after a decrease in sales, $CFO + \partial CFO < 0$, such that the cash burn rate corresponds to the number of years before the firm becomes illiquid. Marginally, for every dollar increase in the value of *Cash* for the firm, the cash burn ratio decreases by

$$\frac{\partial}{\partial Cash} CB = \frac{1}{CFO + \partial CFO}$$

Similarly, for every dollar increase in the firm's cash flow from operations (*CFO*), the cash burn rate decreases by

$$\frac{\partial}{\partial CFO} CB = -\frac{Cash}{(CFO + \partial CFO)^2}$$

Then, it follows immediately that

$$\frac{\partial}{\partial Cash} CB < \frac{\partial}{\partial CFO} CB\ \ if\ \ and\ \ only\ \ if -1 < CB < 0$$

Hence, at the margin, one extra dollar in cash extends the time to illiquidity more than one dollar in tax deferrals (or any other cost reduction measure) if and only if the firm currently has less than one year before it becomes illiquid.

Appendix C. Variable definitions

Variable	Definition
CFO	Sales (*SALE*) minus operating costs (*XOPR*), current taxes (*TXC*), interest payments (*XINT*), and change in current assets net of cash holdings ($\Delta ACT - CHE$), plus deferred taxes (*TXDI*) and change in current liabilities (ΔLCT). (Source: Compustat)
∂CFO	$((SALE - (XOPR \times \frac{1}{2}E_{XOPR})) \times (1 - TaxRate))$ – $(\Delta(ACT - CHE) \times \frac{1}{2}E_{\Delta(ACT-CHE)})$ + $(\Delta LCT \times \frac{1}{2}E_{\Delta LCT})$. We compute each elasticity E_X by estimating country-level regressions with industry (one-digit SIC code) and year fixed effects of the natural logarithm of a firm's sales (*SALE*) on each of the following variables: the natural logarithm of a firm's operating costs (*XOPR*), the natural logarithm of change in current assets net of cash holdings ($\Delta ACT - CHE$), and the natural logarithm of change in current liabilities (ΔLCT). Note that, under the assumption of full operating flexibility, we do not divide each elasticity by half. (Source: Compustat and KPMG Corporate Tax Guide 2018)

(*continued on next page*)

Appendix C (*continued*)

Variable	Definition
Cash burn rate	Cash and short-term investments (*CHE*) plus accounts receivable (*RECT*) relative to the sum of the cash flow from operations and the change in cash flow from operations ($CFO + \partial CFO$). (Source: Compustat)
Cash flow from operations (CFO) to current liabilities	The sum of cash flow from operations and the change in cash flow from operations ($CFO + \partial CFO$) relative to the sum of current liabilities and the change in current liabilities $((LCT \times \frac{1}{2}E_{LCT}) + ((LCT \times \frac{1}{2}E_{CL}) \times \%$ *drop in sales*). We compute E_{CL} by estimating country-level regressions with industry (one-digit SIC code) and year fixed effects of the natural logarithm of a firm's sales (*SALE*) on the natural logarithm of current liabilities (*LCT*). The drop in sales takes on the value of 50 (75) in the moderate-risk (high-risk) scenario. (Source: Compustat)
Cash flow from operations (CFO) to total debt	The sum of cash flow from operations and the change in cash flow from operations ($CFO + \partial CFO$) relative to total liabilities (*LT*). (Source: Compustat)
Illiquid	Indicator variable that takes the value of 1 if the firm's cash burn rate lies between $-$ 0.5 and 0, and zero otherwise. (Source: Compustat)
Cash holdings	Cash and short-term investments (*CHE*) scaled by total assets (*AT*). (Source: Compustat)
Leverage	Total debt ($DLC + DLTT$) relative to total assets (*AT*). (Source: Compustat)
Gross margin	Sales (*SALE*) minus the cost of goods sold (*COGS*) relative to sales (*SALE*). (Source: Compustat)
ROA	Earnings before interests and taxes (*EBIT*) scaled by total assets (*AT*). (Source: Compustat)
Size	Natural logarithm of the firm's total assets (*AT*). (Source: Compustat)
Tax deferral	Current taxes (*TXC*) times 0.50. The cash burn rate with a six-month tax deferral is defined as cash and short-term investments (*CHE*) plus accounts receivable (*RECT*) relative to the sum of the cash flow from operations, the change in cash flow from operations, and the tax deferral ($CFO + \partial CFO + (TXC \times 0.50)$). (Source: Compustat)
Bridge loans	-1 times the sum of the cash flow from operations and the change in cash flow from operations ($CFO + \partial CFO$) times the sum of the cash burn rate of the distress scenario considered and 0.5. (Source: Compustat)
Extra money for bridge loan	The total amount of the country's bridge loans minus the total amount of the country's tax deferral relative to the total amount of its bridge loans, times 100. (Source: Compustat)

Appendix D. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jaccpubpol.2020.106741.

References

Adda, J., 2016. Economic activity and the spread of viral diseases: evidence from high frequency data. Quart. J. Econ. 131, 891–941.
Baldwin, R., Weder di Mauro, B., 2020. Mitigating the COVID Economic Crisis: Act Fast and Do Whatever It Takes. CEPR Press, London.
Banker, R.D., Byzalov, D., Chen, L.T., 2013. Employment protection legislation, adjustment costs, and cross-country differences in cost behavior. J. Account. Econ. 55, 111–127.
Becker, B., Ivashina, V., 2014. Cyclicality of credit supply: firm level evidence. J. Monetary Econ. 62, 76–93.
Bénassy-Quéré, A., Marimon, R., Pisani-Ferry, J., Reichlin, L., Schoenmaker, D., Weder di Mauro, B., 2020. Europe Needs a Catastrophe Relief Plan. CEPR Press, London.
Bischof, J., Daske, H., 2013. Mandatory disclosure, voluntary disclosure, and stock market liquidity: Evidence from the EU bank stress tests. J. Account. Res. 51 (5), 997–1029.
Bloom, D.E., Cadarette, D., Sevilla, J.P., 2018. Epidemics and economics. Finance Develop. 55, 46–49.
Bowen, R.M., Davis, A.K., Rajgopal, S., 2002. Determinants of revenue-reporting practices for internet firms. Contemp. Account. Res. 19 (4), 523–562.
De Haas, R., Van Horen, N., 2013. Running for the exit? International bank lending during a financial crisis. Rev. Financial Stud. 26, 244–285.
Fan, V., Jamison, D.T., Summers, L.H., 2018. Pandemic risk: How large are the expected losses?. Bull. World Health Org. 96 (2), 129–134.
Fornaro, L., Wolf, M., 2020. COVID-19 coronavirus and macroeconomic policy: Some analytical notes. SSRN working paper.
Huizinga, H., Laeven, L., 2012. Bank valuation and accounting discretion during a financial crisis. J. Financial Econ. 106 (3), 614–634.
McKibbin, W., Fernando, R., 2020. The global macroeconomic impacts of COVID-19: Seven scenarios. Centre for Applied Macroeconomic Analysis working paper No. 19/2020.
OECD, 2020a. OECD Economic Outlook - Interim Report March 2020. OECD Publishing, Paris.
OECD, 2020b. Supporting People and Companies to Deal with the COVID-19 Virus: Options for an Immediate Employment and Social-Policy Response. OECD Publishing, Paris.
Petrella, G., Resti, A., 2013. Supervisors as information producers: Do stress tests reduce bank opaqueness?. J. Banking Finance 37 (12), 5406–5420.
Ramelli, S., Wagner, A., 2020. Feverish stock price reactions to COVID-19. SSRN working paper.
Schivardi, F., 2020. Come evitare il contagio finanziario alle imprese. Lavoce.info, March 24, 2020.