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Financing constraints and firm-level responses to the COVID-19 pandemic: International evidence

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ABSTRACT

We explore whether financing constraints affected the ways in which small and medium-sized enterprises navigated through the economic disruptions caused by the COVID-19 pandemic. We draw on data from a novel source, the *COVID-19 Impact Follow-up Surveys* conducted in 19 countries by the World Bank Enterprise Analysis Unit as a follow-up to enterprise surveys conducted in these countries prior to the COVID-19 outbreak. We find that previous bank-lending credit constraints magnified the effects of the pandemic. More specifically, credit-rationed firms were more likely to experience greater liquidity and cash flow problems and more likely than unconstrained firms to be delinquent in meeting their obligations to financial institutions during the economic crisis. Furthermore, these firms were less likely to have access to bank funding as a principal source of financing to address pandemic-induced cash flow and liquidity problems during the COVID-19 outbreak. We further find that credit-constrained firms were more likely to use trade credit, delay payments to suppliers or employees, and rely on government grants to cope with pandemic-related liquidity and cash flow problems. We find little evidence that credit-rationed firms were more likely to raise equity capital during this economic crisis. Finally, we find that financing constraints were more likely to hamper firms' ability to adjust business operations in response to exogenous shocks. This study contributes to the literature on the impact of credit constraints on firm behavior in times of crisis.

1. Introduction

Evolving from a public health emergency into a full-blown global economic crisis in a matter of months, COVID-19 has battered the world economy, thereby causing one of the deepest recessions since the 1930s (Ali et al., 2020; Shehzad et al., 2020). The pandemic has created deep economic distress (Financial Times, 2020) involving significant economic risks (Bloom et al., 2018). The devastating impacts of the COVID-19 pandemic on financial markets and the global economy started in March 2020 and may continue to be felt for the foreseeable future across various economies, long after the pandemic itself has ended and restrictions on social and economic activities have been lifted (Gourinchas, 2020). Companies experience enormous struggles in coping with the impact of the pandemic, and the effects have differed across sectors, financial markets, and economies (Ratnasingam et al., 2020). Micro-, small-, and medium-sized businesses, viewed as the backbone of any economy (e.g., Beck et al., 2005; Aghion et al., 2007), have been hardest hit, given their relatively vulnerable financial condition, disadvantaged position in times of economic crisis (Brown et al., 2020; Doshi et al., 2018), and particularly their reliance on bank financing or commercial lending (Bartik et al., 2020; World Bank, 2020)¹.

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¹ By end of April 30, 2020, 26.5 million jobs were reported to have been lost in the U.S. economy alone (Lambert, 2020).

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The stringent government-enforced lockdowns, restricted mobility, and business closures worldwide have stalled production, disrupted global supply chains (Bassett et al., 2021; Vidya and Prabheesh, 2020), affected consumer demand (Eichenbaum et al., 2020), caused mass layoffs (Bauer and Weber, 2020), and ultimately caused a decline in revenue, earnings, and cash flow for numerous businesses (OECD, 2020; Shen et al., 2020). This deterioration in economic conditions has posed severe challenges to the survival, liquidity, and solvency of small businesses, thereby prompting many governments to engage in various policy interventions primarily aimed at helping firms manage the crisis (e.g., Didier et al., 2021; Garicano, 2020). In their study of the impact of COVID-19 on firms' liquidity, De Vito and Gomez (2020) suggested that firms in such distressed situations must seek a liquidity recourse. Mirza et al. (2020) investigated the impact of COVID-19 on the solvency profiles of firms from 15 European Union member states. They documented a consistent increase in the probability of default and declining debt coverage ratios during the pandemic. At the consumer level, Li et al. (2020) evaluated household liquidity constraints and showed that COVID-19 led to a significant increase in the likelihood of households being exposed to liquidity constraints. To our knowledge, ours is the first study to explore the dynamics of how prior financing constraints have impacted the ability of small and medium-sized enterprises (SMEs) to navigate through the economic disruptions resulting from the COVID-19 pandemic. We identify financially constrained firms as those that were (a) bank credit-rationed (partially or wholly) or (b) discouraged businesses, that is, firms that did not apply for a loan because they anticipated rejection (Kon and Storey, 2003). We consider these financial constraints prior to the outbreak of the COVID-19 pandemic and assess their differential impact on the ways in which SMEs responded to the firm-level financial and operational consequences of the pandemic. More specifically, we aim to address the following research questions. How did financially constrained firms fare during the COVID-19 outbreak compared to firms that were not financially constrained? Did these firms suffer further financial constraints during the outbreak? Did financial constraints have a differential impact on these firm's financing difficulties, particularly liquidity and cash flow shortages, during the pandemic? We examine whether previously financially constrained firms were more likely to use alternative external financing, such as capital markets financing (equity financing), government grants, trade credit, delayed payments to customers and suppliers, or other informal sources. We also examine whether previous financing constraints affected firms' ability to adopt adjustment mechanisms in business operations (e.g., digital platforms, online activities such as delivery and carryout of goods and services) to cope with the economic and operational consequences of the pandemic. We attempt to answer these questions by exploiting a rich dataset that provides timely information on the impact of and adjustments made in response to the pandemic among SMEs across various countries.

We exploit a unique survey data set that offers advantages afforded by the World Bank Enterprise Surveys (WBES). We match pre-COVID-19 WBES surveys with *follow-up* surveys conducted in several countries during the COVID-19 pandemic. A unique feature of this data is that these *follow-up* surveys reinterviewed an entire sample of respondent firms that had recently completed standard WBES surveys. The objective of the *follow-up* surveys is to measure the impact of the Covid-19 pandemic on businesses, including information regarding business closures, changes in sales, employment, access to financing alternatives, financial constraints and incidences of overdue financial obligations to banks, policy responses, and the firm's expectations regarding likely responses to the challenges experienced because of the COVID-19 pandemic.

This study contributes to the limited but growing literature on the economic effects of COVID-19 in general, and the firm-level financial and operational consequences of the pandemic for SMEs in particular. Extant literature on the economic effects of COVID-19 primarily focuses on macroeconomic shocks (e.g., Faria-e-Castro, 2020; Xiong et al., 2020; Rose, 2021), financial market volatility, contagion, and spill-over effects (Ali et al., 2020; Akhtaruzzaman et al., 2021; Huang and Liu, 2021; Costa et al., 2021; Corbet et al., 2021). The firm-level studies on the economic impacts of COVID-19 pandemic examines cash holdings (Qin et al., 2020), firm's speed of adjustments to target leverage (Vo et al., 2021), cost of equity capital (Ke, 2021), and firm's restructuring (Greenwood et al., 2020). Our study complements these firm-level studies. First, we associate firms' ability to cope with the extreme shock of the COVID-19 outbreak to prior actual and perceived financing obstacles. We highlight the relevance of access to financing by exploring the extent to which prior financing constraints are likely to exacerbate pandemic-induced credit risk as well as short-term liquidity/cash flow problems. We find that financially constrained firms are more likely to experience liquidity and cash flow problems and more likely to be overdue in meeting their financial obligations than unconstrained firms during the coronavirus outbreak.

Second, this study is related to a strand of literature focusing on the 2008 global financial crisis and SMEs' capacity to access traditional bank lending (e.g., Casey and O'Toole, 2014; Popov and Udell, 2012; Jimenez et al., 2012). Using survey data, Popov and Udell (2012) examined the sensitivity of access to bank credit in pre- and post-financial crisis periods. They found that the effects of financial crisis-related negative shocks to a bank are larger for riskier firms and those with a smaller amount of tangible assets. Ivashina and Scharfstein (2010) reported that new loans to businesses had declined by 79% at the end of 2008 relative to the peak of the credit boom in 2007. Jimenez et al. (2012) employed data on loan applications from Spanish banks and found that more liquid firms are less vulnerable to the tightening of bank lending during periods of lower economic growth. Examining the demand and supply effects of bank lending in the aftermath of the 2008 financial crisis, Puri et al. (2011) showed that the crisis led to a contraction in the supply of retail lending in Germany. Our study contributes to this strand of the literature by examining whether credit-constrained firms have been able to access bank funding to manage pandemic-induced liquidity and cash flow problems. We show that such firms are less likely to have access to bank financing to cope with these crisis-induced financing problems and are more likely to be overdue in meeting their obligations to financial institutions compared with firms that had not experienced financial constraints in the pre-pandemic period. These results suggest that financial institutions may have responded to the crisis by re-evaluating firm-level risks in their lending decisions.

Third, our study is also closely related to literature focusing on the relationship between bank-lending constraints and alternative sources of financing (e.g., Casey and O'Toole, 2014; Bougheas et al., 2009; Aktas et al., 2012). We examine the demand for trade credit among bank-constrained firms during times of crisis-induced liquidity problems. Specifically, we examine firms that (a) increased

credit purchases or (b) delayed payments to suppliers as a form of trade credit to manage liquidity and cash flow problems. Theoretical research (e.g., [Burkart and Ellingsen, 2004](#); [Petersen and Rajan, 1997](#)) has suggested that as liquidity dries up, firms tend to resort to alternative sources of financing, including trade credit. Similarly, [Nilsen \(2002\)](#) showed that small firms tend to substitute trade credit for bank credit when experiencing bank-lending constraints. In recent studies, [Carbó-Valverde et al. \(2016\)](#) found an increased reliance on trade credit for bank-constrained firms in Spain during the 2008 financial crisis, whereas [García-Appendini and Montoriol-Garriga \(2013\)](#) documented an increase in accounts payable for constrained firms during that period. We contribute to the literature by providing new data and first-hand evidence that bank-lending constrained firms are more likely to use trade credit and to delay payments to suppliers as a source of financing to overcome pandemic-induced liquidity and financial problems.

In addition to trade credit, we also focus on other forms of alternative financing SMEs use to manage liquidity problems. These include raising equity capital, government grants, and informal financing. The availability and use of these alternative forms of financing have been shown to have significant implications for firm survival, financial stability, and growth, particularly in times of economic shock, bank balance sheet impairment, and stringent regulatory requirements ([Wehinger, 2012](#)). We show that bank-lending constrained firms and credit-self-rationed firms are more likely than unconstrained firms to use alternative financing sources (e.g., trade credit, delaying payments to suppliers and workers, and informal financing) to manage liquidity shocks. Regarding local (or national) government aid to support firms during the economic shocks of the COVID-19 pandemic, we find that previously credit-constrained firms were more likely to substitute bank credit with aid from government as the main source of finance to manage the pandemic-induced liquidity shortfalls and credit risk. This result is consistent with [Groenewegen et al. \(2021\)](#) who find that COVID-19 government aid mostly ended up at businesses that were in perceived need of finance the most.

Fourth, our study contributes to a stream of literature that examines whether financing constraints affect a firm's ability to adjust its business models and operations to changing paradigms of customers and suppliers resulting from the coronavirus pandemic (e.g., [Altunbas et al., 2011](#); [Kraus et al., 2020](#); [Ritter and Pedersen, 2020](#)). We provide one of the first firm-level evidence on the role of prior credit constraints on the firm-level operational consequences of economic crisis induced by The COVID-19 pandemic. We show that credit unconstrained firms exhibited more resilient performance during the crisis, and were more likely to adopt adjustment measures in their business models and operations to respond to the operational impacts of the COVID-19 outbreak. More specifically, this study finds that bank *credit-rationed* and credit *self-rationed* firms are less likely to adjust their organizational processes and business operations or increase their online activities or use of delivery and carry-out for goods or services in response to the COVID-19 outbreak.

In summary, our results show that the firms that were most affected by the COVID-19 pandemic were those experiencing some form of financing constraints before the pandemic started. Therefore, we suggest that in times of crisis, policies must focus on vulnerable sectors and firms that already experienced financial constraints. Policy interventions could enhance firms' resilience in the face of extreme shocks and decrease the probability of firms exiting a market or shutting down prematurely.

The remainder of the paper proceeds as follows. Section 2 reviews the relevant literature; Section 3 details the methodology, data description, and data analysis; and Section 4 concludes.

2. Literature review and hypotheses

Previous literature on public health crises has shown that pandemics (e.g., MERS, influenza, and the ZIKA outbreak) damaged economic growth and caused disruptions in supply chain and labor markets (e.g., [Fan et al., 2016](#); [Potter, 2001](#)). Travel restrictions during the SARS outbreak of 2003 caused a noticeable downturn in tourism income in many economies where infections occurred ([Keogh-Brown and Smith, 2008](#)). Subsequent studies have shown that the SARS outbreak led to a disproportionate economic impact compared with what many feared would be a devastating health impact ([Chou et al., 2004](#); [Fan, 2003](#); [Smith, 2006](#)). Although financial literature on the resilience of the business world to those epidemics can provide some guidance, given the unique and extraordinary nature of the current COVID-19 pandemic, those earlier corporate experiences may have little relevance to the unique challenges of the current pandemic ([Barro et al., 2020](#)). Studies motivated by the catastrophic impacts of COVID-19 have primarily focused on the dynamics of the outbreak and its macroeconomic consequences (e.g., [Faria-e-Castro, 2020](#); [Phan and Narayan, 2020](#); [Xiong et al., 2020](#)). However, given the unique and extraordinary nature of the COVID-19 pandemic, few empirical studies have explored the micro-level effects of how small businesses have navigated through the pandemic. In this section, we develop three hypotheses. The first two hypotheses relate to the firm's access to bank credit, alternative financing instruments, and whether prior credit constraints have exacerbated the firm's credit risk during the current economic crisis. The third hypothesis test whether credit constraints have affected the firm's ability to adapt business model adjustments to respond to the current economic crisis.

2.1. Financial crisis, bank lending, and alternative financing channels

Bank lending behavior during economic downturns has been widely studied in the finance literature ([Atahau and Cronje, 2020](#); [D'Aurizio et al., 2015](#); [Hsieh and Lee, 2020](#); [Kapan and Minoiu, 2018](#); [Sääskilähti, 2016](#)). The conventional view is that financial crises disrupt the credit allocation process, resulting in limited credit supply and higher credit costs. In times of crisis, the supply of bank loans generally decreases. This decline may be due to shocks to borrower guarantees, which affect the ability of firms to raise capital when agency and information problems are significant (e.g., [Holmstrom and Tirole, 1997](#)), or to shocks to bank capital and liquidity, which affects the supply of bank lending when agency and information problems limit banks' ability to raise additional capital (e.g., [Kahle and Stulz, 2013](#)).

The COVID-19 crisis shares some similarities with the 2008–09 crisis, as both weigh heavily on the global economy (for instance, through liquidity shortages, corporate bankruptcies, and losses). However, the COVID-19 pandemic represents an aggregate demand

and supply shock for both lenders and borrowers. With the ongoing COVID-19 crisis indefinitely disrupting business revenue streams, businesses face fixed costs, including debt servicing, as well as declining cash balances. Deteriorating financial conditions make it harder for companies urgently in need of liquidity to obtain credit, as banks are reluctant to lend to borrowers with low credit quality and low asset values. We assess whether previous credit constraints further limit a firm's access to external finance during the current pandemic. We expect credit-constrained firms to have a lower likelihood of access to bank credit during the crisis if previous credit constraint is a significant determinant of the firm's access to bank credit. We also expect credit-constrained firms to substitute for alternative sources of financing to compensate for the lack of access to bank credit. The *credit supply shock theory* suggests that credit-rationed firms are more likely to have higher impaired access to external capital during the crisis. We identify credit-rationed and credit *self-rationed firms* before the COVID-19 pandemic to test this approach. Theories of impaired access to bank credit predict that those firms that were credit unconstrained before the crisis are likely to have better access to bank funding than those firms that experienced some form of credit rationing before the crisis. Hence, an expected question concerns the impact of the COVID-19 crisis on the firm's access to bank lending. Hasan et al. (2021) find that loan spreads rose in response to an increase in the lender's and borrower's exposure to COVID-19. They also find that financially constrained firms face higher credit costs compared to unconstrained firms. Thus, we hypothesize that credit-constrained firms in the pre-pandemic period are less likely than unconstrained firms to obtain bank credit during the COVID-19 pandemic. Further, we hypothesize that credit-constrained firms are more likely than unconstrained firms to substitute bank credit with other financing instruments during the COVID-19 pandemic.

2.2. Business model adjustments and credit constraints

The COVID-19 pandemic has presented new challenges for SMEs requiring them to adopt strategic approaches and choices in the light of broader ecosystems. Companies need to revise their existing business models to take advantage of the power of technology, better connect with consumers, and improve customer service in these changing environmental conditions. Kraus et al. (2020) show that family firms adopted several strategic choices, and business model adjustments, that had both short- and long-term consequences, to safeguard liquidity, business operations viability, and ultimately long-term survival of the firm. These adjustments included innovations (both production and service delivery) such as digital platforms (to increase communication with employees and customers) and process streamlining to overcome the COVID-19 crisis. Ritter and Pedersen (2020) suggest that for firms to navigate through the current crisis, the business model ought to have robustness (i.e., Information Technology, logistics, supply chain stability) and adaptability (i.e., conversion to online service, digital platforms, remote-access, etc.). These studies suggest that adjustments in the business models can effectively help firms come out of the crisis and ensure firm viability and survival.

Previous studies on the impact of the 2008 Global financial crisis on the firm-level financial business models highlight how the financial crisis forced many firms to streamline their business model and optimize their business operations to develop the resilience required for short-term and long-term firm survival (e.g., Altunbas et al., 2011; Hryckiewicz and Kozłowski, 2017). However, adapting the business model to bringing in new operational changes are costly and require substantial investments in physical and human resources (Dotan and Ravid, 1985), and depend mainly on the availability of external (or internal) finance (Xu and Birge, 2006). A recent strand of operations management literature (e.g., Kim et al., 2006; Babich et al., 2012) highlights the value of the joint and integrated effects of firm's financing and operating decisions. Hence, we assume that firms with prior credit constraints are less likely to adopt various business models and production adjustment mechanisms to cope with the changing business environmental conditions presented by the current crisis. Thus, we hypothesize that credit-constrained firms are less likely than unconstrained firms to adopt business model adjustments, digital platforms and start or increase online delivery or carryout of goods or services in response to the exogenous shocks of the COVID-19 pandemic.

3. Methodology and data description

We assess whether prior financing constraints amplify the economic effects of the COVID-19 outbreak on businesses. Therefore, we first construct financing constraint indicators from the *WBES* data gathered prior to the COVID-19 pandemic, thereby employing the financing constraints measure used in Khan et al. (2021a, 2021b) and Amin and Soh (2020). For robustness, we also use a credit self-rationing measure by considering discouraged businesses, i.e., firms that did not apply for a bank loan despite the need for external funding because they anticipated rejection (Kon and Storey, 2003). We aim to investigate how post-pandemic factor production adjustments, trade credit, financing constraints, and firm risk (overdue obligations and payments) are affected by perceived and actual financing constraints experienced by businesses before the outbreak of the COVID-19 pandemic.

Our key research objective is to explore how credit constraints affect firms' responses to the pandemic. In particular, our study has three primary research objectives. First, we investigate whether prior financing constraints amplified pandemic-induced firm-level financial fragility. To this end, we formulate three subresearch questions. The first question is whether prior financing constraints exacerbated the likelihood of experiencing pandemic-induced liquidity and cash flow problems. To assess a firm's financial position, we construct a variable *LIQDTY* by using the response to a question in the *COVID-19 Impact Follow-up Surveys (henceforth CIFS)* that asks, "Since the outbreak of COVID-19, has this establishment's liquidity or cash flow increased, remained the same, or decreased?" The variable *LIQDTY* takes a value of 1 if a firm reported that liquidity and cash flows increased, otherwise it is set equal to 0 for all firms that reported that liquidity or cash flow decreased.

Our second subresearch question relates to how firms manage COVID-19-induced short-term liquidity and cash flow problems. We examine whether prior financing constraints exacerbate the likelihood of accessing bank credit to manage these liquidity problems. To assess a firm's access to various sources of external financing to manage cash flow problems, we use the following *CIFS* question "Since

the outbreak of COVID-19, what has been the main source this establishment has used to deal with cash flow shortages? (Cove2).” Based on the response, we construct four dummy variables to identify the firm’s primary source of external financing to manage pandemic-induced liquidity problems. These binary variables have a value of 1 if the primary source of finance, as reported by the firm, was bank credit (*BNK_FIN*), delayed payments to suppliers or workers (*DELY_PAYMENT*), market (equity) financing (*MKT_FIN*), or government grants (*GOVT_GRANT*) and 0 otherwise. Furthermore, we investigate whether prior financing constraints exacerbate a firm’s credit risk by examining whether those constraints increased the probability that the firm would be delinquent on payments because of financial institutions during the COVID-19 outbreak. To construct a proxy for this firm risk, we utilize the following *CIFS* question: “Since the outbreak of COVID-19, has this establishment been overdue on its obligations to any financial institution? (Yes/No) (Cove4).” Based on this information, we construct a dummy, *OVDU*, that takes a value of 1 if a firm responds in the affirmative and 0 otherwise.

We also examine whether prior financing constraints hurt the firm’s ability to cope with COVID-19 by adjusting or converting its operations or production processes to continue to offer goods and/or services during the COVID-19 outbreak. We construct a dummy variable, *CHANGE_PROD*, from the following *CIFS* question. “Has this establishment adjusted or converted, partially or fully, its production or the services it offers in response to the COVID-19 outbreak? Yes/No.” Similarly, we examine whether prior financing constraints affect the firm’s ability to adjust its organizational or production processes. In particular, we examine whether credit constraints influence the likelihood of starting or increasing online activity and/or delivery of goods or services in response to the COVID-19 outbreak. To examine this subresearch topic, we construct a dummy variable, *ONLINE_STRTD*, based on the *CIFS* questions COVe4 and COVe4b: “Did this establishment experience any of the following changes in response to the COVID-19 outbreak: started or increased business activity online (COVe4a), started or increased delivery or carry-out of goods or services? (COVe4b)?”

3.1. Econometric specification: bivariate probit model

We use lagged indicators of being bank credit-rationed and other financing constraints. In other words, our financing constraint indicators are from the period preceding the COVID-19 outbreak, thereby allowing us to address concerns regarding potential endogeneity between financing constraints and liquidity problems brought about by the pandemic. We also control for the possibility that the likelihood of experiencing liquidity and cash flow problems and the prevalence of financing constraints are simultaneously affected by common, unobservable heterogeneity factors; the bivariate probit model that we employ accounts for this simultaneity bias. Bivariate probit model has two binary dependent variables. The binary dependent variable for regression 1 is either proxies of the firm’s liquidity or cash flow problems (*LIQDTY*, *OVDU*) or access to external finance (*BNK_FIN*, *MKT_FIN*, *GOVT_GRANT*). The dependent variable for the second regression in Bivariate Probit model is a dummy variable that proxy for a measure of credit constraint (e.g., *FINCON3* or *DISCBUS*). This specification jointly models the probability that a firm experiences financing constraints, denoted by *FINCON3*, and the likelihood that a firm will experience liquidity or cash flow problems, or access to external finance during the COVID-19 pandemic.

3.2. Data description

We use the *WBES* and *COVID-19 Impact Follow-up Surveys (CIFS)* as our data sources. The latter surveys were conducted in 19 countries as a follow-up to the *WBES* completed in these countries prior to the COVID-19 outbreak. The *WBES* are standardized, nationally representative, firm-level surveys of a sample of nonfinancial firms in a country’s private sector. A stratified random sampling methodology is followed in all of these surveys by using a master questionnaire. The strata used to construct a representative sample in each country are industry, firm size, and economic regions. Because *WBES* surveys employ a global methodology with a common questionnaire, the results are fully comparable and facilitate research and analyses including within- and cross-country comparisons. Another key feature of these surveys is that they systematically collect information on the business environment in addition to a wide range of firm characteristics and financial results².

Our second data source, *CIFS*, measures the impact of the COVID-19 pandemic on the businesses. These follow-up surveys, conducted during May–July 2020, build on *WBES* data collected in several countries in 2019 and capture timely information on how the pandemic has affected business operations and how firms responded to these challenges. The *CIFS* was conducted via phone interviews and supported by emails with self-administered questions as required. We merge this dataset, by using a unique firm identification code “*idstd*,” with the baseline *WBES* data collected in the respective countries before the COVID-19 outbreak.

The *CIFS* effort collected information on the operational status of the businesses surveyed, thereby providing information on the percentage of firms that had temporarily or permanently closed or were likely to close, the duration of temporary closures, and supply and demand shocks affecting firm’s goods and services. The survey further collected information on how firms responded to the challenges of the pandemic and on the impact of global supply chain shocks on a firm’s share of exports and imports, including the percentage of exporters whose exports increased, remained the same, or decreased. Importantly for our study, another block of questions in the *CIFS* addressed SMEs’ financial fragility by focusing on (a) whether firms experienced liquidity and cash flow shocks and (b) how firms managed any pandemic-related cash flow shortages. This section also collected information on whether firms experienced delayed payments or were overdue on their financial obligations. The next section focuses on expectations regarding how

² Detailed information about Enterprise Surveys and methodology can be accessed at: <http://www.enterprisesurveys.org/Methodology/>.

long it would take the firm to navigate through the crisis and return to normal operations. Finally, the policy response section elicited information about the various types of financial assistance received by firms from their local and national governments.

Appendix B reports the breakdown of firms sampled by size and age. A total of 9101 firms were included in the sample from 19 countries and 14 industries (2-digit ISIC Rev 3.1). According to the size categories as defined in the survey, 46.8% are small businesses (5–19 employees)³, 32.2% are medium-sized businesses (20–99 employees), and 21.0% are large businesses (100+ employees). The proportion of firms with more than 250 employees is only 7% of the sample; therefore, most of the firms are SMEs. The sampled firms are from manufacturing (51.48%), retail (17.19%), and other services (31.33%). The breakdown by firm age (see Panel B of Appendix B) shows that the majority of firms in our sample had been in business for more than 10 years (79.80%), whereas start-ups (firms that had been in business for less than two years) constitute only 0.73% of the sample.

All firm-specific variables and indicators of financing constraints used in the study are one-period lagged to address potential endogeneity concerns between firm-specific financing constraints in the pre-pandemic period and during the pandemic.

3.3. Measuring financing constraints

To construct a proxy for credit constraints, we exploit loan application data from *WBES* completed prior to the COVID-19 outbreak. Importantly, *WBES* contains detailed information on various alternative sources of financing firms use to obtain working capital and meet investment requirements. The survey distinguishes between internally generated funds, market financing (issuance of new shares or equity from existing shareholders), bank loans and/or lines of credit, trade credit and customer advances, and informal sources (e.g., friends, relatives, and money lenders). We rely on the survey-based methodology to identify credit-constrained firms based on the approach in Khan et al. (2021a, 2021b) and Casey and O'Toole (2014). Our goal is to directly identify those firms experiencing difficulties accessing formal bank lending; therefore, we limit our focus to the use of bank credit to construct a measure of bank-lending-constrained firms. *WBES* asks firms to report whether they applied for new bank loans or lines of credit during the previous year and the outcome of the application. The possible responses are (a) approved in full, (b) approved in part, (c) the loan was denied, or (d) still pending. For *non-applicant* firms, the questionnaire allows the firm to indicate the primary reason it did not apply for a loan by using one of the following responses: (i) *no need for a loan as the firm has sufficient funds*, (ii) *lending rates were not favorable*, (iii) *tough collateral requirement*, (iv) *cumbersome loan application and paperwork*, (v) *loan size and maturity were not sufficient*, and (vi) *did not think that loan will be approved*. Based on this information, we classify a firm as credit constrained if the firm indicated either (b) or (c) and (ii), (iii), or (iv). In other words, we consider a firm as credit constrained if a loan application was rejected in full or in part or a firm did not apply for a loan because of stringent lending conditions. Using this data, we construct a binary variable, *FINCON3*, that takes a value of 1 if a firm is credit constrained and 0 if a firm reported that its loan application was approved in full or that it did not apply for a loan because it had “*sufficient funds*.” This measure of financial constraint is consistent with one used in Amin and Soh (2020). In our baseline sample, the mean value of *FINCON3* is 0.2498, with a standard deviation of 0.4329. Therefore, approximately 25% of firms in our sample are credit constrained.

3.4. Other controls

We include several controls in our estimations identified in the literature as determinants of financial constraints and liquidity problems (see e.g., Beck et al., 2005; Casey and O'Toole, 2014). These include traditional determinants, such as firm size (based on the number of employees), age, and ownership characteristics (business group affiliation, ownership concentration by the largest shareholder, and legal status of the firm) (e.g., Abdullah et al., 2012; Khan and Rizwan, 2020). Other controls include export intensity, top manager's gender and experience in the relevant sector, pre-existing overdraft facility and loans/lines of credit from a bank, firm location, and finally, whether financial accounts are audited by an external auditor. Country and industry dummies were included in regressions to control for country and industry fixed effects. Table 1 provides the operational definitions of these control variables.

3.5. Descriptive statistics

The descriptive statistics, reported in Table 2, offer a gloomy perspective of the catastrophic impact of the COVID-19 pandemic on the demand for goods and services and therefore revenues as well as interruptions in the supply of input materials, liquidity and cash flow challenges, decreased profitability, financing constraints, suspension in business operations, and even business closures. Panel A of Table 2 shows that 79% of businesses experienced decreased liquidity or cash flow availability during the COVID-19 pandemic, which increased to approximately 84% for small businesses compared with only 3.9% of firms that experienced increased liquidity and cash flow. This decreased liquidity is further compounded by a reduced ability to access input materials using credit because 42.3% of the businesses reported a decline in credit purchases. Further, 44.4% of the businesses reported experiencing decline in credit sales.

Table 2 shows that only 15.4% of firms had access to bank credit as their primary source of financing to address liquidity and cash flow shortages induced by the pandemic. The percentage of firms that accessed credit from nonbank financial institutions (NBFIs) was even lower at only 3.12% (and less than 1% in five countries in the sample). The data show that 34% of the firms resorted to equity financing obtained from existing or new equity issuance to manage liquidity problems that resulted from the COVID-19 outbreak. The

³ Businesses with less than 5 employees are not included by the World Bank's Enterprise Analysis unit in the survey sample.

Table 1
Operational definitions of variables.

Variable Name	World Bank Enterprise Surveys (WBES) Variable Description
FSIZE	Number of full-time employees (Natural logarithm)
FAGE	Number of years since the firm was formally registered (1+ natural logarithm).
BGROUP (0/1)	1 if the firm is part of a business group or a larger firm with multiple establishments (0/1), otherwise equals 0 for stand-alone firms.
ADAC (0/1)	1 if the firm's financial statements are checked and certified by an external auditor (0/1), 0 else.
WCPFIN (%)	Proportion of working capital (e.g., input and raw materials cost, wage bills, etc.) financed from internal funds (%)
EXPORTER (0/1)	1 if the firm's exports are 10% or more, 0 else (0/1)
INTFIN	Proportion of investments financed by internal funds (%)
FOREIGN (0/1)	1 if foreign ownership is 10% or more, 0 else (0/1). Foreign owners include foreign private businesses or foreign individual investors
MAIN_SHARE (%)	Proportion of ownership held by the largest shareholder (%)
CORP (0/1)	1 if firm is publicly listed company, 0 else (0/1)
ODFF (0/1)	1 if a firm has an overdraft facility from a bank, 0 else (0/1)
MAIN_CITY (0/1)	1 if the firm is located in a big city (population more than 1 million) or in the capital city; equals 0 otherwise
MGMTEXP	Natural logarithm of top manager's years of experience in the firm's main sector
FEMLED	1 if the firm's top manager is female, 0 else.
LNCL (0/1)	1 if firm has a loan or a credit line facility from a financial institution, 0 else (0/1)
EM_COMM (0/1)	1 if firm communicates with clients through email, 0 else
OWN_WEB (0/1)	1 if firm has its own website, 0 else
GROWTH (0/1)	1 if the firm's annual sales growth decreased, 0 if increased
COVID-19 Impact Follow-Up Survey Variable Description	
OVDU (0/1)	1 if the firm has been overdue in its obligations to any financial institution; it equals 0 otherwise
LIQDTY (0/1)	1 if the firm's liquidity or cash flow increased during the COVID-19 pandemic; it equals 0 if liquidity or cash flows decreased.
BNK_FIN (0/1)	1 if the firm's primary source of external financing was "loans from commercial banks or nonbank financial institutions" to manage pandemic-induced cash flow shortages; it equals 0 otherwise
DELY_PAYMENT (0/1)	1 if the firm used "delaying payments to suppliers or workers" as the main source to manage cash flow shortages; it equals 0 otherwise
GOVT_GRANT (0/1)	1 if the firm used "Government grants" as the main source to manage the cash flow shortages; it equals 0 otherwise
MKT_FIN (0/1)	1 if the firm used "capital from existing owners/shareholders or issuing new shares" as the main source to manage the cash flow shortages; it equals 0 otherwise
CHANGE_PROD (0/1)	1 if a firm adjusted or converted, partially or fully, its production or the services it offers in response to the COVID-19 outbreak, 0 else (0/1)
ONLINE_STRTD (0/1)	1 if a firm started or increased online activity in response to the COVID-19 outbreak, 0 else (0/1)

Table 2
Summary descriptive statistics of the firm-level economic impacts during COVID-19 pandemic.

(1)	(2) All firms	(3) Small (5–19 employees)	(4) Large (100+ employees)	(5) Prior Credit Constrained firms (%)	(6) Prior Credit un-Constrained firms (%)
Financial Fragility					
Percent of firms experiencing <i>increased</i> liquidity or cash flow availability	3.90%	3.5%	5.3%		
Percent of firms experiencing <i>decreased</i> liquidity or cash flow availability	79.00%	84.0%	67.8%	56.6%	46.7%
Percent of firms using loans from commercial banks as the main source to deal with liquidity and cash flow problems during COVID-19 pandemic	15.40%	13.0%	23.4%	73.35%	26.65%
Percent of firms using equity finance as the main source	34.00%	34.8%	28.1%		
Firms delaying payments to suppliers or workers	15.50%	15.8%	14.7%		
Percent of firms having access to nonbank financial institutions	3.12%				
Percent of firms that are overdue on obligations to financial institutions	20.49%	21.31%	17.95%	13.50%	10.10%
Percent of firms experiencing Decline in Credit Sales	44.40%				
Percent of firms experiencing decreased purchases on credit	42.30%				
Production Adjustment and online activities					
Capacity utilization	49%				
Percent of firms adjusting or converting their production or services	33.6%	33.2%	29.1%		
Percent of firms that started or increased online business activity	24.8%	22.4%	28.6%		
Percent of firms that started or increased delivery of goods, services, or carry-out	24.6%	24.1%	25.2%		

Source: ES follow up on COVID-19 Indicators, September 24, 2020 (<https://www.enterprisesurveys.org/en/covid-19>).

results show that approximately 20.5% of the firms were overdue in meeting their obligations to financial institutions, and approximately 21% and 18% of the small and large firms were overdue in meeting their obligations, respectively. In summary, smaller and younger firms experienced the most financial fragility during the COVID-19 pandemic. The data on capacity utilization shows that, on average, businesses were operating at approximately 49% of capacity, which declined to as low as 27% for firms in Guinea. This finding suggests that SMEs were operating well-below full capacity, thereby putting enormous financial strain on business sustainability.

Table 2 also reports that approximately one-third of the firms adjusted or converted their production and/or service offerings in response to changing business conditions resulting from the COVID-19 pandemic. Similarly, approximately one-fourth of the firms started or increased online business activities, and a similar proportion of firms initiated or increased online delivery or carry-out options for their goods or services. Finally, the descriptive statistics (columns 5–6) show that firms with prior credit constraints were more likely to experience liquidity and cash flows problems, overdue in their financial obligations, and were less likely to have access to bank credit to manage the pandemic-induced liquidity/cash flow problems and credit risk.

3.6. Empirical results

We provide firm-level evidence regarding the ways small businesses responded to the pandemic and whether prior financing

Table 3
Firm-level economic effects of COVID-19 pandemic: Bivariate probit model.

VARIABLES	(1) Liquidity Shortfall	(2) Overdue in financial obligations	(3) Bank Financing	(4) Delay Payment	(5) Equity Finance	(6) Govt. Grant	(7) Change production	(8) online Started
FINCON3	-1.856*** (0.160)	0.728** (0.317)	-0.330* (0.181)	0.676** (0.3357)	-0.763** (0.385)	1.797*** (0.408)	-0.897*** (0.340)	-0.918* (0.489)
FAGE	-0.0614 (0.0693)	0.0294 (0.0689)	0.0648 (0.0510)	-0.0285 (0.0725)	0.0345 (0.0818)	0.194 (0.130)	-0.0150 (0.0655)	0.0678 (0.0998)
FSIZE	-0.0856** (0.0420)	-0.0526 (0.0370)	0.0993*** (0.0279)	0.0499 (0.0414)	-0.139*** (0.0440)	-0.000318 (0.0715)	-0.0333 (0.0352)	-0.0127 (0.0613)
BGROUP	-0.00719 (0.109)	-0.276** (0.112)	0.0273 (0.0811)	0.161 (0.115)	-0.0160 (0.120)	-0.281 (0.228)	0.214** (0.106)	0.317** (0.142)
ADAC			0.0908 (0.0693)			0.298* (0.177)	-0.0170 (0.0898)	
WCPFIN			-0.257*** (0.0914)					
EXPORTER	-0.0340 (0.111)	-0.0674 (0.107)	-0.139* (0.0831)	0.177 (0.119)	0.136 (0.116)	-0.301 (0.198)	-0.0442 (0.0926)	0.0589 (0.176)
FOREIGN	-0.112 (0.138)	-0.234* (0.141)	0.00713 (0.0983)	-0.220 (0.145)	0.294** (0.146)	0.0523 (0.274)		
CORP	0.359** (0.156)	0.113 (0.1561)	-0.0375 (0.106)	-0.004 (0.1690)	-0.181 (0.1986)	0.342 (0.3172)	-0.110 (0.130)	0.261 (0.228)
ODFF	-0.00545 (0.0938)	-0.033 (0.0912)		-0.153 (0.100)	-0.0913 (0.0996)	-0.0360 (0.173)		
FEMLED	0.0311 (0.105)	0.0895 (0.102)	-0.0738 (0.0743)	0.288*** (0.111)	-0.352*** (0.119)	0.188 (0.176)	0.228** (0.0921)	0.231 (0.185)
MGMTEXP	-0.0490 (0.0772)	-0.101 (0.0709)	0.0903* (0.0528)	-0.0869 (0.0789)	-0.0759 (0.0837)	0.224 (0.147)	-0.0395 (0.0646)	-0.0430 (0.111)
LNCL	-0.257*** (0.0915)	0.303*** (0.0914)						
MAIN_CITY		-0.0905 (0.0954)						0.144 (0.145)
INTFIN				-0.0692 (0.118)	0.189 (0.120)	-0.0919 (0.202)		
EM_COMM								-0.0508 (0.272)
OWN_WEB								0.165 (0.139)
MAIN_SHARE								0.473** (0.229)
Constant	-0.0298 (0.383)	-0.978*** (0.328)	-2.260*** (0.380)	-0.364 (0.448)	-5.032 (1954)	-8.399 (12,184)	0.584 (0.373)	-0.983 (0.701)
Observations	1,355	1,664	2,906	1,218	1,099	1,217	1,443	534
Country & industry Dummies	YES	YES	YES	YES	YES	YES	YES	YES

This table provides coefficient estimates of the bivariate probit model (standard errors in parenthesis). The dependent variable for each regression is mentioned in the second row of each column. *FINCON3* (0/1) is a measure of financing constraint as defined in Section 3.3. Other control variables are as defined in Table 1. The number of observations change with each model due to the missing values for some variable, particularly in relation to the post-COVID 19 Following Up surveys. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

constraints amplified the pandemic's effects on firms' risk levels, access to external finance, and adjustments to business operations and business models. The results from the bivariate probit model are reported in Table 3. The dependent variable for each model is mentioned at the top of each column. The first three columns report coefficient estimates for regression specifications where each dependent variable represents different proxies for a firm's financial and credit risk. The negative and statistically significant coefficient for *FINCON3* (in Column 1) shows that financially constrained firms were more likely to experience liquidity and cash flow problems than firms that were not experiencing financial constraints before the COVID-19 outbreak. This result is consistent with our predictions. In Column 2, the dependent variable *OVDU* is a dummy for whether the firm is overdue on its financial obligations, which is a proxy for credit risk. Here, the coefficient estimate is positive and highly statistically significant. This finding shows that financially constrained firms were more likely than unconstrained firms to be overdue in their financial obligations during the economic crisis caused by the pandemic. This result is also consistent with our prediction. In Column 3, the coefficient for *FINCON3* is negative and highly significant, thereby indicating that firms experiencing prior financing constraints were less likely to have access to bank funding as the primary source of financing to address cash flow and liquidity problems during the COVID-19 pandemic. Further, this result is consistent with our predictions.

In columns 4–6, the dependent variables indicate whether firms used alternative sources of financing to cope with their liquidity and cash flow problems. In Column 4, the positive coefficient for *DELY_PAYMENT* suggests that credit-constrained firms are likely to

Table 4

Robustness tests: Probit model with selection.

VARIABLES	(1) Liquidity shortfall	(2) Overdue in financial obligations	(3) Bank Financing	(4) Delay Payment	(5) Equity Financing	(6) Govt. Grant	(7) Informal Finance	(8) Change Production	(9) Online Started
FINCON3	−0.616*** (0.238)	0.166* (0.0936)	−0.238** (0.107)	0.0357 (0.189)	−0.187 (0.1970)	0.450** (0.182)	0.221** (0.1068)	0.130 (0.141)	−0.282** (0.134)
FAGE	0.00120 (0.125)	−0.101* (0.0603)	0.108 (0.0725)	−0.0840 (0.118)	0.046 (0.1329)	0.228* (0.1395)	0.027 (0.0852)	−0.0282 (0.0977)	0.0339 (0.0899)
FSIZE	−0.0586 (0.0741)	−0.0743** (0.0365)	0.0598 (0.0373)	−0.138** (0.0661)	−0.009 (0.0660)	−0.0179 (0.0796)	−0.0372 (0.0436)	−0.00723 (0.0459)	−0.00691 (0.0455)
BGROUP	0.425** (0.188)	−0.179 (0.109)	0.0331 (0.122)	−0.0254 (0.190)	0.0599 (0.191)	−0.0548 (0.230)	0.103 (0.140)	0.249 (0.156)	−0.0741 (0.149)
ADAC	0.243 (0.201)	0.138 (0.0878)		0.247 (0.173)	−0.444** (0.178)	0.116 (0.191)	0.0509 (0.118)		
WCPFIN	0.344 (0.298)	0.0780 (0.200)						0.254 (0.201)	
EXPORTER	−0.140 (0.194)	−0.0827 (0.108)	−0.0973 (0.114)	0.0669 (0.184)	0.146 (0.176)	−0.263 (0.237)	0.107 (0.133)	−0.147 (0.134)	0.0628 (0.133)
FOREIGN	−0.484 (0.303)	−0.121 (0.146)		−0.0509 (0.263)	0.375 (0.253)	−0.000146 (0.351)	−0.0705 (0.177)		
CORP	0.546** (0.264)							−0.204 (0.196)	0.0331 (0.175)
ODFF			0.348*** (0.0956)	−0.356** (0.159)	−0.258 (0.161)	−0.0310 (0.208)	0.0898 (0.110)		
FEMLED	0.395** (0.185)	0.0205 (0.0894)	−0.300*** (0.109)	0.289* (0.171)				0.202 (0.134)	0.151 (0.134)
MGMTEXP		0.000141 (0.0647)	0.109 (0.0765)					−0.152 (0.0974)	−0.0222 (0.0955)
LNCL		0.227 (0.224)		0.325 (0.324)	−0.367 (0.274)				
MAIN_CITY	0.528*** (0.202)	0.0679 (0.0846)							
INTFIN				0.106 (0.194)	−0.130 (0.244)				
GROWTH				0.0627 (0.157)		−0.134 (0.168)	0.0561 (0.0969)		
OWN_WEB									0.363*** (0.127)
MAIN_SHARE									−0.00680 (0.195)
Constant	−2.352*** (0.691)	−0.754*** (0.276)	−2.716*** (0.489)	0.551 (0.600)	−5.222 (1,459)	−2.726*** (0.547)	−7.658 (7,541)	1.088* (0.569)	−0.836* (0.459)
Observations	1,976	5,200	4,664	3,887	1,514	3,884	3,884	1,977	2,064
Country & industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES

This table provides coefficient estimates of the probit model with selection (standard errors in parenthesis). The dependent variable for each regression is mentioned in the second row of each column. *FINCON3* (0/1) is a measure of financing constraint as defined in Section 3.3. The control variables are as defined in Table 1. The number of observations change with each model due to the missing values for some variable, particularly in relation to the post-COVID 19 Following Up surveys. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

delay payments to suppliers and workers as the primary source of financing to manage liquidity shocks during an economic crisis. Similarly, the negative (positive) coefficient of *MKT_FIN* (*GOVT_GRANT*) in Column 5 (6) suggests that credit-constrained firms are less (more) likely to use market equity (government grants) to manage liquidity shocks. Our results are consistent with previous studies showing that firms prefer to switch to alternative financing sources in times of bank-lending-related liquidity shocks during economic crises (e.g., Casey and O'Toole, 2014).

We further examine how credit constraints affected firms' ability to manage operational challenges caused by the COVID-19 pandemic. Columns 7 and 8 reported the estimates from the bivariate probit model regarding whether firms adjusted or converted, partially or wholly, their production or services, or started or increased online activities in response to the COVID-19 pandemic. The negative coefficient suggests that financially constrained firms are more likely to experience difficulties in adjusting their production methods or service offerings during exogenous shocks caused by the COVID-19 pandemic. Bank-lending credit constraints are more likely to hamper a firm's ability to adjust its business operations when responding to exogenous shocks. These results are consistent with our prediction that operational adjustments require financial resources. The firms that were already experiencing financial constraints prior to the pandemic were hampered by the lack of resources in their efforts to adjust their production or services in response to the challenges posed by the pandemic. Therefore, our results are consistent with prior studies showing that financial constraints are likely to exacerbate a firm's ability to manage economic crises.

In summary, the results show that bank-lending credit constraints amplified the effect of the COVID-19 pandemic on firms'

Table 5
Robustness tests: Alternative measure of financing constraints.

VARIABLES	(1) Liquidity Shortfall	(2) Overdue In financial obligations	(3) Bank Financing	(4) Delay payment	(5) Equity Finance	(6) Govt. Grant	(7) Informal Finance	(8) Change Production	(9) Online Started
FINCON3MEAN	-1.318** (0.660)	-0.399* (0.234)	-0.783* (0.443)	0.584* (0.325)	0.578 (0.604)	0.774* (0.4710)	1.288*** (0.356)	-0.205 (0.297)	-0.558* (0.341)
FAGE	0.00130 (0.112)	-0.124** (0.0568)	0.00271 (0.0994)	-0.118 (0.102)	-0.0115 (0.103)	0.213* (0.1156)	0.034 (0.0780)	0.052 (0.0623)	0.052 (0.0597)
FSIZE	0.0198 (0.0618)	-0.0610* (0.0321)	0.128** (0.0514)	-0.0369 (0.0514)	-0.0315 (0.0550)	-0.0447 (0.0670)	-0.0349 (0.0397)	0.004 (0.0298)	0.0152 (0.0418)
BGROUP	0.418** (0.167)	-0.161* (0.0958)	0.0575 (0.153)	0.0485 (0.155)	-0.0860 (0.166)	-0.104 (0.185)	0.0669 (0.128)	0.194* (0.111)	
ADAC			0.190 (0.144)		-0.309** (0.152)	0.129 (0.156)	0.0448 (0.107)		
WCPFIN	0.0786 (0.262)	0.166 (0.131)		-0.313 (0.214)	0.135 (0.212)			0.221 (0.145)	
EXPORTER	-0.121 (0.175)	-0.0818 (0.0961)	-0.267* (0.144)	0.00817 (0.152)	0.0283 (0.153)	-0.320* (0.197)	0.203* (0.121)	0.0635 (0.0918)	-0.00598 (0.127)
FOREIGN	-0.441* (0.265)			-0.105 (0.203)	0.420** (0.207)	-0.0591 (0.275)	-0.163 (0.160)	0.0754 (0.126)	
CORP	0.494** (0.238)	0.107 (0.130)	-0.0437 (0.198)	0.180 (0.206)				-0.276** (0.132)	-0.0119 (0.167)
ODFF				-0.166 (0.129)	-0.0788 (0.133)	-0.0666 (0.165)	0.00792 (0.0998)		
FEMLED	0.433*** (0.164)	0.00764 (0.0856)	-0.223 (0.151)	0.0388 (0.151)	-0.240 (0.157)			0.00363 (0.0863)	0.176 (0.125)
MGMTEXP			0.0779 (0.105)					-0.163*** (0.0600)	-0.0503 (0.0908)
MAIN_CITY	0.485*** (0.182)	0.0929 (0.0809)	-0.157 (0.139)	0.161 (0.129)	0.183 (0.152)			0.0692 (0.0771)	
INTFIN					-0.171 (0.231)				
GROWTH		0.0981 (0.0691)		0.0752 (0.126)		-0.0640 (0.138)	-0.00742 (0.0889)		
MAIN_SHARE			0.160 (0.227)		-0.0849 (0.234)			0.0472 (0.134)	-0.0139 (0.187)
OWN_WEB									0.312*** (0.119)
Constant	-1.963*** (0.648)	-0.226 (0.258)	-2.588*** (0.749)	0.143 (0.472)	-5.870 (497.3)	-2.850*** (0.656)	-6.889 (257.6)	1.201*** (0.404)	-0.312 (0.486)
Observations	2,098	5,381	1,973	1,903	1,937	4,171	4,171	5,074	2,185
Country & industry Dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES

This table provides coefficient estimates of the probit model with selection (standard errors in parenthesis). The dependent variable for each regression is shown in the second row of each column. FINCON3MEAN is a measure of financing constraint as defined in Section 1. The control variables are as defined in Table 1. The number of observations change with each model due to the missing values for some variable, particularly in relation to the post-COVID 19 Following Up surveys. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

financial risk, credit access, and ability to make adjustments in response to the pandemic.

3.7. Robustness tests

We apply two robustness tests to determine whether our primary results are sensitive to alternative measures of financing constraints and econometric specifications to account for the potential sample selection bias.

Financially constrained firms and those that apply for bank loans constitute a subset of firms that may not qualify as a random sample from the underlying population. A firm categorized as a financially constrained firm (i.e., *FINCON3* = 1) is dependent on the condition that the firm is in need of external funds (i.e., *NEED_CRED* = 1). A sample selection bias is likely to arise if the probability that a firm has a demand for credit is not differentiated from the probability that a firm is financially constrained. Therefore, we account for the selectivity bias by using Heckman's (1979) approach by jointly modeling loan demand and the financial constraint measure in a probit model with selection. This approach is consistent with Piga and Atzeni (2007). We first determine whether a firm has a demand for external financing. We infer this from two subquestions in the WBES survey where managers are asked to indicate whether the firm has applied for a loan, and for non-applicant firms, asking the firm to select the primary reason why they had not applied for a loan. Firms that had applied for a loan and non-applicant firms that reported reasons other than "have sufficient funds" were considered firms with a demand/need for external funds. Formally, this observation is captured using a dummy variable, *NEED_CRED*, that equals 1 if a firm has a need for external finance and 0 otherwise. We follow Leon (2015) and use two variables to proxy the firm's need for

Table 6
Robustness Test: Alternative measure of credit constraint.

VARIABLES	(1) Liquidity Shortfall	(2) Overdue in financial obligations	(3) Bank Financing	(4) Delay Payment	(5) Equity Finance	(6) Govt. Grant	(7) Informal Finance	(8) Change Production	(9) Online Started
DISCBUS	-1.259*** (0.389)	0.758*** (0.257)	-0.952** (0.453)	-0.815*** (0.287)	0.572* (0.340)	0.382*** (0.146)	0.637** (0.306)	-1.048*** (0.283)	-1.099*** (0.313)
FAGE	0.00154 (0.114)	-0.0606 (0.0527)	0.136** (0.0638)	-0.0594 (0.0932)	-0.0531 (0.109)	0.202* (0.1141)	0.0614 (0.103)	0.0551 (0.0583)	0.0379 (0.0689)
FSIZE	-0.0303 (0.0608)	-0.0327 (0.0323)	0.0336 (0.0402)	-0.0738 (0.0515)	-0.0276 (0.0561)	-0.0189 (0.0656)	-0.0360 (0.0532)	-0.0203 (0.0317)	-0.0406 (0.0418)
BGROUP	0.295* (0.166)	-0.194** (0.0890)	0.0440 (0.104)	0.127 (0.152)	-0.00236 (0.167)	-0.0917 (0.185)	0.0971 (0.169)	0.135 (0.103)	0.206* (0.109)
ADAC						0.145 (0.155)		-0.0568 (0.0810)	
WCPFIN	0.207 (0.237)	-0.104 (0.109)	0.0790 (0.149)					0.257** (0.113)	
EXPORTER	-0.201 (0.164)	-0.0323 (0.0916)	-0.133 (0.104)	-0.0229 (0.151)	-0.00435 (0.152)	-0.301 (0.190)	0.430*** (0.153)	0.0144 (0.0879)	0.0969 (0.149)
FOREIGN	-0.392 (0.255)	-0.201* (0.120)	-0.121 (0.134)	-0.0879 (0.198)	0.407** (0.203)	-0.0513 (0.266)	-0.201 (0.202)		-0.0366 (0.152)
CORP	0.435* (0.234)	0.0701 (0.124)	-0.111 (0.140)					-0.185 (0.127)	
ODFF	-0.0314 (0.149)		0.261*** (0.0953)	-0.252* (0.131)	-0.0860 (0.142)	-0.0444 (0.163)	0.00209 (0.140)	0.0212 (0.0824)	
FEMLED	0.417*** (0.154)	0.00988 (0.0790)	-0.276*** (0.0988)	0.175 (0.147)	-0.245 (0.159)		0.233 (0.147)	0.0514 (0.0804)	0.334*** (0.121)
MGMTEXP	0.0393 (0.127)	-0.0281 (0.0557)	0.0734 (0.0691)	-0.0673 (0.104)	-0.0540 (0.114)		-0.0311 (0.105)	-0.158*** (0.0562)	-0.0848 (0.0800)
LNCL	-0.292 (0.244)	0.458*** (0.129)	-0.285 (0.198)					-0.393*** (0.145)	-0.362* (0.191)
MAIN_CITY	0.427** (0.169)								0.0260 (0.111)
INTFIN				0.155 (0.168)	-0.0504 (0.187)		-0.289* (0.173)		
GROWTH						-0.0663 (0.134)			
EM_COMM									0.288** (0.142)
OWN_WEB									0.153 (0.103)
MAIN_SHARE									0.0493 (0.183)
Constant	-1.949*** (0.700)	-1.121*** (0.289)	-1.602** (0.626)	0.935** (0.473)	-5.770 (721.8)	-1.865*** (0.336)	-6.479 (676.0)	0.818*** (0.289)	-0.180 (0.486)
Observations	838	2,236	1,714	767	678	4,171	767	1,747	922
Country & industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES

financing in the selection equation: (1) the proportion of annual sales paid by customers after delivery calculated over the previous year and (2) a dummy that equal to 1 if a firm had applied for a construction permit in the last two years. The first variable captures working capital financing requirements, and the second approximates the firm's willingness to make long-term investments, thereby indicating a need for external funding. The results, reported in Table 4, are qualitatively similar to those obtained using the earlier proxies of the need for external capital. In particular, indicators of financial and credit risks, namely *LIQDTY*, *OVDU*, and *BNK_FIN*, retain their statistical significance with their respective negative signs. Furthermore, the coefficient estimates for *ONLINE_STRTD* is negatively correlated with the proxy for financial constraints, thereby confirming the earlier results shown in Table 3. This finding further confirms that prior financing constraints had were more likely to hamper firm's ability to adjust business operations in response to the exogenous shocks caused by the COVID-19 pandemic.

Our second robustness test is related to an alternative construction for the financing constraint variable *FINCON3*. Firm-level responses to the loan application-related questions in the survey, used to construct the financial constraint variable, may be endogenous to a firm's likelihood of encountering liquidity and cash flow problems. These responses may also be related to a firm's ability to adjust its business model, production, and distribution channels in the light of the COVID-19 pandemic (a reverse causality problem). Another potential bias is that a firm's likelihood of encountering financing constraints is also likely to be endogenous to its characteristics (omitted variables issues). For example, smaller firms are more likely to be more financially fragile than the larger and profitable firms in severe economic crises, such as the COVID-19 pandemic. One potential solution proposed in the literature is to proxy the degree of financial constraint experienced by a firm by using the average level of financial constraint experienced by all other firms in the respective country-industry cell, where the average value for the financial constraint variable for each firm is calculated by excluding the firm in question (e.g., Dao and Liu, 2017). Employing this country-industry cell average also allows us to control for potential measurement error in case some firms choose not to respond to the subquestions on a loan application or misreport on the perceived financing constraint-related questions.

The results of the *probit model with selection* are reported in Table 5. Again, the coefficient estimate for the proxy of liquidity and cash flow problems, *LIQDTY*, is negatively correlated with prior financing constraints. The coefficient estimate for accessing bank funding to address pandemic-induced liquidity problems, *BNK_FIN*, is also negative and statistically different than zero. Likewise, a firm's ability to cope with pandemic-induced challenges by starting or expanding online business activities, *ONLINE_STRTD*, is also negative and statistically significant. This also confirms the results reported in Tables 3 and 4.

Continuing with robustness checks, our second measure of financing constraints is the borrower's own credit self-rationing—i.e., firms that choose not to apply for a bank loan due to stringent lending conditions or the manager's perception of a loan application rejection (Khan et al., 2021b). This perceived financing constraints, denoted by *DISCBUS*, is a binary variable that equals 1 if a firm is credit self-rationed and 0 otherwise. More specifically, *DISCBUS* equals 1 if a firm did not apply for a bank loan because of one of the following reasons: (i) interest rates were not favorable; ii) tough collateral requirement; iii) application procedure and paper work was too cumbersome; iv) the manager did not think that loan application would be approved; or v) the size and maturity of the loan was not sufficient; *DISCBUS* equals 0 if a firm applied for a loan. This measure of credit self-rationing is constructed from loan applications data in the original WBES data, from surveys conducted before the COVID-19 outbreak.

The results of the bivariate probit model are reported in Table 6. In Column 1, the negative and significant coefficient for *LIQDTY* is consistent with our prediction that credit-self-rationed firms are more likely to face greater liquidity and cash flow problems than firms that were not experiencing credit self-rationing prior to the COVID-19 outbreak. The positive and significant coefficient for *OVDU*, as reported in Column 2, suggests that credit self-rationing has a differential impact on the likelihood of a firm being overdue in its obligations to a financial institution. The coefficient for *BNK_FIN* is negative and significant, suggesting that during the COVID-19 pandemic, access to bank credit was likely to be lower for credit-self-rationed firms compared to firms that were not credit self-rationed. The positive and statistically significant coefficients for equity finance (*MTK_FIN*) and government grants (*GOVT_GRANT*) imply that self-credit-rationed firms are more likely to use equity financing (new contributions from existing owners or new equity issuance) and government grants more than other alternative financing sources to deal with crisis-induced liquidity problems. Similarly, the self-credit-rationed firms are more likely to use informal sources of finance to manage the COVID-19-induced liquidity shortfalls (column 7). Regarding the production adjustment variable (value = 1 if the firm adjusted its production/services in response to COVID-19), as shown in Column 7, the coefficient is negative and statistically significant. This indicates that businesses with prior credit self-rationing were more likely to face difficulties in adjusting their business model and production modes in response to the pandemic. In Column 8, the coefficient for *ONLINE_STRTD* (= 1 if the firm started or expanded its online activities due to COVID-19 pandemic, otherwise 0) is negative and significant, suggesting that credit-self-rationed firms were less likely to initiate or expand online activities in response to the COVID-19 outbreak. In sum, our empirical analysis and results suggest that a firm's prior financing constraints greatly amplified the unprecedented effects of the shocks caused by the COVID-19 pandemic.

4. Conclusion

In this study, our primary research objective is to examine whether prior actual and perceived financing constraints amplified the economic effects of the COVID-19 pandemic with respect to firm-level financing and operating consequences, impacting firms' ability to cope with pandemic-induced financial challenges. We employ firm-level data from the standard WBES combined with data from the COVID-19 Impact Follow-up Surveys conducted in countries for which WBES surveys were completed before the COVID-19 outbreak. Our study makes the following contributions. First, we determine that financially constrained SMEs were more likely to experience liquidity and cash flow problems and more likely to experience increased credit risk, as proxied by the probability of being overdue in meeting their obligations to financial institutions. Furthermore, we determine that financially constrained firms were less likely to

have access to the traditional bank funding to address pandemic-induced liquidity and cash flow problems and were more likely to use alternative financing sources, such as trade credit, government grants, and informal sources.

Our measures of financial constraints identify both bank credit-rationed and self-credit-rationed firms. We match bank-lending credit constraints and perceived financing obstacles with a firm's access to traditional bank lending as well as access to and use of alternative financing sources during the COVID-19 pandemic. We find that financing constraints amplified pandemic-related liquidity and financial problems for firms that were credit constrained before the COVID-19 pandemic began. Credit-constrained firms were more likely to use alternative financing sources, such as trade credit, delayed payments to suppliers or employees, government grants, and other informal sources. These firms were also more likely to experience an increased level of credit risk relative to unconstrained firms during the COVID-19 pandemic.

We also focus on how financing constraints affected firms' ability to adjust their business operations in response to exogenous shocks. We find that financially constrained firms were less likely to adjust their business processes or production, or to increase online activities or carry-out options for delivering goods and services.

Author statement

This is to certify that I am the sole author of the manuscript entitled "Financing constraints and firm-level responses to the COVID-19 pandemic: International evidence". This is a single author manuscript.

Appendix A. Breakdown of firm observations by country

This table reports the total number of firms and the respective percentage of the sample from each country. The table also reports the proportion of firms that were credit constrained in each country before the COVID-19 outbreak (FINON3) and the proportion of firms that reported experiencing liquidity shortfall (LIQDTY) and the proportion of firms that reported overdue in their financial obligations to banks and non-financial institutions in the respective countries of sample during the COVID-19 pandemic.

Country	observations	Percent of total sample	Credit Constrained (FINON3)	Decreased Liquidity	Overdue in financial obligations
Albania	377	4.14%	6.71%	70.80%	20.06%
Azerbaijan	225	2.47%	23.12%	77.20%	14.85%
Belarus	600	6.59%	18.22%	58.49%	6.80%
Bulgaria	772	8.48%	20.68%	71.35%	5.95%
Chad	153	1.68%	31.50%	92.0%	8.91%
El Salvador	719	7.9%	17.83%	94.80%	27.88%
Greece	600	6.59%	15.95%	61.89%	8.68%
Guatemala	345	3.79%	13.10%	80.90%	18.01%
Guinea	150	1.65%	36.52%	96.12%	18.45%
Honduras	332	3.65%	21.38%	87.12%	36.20%
Moldova	360	3.96%	34.35%	80.92%	13.70%
Mongolia	360	3.96%	47.41%	83.80%	23.60%
Morocco	1,096	12.04%	42.80%	72.10%	20.61%
Nicaragua	333	3.66%	13.06%	79.35%	19.60%
Niger	151	1.66%	29.31%	88.06%	37.30%
Poland	1,369	15.04%	13.85%	44.10%	15.40%
Slovenia	409	4.49%	3.40%	56.22%	9.64%
Togo	150	1.65%	36.40%	90.20%	35.30%
Zimbabwe	600	6.59%	63.80%	86.57%	10.82%
Total	9,101				

Appendix B. Breakdown of observations by firm age

Panel A: Firm size	Frequency	Percentage	Cumulative Percentage
Small (Fewer than 20 employees)	4,264	46.85	45.38%
Medium (20–99 employees)	2,926	32.15	77.86
Large (100+ employees)	1,911	21.00	100.00
Total	9,101	100%	
Panel B: Firm age			
10 years or more	7,297	80.17%	80.17%
5 years to 9 years	1,249	13.72%	93.89%
2–4 years	366	4.02%	97.91%
2 years or less	189	2.08%	100%
Total	9,101	100%	

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