Agribusiness resilience during the COVID-19 pandemic: The role of credit constraints

Ekın Ayşe Özşuca*

Department of International Trade and Finance, Faculty of Economics and Administrative Sciences, Çankaya University, Ankara, Türkyie

*Corresponding author: aozsuca@cankaya.edu.tr

Abstract: This paper investigates the effect of pre-COVID credit constraints and the moderating role of government support on agribusiness resilience following the outbreak of COVID-19. Using a dataset covering 42 countries, we provide empirical evidence on how firm characteristics and credit constraints affect agribusinesses' likelihood of survival and performance during the pandemic. On the enterprise level, size, foreign ownership and gender of the manager are found to display a statistically significant relationship with closure and sales performance. The findings reveal that pre-existing credit constraints tended to magnify the negative impacts of the pandemic. Specifically, agribusinesses with better access to finance were less likely to experience a decline in sales and exit from the market and, hence, were in a better position to withstand pandemic-induced shock. The results further highlighted the positive role of government support on agribusiness resilience, whereas obtaining government aid was found to have no significant effect on moderating the link between financial conditions and resilience. Finally, the results showed that financially constrained agribusinesses are more likely to suffer from liquidity/cash flow problems and experience overdue financial obligations during the pandemic. In coping with their liquidity shortfalls, these agribusinesses were less likely to access formal credit and more likely to delay payments to suppliers/workers.

Keywords: access to finance; crisis; firm performance; World Bank enterprise surveys

The COVID-19 pandemic, which emerged in late 2019 and quickly spread across the world, triggered an unparalleled global health disaster. Apart from its human toll, the pandemic significantly disrupted the world economy. As elaborated by Baldwin and Di Mauro (2020), the coronavirus-induced demand shocks and supply-side disruptions, coupled with supply chain contagion, were among the leading sources of the unfolding economic crisis. The pandemic hit many economies hard, affected and transformed numerous economic sectors, including agribusinesses, which play a crucial role in ensuring food production and distribution. Specifically, agribusiness firms have faced immense challenges, such as supply chain disruptions, higher market uncertainty and price volatility, labour shortages, and reduced access to international markets. One of the major obstacles they faced was the tightening of credit availability, which made it difficult for them to continue operations, buy necessary inputs, and adjust to the rapidly changing market conditions.

An emerging body of literature documents that many enterprises faced a severe liquidity crunch and experienced financial distress during the pandemic (Acharya and Steffen 2020; De Vito and Gomez 2020; Brucal et al. 2021; Demmou et al. 2021; Ebeke et al. 2021; Mirza et al. 2023). At the beginning of the economic disruption, the combined shock of supply and demand caused a sudden and sharp decline in firm revenues, as well as falling cash flows and depleted working capital (Didier et al. 2021). At the same time, the ability to tap external finance had become rather restricted amid high uncertainty. Taken together, these factors caused firms to face acute liquidity shortfalls during the extraordinary shock of COVID-19, while agribusinesses were no exception.

In particular, restrictions on movement, closure of borders, and reduced labour availability posed significant challenges for agribusinesses, leading to disruptions at every stage of the agricultural supply chain, such as processing facilities, distribution networks, and retail operations (FAO 2020). Delays in payments and uncertainty in pricing were brought on by supply chain problems, which also impacted the flow of agricultural products. Due to these interruptions, lenders faced higher credit risks, which resulted in tighter lending standards and less financing availability for agribusinesses (Koloma and Kemeze 2022). The cash flow of agribusinesses was further affected by the drop in consumer demand for specific agricultural products, such as high-value perishables (i.e. seafood, meat, dairy products) as a result of lockdowns, decreased restaurant and hospitality activities, and shifting consumption patterns (Oman et al. 2022). These, in turn, impact their creditworthiness and access to finance. Last but not least, financial institutions became more cautious in an environment of drastic uncertainty and increased market volatility stemming from the unprecedented nature of the pandemic (Amin and Viganola 2023). Subsequently, they are less likely to extend credit to agribusinesses due to concerns regarding repayment capabilities and future market conditions. Given their higher reliance on bank financing or commercial lending, agribusinesses tend to have a lower capacity to absorb liquidity shocks and their financial situation may be further adversely affected in the wake of the economic downturn induced by COVID-19 (FAO 2020).

These abovementioned factors contributing to credit constraints during the COVID-19 pandemic are likely to be more pronounced for agribusinesses with pre-existing credit constraints. The European Investment Bank (2022) pointed out that access to financial resources may even play a double role in times of crisis, such as the coronavirus pandemic, and that pre-established financial lifelines provided by banks acted as an effective insurance tool, enhancing business resilience amidst COVID-19. Credit-constrained agribusinesses, in this respect, are expected to be more vulnerable in acute periods of stress. Against this background, this study aims to examine the impact of pre-COVID credit constraints on the ability of agribusinesses to withstand the pandemic shock. In other words, it attempts to test whether credit-constrained enterprises have lower survival and resilience than others.

Utilising the COVID-19 follow-up enterprise surveys dataset from the World Bank, this paper investigates how financing constraints and firm characteristics impact the severity of the COVID-19 pandemic on the resilience of agribusinesses in 42 countries. To this end, the following three research questions are attempted to be answered: first, whether agribusinesses with different structural characteristics were affected disproportionately by the economic shock resulting from COVID-19; second, how agribusinesses' pre-COVID financial situation impacted their survival and performance during the pandemic, and third, how obtaining government support would affect the financing constraints-survival and financing constraints-performance relationships.

This study endeavours to contribute to the limited but rapidly developing strand of literature regarding the economic impacts of the recent coronavirus pandemic in general and the firm-level financial and operational consequences of COVID-19 for agribusiness enterprises in particular. Prior research has examined the effects of the pandemic on enterprises in a variety of aspects, such as adjusting production or operations (Krammer 2022; Pereia and Saes 2022), employment (Webster et al. 2021; Khan 2023), productivity (Bloom et al. 2020), survival (Liu et al. 2021a; Muzi et al. 2023), performance (Olczyk and Kuc-Czarnecka 2021); financial constraints (Ling et al. 2021), and women-led business (Liu et al. 2021b; Torres et al. 2022). Apart from these papers, some studies (Chundakkadan et al. 2022; Khan 2022; Zhang and Sogn-Grundvag 2022; Amin and Viganola 2023) specifically focused on the effect of pre-pandemic credit constraints on different aspects of firm behaviour amid the COVID-19, and provide supportive evidence of a positive effect of access to finance on enterprise performance and resilience. For instance, Zhang and Song-Grundvag (2022) documented

the positive impact of credit constraints on the severity of COVID-19 effects for a sample of 17 countries with different development levels. Focusing on small and medium enterprises, Khan (2022) found that previous financing constraints amplified the impacts of the pandemic, affecting businesses' ability to withstand financial challenges. Similarly, Chundakkadan et al. (2022) analysed the impact of the pandemic-induced crisis on financially constrained small and medium-sized firms and evaluated the role of government support in their ability to cope with the pandemic. Using data from 35 countries, Amin and Viagnola (2023) showed that better access to finance is negatively associated with a drop in sales, and that the relationship is highly heterogeneous.

Notably, with respect to the effect of the pandemic on agribusinesses, the literature is rather scant and tends to involve individual country-level analysis. Among these studies, Hatab et al. (2021) examined the determinants of risk perception of small and medium-sized agri-food enterprises in Egypt, and found that a higher level of assets and longer periods of cash flow coverage served as a buffer against the effect of the pandemic. Höhler and Lansink (2021) investigated how profits and stock price volatilities of companies operating in the food value chain in the US, Japan, and Europe were affected by the pandemic and demonstrated that results are sub-sector specific. Chen and Yang (2021) estimated the translog revenue function for China using agricultural-listed companies to analyse the impact of the coronavirus pandemic on sales of agri-food products, and they found a more pronounced sales drop for large companies compared to smaller counterparts. Another study about China was done by Xu and Jin (2022), who reported no significant effect of the pandemic on financial performance and cash holdings of Chinese agri-food firms, whereas they found that ownership, leverage level and risk of the affected areas influence this relationship. Employing a mixed-method approach, Bargoni et al. (2022) explored the competitive strategies adopted by Italian agri-food companies in order to adapt to the challenges raised by the coronavirus disease. As one of the very few papers providing cross-country evidence, Ali et al. (2023) analysed the risks and supply chain resilience in small and medium-sized agri-food enterprises operating in Pakistan, Tanzania and Australia. Towards this end, the analysis revealed remarkable differences between developed and developing countries, while authors benchmark robust strategies adopted by some of the firms amid the pandemic.

Yet, despite this growing literature, much remains unknown about the economic consequences of the pandemic on agribusinesses and how financial conditions might have conceivably changed the ways they are affected. In this regard, to the best of our knowledge, the effect of access to finance on agricultural firm resilience in the context of the COVID-19-induced crisis has been fairly untouched in the extant literature. This study fills this gap by following a sector-based investigation of this relationship and, hence, taking into account the peculiarities of the agri-food industry. Last but not least, this paper elaborates on prior research (e.g. Ginder et al. 1985; Zouaghi and Sánchez 2016; Simonovska et al. 2017; Ragazou 2021) on the performance and survival of agribusinesses in times of crisis.

MATERIAL AND METHODS

The term agribusiness encompasses any business involved in the agricultural value chain, which may incorporate acquisition and input of raw materials, value addition, processing and marketing to intermediaries or final consumers (Devaux et al. 2018). In this study, the focus was limited to enterprises classified as agribusinesses in the World Bank Enterprise Survey (World Bank 2021) data. The International Standard Industrial Classification was used to identify food and agribusiness firms within the broader dataset of all firms. According to the World Bank's categorisation of agribusiness enterprises, these firms include food and beverage manufacturers and processors, producers of fertilisers and agrochemical products, wholesalers and retailers of food, beverages, and tobacco, as well as other agriculture-related firms such as those involved in textiles, leather, and wood products. The baseline agribusiness firm-level data obtained from the standard Enterprise Surveys was merged with the data gathered over the course of the pandemic, and accordingly, the final sample corresponded to 2 239 agribusiness companies from 42 countries. Pandemic-related variables were gathered from the first round of COVID-19 follow-up surveys in order to cover as many countries as possible for the econometric analysis.

A probit model was estimated to investigate the effect of previous credit constraints on agribusiness survival and performance during the pandemic and the impact of government support on this relationship. The following model specification was used in the empirical analysis:

$$y = \alpha + \beta_1 creditconstraint + \beta_2 governmentsupport +$$
$$+ \beta_3 creditconstraint \times governmentsupport +$$
$$+ \beta_4 firmcontrols + \beta_5 macrocontrols + \qquad (1)$$
$$+ country\ dummies + \varepsilon$$

As the dependent variables of interest, binary indicators for firm survival and performance were used in the analysis. Firm survival (*CLOSURE*) was a dummy variable which takes the value 1 for agribusinesses that had permanently ceased or temporarily suspended operation, 0 otherwise. Firm performance was captured by the dummy variable (*SALES*) which equals 1 for agribusinesses that had experienced a sales decline relative to the same month in the previous year.

As the primary concern of the paper is to explore the relationship between financing constraints and firm survival in the context of agribusinesses, the choice of credit constraint measures was of particular importance. Noticeably, empirical outcomes may vary depending on the selected credit indicators, as suggested by Hansen and Rand (2014). Accordingly, in line with the existing empirical literature, two alternative credit constraint measures were constructed and employed in the empirical analysis. First was a perception-based subjective credit measure (Beck and Demirgüç-Kunt 2006; Asiedu et al. 2013; Hansen and Rand 2014). A dummy variable (*PERCEPT*) was created, equaling 1 for agribusinesses that reported that access to finance was either a 'moderate', 'major' or 'a very severe' obstacle, and 0 otherwise. The second measure for agribusiness financial status was computed following the methodology adopted by Kuntchev et al. (2013). This method considers whether the business applied for credit and the reasons for not applying for formal credit in order to account for the possibility that not all establishments may have credit demand. Accordingly, three categories of agribusiness firms were constructed: fully constrained, partially constrained, and unconstrained.

i) An agribusiness was treated as being fully credit-constrained if it had no source of external financing, applied for credit and was denied, or was discouraged from applying for a loan due to terms and conditions, such as complex application procedures, high collateral requirements *etc*.

ii) An agribusiness was treated as being partially credit-constrained if it had obtained external finance and did not apply for formal credit due to unfavourable terms and conditions, or applied for a loan and was rejected.

iii) An agribusiness was treated as being unconstrained if it had sufficient capital and did not apply for

a loan from financial institutions, or applied for a credit and that application was approved.

Towards this end, a dummy variable (*FIN_CONS*) was defined and coded as 1 for fully and partially credit-constrained firms and 0 for unconstrained counterparts.

Governments all across the world introduced support mechanisms and policy interventions to assist enterprises throughout the pandemic. Towards this end, measures included financial aid, subsidies, loan moratoria, and regulatory changes to promote more efficient operations. In order to explore the effect of access to government support on agribusiness performance, a dummy variable (*SUPP*) was created, equaling 1 for agribusinesses that had received government aid since the outbreak of the coronavirus and 0 otherwise. The coefficient of interaction between credit constraints and government support was further incorporated into the empirical specification to elucidate whether government support positively moderated the link between financial constraints and firm resilience.

A set of enterprise-specific characteristics that are likely to have an effect on the resilience of agribusinesses were incorporated into the empirical model. Specifically, these were firm age (*AGE*); size (*SME*); exporter status (*EXPORT*); ownership structure as state (*STATE*), foreign (*FOREIGN*) and family *(FAMILY)*; legal status (*SOLE*); female manager (*FEMALE*); top manager's years of work experience (*EXPER*), and firm location (*MAIN_C*). Small and medium enterprises have limited access to technology, human and financing resources, hold lower cash buffers or maintain less diversified revenue streams, which may alleviate their ability to sustain operations and adapt to changing circumstances in times of crisis. They may also face challenges to weather disruptions since they cannot experience benefits arising from economies of scale and have smaller market power when compared to their larger counterparts. Having less diversified business portfolios increases their exposure to risks and decreases overall resilience. In this respect, smaller firms are expected to be more vulnerable during COVID-19 (Bartik et al. 2020; Shafi et al. 2020; Gourinchas et al. 2020). Similarly, firm age is likely to influence firm survival and performance in the pandemic era (Haneberg 2021; Fernandez-Cerezo et al. 2022). Older firms have built up more financial reserves over time and have better access to credit as well as other forms of external finance, which may provide a buffer against the negative impacts of the pandemic-induced economic downturn. Moreover, mature firms with more experience, market dominance, established customer base and

networks may have an advantage in maintaining sales and navigating the challenges posed by COVID-19 more effectively. As put forward by Wagner (2024), exporting is positively related to firm survival during the pandemic. In particular, exporters have access to international markets and often enjoy diversified revenue streams, which may enable them to offset the declines in domestic sales and mitigate the effect of localised disruptions in specific regions, enhancing overall resilience in turbulent times. Prior studies (Perwitasari et al. 2022; Jordaan 2023; Liu et al. 2023; Muzi et al. 2023; Miroshnychenko et al. 2024) report that ownership type is another important feature that seems to affect the firm performance/resilience following the COVID-19 shock. State-owned enterprises may benefit from strategic prioritisation and long-term stability, which may contribute to greater resilience in times of crisis. Obtaining direct financial support or bailouts from the government may further enhance their ability to withstand temporary revenue losses. In a similar vein, foreign-owned businesses are expected be less fragile as they are better positioned to withstand revenue shocks and manage liquidity constraints since they may tap into global capital markets to secure additional funding. They may navigate turbulent market conditions with their superior market knowledge and access to global networks, along with their ability to bring advanced technologies and innovations from their home countries. As their operations spread across multiple

countries and regions, their exposure to country-specific risks and market downturns is reduced to a great extent, making them more resilient to localised disruptions caused by COVID-19. Along these lines, family-owned firms are likely to ensure resilience in the face of uncertainty and disruption as they tend to have strong organisational culture and shared values, and follow more conservative financial practices with lower levels of debt. Moreover, they are more agile and adaptable to changing market conditions than their larger bureaucratic counterparts. The legal status of the firm is another determinant of survival. Accordingly, sole proprietorships may benefit from greater flexibility and agility in decision-making but may face additional challenges related to limited financial resources and access to capital in times of crisis. Also, the gender of the firm owner/manager is known to be correlated with firm performance and survival (Liu et al. 2021b; Birhanu et al. 2022; Wagner 2022; Gomez et al. 2024). It is often argued that women face major financial resource constraints. On the contrary, women tend to be more risk averse and have advanced skills in contingency planning, which may strengthen female-led firm's ability to weather the storm of the pandemic. As documented by some previous studies (Fang et al. 2022; Kumar and Zbib 2022), the experience of the top manager plays a crucial role in business resilience in difficult times such as COVID-19, by contributing their developed skills in crisis management, effective leadership and

Table 1. Summary of descriptive statistics

Variable	Description	Observations	Frequency	Mean
CLOSUR	1 if it is permanently or temporarily closed, 0 otherwise	1 644	8.45	–
SALES	1 if it experienced a reduction in sales, 0 otherwise	1 514	60.63	–
AGE	Age in years (2021-founding year)	2 239	–	22.7946
SME	1 if it is a small or medium-sized, 0 otherwise	2 239	68.91	–
EXPORT	1 if share of exports are 10% or more of total sales, 0 otherwise	2 239	31.97	–
FAMILY	1 if it has at least 50% of family ownership, 0 otherwise	2 239	55.56	–
FOREIGN	1 if it has at least 10% of foreigner ownership, 0 otherwise	2 239	14.82	–
STATE	1 if it has at least 10% of state ownership, 0 otherwise	2 239	1.56	–
SOLE	1 if it is solely owned, 0 otherwise	2 239	17.37	–
FEMALE	1 if top manager is female, 0 otherwise	2 239	31.88	–
EXPER	top manager's years of experience in working for this industry	2 239	–	20.3940
MAIN_C	1 if it is located in a capital city, 0 otherwise	2 239	17.59	–
PERCEPT	1 if it perceived credit as a severe obstacle, 0 otherwise	2 239	42.11	–
FIN_CONS	1 if it is credit constrained, 0 otherwise	2 239	20.58	–
SUPP	1 if it received government support, 0 otherwise	1 514	22.98	–

Source: Author's own elaboration based on the World Bank's Enterprise Surveys – COVID-19 Survey (World Bank 2021)

communication. Their knowledge of market dynamics and established network of contacts within the industry enhance the ability of the firm to navigate the challenges posed by the pandemic. Evidently, the location of the firm is related to lockdowns, COVID-19 cases, and, ultimately, how severe the COVID-19 impact is.

The country-level macroeconomic control variables comprised GDP *per capita* (*GDPPC*) as a measure of the country's economic development, and the government COVID policy stringency index (*STRINGENCY*) as an indicator of the severity of mobility restrictions and business'/individual's activities. Detailed descriptions and summary statistics of the variables are reported in Table 1.

The simultaneity and reverse causality were highly implausible in our empirical analysis since the financial condition and firm-level characteristics were extracted from data in the pre-pandemic period, i.e. one-period lagged, which is relatively exogenous to the COVID-19 outbreak. Besides, the dependent variables can be regarded as direct results of this exogenous unanticipated shock of the pandemic. Hence, it could be inferred that the endogeneity issue is not much of a concern. In order to control for the omitted variable bias, ten agribusiness enterprise-level control variables and country-fixed effects were incorporated in the regressions. Empirical analyses were done with STATA version 15.

RESULTS AND DISCUSSION

Baseline results. The estimation results regarding business closure and sales decline are provided in Tables 2 and 3, respectively. The empirical specification (I) includes firm-level characteristics as explanatory variables, while specifications (II) and (IV) introduce alternative credit measures, namely *FIN_CONS* and *PERCEPT*, respectively. Accordingly, specifications (III) and (V) present the estimation results of the models augmented with the interaction term between government support and credit constraints.

As revealed in column (I) of Table 2, size, foreign ownership, legal status, location and female manager were positively and significantly related to firm closure. The result regarding *SME* suggests that small and medium-sized agribusinesses were subject to a lower probability of survival. Small firms may experience cash flow shortages since they hold low levels of cash buffer and limited access to external funding. Moreover, as indicated by Reardon et al. (2021), small and medium-sized organisations in agri-food supply chain usually have a higher reliance on labour-intensive operations than

larger counterparts. Being more dependent on customers and markets, they are more likely to run into deteriorating sales. These factors, combined with limited human and technological resources, may decrease smaller agribusinesses' ability to cope with the consequences of the pandemic. This finding is in line with Gourinchas et al. (2020) and Fairlie et al. (2023), which provided evidence in favour of the vulnerability of small and medium-sized firms during the pandemic crisis.

The positively significant coefficient of *FOREIGN* further indicates that foreign-owned agribusinesses had a higher likelihood of closure, which was rather unexpected because these enterprises were expected to be in a more advantageous position in ensuring adequate financing as they often use international connections and have access to multiple sources of external funding, which may foster their resiliency in times of crisis. Our result, however, could be attributed to the global nature of the shock, which caused significant interruptions in external connections. As foreign-owned agribusinesses tend to be interconnected with international markets, they have higher exposure to the negative effects of pandemic-induced disruptions on a wider scale, at different times and in multiple countries (Waldkirch 2021). Therefore, they are more disproportionately affected by COVID-19 than their counterparts. This result is consistent with Liu et al. (2021a), while in contrast with Fang et al. (2022).

Regarding the other explanatory variables, the likelihood of an agribusiness being closed was found to be higher if it operated in a larger agglomerate, which is in line with the findings of Gopalan and Reedy (2023).

With regard to ownership variables, *SOLE* loaded positively on firm closure, which suggests that being a company increased the probability of survival for agribusinesses during the pandemic. Put differently, sole proprietor agribusinesses were less likely to be more resilient than their counterparts. This is a corollary to the findings of Islam and Fatema (2023).

Among other firm-level characteristics, a positive and significant coefficient of *FEMALE* suggested that female-managed agribusinesses had a lower likelihood of survival during the pandemic. This result is in line with the disproportionate gendered impact of the pandemic documented by Liu et al. (2021b) and Torres et al. (2022). Although there are studies indicating that female-led enterprises are more successful in times of crises, such as COVID-19, since women tend to be more risk-averse than men, some other studies pointed out that women-led firms are more likely to be financially constrained (Murayyev et al. 2009) and ex-

Table 2. Estimation results: *CLOSURE* (dummy variable for agribusiness survival)

Variables	(I)	(II)	(III)	(IV)	(V)
AGE	0.0001 (0.0003)	0.0001 (0.0003)	0.0002 (0.0001)	0.0001 (0.0002)	0.0002 (0.0001)
SME	0.0835*** (0.0179)	0.0806*** (0.0178)	0.0835*** (0.0024)	0.0836*** (0.0179)	0.0742* (0.0093)
EXPORT	−0.0145 (0.0162)	−0.0138 (0.0160)	−0.0338 (0.0275)	−0.0145 (0.0162)	−0.0487 (0.0146)
FAMILY	0.0158 (0.0177)	0.0156 (0.0176)	0.0192 (0.0111)	0.0158 (0.0177)	0.0120 (0.0172)
FOREIGN	0.0399* (0.0197)	0.0395** (0.0195)	0.03134** (0.0153)	0.0398** (0.0197)	0.0393** (0.0168)
STATE	−0.0008 (0.0742)	−0.0097 (0.0751)	−0.0007 (0.0281)	−0.0009 (0.0742)	−0.0004 (0.0426)
SOLE	0.0350* (0.0179)	0.0325* (0.0177)	0.0195* (0.0147)	0.0348* (0.0179)	0.0134* (0.0174)
MAIN_C	0.0433** (0.0179)	0.0414** (0.0177)	0.0357** (0.0124)	0.0438** (0.0179)	0.0531* (0.0155)
FEMALE	0.0248* (0.0147)	0.0257* (0.0146)	0.0417* (0.0138)	0.0248* (0.0147)	0.0262* (0.0176)
EXPER	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)
FIN_CONS	–	0.0374** (0.0149)	0.0363** (0.0136)	–	–
PERCEPT	–	–	–	0.0018 (0.0136)	0.0021 (0.0144)
SUPP	–	–	−0.0625*** (0.0384)	–	−0.0569* (0.0029)
FIN_CONS × SUPP	–	–	0.0002 (0.0017)	–	–
PERCEPT × SUPP	–	–	–	–	0.0073 (0.0036)
Macro controls	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes
No. of observations	1 484	1 484	1 484	1 484	1 484
Pseudo R^2	0.1001	0.1072	0.1076	0.1029	0.1016
Log likelihood	−412.2164	−462.1362	−498.7742	−452.2071	−497.9001

*, **, *** significance at the 10%, 5%, and 1% levels, respectively; robust standard errors are presented in parenthesis; *AGE* – age of the firm; *SME* – dummy variable for size; *EXPORT* – dummy variable for exporter status; *FAMILY* – dummy variable for family ownership; *FOREIGN* – dummy variable for foreign ownership; *STATE* – dummy variable for state ownership; *SOLE* – dummy variable for sole proprietorship; *MAIN_C* – dummy variable for location; *FEMALE* – dummy variable for female manager; *EXPER* – years of experience of the manager; *FIN_CONS* – dummy variable for credit constraints; *PERCEPT* – dummy variable for credit perception; *SUPP* – dummy variable for government support

Source: Author's own elaboration based on the World Bank's Enterprise Surveys – COVID-19 Survey (World Bank 2021)

hibit lower productivity and profitability, which may have decreased their accumulation of savings in the pre-pandemic period (Islam et al. 2020). As a result of these constraints, female-led firms may have experienced disproportionate deterioration in business performance and become more vulnerable in times of shocks than firms led by men. Indeed, it is reasonable to anticipate that female managers would have less time to dedicate to their jobs in the new demanding environment created by the pandemic. Particularly, stay-at-home orders and school/nursery closings altered the boundaries between work and home, put pressure on parents, and increased the amount of time spent on childcare and housework. Given cultural and social pressures and the conventional division of labour, where women are more involved in domestic duties than men, this strain is more noticeable in women working in rural settings, especially in the agricultural sector, than their male counterparts.

Table 3 reports the regression results for the pandemic-related decline in sales. The positive and statistically significant coefficient estimates of *SME* and *FEMALE* suggest that small and medium-sized and female-led agribusinesses tended to see a higher reduction in sales since the onset of the COVID-19 pandemic, which is in line with *a priori* expectations and estimations regarding closure.

Notably, the variable *EXPORT* turned out to be a significant factor in decreasing the likelihood of a decline in sales. Put differently, estimations revealed that agribusiness enterprises engaged in exporting were less likely to experience a decline in sales. This result is consistent with the study of Brucal et al. (2021), which documented the effects of the pandemic on South Asian firms. Given the chance of substituting sales between home and abroad, it is possible that this pandemic-induced unanticipated systemic shock affected the sales of exporting agribusinesses to a lesser extent compared

Table 3. Estimation results: *SALES* (dummy variable for agribusiness performance)

Variables	(I)	(II)	(III)	(IV)	(V)
AGE	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)
SME	0.1364*** (0.0307)	0.1312*** (0.0309)	0.1334*** (0.0308)	0.1357*** (0.0308)	0.1384*** (0.0309)
EXPORT	−0.0907*** (0.0307)	−0.0905*** (0.0307)	−0.0911*** (0.0308)	−0.0906*** (0.0307)	−0.0912*** (0.0307)
FAMILY	0.0620* (0.0347)	0.0647* (0.0348)	0.0684* (0.0349)	0.0625* (0.0348)	0.0659* (0.0349)
FOREIGN	−0.1038** (0.0408)	−0.1037** (0.0408)	−0.1023** (0.0409)	−0.1034** (0.0408)	−0.1016** (0.0409)
STATE	−0.2226* (0.1154)	−0.2253* (0.1152)	−0.2308** (0.1149)	−0.2224* (0.1154)	−0.2267* (0.1151)
SOLE	0.0313 (0.0416)	0.0275 (0.0416)	0.0244 (0.0417)	0.03256 (0.0417)	0.0299 (0.0418)
MAIN_C	0.0449 (0.0384)	0.0427 (0.0385)	0.0362 (0.0386)	0.0451 (0.0384)	0.0389 (0.0385)
FEMALE	0.0809*** (0.0299)	0.0816*** (0.0299)	0.0829*** (0.0300)	0.0813*** (0.0299)	0.0823*** (0.0674)
EXPER	0.0001 (0.0004)	0.0003 (0.0004)	0.0003 (0.0004)	0.0003 (0.0004)	0.0003 (0.0003)
FIN_CONS	–	0.0579* (0.0349)	0.0611* (0.0350)	–	–
PERCEPT	–	–	–	0.0098 (0.0280)	0.0107 (0.0013)
SUPP	–	–	0.0912** (0.0347)	–	0.0952** (0.0431)
FIN_CONS × *SUPP*	–	–	0.1220 (0.0923)	–	–
PERCEPT × *SUPP*	–	–	–	–	0.0155 (0.0653)
Macro controls	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes
No of observations	1 499	1 499	1 499	1 499	1 499
Pseudo R^2	0.1047	0.1049	0.1025	0.1024	0.1028
Log likelihood	−894.9026	−899.5214	−912.7836	−899.8417	−914.3386

*, **, *** significance at the 10%, 5%, and 1% levels, respectively; robust standard errors are presented in parenthesis; *AGE* – age of the firm; *SME* – dummy variable for size; *EXPORT* – dummy variable for exporter status; *FAMILY* – dummy variable for family ownership; *FOREIGN* – dummy variable for foreign ownership; *STATE* – dummy variable for state ownership; *SOLE* – dummy variable for sole proprietorship; *MAIN_C* – dummy variable for location; *FEMALE* – dummy variable for female manager; *EXPER* – years of experience of the manager; *FIN_CONS* – dummy variable for credit constraints; *PERCEPT* – dummy variable for credit perception; *SUPP* – dummy variable for government support

Source: Author's own elaboration based on the World Bank's Enterprise Surveys – COVID-19 Survey (World Bank 2021)

to their counterparts solely selling in local markets. Arguably, exporters are considered to be more productive, have access to high-end production techniques and reach a broader customer base; as a result, they are expected to sustain their sales in the course of COVID-19.

As the coefficient estimate *FOREIGN* suggests, foreign ownership exhibited a positive impact on sales performance during the pandemic. Some foreign-owned agribusinesses had more resilient and flexible supply chains and, accordingly, were better equipped to adapt to pandemic interruptions, which ensured a more consistent flow of goods and services compared to less prepared domestic counterparts. Moreover, as these businesses had a more diversified customer base and were more likely to be exporters, they may have experienced increased demand, or sales drop in one region may offset with gains in another, reducing the overall effect of the pandemic on their sales. When this result was evaluated with the result regarding closure, it seems

that foreign ownership acted to have helped in maintaining sales but overall, it has fallen short of providing a higher degree of resilience to the economic downturn.

Similarly, the positive coefficient attached to *FAMILY* indicates that the likelihood of a reduction in sales during the pandemic was significantly higher for family-led agribusinesses. This may be attributed to challenges related to limited financial resources, as these enterprises tended to have a lack of resources or limited access to external capital during times of crisis, which may have, in turn, impeded their ability to invest in innovation or adopt strategic efforts to increase or at least preserve their sales performance. Moreover, family agribusinesses' resistance to change may have posed an obstacle to navigating through the crisis in terms of performance. Our results regarding agribusinesses can be interpreted as contrary to Amore et al. (2022), who provided evidence in favour of the superior financial performance of family businesses during the pandemic.

As negatively significant coefficient estimate of *STATE* implies, government ownership was positively associated with sales resilience. State-owned agribusinesses might be better positioned to weather economic disruptions as they may utilise their organisational resources more favourably to maintain stable demand, supply and liquidity (Fang et al. 2022). Accordingly, they may facilitate sales in challenging times than their private counterparts.

As the core part of the analysis, the estimation results for model (II) in Tables 2 and 3 provide supportive evidence that agribusinesses with limited access to finance were likely to be more severely affected by the pandemic since the coefficient of *FIN_CONS* was positive and significant. The reasons may be threefold. First, credit restrictions may limit agribusiness firms' ability to maintain sufficient working capital, which may interfere with their regular business operations, the acquisition of inputs, and the management of cash flow gaps. As a result, they were unable to cover their operating costs, and agricultural product production and distribution were hampered. These findings are backed up by the theoretical models of capital market imperfections (e.g. Fazzari et al. 1987; Hubbard 1998), which posit that external finance is more costly than internal finance, and this premium on external finance has an inverse relationship with net worth of the borrower. To this end, credit-constrained firms were more vulnerable because of their reliance on external finance to cover operational costs and investments. Second, agribusiness firms with limited access to funding may find it challenging to invest in advanced technologies and infrastructure improvements, and to engage in innovative practices. Theoretical research (e.g. Hottenrott and Peters 2012; Gorodnichenko and Schnitzer 2013; Roche et al. 2022) has put forward that limited access to finance restrains the ability of firms to invest in R&D and innovative technologies. As argued by Giebel and Kraft (2024), financial constraints significantly impair R&D spending to a greater extent in times of crisis. This may hinder their ability to increase productivity and efficiency, which, in turn, hampers their resilience in times of crisis. Third, credit constraints exacerbated the vulnerability of agribusiness enterprises, especially small and medium-sized ones, which often lacked alternative sources of funding (Petersen and Rajan 1994; Beck et al. 2005; Beck and Demirgüç-Kunt 2006). Their limited financial resilience made them more susceptible to shocks, reducing their ability to recover from the pandemic's impacts. As asserted by FAO (2020), small and medium agri-food enterprises remained financially vulnerable during the pandemic as liquidity-enhancing measures were often inaccessible to them, particularly in countries where commercial banks had difficulty serving this segment even before the crisis.

The findings coincide with firm-level studies of Khan (2022), Zhang and Sogn-Grundvag (2022), and Amin and Viganola (2023). Notably, as shown in model (IV), the coefficient estimate of *PERCEPT* did not demonstrate a significant relationship with both dependent variables. That is, perceived financing constraints were not associated with closure or sales decline during the economic disruption caused by the pandemic. In our analysis, directly observed measures of financial constraints were found to be significantly important for agribusiness survival and performance, whereas self-reported obstacles that agribusinesses faced when trying to access finance failed to be a significant determinant of firm resilience during the pandemic. It is not surprising to obtain dissimilar estimated coefficients regarding perception-based and objective-based credit measures since they measured different constraints and hence, did not necessarily yield same findings, as put forward by Hansen and Rand (2014).

Columns (III) and (V) of Tables 2 and 3 report the results of government support on survival and sales performance, respectively. As indicated by the negative coefficient of *SUPP* in Table 2, agribusinesses that received government support were more likely to survive, which backs up earlier results of Cirera et al. (2021) and Albagli et al. (2023). This finding suggests that receiving any form of government support may act as a source of additional liquidity and thus help agribusiness to minimise the negative consequences of the pandemic and grow them more resilient against the crisis. In contrast, the coefficient associated with the *SUPP* variable reported in Table 3 positively affected the drop in agribusiness sales, which is in line with Olczyk and Kuc-Czarnecka (2021). Given the result regarding survival, this finding was rather surprising. Taken together, receiving any form of public assistance exerts a significant positive impact on agribusiness survival, whereas it does not tend to effectively result in avoiding declines in sales. Hence, although government aid importantly eases cash flow difficulties encountered by agribusinesses and enables them to navigate through the crisis, it does not significantly help these firms to maintain their sales during COVID-19. The likely reason for this interesting finding is the fact that government support measures were directed at a greater extent towards agribusinesses that were reported dwindling sales in the pre-pandemic period,

a point put forward by Olczyk and Kuc-Czarnecka (2021). Besides, this may also be taken as an indication of better targeting of the agribusinesses whose sales performance is affected the most by the pandemic. It should be noted that governments have utilised many different measures in various forms to address the specific needs of enterprises, particularly aiming to provide emergency liquidity assistance during this turbulent time. Yet, a more detailed analysis, which takes into account the individual types of assistance programs issued by the government and undertaken by agribusinesses in response to the crisis, should be carried out in order to provide further support for these arguments. Lastly, government support turned out to have no effect on moderating the relationship between firm resilience and financial condition, as evidenced by insignificant coefficients for the interaction terms in models (III) and (V).

Further estimations and robustness checks. So far, the relationship between previous financing obstacles and agribusiness resilience in the face of COVID-19 shock has been inspected. In the following part, the analysis is further extended to focus on the impact of credit constraints on agribusinesses' financial and credit risk in the spirit of Khan (2022). Towards this end, two dummy variables were created for the analysis. As a proxy for financial risk, *LIQUIDITY,* was used, equaling 1 for agribusinesses that experienced a reduction in liquidity or cash flow during the pandemic, and 0 otherwise. As an indicator of credit risk, *OVERDUE,* was employed, taking value 1 for agribusinesses that had been overdue in their obligations to financial institutions, and 0 for those who had not. Moreover, additional estimations were carried out to elucidate credit-constrained agribusinesses' likely use of alternative sources of external finance in managing their liquidity and cash flow problems. Accordingly, four dummy variables were constructed indicating each source of financing to cope with liquidity shortfalls, specifically *LOAN* for loans from banks or non-bank financial institutions; *EQUITY* for equity finance; *DELAY* for delaying payments to workers and suppliers; *GRANT* for government grants. The estimation results are reported in Table 4, where the dependent variables employed in each specification are presented at the top of each column. As the coefficients of perception-based credit measure lack statistical significance in previous estimations, only objective credit measure was deployed in this part of the analysis.

As can be seen in columns (I) and (II) of Table 4, financial constraints in the pre-COVID-19 period

tended to magnify pandemic-induced liquidity shortfalls and credit risks. In other words, constrained agribusinesses were more likely to suffer from liquidity/cash flow problems and experience overdue financial obligations. Therefore, along the expected lines, prior financing constraints exacerbated the post-pandemic financial fragility of agribusinesses. Furthermore, the negatively significant coefficient of *FIN_CONS* in model (III) indicates that agribusinesses with financial constraints in the pre-pandemic period were less likely to access loans from banks or non-bank financial institutions during the pandemic-induced crisis than their unconstrained counterparts. This finding supports the evidence documented by Hasan et al. (2021) that financially constrained firms face higher borrowing costs in bank financing during turbulent times of the pandemic. Regarding the alternative sources of financing, the coefficient attached to financial constraints turned out to be statistically significant, with a positive sign only for specification (V). This implies that credit constrained agribusiness enterprises were more likely to delay payments to suppliers and workers to cope with pandemic-induced liquidity shocks. Notably, the *FIN_CONS* variable in models (IV) and (VI) lacked statistical significance. Taken together, evidence appears to be partly, not fully, in line with the hypothesis that firms tend to substitute for alternative financing instruments in times of bank credit supply shocks during economic downturns. Moreover, once delayed payments to suppliers were considered to be a form of trade credit, as pointed out by Khan (2022), the empirical findings further corroborated previous evidence that enterprises tend to resort to trade credit when they were subject to bank-lending constraints (Nilsen 2002; Carbo-Valverde et al. 2016).

While not reported for presentational brevity, several estimations were conducted for robustness purposes. Towards this end, separate regressions were estimated for a sample of countries with second and third survey rounds to compare results across different stages of the pandemic. As different rounds of COVID-19 follow-up surveys covered data for a different number of countries, the number of observations varied across these specifications, but the outcomes have not altered substantially. To be more specific, some estimation coefficients have slightly changed in terms of magnitude, but there were no differences with regard to their significance and sign.

Another check for robustness and endogeneity was to employ an instrumental variable probit model where country averages were utilised to instrument credit

Table 4. Estimation results: Alternative sources of finance and dependent variables

Variables	(I) LIQUIDITY	(II) OVERDUE	(III) LOAN	(IV) EQUITY	(V) DELAY	(VI) GRANT
AGE	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	–0.0006 (0.0005)	–0.0003 (0.0001)
SME	0.2159*** (0.0320)	0.0284 (0.0195)	–0.0547* (0.0278)	–0.1294*** (0.0281)	–0.0775*** (0.0182)	–0.0949*** (0.0161)
EXPORT	–0.0760** (0.0318)	–0.0208 (0.0191)	–0.0155 (0.0319)	–0.0420 (0.0350)	–0.0513** (0.0215)	–0.0231 (0.0156)
FAMILY	0.0373 (0.0360)	–0.0475** (0.0220)	–0.1189*** (0.0307)	0.0047 (0.0319)	–0.0120 (0.0192)	–0.0282* (0.0148)
FOREIGN	–0.0244 (0.0422)	–0.0880*** (0.0277)	–0.0829* (0.0448)	–0.0896* (0.0480)	0.0172 (0.0245)	–0.0961*** (0.0289)
STATE	–0.0698 (0.1107)	–0.0039 (0.0681)	–0.2791 (0.1713)	–0.2222 (0.1617)	–0.0166 (0.0717)	–0.0112 (0.0522)
SOLE	0.0640 (0.0431)	0.0058 (0.0231)	–0.0166 (0.0376)	–0.1775*** (0.0447)	–0.0774** (0.0266)	0.0282* (0.0161)
MAIN_C	0.0837** (0.0397)	–0.0363 (0.0246)	–0.0846** (0.0352)	–0.0279 (0.0381)	–0.0501** (0.0223)	–0.0698*** (0.0205)
FEMALE	0.0974*** (0.0306)	0.0058 (0.0184)	–0.0901*** (0.0303)	–0.0530 (0.0332)	0.0501** (0.0199)	–0.0080 (0.0137)
EXPER	0.0002 (0.0003)	0.0001 (0.0004)	–0.0015 (0.0010)	0.0003 (0.0002)	–0.0031 (0.0008)	–0.0014 (0.0004)
FIN_CONS	0.0653* (0.0360)	0.0367** (0.0201)	–0.0434* (0.0349)	–0.0239 (0.0387)	0.0339* (0.0202)	–0.0180 (0.0171)
Macro controls	yes	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes	yes
No of observations	1 496	1 421	852	852	852	842
Pseudo R^2	0.1087	0.1043	0.1015	0.1028	0.1024	0.1011
Log likelihood	–987.0878	–479.3335	– 448.5030	–515.0395	–293.9113	–204.1686

*, **, *** significance at the 10%, 5%, and 1% levels, respectively; robust standard errors are presented in parenthesis; *AGE* – age of the firm; *SME* – dummy variable for size; *EXPORT* – dummy variable for exporter status; *FAMILY* – dummy variable for family ownership; *FOREIGN* – dummy variable for foreign ownership; *STATE* – dummy variable for state ownership; *SOLE* – dummy variable for sole proprietorship; *MAIN_C* – dummy variable for location; *FEMALE* – dummy variable for female manager; *EXPER* – years of experience of the manager; *FIN_CONS* – dummy variable for credit constraints; *PERCEPT* – dummy variable for credit perception; *SUPP* – dummy variable for government support
Source: Author's own elaboration based on the World Bank's Enterprise Surveys – COVID-19 Survey (World Bank 2021)

constraint indicators and the values of the Wald test demonstrated that exogeneity could not be statistically rejected. To further address the endogeneity issue, an alternative estimation technique proposed by Lewbel (2012) was utilised, where no external instrument is needed, but exogenous variables in the model are used to create instruments. To this end, following Chundakkadan et al. (2022), all agribusiness-level exogenous variables and country dummies were employed to construct the instruments. The results were consist-

ent with the baseline, further strengthening the findings. Continuing with robustness and accounting for simultaneity bias, a bivariate probit model (i.e. one probit model for agribusiness closure and the other probit model for credit constraints) was estimated. Following Zhang and Sogn-Grundvag (2022), a dummy variable that proxies for informal competition in the market was deployed as an instrumental variable in the credit constraints probit model. The last set of robustness checks focused on an alternative measure of credit constraints,

which was a dummy variable coded as 1 if the agribusiness was not currently making use of formal credit, and 0 otherwise (Hansen and Rand 2014). Overall, the findings corroborated initial estimation results, indicating the robustness of the baseline findings.

CONCLUSION

The empirical analysis in this study offers valuable information for designing policy to support the agribusiness sector during times of economic uncertainty and crisis. At the outset, it provided evidence for the disproportionate impact of the pandemic on agribusinesses with different characteristics, which may serve to detect the most vulnerable ones. In light of these findings, governments and policymakers should consider a range of measures tailored to the unique characteristics and specific needs of the sector in general, and agribusiness enterprises in particular. At the firm level, the findings clearly supported the fact that small and medium-sized agribusinesses were significantly disadvantaged in terms of survival and sales. Evidently, policy response should first address the issue of providing support for their resilience and growth. Towards this end, policies may include investing in training programs to empower smaller agribusinesses with knowledge and skills for sustainable business operations, strengthening extension services to provide information on best practices and market trends, developing and promoting risk management tools to safeguard against unexpected shocks and disruptions, and establishing microfinance programs to facilitate access to small loans with reasonable interest rates. Expanding in international markets, which turns out to be positively related to sales performance, may induce agribusinesses to diversify their customer base and reduce their dependence on domestic markets. In this regard, policymakers may facilitate market access by reducing trade barriers and streamlining export/import processes. Another key factor determining the fate of the agribusinesses was the gender of the top manager. Accordingly, policy efforts should aim at promoting an equal share of household responsibilities, supporting work-life balance policies, mitigating the possible gender bias in equity and debt financing, and providing access to credit for women-led agribusinesses.

A salient contribution of the results is the supportive evidence of the effect of prior financial constraints on agribusiness resilience. In this regard, an effective policy might comprise, but should not be limited to, ensuring access to finance for credit-constrained firms

through several policy measures. More specifically, these may include implementing targeted financial assistance programs, like grants, subsidies, or low-interest credits, to assist agribusinesses in covering their operating costs, managing debt, and maintaining liquidity during economic downturns; introducing credit guarantee schemes to encourage financial institutions to extend credit to agribusinesses with minimal collateral; carrying out alternatives to traditional collateral requirements, such as warehouse receipt systems, or co-signing arrangements to make it easier for agribusinesses with limited assets to assure financing; developing agricultural insurance programs and risk management tools to safeguard against unanticipated shocks, like pandemics; establishing credit information systems; providing tax incentives or breaks (e.g. tax credits, deferrals, or exemptions) to support cash flow and alleviate the financial burden during challenging times for agribusinesses. Moreover, policymakers may encourage financial institutions to develop specialised financial products according to the specific needs of agribusinesses, like flexible repayment schedules or seasonal financing options, and make agribusiness lending more attractive for financial institutions by offering financial subsidies or incentives to those engaged in agribusiness financing. To further contribute to a more conducive environment of financing, government agencies, private sector stakeholders and financial intermediaries may form collaborations through joint initiatives or public-private partnerships. Efforts on the part of the government may include improving rural infrastructure to decrease the perceived risks associated with agribusiness investments and streamlining regulations, such as reducing bureaucratic hurdles, which may create and contribute to an enabling environment for agribusiness financing. Another significant effort might involve investing in capacity-building programs and financial literacy initiatives for agribusiness owners, which may foster their knowledge of financial management, and, accordingly, improve their ability to access and manage credit effectively.

Possible avenues for future research may include a deeper and detailed investigation of the aftermath of the pandemic in several ways. As put forward by Höhler and Lansink (2021), companies in different agri-food sub-sectors (e.g. food retailers versus distributors) have been affected by and susceptible to COVID-19-induced shock in opposite ways; in this respect, a differentiated sub-sectoral breakdown of analysis would be highly valuable for further research. Additional potential for future empirical investigations re-

sults from the binary nature of the dependent variables and the time limit of the data sets used in the analysis. To this end, when it becomes available at a later date, conducting a longitudinal analysis by deploying longer-term data and using more precise indicators (e.g. the number of employees who lost their jobs) would provide a more comprehensive diagnosis of long-term consequences of the shock on agribusinesses.

REFERENCES

Acharya V.V., Steffen S. (2020): The risk of being a fallen angel and the corporate dash for cash in the midst of COVID. The Review of Corporate Finance Studies, 9: 430–471.

Albagli E., Fernandez A., Guerra-Salas J., Huneeus F., Munoz P. (2023): Anatomy of firms' margins of adjustment: Evidence from the COVID pandemic. Working Papers Central Bank of Chile 981, Central Bank of Chile. Available at https://www.bcentral.cl/en/content/-/details/working-papers-n-981 (accessed July 25, 2022).

Ali I., Sadiddin A., Cattaneo A. (2023): Risk and resilience in agri-food supply chain SMEs in the pandemic era: A cross-country study. International Journal of Logistics Research and Applications, 26: 1602–1620.

Amin M., Viganola D. (2023): Does better access to finance help firms deal with the COVID-19 pandemic? Evidence from firm-level survey data. Journal of International Development, 35: 2578–2608.

Amore M.D., Pelucco V., Quarato F. (2022): Family ownership during the Covid-19 pandemic. Journal of Banking and Finance, 135: 106385.

Asiedu E., Kalonda-Kanyama I., Ndikumana L., Nti-Addae A. (2013): Access to credit by firms in sub-Saharan Africa: How relevant is gender. American Economic Review, 103: 293–297.

Baldwin, R., Di Mauro, B. W. (2020): Economics in the time of COVID-19: A new eBook. Available at https://cepr.org/voxeu/columns/economics-time-covid-19-new-ebook (accessed Jan 2, 2023)

Bargoni A., Bertoldi B., Giachino C., Santoro G. (2022): Competitive strategies in the agri-food industry in Italy during the COVID-19 pandemic: An application of K-means cluster analysis. British Food Journal, 124: 4782–4799.

Bartik, A.W., Bertrand M., Cullen Z.B., Glaeser E.L., Luca M., Stanton C.T. (2020): How Are Small Businesses Adjusting to COVID-19? Early Evidence from a Survey. NBER Working Paper w26989. Cambridge, National Bureau of Economic Research: 36.

Beck T., Demirgüç-Kunt A. (2006): Small and medium-size enterprises: Access to finance as a growth constraint. Journal of Banking and Finance, 30: 2931–2943.

Beck T., Demirgüç-Kunt A., Maksimovic V. (2005): Financial and legal constraints to firm growth: Does firm size matter? The Journal of Finance, 60: 137–177.

Birhanu A.G., Getachew Y.S., Lashitew A.A. (2022): Gender differences in enterprise performance during the COVID-19 crisis: do public policy responses matter? Enterprenurship Theory Practice, 46: 1374–1401.

Bloom N., Bunn P., Mizen P., Smietanka P., Thwaites G. (2020): The Impact of Covid-19 on Productivity. NBER Working Papers w28233. Available at https://ssrn.com/abstract=3753143 (accessed July 25, 2022).

Brucal A., Ilagan Z., Grover A., Ortega S.R. (2021): Damaged by the Disaster: The Impact of COVID-19 on Firms in South Asia. Policy Research Working Paper 9604. Available at http://hdl.handle.net/10986/35357 (accessed July 25, 2022).

Carbo-Valverde S., Rodriguez-Fernandez F., Udell G.F. (2016): Trade credit, the financial crisis, and SME access to finance. Journal of Money, Credit and Banking, 48: 113–143.

Chen J., Yang C.C. (2021): How COVID-19 affects agricultural food sales: Based on the perspective of China's agricultural listed companies' financial statements. Agriculture, 11: 1285.

Chundakkadan R., Natarajan R.R., Sasidharan S. (2022): Small firms amidst COVID-19: Financial constraints and role of government support. Economic Notes, 51: e12206.

Cirera X., Cruz M., Davies E., Grover A., Iacovone L., Lopez Cordova J.E., Medvedev D., Maduko F.O., Nayyar G., Ortega S.R., Torres J. (2021): Policies to support businesses through the COVID-19 shock: A firm-level perspective. The World Bank Research Observer, 36: 41–66.

Devaux A., Torero M., Donovan J., Horton D. (2018): Agricultural innovation and inclusive value-chain development: A review. Journal of Agribusiness in Developing and Emerging Economies, 8: 99–123.

De Vito A., Gomez J.P. (2020): Estimating the COVID-19 cash crunch: Global evidence and policy. Journal of Accounting and Public Policy, 39: 106741.

Demmou L., Franco G., Calligaris S., Dlugosch D. (2021): Liquidity Shortfalls during the COVID-19 Outbreak: Assessment and Policy Responses. OECD Economics Department Working Papers 1647. Available at https://doi.org/10.1787/18151973 (accessed Jan 3, 2023).

Didier T., Huneeus F., Larrain M., Schmukler S.L. (2021): Financing firms in hibernation during the COVID-19 pandemic. Journal of Financial Stability, 53: 100837.

Ebeke C., Jovanovic N., Valderrama L., Zhou J. (2021): Corporate Liquidity and Solvency in Europe during COVID-19: The Role of Policies. IMF Working Paper 2021 /056. Available at http://dx.doi.org/10.5089/9781513570914.001 (accessed Jan 4, 2023).

European Investment Bank (2022): Business Resilience in the Pandemic and Beyond: Adaptation, Innovation, Financing

and Climate Action from Eastern Europe to Central Asia. Luxembourg, European Investment Bank: 14.

Fairlie R., Fossen F.M., Johnsen R., Drobuniku G. (2023): Were small businesses more likely to permanently close in the pandemic? Small Business Economics, 60: 1613–1629.

Fang S., Goh K., Li S., Xu L.C. (2022): Firm Resources, Strategies, and Survival and Growth During COVID-19: Evidence from Two-Wave Global Surveys. Policy Research Working Paper 999. Available at https://doi.org/10.1596/1813-9450-9997 (accessed July 24, 2022).

FAO (2020): Farmers and Agribusinesses at Risk Under COVID-19: What Role for Blended Finance Funds? Rome, FAO: 11.

Fazzari S.M., Hubbard R.G., Petersen B.C. (1987): Financing Constraints and Corporate Investment. Brookings Papers on Economic Activity. Cambridge, National Bureau of Economic Research: 61.

Fernandez-Cerezo A., Gonzalez B., Peinado M.I., Moral-Benito E. (2022): Firm-level heterogeneity in the impact of the COVID-19 pandemic. Applied Economics, 55: 4946–4974.

Giebel M., Kraft K. (2024): R&D investments under financing constraints. Industry and Innovation, 31: 1141–1168.

Ginder R.G., Stone K.E., Otto D. (1985): Impact of the farm financial crisis on agribusiness firms and rural communities. American Journal of Agricultural Economics, 67: 1184–1190.

Gomez J., Krammer S.M., Perez-Aradros B., Salazar I. (2024): Resilience to the pandemic: The role of female management, multi-unit structure, and business model innovation. Journal of Business Research, 172: 114428.

Gopalan S., Reedy K. (2023): Global Value Chain Disruptions and Firm Survival During COVID-19: An Empirical Investigation. ERIA Discussion Paper Series 485. Available at https://www.eria.org/uploads/Global-Value-Chain-Disruptions-and-Firm-Survival-During-COVID-19.pdf (accessed Sept 26, 2023).

Gorodnichenko Y., Schnitzer M. (2013): Financial constraints and innovation: Why poor countries don't catch up. Journal of the European Economic Association, 11: 1115–1152.

Gourinchas P.O., Kalemli-Özcan S., Penciakova V., Sander N. (2020): Covid-19 and SME Failures. IMF Working Paper 2020/20. Available at https://doi.org/10.5089/9781513557748.001 (accessed July 24, 2022).

Haneberg D.H. (2021): How combinations of network participation, firm age and firm size explain SMEs' responses to COVID-19. Small Enterprise Research, 28: 229–246.

Hansen H., Rand J. (2014): Estimates of gender differences in firm's access to credit in sub-Saharan Africa. Economics Letters, 123: 374–377.

Hasan I., Politsidis P.N., Sharma Z. (2021): Global syndicated lending during the COVID-19 pandemic. Journal of Banking and Finance, 133: 106121.

Hatab A.A., Lagerkvist C.J., Esmat A. (2021): Risk perception and determinants in small- and medium-sized agri-food enterprises amidst the COVID-19 pandemic: Evidence from Egypt. Agribusiness, 37: 187–212.

Hottenrott H., Peters B. (2012): Innovative capability and financing constraints for innovation: More money, more innovation? Review of Economics and Statistics, 94: 1126–1142.

Höhler J., Lansink A.O. (2021): Measuring the impact of COVID-19 on stock prices and profits in the food supply chain. Agribusiness, 37: 171–186.

Hubbard R.G. (1998): Capital-market imperfections and investment. Journal of Economic Literature, 36: 193–225.

Islam M.M., Fatema F. (2023): Do business strategies affect firms' survival during the COVID-19 pandemic? A global perspective. Management Decision, 61: 861–885.

Islam A.M., Gaddis I., Palacios Lopez A., Amin M. (2020): The labor productivity gap between formal businesses run by women and men. Feminist Economics, 26: 228–258.

Jordaan J.A. (2023): Firm-level characteristics and the impact of COVID-19: Examining the effects of foreign ownership and international trade. The World Economy, 46: 1967–1998.

Khan S.U. (2022): Financing constraints and firm-level responses to the COVID-19 pandemic: International evidence. Research in International Business and Finance, 59: 101545.

Khan S.U. (2023): The firm-level employment impact of COVID-19: International evidence from World Bank Group's Enterprise Surveys. Eastern European Economics, 61: 457–490.

Koloma Y., Kemeze F.H. (2022): COVID-19 and perceived effects on agricultural financing in Africa: Evidence and policy implications. African Development Review, 34: S63–S79.

Krammer S.M. (2022): Navigating the New Normal: Which firms have adapted better to the COVID-19 disruption? Technovation, 110: 102368.

Kumar S., Zbib L. (2022): Firm performance during the Covid-19 crisis: Does managerial ability matter? Finance Research Letters, 47: 102720.

Kuntchev V., Ramalho R., Rodríguez-Meza J., Yang J.S. (2013): What Have We Learned from the Enterprise Survey Regarding Access to Finance by SMEs? Policy Research Working Paper 6670. Available at http://hdl.handle.net/10986/16885 (accessed Sept 25, 2023).

Lewbel A. (2012): Using heteroscedasticity to identify and estimate mismeasured and endogenous regressor models. Journal of Business and Economic Statistics, 30: 67–80.

Ling S, Pei T., Li Z., Zhang Z. (2021): Impact of COVID-19 on financial constraints and the moderating effect of financial technology. Emerging Markets Finance and Trade, 57: 1675–1688.

Liu Y., Peng, M., Wei Z., Xu J., Xu L.C. (2021a): Organizational Resources, Country Institutions, and National Culture be-

hind Firm Survival and Growth during COVID-19. Policy Research Working Paper 9633. Available at . https://doi.org/10.1596/ 1813-9450-9633 (accessed Nov 19, 2023).

Liu Y., Wie S., Xu J. (2021b): COVID-19 and women-led businesses around the world. Finance Research Letters, 43: 102012.

Liu Y., Peng, M., Wei Z., Xu J., Xu L.C. (2023): Surviving and Growing in Times of Crisis: A Resource Dependence View of Firm Ownership. Available at https://ssrn.com/abstract=3823869 (accessed Oct 18, 2024)

Miroshnychenko I., Vocalelli G., De Massis A. Grassi S., Ravazzolo F. (2024): The COVID-19 pandemic and family business performance. Small Business Economics, 62: 213–241.

Mirza N., Rahat B., Naqvi B., Rizvi S.A. (2023): Impact of Covid-19 on corporate solvency and possible policy responses in the EU. The Quarterly Review of Economics and Finance, 87: 181–190.

Muravyev A., Talavera O., Schaefer D. (2009): Entrepreneurs' gender and financial constraints: Evidence from international data. Journal of Comparative Economics, 37: 270–286.

Muzi S., Jolevski F., Ueda K., Viganola D. (2023): Productivity and firm exit during the COVID-19 crisis: Cross-country evidence. Small Business Economics, 60: 1719–1760.

Nilsen J.H. (2002): Trade credit and the bank lending channel. Journal of Money, Credit and Banking, 34: 226–253.

Olczyk M., Kuc-Czarnecka M.E. (2021): Determinants of COVID-19 impact on the private sector: A multi-country analysis based on survey data. Energies, 14: 4155.

Oman S., Kongongo F., Kelly S., Ilie E. (2022): Assessing the impact of COVID-19 on agrifood manufacturing small and medium-sized enterprises in sub-Saharan Africa – Recommendations for building back better. FAO and UNIDO. Available at https://doi.org/10.4060/cb8083en (accessed Jan 5, 2024).

Pereira H.M.F, Saes M.S.M. (2022): Government support and institutions' intermediation throughout companies' adaptation to the COVID-19 crisis. Sustainability, 14: 5450.

Perwitasari D., Setiawan D., Nurrahmawati A., Rahmawati I.P. (2022): Firm performance during COVID-19 pandemic: Does ownership identity matter? Evidence from Indonesia. Journal of Risk and Financial Managegement, 15: 444.

Petersen M.A., Rajan R.G. (1994): The benefits of lending relationships: Evidence from small business data. The Journal of Finance, 49: 3–37.

Ragazou K. (2021): Business strategies in HR in times of crisis: The case of agri-food industry in central Greece. Businesses, 1: 36–50.

Reardon T., Heiman A., Lu L., Nuthalapati C.S.R., Vos R., Zilberman D. (2021).: 'Pivoting' by food industry firms to cope with COVID-19 in developing regions: E-commerce and 'copivoting' delivery intermediaries. Agricultural Economics, 52: 459–475.

Roche S., Sun S., Welters R. (2022): Do financial constraints reduce process innovation? Evidence from Australian firms. Economic Record, 98: 335–353.

Shafi M., Liu J., Ren W. (2020): Impact of COVID-19 pandemic on micro, small, and medium-sized enterprises operating in Pakistan. Research in Globalization, 2: 100018.

Simonovska A., Gjosevski D., Elenova S., Martinovska-Stojceska A. (2017): Sensitivity of agri-food sector to the financial crisis: Empirical evidence from a Balkan country. Agriculture and Forestry, 63: 175–190.

Torres J., Maduko F., Gaddis I., Iacovone L., Beegle K. (2022): The Impact of the COVID-19 Pandemic on Women-Led Businesses. Policy Research Working Paper 981. Available at http://documents.worldbank.org/curated/en/808641635211295483/The-Impact-of-the-COVID-19-Pandemic-on-Women-Led-Businesses (accessed July 25, 2022).

Wagner J. (2022): Firm survival and gender of firm owner in times of COVID-19: Evidence from 10 European countries. Economies, 10: 98.

Wagner J. (2024): Exports and firm survival in times of COVID-19 – Evidence from eight European countries. Review of Economics, 75: 63–70.

Waldkirch A. (2021): Firms around the World during the COVID-19 Pandemic. Journal of Economic Integration, 36: 3–19.

Webster A., Khorana S., Pastore F. (2021): The labour market impact of COVID-19: Early evidence for a sample of enterprises from Southern Europe. International Journal of Manpower, 43: 1054–1082.

World Bank (2021): World Bank Enterprise Survey Database. Available at www.enterprisesurveys.org (accessed Sept 26, 2023).

Xu J., Jin Z. (2022): Exploring the impact of the COVID-19 pandemic on firms' financial performance and cash holding: New evidence from China's agri-food sector. Agronomy, 12: 1951.

Zhang D., Sogn-Grundvag G. (2022): Credit constraints and the severity of COVID-19 impact: Empirical evidence from enterprise surveys. Economic Analysis and Policy, 74: 337–349.

Zouaghi F., Sánchez M. (2016): Has the global financial crisis had different effects on innovation performance in the agri-food sector by comparison to the rest of the economy? Trends in Food Science and Technology, 50: 230–242.