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Working Paper

COVID-19 lockdown compliance, financial stress, and acceleration in technology adoption in rural Uganda

DIW Discussion Papers, No. 2007

Provided in Cooperation with:

German Institute for Economic Research (DIW Berlin)

Suggested Citation: Hamdan, Jana Samira; Xu, Yuanwei (2022) : COVID-19 lockdown compliance, financial stress, and acceleration in technology adoption in rural Uganda, DIW Discussion Papers, No. 2007, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin

This Version is available at:

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2007

Discussion Papers

Deutsches Institut für Wirtschaftsforschung

2022

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IMPRESSUM

DIW Berlin, 2022

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<https://www.diw.de>

ISSN electronic edition 1619-4535

Papers can be downloaded free of charge from the DIW Berlin website:
<https://www.diw.de/discussionpapers>

Discussion Papers of DIW Berlin are indexed in RePEc and SSRN:
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COVID-19 Lockdown Compliance, Financial Stress, and Acceleration in Technology Adoption in Rural Uganda *

Jana S. Hamdan [†] and Yuanwei Xu [‡]

July 1, 2022

Abstract

We examine the medium-term impact of COVID-19 for financial well-being and technology adoption in a low-income country. The analysis is based on regionally representative panel data consisting of 1,975 micro-entrepreneurs from rural Uganda. Using a LASSO approach, we first show that several business characteristics predict longer business shutdown due to COVID-19, including running a service business. We also find several respondent characteristics correlate with non-compliance to the lockdown, the strongest predictors being independence of mobility restrictions, financial pressure and extreme remoteness. Second, comparing pre- and post-lockdown levels, we document a sharp increase in the use of financial services. Moreover, we find a substantial drop in business investments and profits. Third, we adopt an instrumental variable approach to analyze the causal impact of the COVID-19 business shutdown. We find that businesses which closed longer are more likely to adopt mobile money services and better business practices.

JEL classification: I18 (Government Policy), I31 (General Welfare, Well-Being), O12 (Microeconomic Analyses of Economic Development)

Keywords: COVID-19, Lockdown, Micro-enterprises, Mobile Money, Coping Strategies, Uganda

*This work was financially supported by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation), project RTG 1723 “Globalization and Development”, and DFG grant CRC TRR 190. The data collection was further funded by the Leibniz Universitätsgesellschaft Hannover e.V. and basic funds by the German Institute for Economic Research (DIW Berlin). We are thankful for invaluable field work guidance by Tim Kaiser, Lukas Menkhoff, and Helke Seitz. We thank them and Laura Barros, Svenja Fluhrer, Sarah Frohnweiler, Tobias Gamp, Krisztina Kis-Katos, Melanie Koch, Jan Lay, Lukas Mogge, Florian Anselm Münch, Emma Riley, Sulin Sardoschau, and Georg Weizsäcker for helpful comments. Moreover, we are grateful to Gaplink Uganda, in particular Filder Aryemo, for her tireless effort in this project. Christopher Kissling provided valuable research assistance. We further thank the seminar and conference participants at the University of Göttingen, the PEGNet PhD Workshop, the Annual Meeting of the German Economic Association (VfS) 2021, and the DENEb-GlaD PhD Workshop 2021 for valuable discussions and comments. All remaining errors are ours.

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1. Introduction

Starting in early 2020, many governments have put in place containment measures to slow the spread of the COVID-19 pandemic. While targeting at flattened infection curves and saving lives, the lockdowns disrupted consumption and global economic operations ([Battistini et al., 2021](#); [Chen et al., 2021](#); [Ozili and Arun, 2020](#)). Among the global poor, the situation was particularly challenging. From surveys among 30,000 respondents in April-June 2020, [Egger et al. \(2021\)](#) find significant immediate declines in employment, income, and food security in Bangladesh, Burkina Faso, Colombia, Ghana, Kenya, Rwanda, and Sierra Leone. Should these effects continue, the risk of poverty for vulnerable households is high. However, it remains unclear how the past lockdowns continue to affect on the people and businesses in low income countries.

In Uganda, micro-entrepreneurs account for the majority of businesses and play a crucial role in the economy. Understanding the impact of lockdowns on this group beyond the immediate effects is important to design better policies and development assistance.

We provide evidence on the persistent impact of COVID-19 on the financial well-being and technology adoption of rural micro-entrepreneurs in Western Uganda, more than one year after the lockdown started. Our analysis utilizes regionally representative survey data from both one year before and several months after the 2020 COVID-19 lockdown. The sample is based on an extensive in-person baseline survey of 2,177 respondents in spring 2019. The endline survey reaches 91 percent of the baseline sample using both phone and in-person interviews between October 2020 and April 2021, thus at least 6 months after the stay-at-home national lockdown. We utilize the first two rounds of panel data collected for a randomized controlled trial, evaluating the impact of a financial education program

implemented in 2019 ([Hamdan et al., 2022](#)). The program has no observable effect on the micro-entrepreneurs' shutdown decisions during the 2020 COVID-19 lockdown.

The survey data provide us with unique information on the individual duration of business closure due to COVID-19. Moreover, we collect detailed information on business performance, financial behaviors, and mobile money use, both before and after the imposed shutdown. This allows us to take three steps, (1) to investigate the duration and (non-)compliance to the national industry-specific lockdown and illustrate several correlating characteristics, (2) to describe the shift in the micro-entrepreneur's financial situation and technology adoption pre- and post-lockdown, and (3) to exploit the variation of the length of shutdown across micro-entrepreneurs and estimate its effect on mobile money use, business performance, and household finance. Here we apply an instrumental variable (IV) approach, instrumenting the individual shutdown decision with a binary indicator of pre-COVID business essentiality.

The Ugandan lockdown rules specified different business shutdown lengths by business types. Businesses selling essential goods or services did not have to be closed at all. However, all non-essential businesses had to be closed at least five weeks. We rely on the reported business categories prior to the COVID-19 spread, i.e. during the baseline survey, and categorize the micro-enterprises into essential and non-essential ones. We use this dummy as an instrumental variable for the self-reported length of business shutdown, and investigate the causal effects on their financial behaviors and well-being.

This paper adds directly to studies investigating the impact of COVID-19 lockdowns on livelihoods in low income economies. In Uganda, negative immediate effects on business profits, household income and consumption are documented both in the capital ([Hartwig and Lakemann, 2020](#)) and rural areas ([Mahmud and Riley, 2021b](#)).¹ Moreover,

¹An important source of data on the impact of COVID-19 in Uganda is the World Bank's Living

similar findings are reached via an online survey study in Uganda and Kenya ([Kansiime et al., 2020](#)). COVID-19 lockdowns are found to cause huge immediate financial stress for households in Bangladesh ([Rahman and Matin, 2020](#)), India ([Gupta et al., 2021](#)), Kenya ([Janssens et al., 2021](#)), Pakistan ([Malik et al., 2020](#)), and Senegal ([Le Nestour et al., 2020](#)). Most evidence highlights that poorer households are more vulnerable to the negative shock.

Compared to the existing evidence, this paper provides insights in four ways. First, this study differs from the previous studies by providing medium-term impact analysis about one year after the national lockdown started. This is relevant as the negative impact on livelihoods may extend beyond the immediate shutdown period. Long lasting effects could not only be different from the immediate impact but also heterogeneous, with households and businesses recovering from the shock at different speeds and their individual experiences shaping their long-run behaviors. From financial diaries, [Rönkkö et al. \(2021\)](#) find evidence for this concern among 60 Bangladeshi households. While the negative effect on household finance was worst during the lockdown, and there was some recovery during the subsequent two months, further decline occurred again in August and September 2020, thus suggesting lasting negative effects on the poor. In addition, [Mahmud and Riley \(2021a\)](#) follow up on a sample of 558 Ugandan households Uganda first interviewed in-person in March 2020 with several phone surveys until March 2021. Business owners made up 19 percent of their initial sample and were the relatively better-off households in terms of income and assets. They find that their business incomes are

Standards Measurement Study (LSMS). While they provide rich data on the evolution of saving practices and concerns, and family dynamics, they do not provide detailed financial information for micro-entrepreneurs. The survey results motivate our research as they find that although employment mostly recovered by autumn 2020, respondents report persistent income losses in non-farm family businesses. Specifically, in February 2021, 50 percent of households still report that business revenues continue to be lower than the pre-pandemic average. Source: [World Bank Data Blog](#).

still 40 percent lower compared to pre-pandemic levels in March 2021 while non-business income recovered.

Second, we discuss the compliance with COVID-19 restrictions, a topic predominantly studied in high income countries. An exception is [Carlitz and Makhura \(2021\)](#) who proxy compliance during the South African lockdown with the mobility reductions from Google Maps user data. They find that mobility reductions are lower in more rural provinces. We further relate to existing evidence from 92 interviews across six communities in Bangladesh on the compliance with the national six-week lockdown ([Ali et al., 2021](#)). They argue that a lack in state capacity and public criticism of the relief regime caused the low compliance in the South Asian country. Our analysis relies on a large regionally representative sample, and provides novel evidence from rural Uganda.

Third, our study is built on an extensive panel of 1,975 regionally representative respondents, enabling the, to date, largest study on the economic impact of COVID-19 in East Africa. In addition, the attrition between the baseline and follow up surveys is small – less than ten percent. Both increase the internal validity of the findings. Moreover, in contrast to previous studies, we focus on micro-entrepreneurs and their finances, as this group is large and relevant in low income economies.

Fourth, this study also adds to the emerging literature on individual behaviors after an extreme and negative shock in a rural setting. For example, [Blumenstock et al. \(2016\)](#) point out that mobile money use and transfers increased after an earthquake in Rwanda. Mobile money is shown to have profound impacts regarding informal risk sharing ([Jack et al., 2013](#); [Jack and Suri, 2014](#); [Riley, 2018](#)). Similarly, we provide consistent evidence that the use of mobile money increases in the aftermath of an unexpected shock.

Our analysis reveals several findings. First, the variation in reported business closure

is substantial. Service businesses are on average most affected, in particular hair dressing and beauty businesses, restaurants and bars. While the imposed industry-specific lockdown ranges between zero and 16 weeks, we find that 70 percent of micro-entrepreneurs who run a non-essential business do not comply to the regulation applicable to them. Non-compliance does not occur at random, but correlates with several respondent characteristics. These include financial pressure and being independent from mobility restrictions, as well as extreme remoteness.

Second, we document that financial stress increases after the COVID-19 lockdown but, at the same time, the adoption of financial innovation increases. We show that micro-entrepreneurs carry a higher debt burden and are more likely to be late with loan payments. Business performance, measured from profits and investments, is on average worse. At the same time, mobile money use increases significantly.

Third, we find from an IV estimation that longer business shutdown is not associated with more debt, lower business survival, lower profit, or smaller investments in the medium term. Instead, we find positive effects of business shutdown duration on active mobile money use, especially for business purposes. This provides evidence consistent with prior literature that the use of mobile money increases in the aftermath of an unexpected shock.

Taken together, these findings suggest that the financial downturn experienced by micro-entrepreneurs in Uganda lasts beyond the imposed lockdown period. However, this impact is not directly linked to the individual business shutdown decision made by micro-entrepreneurs. This motivates more general efforts to stimulate demand and improve market conditions for small businesses. In addition, policy makers may consider the identified determinants of non-compliance with lockdown rules. To increase compliance with future regulations, targeting information campaigns to certain groups could be fruitful.

The structure of this paper is as follows. In Section 2, we outline the course and implications of the enforced COVID-19 measures in Uganda. Section 3 describes our data and empirical strategy. Section 4 provides suggestive evidence that business closure and compliance to the industry-specific lockdown are correlated with several business and personal characteristics. In Section 5, we present our main results on the impact of business closure on business performance, financial well-being, and financial behaviors. Section 6 provides policy suggestions and concludes.

2. Background on the Ugandan Lockdown

The Ugandan government reacted to the COVID-19 pandemic with stringent restrictions to social interactions and mobility. Already on March 18, 2020, public gatherings were suspended, including church services, weddings, cultural meetings, and rallies. Moreover, pubs were ordered to close. On March 22nd, measures were tightened with a strict stay-at-home lockdown, only essential businesses being allowed to remain open after March 30th.² This strict lockdown lasted for five weeks until May 5th. After this date, additional businesses were allowed to operate, including wholesale, garages, hardware and metal-working businesses, and restaurants for take away. However, most businesses and schools still had to remain closed. These restrictions were prolonged by another eleven weeks through July 22nd, after which most of the businesses were gradually allowed to re-open. Until finally being lifted in January 2022, many restrictions remain: most schools are still closed; some businesses such as bars and night clubs have not been permitted to operate; buses and taxis have to operate at half capacity; and there is a night curfew.

²In Uganda, essential businesses are shops selling food, medicine, or veterinary, agricultural and basic household products, and providers of medical, financial, media services and telecommunication and key infrastructure. See definition in the presidential address from May 4th, 2020, retrieved from [State House](#) on February 10, 2022.

In a nutshell, the national lockdown imposed a shutdown for most micro-enterprises that lasted either zero, five or 16 weeks according to official regulations. However, up until 21 months after the lockdown was initiated, some cannot operate as usual and many are subject to mobility restrictions.

To compare the Ugandan measures to those of other sub-Saharan countries, the Oxford COVID-19 Government Response Tracker’s Stringency Index ([Hale et al., 2021](#)) is a useful measure. The index ranks the strictness of government pandemic responses on a scale of zero to 100. The composite measure includes nine metrics: school closures, work-place closures, cancellation of public events, restrictions on public gatherings, closures of public transport, stay-at-home requirements, public information campaigns, restrictions on internal movements, and international travel controls. Appendix Figure [A.1](#) shows that Uganda exhibits a very high index value until September 2020, dropping down thereafter until increasing again in July 2021, compared to 43 other sub-Saharan countries. It is noteworthy that African lockdowns are generally stringent compared to those of other continents while economic support to citizens is simultaneously lower ([Lakemann et al., 2020](#)).³

Due to limited testing, it is difficult to ascertain the extent of COVID-19 diffusion and health effects within the Ugandan population. By October 4, 2021, there have been a total of 123,976 confirmed cases and 3,160 deaths.⁴ This is in a context of a population of 46 million in 2020. Roughly three out of four Ugandans are younger than 25, making it one of the youngest countries on the planet. Less than two percent were older than 65 in 2019 and 74 percent live in rural areas.⁵

³Ugandan government support was limited to committing that electricity and water supply should not being disconnected during the lockdown, promising no confiscation of properties for non-payment of loans, and some distribution of basic foodstuffs to those most in need.

⁴These numbers are from [Worldometer](#), retrieved October 04, 2021, 09:20 GMT.

⁵See [Worldometer](#), retrieved October 4, 2021, 09:20 GMT.

With regard to the economy, the [World Bank \(2020\)](#) reports severe effects of the COVID-19 pandemic in Uganda. These come from the long lockdown, border closures, and further side effects of disruption in global demand and supply chains.⁶ According to the IMF’s World Economic Outlook database, annual real GDP growth contracted by up to one percent in 2020, compared to 7.7 percent growth in 2019, and remained below average at 4.7 percent in 2021.

The imposed strict lockdown in Uganda did not just affect business directly through their opening ban, but also indirectly via social distancing and reduced mobility. Thus, the length of each business’s shutdown and the economic consequences may not only be attributed to the lockdown directly, but also indirectly. For example, businesses might have fewer customers during the lockdown and afterwards due to reduced demand. They might also be short of goods such as products for resale and tools during and after the lockdown. In fact, [Mahmud and Riley \(2021b\)](#) find that 58 percent of their Ugandan sample (1,075 rural households in the districts Kagadi and Kyenjojo) in May 2020 report that the main reason for business closure was regulation. However, 29 percent say that they mainly closed not because of the imposed lockdown, but because no customers came or no stock was available for them to sell. See Appendix Table [A.1](#) for all reported main reasons. This information makes a high variation in the realized length of business closures likely – both within and beyond the actual lockdown period.

In our follow up survey, we collect qualitative evidence on what caused the varia-

⁶The [World Bank \(2020\)](#) further reports that “the COVID-19 crisis is threatening to reverse some of the gains made on structural transformation and the declining poverty trend of the past decade. This transformation was characterized by a reduction in the workforce employed in on-farm agriculture and a take-off in industrial production, largely in agro-processing. However, following the COVID-19 shock, there have already been widespread firm closures, permanent layoffs in industry and services, a rapid slowdown of activity particularly in the urban informal sector, and a movement of labor back to farming. At the same time, household incomes have fallen which is concerning given the high levels of vulnerability to poverty, limited social safety nets, and impacts this might have on human capital development and Uganda’s capacity to benefit from its demographic transition.”

tion in business shutdown length. First, there is variation across different villages. The respondents indicated that the strictness of the enforcement of the national lockdown orders by local leaders and the resident district commissioners may vary. Second, within villages, different micro-entrepreneurs showed different levels of compliance to the national lockdown regulations. While some respondents closed down their businesses due to the lockdown rules, others reported closure due to the higher cost of running a business during the lockdown period. They reported suffering from high transport fares during and after the lockdown, meaning they could not afford to go to towns to buy goods. Local corruption was reported to occur more frequently, increasing the cost of business operation. Some respondents reported goods being confiscated when a business operated illegally and then had to pay a bribe in order to release the goods. During the lockdown, some respondents reported that they focused fully on agricultural cultivation of their land. Further, some business premises were broken into during the lockdown and trade items were stolen, therefore causing even more losses to the owners. There were also some reported non-compliance with the order of the strict lockdown. For instance, some businesses continued to operate illegally from the backdoor. Some respondents stated that they would open briefly, keeping their eyes open for authorities. Others would get orders from clients, then open briefly or deliver the goods to customers without having to open the business.

3. Method

3.1. Data

The study region for our panel data spans 108 rural trading centers in the Kabarole district of Western Uganda. Trading centers are shopping streets along village roads

where almost all shops are located and where the main business activity occurs. Their distribution is shown on a map in Figure 1. These locations were mapped in cooperation with local officials and the staff at the Mountains of the Moon University in November 2018. The average distance to the district’s main town, Fort Portal, is about 28 minutes by car or 19 kilometers (ranging between three and 50 kilometers). In addition, trading centers vary in size, ranging from about five to 392 settled micro-entrepreneurs, with an average of 51 (median 35). Trading centers with 100 or fewer small businesses tend to be less busy, with businesses typically closed for parts of the day. In these small trading centers, we target all open shops at the time of the visit to interview sufficient business owners in these locations. In the nine larger trading centers, we randomly approach every third open business.⁷ The share of micro-entrepreneurs declining to participate is negligible. Overall, we sample a large, regionally representative, fraction of micro-enterprises in our study region. We interview 2,177 rural micro-entrepreneurs, on average of 21 per trading center, representing about 41 percent of the estimated total in the district.

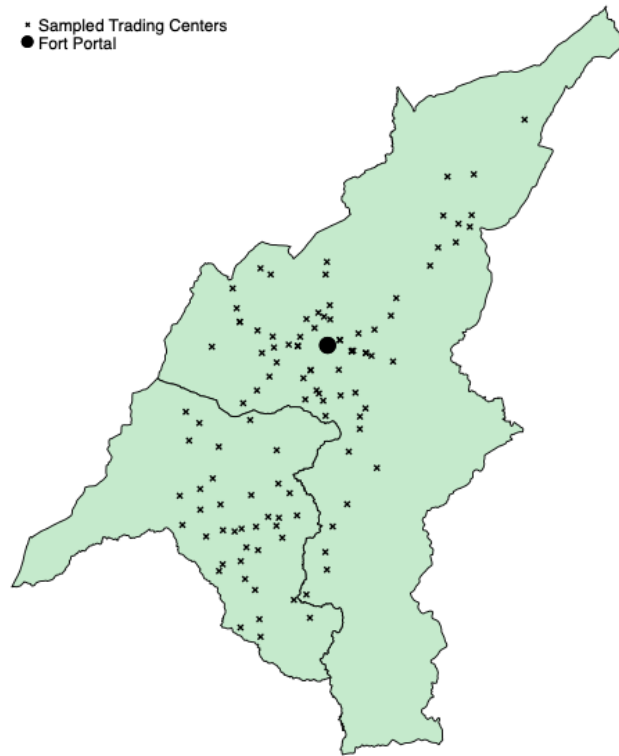
Our baseline survey is implemented via in-person interviews from February to April 2019 with trained local university students as enumerators, supervised by local researchers and the authors. We follow up with our sample via phone surveys from October to December 2020 and face-to-face interviews in March and April 2021, ultimately reaching about 91 percent of the baseline sample.⁸ Thus, after more than 1.5 years, we successfully re-interview 1,975 of the micro-entrepreneurs.⁹

⁷This sampling strategy produces a mean interviewee fraction of 47 percent in the smaller trading centers and 35 percent in the larger centers.

⁸The follow-up is implemented in cooperation with Gaplink, an independent Ugandan research company.

⁹The phone survey conducted in winter 2020 successfully interviews 73 percent of the baseline sample, making up to eight attempts to reach respondents via the contact information collected at baseline. We then follow up with the micro-entrepreneurs who are not reached on the phone via face-to-face interviews in spring 2021.

Figure 1: Distribution of Trading Centers in Kabarole



Note: This figure displays the location of the 108 trading centers and the district capital, Fort Portal, in the Kabarole district in Western Uganda. We take this district as it used to be known to people during baseline and still appears in several government statistics. Officially, the southern part of this district, the former county of Bunyangabu, has become a new independent district in 2017.

We document the reasons for the moderate attrition during the follow up survey. 88 percent of the attrition is due to a relocation of a micro-entrepreneur out of our study region, with only 25 cases of attrition due to refusal, death, imprisonment, or sickness. The relocators are characterized by worse business performance at baseline. Therefore, we suspect that they are more likely to close down the original business permanently and move away as their businesses might have a lower chance of surviving the COVID-19 crisis. Thus, our study results on the negative lockdown impact on business survival and performance may be downward biased.

Both baseline and follow up surveys cover the financial situation of the businesses and

the owners in detail, particularly their profits, and their saving, investing, borrowing, and transfer behaviors, as well as their use of mobile money. In the Appendix B, we provide variable definitions. Importantly, the follow up survey includes a question on the length of business closure due to COVID-19.

Summary statistics of our panel sample at baseline are displayed in Table 1. Almost two-thirds of all micro-entrepreneurs are female. They average 34 years of age and have seven years of work experience in a business. About 62 percent run a retail or wholesale business, while 28 percent manage a service business, with the remaining ten percent working in the manufacturing sector. While 81 percent are formalized with a trading license, only 22 percent keep business records.

Both baseline and follow up surveys cover the financial situation of the businesses and the owners in detail, particularly their profits, and their saving, investing, borrowing, and transfer behaviors, as well as their use of mobile money. In the Appendix B, we provide variable definitions. Importantly, the follow up survey includes a question on the length of business closure due to COVID-19. While almost all respondents have access to mobile money services, only 22 percent own a bank account. On average they make a monthly profit of US\$ PPP 133, and have outstanding loans almost twice that amount (34 percent had a loan at baseline). Before COVID-19, the micro-entrepreneurs had, on average, 2.8 times their monthly consumption as savings. However, it is noteworthy that the median total savings are only 162 US\$ PPP, meaning actually less than one month's consumption in savings. Every third business is not located along a main road in the district and, as such, can be considered as being remote.

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Obs.
Female	0.633		1,975
Age	34.238	11.716	1,967
Married	0.504		1,975
Illiterate	0.117		1,975
Years of Education	8.830	4.596	1,975
Previous Financial Education	0.374		1,975
Financial Literacy (Std.)	0.013	0.767	1,975
Risk Tolerance (Std.)	0.019	0.994	1,975
Work Experience (Years)	7.147	7.809	1,975
Household Size	4.039	2.470	1,975
Number of Assets	37.565	17.697	1,975
Consumption per Adult Equiv. (US\$ PPP)	199.302	123.732	1,975
Essential Business	0.533		1,975
Retail/Wholesale Business	0.699		1,975
Services Business	0.254		1,975
Manufacturing Business	0.047		1,975
Trading License	0.813		1,975
Record-Keeping	0.219		1,975
Number of Workers	0.430	0.715	1,975
Mobile Money Account	0.867		1,975
Bank Account	0.219		1,975
Monthly Profit (in US\$ PPP)	133.420	178.860	1,938
Investments in Past Year (in US\$ PPP)	1,182.489	2,288.314	1,947
Current Loans (in US\$ PPP)	226.675	632.492	1,975
Total Savings (in US\$ PPP)	564.654	1,229.620	1,975
Remote Location	0.311		1,975
Mobile Money Agent Density	3.941	3.600	1,975
Network Quality (0-10 Scale)	7.246	2.151	1,975

Note: The table shows summary statistics for 1,975 small business owners in the rural Kabarole district in Western Uganda at baseline (27th February-11th April 2019). The variables consumption, profits, investments and loans are winsorized at 99% and converted from Ugandan Shilling (UGX) using the 2019 PPP conversion factor for private consumption for Uganda: 1 US\$ = 1,235.95 UGX ([World Bank, 2019](#)). To calculate the adult equivalent of household-level consumption, we use the OCED-modified scale, first proposed by [Hagenaars et al. \(1994\)](#) which assigns the weight 1 to the household's first adult, 0.5 to each additional one, and 0.3 to each child.

3.2. Empirical Strategy

As a first step, we estimate the correlates of business closure because of COVID-19. As described in Section 2, the business shutdown is a decision a micro-entrepreneur takes and not necessarily related to the official lockdown rules. Personal, business, and location characteristics may also influence the actual shutdown. The determinants of shutdown duration are of interest to policy makers to understand on who and where it may be important to focus. Thus, we estimate what variables predict shutdown. We use the following model for the analysis:

$$Shutdown_i = \alpha + \beta' X_{i0} + \varepsilon_i \quad (1)$$

where $Shutdown_i$ is the self-reported decision (either incidence or duration) of business shutdown by micro-entrepreneur i . On the right hand side, α is a constant and X_{i0} includes a set of observed characteristics of micro-entrepreneur i at baseline. The standard errors, ε_i , are clustered at the trading center level. With a large number of possible explanatory variables X_{i0} , a model could be easily over-fitted. Therefore, we use the machine learning technique LASSO (Tibshirani, 1996) to select the variables which best explain the variation in the shutdown decision. The procedure reduces the complexity of the model and aims to solve the covariate selection problem. The chosen determinants are presented in Section 4.

Second, we study the correlates of non-compliance with the lockdown regulation (zero, five, or 16 weeks, depending on the business sector) as follows:

$$Non\ Compliance_i = \alpha + \beta' X_{i0} + \varepsilon_i \quad (2)$$

where $Non\ Compliance_i$ captures the extent to which micro-entrepreneur i did not comply to his or her respective lockdown regulation, measured in number of weeks. Similarly, we use LASSO to select the individual and location characteristics that explain the degree of the compliance to the national lockdown rule. ε_i stands for the standard errors.

Finally, we study the economic impacts of COVID-19 related business closure on the micro-entrepreneurs. We first perform descriptive analysis by estimating the mean of each outcome of interest by the two survey waves (before and after the COVID-19 shock). Then, we estimate the impact of the length of the business shutdown on the micro-entrepreneurs financial well-being and technology adoption, to assess whether those who closed down longer have persistent losses (or gains) compared to those who closed less. We apply a two-stage least square estimation to tackle these effects. Specifically, we use the exogenous variation in the length of business shutdown by the national sector-specific rule as an instrument. According to the lockdown rules in Uganda, all non-essential businesses have to be closed after March 30th, 2020. Non-essential businesses are ordered a shutdown of either five weeks or 16 weeks. The distinction between the essential and non-essential businesses are solely dependent on the reported business activities at the baseline interview in spring 2019, which could not be influenced by the COVID-19 rules in 2020. We use a binary indicator of business essentiality as an instrument in the following analysis.

Specifically, the model takes the following form in the first stage:

$$Shutdown_{it} = \alpha + \beta Essential_{i0} + \theta \mathbf{X}_{i0} + \lambda Y_{i0} + \gamma_t + \varepsilon_{it} \quad (3)$$

and in the second stage, the equation takes the form as follows:

$$Y_{it} = \alpha + \beta \hat{Shutdown}_{it} + \theta \mathbf{X}_{i0} + \lambda Y_{i0} + \gamma_t + \varepsilon_{it} \quad (4)$$

In the first stage, $Essential_{i0}$ on the right hand side denotes a dummy, indicating whether the business belongs to the essential group or not by the national lockdown rule during the baseline. On the left hand side, $Shutdown_{it}$ is the self-reported business closure due to COVID-19 restrictions of business i interviewed in year-month t during the endline survey, measured in number of weeks.

In the second stage, Y_{it} is the outcome of interest of the business or micro-entrepreneur i surveyed at the follow-up survey in year-month t . α is a constant. $\hat{Shutdown}_{it}$ is the predicted business shutdown length from the first stage. \mathbf{X}_{i0} is a set of baseline characteristics which may predict the outcome variable directly. Specifically, they are selected using the LASSO. The predictors of the business shutdown length include the education attainment, work experience, whether they belong to the main tribe, whether they applied for a loan to cover emergency, distance to the mobile money agents, whether they used mobile money to pay suppliers, size of the agricultural plots, sales amount, and planned business investments for the next year. We additionally control for the baseline value of the outcome variable Y_{i0} . Moreover, γ_t denotes the year-month fixed effects, which further adjust for changes in the outcomes due to seasonality or any macro shock affecting all micro-entrepreneurs in the same month. The year-month fixed effects also take into account potential differences due to interview method, since all face-to-face follow up interviews took place in March and April 2021. All standard errors are clustered at the baseline trading center level.

4. Correlates of Business Shutdown due to COVID-19

In our follow up survey, respondents were asked “Did you have to shut your business due to the corona virus (COVID-19)? If yes, for how many weeks?.” We show the distribution of answers (in percentages) in Appendix Figure C.1. Generally, it shows a wider range than the expected zero to 16-weeks imposed by the Ugandan government. Around every fourth respondent did not close their business at all. In turn, 72 percent report that they closed their business due to COVID-19, 52 percent shut for five weeks or longer, and about 20 percent shut longer than the upper bound of the lockdown regulations. Conditional on any closure, they shut down on average for 11 weeks (median 12), with closures ranging between one and 52 weeks.

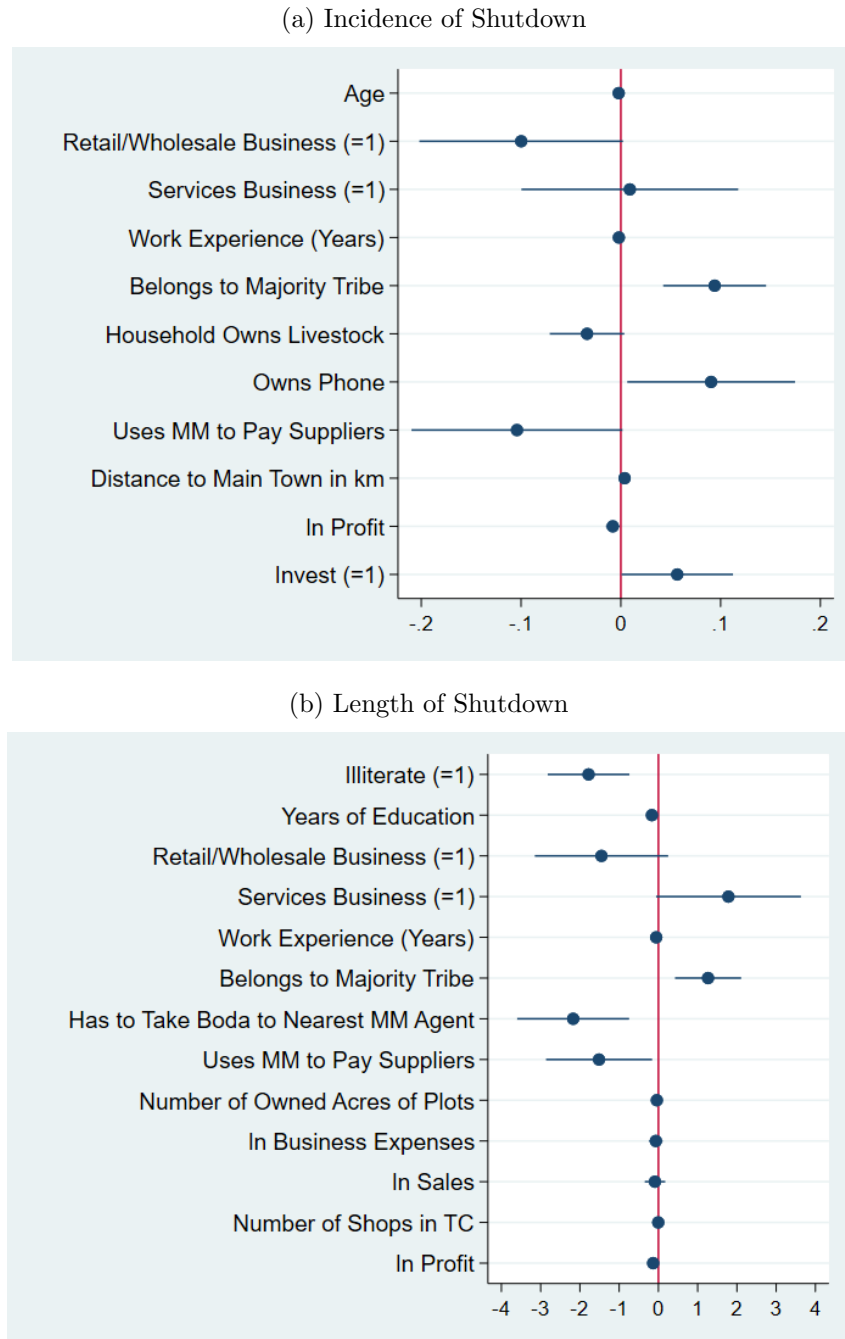
Essential businesses closed about four weeks less than non-essential businesses, however most of them closed more than required. About 63 percent of non-essential business respondents closed at least five weeks in accordance with the lower bound of the lockdown regulations. Appendix Figure C.2 displays these descriptively for essential and non-essential businesses separately. Overall, 34 percent i.e. about every third business closes longer than being obliged to by to their business type respectively applying lockdown regulations. In turn, 70 percent of non-essential businesses close less than they should. To better understand why business closure and compliance is so heterogeneous, we discuss some factors that could be at play and provide suggestive evidence.

First, there is likely local variation in information dissemination and the level of enforcement of lockdown measures by local officials. This could affect compliance throughout our sample and also cause differential knowledge about COVID-19 and imposed regulations. Second, micro-entrepreneurs possibly closed their business longer than being obliged

to due to market conditions, individual health and safety concerns, or any other personal issues. For example, this could be the case due to low profitability, low sales and inventory, and higher transport fares, making outside options such as cultivating land more attractive. Actually, business income was more than 20 percentage points more likely to fall than farm income in Uganda between May and August 2020 ([Josephson et al., 2021](#)). While we cannot disentangle the exact reasons for individual business closure related to the pandemic, we are able to assess the general correlates of business shutdown. This is important for understanding what business types and which micro-entrepreneurs comply more to the policy and are most affected by consequences of longer business closure, as discussed in the next section.

We use LASSO to select the determinants for business shutdown among 118 possible explanatory variables from the baseline survey data. For the binary dependent variable of any business closure, 11 variables are selected by the approach as relevant determinants. For the continuous variable, length of business closure measured in number of weeks, 13 variables are chosen. After selecting these substantial variables, we conduct the ordinary least squares regression (OLS post-LASSO) in a multivariate analysis. We plot the resulting coefficients in Figure 2. This presentation accentuates the relative impact of the coefficients on the shutdown probability.

Figure 2: Post-LASSO Correlates of Business Shutdown due to COVID-19



Note: The figure displays the point estimates and their confidence intervals of post-LASSO (OLS) regression results. These are shown in Appendix Table C.1 and C.2.

Most significant are the business type characteristic, indicators of remoteness, tribal affiliation, mobile money use, and illiteracy. According to the LASSO approach, variables such as debt, financial literacy, and risk preferences are not important determinants of business closure due to COVID-19. The related full regression results are shown in Appendix Tables [C.1](#) and [C.2](#).

It is striking that businesses in one sector shut down longer: owning a service business is associated with slightly higher likelihood and significantly longer business closure. On average, they closed almost three weeks longer than retail or manufacturing businesses. Appendix Figure [C.3](#) visualizes these differences by business type. As we control for factors such as profits, investments, and work experience,¹⁰ we speculate that the driving factor of this distinction is the higher contact intensity and resulting perceived COVID-19 risks associated with this sector compared to other types of micro-enterprises. Moreover, they could be perceived as less of a necessity by their customers compared to retail and wholesale products, driving down demand. These possible explanations most apply to two specific service businesses: hair and beauty salons, and restaurants. They closed twelve and ten weeks on average. Thus, compared to all others, they even closed an additional five and three weeks, respectively.

Four other factors stand out to explain business closure: (1) profitability reduces the likelihood to close down the business and the duration of business shutdown. This could be due to opportunity costs. (2) Remoteness as living in a very remote location where one needs to take a motorcycle taxi (boda) to the nearest mobile money agent (this is the case for only five percent of the panel), is on average associated with closing the business for about two weeks less. However, the local probability of business closure increases

¹⁰On average, service businesses made 19 percent less profits, were three percentage points more likely to have made investments in the past year before baseline, and their owners have about 1.5 years less work experience.

with distance to the district main town: ten additional kilometers to the main town are, on average, associated with a three to four percentage point higher likelihood of local business closure. We argue that this suggests a larger impact of opportunity costs rather compared to lockdown enforcement, since those trading centers closer to the city are larger and along main roads. More rural micro-entrepreneurs may retreat more easily to farming (at baseline, there is a strong positive correlation between distance to the main town and non-business income sources). Nonetheless, extremely remote located micro-entrepreneurs may not be as knowledgeable or concerned by regulations and thus close less. (3) Mobility restrictions as those who use mobile money to pay suppliers (just 3.5 percent of the panel did so at baseline), close their business less and more briefly. This could be due to a higher independence from mobility restrictions. (4) Lastly, literacy, as being illiterate also correlates negatively with the number of weeks a business closed. This attribute applies to 12 percent of the panel. It could be that COVID-19 awareness campaigns and the lockdown declaration did not reach them due to their limitation and also failed to reach those in very remote locations. Being in the majority tribe may be a proxy for a large social network, thus we speculate that this is why we find an opposing effect to illiteracy on business shutdown for this group.

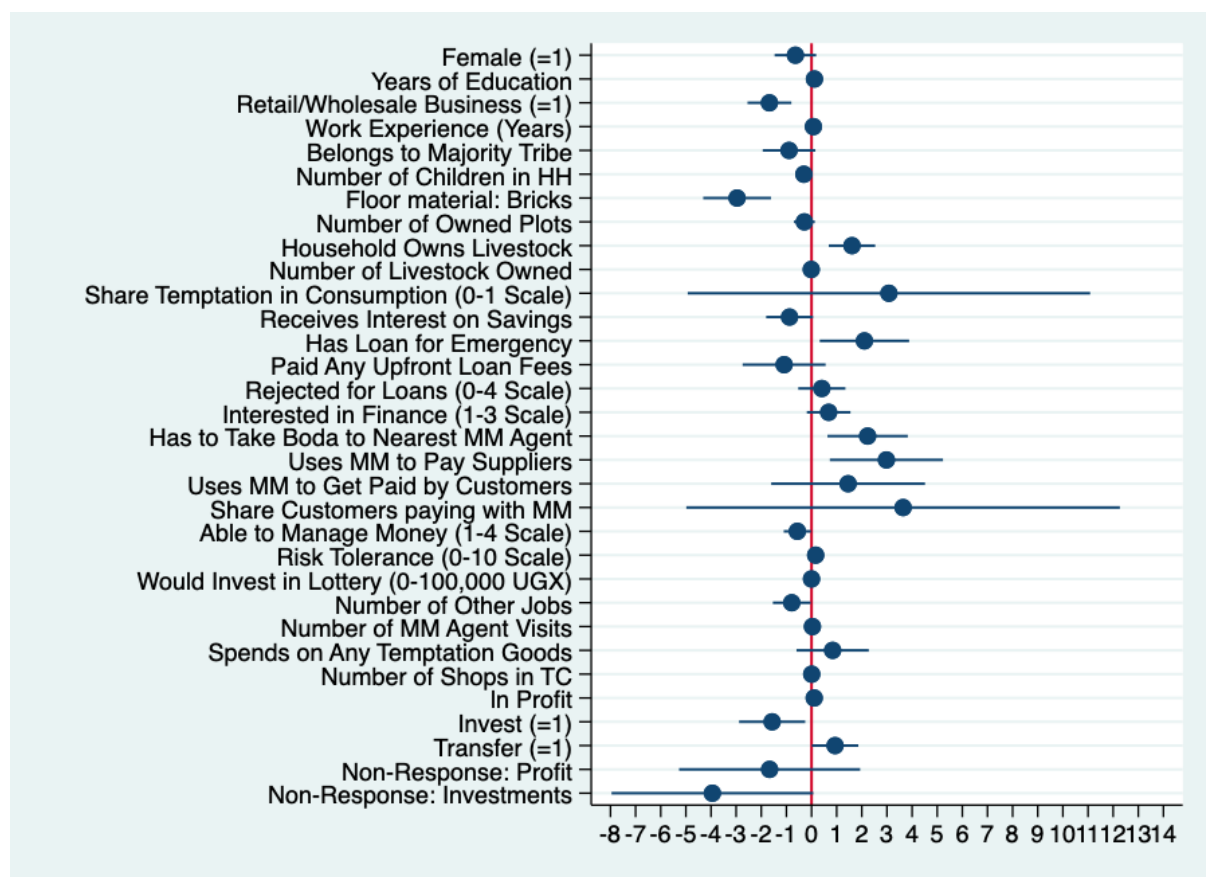
In sum, we find suggestive evidence that service businesses are more likely to have longer business closure compared to retail and wholesale businesses. These should be specifically targeted by aid programs to compensate for their substantial losses.

To investigate who complied more or less with (or knew less about and unknowingly acted or did not act in accordance with) the lockdown regulations, we run an OLS post-LASSO regression on 32 variables that are selected to be determinants of non-compliance, measured on a continuous scale with zero being closing exactly as much as required,

negatives being closing more than required, and positives being closing less than required.

The resulting coefficients are shown in Figure 3. We observe that respondents with household livestock assets, an existing unproductive loan (speaking for financial pressure), very remote location and independence from mobility restrictions tend to comply less with their respectively imposed lockdown regulation.

Figure 3: Post-LASSO Correlates of Non-Compliance to the COVID-19 Regulations



Note: The figure displays the point estimates and their confidence intervals of post-LASSO (OLS) regression results. These are shown in Appendix Table C.3.

When comparing compliance of non-essential businesses by baseline outcome variables, Appendix Table C.4, non-compliers had on average less savings and investments, and more mobile money transactions. However, these differences are small in magnitude and we conclude that baseline outcome variables are unlikely to affect business shutdowns as major factors.

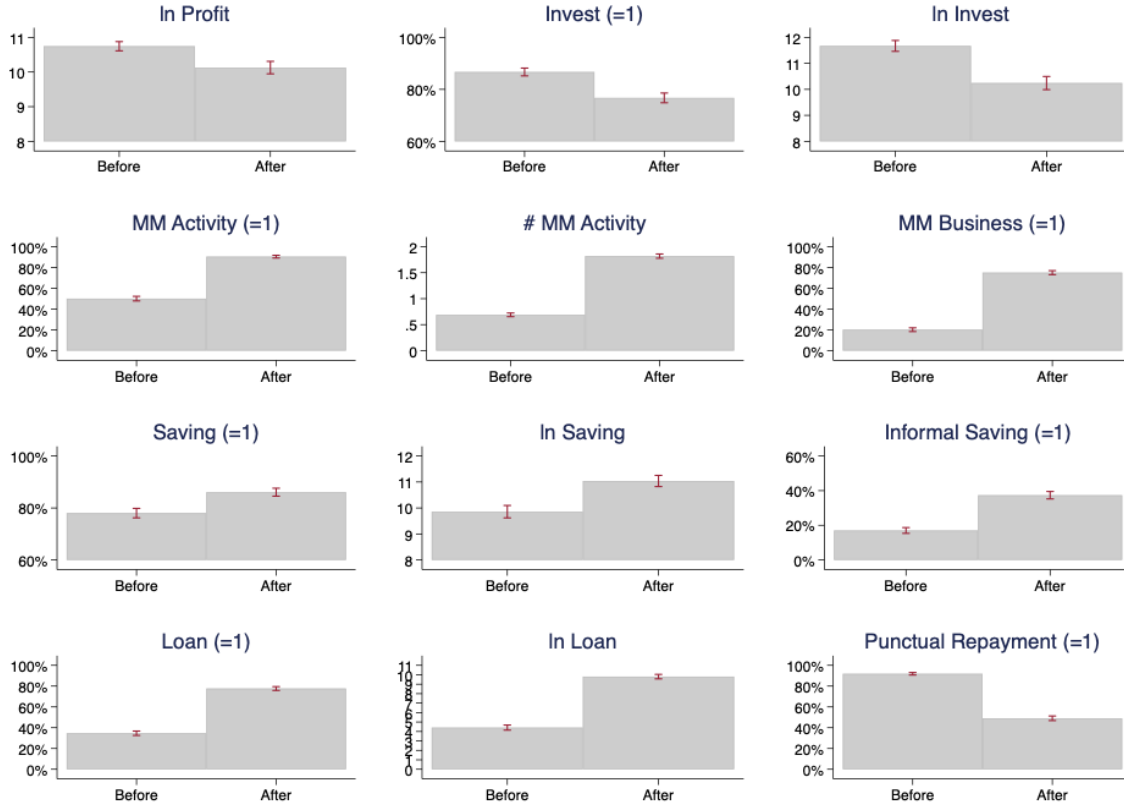
5. Trends and Impact on Micro-Entrepreneurs

5.1. Descriptive Findings

Descriptive figures, illustrating the considerable changes over time across financial outcomes and mobile money use are shown in Figure 4. First, regarding the business performance, we document that micro-entrepreneurs have smaller business profits and invest less compared to the pre-COVID period. Moreover, prior to the COVID-19 crisis, only about 50 percent of micro-entrepreneurs use mobile money actively. In late 2020 and early 2021, almost 90 percent of them are qualified as active mobile money users. Moreover, they are also more likely to use mobile money to transfer money to business partners than before. This could be driven by the temporary fee waivers in spring 2020, changes in awareness and preferences, and restrictions to physical mobility. The rise in mobile money use also speaks for risk sharing within social networks during an economic crisis. In addition, we observe that the micro-entrepreneurs are almost ten percentage points more likely to save and they increase their savings. However, the increase is mainly driven by the rise in informal savings. This implicates lower financial safety among the micro-entrepreneurs.

Despite the generally increasing savings, a sharp increase in individual debt is observed. After the COVID-19 crisis, almost 80 percent of the respondents have an outstanding loan. However, prior to the crisis, less than 40 percent of them have an existing loan. The average loan amount in Ugandan Shilling has increased by over 2.4 times. In addition, the probability of the micro-entrepreneurs being punctual with loan repayment decreases from 92 percent to only 49 percent.

Figure 4: Descriptive Changes of Financial Outcomes: Before and After the 2020 Lock-down



5.2. Main Results

As explained in Section 3, we use a dummy indicating whether the business sells essential products or services as an instrument to predict the length of business shutdown. In the second stage, we use the predicted length of shutdown to analyze the impact on their financial well-being and behavior.

We focus on the impact of business shutdown on the use of business performance, loans and transfers, savings, and mobile money. The results are set out in Tables 2, 3, 4, and 5, respectively.

In the first stages, we see that running an essential business at the baseline survey strongly predicts the length of business shutdown. On average, the essential businesses

are closed three weeks shorter than the non-essential businesses. This is congruent with the descriptives in Appendix Figure C.2. In addition, the F-statistic from the first stage estimation is larger than 40 across all regressions. This further proves that the instrument is not weak.

Surprisingly, we do not observe negative effects of a longer business shutdown on the business performance and household finance. On the contrary, most of the estimation results from the second stage appear to be positive. For example, when the business shutdown is extended by one week, in the medium term, the business would have 10.5 percent higher business profit (column (2), Table 2), 1.9 percentage point higher probability of keeping business record (column (5)) and 0.04 more workers (column (6)), suggesting tentative catch-up effects.

Regarding household finance, covering both loans and savings, the majority of the estimation show insignificant results (Tables 3 and 4). We find that when the business shutdown is extended by one week, in the longer run, the micro-entrepreneurs are 1.1 percentage points more likely to transfer money, and the money transfer amounts would be increased by 19.3 percent.

When it comes to the use of mobile money, we observe an increased use both at the extensive and intensive margins in Table 5. Specifically, the coefficient in column (1) suggests that one additional week of business shutdown would cause a 1.1 percentage point increase in the active use of mobile money. Moreover, the micro-entrepreneurs are more likely to having used mobile money for making payments, like paying suppliers, bills, and receiving customer payments.

These results indicate that whether the micro-entrepreneurs experience long or short closures does not contribute much to their generally worsened financial well-being. How-

Table 2: Effects of Shutdown due to COVID-19 on Business Outcomes

	Survival (=1)	ln Profit	Invest (=1)	ln Invest	Record (=1)	# Workers
	(1)	(2)	(3)	(4)	(5)	(6)
Length of Shutdown (Weeks)	0.002 (0.004)	0.105 (0.077)	0.001 (0.008)	0.078 (0.116)	0.019** (0.009)	0.037* (0.022)
<i>First-stage Results</i>						
Essential (=1)	-2.832*** (0.424)	-2.832*** (0.424)	-2.832*** (0.424)	-2.890*** (0.422)	-2.815*** (0.429)	-2.832*** (0.426)
F-statistic	44.65	44.65	44.65	46.97	43.10	44.26
Observations	1,975	1,975	1,975	1,975	1,975	1,975
R^2	-0.019	-0.050	0.015	-0.011	0.001	0.007

Note: The table shows regression results for six variables linked to business performance and behaviors. Controls for business fixed effects, and interview month-year dummies. Weighted by sampling weights and follow-up attrition probability. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Effects of Shutdown due to COVID-19 on Loans and Transfers

	Loan (=1)	ln Loan	Never Late (=1)	Profit Debt Ratio	Transfer (=1)	ln Transfer	Transfer Stolen (=1)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Length of Shutdown (Weeks)	-0.014* (0.008)	-0.129 (0.102)	0.017* (0.010)	-0.554 (0.511)	0.011* (0.006)	0.193** (0.086)	0.005 (0.008)
<i>First-stage Results</i>							
Essential (=1)	-2.836*** (0.423)	-2.834*** (0.423)	-2.850*** (0.427)	-2.832*** (0.424)	-2.834*** (0.422)	-2.834*** (0.422)	-2.822*** (0.423)
F-statistic	44.98	44.83	44.60	44.58	45.07	45.08	44.54
Observations	1,975	1,975	1,975	1,975	1,975	1,975	1,975
R^2	-0.065	-0.017	-0.062	-0.007	-0.015	-0.041	0.013

Note: The table shows regression results for six variables linked to loans and transfers. Controls for business fixed effects, and interview month-year dummies. Weighted by sampling weights and follow-up attrition probability. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Effects of Shutdown due to COVID-19 on Savings

	Saving (=1)	ln Saving	Formal (=1)	ln Formal	Informal (=1)	ln Informal	Savings Stolen (=1)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Length of Shutdown (Weeks)	-0.003 (0.007)	-0.050 (0.103)	0.014 (0.009)	0.165 (0.114)	-0.019** (0.009)	-0.208** (0.101)	-0.008 (0.008)
<i>First-stage Results</i>							
Essential (=1)	-2.836*** (0.423)	-2.831*** (0.423)	-2.818*** (0.418)	-2.817*** (0.417)	-2.830*** (0.428)	-2.828*** (0.430)	-2.838*** (0.423)
F-statistic	45.00	44.81	45.50	45.57	43.70	43.32	44.96
Observations	1,975	1,975	1,975	1,975	1,975	1,975	1,975
R ²	0.028	0.039	0.015	0.015	-0.058	-0.047	-0.016

Note: The table shows regression results for seven variables linked to savings. Controls for business fixed effects, and interview month-year dummies. Weighted by sampling weights and follow-up attrition probability. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Effects of Shutdown due to COVID-19 on Mobile Money Use

	MM Active (=1)	# MM Active	MM Transfer (=1)	ln MM Transfer	MM Pay (=1)	MM Business (=1)
	(1)	(2)	(3)	(4)	(5)	(6)
Length of Shutdown (Weeks)	0.011* (0.006)	0.028 (0.019)	0.005 (0.009)	0.092 (0.110)	0.016** (0.008)	0.013 (0.008)
<i>First-stage Results</i>						
Essential (=1)	-2.843*** (0.423)	-2.833*** (0.424)	-2.836*** (0.423)	-2.835*** (0.423)	-2.832*** (0.424)	-2.827*** (0.422)
F-statistic	45.11	44.66	44.89	44.85	44.65	44.81
Observations	1,975	1,975	1,975	1,975	1,975	1,975
R ²	0.007	0.057	0.043	0.047	-0.017	0.025

Note: The table shows regression results for six variables linked to mobile money services. Controls for business fixed effects, and interview month-year dummies. Weighted by sampling weights and follow-up attrition probability. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ever, we observe that when they experience a longer lockdown, they improve their business practices, for example, mobile money use for business purposes, and show tentative catch-up effects. We hypothesize the following reasons for these positive impacts of business shutdown. Firstly, when businesses remain closed for a long time, the micro-entrepreneurs may be in more severe financial situation. Thus, they rely more on their social network to get assistance through receiving mobile money transfers. Similar evidence has been found in [Jack et al. \(2013\)](#); [Jack and Suri \(2014\)](#). At a later point in time, they may return the borrowed money which could explain larger transfers overall. Secondly, a long business shutdown implies increased stress, which may trigger motivation to adopt better business practices, including, for example, more financial planning. We have observed in [Table 2](#) column (5) that a longer business shutdown is associated with a higher likelihood of micro-entrepreneurs keeping business records. Similarly, the willingness to adopt a new technology may change, explaining the on average higher mobile money adoption rates among those who closed their businesses longer due to COVID-19. In the longer run, this may pay off for them, as mobile money is causally linked to improved household welfare ([Suri and Jack, 2016](#)) and economic growth ([Fabregas and Yokossi, 2022](#)).

We check the robustness of the results by running the regressions without the control variables. The results are shown in [Table C.5-C.8](#) in the Appendix. We could observe very similar results compared to those in [Table 2-5](#).

6. Conclusion

So far, the attention of COVID-19 research in low income countries has been focused on documenting increased poverty and food insecurity. We provide unique evidence on the more persistent impact of COVID-19 on financial well-being and behaviors from a large

panel of micro-entrepreneurs in rural Uganda.

In this paper, we present two major contributions: one on the heterogeneity in non-compliance to lockdown regulations, and the other on the impact of the business shutdown on financial well-being and technology adoption.

Firstly, we find that only about 30 percent of the sampled non-essential businesses comply with their applicable minimum lockdown regulations. Several micro-entrepreneur and location characteristics correlate with the closure decision due to COVID-19. Most important for policy makers should be that service businesses (especially those with high contact intensity) were more likely to shut down. In addition, we find that micro-entrepreneurs more independent from mobility, extremely remote, and under financial pressure, on average comply less to their lockdown restrictions. These findings suggest that opportunity costs and information dissemination play important roles.

Secondly, we show that while COVID-19 appears to be a driver of innovation and business practices (boosting the use of mobile money and record-keeping practices), it generally worsens business performance in terms of profits, investments, and financial stress, as it causes higher debt levels for the micro-entrepreneurs, almost regardless of what decisions the micro-entrepreneur takes during the lockdown period.

The findings in this paper have several important policy implications. In these exceptional circumstances, micro-entrepreneurs have a higher need of financial services, especially mobile money services and loans. This suggests that governments in low income countries need to ensure that the corresponding costs are affordable even when demand increases. In Uganda, mobile money transfer fees were suspended temporarily and voluntarily by the main providers. This likely supported risk sharing among social networks and could be partially responsible for the higher usage rates today. By further

promoting the adoption of mobile financial services and ensuring consumer protection, specifically with regard to loans and repayment flexibility, governments in low income setting may improve general welfare.

As certain micro-entrepreneurs are more likely to shut down businesses during the pandemic, these should be targeted by aid programs by providing, for instance, subsidies for service businesses. Low compliance among certain groups underlines that policy makers need to give out special support and target information campaigns during a lockdown period to achieve higher levels of compliance.

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Appendix for “COVID-19 Lockdown Compliance,
Financial Stress, and Acceleration in Technology
Adoption in Rural Uganda”

Content:

[A](#): Context

[B](#): Variable Description

[C](#): Additional Results

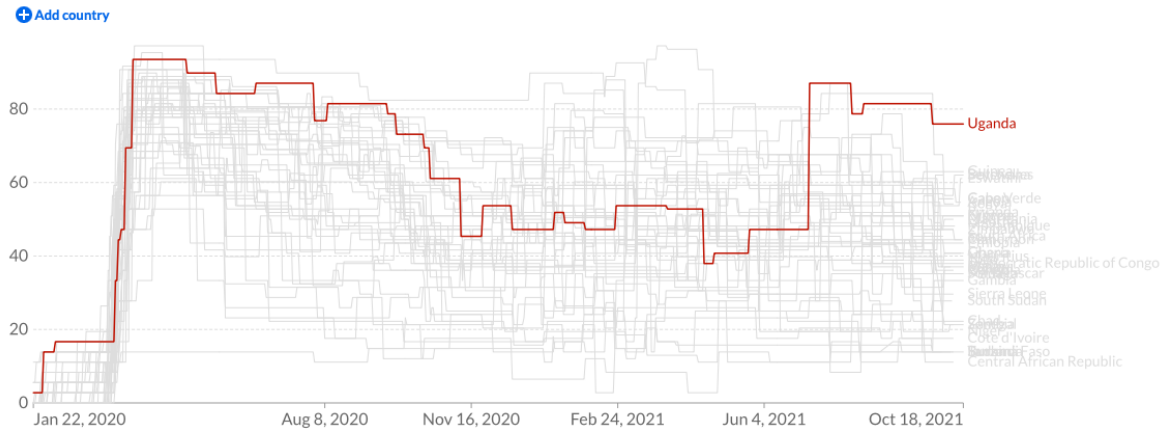
A. Context

Figure A.1: Stringency of COVID-19 Measures in Sub-Saharan Africa

COVID-19: Stringency Index

This is a composite measure based on nine response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 = strictest). If policies vary at the subnational level, the index is shown as the response level of the strictest sub-region.

Our World
in Data



Source: Oxford COVID-19 Government Response Tracker, Blavatnik School of Government, University of Oxford - Last updated 20 October 2021, 12:50 (London time)

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Note: This figure highlights the stringency of the COVID-19 policy response in Uganda against all available sub-Saharan African countries. Based on data published by Hale et al. (2021) and visualized by Our World in Data, <https://ourworldindata.org/grapher/covid-stringency-index> [Online; accessed 6-November-2021].

Table A.1: Main Reason for Business Closure during the Ugandan Lockdown

Not Allowed to Open due to Lockdown	58%
No Customers due to Lockdown	22%
No Stock Available due to Lockdown	7%
Unrelated to Lockdown: Making a Loss	7%
Seasonal Closure or Usually Closed in this Season	5%
Other	3%
Unrelated to Lockdown: Could Not Give it Time	0%
Unrelated to Lockdown: Did Not Have Required Expertise	0%
Total	100%

Note: Own visualization of the self-reported reasons for business shutdown in Mahmud and Riley (2021b) which are based on a phone survey conducted among 1,075 respondents from 12th to 23rd May 2020 in the Kagadi and Kyenjojo districts in Western Uganda.

B. Variable Description

Table B.1: Variables for Individual Characteristics

Variable	Type	Level	Description
Female	Binary	Individual	1 if respondent is female; 0 if male.
Age	Continuous	Individual	Age in years
Married	Binary	Individual	1 if respondent is married; 0 if not married.
Illiterate	Binary	Individual	1 if respondent neither able to read or write, or read only; 0 if able to read and write.
Years of Education	Continuous	Individual	Education in years
Previous Financial Education	Binary	Individual	1 if respondents reports to have received financial literacy training before baseline or participated in the intervention.
Financial Literacy (Std.)	Continuous	Individual	Number of correct financial literacy questions out of seven; standardized via item response theory.
Risk Tolerance (Std.)	Continuous	Individual	Likert scale item on “Are you generally a person who is fully prepared to take risks or do you try to avoid taking risk?” 0 if completely unwilling to take risks; 10 if fully prepared to take risk. Standardized z-score.
Able to Manage Money (1-4 Scale)	Continuous	Individual	Scale item on “If you get money, do you tend to spend it too quickly?”. [1=Often, 2=Sometimes, 3=Rarely, 4=Never]
Work Experience (Years)	Continuous	Individual	Number of years respondent has been working in any shop in general.
Bank Account	Binary	Individual	1 if respondent has an individual bank account at a commercial bank; 0 if not.
Survival	Binary	Individual	1 if respondent still runs a business during the follow-up survey, 0 if not.

Table B.2: Variables for Household Characteristics

Variable	Type	Level	Description
Household Size	Continuous	Household	Number of people in household including respondent. A household comprises all the people who normally live and eat meals together in a home.
Number of Children in Household	Continuous	Household	Number of children below the age of 18 in the household.
Household Consumption (US\$ PPP)	Continuous	Household	The value of all consumption within past four weeks. Includes food inside and outside the household, toiletries, water, rent, electricity, clothing, school fees, medical costs, leisure expenses, other necessities etc. [In US\$ PPP; top coded at 99%]
Number of Assets	Continuous	Household	Sum over a list of standard items owned by the household without live-stock.

Table B.3: Variables for Location Characteristics

Variable	Type	Level	Description
Network Quality (0-10 Scale)	Continuous	Individual	Scale item on “From a scale from 0 to 10, how do you rate the quality of the network coverage at your shop during the past 7 days? 0 means very bad, no communication (phone calls, sending/receiving SMS) possible and 10 means very good quality of network coverage”.
Remote Location	Binary	Location	1 if the trading center is not located along one of the paved main roads through the district; 0 if it is.
Distance to District Main Town (km)	Continuous	Location	Road distance from trading center to the center of the district main town, Fort Portal, in kilometers.
Mobile Money Agent Density	Continuous	Individual	Number of reported mobile money agents within a 15-min walking distance from the business.
Has to Take Boda to Nearest Mobile Money Agent	Binary	Individual	1 if respondents needs to take a boda or motor-vehicle to get to the nearest mobile money agent from the business; 0 if not.

Table B.4: Variables for Business Characteristics

Variable	Type	Level	Description
Trading License	Binary	Individual	1 if respondent has a trading license for any business, 0 if not.
Record-Keeping	Binary	Individual	Keeping a log or record of expenses and revenues for any businesses. [Yes/No]
Separate Personal	Binary	Individual	Keeping money separate for business and personal finances. [Yes/No]
Retail/ Wholesale Business	Binary	Individual	Main sector of business is retail or wholesale (e.g., retail of food, beverages, tobacco, motor vehicle parts, construction materials, clothes or shoes).
Services Business	Binary	Individual	Main sector of business is services (e.g., hair dressing and beauty, hotels, restaurants, bars, repair shops for motor vehicles).
Manufacturing Business	Binary	Individual	Main sector of business is manufacturing (e.g., food processing, metal products, furniture making).
Number of Workers	Continuous	Individual	Number of people regularly working in the shop (excl. respondent).
ln Profit	Continuous	Individual	Total profit of the business made in the last four weeks after paying all expenses. [In Ugandan Shilling; top coded at 99% and logarithmized]
Invest	Binary	Individual	Any money invested into the business during the past 12 months. Investments could be new equipment, restocking done on top of regular restocking, new furniture or signs for advertising but do not include regular expenditures for buying new supplies or stock.
ln Invest	Continuous	Individual	Amount of money invested in the business in total during the past 12 months. [In Ugandan Shilling; top coded at 99% and logarithmized]

Table B.5: Variables for Loans and Transfers

Variable	Type	Level	Description
Loan	Binary	Individual	Currently any loan outstanding with a family member or friend or moneylender, an ASCA, SACCO or a microfinance institution, a commercial bank or mobile money.
ln Loan	Continuous	Individual	Amount of money currently outstanding in total across aforementioned places. [In Ugandan Shilling; top coded at 99% and logarithmized]
Never Late	Binary	Individual	1 if respondent was late with the repayment of any loan in the past five years (<i>in follow-up</i> : in the past year); 0 if not.
Transfer	Binary	Individual	During the past three months, any money transferred to people living outside own village using personal travel, asking a friend or relative to travel there, giving money to the bus driver, a SACCO, ROSCA or microfinance institution, a commercial bank or a mobile money account. [Yes/No]
ln Transfer	Continuous	Individual	Amount of money transferred in total across aforementioned places over the past three months. [In Ugandan Shilling; top coded at 99% and logarithmized]
Transfer Stolen	Binary	Individual	1 if respondent reports that some or all of the money transferred in the past 12 months got stolen or lost; 0 if not.

Table B.6: Variables for Savings

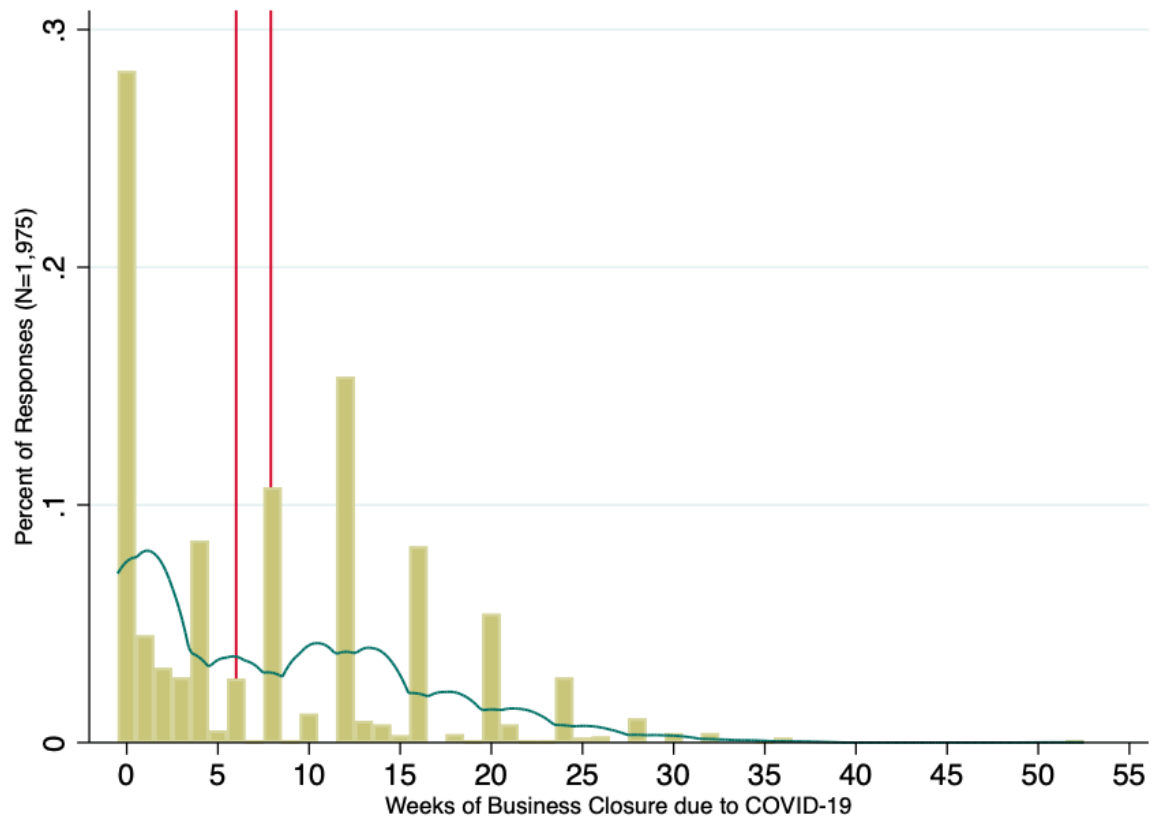
Variable	Type	Level	Description
Saving	Binary	Individual	Currently any money saved in informal places, in a SACCO or in a ROSCA, in a commercial bank account, or a mobile money account (for example MoKash). [Yes/No]
ln Saving	Continuous	Individual	Amount of money saved in total across aforementioned places at the moment. [In Ugandan Shilling; top coded at 99% and logarithmized]
Formal Saving	Binary	Individual	Currently any money saved in a commercial bank account.
ln Formal Saving	Continuous	Individual	Amount of money saved in a commercial bank account at the moment. [In Ugandan Shilling; top coded at 99% and logarithmized]
Informal Saving	Binary	Individual	Currently any money saved in informal places (for example somewhere at home, in the garden, in the pocket, or with a friend or relative).
ln Informal Saving	Continuous	Individual	Amount of money saved informally at the moment. [In Ugandan Shilling; top coded at 99% and logarithmized]
Savings Stolen	Binary	Individual	1 if the respondent reports that some or all the money saved in any of the aforementioned places in the past 12 months was stolen or lost; 0 if not.

Table B.7: Variables for Mobile Money Use

Variable	Type	Level	Description
Mobile Money Account	Binary	Individual	1 if respondent has a mobile money account; 0 if not.
Mobile Money Active	Binary	Individual	1 if respondent qualifies as an active mobile money user; 0 if not. We define active mobile money use via four conditions, out of which at least one must be fulfilled: current mobile money savings or loans; any mobile money transfers made in the past three months; or ever made mobile payments directed at other businesses.
Number of Mobile Money Active	Continuous	Individual	Number of different mobile money services used out of the aforementioned four conditions.
Mobile Money Transfer	Binary	Individual	Transferred money to people outside the respondent's village using a mobile money account during the past three months. [Yes/No]
ln Mobile Money Transfer	Continuous	Individual	Amount of money transferred using a mobile money account in total over the past three months. [In Ugandan Shilling; top coded at 99% and logarithmized]
Mobile Money Payment	Binary	Individual	Ever made a payment using the mobile phone. This means a payment to another business, supplier, employee or utility provider, for example with MTN MoMoPay or Airtel Money Pay. [Yes/No]
Mobile Money Business Use	Binary	Individual	Uses mobile money to pay for supplies (for example raw materials, items for resale), pay employees, utilities and/or allows customers to pay using mobile money. [Yes/No]

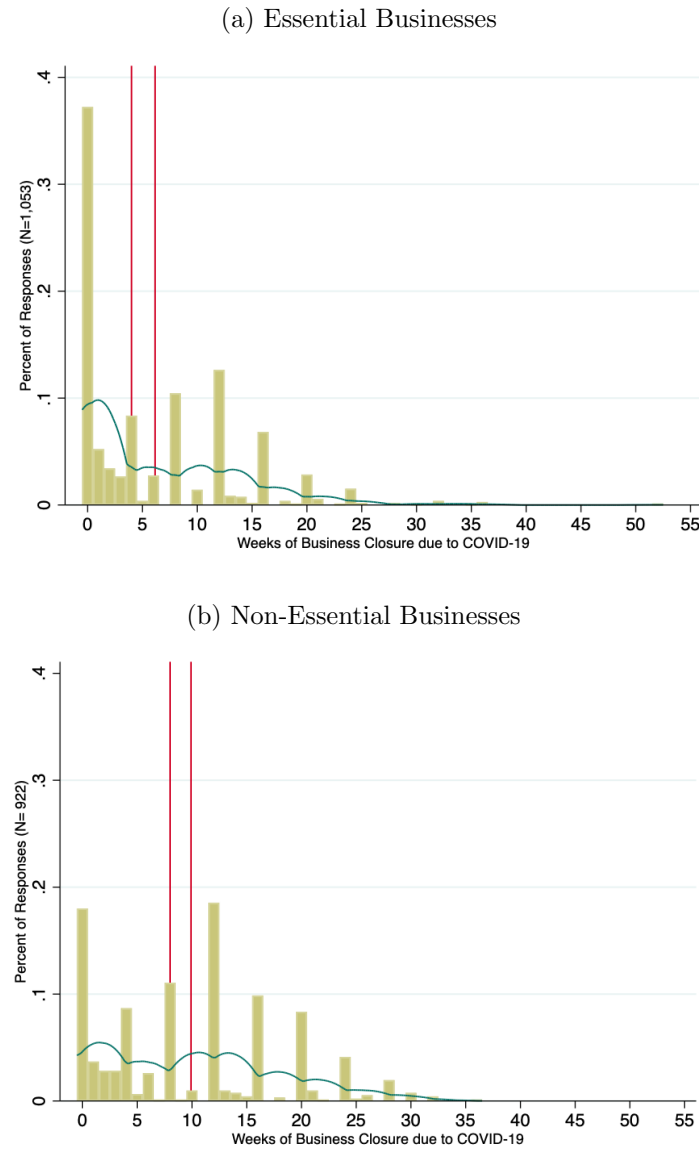
C. Additional Results

Figure C.1: Distribution of Business Shutdown due to COVID-19



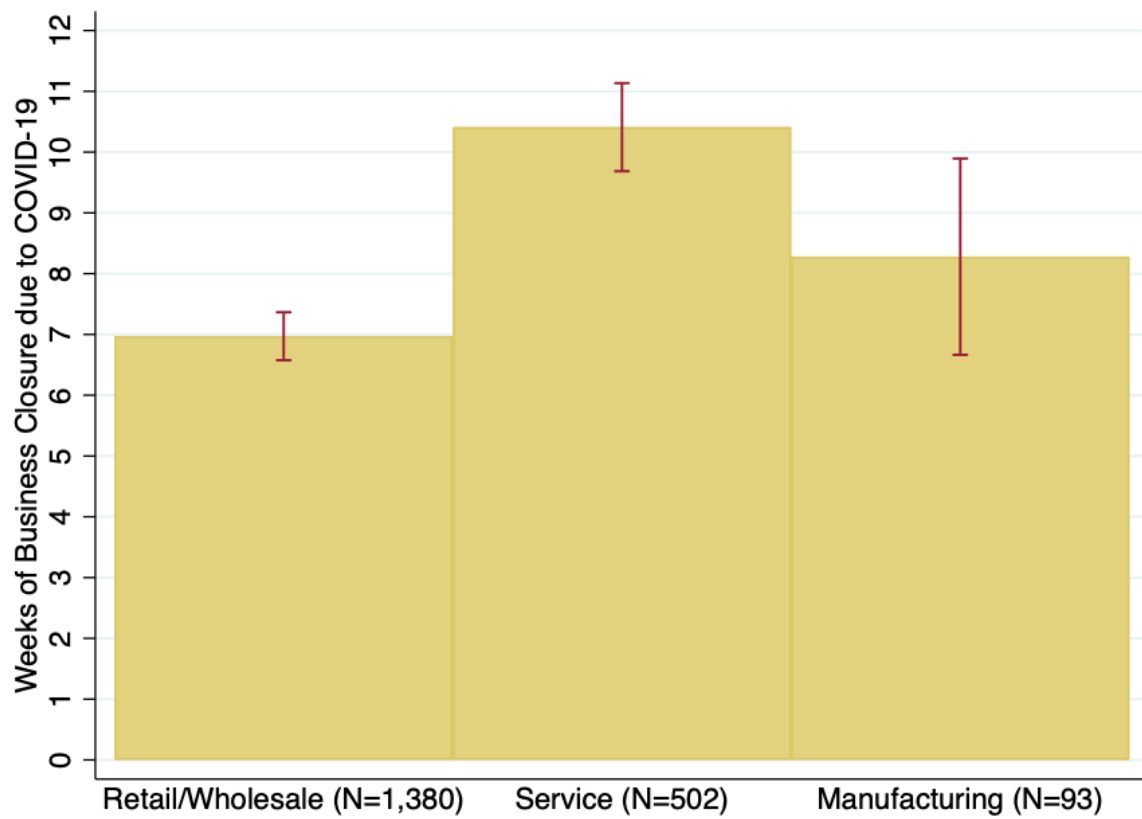
Note: The figure displays the distribution of business closure length in 2020 for 1,975 rural small business owners interviewed between 12th October 2020 and 22nd April 2021 in the Kabarole district in Western Uganda. The blue line indicates the Kernel density estimate. The red vertical lines show the median (=6) and the mean (=7.91) of the number of weeks a business closed due to COVID-19 restrictions in 2020.

Figure C.2: Distribution of Business Shutdown due to COVID-19 by Essentiality of Business Type



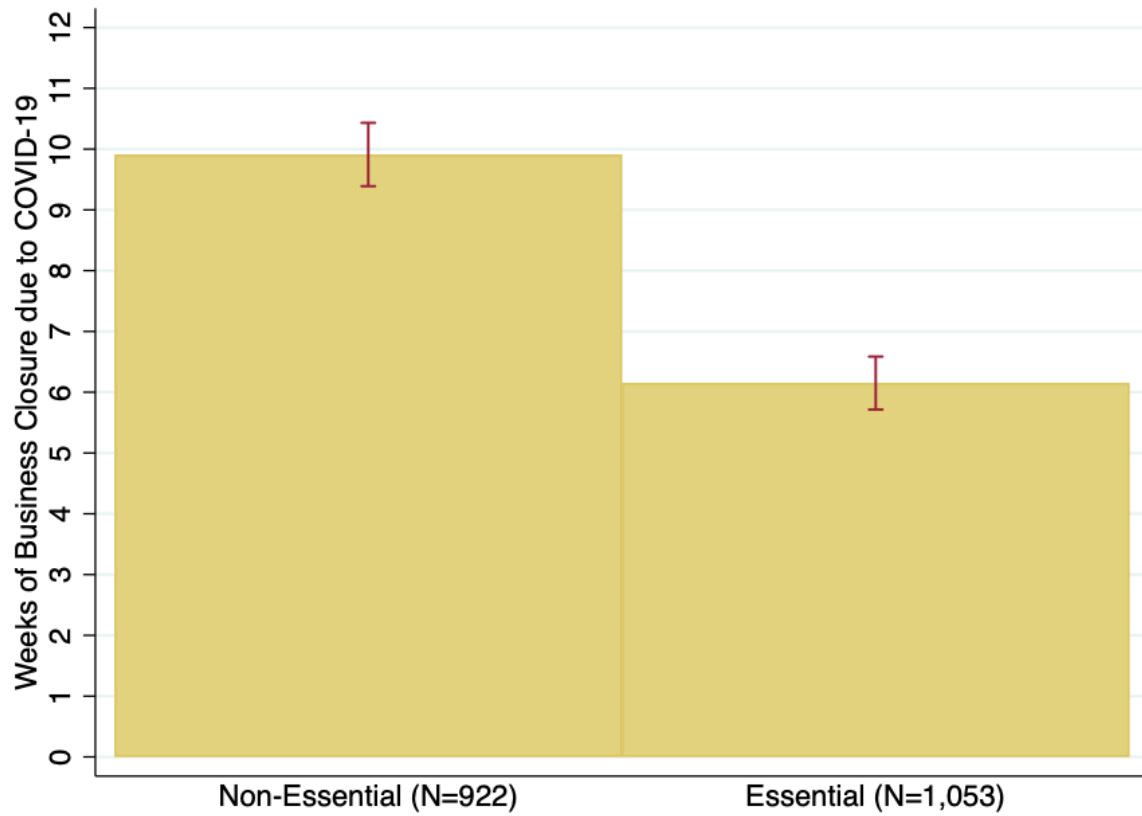
Note: The figure displays the distribution of business closure length by business type (essential versus non-essential) in 2020 for 1,975 rural small business owners interviewed between 12th October 2020 and 22nd April 2021 in the Kabarole district in Western Uganda. The blue line indicates the Kernel density estimate. The red vertical lines show the median (=4 and =8) and the mean (=6.15 and =9.91) of the number of weeks a business closed due to COVID-19 restrictions in 2020.

Figure C.3: Business Shutdown due to COVID-19 by Business Type



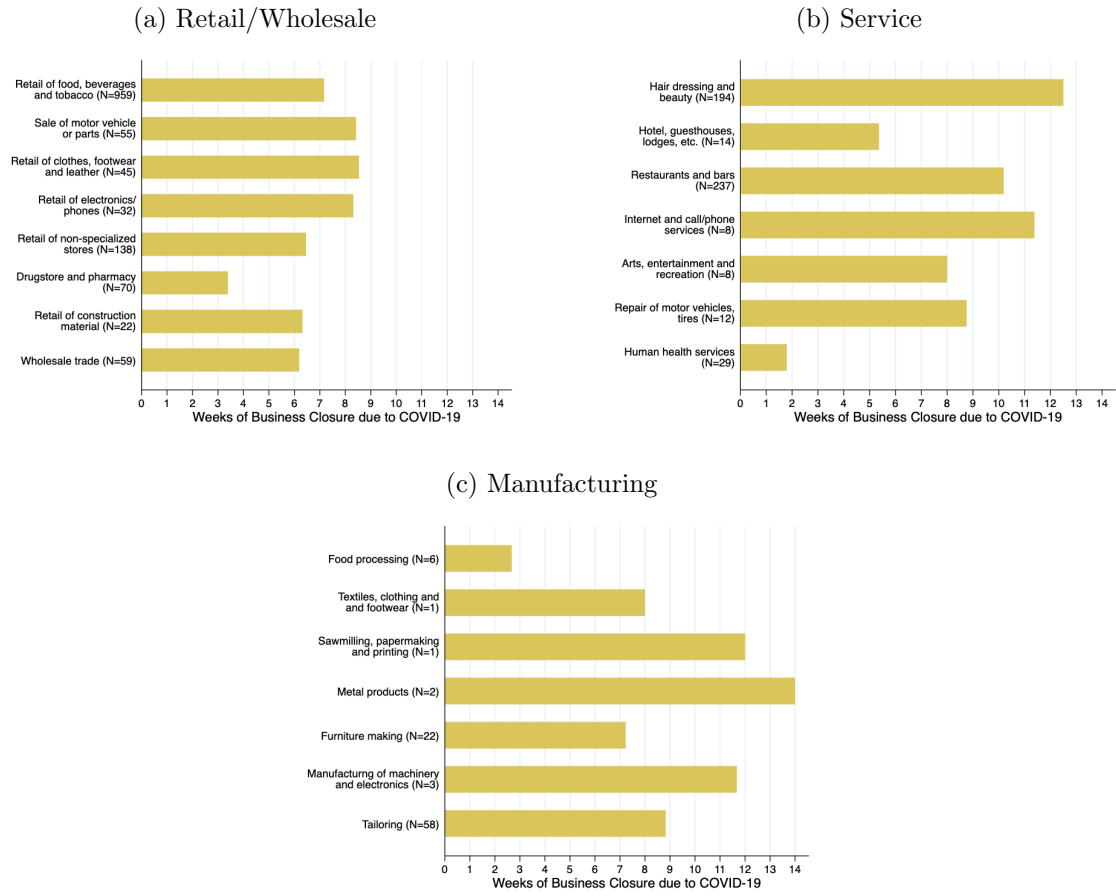
Note: The figure displays the average duration of reported business shutdown due to COVID-19 for retail/wholesale, service and manufacturing businesses.

Figure C.4: Business Shutdown due to COVID-19 by Essentiality of Business Type



Note: The figure displays the average duration of reported business shutdown due to COVID-19 for essential and non-essential businesses. Essential businesses include those selling food, medicine, key household and farming products, and providing health services.

Figure C.5: Business Shutdown due to COVID-19 by Disaggregated Business Type



Note: The figure displays the average duration of reported business shutdown due to COVID-19 for detailed business types.

Table C.1: Correlates of the Incidence of Business Shutdown due to COVID-19

	Any Closure (1)	Any Closure (2)	Any Closure (3)
Age	-0.002** (0.001)	-0.002* (0.001)	-0.002* (0.001)
Retail/Wholesale Business (=1)	-0.100* (0.051)	-0.105** (0.052)	-0.107** (0.050)
Services Business (=1)	0.009 (0.055)	0.007 (0.053)	0.007 (0.052)
Work Experience (Years)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)
Belongs to Majority Tribe	0.094*** (0.026)	0.083*** (0.025)	0.078*** (0.026)
Household Owns Livestock	-0.034* (0.019)	-0.036* (0.018)	-0.039** (0.018)
Owns Phone	0.090** (0.042)	0.079* (0.041)	0.079* (0.042)
Uses MM to Pay Suppliers	-0.104* (0.053)	-0.112* (0.057)	-0.117** (0.056)
Distance to Main Town in km	0.004*** (0.001)	0.004*** (0.001)	0.003*** (0.001)
ln Profit	-0.008** (0.003)	-0.010*** (0.003)	-0.009** (0.004)
Invest (=1)	0.057** (0.028)	0.056* (0.029)	0.064** (0.030)
Constant	0.700*** (0.101)	0.748*** (0.095)	0.745*** (0.093)
Observations	1,975	1,975	1,975
Inverse Sampling Weights	—	✓	✓
Inverse Attrition Weights	—	—	✓
R^2	0.045	0.046	0.047

Note: The table shows post-LASSO (OLS) regression results with the binary dependent variable being any reported business closure due to COVID-19 in 2020, clustering standard errors at the trading center-level in parentheses. Column (2) includes inverse sampling probability weights, and column (3) additional inverse weights to account for attrition. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table C.2: Correlates of the Length of Business Shutdown due to COVID-19

	# Weeks of Closure (1)	# Weeks of Closure (2)	# Weeks of Closure (3)
Illiterate (=1)	-1.779*** (0.525)	-1.593*** (0.535)	-1.783*** (0.546)
Years of Education	-0.166*** (0.043)	-0.150*** (0.045)	-0.170*** (0.044)
Retail/Wholesale Business (=1)	-1.450* (0.857)	-1.295 (0.854)	-1.349 (0.880)
Services Business (=1)	1.784* (0.931)	1.976** (0.897)	1.921** (0.929)
Work Experience (Years)	-0.055** (0.025)	-0.054** (0.026)	-0.059** (0.026)
Belongs to Majority Tribe	1.264*** (0.425)	1.142*** (0.432)	1.096** (0.434)
Has to Take Boda to Nearest MM Agent	-2.172*** (0.719)	-2.415*** (0.698)	-2.341*** (0.712)
Uses MM to Pay Suppliers	-1.512** (0.682)	-1.470** (0.729)	-1.613** (0.704)
Number of Owned Acres of Plots	-0.040*** (0.010)	-0.039*** (0.010)	-0.041*** (0.009)
ln Business Expenses	-0.065 (0.086)	-0.044 (0.088)	-0.031 (0.093)
ln Sales	-0.087 (0.132)	-0.182 (0.132)	-0.171 (0.138)
Number of Shops in TC	-0.004 (0.004)	-0.005 (0.004)	-0.005 (0.004)
ln Profit	-0.134** (0.067)	-0.154** (0.066)	-0.133** (0.066)
Constant	15.533*** (2.074)	16.646*** (1.989)	16.409*** (2.064)
Observations	1,975	1,975	1,975
Inverse Sampling Weights	—	✓	✓
Inverse Attrition Weights	—	—	✓
R^2	0.068	0.070	0.071

Note: The table shows post-LASSO (OLS) regression results with the dependent variable being the number of weeks of business closure (not dependent on any closure) due to COVID-19 in 2020, clustering standard errors at the trading center level in parentheses. Column (2) includes inverse sampling probability weights, and column (3) additional inverse weights to account for attrition. *** p<0.01, ** p<0.05, * p<0.1.

Table C.3: Correlates of Non-Compliance

	# Weeks of Non-Compliance (1)	# Weeks of Non-Compliance (2)	# Weeks of Non-Compliance (3)
Female (=1)	-0.642 (0.417)	-0.700* (0.413)	-0.662 (0.425)
Years of Education	0.116** (0.052)	0.113** (0.051)	0.109** (0.052)
Retail/Wholesale Business (=1)	-1.675*** (0.440)	-1.549*** (0.448)	-1.733*** (0.455)
Work Experience (Years)	0.074** (0.033)	0.069** (0.033)	0.066** (0.032)
Belongs to Majority Tribe	-0.894* (0.528)	-0.839 (0.533)	-0.841 (0.534)
Number of Children in HH	-0.305* (0.154)	-0.314* (0.159)	-0.309** (0.155)
Floor material: Bricks	-2.962*** (0.681)	-2.907*** (0.671)	-2.996*** (0.729)
Number of Owned Plots	-0.285 (0.211)	-0.302 (0.222)	-0.282 (0.214)
Household Owns Livestock	1.610*** (0.466)	1.655*** (0.458)	1.747*** (0.448)
Number of Livestock Owned	-0.011** (0.005)	-0.010* (0.005)	-0.010* (0.005)
Share Temptation in Consumption (0-1 Scale)	3.079 (4.038)	3.275 (3.780)	3.078 (3.798)
Receives Interest on Savings	-0.874* (0.470)	-0.756 (0.477)	-0.830* (0.480)
Has Loan for Emergency	2.105** (0.897)	2.139** (0.887)	2.171** (0.874)
Paid Any Upfront Loan Fees	-1.091 (0.833)	-1.084 (0.892)	-1.095 (0.894)
Rejected for Loans (0-4 Scale)	0.409 (0.474)	0.328 (0.477)	0.430 (0.481)
Interested in Finance (1-3 Scale)	0.681 (0.438)	0.726* (0.427)	0.747* (0.437)
Has to Take Boda to Nearest MM Agent	2.232*** (0.806)	2.526*** (0.893)	2.546*** (0.832)
Uses MM to Pay Suppliers	2.979*** (1.135)	2.722** (1.127)	2.561** (1.129)
Uses MM to Get Paid by Customers	1.454 (1.544)	1.668 (1.622)	1.701 (1.686)
Share Customers paying with MM	3.643 (4.351)	2.839 (4.338)	3.849 (4.335)
Able to Manage Money (1-4 Scale)	-0.563** (0.274)	-0.490* (0.274)	-0.490* (0.277)
Risk Tolerance (0-10 Scale)	0.164** (0.078)	0.167** (0.082)	0.174** (0.083)
Would Invest in Lottery (0-100,000 UGX)	0.000*** (0.000)	0.000** (0.000)	0.000** (0.000)
Number of Other Jobs	-0.786** (0.379)	-0.829** (0.398)	-0.811** (0.389)
Number of MM Agent Visits	0.035 (0.028)	0.035 (0.029)	0.037 (0.029)
Spends on Any Temptation Goods	0.840 (0.725)	0.819 (0.703)	0.892 (0.716)
Number of Shops in TC	0.008*** (0.002)	0.008*** (0.002)	0.008*** (0.002)
ln Profit	0.107 (0.098)	0.156 (0.104)	0.133 (0.095)
Invest (=1)	-1.568** (0.664)	-1.617** (0.719)	-1.624** (0.703)
Transfer (=1)	0.937** (0.466)	0.961** (0.462)	1.087** (0.466)
Non-Response: Profit	-1.668 (1.817)	-0.852 (1.765)	-0.945 (1.716)
Non-Response: Investments	-3.945* (2.024)	-4.980** (2.042)	-5.402*** (2.030)
Constant	-5.798*** (2.096)	-6.825*** (2.151)	-6.632*** (2.103)
Observations	1,975	1,975	1,975
Inverse Sampling Weights	—	✓	✓
Inverse Attrition Weights	—	—	—
R ²	0.089	0.090	0.094

Note: The table shows post-LASSO (OLS) regression results with the dependent variable being the number of weeks non-compliant with business type specific business closure due to COVID-19 regulations in 2020, clustering standard errors at the trading center level in parentheses. Column (2) includes inverse sampling probability weights, and column (3) additional inverse weights to account for attrition. *** p<0.01, ** p<0.05, * p<0.1.

Table C.4: Compliance among Non-Essential Businesses by Baseline Outcomes

	Complier	Non-Complier	
	Mean	Mean	Diff.
	(Std. Dev.)	(Std. Dev.)	(p-values)
ln Profit	10.741	10.907	-0.166
	(2.874)	(2.928)	(0.428)
Invest (=1)	0.902	0.859	0.042*
	(0.298)	(0.348)	(0.078)
ln Investment	12.020	11.692	0.328
	(4.144)	(4.904)	(0.331)
Record (=1)	0.193	0.241	-0.048
	(0.395)	(0.428)	(0.109)
# Workers	0.425	0.437	-0.012
	(0.697)	(0.788)	(0.828)
MM Active (=1)	0.476	0.543	-0.066*
	(0.500)	(0.499)	(0.066)
# MM Active	0.665	0.747	-0.081
	(0.804)	(0.801)	(0.161)
MM Transfer (=1)	0.258	0.328	-0.069**
	(0.438)	(0.470)	(0.036)
ln MM Transfer	2.891	3.725	-0.833**
	(4.955)	(5.399)	(0.028)
MM Payments (=1)	0.284	0.326	-0.042
	(0.452)	(0.469)	(0.204)
MM Business (=1)	0.215	0.226	-0.011
	(0.411)	(0.418)	(0.711)
Transfer (=1)	0.458	0.468	-0.010
	(0.499)	(0.499)	(0.778)
ln Transfer	5.054	5.344	-0.291
	(5.582)	(5.781)	(0.481)
Any Transfer Stolen (=1)	0.044	0.032	0.011
	(0.205)	(0.177)	(0.404)
Saving (=1)	0.844	0.781	0.063**
	(0.364)	(0.414)	(0.029)
ln Saving	10.543	9.953	0.590
	(4.731)	(5.453)	(0.119)
Formal (=1)	0.153	0.164	-0.011
	(0.360)	(0.370)	(0.675)
ln Formal	2.066	2.199	-0.133
	(4.893)	(5.038)	(0.712)
Informal (=1)	0.200	0.187	0.013
	(0.401)	(0.390)	(0.647)
ln Informal	2.197	2.180	0.016
	(4.481)	(4.579)	(0.960)
Savings Stolen (=1)	0.040	0.053	-0.013
	(0.196)	(0.223)	(0.419)
Loan (=1)	0.313	0.354	-0.041
	(0.464)	(0.479)	(0.228)
ln Loan	3.868	4.558	-0.690
	(5.799)	(6.211)	(0.116)
Never Late (=1)	0.916	0.920	-0.003
	(0.277)	(0.272)	(0.868)
Debt Burden Proxy	1.798	3.970	-2.171
	(5.261)	(29.646)	(0.228)
Observations	275	647	922

Note: The table shows mean differences in baseline outcomes by compliance for non-essential businesses during the Covid-19 lockdown. Compliers are those who report to close at least as many weeks as obliged to under the lockdown regulations for their business type, i.e. either five or 16 weeks. Non-compliers are those who close less. *** p<0.01, ** p<0.05, * p<0.1.

Table C.5: Effects of Shutdown due to COVID-19 on Business Outcomes - No Controls

	Survival (=1)	ln Profit	Invest (=1)	ln Invest	Record (=1)	# Workers
	(1)	(2)	(3)	(4)	(5)	(6)
Length of Shutdown (Weeks)	0.003 (0.003)	0.089* (0.049)	0.005 (0.005)	0.083 (0.072)	0.012** (0.006)	0.047*** (0.016)
Observations	1,975	1,975	1,975	1,975	1,975	1,975
R^2	-0.042	-0.062	-0.030	-0.040	-0.010	-0.037

Note: The table shows regression results for six variables linked to business performance and behaviors. Controls for business fixed effects, and interview month-year dummies. Weighted by sampling weights and follow-up attrition probability. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table C.6: Effects of Shutdown due to COVID-19 on Loans and Transfers - No Controls

	Loan (=1)	ln Loan	Never Late (=1)	Profit Debt Ratio	Transfer (=1)	ln Transfer	Transfer Stolen (=1)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Length of Shutdown (Weeks)	-0.007 (0.005)	-0.063 (0.069)	0.007 (0.006)	-0.417 (0.411)	0.008* (0.004)	0.114** (0.057)	0.006 (0.004)
Observations	1,975	1,975	1,975	1,975	1,975	1,975	1,975
R^2	-0.018	-0.000	-0.018	-0.009	-0.025	-0.030	0.007

Note: The table shows regression results for seven variables linked to loans and transfers. Controls for business fixed effects, and interview month-year dummies. Weighted by sampling weights and follow-up attrition probability. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table C.7: Effects of Shutdown due to COVID-19 on Savings - No Controls

	Saving (=1)	ln Saving	Formal (=1)	ln Formal	Informal (=1)	ln Informal	Savings Stolen (=1)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Length of Shutdown (Weeks)	0.001 (0.004)	-0.008 (0.061)	0.003 (0.006)	0.026 (0.072)	-0.005 (0.006)	-0.055 (0.065)	-0.002 (0.005)
Observations	1,975	1,975	1,975	1,975	1,975	1,975	1,975
R^2	0.011	0.020	0.044	0.042	-0.008	-0.006	-0.004

Note: The table shows regression results for seven variables linked to savings. Controls for business fixed effects, and interview month-year dummies. Weighted by sampling weights and follow-up attrition probability. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C.8: Effects of Shutdown due to COVID-19 on Mobile Money Use - No Controls

	MM Active (=1)	# MM Active	MM Transfer (=1)	ln MM Transfer	MM Pay (=1)	MM Business (=1)
	(1)	(2)	(3)	(4)	(5)	(6)
Length of Shutdown (Weeks)	0.009** (0.004)	0.025** (0.012)	0.004 (0.006)	0.060 (0.074)	0.015*** (0.005)	0.012** (0.005)
Observations	1,975	1,975	1,975	1,975	1,975	1,975
R^2	-0.018	-0.012	0.004	0.002	-0.057	-0.024

Note: The table shows regression results for six variables linked to mobile money services. Controls for business fixed effects, and interview month-year dummies. Weighted by sampling weights and follow-up attrition probability. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.