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Adapting to an aggregate shock: The impact of the Covid-19 crisis on rural households

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Abstract

We examine the response of rural Ugandan households to a large aggregate shock, the Covid-19 pandemic, during and one year after the first lockdown in March 2020. Using 6 rounds of phone surveys from 558 households in western Uganda, we find that household income recovery from the lockdown differs by whether households had a business pre-pandemic. After an initial sharp fall, the incomes of those without a business have recovered to pre-pandemic levels. However, the relatively better-off households with a business before the pandemic still have one-third lower income, due to sustained closure of businesses even after the end of the first lockdown restrictions. Additionally, business-owning households have 30% lower wealth one-year into the pandemic, driven by 44% lower assets, 45% drop in savings, and a 15 fold increase in net-borrowing, suggesting long-term damage. Our findings point to the need to support households who face dwindling finances to fall back on.

JEL classification I32 · O12 · O15 · Q12

Keywords Aggregate shock · COVID-19 · Sub-Saharan Africa · Household welfare

1 Introduction

The Covid-19 pandemic, and the resulting Government-imposed lockdowns across the world, caused profound disruption to people's economic livelihoods. Even in countries which experienced relatively few cases of Covid-19, the disruption from

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stringent lockdowns on markets and livelihoods has had significant economic costs for the poorest, in both rural and urban areas (Aggarwal et al., 2020; Davis, 2021; Egger et al., 2021; Kansiime et al., 2021; Mahmud & Riley, 2021; Miguel & Mushfiq, 2021).

In the immediate aftermath of an aggregate shock, households have different possible coping strategies: They could liquidate assets to compensate for the shortfall in income and smooth consumption, compromise on consumption to keep expenditures low and protect assets, or borrow money (Dercon, 2002; Fallon & Lucas, 2002; Zimmerman & Carter, 2003). With time, they can also adapt by shifting toward income generating activities that are not as adversely affected by the shock. We use the case of the Covid-19 pandemic to understand the coping strategies employed over the short and medium term by different types of rural households to a severe aggregate shock. All households were badly hit at the start of the pandemic, but household ability to cope and adapt will depend on their source of income pre-pandemic and how badly these are affected.

To examine the impact of the pandemic on households, we use unique data from a panel of 558 households in rural Uganda surveyed in person in March 2020, just before the lockdown began, monthly by phone from May - September 2020 and again by a phone survey in March 2021, one year after the start of the pandemic.[1] This data provides us with high frequency measures of the impact of the lockdown during its peak stringency and as it started to be relaxed, as well as 6 months after the end of most lockdown restrictions in Uganda, allowing us to look at the short-term and medium-term impacts of this shock. Uganda experienced one of the strictest lockdowns in the world from the end of March 2020, with police enforced closures of all businesses and curfews, and only relaxed fully the economic restrictions in late July 2020, despite low cases of Covid-19, allowing us to focus on the impact of the lockdown separately from direct health effects or death from Covid-19.[2]

The Covid-19 lockdown in Uganda prohibited most non-farm business activities for four months, an enormous shock to business owners' livelihoods, while farming activities were never prohibited.[3] We therefore focus on non-farm business ownership pre-pandemic as an important expected dimension of heterogeneity in the impact of the pandemic. In our setting, business owners, who comprised 19% of our sample pre-pandemic, were the relatively better-off households: Before the pandemic they had three times higher income and twice as large non-land assets as non-business households.[4] The

[1] We were able to survey in March 2021 81% of the 689 households that were surveyed before the start of the pandemic in March 2020. We focus all analysis on the panel of 558 households surveyed in March 2021.

[2] Uganda had only 5,000 cumulative cases of Covid-19 by September 2020 and 40,000 cumulative cases by March 2021. Uganda's cumulative cases per 100,000 at the end of September 2020 were 170/100,000. In contract, in India they were 4,600, and in the USA 21,700. In March 2021 Uganda had 857/100,000 compared to 8000/100,000 in India and 86,380/100,000 in the USA (Ritchie et al., 2020)

[3] In our sample, business owners get over half of their income from their business. Non-business owners get almost all their income from their own farming or casual wage labour on other's farms. While it is still likely farming activities experienced some disruption from the lockdown, they were never prohibited in the same way as non-farm business activities were.

[4] Land ownership in our setting is ubiquitous, unlike in other contexts, such as in Bangladesh where it is a crucial dimension along which household income is different (Bandiera et al., 2017).

most common types of non-farm businesses were retail (40%) or meal, snack or drink production (30%). As well as operating businesses, they also generally carried out farming activities. Note though that despite being relatively better-off than non-business owning households, they are still extremely poor in absolute terms, with 42% of business owning households below the World Bank Poverty line.

Households who owned a business before the pandemic were hit significantly more badly by the Covid-19 lockdown than non-business owners, and are still experiencing severe financial repercussions one year later. After being forced to close for months, owners have struggled to restart their businesses. Even though businesses had been allowed to reopen for over 6 months, 50% of the businesses operating in March 2020 continued to be closed in March 2021. The continued closure of these businesses is consistent with household's deteriorated financial position preventing re-purchase of inventory or assets which had been sold off.[5]

In March '21, one year into the Covid-19 pandemic, the monthly household income of business owners is significantly lower by US$ 80 PPP, a drop of 40% on their pre-pandemic income of US$ 200. The income of non-business owners is not significantly different in March '21 as compared to March'20. During the lockdown from May to August 2020, both households with a business and those without a business saw sizeable decline in incomes, of 75% and 58% respectively. Both types of households saw declining crop incomes, and a sharp and persistent drop in casual wage income. While the income of households without a business subsequently recovered completely by March '21, that of households with a business did not.

How did non-business owning households recover? Both business and non-business owning households significantly increase labour supplied toward farm activities which, when combined with favourable climate conditions (FEWS-NET, 2021b), resulted in households having higher crop yields in March 2021 and being 20 percentage points more likely to sell crops to the market, raising farm income. For non-business owning households, this increase in farm income compensates for the loss in casual labour income. For business-owning households, higher incomes from farming are unable to fully compensate for the large loss in business income.

Business owners have experienced enormous declines in their wealth since the start of the pandemic: a decline of 30% on the March '20 total non-land wealth. Their assets are 44% lower, their savings are 45% lower and their net borrowing has risen an astonishing 15 times (from $11 to $175) over the one year period since the start of lockdowns in Uganda. The sale of assets, use of savings and borrowing have been needed by households to cover persistent income losses during the period of enforced business closure during the lockdown. Non-business owners have not been so badly affected: non-business household's wealth is not significantly different in March 2021 as compared to March 2020, though their assets are 18% lower and their net borrowing has doubled (from $44 to $99). This raises concerns about the ability of business-owning household to recover from the pandemic and cope with future shocks. The draw-down of their wealth could also explain why they are not able to

[5] We do not measure the fixed assets or inventory value of businesses in our surveys but given the large debt the households have accumulated and the decline in savings, we can hypothesises that lack of monetary resources is a major reason for these businesses not re-starting. Households may also be concerned about depressed demand and risk of future lockdowns.

move into other income generating opportunities or re-start their businesses, and points to the potential for poverty traps limiting households' ability to recover.

We likewise see significantly larger declines in expenditure for business owning households as compared to those households that didn't own a business before the pandemic, driven by declines in food expenditure, as well as a general shift in the composition of food expenditure towards cheaper, staple foods.[6] Consistent with the financial deterioration, households that owned a business before the pandemic report a significantly larger drop in satisfaction with their quality of life (0.83 points lower on a pre-pandemic mean of 5.3) one year into the pandemic, while that of non-business-owning households is not significantly different.

We consider two potential confounders to our findings: not knowing the usual intra-year fluctuations in our outcome measures and selective attrition. We use a combination of data from the Ugandan National Panel 2015 survey and our own survey questions on the cause of changes in outcomes to argue that our findings are not consistent with usual intra-year fluctuations. Additionally, we focus on the impact of the pandemic one-year later, allowing us to examine key economic and welfare metrics at the same point in the agricultural cycle. We also confirm that our results are robust to re-weighting to account for the potential for selective attrition, and note importantly that business ownership does not predict attrition.

Our paper contributes to the literature on how households recover from an unprecedented aggregate shock, linking to a broader literature on post shock recovery (Del Ninno et al., 2003; Fallon & Lucas, 2002; McKenzie, 2003; Thomas & Frankenberg, 2007). We are able to trace the effect on the households through the Covid-19 lockdown and a year after the first lockdown, allowing us to understand in detail how households respond in both the short and medium term. While a number of papers document severe impacts of the pandemic on households in developing countries from April-October 2020 (Aggarwal et al., 2020; Bau et al., 2021; Egger et al., 2021; Furbush et al., 2020; Josephson et al., 2020; Kansiime et al., 2021; Mahmud & Riley, 2021), we also look at how things have changed exactly one year after the pandemic started, 6 months after the lockdown ended in Uganda. To the best of our knowledge, this is the first paper to examine how households adapt to the pandemic over a one year period.

Our data from just before the pandemic allows us to examine in detail subgroups who are still experiencing severe impacts of the lockdown. This speaks to the literature on who experiences the worst negative effects from an aggregate shock (Glewwe & Hall, 1998). We highlight the vulnerability of entrepreneurs in particular to lockdown related restrictions (BRAC, 2020; Brooks et al., 2020), and show that entrepreneurs are still struggling even six months after restrictions have been relaxed. This limits their investment potential and ability to respond to subsequent shocks (Carter & Lybbert, 2012).

The rest of the paper is organised as follows: Section 2 describes the setting and background and section 3 the data. The estimation strategy is outlined in Section 4. Section 5 reports results on the adjustment of different types of households to the pandemic after one year. Section 7 concludes.

[6] Campos-Vazquez and Esquivel (2021) argue that mobility restrictions have larger negative impacts on consumption in developing countries, and since Uganda had such strict restrictions, our finding of a large negative impact on consumption for both business and non-business owning households is consistent with this.

2 Setting and background

2.1 Study location

Our study setting is rural Western Uganda, specifically Kagadi and Kyenjojo districts. The exact location of our study villages and households are shown in Appendix Fig. A2.

The villages in our sample were chosen in conjunction with the local government as particularly disadvantaged, defined as the majority of the households living on less than $2 a day, with the village having poor transport links and limited services such as wells, health clinics or schools. These villages were selected as part of a village-clustered randomised control trial of an anti-poverty programme run by the NGO Raising the Village. In this paper, we focus on a sub-sample of the villages in that RCT where households were baselined in March 2020 and later assigned to be in the control group of the RCT.[7] This sample includes 62 villages.[8] Within each village, 12 households were randomly selected to be surveyed and be part of the study sample.

2.2 Covid-19 in Uganda

Uganda has had one of the strictest lockdowns in the world since the end of March 2020, with all public transport, markets, businesses, schools and places of worship reported being closed, curfews and restrictions on public and private transport, across the country (Hale et al., 2020). These restrictions were strictly enforced by police, including in rural areas. To verify this, we conducted phone surveys with the village elder at the same time as the household surveys and asked about restrictions and closures. The restrictions reported to us by the village elder match what is reported nationally and confirm that restrictions were strictly enforced even in remote, rural areas.[9] Respondents would also report restrictions in their activities during the phone surveys that match the national restrictions. Restrictions first began to be slowly relaxed from the end of May 2020, with businesses not able to fully re-open until late July 2020, 4-months into the lockdown. A timeline of restrictions and reopening activities is shown in Table 1, along with our survey round dates.

Covid-19 cases in Uganda remained extremely low throughout the period of study in this paper, and any cases mainly occurred in the cities. The first death from Covid-19 in Uganda was not reported until July 23rd 2020. Cases only began to grow from

[7] Randomisation was done at the end of June 2020 and the intervention began in the treatment villages in October 2020. While it is only the March 2021 survey wave which occurred after the intervention had started in treatment villages, we show results throughout only in the control group for ease of comparison.

[8] This sample is a subsample of that used in Mahmud and Riley (2021). It consists only of those households assigned to the control group of the RCT. The control and treatment group are very well-balanced at baseline in March'20 and the immediate impacts in May'20 were similar in the two groups.

[9] In particular, the village elders confirmed that during May and June 2020 there were police outside the village preventing people moving around, that you could not access markets in nearby towns, that transport was unavailable and, in all but one village, that the village market and businesses were closed. Half of village leaders reported transport restrictions and police presence were relaxed from July, and all reported a relaxation of these restrictions by September. Leaders continued to report it was difficult to access nearby markets until September 2020. Village leaders confirmed that schools were closed continuously until September 2021. Places of worship were closed continuously until August 2020, and we see that half had reopened in September 2020.

Table 1 Timeline of lockdown, reopening and key events

Date	Event
March 18th 2020:	March'20 survey round start date
March 17th:	Large gatherings suspended. Quarantine for arriving foreigners
March 20th:	Schools close
March 21st:	First case of Covid-19 in Uganda. Boarders closed
March 25th:	All transport suspended. All Businesses closed.
March 30th:	Curfew from 19:00-06.30.
May 4th:	Facemasks mandatory in public.
May 6th:	100 cases of Covid-19 in Uganda
May 25th:	May survey round start date
May 26th:	Essential shops and restaurants reopen, private transport allowed
June 4th:	Public transport resumes
June 9th:	1,000 cases of covid-19 in Uganda
June 12th:	June survey round start date
July 1st:	July survey round start date
July 22nd:	Non-essential business reopened, curfew shortened to 21:00-05:30
July 23rd:	First death reported in Uganda from Covid-19
July 27th:	Motorcycle transport resumes
July 28th:	August survey round start date
September 14th:	September survey round start date
September 15th:	5,000 cases of covid-19 in Uganda
September 20th:	Borders reopen
October 15th:	Schools reopened for children in candidate (final year) classes only[a]
March 1st 2021:	Schools reopen for children in semi-candidate classes[b]
March 15th:	March '21 survey round start date

[a]these are year groups primary 7, senior 4 and senior 6

[b]these are primary 6, senior 3 and senior 5

late August 2020, reaching 240 cases a day on 24th September, with a second spike in December 2020, reaching 700 cases a day on 13th December. At the time of our study, hospitals had never been over burdened by Covid-19 cases.[10] Cumulative deaths, a potentially more accurate measure of Covid-19 prevalence in the case of limited testing, were 75 on the 30th September 2020, and 335 on the 30th March 2021. Excess deaths likewise suggest a low burden from Covid-19 in Uganda during our study period: between March 2020 and March 2021, mean cumulative excess

[10] Uganda experienced a steep climb in cases, hospitalisations and deaths from the end of May 2021, after this study takes place.

deaths were 2,963, with a 95% confidence interval of -14,160 to 4,981 (Wang et al., 2022), suggesting no evidence of excess deaths from Covid-19.

The impacts studied in this paper are therefore primarily the result of the lockdown imposed to stop the spread of Covid-19, rather than as a direct result of illness or death after catching Covid-19.[11]

3 Data

This study sample consists of 689 households, surveyed in person between 17th and 24th March 2020, before the full lockdown in Uganda started. The baseline survey and all subsequent surveys took place with either the household head or their spouse.[12] We followed up with these households on the phone six times: in May, June, July, August, September 2020 and in March 2021.[13] We were able to survey 558 households a year later by phone in March 2021, an 81% follow-up rate.[14,15] All analysis in this study is restricted to households surveyed in the March 2021 round.[16]

The primary reason for attrition is that the phone was switched off; there were only 9 refusals. There were no monetary incentives provided to the respondents. We check whether characteristics of the households measured at baseline predict attrition (Appendix Table A1). We find that the no individual characteristic predicts attrition and the characteristics jointly do not predict attrition (F stat 0.97, p-value 0.48). Importantly, we do not see selective attrition by whether the household owned a business at baseline.

The in-person baseline survey in March'20 and the subsequent phone follow-up survey were developed using standard validated questions on households income, expenditures, and wealth. The surveys were carried out by staff of the NGO, Raising the Village (RTV), as part of a baseline for an evaluation of their anti-poverty programme. There therefore could be concerns that the respondents are overstating poverty in the hope of getting help from the NGO. We do not think this is likely to be a problem for this analysis for three reasons. One, RTV used the same enumerator teams to do all survey rounds, including the baseline, so if this is an issue, it would be

[11] We asked households if either a member of their household or anyone they knew in their village had been sick with suspected Covid-19. In March 2021, 90% of people said no one in their village had ever had Covid-19. Only 5 households said they thought someone in their household had ever had Covid-19. We also asked about whether any member of the household had had a dry cough, a good indicator of Covid-19 for the variant at the time. Only 2% of households report that a member had a dry cough across all survey rounds.

[12] In 9 cases the survey took place with someone else, almost always as the head was ill.

[13] The immediate impact of the lockdown measured in an early Mary 2020 round of survey are reported in Mahmud and Riley (2021). We do not include this early May'20 round of survey in this paper.

[14] We discuss the potential for selective attrition to bias our findings in Section 6.

[15] Our followup rate is higher than the proportion of households who owned a mobile phone as usually even households without their own phone had access to shared one with another household. We asked for this shared phone number even if a household didn't have a phone of their own.

[16] The follow-up rates between May and September 2020 were higher than in March 2021 so we have high proportion of the 558 households surveyed in March 2021 in all rounds: 499 surveyed in May'20, 503 in June'20, 503 in July'20, 515 in August'20, and 505 in Sept'20.

present in all rounds and hence not affect analysis looking at changes in these measures. Second, the enumerators introduced themselves as conducting survey work and clearly told respondents that the survey responses would not be used to determine eligibility for any assistance. Third, we actually find income levels have returned, on average, to pre-pandemic levels by March 2021 (Appendix Table A4). Our results show a change in the composition of income, which does not seem consistent with respondents trying to make their income seem lower than it really is. Fourth, we find consistent results across different outcomes, which respondents would be less likely to think it beneficial to misreport in, such as labour supply. However, we cannot rule out completely that respondents thought at particular survey rounds that understating their income might result in them being given assistance, or that business owners might be differentially likely to under-report.

All nominal values are reported at the World Bank 2018 Purchasing Power Parity (PPP) conversion factor for private expenditure for Uganda: 1 USD =1,223.25 Ugandan Shilling. We also deflate the March 2021 round monetary variables at the annual rate of inflation in Uganda of 4.1%. We winsorise the top 1% of all monetary values.

3.1 Household profiles

Literature on sub-Saharan Africa has focused on financial access and savings constraints as impeding household ownership of non-farm activities that may require lumpy assets, creating a distinction between business-owning households and those focused on agriculture only (Barrett et al., 2001; Dercon, 1998). We consider these two types of households: those that owned a non-farm business and those that did not before the onset of the pandemic, in March 2020. In our sample, 19% of households owned a non-farm business.[17] Consistent with the literature, business owning households are relatively better-off than non-business owning households, as seen in Table 2.[18]

29% of the heads of business owning households at baseline had some secondary education, as opposed to only 16% of the heads of non-business owning households. Business-owning households are less likely to be headed by a woman and are slightly larger. Business owners have $106 PPP higher expenditures per month and own twice the value of assets as non-business owners. However, they are equally likely to own land and their land is of relatively similar value, highlighting the importance of farming to both types of household.

Total income in business owning households was $209 PPP a month, compared to only $65 PPP in non-business owning households, with the difference entirely driven by business profits. For business owning households, one-third of the total household labour was devoted to the enterprise before the pandemic, and about half of the days to the farm. On the other hand, non business owning households, devoted about 73% of total household labour supply to the farm. Interestingly, business owning households have similar levels of crop and labour income as non-business-owning

[17] In terms of the types of businesses households operate: 15% of businesses are grocery stores, 22% other types of retail stores, 11% restaurants, 10% involved in brewing, 10% food stands, 7% in building and construction and 5% tailors.

[18] The summary statistics for the sample used for analysis in this paper that were surveyed in March 2021 are in Appendix Table A3.

Table 2 Summary Statistics by business ownership (Full baseline sample)

	(1)		(2)		(3)			
	All		Business		No business			
	Mean	S.D.	Mean	S.D.	Mean	S.D.	(3) - (2)	*p*-value
Panel A: Household Characteristics								
Female head dummy	0.27	0.45	0.17	0.38	0.30	0.46	0.12**	(0.00)
HH head has no educ	0.20	0.40	0.07	0.26	0.22	0.42	0.15***	(0.00)
HH head has any primary educ	0.62	0.49	0.64	0.48	0.61	0.49	–0.02	(0.62)
HH head has any secondary educ	0.19	0.39	0.29	0.46	0.16	0.37	–0.13**	(0.00)
Household size	5.12	2.48	5.55	2.15	5.02	2.54	–0.53*	(0.02)
Has mobile dummy	0.69	0.46	0.91	0.29	0.65	0.48	–0.26***	(0.00)
Risk taking 0–10	5.14	2.58	6.13	2.38	4.92	2.57	–1.21***	(0.00)
Patience 0–10	5.05	2.54	5.61	2.44	4.92	2.54	–0.69**	(0.00)
Panel B: Consumption and Assets								
Total Expenditure	237.96	187.62	324.83	230.60	218.33	170.68	–106.51***	(0.00)
Expenditure per adult equivalent	80.36	62.92	101.64	69.01	75.55	60.49	–26.09***	(0.00)
Food Expenditure	147.81	135.43	200.63	160.00	135.87	126.37	–64.76***	(0.00)
Any hungry days	0.29	0.46	0.26	0.44	0.30	0.46	0.04	(0.33)
Total Wealth exc Land	824.13	1249.87	1327.53	1413.55	710.37	1181.82	–617.16***	(0.00)
Assets	474.25	683.55	803.11	969.31	399.93	576.17	–403.17***	(0.00)
Livestock	285.50	785.40	312.66	662.57	279.36	810.98	–33.30	(0.62)
Savings	103.04	234.54	228.95	325.40	74.59	198.20	–154.36***	(0.00)
Net borrowing	38.66	215.97	17.19	326.08	43.51	182.19	26.32	(0.38)
Own land dummy	0.90	0.30	0.91	0.28	0.90	0.30	–0.01	(0.64)
Land value	4724.11	7267.66	5194.76	8068.86	4617.76	7077.55	–577.00	(0.46)
Panel C: Income								
Total Income	91.72	144.01	208.77	239.08	65.27	93.78	–143.50***	(0.00)
Crop sales	40.16	67.43	45.93	79.47	38.86	64.41	–7.07	(0.35)
Livestock sales	2.62	9.69	4.15	11.45	2.28	9.23	–1.88	(0.09)
Enterprise profit	25.32	96.26	137.38	187.29	0.00	0.00	–137.38***	(0.00)
Labour income	27.41	70.13	28.07	81.73	27.26	67.32	–0.81	(0.92)
Net transfers	−2.22	8.77	−4.71	10.92	−1.66	8.12	3.05**	(0.00)
Rental income	0.97	5.21	1.97	7.61	0.74	4.47	–1.23	(0.08)
Panel D: Labour Supply								
Total labour supply	37.23	28.29	52.07	34.00	33.88	25.70	–18.19***	(0.00)
Farm labour supply	24.46	19.63	23.33	22.06	24.72	19.05	1.38	(0.51)
Livestock labour supply	5.17	10.58	7.05	12.00	4.75	10.20	–2.30*	(0.05)
Casual labour supply	3.37	7.20	2.02	5.54	3.67	7.49	1.65**	(0.01)
Salaried labour supply	0.95	4.86	1.83	7.15	0.75	4.15	–1.09	(0.10)
Enterprise labour supply	3.29	9.18	17.83	14.08	0.00	0.00	–17.83***	(0.00)
Panel E: Poverty levels								
WB poverty line income	0.87	0.34	0.68	0.47	0.91	0.28	0.23***	(0.00)
WB poverty line expenditure	0.56	0.50	0.42	0.50	0.59	0.49	0.17***	(0.00)
Number of households	689		127		562		689	

Note: All statistics are reported from the pre-pandemic March 2020 in-person survey. Business refers to households which had a non-farm business in March 2020. The variables are described in the Table A2. WB poverty line if the proportion of households that are categorised as "poor" according to the World Bank global poverty line of $1.90 per person per day in 2011 PPP. All nominal values are reported at the World Bank 2018 Purchasing Power Parity (PPP) conversion factor for private expenditure for Uganda: 1 USD =1,223.25 Ugandan Shilling

households, highlighting the diversity of labour activities that households carryout. In March 2020, 65% of business owning households income came from their business, 25% came from farming and 10% from wage labour. For non-business

owning households, 60% of their income came from farming and 40% from wage labour, predominantly casual labour on other's farms.

42% of business owning households were classified as poor according to the world bank expenditure measure, compared to 59% of non-business owning households, highlighting that while business-owning households are relatively richer, they are still very poor on average. Consistent with both theoretical and empirical literature, business owners are more risk taking and more patient (Stewart & Roth, 2001; Vereshchagina & Hopenhayn, 2009).

4 Estimation strategy

We estimate the following equation to study the effect of the Covid-19 pandemic over time on business and non-business owning households:

$$Y_{it} = \beta_0 + \sum_{i=1}^{6} \theta_i Followup_i + \sum_{i=1}^{6} \gamma_i Followup_i X_i + \alpha_i + \varepsilon_{it} \quad (1)$$

where Y_{it} is the outcome variable of interest and i and t index households and the survey round respectively. *Followup*_1 is an indicator variable equal to 1 for May, *Followup*_2 for June, *Followup*_3 for July, *Followup*_4 for August, *Followup*_5 for September 2020 and *Followup*_6 for March 2021 surveys, and 0 for March 2020. X_i is a dummy variable this is one for business owning households in March 2020 and zero otherwise. α_i refers to the household fixed effects. The coefficients of interest are θ_i which identify the effect of the Covid-19 pandemic for non-business owning households at follow-up rounds as compared to the baseline survey in March 2020 before the lockdown and γ_i which identify the differential impact of the Covid-19 pandemic for business owning households at followup rounds compared to non-business owning households. All standard errors are clustered at the village level.

5 One year later: How have households responded to the Covid-19 pandemic?

One year after the start of the first lockdown in Uganda, non-business owners' incomes are back to their pre-pandemic level while that of business owners has not recovered.[19] Households that had a business at baseline have incomes $80 PPP lower than before the pandemic, a 40% drop on their baseline income of $200 a month (Fig. 1). This is however a recovery from their lowest income of only $50 (75% drop from baseline) for most of May-Sept 2020. Households that did not have a business at baseline have $9 higher incomes in March 2021 than March 2020, from a baseline

[19] All outcomes examined in this paper were pre-registered with EGAP on 20th May 2020. The pre-analysis plan is available here: https://drive.google.com/file/d/1jgzY4u8_O2UE19OMZgZkY7pmXoR-oRMX/view?usp=sharing. We also pre-registered that we would use k-means clustering to examine heterogeneous effects. It was through the k-means clustering that business-owners appeared as a distinct group that was particularly badly affected by the pandemic. However, we did not pre-specified that we would look at business ownership as a heterogeneity dimension.

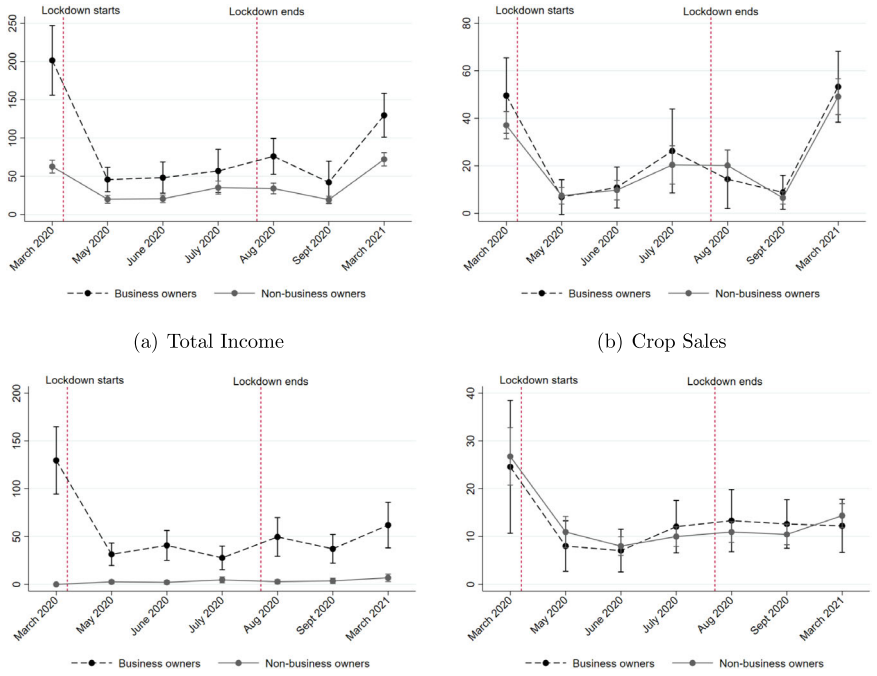


Fig. 1 Impact of the lockdown on business and non-business owners: Income (US$ PPP). Note: The figure shows the mean value by whether the household had a business or not at baseline for the outcome variable for each survey round with bars displaying the 95% confidence intervals. **a** is total income, which is the sum of earnings from crop sales, livestock produce sales, business profits, wages,rental income and transfers received (**b**) is the value of crop sales (**c**) is business profits and (**d**) is wage income. Lockdown starts refers to 25th March 2020 when all transport was suspended and businesses closed and lockdown end refers to July, 22nd 2020 when all non-essential businesses were allowed to re-open. Details on the lockdown timeline are in Table 1. Total number of observations: 3,641; Total number of households March '21: 558. A table version of this figure can be found in Appendix Table A5

value of $62 a month, though their income also fell by on average 58% during May-Sept 2020. The income fall for business owners was consistently significantly larger than for non-business owners (Appendix Table A5). The gap in income between business and non-business owning households has also declined significantly: While at baseline the incomes of business owners were three times higher than that of non-business owners, one year later the incomes of business owners are $130 a month, compared to $70 for non-business owners, or slightly under double.

Looking at the components of income, we can see that the entire differential drop in income for business owners is coming from loss of business profits, which made up a third of business owning household's income at baseline. Between 25th March 2020 and 22nd July 2020 nearly all businesses were closed. We see some recovery in business income after July 2020, but the average profits is still less than half the pre-pandemic level in March 2021. Over half of the enterprises that were operating in March'20 are still shut in March 2021, though respondents hope to re-open two-thirds of these businesses. Of those shut, 84% cite the Covid-19 pandemic as the primary reason for the

business closure in May 2021, falling to 36% of businesses shut in March 2021.[20] Beyond the pandemic, the most common reason cited for the business being closed is that it was making a loss, which could also be indirectly affected by the pandemic.[21] In terms of recovery from the lockdown, non-business owning households have increased their income shares from crop sales by 32%[22] and started some new enterprises, making up for the continued suppression of wage income from casual labour supply. Households that owned a business at baseline have not made-up for the shortfall in business income through increasing incomes in other areas. This could be because there are limited other opportunities available for income generation or alternatively because of the magnitude of the loss they had to compensate for. These households already had sizeable cropping income pre-pandemic - as large as what the non-business owners now have in March 2021 - perhaps limiting the potential to expand farming further. Incidentally, a need to diversify and mitigate against shocks to certain occupations could explain why even the business owners continued to maintain cropping activities rather than focus exclusively on their enterprises. Additionally, as we will see, business-owning-households experienced a large negative shock to their wealth, which may have made it difficult for them to restart their businesses after the lockdown was relaxed or invest in other activities.

Similar patterns of results are seen when looking at labour supply, with total days worked of business owning households down 12 days as compared to non-business owning households in March 2021 (Appendix Table A6). This is entirely driven by a decline in labour to businesses. However, the labour supply of all households has increased overall by 7 days in March 2021, driven by increased labour supply to the farm. As such, business owning households see a net decline in labour supply of 5 days. It seems that they are unable to fully make up for the reduction in labour devoted to their business by expanding labour in other activities.

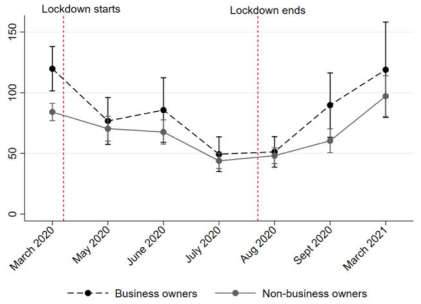
Expenditure also falls significantly more for business owners than non-business owners, though from a higher starting value at baseline, and remain depressed one-year after the start of the pandemic (Fig. 2; Appendix Table A7). Accompanying this decline in expenditure on food, we see a decline in prices of staple foods[23] and a shift in the composition of spending from high cost foods like meat and vegetables to low cost foods like staples and pulses. This could suggest households are getting equivalent amounts of calories for lower expenditure, though potentially at a cost of nutrition. As would be

[20] A small number of new businesses have opened post-pandemic: 17 in May'20, 7 in June'20, 2 in July'20, 4 in August'20, 5 in September'20 and 17 more by March 2021.

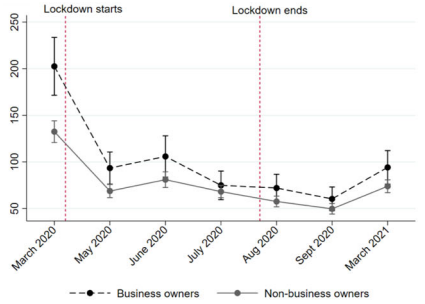
[21] The death rate of microenterprises in developing countries is generally high, with McKenzie and Paffhausen (2019) finding over 20% of Ugandan microenterprises have closed within a year.

[22] Uganda has two cropping seasons: in the study region, one season lasts approximately from February to August and the other from September to January. The increase in total crop sales income has been possible despite prices being lower than pre-pandemic due to household producing higher crops yields and selling the extra yield in both seasons since the start of the pandemic. The proportion of households who planted anything has not changed post-pandemic, but there is a nearly 20 percentage points increase in the proportion who sold crops (up from 67% to 88% of the households). Climate conditions during 2020 were also favourable to crops, with harvests being average during the July 2020 harvest and above average in January 2021 (FEWS-NET, 2020, 2021a, b).

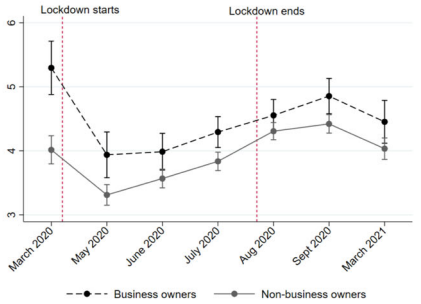
[23] For commonly consumed food items such as beans, maize flour, matoke, salt, sugar, and cooking oil, if the household reported purchasing it in the last 7 days, we asked them for the price they purchased it at. This allowed us to construct a measure for average price of staple foods.



(a) Non-food Expenditures



(b) Food expenditures



(c) Life satisfaction

Fig. 2 Impact of the lockdown on business and non-business owners: Expenditures (US$ PPP). Note: The figure shows the mean value by whether the household had a business or not at baseline for the outcome variable for each survey round with bars displaying the 95% confidence intervals. **a** Non-food expenditures are the spending on on personal (non-food non durable) goods, education, rent, and health scaled to 30 days. **b** Food expenditures is the value of food consumed in the last 7 days within and outside the household, whether purchased or produced, scaled to 30 days. Life satisfaction is reported satisfaction with quality of life on a scale of 1 to 10. The analysis for (**c**) life satisfaction only includes data from households where the respondent surveyed at the baseline and follow ups is the same person. Lockdown starts refers to 25th March 2020 when all transport was suspended and businesses closed and lockdown end refers to July, 22nd 2020 when all non-essential businesses were allowed to re-open. Details on the lockdown timeline are in Table 1. For (**a**) and (**b**), total number of observations: 3,641; Total number of households March '21: 558. For (**c**), total number of observations: 2,752 ; Total number of households March '21: 399. A table version of figures (**a**), (**b**) and (**c**) can be found in Appendix Table A7

expected given the dramatic deterioration in household financial situation, life satisfaction was consistently worse during the lockdown and is still significantly lower by 0.83 points on a 10 point scale for households which had businesses at baseline as compared to those that didn't (Fig. 2; Appendix Table A7). We do not see any change in life satisfaction for households who did not have a business at baseline one year into the pandemic, though they also experienced declines during the early months of the lockdown.

Turning to wealth in Fig. 3, we see that business owning households have experienced a 30% decline in non-land wealth. This is in part due to an extremely large decline in assets of $350, a 44% fall from their baseline mean of $800 PPP. Physical asset values has declined due to sale of high value assets such as furniture, electrical items and bicycles/motorbikes. Bicycles/motorbikes owned by the household are often used for business activities or for transporting crops, and so their loss

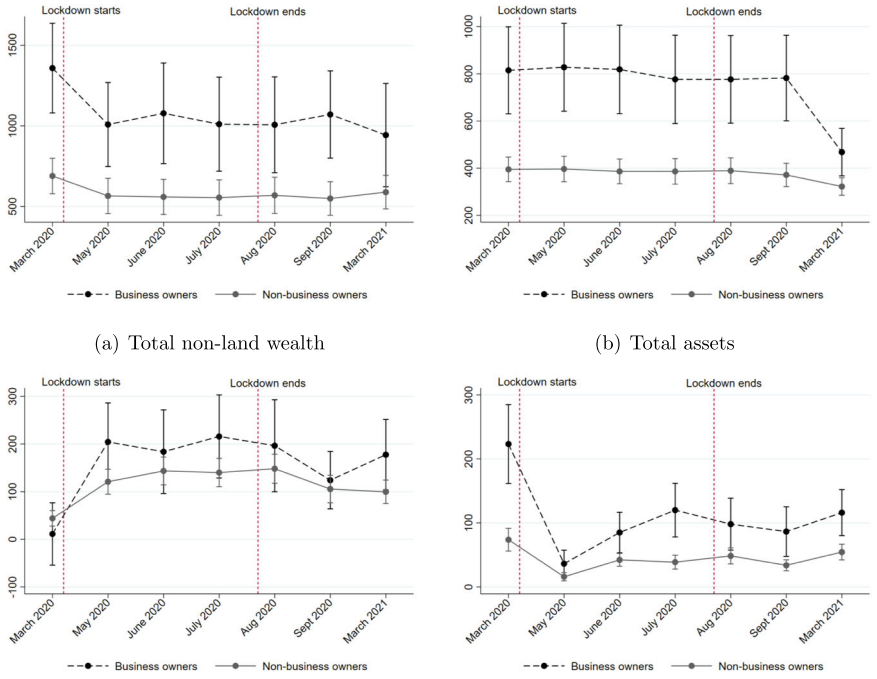


Fig. 3 Impact of the lockdown on business and non-business owners: Wealth (US$ PPP). Note: The figure shows the mean value by whether the household had a business or not at baseline for the outcome variable for each survey round with bars displaying the 95% confidence intervals. **a** Total wealth is the total value of physical assets, livestock, and savings, minus net borrowing. It does not include land. **b** Total assets include the value of both productive and non-productive assets that the household owns. **c** Net borrowing is money lent minus loans. **d** Savings is all money saved excluding as assets, land or livestock. Lockdown starts refers to 25th March 2020 when all transport was suspended and businesses closed and lockdown end refers to July, 22nd 2020 when all non-essential businesses were allowed to re-open. Details on the lockdown timeline are in Table 1. Total number of observations: 3,641; Total number of households March '21: 558. A table version of this figure can be found in Appendix Table A8

will have a negative impact on the household's general productive capacity. The other major asset the households hold are livestock. We do not find any evidence for households selling livestock to cope with the pandemic.[24]

Business owning households also see a $100 fall in savings from $223 (45% fall) and a $165 increase in net borrowing from $11 before the pandemic (15 times higher). Overall, their total non-land wealth is 30% lower compared to a year ago (Appendix Table A8). These are extremely large and devastating declines in household's financial situation. The negative impact on wealth for business owners is significantly worse than for non-business owners: non-business owners total wealth and savings are not significantly different one year after the start of the pandemic, though their assets are $72 (18%) lower and net borrowing $55 (125%) higher (Appendix Table A8).

[24] Livestock value reported in March 2021 is in fact (insignificantly) higher than in March 2020 (Appendix Table A8), but this is due to an increase in the reported price of these livestock. We do not see a change in holdings of livestock since the baseline.

For both business owning and non-business owning households, the fall in assets only appears in March 2021. On the other hand, both savings and net borrowing immediately deteriorate in May 2020. While it is difficult to determine exactly why assets only decline a year into the pandemic, it is possible that households delayed selling assets as long as possible, using savings and borrowing instead. We see evidence in support of this in the self-reported reasons for drawing down on savings and taking more loans, with 20% of households reporting taking a loan primarily to avoid having to sell assets. Additionally, it may have been difficult to sell assets during the lockdown period from end March to end July 2020, since all markets other than for food were shut. As such, selling assets may not have become possible until August 2020, and might not have occurred frequently enough by September 2020 for us to pick this up in the survey.

It is clear that business owning households have made up for their large declines in income by selling down liquid and illiquid sources of wealth and increasing debt substantially. This huge decline in their financial position could also explain why they were not able to restart their enterprises, even a year later, and why they do not expand their farming activities. The impact of this for their financial position going forward is extremely concerning.

6 Identification threats

The identification of the effect of the Covid-19 pandemic in the one-year period since the lockdown was first imposed is threatened by usual fluctuations in the economic variables we examine due to seasonality. This is particularly likely to be a concern amongst agricultural households of the sort we study here. While potentially a concern for the intra-year analysis, it's important to note that we focus in this paper on household outcomes in the same month – March – pre and post pandemic in 2020 and 2021, which cannot be threatened by intra-year seasonality.

To help quantify the usual intra-year fluctuations in the outcomes, we use the Uganda National Panel Survey (UNPS) 2015-2016 to understand what the patterns of key outcomes are over the year. We analyse key outcomes available in the UNPS dataset that closely match ours: average consumption expenditures, labour supply and earnings in the last 7 days for the same months as the surveys done for this study to see if we see similar patterns to those we find (Appendix Fig. A2). The patterns we find for the same outcomes are a lot more stark than the usual fluctuations in the same months during a normal year, and do not always move in the same direction at the same time. For example, we find a 50% increase in labour supply per adult from March to May while in UNPS, there is only a 15% increase for the same months, we find that food expenditures decrease by 50% from March to May, while in the UNPS there is only a slight decrease, and there are small fluctuations in labour earnings through the year in UNPS while we saw a large 65-70% decline from March to May/June and then a small steady recovery each month. While we cannot completely rule out the impacts of seasonality, these patterns make us confident that the results we find are not driven by it entirely.

Additionally, we asked respondents directly for the reason for some of the changes in outcomes and find that in the majority of the cases, this is due to the pandemic. For example, 36% of the closed businesses report being closed due to the pandemic in

March 2021 (and 84% did in May 2020). Further, 53% of households report needing to reduce spending, 58% report having to work more and 38% needed to take out loans as a result of the pandemic, matching out findings, with only 9% reporting no impact of the covid-19 pandemic. We also have information from the village leadership about the pandemic restrictions in these communities, which closely match the national restrictions. While we cannot rule out that business owners reported more severe impacts of the pandemic, i.e. differential mis-reporting, we think this is unlikely given the consistency of our findings across outcomes and corroboration with reports from the village leadership.

We also consider that selective attrition could have biased our findings, as we are able to followup with 81% of our original households. In order to check the robustness of our results to attrition, we use propensity score matching to weight our regressions by the probability of being found. We use the full set of covariates from Table 2 to find the found households that looked most similar to the attriters at baseline (Appendix Table A9). These matched households are given double weight in a regression, and we compare the results for each of our primary outcomes (Appendix Table A10). The results barely change for any of our primary outcomes after re-weighting, suggesting attrition is unlikely to be affecting our analysis.

7 Conclusion

A year after the start of the Covid-19 pandemic, we find mixed success of households in coping with a large aggregate shock. Households without a business in March 2020, which were more reliant on farm income, have fared much better. Their incomes, on average, are back to pre-pandemic levels. This has been made possible due to a rise in crop income compensating for any loss in casual labour income. These households did see a large drop in income in the initial months after the onset of the pandemic and the ensuing lockdown, and so we see a continued decline in their assets and an increase in loans.

On the other hand, the 19% of the households which had a business before the start of the pandemic are still severely hit. Half of the businesses that operated before the pandemic are still closed. Despite households that owned businesses being relatively wealthier before the pandemic, they appear to have been unable to compensate for the large decline in non-farm business income with income from other sources. As a result, their income is 40% lower than just before the pandemic. They have also seen a strong deterioration in their financial position, with assets 44% lower in March 2021 as compared to a year earlier. Their net borrowing has risen a startling 15 times. These households are also reporting a significant decline in their quality of life.

The liquidation of physical assets, sizeable drop in household savings and an accumulation of debt will pose significant challenges for these households in the future and they will need to be supported in case of future lockdowns to avoid a further slide into indebtedness.

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Conflict of interest The authors declare no competing interests.

Ethics approval This study received ethics approval from the University of Oxford (protocol number ECONCIA20-21-05-001).

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