Financial Inclusion and Resilience to COVID-19 Economic Shocks in Nigeria

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Bringing Rigour and Evidence to Economic Policy Making in Africa

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List of abbreviations and acronyms

CIPE	Center for International Private Enterprise
COVID-19	Corona Virus Disease 2019
DDD	Difference-in-Difference-in-Differences
DiD	Difference-in-Difference
FCT	Federal Capital Territory
GHS	General Household Survey
NBS	Nigeria Bureau of Statistics
NGN	Nigerian Naira
NLPS	National Longitudinal Phone Survey
OPS	Organized Private Sector
PwC	PricewaterhouseCoopers
UNICEF	United Nations Children's Fund

Abstract

We examine the role of financial inclusion, ownership of bank accounts, and previous use of formal financial saving facilities as a resilience factor in the effect of COVID-19 on households' welfare in Nigeria. Using a novel data set that tracks food security among families in Nigeria before and during COVID-19, we find a negative effect of COVID-19 on welfare. The impact is more severe among male-headed households, those living in the southern region of Nigeria, and lower educated households. We also test how financial inclusion mitigates this effect through a triple difference analysis in which the households that are financially included and in non-agricultural sector are considered the treatment group. Financial inclusion did not support resilience to shock among non-agricultural homes. Given the magnitude and multisectoral dimension of the COVID-19 shock, financial inclusion was not enough to mitigate the effect. This, therefore, points to a role for stronger government support in a large shock like COVID-19.

1. Introduction

The present study investigates the influence of financial inclusion on the resilience of households to economic shocks caused by the COVID-19 pandemic in Nigeria. As Africa's largest economy and most populous country, Nigeria has been significantly impacted by the multisectoral effects of the global pandemic. The COVID-19 crisis has brought to light the critical issue of poverty and inequality, and its implications for the international and national economies (World Bank, 2022). The impact of the pandemic continues to be felt worldwide, with mitigation efforts varying across countries. Without comprehensive social protection programmes, poor households in developing countries, including Nigeria, are particularly vulnerable to food insecurity and other adverse effects of the pandemic (Amare et al, 2020; Balde et al, 2020). The World Bank (2020) has reported that the pandemic has set back, by at least four years, global efforts to end poverty.

Given the issue's significance, numerous studies have sought to examine the efficacy and relevance of various government and donor interventions to address the challenges and gaps created by the COVID-19 pandemic. At a global level, the World Bank (2020a) has estimated that without adequate socioeconomic support, up to 150 million people could fall into extreme poverty as a result of the pandemic by 2021. In addition to global assessments, there have been numerous country case studies that have analysed the impact of the pandemic on household incomes and welfare, as well as individuals' responses to the economic shocks associated with the pandemic (Ozili, 2020; Sánchez et al, 2021; Akim et al, 2021).

Our study attempts to deepen this literature with a further investigation of how various households' characteristics and assets (financial assets) support resilience to COVID-19 shocks. Even though financial inclusion and resilience have been widely studied jointly and separately (see Andam et al, 2020), our study is interested in the specific role that financial inclusion plays during the COVID-19 economic disruption using Nigeria as a case study. Given that COVID-19 is still nascent, there is a dearth of empirical studies addressing financial inclusion's role in mitigating the adverse COVID-19 economic shocks.

The study focuses on Nigeria and is motivated by two reasons. First, Nigeria has responded relatively better to COVID-19 than most African countries. However, the World Bank estimated that an additional five million people had been pushed into poverty due to the pandemic (World Bank, 2020b). Ozili (2021) reported significant social palliative spending amounting to NGN 3.5 trillion that was directed to selected

economic sectors, including households, businesses, stakeholders, and regulated financial institutions affected by the pandemic to mitigate its effects. The central bank also made other interventions, including extending loan payment moratoria, lowering interest rates on intervention loans, and giving credit facilities for businesses like hotels, hospitals, and airlines. Despite these massive government efforts, which are among the largest in Africa, Ozili (2021) observes they did not prevent economic and food crises in Nigeria. This issue raises questions about individuals' characteristics, such as financial inclusion, that could amplify or mitigate the shock. Second, the availability of household surveys before and during COVID-19 provides a novel data set to assess the impact of COVID-19 and the mitigating effect of financial inclusion.

The organization of the rest of the paper is as follows. In Section 2, the existing literature on resilience and its connection to financial inclusion is reviewed. Section 3 gives an overview of the study's economic context, and presents stylized data on financial inclusion and COVID-19 in Nigeria. In Section 4, the development of hypotheses is discussed. Section 5 outlines the measurement of key variables and the econometric approach used in the study. The empirical results are presented in Section 6. Finally, Section 7 concludes with contextualizing the findings, and highlights its policy implications.

2. Literature review

This section reviews the literature on resilience and financial inclusion; and after that, examines the evidence on the linkages between the two variables.

Literature on resilience

The study of resilience construct is multidisciplinary and attracts substantial research interest in development studies, psychology, and engineering, among others. While each discipline has attempted to define resilience, Knippenberg et al (2019) observe a broad consensus that resilience focuses on measures that determine the effect a given shock will have on an individual's wellbeing now and in the future. The relationship between financial inclusion and resilience to the coronavirus pandemic is currently vague as research on the financial effects of COVID-19 shocks is still in its early stages.

Household characteristics that enable resilience to the pandemic shocks cannot be overlooked in light of recent evidence by Egger et al (2021). The research shows a significant decrease in households' income and increased food insecurity. Notably, Gourlay et al. (2021) study in sub-Saharan Africa observes high rates of food insecurity that preceded the pandemic, and the COVID-19 shock has exacerbated the food security challenges. Specifically, for Nigeria, the study documented an increase in food insecurity from 46.8% of the population in July 2018 to 75.1% in June 2020.

Furthermore, the recently published research brief by Turiansky et al (2021) sheds some light on financial inclusion and resilience to COVID-19 economic shocks in Kenya, Nigeria, and Uganda. Turiansky et al (2021) study used pre-pandemic bank account usage and household ownership of a financial account in the past 30 days as proxies for financial inclusion to determine whether or not the consequences of the pandemic vary by financial inclusion and household economic status. The survey did not look at the type of savings or the channels it goes through, formal or informal. Turiansky et al (2021) found that financially included Nigerian households sent more cash remittances than the non-financially included households receiving fewer remittances. Hence, they conclude that financial access may not necessarily imply resilience to economic shocks. They contend that since there is no direct relationship between financial access and borrowing behaviour in Nigeria, the households' resilience to shocks related to the COVID-19 pandemic is not necessarily accounted for by financial access. Although Turiansky et al (2021) conclude that financial access may not always

imply resilience, we contend that their largely descriptive research lacks definitive proof, given other household criteria such as household industry of employment, degree of education, and place of residence were not considered when determining the effect of financial inclusion.

In sum, it is important to have an appropriate counterfactual that compares household resilience before and during COVID-19. This is because COVID-19 represents multiple shocks ranging from health to economic shocks. Hence, the multiple and contemporary nature of COVID-19 shocks differs from the single and localized shocks mostly evaluated in the existing studies. Various containment measures from COVID-19, such as movement restrictions and business closures, have further potential to affect the financial inclusion modality. Financial institutions were closed, with only online transactions possible. This means resilience to shocks, in this instance, does not just rely on access to financial products but type and scope of the financial products, such as online and mobile banking.

Literature on financial inclusion

Financial inclusion has been defined as the process that leads to the ease of access, availability, and usage of the formal financial system for all members of the nation (Sarma, 2008). Financial inclusion has attracted significant research interest due to the importance many countries place on having an inclusive financial system. According to Sarma (2008), an inclusive financial system prevents predatory lenders' emergence, therefore encouraging secure and safe saving habits. Studies have also found that financial inclusion is important for economic development (Zins and Weill, 2016), supports poverty reduction (Enisan and Akinwumi, 2020), and aids in mitigating the risks faced by the poor (Mehrotra et al, 2009). In addition, Naceur et al (2015) argue that financial inclusion can improve the output of a nation if a large proportion of the population is financially included.

In the wake of COVID-19-related shocks, recent studies have examined whether financial inclusion can help the poor mitigate the negative effects of different pandemic-related shocks. Evidence suggests that individual and household resilience is somehow linked to financial inclusion (Sanderson et al, 2018). The vast literature on financial inclusion programmes has already shown that households with access to financial products have higher precautionary savings and more access to credit, and better consumption smoothing during shocks. For example, Van Hove and Dubus (2019) find that financial inclusion enables the poor to build resilience to income shocks through savings which spur investment in businesses. Furthermore, the study on poor fishing households conducted by Pomeroy et al (2020) documents that financial inclusion can mitigate the fishermen's exposure and vulnerabilities, thus enhancing their economic resilience. Thus, financial inclusion has attracted significant interest, especially among development practitioners as a tool to promote inclusive economic growth and resilience to shocks.

Limit of financial inclusion

While financial inclusion has been hailed globally as the panacea for poverty reduction and food security, among other benefits, recent evidence suggests that financial inclusion has its shortcomings. For instance, Ozili (2021) observes several controversies revolving around the financial inclusion debate; these include: inactive users of financial products after accessing the financial products, thus creating policy dilemmas for policy makers. The problem of financial 'over' inclusion also known as extreme financial inclusion also arise where financial access is expanded without due regard to their riskiness and other vulnerability factors. Further, there is a concern in the financial inclusion literature that most studies have focused on the wrong channels of financial inclusion, savings, while ignoring other important channels such as ease of accessing remittance, loans, and other financial assets that are crucial for poverty reduction (Cull et al, 2012).

Contribution of the study

This study adds valuable insights and contributions to the existing literature in several ways. We estimate the effect of COVID-19 shocks on households' welfare and further interrogate the mediating role of financial inclusion in the observed welfare changes, in order to evaluate the effectiveness of past drives at financial inclusion in Nigeria. Our study is also unique, not only focusing on changes in welfare during COVID-19, but also tracking household welfare before the pandemic. COVID-19 also led to a unique approach in social data collection, using phone surveys to track household over time. Nigeria, for example, has a data set covering the COVID-19 period, namely the National Longitudinal Phone Survey (NLPS), which was collected by the Nigeria Bureau of Statistics (NBS) between March 2020 and December 2020; and together with the General Household Survey, provides a clear empirical approach to evaluate the effect of COVID-19. Our study is among the few studies exploring this unique data set to evaluate the key economic and policy questions emerging from the COVID-19 pandemic.

Our study primarily builds on Turiansky et al (2021) work, which finds no evidence of a causal relationship between financial access and resilience to COVID-19 economic shocks in Nigeria. Of further interest to our study is the link between the availability and usage of the formal financial system and resilience to COVID-19 economic shocks in Nigeria. Notably, whereas Turiansky et al (2021) find no relationship between financial access and resilience to COVID-19, our study seeks to establish a more rigorous causal link between the two variables. Unlike Turiansky et al (2021) approach, which focuses on data collected during COVID-19, we compare resilience to shocks pre and during COVID-19, because the data focusing solely on the COVID-19 period could be biased, given the multi-sectorial nature of shocks and the absence of appropriate counterfactual.

3. Economic background of the study

Several existing sources of data on financial inclusion in Nigeria consistently report high levels of financial exclusion. For example, according to the General Household Survey conducted by the National Bureau of Statistics (NBS, 2019), the number of individuals who own a bank account or an account in other formal financial institutions in Nigeria was 48.5% (see Figure 1). Furthermore, as shown in Figure 1, individuals are more financially included in the urban areas (65.5%) than in rural areas (31.79%). Further, the southern region (South-South, South West, and South East) has a highest level of financial inclusion than the northern region. Due to the region's relative economic development, the southern region is a major contributor Nigeria's economy.

Figure 1: Percentage of individuals who own a bank account
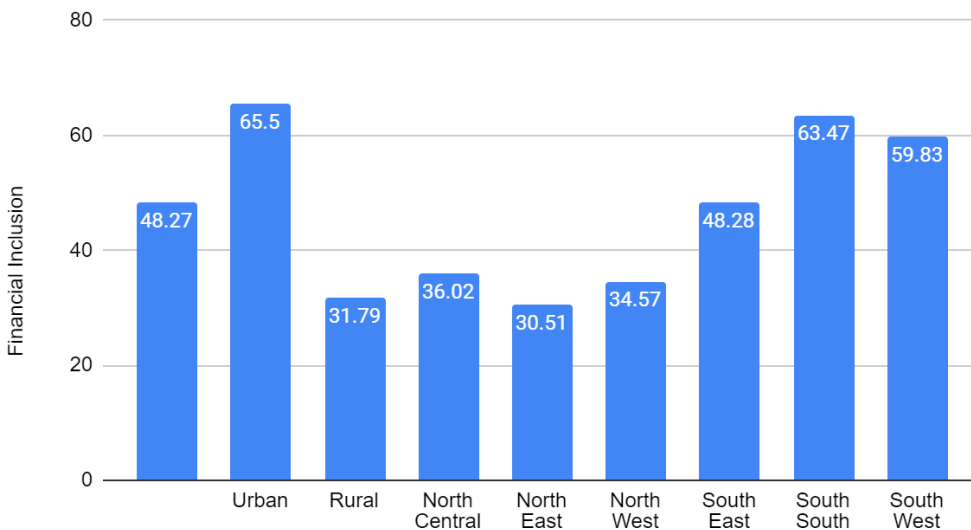
Source: NBS (2019), General Household Survey (GHS).

While owning a formal bank account is considered a component of financial inclusion, actively using the bank account benefits the account holder. For example, to secure a loan, most banks and financial institutions require a prospective borrower to register as a customer and actively use the account for economic transaction. Figure 2 shows that, in Nigeria, the urban population makes up over 50% of bank account holders who use their accounts for savings, compared to 37.6% in rural areas.

Figure 2: Share of Nigerians using their bank account for savings
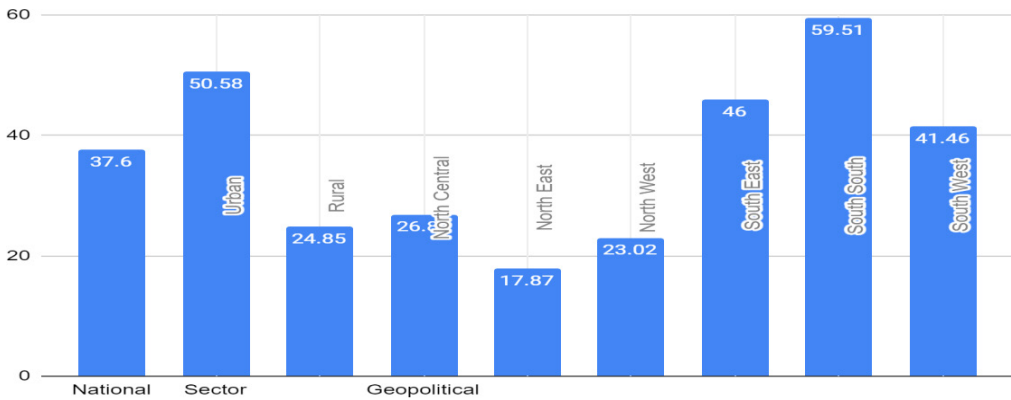
[Source: NBS (2019), General Household Survey (GHS)

The GHS estimate is consistent with other data sources regarding the higher rate of financial exclusion in Nigeria. For example, the National Population Commission (2018) in its Demographic Health Survey shows that the percentage of the adult population with formal financial products is 20.5%. Looking at the main modality of financial inclusion in Nigeria, the GHS data (see Figure 3) further reveals that commercial banks have been the main financial intermediaries supporting financial inclusion, compared to other formal financial institutions (such as microfinance banks), informal financial institutions, cooperative societies, and savings associations. Access to commercial banks comes with various financial products, namely, savings, loans, and mobile banking that can be crucial in times of crises.

In the presence of shocks such as COVID-19, access to financial services might not be enough in view of the types of financial products accessible to households. Access to loans, internal banking, and digital connectivity are crucial aspects of financial access that could support resilience. For COVID-19, physical restriction and the use of formal financial institutions in implementing palliatives were crucial, and they made understanding the depth of financial access important.

Figure 3: Percentage of individuals saving using other means
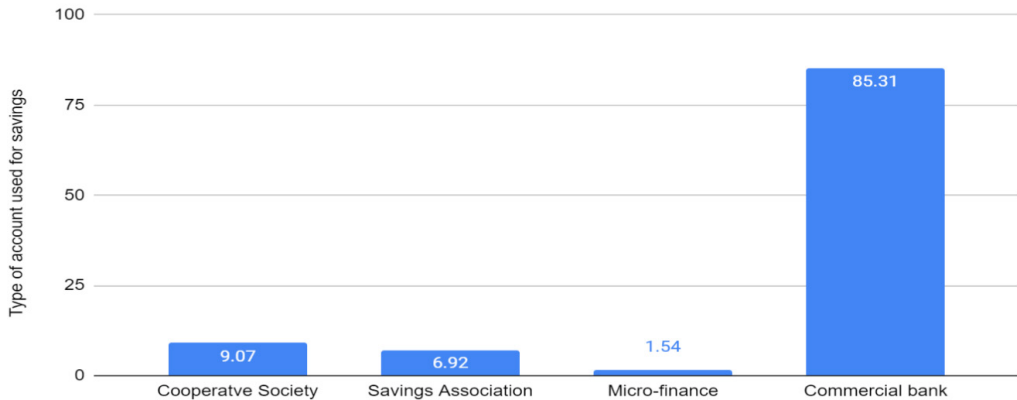
Source: GHS (2018).

Effect of COVID-19 pandemic on the Nigerian economy and implications for financial inclusion

On 27 February 2020, Nigeria reported its first case of COVID-19. Like most parts of the world, there was a spike in the number of cases over a relatively short period, leading to pragmatic policy responses. The government initially introduced a four-week lockdown halting all non-essential activities in four of the most industrialized states in the country — Lagos, Ogun, Kano, and Abuja, the Federal Capital Territory (FCT). Curfews were imposed across other affected states while travels both within and outside the country were halted entirely. Banks and markets were closed, and the only means of economic transaction moved through neighbourhood markets or digital platforms.

The containment efforts had severe implications for many households' economic activities and welfare. For example, the monthly longitudinal phone survey by the National Bureau of Statistics (NBS) shows that the number of households engaged in employment activities stood at 57.44% in April, coinciding with the restriction periods (see Table 1). Table 1 also shows that the majority of the businesses (81.2% in April) recorded lower or no revenue due to the pandemic. Similarly, the Center for International Private Enterprise and Organized Private Sector (CIPE and OPS, 2020) reports that more than two-thirds of businesses in Nigeria experienced significant difficulty in accessing finance and sourcing capital, resulting in financial liquidity problems, raw material shortages and, more importantly, a huge dip in demand.

The pandemic also affected every household's food security and livelihood. Between 52% and 59% of the households reported that they could not purchase rice and cassava, the two main Nigerian staple foods. As of December 2020, a significant number of households were still facing constraints in accessing food. The implications of livelihood disruption and food insecurity include a rise in extreme poverty and slow economic recovery. Household resilience is, therefore, affected by multiple shocks from COVID-19.

Table1:ImpactofCOVID-19onfirmsandhouseholdsinNigeriafromApriltoDecember2020

Dimension of Impact	April	August	December
Employment - % of adult population not working	57.44	30.55	29.86
Revenue losses: Change in business revenue - Lower/no revenue	81.2	46.02	37.37
- No change in revenue	8.25	17.13	17.9
- Higher revenue	10.54	36.85	44.74
Food security: % of respondents who are unable to buy Nigerian staple food - Rice	59.14	36.56	20.33
- Cassava	51.79	17.56	12.82

Sources: Ekeruche and Adeniran (2021) based on World Bank (2021) and National Bureau of Statistics (2021); COVID-19 National Longitudinal Phone Survey 2020.

The deleterious effect of the COVID-19 pandemic could vary between households and firms based on access to financial institutions and services. First, there was a shift to digital platformsdue to restriction on physical movement and interactions. Transition to a digital platform is more likely for those that are already within the financial ecosystem, with capacity to use the digital payment system. Second, many government interventions, including cash transfer, grants and loans to firms, were majorly channelled through the financial system. Third, the literature has shown that financial inclusion increases household savings (Aportela, 1999), andthis has implications for responding to shocks such as COVID-19 by drawing down on the savings.

4. Hypotheses development

Against the documented economic and health background around COVID-19, we set out to test two key hypotheses. First, as observed in the literature, a change in welfare can be represented by changes in household consumption patterns before and during (COVID-19) shock, which also measures resilience to shocks (Alfani et al, 2015; Upton, 2019). Further, as discussed in the next section, wellbeing or welfare can also be measured by food insecurity (Upton, 2019) and access to basic needs (United Nations Children's Fund [UNICEF], 2018; Jones and Samman, 2016). So, it is possible that the COVID-19 mitigation measures, such as lockdowns and movement restrictions, limited households' income generating activities, thus effectively impairing their ability to afford food and basic needs. We, therefore, state hypothesis one as follows:

H1: The COVID-19 pandemic was negatively associated with households' welfare.

There is evidence to suggest that financial inclusion helps in mitigating the risks faced by the poor (Mehrotra et al, 2009) and that individual and household welfare are deeply linked to financial inclusion (Sanderson et al, 2018). These risks include the inability to afford food and basic needs. Thus, individuals and households, who are financially included, are better equipped to absorb economic shocks, such as those associated with COVID-19, than their financially excluded counterparts. Consequently, considering the literature, we state our second hypothesis:

H2: The negative association between the COVID-19 pandemic was weaker for financiallyincluded households.

5. Methodology

This section discusses the relevant data set and the empirical approach adopted for this study.

Data set

The study uses a novel data set, the COVID-19 National Longitudinal Phone Survey (NLPS), collected by the Nigeria Bureau of Statistics (NBS) and World Bank between March and December 2020 to track households' welfare and socioeconomic outcomes during the pandemic. The households surveyed in the NLPS were sampled from those participating in the 2018/19 General Household Survey (GHS) Wave 4, which predates COVID-19. Hence, combining the two data sets ensures we can track the household welfare dynamics before and during the pandemic. Both surveys are nationally representative and cover the various geopolitical zones in the country.

The GHS covers 4,976 households interviewed twice—first, after the planting season (post-planting) between July and September 2018 and second, after the harvest season (post-harvest) between January and February 2019. The NLPS has a much lower sample comprising 1,950 households participating in the phone survey. From the initial sample of 4,976 households interviewed in the post-harvest survey, the phone numbers of 4,961 households were collected. Respondents with available phone details constitute the population from which participants for the NLPS were drawn. For national representativeness and accounting for non-responses, the baseline NLPS successfully contacted 69% of this population. Among those contacted, 94% or 1,950 households were fully interviewed. These 1,950 households constitute the final sample for the NLPS. We can uniquely identify all these households using the household identifier for food security and financial inclusion modules. This gives panel data of 1,950 households before and during COVID-19 (2018/2019 and 2020).

However, selection bias and non-response are higher with phone surveys, as most poor households have no access to phones. It has been shown that this can be addressed using appropriate sampling weight (see Wooldridge, 2007). Again, the NLPS applied the GHS-panel weight, but adjusted for non-responses and excluded households with no phone contact. We applied the corrected sampling weights to all analyses to reduce this bias.

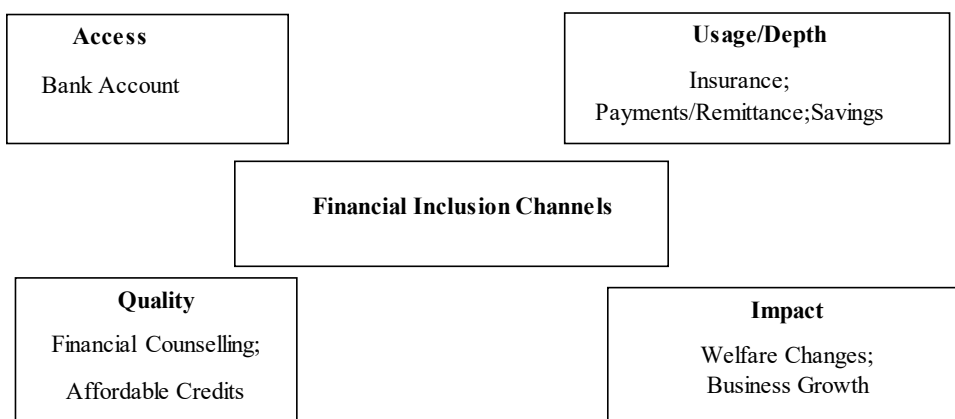# Measuring key variables and the econometric approach

Measuring key variables

Food security: We want to estimate the resilience of households to shock through variations in welfare across time. Resilience to shock is defined in the literature as a situation when there is no significant difference in household welfare before and after a shock (Alfani et al, 2015). We are, therefore, interested in an indicator of welfare that can be tracked before and after the COVID-19 shock to capture resilience.

So, we measure welfare using the household level of food security in light of the approach used in recent related studies (Upton, 2019; Akim et al, 2021) and also because both GHS and NLPS collect data on household food insecurity. We specifically focus on three questions: (1) Has the household run out of food in the past 30 days? (2) Has the household had to skip a meal in the past 30 days? (3) Has the household gone without eating for a whole day in the past 30 days? These questions measure different aspects and levels of food deprivation experienced by the households. The same questions were repeated in wave four of GHS (post-planting and post-harvesting) and the first two months for NLPS.

Based on data availability, we adopt the household level of food security as our welfare measure. For all households, the index is 1, indicating that the household experienced a food shortage or 2 if otherwise. We rescale this original score to 0 if the household experience food insecurity and 1 if otherwise. We also followed Akim et al (2021) approach by aggregating the three responses into a composite index. The composite index is the sum of the household's responses to the three questions highlighted above. This gives the food security index score that ranges between 0 and 3. The lowest score of 0 means the households answered yes to the three questions, implying the presence of food insecurity. A score of 3 means the households answered no to all the questions, indicating that the household did not experience food insecurity. Hence, the lower the score, the higher incidence of the food insecurity/shortage that household has experienced. We use this composite index to measure food security in the rest of the paper.

Financial inclusion: According to Serrao et al (2012), financial inclusion can be measured in four different ways. First is the level of access to financial services and products, such as bank account ownership. The second measure captures the depth of financial services usage, such as the use of the bank account for savings, payments, and to receive remittances. The third measure is the quality of financial inclusion, and it captures the relevance of the financial services to the needs of the consumer. This can come from access to affordable credit or financial advisory. The last measure relates to impact of financial inclusion, which is the extent to which inclusion translates to socioeconomic benefits at household or firm level.

Figure 4: Channels of financial inclusion

Access		Usage/Depth
Bank Account		Insurance; Payments/Remittance;Savings

Financial Inclusion Channels

Quality		Impact
Financial Counselling; Affordable Credits		Welfare Changes; Business Growth

Source: Authors' own illustration.

In this study, we focus on the first two measures of financial inclusion due to data availability. First, we used a simple measure based on a question in the survey, asking whether the respondent has a bank account. Those who answered 'no' are without bank accounts and are defined as financially excluded/unbanked. The second measure of financial inclusion is based on using financial services such as savings through the bank account. Specifically, respondents were asked if they have used their commercial bank or account in a cooperative society to save money in the last 12 months. The sub-sample of households not using various financial services is classified as financially excluded. Overall, the indicators are dichotomous variables, with 1 indicating being financially included or 0 otherwise.

The descriptive statistics are detailed in Table 2. By comparison, the unbanked population is older, and higher among rural residents, the northern region, and female-headed households. We applied the sampling weight, which accounts for the nature of data collection (phone survey) and country's population. The banked population is higher among those with access to the internet, the educated households' heads, and those living in the southern region. There is significant difference in these variables between the banked and unbanked populations hence their inclusion as control variables in our analysis to account for the possible confounding effects.

Table 2: Descriptive statistics

Pooled Sample				Banked			Unbanked		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Difference
Rural (%)	3900	0.68	0.46	1,003	0.53	0.50	947	0.805	0.397	-0.275***
Age of household head	3900	49.21	14.88	1,003	46.55	13.78	947	51.2	15.4	-4.65***
Agriculture	3900	0.75	0.44	1,003	0.40	0.49	947	0.147	0.354	0.253***
Access to internet	3900	0.28	0.45	1,003	0.48	0.50	947	0.125	0.331	0.355***
Ownership of phone	3900	0.93	0.26	1,003	0.99	0.11	947	0.879	0.327	0.111
Education of household's head										
None	3900	0.68	0.45	952	0.74	0.41	898	0.24	0.33	0.211***
Primary	3900	0.12	0.32	952	0.19	0.40	898	0.059	0.236	0.131***
Secondary	3900	0.08	0.26	952	0.13	0.34	898	0.031	0.174	0.099***
Tertiary	3900	0.02	0.12	952	0.02	0.15	898	0.008	0.091	0.012***
Female (%)	3900	0.18	0.39	1,003	0.13	0.34	947	0.221	0.415	-0.091***
Zone										
North East	3900	0.11	0.31	1,003	0.08	0.27	947	0.137	0.344	-0.057***
North West	3900	0.23	0.42	1,003	0.13	0.34	947	0.300	0.459	-0.17***
South East	3900	0.16	0.37	1,003	0.19	0.39	947	0.134	0.341	0.056
South-South	3900	0.18	0.38	1,003	0.24	0.43	947	0.133	0.340	0.107***
South West	3900	0.17	0.38	1,003	0.20	0.40	947	0.151	0.358	0.049***

Note: * p<0.1, ** p<0.05, *** p<0.001.

Econometric approach

We set out by empirically evaluating the first hypothesis regarding the negative effect of the COVID-19 pandemic on households' welfare in Nigeria. Following Kass-Hanna et al (2022), we specify a simple linear model as follows:

$$Y_{ht} = \alpha_1 \, Period_t + \alpha_2 \, X_{ht} + c_h + \epsilon_{ht} \tag{1}$$

For households, h=1,…,K, and Period =1 and 2. Where: Y_{ht} is a measure of household welfare (food security), as previously described, and $Period_t$ is the time indicator with t=0 for the pre-COVID period and t=1 if otherwise. X_{ht} is a vector of control variables including the demographic characteristics of household (education, gender) and geographical factors (urban/rural location; ethnopolitical region). In Table 3, we discuss in detail the measure for each control variable and their expected sign. c_h captures the household specific effects, while idiosyncratic shock is represented by ϵ_{ht}. The major coefficient of interest is α_1 that captures the changes in household welfare during the COVID-19 pandemic, compared to the reference period, pre-COVID. In line with Hypothesis 1, a negative and significant value of α_1 implies food insecurity increased during COVID-19. Equation 1 will be estimated using a fixed-effects model.

Table 3: Definition and expected sign for the control variables

Level	Variable	Code	Expected Sign	Literature
Households factors	Gender of household head: What is the sex of [NAME]?	0=Female1=Male	Positive: While literature shows that female-headed households have less resilience, pre-pandemic poverty rate is higher among male-headed households than female-headed households. Hence, we postulate that female-headed households will show more resilience based on pre-pandemic economic condition.	Fuller and Lain (2020) NBS (2019)
	Education: What was the highest educational level completed by [NAME]?	0=None 1=Primary 2=Secondary 3=Post-secondary	Positive: With higher levels of education associated with high-income levels, those with higher education should perform relatively better than the reference group.	Glewwe and Hall (1998)
	Sector of employment: Has [NAME] worked on a household farm, cared for livestock or fishing activity?	0=Agricultural sector 1=Other sectors	Ambiguous: On the one hand, those in the agriculture sector earn less than those in the non-farm sector in Nigeria. However, auto-consumption augments the food security of those in the agricultural sector. High food prices induced by the pandemic can be positive for farming households. These counteracting factors point to ambiguity in the expected effect of sector employment on food security.	World Bank (2014)

Table 3: Definition and expected sign for the control variables contd.

Geographical factors	Location: (urban/rural)	Sector	0=Rural 1=Urban	Ambiguous: On the one hand, those in the rural areas are expected to earn less than those in the urban area. However, higher participation of rural residents in the agriculture sector and the implied auto-consumption means food security can be lower among rural residents.	Young (2013)
	Regional factor: Zone code		0=North Central 1=North East 2=North West 3=South East 4=South-South 5=South West	Negative: Poverty and economic vulnerability are higher in northern Nigeria than in the southern region.	Jaiyeola and Choga (2020)
Time indicator	Period: Type of survey use		1=GHS for the post-planting period (July– September 2018) 2= GHS for planting period (February–March 2019) 3=NLPS for April 2020 4=NLPS for May 2020	Negative: The reference category is during COVID-19 and the food security challenges are expected to be amplified.	Workie et al. (2020)

We proceed afterwards to test the second hypothesis regarding the mitigating effect of financial inclusion on the COVID-19 shock. Based on the definition of financial inclusion above, we divide the sampled households into treated groups (if the household is financially included) and a control group (households that are financially excluded). The main intervention/treatment against shock in our analysis is access to financial inclusion. We now want to estimate the average mean effect between the treated and controls before and after COVID-19 shock. While the difference-in-difference (DiD) estimator is more prominent among the quasi-experimental techniques in this respect, there is a key limitation in applying the approach to the present study. The idea of difference-in-difference is to compare the effect of an intervention over time, but time itself is an intervention in this case, given that the time effect perfectly correlates with COVID-19 shock. A solution that is widely adopted in the literature is the extension of DiD to a triple difference estimator by including another covariate with no correlation to the time indicator that enables the separation of COVID-19 impact from the time effect. We will, therefore, adopt the triple difference estimator, also called the difference-in-difference-in-differences (DDD) approach.

In applying the DDD approach, we have to identify another independent variable that can be treated as another intervention based on its heterogeneous effect between the initial treatment and control group. A potential variable is the household's sector of employment, specifically households in the non-agricultural sector. While the effect of COVID-19 affects every sector, the magnitude and mechanism of effect vary across agricultural and other sectors. The effect of movement restriction was less effective in rural areas where agriculture is the dominant employment. As shown in Figure 5, in the two quarters over which COVID-19 restriction was in place (2020.2-2020.3), the agricultural sector recorded a positive growth, while industry and service sectors had negative growth. Similarly, a major channel through which COVID-19 affected food security is due to higher inflation on food items (PricewaterhouseCoopers [PwC], 2020). This can be a net gain for farm households that could benefit from higher prices.

Figure 5: Quarterly economic growth rate in agricultural and other sectors in Nigeria
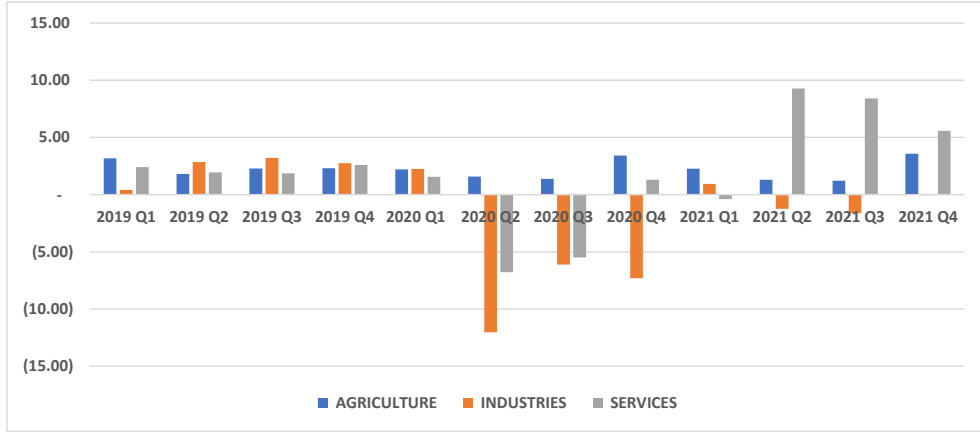
Source: National Bureau of Statistics (2022)

Following Muralidharan and Prakash (2017), we formally test the appropriateness of using the non-agricultural sector based on the parallel trend assumption. This is tested with the specifications below:

$$Y_{ht} = a + \alpha_2 \, Period_t + \alpha_3 Nagric_h + \delta_1 Nagric_h \times Period_t + \varepsilon_{ht} \quad \dots (Column \ 2) \tag{2}$$

$$Y_{ht} = \alpha_1 F_h + \alpha_2 \, Period_t + \alpha_3 F_h \times Period_t + \varepsilon_{ht} \quad \dots (Column \ 3) \tag{3}$$

$$
\begin{aligned}
Y_{ht} = \; & \gamma F_h \times Nagric_h \times Period_t \\
& + \alpha_1 F_h + \alpha_2 \, Period_t + \alpha_3 Nagric_h \\
& + \delta_1 F_h \times Nagric_h + \delta_2 \, Nagric_h \times Period_t + \delta_3 F_h \times Period_t \\
& + \varepsilon_{ht} \quad \dots (column \ 4)
\end{aligned}
\tag{4}
$$

Where: Y_{ht} is the outcome variable of interest and represents the level of food security, as previously described. F_h is the variable measuring financial inclusion, as discussed in the foregoing. Sec_h measures the economic sector of the household head, and takes a value of 1 if the household head works in the non-agriculture sector and zero otherwise. $Period_t$ is the time indicator, with t=0 for the pre-COVID period or t=1 for the period under COVID-19.

Table 4 shows the test of parallel trend between agricultural and non-agricultural sectors in the two periods prior to COVID-19 (GHS planting and harvesting modules). The parallel trend test is important to establish that the pattern of food security is not significantly different between the treated and control groups prior to the shock

(see appendix for the graphical illustration). The coefficient of the triple difference estimate (for DDD) should be insignificant if the parallel trend assumption holds. This will mean that the difference between the treatment and the control groups is constant over time, and will remain so in the absence of the intervention. Column 1 performs the same test for those in agriculture and other sectors (second treatment). Column 2 tests for the parallel trend assumption between those that are financially included and excluded (first treatment). Column 3 tests the triple difference parallel trend assumption, by combining the financial inclusion and sector of employment. The coefficients of the interaction term were insignificant in all cases, hence accepting the null hypothesis of parallel trend. We, therefore, proceed to construct a triple difference (DDD) estimator.

Table 4: Test of parallel trends assumption

	(1) Double difference (period interaction with financial inclusion)	(2) Double difference (period interaction with the sector of employment)	(3) Triple difference
Non- agricultural sector × Financial Inclusion × Period			-0.0393
			(0.28)
Financial inclusion × Period	-0.102		-0.0904
	(1.78)		(1.31)
Sector of employment × Period		-0.0424	0.0179
		(0.67)	(0.15)
Sector of employment × Financial Inclusion			0.250
			(1.08)
Financial Inclusion	0.308**		0.307**
	(3.26)		(2.69)

Period	0.850***	0.810***	0.847***
	(20.66)	(23.72)	(18.99)
Sector of employment		-0.0845	-0.377*
		(-0.81)	(-1.98)
Constant	3.690***	3.873***	3.746***
	(54.39)	(68.83)	(50.98)
N	3,900	3,900	3,900

Notes: Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.001

We introduced the variable Nagrich, which is defined as the economic sector of the household head, and is a dichotomous variable that takes a value of 1 if the household head works in non- agricultural sectors or zero if employed in agricultural sector.

Following Muralidharan and Prakash (2017), we specify the DDD model below:

$$Y_{ht} = c_h + \gamma \, F_h \times Nagric_h \times Period_t$$
$$+ \alpha_1 F_h + \alpha_2 Period_t + \alpha_3 Nagric_h$$
$$+ \delta_1 \, F_h \times Nagric_h + \delta_2 \, Nagric_h \times Period_t + \delta_3 \, F_h \times Period_t$$
$$+ \beta X_{ht}$$
$$+ \varepsilon_{ht} \; ... \tag{5}$$

The independent and dependent variables are as previously defined. X_{ht} is a vector of control variables, including the demographic characteristics of household head (education, gender, andlevel of digital access) and geographical factors (such as urban/rural location, and region). Finally, ϵ_{ht} captures the idiosyncratic shocks, and c_h is the cross-section fixed-effect.

The main parameter of interest is γ (the triple-difference estimator). It captures the effect of being financially included for a household in the non-agricultural sector during COVID-19. Since these are categorical variables, a positive coefficient implies higher resilience to COVID-19 among those that are financially included and in the non-agricultural sector relative to the control group. Hence, a positive and significant value γ confirms the null hypothesis thatfinancial inclusion enhances households' resilience to shock.

However, coefficients of the various interaction terms are also of interest and have implications for the dynamics of household resilience. First, δ_1 measures difference in effect of being financially included for households in the non-agricultural sector versus those in the agricultural sector prior to COVID-19. The expected sign is ambiguous. While the literature shows that financial inclusion positively contributes to food security, the evidence is mixedon the effect of the non-agricultural sector on food security. The Nigerian agricultural sector grew at 2.39% in 2019, more than the aggregate growth of 2.21% (Statista, 2020). High food inflation also raises the

food security problem among non-farms, while yielding a net gain for farmers. Second, δ_2 measures the difference in the effect of COVID-19 for non-agricultural versus agricultural sector among households that are not financially included. In the absence of financial inclusion and the nature of COVID-19 containment measures that constrained mostly non-farm activities, the expected sign of δ_2 should be negative. The final interaction term is δ_3, and this measures the difference in the effect of COVID for financially versus non-financially included households in the agricultural sector. The expected sign is positive; financial inclusion is expected to support resilience to shock. The effect of financial inclusion on resilience to shocks has been found in studies on farming and non-farming communities. All estimations will be weighted to control for possible heteroscedasticity, resulting from the survey sampling method.

6. Empirical results

Estimating the effect of COVID-19 on food security

We present the empirical results relating to the first hypothesis on the negative effect of COVID-19 on household welfare in Nigeria. We tracked food security over two periods, before and during COVID-19, while controlling for household and geographical characteristics. Table 5 presents the results based on fixed effect estimation (Column 1). As a robustness check, we also present the result for the correlated random effect in Column 2. The correlated random effect allows for the estimation of time-invariant explanatory variables, and can also indicate the efficiency of the fixed effect relative to the random effect model. According to Woodridge (2010), by allowing each heterogeneity term to be correlated with the time averages of the time-varying covariates, the correlated model yields an efficient estimator. Further, Woodridge (2010) contends that the estimator is appropriate when the number of time periods is small relative to the number of cross-sectional units, which fits the structure of the data set used for our study. Thus, the main variable of interest is the coefficient of the $Period_t$ which captures the change in food security during COVID-19.

The result shows that food insecurity increased in Nigeria between 2019 (Period 0) and 2020 (Period 1). Specifically, food security decreases in Nigeria by 0.25 points during COVID-19 shock. This is close to the estimation of a 0.29-point decrease in food security for Nigeria reported by Akim et al (2021), which is considered a highly negative effect. The NLPS survey took place in March and April 2020, which coincided with the period of partial lockdown and restriction on economic activities, thus revealing the negative effect of COVID-19. The result aligned with the global literature, that COVID-19 has a negative effect on household welfare and the national economy at large (Fan et al, 2021; Suri, 2021). The key channel through which the pandemic affects welfare is through the demand and supply shocks on households. The containment strategies reduced household labour participation and, invariably, income level. Similarly, the supply and logistics systems were disrupted with restrictions on intra- and inter-state mobility and closure of markets. The COVID-19 shocks also caused higher food prices that affected purchasing power of households. These factors combined explain the observed negative effect on food security.

This result is robust to an alternative estimation technique based on correlated random effect (see Table 5, Column 2). The correlated random effect also provides an estimate for the control variables (both time-variant and time-invariant), and this elicits some interesting findings. For example, we find that male-headed households display

higher food insecurity than female-headed households, and this illustrates the gender dimension of the COVID-19 pandemic. Recent poverty survey, such as the Nigerian Living Standard Survey (2018/2019), similarly reported higher poverty level among male-headed households than female-headed households before the pandemic. This could provide a higher coping mechanism for female-headed households during the pandemic. The education of a given household's head also seems to play a role. While a household with an uneducated head has a lower food security score, households whose heads have tertiary education have a relatively higher level of food security. Again, this can be due to the tendency of educated individuals to be employed in the formal sector, where remote work is more feasible during COVID-19, or government palliative measures are easier to target.

Notably, we find no differences between those in the rural and urban areas. However, households in the north-central region recorded higher levels of food security compared to other regions. This can be explained by the fact that the region is noted for high agricultural production. The result shows that the southern region (South East, South-South, and South West) experienced a lower level of resilience than the northern region. This can be explained by the fact that the southern regions are more affected by the movement restriction due to high urbanization, low population density, and a lower share of the population engaging in farming activities. The main economic hub (Lagos and Ogun) in the region was placed under a more stringent lockdown than elsewhere. The dominance of agriculture in the northern region is also a plausible explanation for this result. Literature has shown that the agriculture sector in Nigeria is resilient to shock due to its subsistence (World Bank, 2014).

Table 5: Estimating the effect of COVID-19 on food security

	(1) Fixed Effect	(2) Correlated Random Effect
Period 1 (during COVID-19)	-0.250***	-0.0172*
	(-6.87)	(-0.03)
Age	0.250	-0.233
	(0.23)	(-0.36)
Primary		0.137**
		(2.12)
Secondary		0.290**
		(3.24)
Tertiary		0.368**
		(2.59)
North East	2.050	-0.0494
	(0.84)	(-0.68)
North West		-0.0118
		(-0.16)
South East	1.800	-0.325***
	(0.94)	(-4.53)
South-South	0.550	-0.345***
	(0.47)	(-4.55)
South West	0.600	-0.137*
	(0.63)	(-1.87)
Location (urban)		-0.0446
		(-0.87)
Gender (male)		-0.144**
		(-2.63)
Mean Age		0.236
		(0.36)
Constant	0.636***	1.520***
	(3.33)	(13.46)
N	3,900	3,900

Notes: Standard errors are in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.001$

Estimating the moderating effect of financial inclusion on COVID-19 effect

While COVID-19 has a devastating effect on welfare, there are certain factors, including access to financial services that support resilience to the shocks. Table 6 shows the

result of the triple-difference estimates of the differential impact of COVID-19 based on the food security model in Equation 2. This model is estimated as specified in Equation 3, which is based on the second hypothesis of a differential effect in the effect of COVID-19 on the banked and unbanked population. For comparability, we first estimate, in Column 2, a double difference equation with only the interaction between financial inclusion and period, while controlling for household and community characteristics. The triple difference estimates with no control are shown in Column 3, and the result after controlling for households' characteristics and geographical factors are presented in Column 4.

The double difference estimate confirms the common correlated regression result regarding the negative effect COVID-19 on food security. The result also shows that those financially included had less food insecurity than those excluded. This signals that financial inclusion mitigates the negative effect of the pandemic on food insecurity. However, food security dynamics can be affected by other factors, including seasonal factors and government policies. In this instance, the period variable is not enough to separate the effect of the financial inclusion from the other factors, hence the estimation of the triple difference equation that also accounts for sector of employment of the households.

For the triple difference estimate with no control variable, the result shows that the triple coefficient was negative and significant on food security. However, the more relevant result is the one in which we include the control variables given the observed differences between the banked and unbanked population. With the inclusion of the control variables (Column 3), the result remains negative but now insignificant, indicating that financial inclusion did not mitigate COVID-19 shocks for households in the non-agricultural sector. Note that the coefficient of the financial inclusion alone (without any interaction) is positive and significant, implying that financial inclusion is associated with higher food security, but there is no heterogeneity in its effect for those in non-agricultural sectors during COVID-19.

A plausible factor for the weak effect of financial inclusion among households in the non-agricultural sector could be the presence of multiple channels of accessing savings and remittances that is available in urban areas, where most non-agricultural sector households reside. This could include access to alternative financial modalities like the informal financial sector. This would be consistent with Carlson et al (2015) evidence suggesting that households with financial access in Nigeria who experience an unexpected negative income shock see their consumption fall by 15 percentage points less than those without access. They find that the effect is mainly driven by households with informal financial access. Given that COVID-19 shock consists of income and consumption shocks, informal savings and financial access could also play a similar role.

An additional observation of this is the effect of the control variable on the sign and size of the triple difference coefficient. The triple difference coefficient becomes lower and insignificant with the inclusion of control variables. This suggests other factors outside of financial inclusion affect the resilience to shocks among the sample

households. In Table A1 (in the appendix), we test for the sensitivity of the inclusion of each of the control variables to the size, sign, and significant level of the triple difference coefficient, and we find the education of the household heads as the key factor. One underlying factor could be the potential for education to expand the information set available to households; hence, they are less constrained with or without financial inclusion. The results can also be interesting based on the labour market channel, as high education level is associated with employment opportunities, which enable access to deeper financial services such as credit facilities.

Table 6: Triple difference estimation of moderation effect of financial inclusion

	Double Difference	DDD Model (No Control)	DDD Model (Control)
Financial Inclusion (access)	.1913***	0.114**	0.232***
	(3.33)	(2.12)	(4.12)
Non-agricultural sector (sector of employment)		-0.409***	-0.267**
		(-4.92)	(-3.15)
Financial Inclusion × Non-agricultural sector		0.122	0.0981
		(1.13)	(0.91)
Period (Period 1)	-.369***	-1.104***	-1.100***
	(-7.29)	(-24.53)	(-24.35)
Financial Inclusion × Period	.20*	0.131*	0.0906*
	(.071)	(1.72)	(1.18)
Non-agricultural sector × Period		-0.318**	-0.296**
		(2.70)	(2.57)
Financial Inclusion × Period × Non- agricultural sector		-0.256*	-0.187
		(-1.68)	(-1.24)
Constant		1.461***	1.261***
		(171.56)	(61.03)
HH socioeconomic controls	Yes	No	Yes
N	3,900	3,900	3,900

Notes: HH characteristics include education, gender of household heads, location, and zone.
Standard errors are in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.001$

The double difference estimator also reveals the dynamics underpinning the results. The interaction of financial inclusion and the period variable is positive and significant, which implies that the probability of experiencing food insecurity is lower during COVID-19 for household with access to formal financial institution products and services and in agricultural sector (control group). The interaction of the sector of employment and the period is negative and significant, suggesting that food insecurity

is higher during the shock for households in non-agricultural sector without financial inclusion. This essentially suggests that, overall, the effect of COVID-19 is negative, but the financial inclusion and other household characteristics help to mitigate it to some extent. The last double difference coefficient is the interaction of the employment sector and financial inclusion. While the coefficient is positive, it is not significant, indicating that before the COVID-19 shock, the impact of financial inclusion on food security is not significant among non-farming households. Hence, the triple difference estimate simply suggests that COVID-19 did not change the behaviour of households.

In Table 7, we estimate the same model, but now with the alternative measure of financial inclusion (depth of inclusion measured by use of banking services, namely savings). We find that, again, financial inclusion measured by savings history did not have any significant effect in mitigating the COVID-19 impact. This confirms the previous results that households in non-farming activities benefit less from financial inclusion. Overall, the result concurs with similar findings by Turiansky et al (2021), that financial inclusion did not support household resilience to COVID-19 shock. However, this contradicts Akim et al (2021) findings on the positive effect of financial inclusion on households' food security in Nigeria. A notable addition to this literature from the present study is that the effectiveness of financial inclusion depends on the employment sector as it supports resilience among farming households, as against the no effect on the non-agricultural sector. The coefficients of the double interaction terms did not change from the previous estimates; hence the preceding explanation holds.

Table 7: Testing for the effect of an alternative measure of financial inclusion

	Double Difference	DDD Model (No Control)	DDD Model (Control)
Financial Inclusion (savings)	.187	0.0527	0.164**
	(-3.47)	(0.93)	(2.76)
Non-agricultural Sector (Sector of Employment)		-0.232***	-0.105
		(-3.36)	(-1.45)
Financial Inclusion × Non-agricultural Sector		-0.139	-0.160
		(-1.32)	(-1.53)
Period (Period 1)	-0.189	-1.092***	-1.102***
	(-3.84)	(-25.24)	(-25.28)
Financial Inclusion × Period	.004	0.114	0.113
	(0.06)	(1.43)	(1.39)
Non-agricultural Sector × Period		-0.228**	-0.228**
		(2.34)	(2.36)
Financial Inclusion × Period × Non-agricultural Sector		-0.129	-0.103
		(-0.87)	(-0.70)
_cons		1.485***	1.362***
		(179.35)	(62.99)
HH socioeconomic controls	Yes	No	Yes
N	3,900	3,900	3,900

Notes: HH characteristics include education, gender of household heads, location, and zone.
          Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.001

Impact of digitalization

Digital platforms serve as the alternative medium for social and economic engagements during the COVID-19 pandemic. It is, therefore, possible that the result is driven more by household access to digital platforms. Studies have shown that access to digital trade and services increased during the COVID-19 pandemic. Banga and Raga (2021) note that e-commerce and the digital economy platforms are key to economic recovery and resilience to COVID-19 shocks. We next test the effect of digitalization based on the households' access level to digital platforms such as phones and the internet.

Table 8 presents the DDD estimation with additional control variables that capture digitalization. Specifically, we control households' access to phones and the internet. The results show that internet access has a significant positive effect on food security, while owning a phone has no effect. Given that having a phone is a requirement for participating in the COVID-19 survey, there aren't many differences in access to phones among families, which accounts for the non-significant finding. However, the result shows that access to internet varies among households and this has a strong impact on household resilience to COVID-19 shocks. Specifically, the coefficient measuring internet access is positive and significant, implying that a high level of digitalization is associated with lower food insecurity.

Table 8: Accounting for the impact of digitalization
Dependent Variable: Food Security Index

	DDD	DDD
Financial Inclusion (col.2 access| col 3: savings)	0.139**	0.0889
	(2.54)	(1.55)
Non-agricultural Sector (sector of employment)	-0.271**	-0.130*
	(-3.24)	(-1.83)
Financial Inclusion × Non-agricultural Sector	0.121	-0.112
	(1.14)	(-1.09)
Period (Period 1)	-1.104***	-1.092***
	(-25.23)	(-25.96)
Financial Inclusion × Period	0.131*	0.114
	(1.77)	(1.47)
Non-agricultural sector × Period	-0.318**	-0.228**
	(2.78)	(2.41)
Financial Inclusion × Period × Non- agricultural Sector	-0.187	-0.129

	(-1.73)	(-0.90)
Access to phone	0.164	0.194
	(2.70)	(3.20)
Access to internet	0.191***	0.235***
	(4.90)	(6.17)
Constant	4.947***	4.963***
	(46.30)	(46.33)
HH socioeconomic controls		Yes
N	3,900	3,900

Notes: HH characteristics include education, gender of household heads, location, and zone. Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.001

However, it is important to interrogate these results further in light of the many channels through which digitalization intertwined with financial inclusion. Internet access could play a role in households accessing their bank or making payments for digital services, thus reinforcing financial inclusion. However, it is also possible that internet access is a proxy for wealth, implying that households that are better off have access to more financial services and can mitigate the effect of COVID-19 shocks on food security. While data limitation makes it impossible to test different channels, a descriptive analysis of the NLPS data suggests this latter explanation is more feasible (see Figure 6). Also, 82% of respondents without access to the internet were able to access their money during the lockdown, compared to 92% of those who did. This means access to the internet does not constitute a significant barrier to accessing bank services, and points to the country's achievement over the years in creating multiple channels for people to interface with financial institutions. This result suggests that financial inclusion might not be driven by digitalization in the areas of expanded internet access, but more around digitalization in terms of automation, diversification, and FinTech presence. An implication of this is that the agricultural sector, which is dominant in rural areas where digital coverage is low, will benefit more from financial inclusion, especially if the critical channels—ranging from financial inclusion to food security—are through access to a bank account. According to this, increasing household welfare and shock resilience in Nigeria will help the credit market, especially in regions with high levels of digital penetration.

Figure 6: Were you able to successfully access the bank, money agent, ATM, etc?
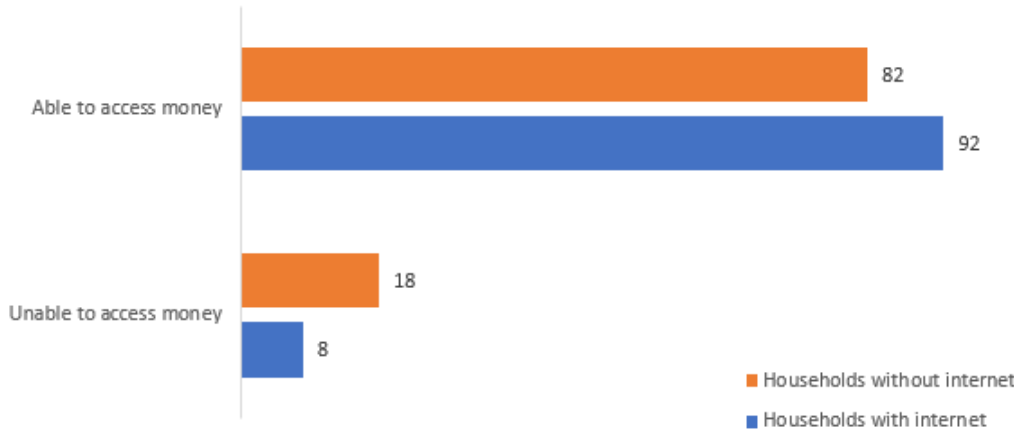
Source: NLPS (2020).

7. Conclusion

This study has empirically tested the link between financial inclusion and resilience to COVID-19 economic shocks in Nigeria. We sought to establish whether the COVID-19 pandemic was negatively associated with households' welfare and whether the negative association with the COVID-19 pandemic was weaker for financially included households. While we measured the resilience of households to shock through variations in food security over time, financial inclusion is represented by households' access to financial products and services from commercial banks and microfinance. Our study used a novel data set that tracked food security among households in Nigeria before and during COVID-19. We find a negative effect of COVID-19 on welfare, where the effect is more severe among male-headed households living in the southern region of Nigeria, and lower-educated households. Given that COVID-19-induced lockdowns restricted movements leading to business closures and access to market, this would ultimately negatively affect welfare.

We also tested how financial inclusion mitigates the negative impact on welfare through a triple difference estimate. We find that financial inclusion did not support resilience to shock among non-agricultural households or only moderately reduce the impact of the pandemic among those in the agricultural sector. The result suggests that, despite the high level of financial inclusion, the impact of the pandemic is higher among those in the non-agricultural sector. There are two perspectives to evaluate this result. First is that the scale and size of the shock are significant, and as such, there is limited capacity from individuals alone to avert its full impact. The pandemic chain of effect manifests in various forms, including on the supply chain, labour supply, food prices, and market access (with movement restriction). The period of the shock is prolonged, with complete closure over the first three months and gradual phasing out of the various restriction measures over another six months. The shock's multi-dimensional and prolonged nature suggests that individual mitigation strategy is insufficient.

Another perspective to gauge the findings is the measure of financial inclusion used in the study. By using only bank account ownership and previous use for savings, the depth of financial inclusion is not examined, which is a significant limitation of this study. The nature of COVID-19 shock suggests that the depth of financial inclusion will be necessary. For example, a survey by the CIPE and OPS (2020) shows that the firms in Nigeria want government mitigation efforts to focus on business loans, followed by the tax cut and subsidies for inputs and services. Government policy responses, which

primarily focus on credit support, also reinforce this. However, this is very limited, and the role of financial institutions in providing affordable credits or insurance will have complemented the government's efforts. Data shows that only 3.78% of the bank account holders were able to loans from formal financial institutions (Okafor, 2022), an indication of lack of depth of the financial system in Nigeria. These results suggest that the Nigerian financial system and the level of financial inclusion will need to scale up to better support household welfare.

This study has several policy implications. There is persistent risk of a rise in food insecurity due to shocks; as such, better preparedness is crucial. A robust financial system needs to be part of this disaster preparation and management. For the financial system to play this role might require improvement in quality of financial services that comes with financial inclusion such as credit access, financial advisory, digital payment, among others. This is crucial because financial access is the starting point in attaining the four dimensions of financial inclusion: access, usage/depth, quality, and impact. However, as COVID-19 shock demonstrated, individual resilience measures might be limited in addressing prolonged and multisectoral shocks. Other supporting measures and government social policy will be integral part of the larger preparedness measures to enhance food security and resilience.

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Appendix

Table A1 shows the sensitivity of the estimated triple difference coefficient to the inclusion of each of the control variables. The result is most sensitive to the inclusion of the education variable. This reduces the size and significant level of the triple difference coefficient.

Table A1: Triple difference estimation of moderation effect of financial inclusion

	(1) DDD	(2) DDD	(3) DDD	(4) DDD	(5) DDD
Financial Inclusion (access)	0.128**	0.188***	0.215***	0.198***	0.232***
	(2.37)	(3.51)	(4.00)	(3.67)	(4.12)
Non-agricultural Sector (sector of employment)	-0.410***	-0.360***	-0.297***	-0.276**	-0.267**
	(-4.94)	(-4.35)	(-3.55)	(-3.29)	(-3.15)
Financial Inclusion × Non-agricultural Sector	0.135	0.142	0.160	0.145	0.0981
	(1.25)	(1.33)	(1.51)	(1.37)	(0.91)
Period (Period 1)	-1.104***	-1.104***	-1.104***	-1.104***	-1.100***
	(-24.57)	(-25.04)	(-25.10)	(-25.13)	(-24.35)
Financial Inclusion × Period	0.131*	0.131*	0.131*	0.131*	0.0906
	(1.72)	(1.75)	(1.76)	(1.76)	(1.18)
Non-agricultural Sector × Period	-0.318**	-0.318**	-0.318**	-0.318**	-0.296**
	(2.71)	(2.76)	(2.77)	(2.77)	(2.57)
Financial Inclusion × Period × Non-agricultural Sector	-0.256*	-0.256*	-0.256*	-0.256*	-0.187
	(-1.68)	(-1.71)	(-1.72)	(-1.72)	(-1.24)

	(1)	(2)	(3)	(4)	(5)
Financial Inclusion (access)					
Age	0.00392***	0.00575***	0.00577***	0.00621***	0.00585***
	(3.68)	(5.36)	(5.39)	(5.76)	(5.01)
North East		-0.281***	-0.277***	-0.291***	-0.296***
		(-4.62)	(-4.57)	(-4.78)	(-4.66)
North West		-0.0858*	-0.0848*	-0.0978*	-0.0931*
		(-1.67)	(-1.65)	(-1.90)	(-1.75)
South East		-0.518***	-0.507***	-0.487***	-0.451***
		(-9.26)	(-9.08)	(-8.67)	(-7.71)
South-South		-0.499***	-0.506***	-0.494***	-0.471***
		(-9.27)	(-9.42)	(-9.18)	(-8.35)
South West		-0.340***	-0.290***	-0.283***	-0.260***
		(-6.12)	(-5.14)	(-5.01)	(-4.49)
Location (rural)			0.183***	0.176***	0.168***
			(4.59)	(4.41)	(4.11)
Gender (female)				-0.130**	-0.132**
				(-3.04)	(-3.04)
Primary					0.0223
					(0.41)
Secondary					-0.162**
					(-2.42)
Tertiary					0.242*
					(1.84)
Constant	5.260***	5.410***	5.243***	5.252***	5.261***
	(83.19)	(74.51)	(64.69)	(64.83)	(61.03)
N	3,900	3,900	3,900	3,900	3,900

Notes: Standard errors are in parentheses. * p<0.1, ** p<0.05, *** p<0.001

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