CGIAR
FOOD FRONTIERS
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POLICY BRIEF SERIES

Fragile and Conflict-Affected Food Systems

FCA BRIEF | DECEMBER 2025

Livelihoods and Recovery After Cyclone Idai

Short- and Long-Run Household Evidence from Mozambique

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Overview

Sub-Saharan Africa bears a disproportionate share of global poverty and is also among the regions most vulnerable to natural disasters that pose persistent threats to livelihoods, food security, and long-run development. This study examines how exposure to a major natural disaster—Cyclone Idai, one of the deadliest and costliest disasters in Mozambique's history—affected household well-being and economic behavior in central Mozambique following its landfall in March 2019. We combine satellite-based best-track data on Cyclone Idai's trajectory with longitudinal household survey data collected both shortly after the disaster and five to six years later. Specifically, we link predicted maximum wind speed at the community level to a pre-defined sample of households surveyed before the cyclone, allowing us to estimate impacts in the short run (within the same year) and the longer run. This design leverages rich pre-baseline data and province fixed effects to mitigate concerns about selection bias, displacement, and omitted variables that commonly complicate causal inference in disaster impact studies.

We find that greater cyclone exposure is strongly associated with short-run reports of shock experience and asset loss, validating predicted wind speed as a measure of disaster intensity. In the long run, however, households appear to recover from the immediate shock. Cyclone exposure is associated with persistent declines in reliance on agriculture as a primary livelihood and increases in small business activity and formal wage employment. At the same time, we observe mixed effects on asset ownership, with sustained declines in housing ownership alongside increases in durable asset holdings. Future work will continue to highlight how complex and heterogeneous pathways through which large-scale disasters reshape household livelihoods and economic behavior over time.

1. Introduction

The global burden of extreme poverty remains heavily concentrated in Sub-Saharan Africa (SSA). As of 2015, SSA exhibited the highest regional extreme poverty rate worldwide, with 41.1 percent of the population living on less than PPP $1.90 per day. This rate far exceeded those observed in other developing regions, including South Asia (12.4 percent) and Latin America and the Caribbean (4.1 percent). Despite accounting for only 16.3 percent of the global population, SSA was home to more than half (56.2 percent) of the world's extremely poor. These stark disparities underscore the persistence of poverty in the region and motivate continued inquiry into the structural and environmental factors that impede sustained welfare gains.

In addition to widespread poverty, SSA is unusually vulnerable to natural hazards and other negative shocks. The region is characterized by high rainfall variability (Strahler and Strahler, 1991) and pronounced susceptibility to drought (Chang, 1968), features long argued to constrain agricultural productivity and economic development (Bloom and Sachs, 1998). Broader assessments of disaster risk that incorporate both hazard exposure and institutional coping capacity consistently place SSA among the most vulnerable regions globally. Climate change is expected to exacerbate these vulnerabilities, with SSA projected to remain at the very top of global rankings for disaster risk and climate-related exposure (IPCC, 2023). Taken together, the coincidence of pervasive poverty and high exposure to natural hazards raises the possibility that disasters play a central role in sustaining poverty and food insecurity in the region. This project explores the link between these two prominent features of SSA, seeking to better understand how disaster exposure contributes to persistent poverty and food insecurity, and to identify policies that may strengthen post-disaster resilience.

This study examines the welfare impacts of a major natural disaster—Cyclone Idai—that struck central Mozambique in March 2019, in the midst of an ongoing household data collection for an evaluation of a community health intervention (Yang et al., 2023). Prior to the cyclone in 2017–2018, the study team conducted a baseline survey of approximately 5,000 households. Then, Cyclone Idai, one of the strongest tropical cyclones recorded in the Southern Hemisphere, hit two months before planned follow-up data collection, causing extensive flooding, widespread displacement, and severe damage to housing, infrastructure, and agricultural systems. Beyond its immediate human and economic toll, the cyclone plausibly generated longer-run welfare impacts by disrupting livelihoods and decimating agricultural production during the critical May–July 2019 harvest season. We then conducted short-run post-disaster follow-up surveys from May to November 2019 and additional household surveys in 2024 and 2025—four to five years after the cyclone—allowing for comparison of short- and long-run impacts.

Empirically, we exploit spatial variation in cyclone intensity across study communities, measured using estimates of maximum predicted wind speed at the community level, to identify the effects of disaster exposure on poverty, food security, and related outcomes. The analysis examines not only average impacts, but also the mechanisms through which disasters translate into welfare losses. Understanding these mechanisms is essential for policy design, as it can illuminate pathways through which interventions may mitigate post-disaster declines. Of particular novelty, the study examines how changes in livelihood strategies—such as shifts in agricultural production, labor allocation, and income-generating activities—mediate the relationship between disaster exposure and household welfare.

We find that greater cyclone exposure is strongly associated with short-run reports of shock experience and asset loss, confirming that predicted wind speed captures meaningful variation in disaster intensity. In the longer run, however, households appear to recover from the immediate effects of the cyclone

along several dimensions. At the same time, exposure to higher wind speeds is associated with persistent changes in economic behavior, including a reduced reliance on agriculture as a primary livelihood and increased engagement in small business activities and formal wage employment. The evidence on material well-being is more mixed: while housing ownership remains lower in more severely affected areas, ownership of other durable assets increases over time. Together, these patterns suggest that Cyclone Idai induced lasting adjustments in livelihood strategies rather than uniform long-run declines in welfare.

The study's central contribution lies in its ability to credibly estimate the causal effects of disaster exposure while addressing key identification challenges that have constrained much of the existing literature. A core concern in disaster research is selection bias arising from displacement: post-disaster samples may differ systematically across more- and less-affected areas, confounding causal inference. By following a sample of households defined prior to Cyclone Idai, this study avoids reliance on post-disaster cross-sections and substantially reduces selection bias. In addition, the availability of rich pre-disaster baseline data allows us to directly assess correlations between baseline characteristics and disaster exposure, and to control flexibly for pre-existing differences across households and communities. Aside from seminal studies following the 2004 Indian Ocean tsunami in Indonesia and Sri Lanka (Frankenberg et al., 2011; De Mel et al., 2011), relatively few disaster studies track a pre-defined sample from before to after a major shock. Our causal identification exploits heterogeneous disaster exposure within this panel, strengthening inference relative to observational designs that lack pre-shock data.

This study contributes to a large and diverse literature on the long-run consequences of natural disasters. Conceptual and empirical work emphasizes that disasters may generate persistent welfare losses through poverty traps, particularly when households respond by liquidating productive assets or disinvesting in human capital (Carter et al., 2007; Arcaya et al., 2020). Empirical evidence from a range of contexts documents negative long-run impacts on income, education, and health following exposure to floods, droughts, earthquakes, and storms (Rodriguez-Oreggia et al., 2013; Anttila-Hughes and Hsiang, 2013; Andrabi et al., 2023). A closely related strand highlights how disasters induce shifts toward more defensive but lower-return livelihood strategies, potentially locking households into persistently lower welfare trajectories (Van den Berg, 2010; Yang et al., 2018). Studies of the Indian Ocean tsunami further underscore the complex interplay of mortality selection, scarring, and household decision-making in shaping long-term outcomes (Frankenberg et al., 2011; Ho et al., 2016).

At the same time, another body of work documents cases in which affected populations recover or even experience long-run welfare gains following disasters. Exposure to a 2005 earthquake in Pakistan was found to have no impact on household or adult outcomes four years later (Andrabi et al., 2023). Using longitudinal data, Gignoux and Menéndez (2016) find that earthquake-affected individuals in rural Indonesia recover in the medium run and exhibit higher incomes in the long run, potentially reflecting reconstruction investments and infrastructure improvements. Evidence from Hurricane Katrina similarly suggests that, despite massive displacement, affected individuals experienced surprisingly transitory income losses and, in some cases, improved long-run economic and mortality outcomes due to migration to lower-risk or higher-opportunity locations (Deryugina et al., 2018; Deryugina and Molitor, 2020). Historical analysis of the U.S. Dust Bowl highlights yet another adjustment margin, with long-run population decline rather than local economic recovery driving equilibrium responses (Hornbeck, 2012). Together, these findings underscore that long-run disaster impacts are complex and dynamically related to disaster-induced changes to household decisions around migration and livelihood strategies while also depending on context-specific institutions, mobility, aid responses, and the nature of affected assets.

Finally, this study contributes to a literature on Cyclone Idai and its impacts in Mozambique. Existing work has documented severe environmental damage, including large declines in vegetation productivity and land cover changes correlated with proximity to the cyclone's path (Charrua et al., 2021). Other research highlights substantial short-run disruptions to maternal and child health services, followed by relatively rapid recovery in many districts (Fernandes et al., 2022), persistent increases in malaria risk associated with long-lasting housing damage (Searle et al., 2023) and losses in access to basic services and the potential for disasters to exacerbate urban inequality (Williamson et al., 2023). While this literature provides critical evidence on environmental damage, service disruption, and health risks, it has largely relied on administrative data, satellite imagery, or post-disaster surveys. By combining rich pre-disaster household data with detailed post-disaster follow-up, the present study complements and extends this work by providing causal evidence on how Cyclone Idai affected household welfare, poverty, food security, and livelihood strategies in Mozambique's central provinces, and by identifying mechanisms relevant for designing policies to enhance resilience in disaster-prone settings.

2. Cyclone Idai

Tropical cyclones represent a major source of risk for human welfare and economic development in near-coastal regions, particularly in low-income countries with limited adaptive capacity (Charrua et al., 2021). Mozambique faces especially high exposure to cyclone-related hazards due to its position along the Southwestern Indian Ocean, a region characterized by frequent and intense storm activity. Cyclones regularly form in the Mozambique Channel during the November–April cyclone season, placing much of the country's coastline and adjacent inland areas at repeated risk. Within Mozambique, the central region—and Sofala Province in particular—has historically experienced some of the most severe impacts due to its low elevation, extensive floodplains, and proximity to common cyclone trajectories. Over recent decades, Sofala has been struck by a succession of major storms, culminating in Cyclone Idai in 2019.

Cyclone Idai made landfall as a category two storm near the city of Beira on March 14, 2019, before moving inland across central Mozambique and into neighboring countries. The storm brought torrential rainfall—exceeding 200 millimeters within 24 hours in some areas—and wind speeds reaching approximately 220 kilometers per hour, leading to catastrophic flooding, infrastructure collapse, and widespread displacement. Floodwaters in some locations rose by more than 10 meters (ACAPS, 2019). Drawing on satellite-based evidence, Charrua et al. (2021) show that Idai caused widespread disruption to land use and vegetation systems across the province, with especially pronounced damage to wetlands, shrublands, and densely vegetated areas, and that the severity of environmental damage closely tracked distance from the cyclone's path.

Across southern Africa, Idai is estimated to have caused approximately 1,593 deaths, with thousands more reported missing in the immediate aftermath. In Mozambique alone, official figures report roughly 468 confirmed deaths, more than 1,500 injuries, and damage to or destruction of approximately 90,000 homes. An estimated 1.85 million people were affected in Mozambique, with roughly 127,500 displaced, while total affected populations across the region reached approximately 3.1 million. Economic damages and losses associated with the cyclone were estimated at between US$3.2 and US$3.3 billion (2019 USD), making Idai one of the costliest disasters in the country's history (ACAPS, 2019; Charrua et al., 2021). Beyond its immediate impacts, the cyclone posed serious medium-term risks through the destruction of crops before the 2019 mid-year harvest and heightened exposure to water-borne diseases, raising concerns about prolonged food insecurity and health consequences in affected areas.

In the aftermath of Cyclone Idai, Mozambique received substantial humanitarian assistance from a range of multilateral organizations focused on emergency relief and early recovery. Key actors included the World Food Programme (WFP), which prioritized emergency food assistance and longer-term actions to reduce food insecurity among affected households, and the United Nations Children's Fund (UNICEF), which worked with government partners to protect vulnerable populations—particularly women and children—by supporting access to health care, education, nutrition, and adequate shelter. Other United Nations agencies played complementary roles: the United Nations Development Programme (UNDP) provided technical assistance aimed at strengthening institutional capacity and disaster-related policy frameworks, while UN-HABITAT focused on shelter provision and the promotion of socially and environmentally sustainable resettlement solutions. As the response evolved, aid activities increasingly emphasized resilience and livelihood recovery. These measures included support for small-scale livestock production, establishment of community agricultural fields, promotion of energy-efficient cooking technologies, expansion of microcredit and savings schemes organized through community associations, and pilot investments in renewable energy—such as solar panels—in resettlement areas (Matos and Ndapassoa, 2020). Together, these interventions formed an integrated response that extended beyond immediate relief toward medium-term recovery and resilience building.

3. Methodology

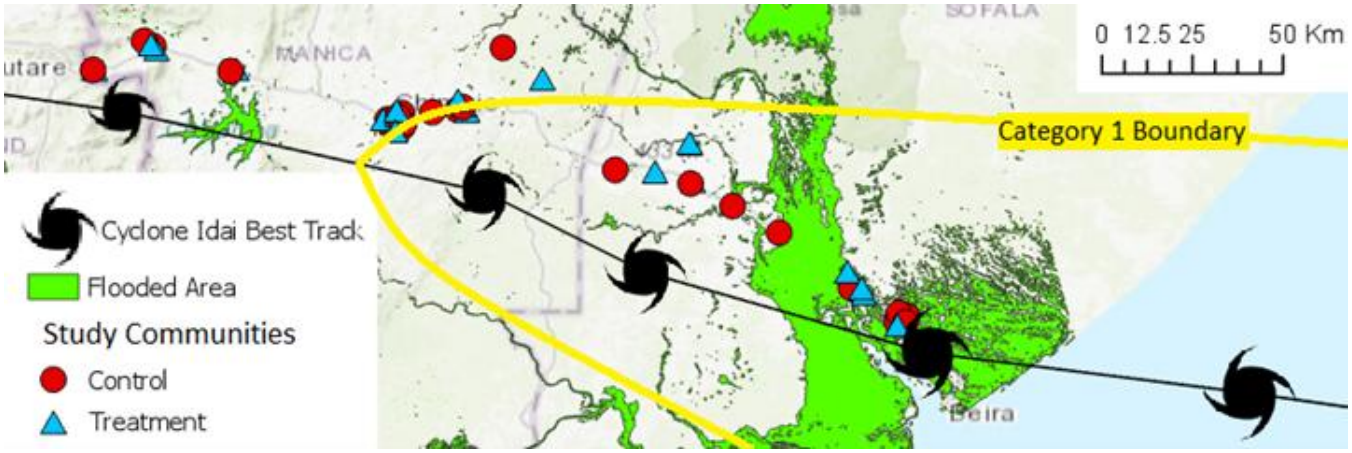
3.1 Measuring Cyclone Intensity / Predicted Wind Speed

We quantify disaster exposure using a continuous, community-level measure of cyclone intensity based on predicted maximum wind speed. Wind exposure is constructed using satellite-based best-track data on Cyclone Idai's trajectory from the National Oceanic and Atmospheric Administration (NOAA, 2019), combined with geographic information systems (GIS) methods that have been applied in prior work to study the impacts of tropical cyclones (Yang, 2008; Mahajan and Yang, 2020). The procedure begins by mapping the full path of Cyclone Idai and calculating the minimum distance from each study community to the cyclone's central track. Community locations are defined using the geographic coordinates of each community's central school, for which precise GPS data were collected prior to the disaster.

For each point along the cyclone's trajectory, we obtain estimates of wind speed and then apply a meteorological decay function that models how wind intensity dissipates with distance from the storm center. The wind speed at the closest point on the cyclone path, adjusted for spatial decay, is assigned as the community's maximum predicted wind speed. This approach yields a continuous measure of cyclone intensity that captures meaningful heterogeneity in exposure both across and within provinces, rather than relying on coarse indicators such as binary treatment status or administrative boundaries.

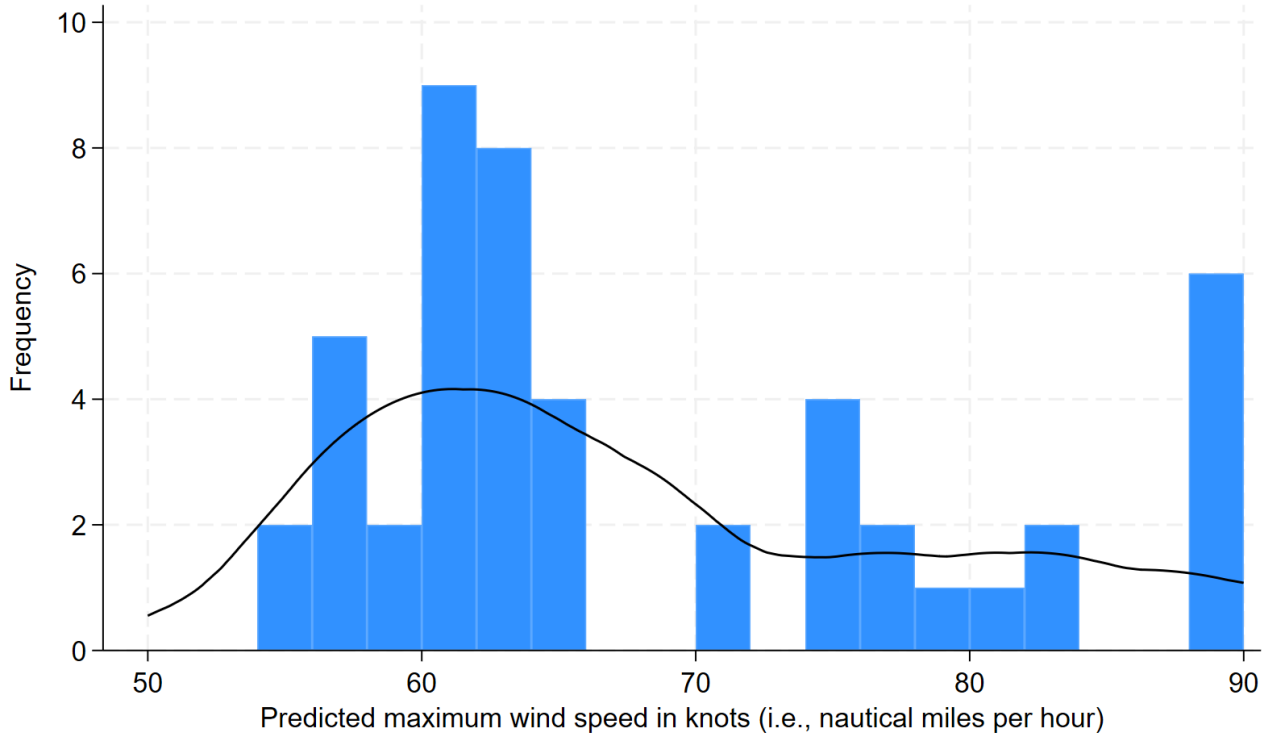
Figure 1 illustrates the spatial distribution of study communities in Manica and Sofala provinces, which experienced the most severe impacts from Cyclone Idai. The black solid line depicts the cyclone's central path as it moved from east to west across Mozambique, while the yellow contour marks the approximate boundary of hurricane-force winds, defined as Saffir–Simpson Category 1 or higher (64+ knots). Flooded areas are shown in green. Treatment and control communities from a related randomized study that concluded prior to the cyclone are indicated by blue triangles and red circles, respectively (Yang et al., 2023), which are not discussed further in this project note. As the storm progressed inland, both wind speeds and flooding intensity declined sharply. Communities in Sofala, located closer to the coast, experienced substantially higher wind exposure than those in Manica further inland.

Figure 1: Flooding and Windspeeds due to Cyclone Idai



There is substantial variation in predicted wind exposure across the study area. All Sofala communities experienced at least Category 1 hurricane-force winds, with eight study communities in Sofala exposed to Category 2 winds. In contrast, none of the Manica communities experienced Category 2 winds, and only seven study communities in Manica were exposed to Category 1 winds; the remaining Manica communities experienced sub-hurricane-force winds. Mean predicted maximum wind speed is 81.0 knots (standard deviation 6.7) in Sofala communities, compared to 61.1 knots (standard deviation 2.8) in Manica communities. Across all communities in the analytic sample, predicted wind speed has a mean of 68.6 knots (standard deviation of 10.7), a minimum of 54.7 knots, and a maximum of 89.9 knots. Figure 2 presents the full distribution of predicted maximum wind speed across communities.

Figure 2: Predicted Maximum Windspeed from Cyclone Idai across Communities



As in all studies of disaster impacts, a central empirical concern is omitted-variable bias, as locations that experience more severe disaster exposure may differ systematically from less-affected areas even prior to the event. A key strength of our study is the availability of rich pre-disaster baseline data collected in 2017–2018. We use these baseline data, when available, as controls in all regression specifications to account for pre-existing differences that could confound estimated disaster impacts.

3.2 Household Surveys Data and Sample

Data for this study come from several waves of household surveys administered between 2017 and 2025. The pre-baseline, baseline and short-run follow-up survey were conducted for a study evaluating a community-wide public health program (Yang et al., 2023). The long-run follow-up survey was conducted for an ongoing study evaluating methods of hiring public health workers (Allen IV et al., 2024).

Household enrollment and baseline data collection took place between May 2017 and March 2018, prior to Cyclone Idai. Households were selected using a random-route sampling methodology designed to identify vulnerable households. Eligibility criteria required households to meet at least one of several indicators of socioeconomic vulnerability, including high dependency ratios, food insecurity, lack of stable income sources, the presence of chronically ill or HIV-positive members, reliance on antiretroviral therapy, the presence of orphaned children, or recent adult mortality due to chronic illness. This targeting strategy ensured that the baseline sample captured households likely to be particularly sensitive to large negative shocks.

Household surveys were administered by trained Mozambican enumerators fluent in local languages. Surveys were conducted at respondents' residences using digital questionnaires programmed on tablet computers, with data entered in real time during interviews. Completed surveys were uploaded daily to a secure cloud server, allowing the U.S.-based research team to conduct immediate data quality checks and provide rapid feedback to field teams. Additional quality assurance was carried out through field audits, in which a randomly selected subset of households was re-surveyed approximately two weeks after the main interview. Exact household geographic coordinates were recorded using tablet-based GPS, facilitating household tracking across survey waves and enabling spatial linkage with cyclone exposure measures.

Short-run post-disaster outcomes are drawn from a household survey that started data collection in early May 2019, approximately two months after Cyclone Idai made landfall, and continued through November 2019. In both the baseline and short-run follow-up surveys, the primary respondent was the household head, and household-level outcomes are constructed either directly from the respondent's reports or by aggregating information collected from individual household members. We also implemented intensively tracking of disaster-affected households using survey protocols specifically designed for post-disaster contexts (Gray et al., 2014). The short-run sample includes 3,658 households.

Long-run post-cyclone outcomes are drawn from a subsequent household survey conducted in Sofala and Manica provinces by the same research team for Allen IV, et al. (2024). This survey covered 4,406 households overall and aimed, where possible, to re-interview households included in the earlier waves. A total of 1,256 households from the short-run post-disaster sample fell within the geographic scope of the long-run follow-up. Of these, 924 households were successfully re-surveyed (retention rate of 73.6 percent), forming a long-run household panel spanning the pre- and post-cyclone period. Note that these data reflect the current analytic sample and may be updated as we finalize data processing.

Table 1: Attrition analysis for panel households

VARIABLES	(1) Surveyed in LR	(2) No Info in LR	(3) Moved in LR
Cyclone Wind Speed	-0.00522	0.00228	0.00294
	(0.00360)	(0.00192)	(0.00241)
Observations	1,256	1,256	1,256
R-squared	0.089	0.038	0.054
Province FE	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes
Outcome Mean	0.736	0.114	0.150

Source: Cyclone Wind Speed is a community's predicted maximum wind speed measured in knots. All regressions include province fixed effects and vector of 11 pre-baseline household characteristics. Community-clustered standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

To assess the potential for selective attrition related to disaster exposure, Table 1 presents regressions of long-run survey participation on predicted cyclone wind speed, controlling for province fixed effects and baseline household characteristics. We find no statistically significant relationship between predicted wind speed and the likelihood of being surveyed in the long-run follow-up. Moreover, cyclone exposure is not associated with specific reasons for attrition, including lack of information on household whereabouts or reported household relocation. These results suggest that Cyclone Idai did not induce differential attrition that would compromise the internal validity of the long-run panel analysis.

3.3 Outcomes

We examine three broad categories of outcomes capturing households' cyclone experiences, material well-being, and economic behavior. First, we analyze self-reported cyclone exposure using responses to questions asking whether the household was negatively affected by any shocks in the past 12 months and, conditional on being affected, which assets were lost specifically due to Cyclone Idai. To capture cyclone-related losses, we construct an indicator equal to one if the household reports losing any assets due to Cyclone Idai and zero otherwise. These measures were only asked to panel households in the long-run follow-up and provide a direct assessment of these households' cyclone experience and immediate material losses.

Second, we study changes in asset ownership. Home ownership is measured as an indicator equal to one if the household reports owning their house and zero otherwise. Asset ownership is measured using indicators for fourteen durable goods, including beds, mobile phones, solar panels, clocks, motorcycles, sewing machines, bicycles, refrigerators, televisions, freezers, radios, ironing machines, tables, and cars. An asset index is constructed as the first principal component of these ownership indicators, normalized to have mean zero and standard deviation one in the baseline sample.

Third, we analyze livelihood strategies and investment behavior, which are central to understanding the mechanisms through which disasters affect longer-run welfare. Primary livelihood is defined based on households' reported main source of income, with categories including farming, small business ownership, and salaried or formal employment. In addition, we examine agricultural investments reported being purchased in the past 12 months.

3.4 Regression Specification

To estimate the impact of the cyclone on household outcomes, we run the following regression:

$$Y_{ijt} = \beta_0 + \beta_1 \text{pwspeed}_j + \gamma' X_i + \delta + \varepsilon_i$$

where Y_{ijt} is the outcome variable for household i in community j after the cyclone in time t; pwspeed_j is the predicted maximum wind speed experienced by community j; X_i is a vector of 11 pre-baseline household characteristics included as controls (when available[1]); δ are province-level fixed effects. Standard errors are clustered at the community level.

For causal identification, cyclone exposure would need to be exogenous across households and communities, which is unlikely to hold unconditionally. Although Cyclone Idai was an unexpected shock, realized exposure is likely correlated with underlying factors such as geographic location and pre-existing poverty. Our identifying assumption therefore requires that cyclone exposure is conditionally exogenous after controlling for province fixed effects and pre-baseline household characteristics. Province fixed effects account for time-invariant provincial characteristics, including distance to the ocean, while baseline household controls capture pre-cyclone vulnerability, such as food insecurity and chronic illness. Throughout the project note, we occasionally use language suggestive of causality under this assumption, and readers should bear in mind the conditions required for such interpretation. We also show long-run results separately for the sub-sample of households that were also surveyed at baseline (Long-Run Panel) as Table 1 shows that the cyclone did not induce differential attrition in this group and the inclusion of their pre-baseline household controls help to more credibly meet our assumption for causal identification. Future work will assess robustness to alternative specifications and expanded control sets. As exposure to natural disasters is rarely random, most empirical studies of disaster impacts rely on similar identifying assumptions.

The coefficient of interest is β_1, which captures the effect of a one-unit increase in predicted cyclone wind speed, measured in knots. We expect β_1 to be negative for desirable outcomes and positive for undesirable outcomes in the short run, while we do not make strong ex ante predictions regarding long-run effects. As predicted wind speed has a standard deviation of 10.7, coefficients may be scaled accordingly to interpret the impact of a one standard deviation increase in cyclone intensity.

4. Findings

Early results from this analysis are presented in Tables 2 through 5. Coefficients are interpreted as the change in the outcome associated with a one-unit increase in predicted cyclone wind speed. For outcomes where data are available, we estimate effects across three samples: the short-run post-cyclone

[1] For households new to the sample in the long-run, we replace the pre-baseline household variables with zeros and include an indicator for their new status (i.e., "dummy out") to control for their missing pre-baseline data in the regression.

sample (Short-Run), the full household sample in the long-run survey (Long-Run Full), and the sub-sample of households in the long-run survey that were also surveyed at baseline (Long-Run Panel).

Table 2 presents results on self-reported cyclone experience and cyclone-related asset loss, which were only asked to panel households in the long-run follow-up. In the short run, higher predicted wind speed is associated with large and statistically significant increases in the likelihood that households report the cyclone as a negative shock and report asset losses due to the cyclone. A one standard deviation increase in wind speed is associated with an increase of more than 15 percentage points in both outcomes. These results provide credibility for using predicted wind speed as a measure of experienced cyclone intensity. In contrast, we find no statistically significant effects in the long-run panel; point estimates are small and precisely estimated around zero. This suggests that, on average, households identified and surveyed prior the cyclone had recovered from the immediate perceived impacts of the cyclone five to six years after landfall.

Table 2: Cyclone experience and asset loss

	(1)	(2)	(3)	(4)
	Indicator: experienced cyclone as shock		Indicator: asset loss from cyclone	
VARIABLES	Short-Run	Long-Run Panel	Short-Run	Long-Run Panel
Cyclone Wind Speed	0.0148***	-7.30e-05	0.0147***	0.00170
	(0.00470)	(0.000454)	(0.00469)	(0.00345)
Observations	3,321	924	3,328	924
R-squared	0.205	0.216	0.212	0.018
Province FE	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes
Outcome Mean	0.757	0.977	0.748	0.536

Source: Outcomes measured in the short-run post-cyclone sample (Short-Run) or the sub-sample of households in the long-run survey also surveyed at baseline (Long-Run Panel).Cyclone Wind Speed is a community's predicted maximum wind speed measured in knots. All regressions include province fixed effects and vector of 11 pre-baseline household characteristics. Community-clustered standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 3 examines impacts on asset ownership over time and reveals a mixed pattern of effects. Columns (1)–(3) show that home ownership declined in the short run and does not appear to have fully recovered in the long run. In the long-run full sample, a one standard deviation increase in cyclone wind speed is associated with an almost 10 percentage point reduction in the likelihood of owning a house, and estimates for the long-run panel are similar in magnitude to those observed in the short run. By contrast, columns (4)–(6) indicate that greater cyclone winds are associated with higher ownership of durable assets, as captured by the asset index, in both long-run samples. A one standard deviation increase in wind speed corresponds to a 0.7 standard deviation increase in the asset index in the full long-run sample and a 0.51 standard deviation increase in the panel. Taken together, these results indicate divergent long-run effects across different dimensions of asset accumulation.

Table 3: Mixed impacts on asset ownership

	(1)	(2)	(3)	(4)	(5)	(6)
	Indicator: household owns house			Asset index (1st PC of 14 assets)		
VARIABLES	Short-Run	Long-Run Full	Long-Run Panel	Short-Run	Long-Run Full	Long-Run Panel
Cyclone Wind Speed	-0.00314**	-0.00919***	-0.00322	0.00814	0.0647***	0.0476***
	(0.00147)	(0.00257)	(0.00205)	(0.00820)	(0.00827)	(0.00874)
Observations	3,325	4,406	924	3,321	4,406	924
R-squared	0.012	0.216	0.027	0.115	0.257	0.185
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Outcome Mean	0.913	0.848	0.953	0.153	0.0515	-0.128

Source: Note/Source (8pt). Outcomes measured in the short-run post-cyclone sample (Short-Run), the full household sample in the long-run survey (Long-Run Full), or the sub-sample of households in the long-run survey also surveyed at baseline (Long-Run Panel). The asset index the normalized first principal component of a vector of indicator variables for ownership of 14 assets: car, motorcycle, bicycle, radio, television, sewing machine, refrigerator, iron, bed, table, clock, solar panel, freezer and mobile phone. Cyclone Wind Speed is a community's predicted maximum wind speed measured in knots. All regressions include province fixed effects and vector of 11 pre-baseline household characteristics. Community-clustered standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

We next examine household livelihood strategies. Table 4 presents results on reliance on agriculture as a primary income source and on agricultural investment behavior. Across all three samples, higher cyclone wind speed is associated with substantial declines in the likelihood that households report agriculture as their primary source of income. A one standard deviation increase in wind speed is associated with a reduction of more than 15 percentage points in reporting agriculture as the primary source of income in all three samples. Then, in columns (4)-(6), greater cyclone wind speed is associated with increases in making agricultural investments in the previous year, but then large decreases in agricultural investments in the long run. The short-run increase may reflect investments undertaken prior to the cyclone but reported retrospectively, or immediate post-cyclone investments aimed at repairing damaged equipment. Regardless, households more heavily exposed to the cyclone were less likely to rely on agriculture as a primary livelihood both immediately after the event and several years later.

Finally, Table 5 provides evidence that the cyclone-induced shift away from agriculture was accompanied by increased engagement in other livelihood strategies. In columns (1)-(3), higher predicted wind speed has no significant effect on reporting small business ownership as a primary income source in the short run, but is associated with significant increases in the long run. Similarly, in columns (4)-(6), greater cyclone exposure is positively associated with holding formal wage employment in both the short and long run. In general, the sum of the positive coefficients on declaring small business and formal salary as top in-come sources are comparable to the negative coefficient on declaring agriculture as a top income source in the long-run samples, consistent with a shift away from agriculture toward other livelihoods or income diversification.

Table 4: Agriculture as a household livelihood

	(1)	(2)	(3)	(4)	(5)	(6)
	Indicator: farming is top income source			Indicator: agricultural investment in last year		
VARIABLES	Short-Run	Long-Run Full	Long-Run Panel	Short-Run	Long-Run Full	Long-Run Panel
Cyclone Wind Speed	-0.0142***	-0.0255***	-0.0192***	0.00788**	-0.0109***	-0.00769**
	(0.00432)	(0.00357)	(0.00288)	(0.00313)	(0.00240)	(0.00314)
Observations	3,321	4,274	924	3,328	4,406	924
R-squared	0.057	0.121	0.093	0.014	0.048	0.024
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Outcome Mean	0.347	0.260	0.347	0.193	0.346	0.393

Source: Outcomes measured in the short-run post-cyclone sample (Short-Run), the full household sample in the long-run survey (Long-Run Full), or the sub-sample of households in the long-run survey also surveyed at baseline (Long-Run Panel). Cyclone Wind Speed is a community's predicted maximum wind speed measured in knots. All regressions include province fixed effects and vector of 11 pre-baseline household characteristics. Community-clustered standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 5: Other livelihoods strategies

	(1)	(2)	(3)	(4)	(5)	(6)
	Indicator: small business is top income			Indicator: formal salary is top income source		
VARIABLES	Short-Run	Long-Run Full	Long-Run Panel	Short-Run	Long-Run Full	Long-Run Panel
Cyclone Wind Speed	-0.000144	0.00527***	0.00474*	0.00610***	0.0147***	0.00719***
	(0.00255)	(0.00172)	(0.00260)	(0.00203)	(0.00304)	(0.00252)
Observations	3,321	4,274	924	3,321	4,274	924
R-squared	0.016	0.016	0.023	0.029	0.035	0.035
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes
Outcome Mean	0.208	0.188	0.154	0.199	0.246	0.181

Source: Outcomes measured in the short-run post-cyclone sample (Short-Run), the full household sample in the long-run survey (Long-Run Full), or the sub-sample of households in the long-run survey also surveyed at baseline (Long-Run Panel). Cyclone Wind Speed is a community's predicted maximum wind speed measured in knots. All regressions include province fixed effects and vector of 11 pre-baseline household characteristics. Community-clustered standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

This study examines the short- and long-run impacts of Cyclone Idai on household outcomes in central Mozambique using detailed pre- and post-disaster survey data combined with satellite-based measures of cyclone intensity. By following a defined sample of households from before to after the disaster and exploiting spatial variation in predicted wind speed, we provide evidence on how severe cyclone exposure affects reported shocks, asset ownership, and livelihood strategies. The results indicate that while households experience substantial short-run disruption and material loss, many seem to recover from the immediate effects of the cyclone over time. At the same time, exposure to greater cyclone intensity is associated with persistent changes in economic behavior, particularly a shift away from agriculture as a primary livelihood and toward small business activity and formal wage employment.

Together, these early results suggest that Cyclone Idai may have induced structural changes in household livelihood strategies rather than generating uniform long-run welfare losses. However, mixed impacts on asset ownership—especially the divergence between housing and other durable assets—leave open the question of whether households are ultimately better or worse off as a result of these shifts. Moving forward, we plan to extend the analysis to additional outcomes that are still being harmonized across survey waves, including food security, household income, financial service use, and behavioral preferences. We also plan to explore whether livelihood changes were driven solely by household-level adaptation or due to household receipt post-Idai humanitarian assistance and recovery-oriented interventions implemented in affected areas. We will also implement a suite of robustness checks, including alternative measures of cyclone intensity, explicit consideration of flooding exposure, and expanded sets of geographic controls.

Understanding how disasters affect household livelihoods is critical for designing policies that promote post-disaster resilience. By documenting detailed patterns of adjustment in income generation and asset accumulation, this study can help inform the targeting and design of post-disaster interventions. For example, if disasters inhibit agricultural recovery or discourage future technology adoption, policymakers may wish to place greater emphasis on post-disaster programs that support agricultural investment, technology use, and risk management, alongside efforts that facilitate successful transitions into non-agricultural livelihoods where appropriate.

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ACKNOWLEDGMENTS

This work was supported by the donors who fund the CGIAR's Science Program on Food Frontiers and Security through their contributions to the CGIAR Trust Fund. Data collection was supported by International Growth Centre (IGC), National Institutes of Health (NIH), the Michigan Institute for Teaching and Research in Economics via the Ulmer Fund (award no. G024289), and the United States Agency for International Development (USAID) awarded through the Feed the Future Innovation Lab for Markets, Risk and Resilience (MRR) Innovation Lab (award no. A20-1825-S007). We thank Faustino Lessitala for stellar leadership and field management throughout the project, and to the households for their time. This work has not been independently peer reviewed. The author used a generative AI tool as an editorial aid during manuscript preparation, primarily to improve clarity, coherence, and concision of the written text. The AI was not used to generate original research content, including data or analysis. All content was carefully reviewed and revised by the author, who retains full responsibility for the accuracy and integrity of the publication. Any opinions expressed here belong to the authors and are not necessarily representative of or endorsed by IFPRI or CGIAR. Address for correspondence: James Allen IV, j.allen@cgiar.org

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