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Household Coping Strategies and Food Security in the Multi-shock Environment of Mali

John M. ULIMWENGU

Abstract

This study investigates household coping strategies and food security outcomes within the context of multiple, overlapping shocks, including conflict, food price volatility, climate events, and economic instability. Utilizing a unique household dataset on Mali combined with probit models to account for the compounded effects of these systemic shocks, the analysis highlights significant elasticities between specific shocks and household responses. Key findings demonstrate that while preventive measures, such as income diversification, strengthen resilience, reactive strategies like selling productive assets or borrowing money or food provide only short-term relief but undermine long-term sustainability. The impact of coping strategies on food security measures, including the Food Consumption Score (FCS), Household Dietary Diversity Score (HDDS), and Household Hunger Scale (HHS), reveals the trade-offs Malian households make between immediate needs and future stability. The study emphasizes the critical role of policy interventions in mitigating these vulnerabilities, including strengthening social safety nets, expanding access to financial services, and promoting climate-resilient agricultural practices. By integrating the analysis of multiple shocks, this research provides actionable insights for building household and community resilience in environments of compounded risk.

1. Introduction

Food security, defined as the state in which all people have consistent access to sufficient, safe, and nutritious food to meet their dietary needs and preferences for an active and healthy life (FAO, 2008), is a fundamental pillar of human welfare. However, achieving and sustaining food security is increasingly challenging in today's world, where households are frequently exposed to a wide range of disruptive shocks. These shocks—whether natural, economic, or social—can severely impair a household's capacity to secure adequate food, often resulting in periods of heightened vulnerability and food insecurity. Recognizing how households cope with these shocks is essential for crafting policies that not only enhance resilience but also protect food security in environments where multiple shocks frequently occur or compound each other.Shocks affecting food security can be broadly classified into two categories: covariate and idiosyncratic. Covariate shocks impact large groups or entire communities simultaneously.

Examples include natural disasters such as droughts, floods, and hurricanes; economic disturbances like recessions and inflation spikes; and social upheavals such as conflicts or pandemics (Dercon, 2002). These shocks typically disrupt the social and economic structure of communities, leading to widespread food insecurity. In such situations, households may resort to community-wide coping mechanisms, such as pooling resources, participating in collective labor exchanges, or seeking external aid. For instance, during the 2008 global financial crisis, many households in developing nations faced reduced incomes and higher food prices, leading them to rely on extended family networks or community support to meet basic needs (Hoddinott, 2006).

Conversely, idiosyncratic shocks affect individual households or persons rather than entire communities. These shocks include personal tragedies such as illness, the death of a family member, job loss, or accidents (Skoufias, 2003). Although idiosyncratic shocks tend to be localized, their impact on affected households can be severe, necessitating individual coping strategies. In such cases, households may turn to mechanisms like borrowing money, selling assets, reducing food consumption, or even pulling children out of school to save costs and increase household labor (Carter & Barrett, 2006). Distinguishing between covariate and idiosyncratic shocks is crucial, as each type influences the choice of coping strategy, which has significant implications for the household's long-term resilience and food security.

In environments where multiple shocks occur—either concurrently or in succession—households face compounded risks that can exacerbate food insecurity. The frequency, duration, and intensity of these shocks further complicate the situation. Chronic and frequent shocks, such as recurring droughts or prolonged economic downturns, often necessitate long-term coping strategies like migration, income diversification, or permanent dietary adjustments (Ellis, 2000). In contrast, acute, one-off shocks typically trigger immediate but potentially unsustainable responses, such as distress sales of productive assets or sharp reductions in food intake (Devereux, 2007). These compounded shocks place extraordinary strain on household resilience, as they may simultaneously erode income sources, weaken social support systems, and heighten vulnerability to subsequent shocks.

Due to data limitations, this study focuses specifically on systemic (or covariate) shocks—those affecting entire communities or regions rather than individual households. Although understanding the effects of idiosyncratic shocks is equally important, the available data restrict this analysis to systemic events. This focus allows for a detailed exploration of how widespread shocks such as natural disasters, economic downturns, and conflict impact food security and necessitate community-wide coping responses. In regions frequently affected by systemic shocks, identifying effective coping mechanisms is essential for designing policies that can mitigate the collective risk and protect community resilience.

This study contributes to the growing body of research on food security by examining how households navigate the complexities of a multi-shock environment—a subject that has gained attention but remains underexplored, particularly in the context of overlapping shocks and their compounded effects. By analyzing the ways in which covariate shocks interact to influence household coping strategies, this study provides a nuanced understanding of adaptive behaviors that households employ to maintain food security. This focus is especially pertinent given global challenges such as climate change, economic instability, and emerging health crises, all of which are expected to increase both the frequency and severity of these shocks (Barrett & McPeak, 2006). Insights from this research could inform the development of targeted policies that address not only immediate food security needs but also enhance household resilience to future shocks.

2. Literature review on coping strategies, shocks, and food security

Coping with shocks and food security is an increasingly critical issue, given the global impacts of climate change, pandemics, and economic crises. This section explores how different coping strategies are employed to mitigate shocks and ensure food security, delving into their implications, effectiveness, and challenges.

Shocks such as droughts, floods, pandemics, and economic downturns significantly threaten food security worldwide. For instance, extreme weather events disrupt agricultural production, leading to decreased yields and increased prices, directly impacting food availability and affordability (Xie et al., 2025). Similarly, economic shocks can reduce household income, making nutritious food inaccessible to vulnerable populations (Mazenda & Mushayanyama, 2024).

In regions like Sub-Saharan Africa and South Asia, where food systems are highly climate-dependent, such shocks exacerbate existing vulnerabilities. The interplay between shocks and food security is further complicated by socioeconomic inequalities, governance issues, and a lack of robust infrastructure (Higgins & Ruben, 2024).

Households adopt diverse measures to ensure food security during crises, including dietary adjustments, savings depletion, and reliance on social networks. For example, in urban areas of Malawi, families adapt by reducing meal portions or shifting to less expensive food items (Romano & Tiberti, 2025). Urban gardening has also emerged as a viable strategy, providing households with supplementary food sources while promoting self-reliance (Mukaila & Enete, 2025).

Community-driven initiatives, such as cooperative farming and communal grain storage, enhance collective resilience. During the COVID-19 pandemic, community health center programs like “Food is Medicine” proved instrumental in Northern California, distributing resources and improving access to nutritious food for affected families (Moraga Franco et al., 2024). These initiatives emphasize the role of social cohesion in mitigating shocks.

Governments and international bodies have implemented policies aimed at strengthening food systems. Innovations in agricultural technology, such as drought-resistant crop varieties and precision farming, are pivotal in building resilience against climate-induced shocks (Bhandari et al., 2024). Policies promoting social safety nets, such as Ethiopia's Productive Safety Net Program, protect vulnerable populations by providing financial aid and food supplies during crises (Leight & Tambet, 2024).

Digital economy tools have also shown promise in mitigating shocks. They facilitate efficient resource allocation and empower farmers with real-time information on weather patterns and market conditions, enhancing their decision-making capabilities (Xie et al., 2025).

Despite the advancements, significant challenges remain. For instance, reliance on reactive measures, such as food aid, often undermines long-term resilience by creating dependency (Murgatroyd et al., 2024). Structural issues, such as gender inequality and land tenure insecurity, further hinder the effectiveness of coping strategies (Romano & Tiberti, 2025). Women, who often shoulder the burden of securing household food, are disproportionately affected by shocks due to limited access to resources and decision-making power.

Moreover, the sustainability of coping mechanisms is a pressing concern. While urban gardening and cooperative initiatives offer short-term relief, their scalability and integration into broader food systems remain limited (Mukaila & Enete, 2025). Additionally, climate change continues to intensify the frequency and severity of shocks, outpacing the adaptive capacities of existing strategies (Mazenda & Mushayanyama, 2024).

To enhance food security resilience, a shift toward proactive and integrative strategies is essential. Emphasis on sustainable agricultural practices, such as agroecology and conservation agriculture, can reduce vulnerability to climate shocks. Investments in rural infrastructure, including irrigation systems and storage facilities, are equally critical (Higgins & Ruben, 2024).

Equally important is the role of international cooperation in addressing transboundary shocks, such as pandemics and global supply chain disruptions. Strengthening global food reserves and promoting equitable trade policies can cushion vulnerable regions from external shocks (Moraga Franco et al., 2024).

Understanding how households respond to multiple, simultaneous shocks is crucial for developing effective policies that enhance resilience and food security. Households often face overlapping challenges, including price volatility, seasonal fluctuations, conflict, and climate-related disruptions. This report discusses the integration of these diverse shocks into a combined analytical framework and examines the relationship between coping strategies and food security outcomes.

3. Methodology

Combined Effects of Multiple Shocks

To capture the simultaneous effects of different shocks, we use a modeling framework that includes price shocks (p_n), seasonal performance shocks (T_n), conflict shocks (co_n), and climate shocks (W_n). The combined model is expressed as:

$$Pr(C_j = 1 | p, T, co, W, X) = F\left(\pi + \sum_{n=1}^{N}\left(\beta_{jn}p_n + \gamma_{jn}T_n + \theta_{jn}co_n + \delta_{jn}W_n\right) + \alpha X\right)$$

In this equation, β_{jn}, γ_{jn}, θ_{jn},and δ_{jn} denote the effects of the respective shock categories on the probability of adopting coping strategy C_j. The term αX captures the influence of control variables such as household demographics, asset holdings, and access to social networks. The cumulative density function $F(\cdot)$ ensures that the probabilities follow a cumulative normal distribution.

This model accounts for the compounded impact of multiple shocks, providing insights into how overlapping vulnerabilities influence household behavior. For instance, a household experiencing both a drought (climate shock) and a rise in food prices (price shock) might respond differently than one facing either shock in isolation. The interactions between shocks can amplify household vulnerabilities, leading to more drastic coping measures such as distress migration, sale of critical assets, or reliance on food aid.

The compounded effects of multiple shocks are critical in understanding multi-dimensional vulnerability. For example, Dercon (2004a) emphasizes that households often face interlinked risks that cannot be addressed effectively by single-dimensional strategies. This combined model allows for testing interactions between shocks, providing nuanced insights into the drivers of household coping mechanisms.

Effect of Coping Strategies on Food Security

Household coping strategies play a pivotal role in determining food security outcomes. However, the relationship between coping strategies and food security is complex, partly due to the potential endogeneity between the two. Food-secure households are more likely to engage in proactive risk management strategies, making them better equipped to withstand future shocks. In contrast, food-insecure households often resort to reactive or unsustainable measures, such as selling productive assets or reducing meal quality and quantity, which can perpetuate their vulnerability.

To address endogeneity, we estimate a probit model that incorporates predicted probabilities of coping strategy adoption from the combined shocks model:

$$Pr\left(outcome_k = 1 \middle| \hat{C}, X\right) = G\left(\alpha_0 + \sum_{j=1}^{J} \gamma_j \hat{C}_j + \alpha_1 X\right)$$

In this equation, $\hat{C}_j$ represents the predicted probability of adopting coping strategy j from the earlier model. "Outcome" refers to food security indicators such as the Food Consumption Score (FCS) or the Household Dietary Diversity Score (HDDS). The coefficients γ_j measure the impact of each coping strategy on food security outcomes, and the inclusion of predicted values mitigates potential biases arising from reverse causality.

Insights from the Combined Framework

This integrated approach provides several critical insights. First, the combined model highlights the importance of considering multi-dimensional shocks when evaluating household responses. For example, climate shocks may exacerbate the effects of price shocks, leading to more severe food insecurity. Understanding these interactions is essential for designing policies that address the root causes of vulnerability.

Second, the analysis demonstrates that different coping strategies have varying impacts on food security. Strategies like livelihood diversification and asset accumulation are often associated with better food security outcomes, while distress-driven measures like asset liquidation and reliance on informal loans can lead to longer-term insecurity. These findings align with the work of Brinkman and Hendrix (2011), who argue that adaptive strategies are more sustainable than reactive ones in the context of food security.

Finally, the model underscores the role of external support systems in mitigating the adverse effects of shocks. Social safety nets, access to credit, and community-based initiatives can significantly enhance the effectiveness of household coping strategies. By incorporating these factors into the model, the analysis provides actionable insights for policymakers aiming to build resilience at both the household and community levels.

By combining the effects of multiple shocks and addressing the interplay between coping strategies and food security, this study offers a comprehensive framework for understanding household vulnerability. The findings highlight the need for integrated, multi-sectoral interventions that address the compound risks faced by vulnerable populations. Furthermore, the emphasis on proactive and adaptive coping strategies underscores the importance of investments in resilience-building measures, such as social safety nets, climate-resilient agriculture, and community-based support systems. Future research can build on

this framework to explore the long-term impacts of shocks and coping strategies, contributing to a more resilient and food-secure world.

4. Data and descriptive statistics

Using data on covariate shocks and household coping strategies compiled for Mali (Marivoet & Hema, 2024), this analysis employs a diverse set of variables (see Tables 1 & 2) across several categories, each capturing different dimensions of household coping strategies, food security, conflict, and price and environmental shocks. Here is a detailed description of each group of variables and their significance.

Table 1: Descriptive statistics for shocks and demographics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
deadliness	85,430	36.34	79.43	0.00	639.00
danger	85,430	6.88	11.35	0.00	63.00
diffusion	85,430	0.04	0.08	0.00	0.25
fragmentation	85,430	2.26	2.40	0.00	13.00
zs_maize_spell	54,928	5.95	6.10	0.00	24.00
zs_millet_spell	70,240	5.75	6.42	0.00	22.00
zs_rice_spell	71,332	7.88	8.40	0.00	31.00
zs_cowpea_spell	60,222	4.42	5.87	0.00	21.00
zs_peanut_spell	57,534	5.81	5.79	0.00	20.00
R_drought	85,430	146.86	28.95	106.94	231.22
R_flood	85,430	113.76	4.57	107.92	121.59
R_heat	85,430	130.67	21.20	105.82	187.72
cdi_rainfall	85,430	0.62	0.14	0.25	0.91
cdi_soilmoisture	85,430	0.30	0.15	0.05	0.91
cdi_evapotranspiration	85,430	0.47	0.23	0.06	0.87
area	85,430	0.22	0.41	0.00	1.00
education_head[1]	85,430	0.55	0.50	0.00	1.00
marital_head[2]	85,430	0.92	0.26	0.00	1.00
sex_head	85,430	0.92	0.27	0.00	1.00

Notes:

[1] Education of Household Head (education_head): This variable was initially categorized into five levels: no education (0), primary education (1), middle school (2), secondary school (3), and higher education (4). For the purpose of this analysis, the variable was dichotomized, with individuals having no formal education coded as 0, while those with any level of formal education (primary, middle, secondary, or higher) were coded as 1. This transformation reflects the difference between having received any formal education versus none.

[2] Marital Status of Household Head (marital_head): The original variable included five categories: single (1), married (2), divorced/separated (3), widow(er) (4), and free union (5). To simplify the analysis, the variable was dichotomized by grouping individuals who were single, divorced/separated, widowed, or in a free union under 0, while those who were married were assigned a value of 1. This recoding distinguishes between households with a legally married head and those with other marital statuses.

Source: Marivoet and Hema (2024).

Table 2: Descriptive statistics for coping strategies and food security outcomes

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Lcs_stress_DomAsset	65,092	0.05	0.21	0.00	1.00
Lcs_stress_Saving	39,573	0.20	0.40	0.00	1.00
Lcs_stress_EatOut	32,944	0.05	0.21	0.00	1.00
Lcs_stress_BorrowCash	65,926	0.22	0.41	0.00	1.00
Lcs_stress_BorrowFood	33,787	0.20	0.40	0.00	1.00
Lcs_stress_MoreLabour	34,053	0.19	0.39	0.00	1.00
Lcs_stress_Animals	54,511	0.10	0.30	0.00	1.00
Lcs_crisis_ProdAssets	61,924	0.05	0.21	0.00	1.00
Lcs_crisis_Edu_Health	66,610	0.10	0.30	0.00	1.00
Lcs_crisis_OutSchool	57,073	0.03	0.16	0.00	1.00
Lcs_em_ResAsset	51,616	0.03	0.17	0.00	1.00
Lcs_em_Begged	58,229	0.04	0.19	0.00	1.00
Lcs_em_IllegalAct	30,669	0.01	0.10	0.00	1.00
Lcs_em_FemAnimal	53,408	0.06	0.24	0.00	1.00
HDDS[1]	85,430	0.85	0.36	0.00	1.00
HHS[2]	85,430	0.91	0.29	0.00	1.00
CARI[3]	85,430	0.78	0.42	0.00	1.00
FCS[4]	85,430	0.91	0.28	0.00	1.00

Notes:

[1] Household Dietary Diversity Score (HDDS): The original classification had five categories, ranging from households consuming food from five or more groups (1) to those consuming from only one or zero food groups (5). For dichotomization, households with a dietary diversity score of five or more groups were assigned a value of 1, while those with four or fewer groups were coded as 0. This recoding captures the contrast between adequate and inadequate dietary diversity.

[2] Household Hunger Scale (HHS): The HHS was initially categorized into five levels: 0 (no hunger), 1 (mild hunger), 2-3 (moderate hunger), 4 (severe hunger), and 5-6 (very severe hunger). For analysis, households reporting no hunger (HHS=0) were assigned a value of 1, while those experiencing any level of hunger (HHS>0) were grouped together and assigned a value of 0. This transformation highlights the difference between food-secure and food-insecure households.

[3] Consolidated Approach for Reporting Indicators (CARI): The original categories included food secure (1), marginally food secure (2), moderately food insecure (3), and severely food insecure (4). The variable was dichotomized by grouping food-secure and marginally food-secure households (CARI=1 or 2) into category 1, while moderately and severely food-insecure households (CARI=3 or 4) were assigned a value of 0. This transformation distinguishes between relatively food-secure and food-insecure households.

[4] Food Consumption Score (FCS): This measure was originally classified into three groups: poor (1), borderline (2), and acceptable (3). To facilitate the analysis, the variable was dichotomized by grouping households with a "poor" food consumption score into category 0, while those classified as "borderline" or "acceptable" were assigned a value of 1. This recoding differentiates between severely food-insecure households and those with relatively better food security.

Source: Marivoet and Hema (2024).

- Lcs_stress_DomAsset (Selling household assets or goods): This includes selling radios, furniture, televisions, or jewelry, indicating a willingness to part with non-productive assets. Such sales often provide short-term relief for immediate cash needs without depleting productive resources.
- Lcs_stress_Saving (Spending savings): Reflects households utilizing their financial savings to cope with shocks. This approach indicates a depletion of safety nets, which can jeopardize long-term financial stability.
- Lcs_stress_EatOut (Sending household members to eat elsewhere): Sending family members to eat outside the household often signals dependence on external support networks or community aid to manage food insecurity.
- Lcs_stress_BorrowCash (Borrowing money to cover food needs) and Lcs_stress_BorrowFood (Buying food on credit): These coping strategies reflect a reliance on credit to secure food, highlighting financial strain and potential indebtedness if credit is continually accessed.

- Lcs_stress_MoreLabour (Resorting to casual labor more than usual): This response shows an increased reliance on informal labor to compensate for income losses. Casual labor is generally unstable, offering temporary relief without long-term security.
- Lcs_stress_Animals (Selling animals more than usual): Selling livestock, often a key income source, indicates a moderate level of distress. Livestock sales can undermine long-term food production and economic resilience.
- Lcs_crisis_ProdAssets (Selling productive assets or means of transport): Selling items like bicycles or tools represents a crisis-level response. These assets are usually linked to income-generating activities, so selling them could permanently affect household earning potential.
- Lcs_crisis_Edu_Health (Reducing essential non-food expenditure on education/health): Reductions in education and healthcare spending imply tough trade-offs, potentially hindering human capital development and worsening long-term poverty.
- Lcs_crisis_OutSchool (Withdrawing children from school): This crisis-level coping strategy disrupts education, often affecting children's future earning potential.
- Lcs_em_ResAsset (Mortgaging/selling the house/land): Mortgaging or selling a home or land, classified as an emergency strategy, reflects extreme financial distress and may result in permanent losses of property or security.
- Lcs_em_Begged (Begging or asking strangers for money/food): This emergency response shows the extreme vulnerability of a household with no available resources or social safety nets.
- Lcs_em_IllegalAct (Engagement in high-risk or exploitative jobs): Resorting to dangerous or degrading jobs indicates desperation and extreme coping, potentially leading to long-term social and economic consequences.
- Lcs_em_FemAnimal (Selling of last female animals): Selling the last female livestock, which is essential for herd regeneration, signifies a critical depletion of future food and income sources.

Overall, food security variables, the Food Consumption Score (FCS), Household Dietary Diversity Score (HDDS), Household Hunger Scale (HHS), and Consolidated Approach for Reporting Indicators (CARI) reveal significant challenges for households in maintaining adequate food security. A substantial proportion of households fall into categories designated as "poor" or "food insecure," underscoring a persistent concern around dietary diversity and reliable access to food. Furthermore, the data show limited variation in food security levels among households, indicating that food insecurity is not isolated but rather a widespread issue affecting much of the population in Mali.

Regarding coping strategies, households are observed to adopt a range of methods in response to economic strain and food insecurity, with a particular emphasis on asset liquidation, borrowing, and expanding labor. One of the more common strategies includes selling household assets (Lcs_stress_DomAsset), suggesting that many households are in such precarious financial situations that they are willing to sacrifice long-term stability for immediate relief. This choice reflects a trade-off, where valuable items are relinquished to generate cash flow, highlighting the urgent need to address immediate demands despite the potential for future financial vulnerability. Additionally, strategies such as spending savings (Lcs_stress_Saving) and borrowing money for food (Lcs_stress_BorrowCash) are prevalent, pointing to a dependency on both savings and credit. While these strategies offer temporary financial support, they are not sustainable over extended periods and may leave households in deeper financial hardship if economic shocks persist.

More severe measures, such as reducing essential non-food expenditures (Lcs_crisis_Edu_Health) and withdrawing children from school (Lcs_crisis_OutSchool), though less frequent, reveal the significant sacrifices some households are making, especially concerning long-term welfare in education and health.

These decisions, which undermine future stability, indicate that certain households are reaching critical thresholds in coping. Finally, extreme actions such as begging (Lcs_em_Begged) or engaging in high-risk work (Lcs_em_IllegalAct) are notable, albeit rare, coping mechanisms. These strategies illustrate acute distress within a subset of households, signaling a level of hardship where even basic needs cannot be met through traditional means.

The dataset also includes key demographic factors that influence both food security outcomes and coping strategies. The area classification (urban versus rural) reveals that most households are located in rural areas, which often face heightened vulnerability to food insecurity due to limited market access, fewer income opportunities, and scarce support resources. The education level of the household head, with primary education being the most common attainment, suggests limited educational advancement among household leaders. This restricted educational background may correlate with reduced earning potential, which in turn limits the array of coping strategies available to households under economic stress.

Finally, the marital status and gender of the household head further contextualize the coping behaviors observed. Most households are headed by single, male individuals, a demographic composition that could shape coping strategy preferences and resource distribution within the household. Single-headed households, especially in rural contexts, might face compounded challenges, including restricted access to social support networks and fewer income sources, thus intensifying their vulnerability in times of economic crisis.

5. Estimation results[1]

Selling Domestic Assets (Lcs_stress_DomAsset)

Selling domestic assets is a common coping strategy adopted by households during periods of crisis, reflecting their attempts to manage short-term financial or food insecurity. The analysis indicates that prolonged food price shocks, especially those linked to staple crops such as millet and rice, significantly influence this behavior. For instance, the coefficients for zs_millet_spell and zs_rice_spell highlight that extended periods of elevated prices drive households to liquidate their assets. Similarly, climatic shocks, particularly drought (R_drought), exacerbate the need to sell possessions due to reduced agricultural yields and limited income.

Households typically sell non-productive assets like furniture, electronics, or household goods to generate immediate cash. This approach provides short-term relief, enabling them to purchase food, settle debts, or address pressing needs. However, it undermines their long-term resilience. Depleting domestic assets, especially under repeated shocks, erodes the household's safety net and leaves them vulnerable to subsequent crises. Moreover, households in rural areas, which often lack access to formal financial institutions or insurance schemes, are disproportionately affected. For them, asset sales become a default strategy rather than a choice.

The reliance on selling domestic assets also has social and economic implications. In many contexts, these assets hold symbolic or cultural value, and their liquidation can affect a household's social standing. Furthermore, the frequent selling of assets disrupts intra-household dynamics, often placing an undue burden on women, who may be responsible for managing the household's inventory.

[1] A detailed table with the estimation results for coping strategies can be found in Annex A.

Addressing this issue requires multi-pronged interventions. Governments and development organizations should prioritize stabilizing food prices through improved market regulations and strategic reserves. For instance, the Food and Agriculture Organization (FAO) emphasizes the importance of price monitoring systems to preemptively manage market volatility. Furthermore, cash transfer programs can provide households with the resources needed to meet immediate needs without resorting to asset liquidation. Studies, such as Dercon (2004b), demonstrate that such financial support mechanisms reduce reliance on damaging coping strategies. Additionally, community savings groups should be promoted to encourage the accumulation of financial buffers. These groups have been effective in providing alternative sources of liquidity during crises, as evidenced by programs in Sub-Saharan Africa.

In conclusion, while selling domestic assets serves as a survival strategy, it reflects underlying vulnerabilities that need urgent attention. Strengthening social safety nets, stabilizing food prices, and promoting financial inclusion are crucial to mitigating the detrimental effects of this coping mechanism and building household resilience in the long term.

Using Savings (Lcs_stress_Saving)

The depletion of household savings is another widely observed response to economic and climatic shocks. This strategy reflects the use of accumulated financial resources to cushion the effects of crises. The analysis shows that food price shocks, particularly prolonged periods of high millet prices (zs_millet_spell), and climatic challenges like flooding (R_flood) and poor soil moisture performance (cdi_soilmoisture), significantly drive this behavior. Households rely on their savings to cover immediate expenses, such as purchasing food, repairing flood-damaged homes, or securing alternative income sources.

Savings play a critical role in mitigating the impacts of shocks, acting as a first line of defense against financial instability. However, their depletion often leaves households vulnerable to future crises. Once savings are exhausted, households are forced to adopt more severe measures, such as borrowing or selling assets. This dynamic underscores the finite nature of savings as a resource and highlights the structural vulnerabilities that prevent households from replenishing their financial reserves. In many cases, savings are already limited due to low or irregular incomes, particularly in rural areas where economic opportunities are scarce.

The link between climatic shocks and savings depletion also underscores the growing risks posed by climate change. Flooding not only damages physical assets but also increases recovery costs, while poor soil moisture reduces agricultural yields, diminishing the household's ability to generate income. This dual impact—on both savings and income generation—creates a cycle of vulnerability that is difficult to escape.

To address this issue, interventions must focus on enhancing the capacity of households to save and manage risks more effectively. One approach is to promote financial literacy programs that encourage diversified saving strategies, helping households prepare for multiple types of shocks. Additionally, governments can introduce subsidized insurance schemes that protect against climate-related losses, reducing the financial burden on affected households. The World Bank (2018) highlights the success of such initiatives in improving household resilience to climate variability. Furthermore, investments in climate-resilient infrastructure, such as flood defenses and irrigation systems, can reduce the frequency and severity of climate shocks, thereby lessening the need for households to deplete their savings.

Sending household members to eat elsewhere (Lcs_stress_EatOut)

Sending household members to eat elsewhere is a commonly observed coping strategy among households during economic or climatic shocks. The analysis reveals significant associations between this behavior and variables such as prolonged high maize prices (zs_maize_spell), inadequate rainfall (cdi_rainfall), and civilian-targeting conflict events (danger). These findings indicate that households, when faced with resource constraints, may send certain family members to eat outside the home—often at the homes of relatives, neighbors, or charitable institutions—as a means of stretching limited household food supplies.

This strategy is often among the first steps taken to mitigate food insecurity because it provides temporary relief without requiring households to sell assets or take on debt. By shifting some food consumption outside the household, families attempt to ensure that all members continue to have access to meals, even if it means relying on external support networks. However, while this approach may help in the short term, it can have unintended social and nutritional consequences. Dependence on external sources of food may reduce dietary diversity if meals provided elsewhere lack nutritional balance. Additionally, it can create social strain within extended families or communities, as hosting additional individuals for meals places a burden on others who may also be struggling with limited resources.

Policy interventions should focus on addressing the economic and structural factors that compel households to adopt this strategy. Price stabilization programs, particularly for staple foods like maize, can help mitigate food cost surges that push families into food-sharing arrangements. Expanding targeted food assistance programs, such as school meal programs or community kitchens, can provide more sustainable options for households in crisis. Moreover, ensuring that local food markets remain functional during periods of conflict or climatic disruptions can reduce food scarcity pressures, helping families maintain normal eating patterns within their own homes. By implementing such measures, policymakers can alleviate the need for households to rely on external meal support and strengthen overall food security.

Borrowing Cash (Lcs_stress_BorrowCash)

Borrowing cash emerges as a critical coping mechanism for households facing severe shocks, particularly those related to conflict and climate. The regression results highlight significant links between this strategy and variables such as civilian-targeting conflict events (danger), drought severity (R_drought), and conflict fragmentation (fragmentation). These findings indicate that households resort to borrowing cash to cover immediate needs, including food, healthcare, and shelter, when regular income sources are disrupted.

While borrowing provides short-term financial relief, it often creates long-term challenges for households. High-interest rates and limited access to formal credit services mean that many families borrow from informal sources, leading to a cycle of debt that can be difficult to escape. Female-headed households, in particular, face additional barriers to accessing affordable credit, exacerbating their vulnerability during crises. Furthermore, the reliance on borrowing during prolonged droughts reflects the critical role of climate variability in destabilizing household economies, especially in rural areas.

Policy solutions should focus on increasing access to affordable credit and reducing the financial strain on vulnerable households. Expanding microfinance programs with low-interest loans can provide households with an alternative to high-cost informal borrowing. Additionally, promoting community-based lending initiatives, such as savings and credit cooperatives, can strengthen local financial systems. Climate-

resilient agriculture programs can also reduce the frequency of income shocks, thereby decreasing the reliance on borrowing.

Borrowing Food (Lcs_stress_BorrowFood)

Borrowing food is a critical coping strategy adopted by households facing acute food insecurity, often driven by prolonged food price instability and climatic disruptions. Significant predictors for this behavior include elevated maize prices (zs_maize_spell), prolonged high cowpea prices (zs_cowpea_spell), and drought severity (R_drought). These findings highlight the reliance on social networks and community support when formal safety nets are inadequate or unavailable.

While borrowing food provides immediate relief, it reflects underlying vulnerabilities and can strain social relationships, especially in communities where resources are already scarce. Repeated borrowing creates a dependency cycle, leaving households unable to recover fully between shocks. Furthermore, reliance on borrowing can exacerbate food insecurity for lenders, particularly in rural areas where climatic shocks are widespread and communal resources are limited. Over time, this strategy becomes unsustainable, leading households to adopt more extreme measures such as selling assets or skipping meals.

Addressing the root causes of food borrowing requires strengthening local food systems and ensuring equitable access to nutritious foods. Governments and development agencies should prioritize the establishment of community food banks and cooperatives, which can act as formalized mechanisms for resource sharing during crises. Expanding social safety nets, such as targeted food aid and cash-for-food programs, can reduce reliance on informal borrowing. Furthermore, investments in climate-resilient agriculture, such as drought-resistant crops, can help stabilize food production and availability during climatic shocks.

Selling Productive Assets (Lcs_crisis_ProdAssets)

The sale of productive assets, such as livestock or farming equipment, represents a severe coping mechanism often linked to prolonged crises. The regression results identify significant associations between this strategy and variables like extreme heat conditions (R_heat), high rice prices (zs_rice_spell), and fatalities from political violence (deadliness). These findings suggest that households resort to asset liquidation when income-generating opportunities are disrupted or essential needs cannot be met through other means.

Selling productive assets provides short-term financial relief but undermines long-term household resilience. Liquidating livestock or tools reduces future income potential, particularly in rural areas where agriculture and livestock rearing are primary livelihoods. This strategy is especially detrimental during climatic shocks, such as extreme heat, which already strain agricultural productivity. Political violence exacerbates this behavior by displacing households and disrupting markets, further reducing access to stable incomes.

To mitigate the reliance on asset sales, policies should focus on protecting household livelihoods and enhancing resilience to shocks. Governments can introduce subsidized livestock insurance programs to safeguard household assets during climatic disruptions. Expanding access to affordable agricultural inputs, such as seeds and fertilizers, can reduce the need for asset sales during periods of financial strain. Furthermore, peacebuilding efforts in conflict-affected areas are crucial to restoring market stability and enabling households to recover economically.

Begging (Lcs_em_Begged)

Begging emerges as an extreme coping strategy, often adopted by households experiencing severe and prolonged shocks. Significant predictors include civilian-targeting conflict events (danger), flooding (R_flood), and inadequate seasonal rainfall (cdi_rainfall). These findings highlight the role of both conflict and climatic shocks in driving households to the brink of survival, where informal or institutional support is insufficient.

The reliance on begging underscores the absence of effective safety nets and formal assistance mechanisms. Households that resort to this strategy often face stigma and marginalization, which can further erode social cohesion. Moreover, begging is not a sustainable solution, as it depends on the willingness and capacity of others to provide aid, which may also be limited during widespread crises.

Policy interventions should focus on strengthening social protection systems to reduce reliance on begging. Expanding cash transfer programs, food aid, and public works initiatives can provide vulnerable households with alternative means of support. Community-based support networks, such as neighborhood committees, can also play a vital role in identifying and assisting households at risk. Furthermore, investments in disaster risk reduction, such as flood defenses and water management systems, can mitigate the impact of climatic shocks and reduce the incidence of extreme coping behaviors.

Engaging in Illegal Activities (Lcs_em_IllegalAct)

Engaging in illegal activities represents one of the most extreme coping mechanisms adopted by households during prolonged crises. The regression results highlight significant predictors such as fragmented conflict environments (fragmentation), civilian-targeting conflict events (danger), and drought severity (R_drought). These factors disrupt legitimate income-generating opportunities, pushing households toward activities such as smuggling, theft, or participation in illicit trade.

Illegal activities reflect both economic desperation and a breakdown of social and institutional structures. Households in conflict-affected regions are particularly vulnerable, as the presence of multiple rebel groups and militias disrupts governance and legal economic systems. Drought conditions exacerbate this behavior by reducing agricultural yields and intensifying food insecurity, leaving few viable alternatives for income generation.

Addressing this issue requires a combination of economic development, conflict resolution, and social support. Governments and international organizations must invest in livelihood programs that provide alternative employment opportunities, particularly in conflict-prone areas. Job training initiatives, public works programs, and microenterprise support can help households transition away from illicit activities. Additionally, peacebuilding efforts are essential to restore governance and create a stable environment for legal economic activities.

Selling Female Animals (Lcs_em_FemAnimal)

Selling female animals represents a significant coping strategy, often adopted during periods of acute financial or food insecurity. Female animals, particularly livestock such as cows, goats, or chickens, are critical household assets due to their reproductive potential and contribution to sustained livelihood. The analysis reveals significant associations between this strategy and climatic and economic shocks, including extreme heat conditions (R_heat) and prolonged food price instability for key staples. These findings highlight the vulnerability of households reliant on livestock-based livelihoods during adverse events.

Selling female animals provides immediate financial relief, allowing households to purchase food, pay debts, or address urgent needs during crises. However, it undermines long-term livelihood sustainability. Female livestock is vital for herd regeneration and production, such as milk, eggs, or offspring, which provide both nutrition and income. Liquidating these animals not only reduces the household's ability to recover from future shocks but also exacerbates gendered vulnerabilities, as women often manage small livestock and depend on them for income and food security.

The sale of female animals is particularly common in rural areas where alternative income sources are limited, and households face significant climatic and economic risks. Heat stress, for instance, can severely impact livestock health, reducing productivity and forcing households to sell animals at suboptimal prices. Moreover, food price shocks increase the financial burden on households, leaving them with limited options but to liquidate valuable reproductive assets.

Policy interventions are critical to mitigate the reliance on this unsustainable strategy. Governments and development organizations should promote livestock insurance schemes to protect against climate-induced losses, ensuring households retain critical assets. Expanding access to veterinary services and climate-resilient livestock management practices can enhance the health and productivity of animals, reducing the likelihood of distress sales. Additionally, introducing cash transfer programs during periods of crisis can provide households with the financial resources needed to meet immediate needs without resorting to asset liquidation.

Figure 1 provides an overview of the estimated probabilities associated with various coping strategies employed by households when responding to a combination of economic, climatic, and conflict-related shocks and stressors. These probabilities do not represent reactions to a single uniform shock but rather reflect the likelihood of adopting specific strategies in the face of multiple stressors. The analysis accounts for the compounded effects of different shocks, including food price volatility, extreme weather events, and security threats, which collectively influence household decision-making.

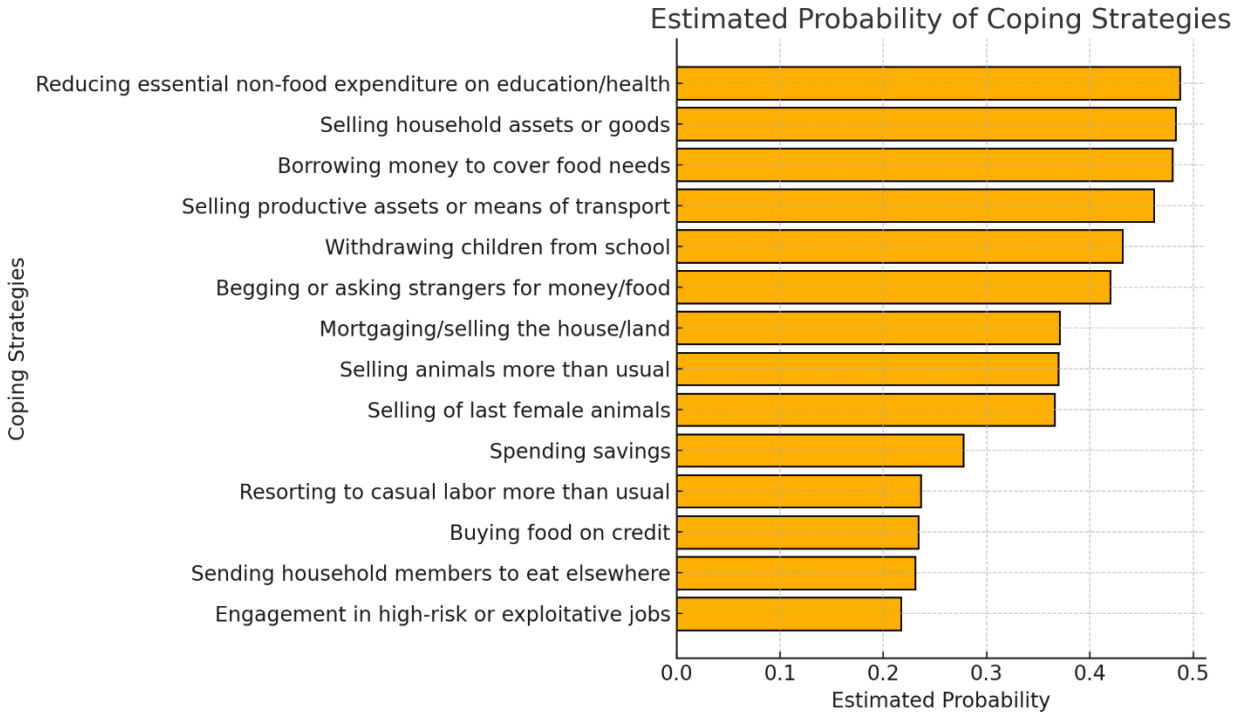
High-risk coping mechanisms such as reducing essential non-food expenditures on education or health (48.7%), withdrawing children from school (43.1%), and mortgaging or selling the house or land (37.1%) exhibit significant probabilities. While these strategies may provide temporary relief, they often have long-term detrimental effects on household welfare, perpetuating cycles of poverty and limiting future opportunities.

Asset liquidation, including selling household assets or goods (48.3%) and productive assets or means of transport (46.2%), is another frequently observed response. Though these strategies can generate immediate cash flow, they also deplete critical resources, eroding the household's productive capacity and increasing its vulnerability to future shocks.

Dependence on borrowing, such as borrowing money to cover food needs (47.9%) and buying food on credit (23.4%), highlights the reliance on external financial support mechanisms. However, repeated borrowing, particularly from informal sources, can lead to long-term debt accumulation, further straining household finances and reducing financial resilience.

Social and emotional costs are also evident in coping strategies such as sending household members to eat elsewhere (23.1%) or begging for food or money (41.9%). These measures reflect extreme levels of distress and insecurity, often leading to the breakdown of social ties and contributing to emotional and psychological hardship.

Figure 1: Estimated probability coping strategies



Source: Based on the integrated and enhanced dataset on food security and household coping strategies of Mali (2018-2023), see: https://doi.org/10.7910/DVN/NNAYAM.

To ensure clarity, it is important to interpret these probabilities as an aggregation of household responses across multiple shocks rather than as reactions to any single event. The diverse and overlapping nature of these stressors means that households must navigate a complex decision-making process, balancing short-term survival needs with long-term sustainability.

Impact of coping strategies on food security outcomes

The regression results for food security outcomes (Table 3), including Food Consumption Score (FCS), Household Dietary Diversity Score (HDDS), Household Hunger Scale (HHS), and Consolidated Approach for Reporting Indicators (CARI), reveal critical relationships between household characteristics, coping strategies, and food security measures. Education of the household head significantly improves all food security outcomes except HHS. The positive coefficients for FCS (0.264), HDDS (0.192), and CARI (0.244) underscore the importance of education in improving dietary diversity and coping capacity. However, the negative relationship with HHS (-0.125) suggests that educated household heads may experience greater difficulty meeting immediate food needs during crises, potentially due to higher household consumption standards.

The sex of the household head shows significant positive relationships across all outcomes, particularly with HHS (0.406). This indicates that households led by males or individuals with certain societal advantages may access resources more effectively, although this finding might also reflect gendered differences in societal roles.

Table 3: Estimation results on the impact of coping strategies on food security

	FCS	HDDS	HHS	CARI
Area	0.263***	0.209***	0.191***	0.479***
Education_head	0.264***	0.192***	-0.125***	0.244***
Marital_head	0.029	0.044	0.182***	0.129***
Sex_head	0.180***	0.163***	0.406***	0.137***
Selling household assets or goods	0.343***	0.342***	0.280***	0.308***
Spending savings	-0.103***	-0.077***	-0.011	0.002
Sending household members to eat elsewhere	-0.294***	-0.279***	-0.091	-0.127
Borrowing money to cover food needs	0.218***	0.221***	-0.041	0.134***
Buying food on credit	0.134	0.062	-0.290**	-0.092
Resorting to casual labor more than usual	0.167*	0.001	-0.344***	0.058
Selling animals more than usual	-0.215***	-0.287***	-0.058	-0.195***
Selling productive assets or means of transport	0.258***	0.230***	0.382***	0.290***
Reducing essential non-food expenditure on education/health	0.003	0.048	-0.132**	0.016
Withdrawing children from school	0.113***	0.066*	0.216***	0.185***
Mortgaging/selling the house/land	-0.116***	-0.130***	-0.024	-0.126***
Begging or asking strangers for money/food	0.044	0.054	-0.067	-0.013
Engagement in high-risk or exploitative jobs	0.126*	0.150***	0.713***	0.216***
Selling of last female animals	-0.149***	-0.018	0.140***	-0.125***
Intercept	0.809***	0.550***	0.741***	0.106***
Number of obs	85,430	85,430	85,430	85,430
Population size	13,441,710	13,441,710	13,441,710	13,441,710
Design df	85,429	85,429	85,429	85,429
F	82.82	81.22	94.14	162.04
Prob > F	0	0	0	0
*** p<0.01, ** p<0.05, * p<0.1				

Source: Based on the integrated and enhanced dataset on food security and household coping strategies of Mali (2018-2023), see: https://doi.org/10.7910/DVN/NNAYAM.

Several coping strategies correlate strongly with food security outcomes. Selling household assets, such as goods and productive assets, positively impacts all measures, particularly FCS (0.343) and HDDS (0.342), reflecting the short-term benefits of asset liquidation to secure food needs. However, reliance on such strategies erodes long-term resilience, as households deplete essential resources for future sustainability. Spending savings negatively affects FCS (-0.103) and HDDS (-0.077), suggesting that reliance on savings does not adequately address food insecurity. This may indicate that savings levels are insufficient to meet rising food needs. Borrowing money has positive effects on FCS (0.218) and HDDS (0.221). This suggests that borrowing helps maintain food consumption diversity but does not alleviate stress or perceived food insecurity. High-risk strategies, such as engagement in exploitative labor, show a significant positive association with HHS (0.713). This highlights the potential harm of such strategies despite their ability to generate short-term income.

Interestingly, strategies like sending household members to eat elsewhere and selling animals negatively impact most food security outcomes, reflecting their high social and economic costs. Selling animals particularly lowers FCS (-0.215) and HDDS (-0.287), emphasizing the detrimental impact of depleting livestock assets on household resilience.

6. Policy implications

In the face of systemic shocks, Malian households often resort to high-risk coping mechanisms such as reducing essential non-food expenditures on education and health, withdrawing children from school, or mortgaging and selling vital assets such as homes and land. While these strategies may provide temporary relief, their long-term consequences are severe, often trapping families in cycles of poverty and vulnerability. To mitigate these negative effects and enhance household resilience, policymakers must prioritize social protection, financial inclusion, and economic stability measures.

One of the most effective ways to reduce reliance on harmful coping strategies is by strengthening social protection systems. Conditional cash transfer (CCT) programs that tie financial assistance to school attendance and healthcare utilization have proven successful in preventing families from cutting back on these essential services. By ensuring that financial constraints do not force children out of school or limit access to medical care, such policies safeguard both immediate well-being and long-term economic mobility. Education support initiatives, including subsidized school fees, free school meals, and transportation assistance, further alleviate financial pressure on struggling households. Similarly, universal health coverage (UHC) programs can ensure access to affordable healthcare, preventing families from having to choose between basic medical needs and other pressing financial obligations.

Beyond direct financial support, improving access to credit and financial services is crucial in reducing the need for asset liquidation under distress. Many households resort to selling homes or land due to a lack of alternative financial options. Expanding microfinance services and community savings programs can offer households a financial buffer, providing access to low-interest credit during crises. Emergency loan schemes, backed by governments or international organizations, can serve as an alternative to distress sales, allowing families to address urgent needs without permanently compromising their long-term security.

Building economic resilience is another key aspect of reducing dependence on extreme coping strategies. Many vulnerable households rely on subsistence farming or informal labor, leaving them particularly exposed to economic and climate-related shocks. Investment in income diversification programs, such as vocational training and skill development initiatives, can provide alternative employment opportunities and create more stable income streams. In agricultural communities, the promotion of climate-resilient farming techniques, including drought-resistant crops and improved irrigation infrastructure, can reduce the impact of environmental shocks. Governments can also implement public works and employment schemes, particularly during periods of economic distress, ensuring that affected households have access to temporary work opportunities that provide financial relief.

Protecting household assets, particularly housing and land, is essential to prevent families from becoming permanently dispossessed due to financial instability. Governments should establish legal safeguards against forced property sales, ensuring that vulnerable households are not coerced into losing their primary assets. Secure land tenure systems, along with housing stability programs such as rental assistance or mortgage relief, can prevent displacement and long-term destitution. Strengthening property rights and providing targeted support to households at risk of eviction can reduce the number of families forced into homelessness as a result of economic hardship.

A comprehensive policy response is necessary to address the underlying factors that push households toward high-risk coping mechanisms. By reinforcing social safety nets, expanding financial access, and fostering economic resilience, policymakers can mitigate the negative impacts of systemic shocks and

ensure that families do not have to make choices that compromise their future well-being. These interventions must be coordinated at multiple levels, involving governments, international organizations, and local communities to create a sustainable and inclusive approach to household stability. In the long run, proactive investment in resilience-building measures will reduce vulnerability and promote lasting economic security for the most at-risk populations.

7. Concluding remarks

The study underlines the profound impact of systemic shocks—such as economic instability, climate events, and conflict—on household food security, emphasizing that these shocks do not act in isolation. Instead, they interact in a compounded manner, intensifying the vulnerability of affected households. This multi-dimensional framework of understanding food security challenges helps illuminate the intricate web of risks that exacerbate poverty and deplete resources.

One of the core findings is the distinction between coping strategies, which range from proactive to reactive. Proactive measures, like income diversification and investment in resilient agriculture, are more sustainable and tend to buffer households against future shocks. Conversely, reactive strategies—such as asset liquidation, borrowing, and reducing essential expenditures—offer short-term relief but often deepen vulnerability over time. The study reveals that these reactive measures are more prevalent among marginalized groups, including rural and female-headed households, who face systemic inequities in access to resources and decision-making.

Gender disparities emerge as a recurring theme, as women often bear a disproportionate burden during crises due to limited access to resources and social networks. This calls for targeted interventions that empower women through financial inclusion, education, and land ownership rights. Similarly, the findings point to geographic vulnerabilities, with rural households being more exposed to food insecurity due to their dependence on climate-sensitive agriculture and limited market access.

The study also highlights the role of social safety nets in mitigating the adverse impacts of shocks. Effective programs—such as cash transfers, community food banks, and subsidized credit schemes—can significantly reduce the reliance on detrimental coping mechanisms. These mechanisms not only provide immediate relief but also contribute to long-term resilience by enabling households to rebuild assets and secure livelihoods.

Policymakers are urged to focus on resilience-building strategies that address both immediate and structural vulnerabilities. Investments in climate-resilient agriculture, such as drought-resistant crops and advanced irrigation systems, can shield households from climate shocks. Equally critical are measures to stabilize food prices and ensure equitable access to nutritious food, which can alleviate the financial strain on vulnerable populations.

The paper's findings underscore the necessity of integrated policy frameworks that account for the multifaceted nature of food insecurity. Addressing this challenge requires collaboration across sectors, combining economic, social, and environmental strategies. For instance, linking conditional cash transfers to education and healthcare can provide dual benefits, fostering human capital development while addressing immediate food security needs.

In conclusion, the study paints a complex yet actionable picture of food security in the multi-shock environment of Mali. It advocates for a proactive, inclusive, and integrative approach to policy-making that prioritizes the most vulnerable households. By strengthening social safety nets, empowering marginalized groups, and investing in resilience-building measures, communities can navigate the challenges of systemic shocks more effectively, fostering sustainable development and food security for all.

ABOUT THE AUTHOR

John M. ULIMWENGU, Senior Research Fellow, Development Strategy and Governance Unit, International Food Policy Research Institute (j.ulimwengu@cgiar.org)

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ANNEX A: ESTIMATION RESULTS FOR COPING STRATEGIES

Variables	Lcs_stress_DomAsset	Lcs_stress_Saving	Lcs_stress_EatOut	Lcs_stress_BorrowCash	Lcs_stress_BorrowFood	Lcs_stress_MoreLabour	Lcs_stress_Animals
zs_maize_spell	-0.00559	-0.0165***	0.0264*	-0.0146***	0.0299***	0.0381***	-0.00895**
zs_millet_spell	0.0115**	0.0115***	-0.0159*	0.0218***	0.0211***	0.0190***	0.0178***
zs_rice_spell	0.00979***	-0.0024	0.0107*	-0.0159***	-0.00519	-0.00755**	0.00388
zs_cowpea_spell	0.00666**	-0.00897***	-0.0361***	-0.00560**	-0.0115*	-0.00662	0.00557*
zs_peanut_spell	-0.0059	-0.00126	-0.0356**	-0.0143***	-0.00105	0.0241**	-0.00295
cdi_rainfall	0.495**	0.688***	-0.239	0.355***	0.36	1.343***	0.314*
cdi_soilmoisture	-0.328	0.390**	1.141***	1.430***	0.458**	-1.282***	0.338*
cdi_evapotranspiration	-0.245*	-0.00488	0.39	-0.184**	-0.680***	-1.041***	-0.521***
deadliness	0.00220***	0.000698**	0.000203	0.000576*	-0.00989***	-0.00528***	0.000468
danger	0.0158***	0.0150***	-0.00932	0.0129***	0.0633***	0.0537***	0.0131***
diffusion	-0.858***	0.513**	-0.478	0.340*	0.891***	0.249	-1.525***
fragmentation	-0.0678***	-0.0843***	-0.0567***	-0.0656***	-0.0803***	-0.107***	-0.0408***
R_drought	-0.0150***	-0.00684***	-0.0127***	-0.0169***	-0.0286***	-0.0218***	-0.0113***
R_flood	0.0793***	0.0810***	0.0727***	0.0494***	0.0682***	0.0692***	0.0380***
R_heat	0.0192***	0.0129***	0.0204***	0.0129***	0.0255***	0.0307***	0.00849***
area	0.0965**	-0.191***	-0.148*	-0.05	-0.291***	-0.0293	-0.0729
education_head	-0.111***	0.0580**	-0.0206	-0.0605**	-0.0838**	-0.0124	-0.027
marital_head	0.0315	-0.200***	-0.286***	-0.117**	0.0501	-0.0852	-0.0759
sex_head	-0.244***	0.0514	-0.198*	-0.0225	-0.280***	-0.104	-0.0751
Intercept	-11.13***	-11.02***	-10.57***	-5.904***	-7.499***	-9.259***	-5.271***
Observations	41,274	23,687	19,716	40,978	19,989	20,172	31,553
Number of obs	41,274	23,687	19,716	40,978	19,989	20,172	31,553
Population size	7,952,124	4,571,246	3,385,493	7,872,106	3,395,922	3,441,889	5,930,615
Design df	41,273	23,686	19,715	40,977	19,988	20,171	31,552
F	74.66	47.07	12.49	154.39	95.49	45.31	45.2
Prob > F	0	0	0	0	0	0	0

Variables	Lcs_crisis_ProdAssets	Lcs_crisis_Edu_Health	Lcs_crisis_OutSchool	Lcs_em_ResAsset	Lcs_em_Begged	Lcs_em_IllegalAct	Lcs_em_FemAnimal
zs_maize_spell	-0.00211	-0.0381***	0.001	0.0199**	0.00971*	0.0996***	0.00353
zs_millet_spell	0.00825*	0.0120***	0.0184***	0.00212	0.00637	-0.0237	0.00738
zs_rice_spell	0.00707**	0.00515**	0.00536	0.0117**	-0.000961	0.0174**	0.00041
zs_cowpea_spell	-0.00125	0.0113***	-0.00575	-0.0277***	-0.0276***	-0.0887***	-0.0171***
zs_peanut_spell	-0.0113**	0.0139***	-0.0132**	-0.0232***	-0.00523	-0.0513	-0.0138***
cdi_rainfall	0.681**	1.097***	1.268***	1.028***	0.09	1.101	0.207
cdi_soilmoisture	0.0736	-0.19	0.182	-0.107	0.336	0.594	1.481***
cdi_evapotranspiration	-0.523***	-0.370***	-0.598***	-0.0236	0.540***	-0.295	-0.127
deadliness	0.00222***	0.00135***	0.00250***	0.00373***	0.00337***	0.00597	0.00311***
danger	0.0113***	0.0140***	0.00547**	0.00163	0.00551*	-0.0713**	0.00271
diffusion	-1.237***	0.625***	0.192	-0.873**	-1.195***	-2.094**	-0.333
fragmentation	-0.0818***	-0.0427***	-0.0253**	-0.0173	0.0102	-0.0405	-0.0460***
R_drought	-0.0118***	-0.0137***	-0.00746***	-0.0124***	-0.00872***	-0.0191***	-0.0111***
R_flood	0.0815***	0.0653***	0.0626***	0.0606***	0.0078	0.0932***	0.0444***
R_heat	0.0153***	0.0169***	0.0160***	0.0202***	0.0169***	0.0315***	0.0140***
area	0.124**	-0.110***	-0.0691	0.104	0.0943	0.00202	0.0793
education_head	-0.0652	-0.0166	-0.141***	-0.114**	-0.00216	0.113	-0.0521
marital_head	-0.179**	-0.266***	-0.0454	-0.0122	-0.106	0.0519	-0.0874
sex_head	-0.126*	-0.115*	-0.170*	-0.169*	-0.307***	-0.249	-0.252**
Intercept	-11.23***	-9.163***	-10.56***	-10.22***	-3.889***	-14.53***	-7.129***
Observations	39,443	41,617	36,846	31,656	35,822	18,549	31,232
Number of obs	39,443	41,617	36,846	31,656	35,822	18,549	31,232
Population size	7,601,026	8,038,522	7,158,251	6,060,541	6,883,649	3,186,893	5,967,186
Design df	39,442	41,616	36,845	31,655	35,821	18,548	31,231
F	42.81	81.36	30.96	40.67	37.7	10.07	55.01
Prob > F	0	0	0	0	0	0	0

Source: Based on the integrated and enhanced dataset on food security and household coping strategies of Mali (2018-2023), see: https://doi.org/10.7910/DVN/NNAYAM.

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IFPRI is a CGIAR Research Center

1201 Eye Street, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: ifpri@cgiar.org | www.ifpri.org | www.ifpri.info