Addressing Conflict and Weather Shocks in Agrifood Value Chains:
Policy Preferences of Nigerian Maize Traders

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Abstract

With growing concerns about the multifaceted challenges faced by agrifood value chains in developing countries, understanding the perspectives of value chain participants becomes vital for designing effective policies to address the challenges. This study examines the preferences of Nigerian maize wholesale traders, as representative actors in the midstream of the maize value chain, regarding policies aimed at mitigating the impacts of violent conflicts and extreme weather events. Using the best-worst scaling method, we evaluate their preferences for nine alternative policy options concerning conflict shocks and eight policy options for weather shocks, categorized into hard and soft infrastructure policy measures. A survey of 300 maize traders across major maize-producing and consuming states reveals that traders make trade-offs between soft and hard infrastructure policy options depending on the type of shocks encountered. Additionally, traders' demographic and business characteristics significantly influence their policy preferences, highlighting the need for tailored policy responses aligned with the specific nature of shocks and trader characteristics.

1. Introduction

Agrifood value chains in developing countries have undergone rapid growth and transformation in recent decades, extending across larger geographical areas and involving more actors. This significant change in a relatively short period necessitates an urgent understanding of these transformations and the development of supportive policies and infrastructure to adapt to the evolving nature of the value chains (Barrett et al., 2019; Tadesse and Badiane, 2020; Vos and Cattaneo, 2020). This need becomes particularly evident as the expansion of value chains is likely to increase the exposure of participating actors to risks stemming from various factors such as climate change, insecurity, and violent conflicts.

Within agrifood value chains, actors in the middle segment, including transporters, wholesalers, and processors, play a pivotal role as they are vital links between the upstream and downstream components. For example, in Nigeria, maize wholesale traders serve as a major market outlet for farmers; in turn, these traders supply maize to approximately 75% of the Nigerian population (Liverpool-Tasie et al., 2017). Reardon et al. (2012) underscore that midstream actors make substantial contributions to staples value chains, constituting 30-40% of the total value added.

Despite the pivotal role of midstream actors and the disruptions to their activities caused by various risks and shocks, there is limited understanding of their challenges and policies aimed at addressing them. Furthermore, discussions surrounding policies supportive of the resilient and effective functioning of agrifood value chains have primarily focused on hard infrastructure policy measures (e.g., dams and electrification), with minimal attention given to soft infrastructure policy measures (e.g., financial services and information technologies) (Ghosal, 2013; Rocker, 2019). Nonetheless, the needs of agrifood value chain actors regarding both hard and soft infrastructure have not been thoroughly investigated. Moreover, their perspectives on existing policies promoting infrastructure, as well as their preferences for potential policies, remain unexplored.

This study investigates the perspectives of midstream actors on policy interventions aimed at addressing the potential risks and shocks faced by agrifood value chains. Specifically, we examine the policy preferences of small and medium-sized Nigerian maize wholesale traders in response to policies addressing common shocks in Nigeria. These shocks include extreme weather events such as floods and droughts, as well as conflict (or insecurity) incidents such as those involving Boko Haram, herder-farmer conflicts, armed robbery or banditry, and kidnapping. We examine various policy options for addressing these shocks, encompassing safety and energy infrastructure-related policies as hard infrastructure policy measures, along with financial, informational, and security policies as soft infrastructure policy measures.

We employ the Best-Worst Scaling (BWS) approach to assess maize trader's relative preferences for various policy options, while exploring traders' trade-offs between them (Lusk and Briggeman, 2009), especially hard and soft infrastructure policy measures. The BWS method, initially introduced by Finn and Louviere (1992), has found wide application in the agricultural marketing literature to evaluate consumer preferences for food values (Bazzani et al., 2018; Costanigro, Appleby, and Menke, 2013; Lister et al., 2017; Lusk and Briggeman, 2009). It has also been widely employed in the agricultural and food policy literature to examine preferences for food production practices (McKendree, Tonsor, and Wolf, 2018) and policy preferences of input suppliers (Maredia et al., 2022), farmers (Ola and Menapace, 2020; Ortega et al., 2015; Wolf and Tonsor, 2013; Maredia et al., 2022; Mason et al., 2019), consumers (Caputo and Lusk, 2019; Stone, Costanigro, and Goemans, 2018), and other agricultural sector stakeholders such as research organization and government (Mason et al., 2019). However, there is a notable gap in the existing literature regarding the assessment of policy preferences among midstream actors in agrifood value chains. One exception is Maredia et al.'s (2022) examination of crop millers and traders' preferences for COVID-19 pandemic recovery policies.

This study contributes to the agricultural and food policy literature in three ways. First, while the policy preferences of upstream and downstream actors have been extensively studied, relatively little attention has been given to the preferences of midstream actors. We contribute to this thin literature by presenting evidence from maize wholesale traders in Nigeria, one of the largest maize-producing countries in Africa (USDA, 2022). Policies derived from understanding and addressing the assessment and needs of midstream actors have the potential to mitigate the effects of shocks on their activities, thereby benefiting the entire value chain, particularly farmers upstream and consumers downstream.

Second, we offer new insights into addressing prevalent and rising shocks in agrifood value chains. Extreme weather events and violent conflicts can impact agricultural systems and value chains at multiple stages, affecting production, harvest, storage, and transportation (Dercon, 2002; Gommes, 1998; Lobell and Field, 2007; Lobell, Schlenker, and Costa-Roberts, 2011; Liverpool-Tasie and Parkhi, 2021), all of which influence maize traders. To the best of our knowledge, this study is the first to evaluate policy preferences among midstream actors in agrifood value chains in the context of weather and conflict shocks.

Third, we explore heterogeneity in policy preferences based on midstream actors' characteristics. The preferences of these actors regarding various policy options, including both hard and soft infrastructure policy measures, are potentially shaped by their demographic and business traits, as well as their prior experience with shocks. Through our analysis of maize traders' preferences for each type of shock and across different subgroups, we underscore the importance of tailoring policy responses to the specific nature of shocks and characteristics of traders.

Our findings reveal that regarding conflict shocks, maize traders prioritize soft infrastructure policy measures, such as enhanced security services. On the other hand, their priority shifts to hard infrastructure policy measures, such as improved flood-proof infrastructure, in response to weather shocks. Subgroups of traders, categorized by gender, business scale, education, geographic region, and prior experience with shocks exhibit heterogeneous policy preferences. For example, despite expectations that female traders, often facing resource constraints, would prioritize financial assistance such as cash relief, we find that concerning both conflict and weather shocks, they prioritize physical infrastructure more as a preventive measure, likely due to their heightened vulnerability to shocks. Furthermore, since northern Nigeria is the primary maize-producing region, the frequent occurrence of violent conflicts in this area affects southern traders who rely on the northern region for sourcing maize, leading to distinct policy preferences across northern and southern trader groups.

2. Background and Policy Identification

Jaffee, Siegel, and Andrews (2010) developed a conceptual framework for identifying risks within agricultural value chains, as well as for assessing participating actors' exposure to, and potential losses from, these risks. Primary risks encountered by economic agents throughout agricultural value chains include extreme weather events such as floods, droughts, and hurricanes, biological and environmental risks like crop diseases, risks related to changing market conditions, as well as logistical and infrastructural risks involving conflicts and physical destruction of infrastructure. Of particular focus in our study are weather and conflict-related shocks, which are increasingly prevalent in many countries, including Nigeria (Nogales and Oldiges, 2023; Ojo, Oyewole, and Aina, 2023).

Weather and conflict shocks have the potential to impact various stages of the maize value chain and midstream actors, especially wholesale traders. For example, floods or droughts in the upstream farm area can affect the production and availability of maize, subsequently influencing traders' maize purchases. Floods, in particular, can damage traders' maize storage by increasing the likelihood of pest infestations or mold growth (Liverpool-Tasie and Parkhi, 2021), and they can also disrupt the transportation of maize by causing road washouts. Violent conflicts can similarly disrupt entire value chains, from production areas to transportation routes and markets, thereby limiting traders' ability to buy, transport, store, and sell maize. Vargas, Reardon, and Liverpool-Tasie (2023) observed that between August 2020 and July 2021, 13% of Nigerian maize wholesale traders in the northern region and 26% of traders in the southern region experienced disruptions caused by floods and droughts. Additionally, nearly half of the traders were affected by violent conflicts during the same period.

The set of risk management measures proposed by Jaffee, Siegel, and Andrews (2010) includes, but is not limited to: (i) financial instruments (e.g., credit, savings, and insurance); (ii) enterprise management practices (e.g., farm and firm diversification practices); (iii) technology development and adoption (e.g., postharvest technology and information technology); (iv) public policy and programs (e.g., law enforcement and protection of property and human rights); and (v) infrastructure investment (e.g., transport and communication infrastructure). We examined these five instruments within the Nigerian context, drawing from government documents and inputs provided by Nigerian maize traders. Consequently, we identified nine policy options for addressing conflict shocks and eight policy options for addressing weather shocks, all of which fall under these five categories. The policy options are categorized into two broad types: soft and hard infrastructure policy measures. The detailed policy options for conflict and weather shocks are presented in Table 1.

Soft infrastructure policy options include policies to improve access to financial services, information technology, and security operations. Financial policies involve providing (ex-post) cash assistance to traders who suffered losses due to conflict or weather shocks; enhancing access to (ex-ante) insurance coverage to compensate for potential losses due to these shocks; and facilitating access to loans for investing in technologies such as security cameras and better storage facilities, to help prevent losses from conflict and weather shocks, respectively. Policies targeting improved access to information technology include the establishment of early warning systems and call centers that provide real-time information on route safety. These measures can assist traders in avoiding unsafe routes where conflicts are ongoing or imminent, as well as flooded routes, and in using alternative routes. Furthermore, information technology policies involve strengthening traders' capacity through training on risk management technologies, such as strategies to diversify suppliers in response to conflict shocks and measures to prevent mold or rodent growth following weather shocks. Additionally, enhancing security services (e.g., police, security personnel, or surveillance systems) along roads and in market or warehouse areas is included to address conflict shocks.

On the other hand, hard infrastructure policy options encompass the construction or improvement of road infrastructure, such as building or improving dams, culverts, or drainage systems on roads to prevent or minimize flooding (for weather shocks); and the installation of protective hardware (e.g., concrete barriers for conflict shocks and flood barriers, sandbags, or tarps for weather shocks) for markets and warehouses. Additionally, it includes investments in energy infrastructure to provide a more reliable electricity supply, for purposes such as lighting to improve safety and security in response to conflict shocks, as well as for ensuring the reliable operation of temperature-controlled warehouses to preserve stored maize in response to weather shocks.

3. Data and Survey Design

We designed a survey to collect data from a sample of Nigerian maize wholesale traders, including their demographic and business characteristics, as well as their relative preferences for the aforementioned policy options to address conflict and weather shocks. Between May and August 2023, we conducted in-person interviews with a total of 300 maize wholesale traders, selected as a sub-sample from a previous survey involving maize traders.

The initial maize trader survey in Nigeria was conducted in 2017, including 1,405 maize traders from the primary maize-producing states in northern Nigeria (Kaduna, Kano, Katsina, and Plateau), as well as the key maize-consuming state in southern Nigeria (Oyo). Within each state, all maize traders in the primary city markets were interviewed. In addition, in the four northern states, traders from the top five regional markets with the highest total maize sales volume were listed and categorized into two groups: the 'large trader stratum', comprising traders with maize sales above 32 tons during a typical month in the high maize trading season (from August to February), and the 'small trader stratum', consisting of those with maize sales below 32 tons during the same period. The cutoff of 32 tons represents the average volume of maize traded during this period across all the regional markets in the study states. Traders were then randomly selected based on the proportion of small and large traders in each market. In

2021, 1,111 traders from the 2017 sample were re-surveyed, including 584 traders from Kano, 138 traders from Kaduna, 170 traders from Katsina, 137 traders from Plateau, and 80 traders from Oyo. For this study, from among those interviewed in 2021, we randomly selected 60 maize traders from each of the five states, totaling 300 traders.[1]

We developed a Best-Worst Scaling (BWS) experiment to elicit maize traders' preferences for alternative policy options regarding conflict and weather shocks. This experiment aimed to understand how traders make trade-offs among competing policy options as they select the best and worst options from a choice set, which is a collection or subsample of the available policy options. Additionally, it sought to comprehend how traders prioritize the policy options through both ordinal and cardinal rankings.

Balanced Incomplete Block Designs (BIBDs) are frequently used in experimental designs for Case 1 (object case) BWS surveys, where a set of objects or items (i.e., policy options in this study) is measured (Bazzani et al., 2018; Louviere, Flynn, and Marley, 2015).[2] Balance is achieved by ensuring that each choice set contains an equal number of objects that are repeated an equal number of times across all the choice sets. Furthermore, the objects are allocated orthogonally, implying each object appears together with other objects with equal frequency across the choice sets. However, generating a BIBD may lead to a large number of choice sets, potentially causing respondent fatigue (Bazzani et al., 2018). Implementing a BIBD in our case would result in 18 BWS choice sets regarding conflict shock policies and 14 BWS choice sets regarding weather shock policies, each containing four different policy options.

Therefore, we opted to use a generalized Cyclic Incomplete Block Design (CIBD) (Jarrett

[1] If the randomly selected trader was unavailable for an interview due to reasons such as death or being unreachable, we substituted them with another randomly selected trader from the same state.
[2] Case 2 (profile case) and Case 3 (multi-profile case) BWS surveys involve measuring attribute levels and profiles, respectively.

and Hall, 1978; John, 1981), which is a class of Partially (or nearly) Balanced Incomplete Block Designs (PBIBDs) relaxing the orthogonality requirement. While all pairs of objects are estimated with the same accuracy in BIBDs, PBIBDs help in reducing the number of required choice sets at the cost of some pairs of objects having different efficiency from other pairs of objects. Among different types of PBIBDs, CIBDs are easy to construct, possess good statistical properties, and their analysis is the same as the analysis of BIBDs (Lawson, 2014). In our case, the design resulted in nine BWS choice sets for conflict shock policies and eight BWS choice sets for weather shock policies, each containing four policy options. Each of the nine conflict shock policy options is repeated four times across the nine conflict shock choice sets. Similarly, each of the eight weather shock policy options appears four times across the eight weather shock choice sets. In addition, each conflict shock policy option has four first associates and four second associates, while each of weather shock policy option has five first associates and two second associates. First associates refer to a pair of policy options that occur together in two choice sets, while second associates are a pair of policy options that occur together in one choice set. The design maximizes D-efficiency, which assesses the goodness of a design compared to orthogonal designs with optimal efficiency (Kuhfeld, 2005).

In each BWS choice set, traders were asked to select the best (most preferred) and worst (least preferred) policy option. Examples of BWS choice sets for conflict and weather shock policies are provided in Figure 1.

4. Empirical Strategy

The count method serves as the initial step for analyzing BWS data (Louviere, Flynn, and Marley, 2015). Initially, we counted how many times each policy option was selected as the best and the worst across all choice sets and respondents. Subsequently, we calculated the Best-Worst (BW) score for each policy option as the difference between the best and worst counts. The policy option with the lowest BW score is used as the reference policy in the empirical model.

The assumption underlying the BWS approach is that respondents choose the best and worst options within a choice set so that the difference in latent scale between the selected pair of options is maximized (Flynn and Marley, 2015). If there are J options in a choice set, there are $J(J-1)$ possible best-worst pairs, from which respondent n can make a choice. In our study, with four policy options in each choice set, there are 12 such pairs. Employing random utility theory (McFadden, 1974), which underpins the BWS method, respondents choose pair j and i ($\neq j$) as the best and worst policy options, respectively, to maximize utility:

$$U_{nji} = \beta_j - \beta_i + \varepsilon_{nji}, \tag{1}$$

where ε_{nji} is the random error term and β_j (β_i) is the importance parameter of policy option j (i) relative to a reference policy option, whose importance parameter is normalized to zero.

The probability of a respondent choosing the combination j and i in a choice set s equals the probability that the utility from this combination, U_{nji}, is greater than the utilities from all the other possible $J(J-1)-1$ combinations. Assuming the random error term follows an extreme value type I distribution, we estimate random parameters logit (RPL) models, allowing preferences for policy options to vary across respondents. The unconditional probability of respondent n selecting policy option j and i as the best and the worst from J options over S choice sets is represented as:

$$P_{nji} = \int_{\beta} \prod_{s=1}^{S} \frac{e^{[\beta_{njs}-\beta_{nis}]}}{\sum_{m=1}^{J}\sum_{k=1}^{J} e^{[\beta_{nms}-\beta_{nks}]-J}} f(\beta_n) d\beta_n, \tag{2}$$

where $f(\beta_n)$ denotes the density function of the importance parameters β_n to be estimated, which we assume to be normally distributed and can be fully correlated. We estimate the parameters employing simulated maximum likelihood estimation with the use of Halton draws (Bhat, 2001; Train, 2009).

Subsequently, based on the estimated parameters ($\widehat{\beta_n}$), we derive the share of preferences for each policy option m (SOP_m) using the bootstrapping method by Krinsky and Robb (1986):

$$SOP_m = \frac{e^{\widehat{\beta}m}}{\sum_{k=1}^{J} e^{\widehat{\beta}_k}} \tag{3}$$

The share of preferences (SOP) for each option is the predicted probability of that option being selected as the best, and these shares of preferences must add up to one across all the options, such as the nine (eight) policy options related to conflict (weather) shocks in this study (Lusk and Briggeman, 2009). These shares of preferences offer insights into the importance of each policy option relative to the others and provide cardinal interpretations. For example, if the share of preferences for policy j is three times that of policy i, it can be interpreted that policy j is three times more preferred than policy i. We report the mean and standard errors of the share of preferences for each policy option.

Additionally, we compute the individual-specific share of preferences for each policy option using individual-specific parameter estimates derived from the RPL model and the actual choices made by each individual. The share of preferences for individual n and policy m, sop_{nm}, is bounded ($0 \leq sop_{nm} \leq 1$), and for each individual, the shares of preferences over the J policy options sum up to 1 ($\sum_{k=1}^{J} sop_{nk} = 1$). Using these individual-specific shares of preferences for the nine (eight) conflict (weather) shock policy options as dependent variables, we employ a fractional multinomial logit (FML) model (Papke and Wooldridge, 1996) to investigate the relationship between individual characteristics ($\boldsymbol{x}_n$) and policy preferences. The FML model is represented as the conditional mean of the individual share of preferences as follows, with the coefficient of a base policy normalized to zero (Mullahy, 2015):

$$E(sop_{nm}|\boldsymbol{x}_n) = \frac{e^{\alpha_m x_n}}{\sum_{k=1}^{J} e^{\alpha_k x_n}} \quad (4)$$

Explanatory variables ($\boldsymbol{x}$) include traders' gender, education, business region, operational scale, years of trading, engagement in other income-generating jobs, and experience with prior conflict and weather shocks (discussed below). The coefficients, $\boldsymbol{\alpha}$, are estimated by the quasi-maximum likelihood estimation (Papke and Wooldridge, 1996), and the average marginal effects are reported.

5. Results and Discussion

The characteristics of maize traders are summarized in Table 2.[3] On average, traders are 47 years old, and approximately 20% of them are female. About 65% of traders have completed formal education, either at the primary, secondary, or post-secondary level. Additionally, 55% of traders are classified as large-scale traders with monthly maize sales exceeding 32 metric tons during the high-volume maize trading period from August 2020 to February 2021. The majority of traders (about 90%) did not engage in other income-generating jobs between August 2020 and July 2021. Following our sampling strategy, 80% of traders are located in the northern region, which includes Kaduna, Kano, Katsina, and Plateau, while the remaining 20% are located in the southern region, specifically Oyo. The average trading experience of traders is nearly 23 years. Additionally, only 15% and 3% of traders in our sample experienced conflict shocks and weather shocks, respectively, between August 2020 and July 2021.

Preferences for Conflict and Weather Shock Policies

[3] Nine traders transitioned out of maize trading between the 2021 maize trader survey and the current 2023 survey. Although these traders are no longer engaged in maize trading, we retained them for participation in the policy preference BWS choice sets, without collecting additional demographic or maize business data.

To estimate the RPL model, we used *Real-time safety info* as the reference for conflict shock policies and *Real-time weather info* as the reference for weather shock policies, guided by the lowest BW scores (Appendix B, Table 9). The results of the correlated RPL models are reported in Tables 3 and 4.[4] The shares of preferences for both conflict and weather shock policies reveal that cash relief is the most favored policy option. This preference for cash relief contrasts with the findings of Maredia et al. (2022), where cash transfers as part of the COVID-19 pandemic recovery were rated among the least preferred policies for crop traders in Myanmar. This disparity may suggest a nuanced response to crises: while traders in Myanmar may have leaned towards government-led, systematic initiatives for the unprecedented pandemic, Nigerian traders, somewhat accustomed to recurrent conflict and weather shocks, may favor the flexibility of cash to address their various needs.

In addition to the widely favored cash relief option among maize traders, their preferences exhibit an interesting trend where they prioritize different types of policy options depending on the nature of the shocks they face. For instance, in response to conflict shocks (Table 3), traders tend to place a higher emphasis on soft infrastructure policy measures aimed at ensuring a secure environment (i.e., *Improved road security* and *Improved market/warehouse security*), followed by hard infrastructure measures (i.e., *Improved market/warehouse safety infrastructure* and *Improved market/warehouse lighting*). It is likely that traders facing conflict shocks, which often involve threats from human actions, are inclined to emphasize security measures that provide immediate protection against potential harm and ensure a safe business environment.

[4] We performed the likelihood ratio test between uncorrelated and correlated RPL models, rejecting the null hypothesis of uncorrelated parameters, and present the results of the correlated RPL models. Correlated models allow for correlations among utility coefficients (or importance parameters), which can arise from various sources, including scale heterogeneity (Hess and Train, 2017).

On the contrary, when encountering weather shocks (Table 4), traders predominantly prioritize hard infrastructure policies such as improved road infrastructure and market/warehouse flood protection infrastructure. These are followed by financial services-related policies (i.e., *Loans for weather tech* and *Weather insurance*), categorized as soft infrastructure policies. This shift in preference could possibly be attributed to the physical and logistical challenges posed by adverse weather shocks, necessitating more tangible and enduring solutions to protect their trading activities. Notably, hard infrastructure on the road (26.8% SOP) is considered more crucial than that in the market/warehouse area (16% SOP), indicating that disruptions in transportation is likely to present a considerable obstacle for traders.

Regarding both conflict and weather shocks, the establishment of call centers for real-time information, which served as the reference policy, emerges as the least preferred option. This may reflect a lack of trust in the feasibility of obtaining real-time information given the current state of information technology in the country. In addition to the real-time information policy option, *Conflict training* and *Loans for security* rank among the lowest three policies in response to conflict shocks. The low interest in training could be attributed to a perceived lack of value in information provided by the government relative to traders' own experiences and networks. Similarly, *Weather training* and *Improved market/warehouse electricity* occupy the bottom three positions in response to weather shocks. This lack of interest in electricity infrastructure may stem from a generally low-level trust in the government's capability to implement such improvements.

Factors Influencing Policy Preferences

The application of the fractional multinomial logit (FML) model enhances our understanding of the determinants shaping maize traders' policy preferences. Tables 5 and 6 present the average marginal effects of traders' characteristics on the shares of preferences for conflict and weather shock policies, respectively. Notable findings pertain to the gender, business scale, education, and regional disparity among traders.[5]

As observed from both current and previous datasets from 2021, the Nigerian maize wholesaling sector is predominantly male-dominated, with male traders constituting approximately 80% of traders in major maize-producing and consuming states.[6] Moreover, the maize trading sector reflects the widely documented gender disparity in Nigeria, where women typically face greater social barriers (Adebayo and Akanle, 2014) and resource constraints than men (see, for example, Ajadi, 2015; Muoghalu and Abrifor, 2012), as well as having limited access to agricultural inputs compared to men (Uduji and Okolo-Obasi, 2018). Male traders tend to possess greater resources, often operating on a larger and more extensive scale. In contrast, female traders tend to operate on a smaller scale and primarily target local markets.[7] Hence, the expectation was that female traders, facing more significant resource limitations, are likely to prioritize cash assistance against conflict shocks, while male traders, with more substantial business operations, would probably advocate for preventive safety infrastructure measures to safeguard their enterprises given the higher stakes involved. However, our analysis reveals a contrary trend (Table 5). The average share of preferences among female traders for *Conflict*

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[5] Traders' prior experiences with conflict and weather shocks were not included in the FML models due to the small number of observations with such experiences. However, we provide sub-group RPL model results in the latter part of this section.

[6] Based on the 2021 Nigerian maize trader dataset, comprising a total of 1,111 maize traders, the proportion of male traders in northern states is as follows: 91% in Kaduna, 97% in Kano, 100% in Katsina, and 70% in Plateau. Conversely, in the southern state, Oyo, male traders account for 41%.

[7] Our data suggest that 63% of male traders are large-scale traders, whereas only 24% of female traders belong to this category. Additionally, male traders tend to travel longer distances in their maize sourcing and selling activities. For instance, male traders operating in the northern regions typically engage with maize suppliers located about 132km away, while their female counterparts interact with suppliers located at a distance of around 45km.

cash relief is observed to be 7 percentage points lower than that of male traders, all else being equal. Remarkably, female traders exhibit a higher share of preferences for *Improved market/warehouse safety infrastructure*. This pattern can possibly be contextualized within the broader understanding that women are often disproportionately vulnerable to the disruptive impacts of conflicts compared to their male counterparts (Isola and Tolulope, 2022).[8] Consequently, our findings suggest that female traders emphasize preventive safety infrastructure in the market or warehouse area, likely reflecting their vulnerability to conflict shocks. It may also suggest that conflict is one of the factors limiting women's engagement in maize trading in wholesale markets with prevalent conflicts, and such preventive policies might mitigate that constraint.

The heightened vulnerability of female traders potentially explains their higher share of preferences for *Improved market/warehouse security*. However, our analysis does not indicate a statistically significant difference in preferences for *Improved road security* between female and male traders, other factors constant. While security is key for female traders, security in the market may be more of a concern for them than security on the road, possibly due to the nature of their operations involving less extended travel. Similarly, female traders may place less emphasis on training in conflict risk alleviation strategies, such as diversifying suppliers or market channels, as their primary focus typically lies on local markets. Additionally, security concerns may deter female traders from conducting business activities during nighttime hours, potentially explaining the statistically insignificant preferences for *Improved market/warehouse area lighting*, which is typically essential during night operations.

Traders' gender also influences preferences for *Conflict insurance*, with female traders

[8] Especially in Nigeria, women are disproportionately affected by conflicts, including violence incurred by Boko-Haram (Adelaja and George, 2019) and clashes between farmers and herders (Theophilus, 2020).

showing a 7 percentage point higher average share of preferences compared to their male counterparts, holding other factors constant. Empirical evidence from gendered studies on insurance demand or preferences shows mixed results. Some studies suggest that female actors exhibit lower interest to insurance due to lower financial literacy or trust levels towards insurance institutions compared to male actors (for example, Akter et al., 2016). Others indicate that female actors have a stronger demand for insurance due to their increased vulnerability to risks and higher risk aversion (for instance, Sibiko, Veettil, and Qaim, 2018).[9] Our finding aligns more closely with the latter literature.

In terms of traders' business scale, other factors constant, large-scale traders exhibit a higher share of preferences for insurance than small-scale traders. This disparity may be explained by the credit constraints and high discount rates faced by small enterprises, making them less able to purchase insurance despite its potential benefits (Binswanger-Mkhize, 2012; Foster and Rosenzweig, 2010).[10] Instead, the results suggest that, all else being equal, small-scale traders prefer loans for investing in technologies that can mitigate losses from conflicts, as well as training in such strategies, compared to large-scale traders. Small traders' stronger preference for loans, relative to larger traders, may be partly attributed to their lower likelihood of receiving advance payments from their buyers, which could have been utilized instead of loans.[11] In addition, they may be more likely to require training in various risk-mitigating technologies or strategies compared to large traders, who are more likely to already possess them.

Traders' business scale is not a statistically significant determinant for preferences

[9] Akter et al. (2016) and Sibiko, Veettil, and Qaim (2018) explore gender disparities in weather-index insurance preferences among smallholder farmers in Bangladesh and Kenya, respectively.
[10] Binswanger-Mkhize (2012) also suggests that large, wealthier farmers who are sufficiently self-insured through their wealth, credit, or other risk management strategies have lower demand for insurance. However, our study focuses on Nigerian maize traders, small and medium-sized enterprises (Liverpool-Tasie and Parkhi, 2021), for whom this context may not be applicable.
[11] While 16% of large traders received advance payments from their buyers, only 8% of small traders did so.

regarding cash relief or policies related to security services and hard infrastructure. It is observed from our data that travel distances to source or sell maize do not significantly vary across large and small trader groups, potentially explaining the lack of significant differences in their preference for road security. Similarly, the proportion of traders who stored maize in their own warehouses versus in rented storage space was approximately 60% for both large and small traders, which could potentially account for the insignificant differences in their preferences for security, safety infrastructure, and lighting in the market or warehouse.

Education emerges as a significant factor influencing traders' preferences across various policy options. Traders with formal education may prefer insurance, investment in security facilitated by loans, and receiving training in risk-alleviating strategies as crucial components of addressing conflict shocks compared to those without formal education. This might be because educated traders may possess a deeper comprehension of the potential adverse effects of unforeseen conflicts. Another intriguing observation is that, holding other factors constant, educated traders express a stronger preference than less educated traders for measures that may not necessarily rely on government or public sector implementation, such as the provision of security measures or physical infrastructure. Educated individuals typically possess a better understanding of their political systems and exhibit lower levels of trust in political institutions (Lavallée, Razafindrakoto, and Roubaud, 2008; Seligson, 2002). Given that insurance and loans can also be provided by the market or private sector, we sought traders' opinions regarding the primary responsibility for, or leadership in, the provision of insurance and loans. On average, educated traders showed a lower level of support for the public sector compared to uneducated traders, with approximately a 10 percentage point difference (Appendix B, Table 10). A simple regression analysis confirms the negative correlation between traders' completion of formal education and their perception of the public sector's role in providing insurance and loans, indicating that educated traders are less likely to prefer the government as the primary entity responsible for such provisions (Appendix B, Table 11).

Similarly, educated traders' inclination towards market-oriented solutions is likely to be reflected in their higher share of preferences for improved lighting or electricity compared to that of uneducated traders, all else being constant. Despite the privatization of the electricity sector in Nigeria, with the private sector responsible for generating and distributing electricity, electricity access challenges persist due to underdeveloped supply infrastructure and an ineffective or weak regulatory framework (Arowolo and Perez, 2020). In this context, educated traders may advocate for public intervention to create an enabling environment for facilitating electricity access. Conversely, more educated traders show a relatively lower share of preferences for *Improved road security*, a domain unlikely to be addressed by the market but rather by the public sector.

Another interesting aspect regarding conflict shock policies involves the geographical location of traders' businesses, specifically whether they are based in the southern (Oyo) or northern (Kaduna, Kano, Katsina, and Plateau) regions of the country. The southern and northern regions differ not only in their geographical locations but also in their economic conditions. The northern region generally experiences higher poverty rates and more frequent conflicts, such as those associated with Boko Haram, which operates in the northeast region (Awojobi, 2014). However, despite the risks pertaining to the north, it is the southern traders who are more likely to experience conflict shocks as they depend on the north for sourcing maize (Vargas, Reardon, and Liverpool-Tasie, 2023). We find that traders in the southern region prioritize road security more highly in response to conflict shocks than their northern counterparts, all other factors held constant. This could possibly be attributed to the longer distances typically covered by southern traders to source maize from the northern maize-producing region.

Southern traders' higher share of preferences for improved lighting or electricity in the market and warehouse area may also be understood in the context of their reliance on the north for sourcing maize. Given the longer distances to the north and the potential exposure to conflict shocks during transit, sourcing activities could potentially become more burdensome for southern traders compared to their northern counterparts. Consequently, southern traders may purchase maize less frequently and need to store it over a longer period of time to meet their demand, incentivizing them to prioritize improved lighting and electricity in the warehouse.[12]

In contrast, northern traders have, on average, a stronger preference for *Conflict insurance* than southern traders, other factors constant. One might expect that southern traders, given their potentially heightened vulnerability to conflicts during transit, would prioritize preventive insurance more than their northern counterparts. However, we observe a relatively lower share of preferences for insurance among southern traders. Given that the shares of preferences across the nine conflict shock policy options sum to one, the aggregate of the average marginal effects for any single covariate (e.g., geographical location) equals zero (Allen IV, 2014). This suggests that preferences are substituted among the options, implying that the higher preferences of southern traders for very specific road security measures may lead to lower preferences for a more general risk protection scheme, such as insurance.[13] It could be that northern traders, situated in areas where conflict shocks are more frequent, prioritize insurance

[12] Our data demonstrate that southern traders purchase maize for an average of 1.4 days in a typical week during the high trading season, whereas northern traders purchase more frequently, averaging 2.9 days. Furthermore, southern traders store maize for a longer duration (21 days) compared to northern traders (12 days), on average.
[13] The disparities between northern and southern traders may indeed primarily be attributed to southern traders' reliance on the north for sourcing maize and the subsequent longer travel distances. We attempted to additionally control for the actual distances (in kilometers) from traders' bases to their main sources in the north and discovered that the statistically significant average marginal effects for *Improved road security*, *Improved market/warehouse lighting*, and *Conflict insurance* became statistically insignificant.

possibly as part of a broader risk management strategy.

While traders' years of trading experience may contribute to their overall resilience and ability to navigate risks, we do not find that it has a direct impact on their preferences for both conflict and weather shock policies (Tables 5 and 6). On the other hand, while traders' engagement in other income-generating jobs is not correlated with their preferences for conflict shock policies, it emerges as an influencing factor for weather shock policies (Table 6). Conflict shocks and weather shocks may have different implications and consequences for traders. For example, conflict shocks may directly disrupt transportation, market access, and traders' safety, hence making engagement in other income-generating activities less feasible or practical for traders. In contrast, weather shocks, such as floods or droughts, directly impact agricultural production and traders' trading businesses, making alternative income sources crucial for coping. We find that traders who have engaged in other jobs have a lower preference for loans than those without other jobs, all else being equal. Traders with multiple income streams are likely to have more resilient financial situations and less need for loans when facing weather shocks. They also have a relatively lower share of preferences for training, possibly because their other occupations may provide them with relevant knowledge and skills for coping with weather shocks. This may be particularly applicable to traders who engage in farming themselves, as they would likely have more varied experience with shocks and access to information from a broader network of farmers, which can directly assist their sourcing, compared to those solely involved in trading.

Concerning the other determinants of preferences for weather shock policies, traders' gender and region stand out as significant factors, affecting the share of preferences for all policy options except *Weather insurance*. Specifically, female traders exhibit a lower share of preferences than men, on average and other factors constant, for cash relief and a higher share of preferences for enhanced physical infrastructure in the market/warehouse area, similar to the findings for conflict shock policies. While women are often considered to be disproportionally affected by adverse weather shocks (Asfaw and Maggio, 2018), our data did not show differences in the exposure of female and male traders to weather shocks. Instead, the differences in policy preferences between male and female traders may be attributable to gender-specific perceptions of vulnerability to the effects of climate change. Anugwa, Agbo, and Agwu (2020) document that female farmers in Nigeria, who often face limited access and control over resources compared to their male counterparts, tend to perceive their vulnerability to be due primarily to inadequate access to physical resources such as irrigation facilities. In contrast, they note that male farmers tend to perceive their vulnerability primarily as stemming from a lack of weather forecasting technology such as radio access. This gendered perception aligns with our findings among traders. Male traders prioritize training in technologies as well as loans for investing in technologies to prevent weather-related losses more than female traders do. Conversely, female traders prioritize improved physical flood-proof infrastructure on roads and in the market/warehouse area as tangible and lasting solutions.[14]

Additionally, the relatively higher share of preferences among male traders for *Improved market/warehouse electricity*, compared to their female counterparts, may be attributable to their heavier electricity usage. Although less than 5% of both male and female traders paid electricity bills specific to their trading businesses (at stalls and warehouses), male traders spend an average of 4,450 Nigerian Naira per month, while female traders only spend 500 Naira. This heightened usage and expenditure on electricity may lead male traders to be more concerned about better electricity provisions.

[14] Road conditions can directly impact female traders' ability to transport maize safely, even if they are traveling shorter distances.

There is also a discernible difference in policy preferences between traders in the south and those in the north. The northern region, particularly susceptible to droughts due to its dry climatic conditions and facing the threat of annual floods (Kwari, Paul, and Shekarau, 2015), prioritizes enhanced hard infrastructure on roads and within the market/warehouse area to prevent the physical disruptions of weather shocks. However, these weather shocks occurring in the North are likely to affect southern traders in terms of maize prices as well as transportation and transaction costs, as they rely on the north for sourcing maize. This may explain why traders based in the south tend to prioritize soft infrastructure policy measures, such as cash relief to cover rising costs, along with loans and training to deal with weather shocks. In addition, southern traders' higher emphasis on market/warehouse electricity, similar to the findings in conflict shock cases, may be attributed to their longer storage durations, possibly due to the increased burden of sourcing induced by weather shocks.

The association between traders' business scale and their preference for weather shock policies shows a similar pattern to that observed in conflict shock policy preferences. Small-scale traders tend to prioritize loans and training, whereas large-scale traders, operating more substantial businesses, favor insurance as a formal protection scheme. In the context of weather shocks, large traders also display a stronger preference for improved road infrastructure compared to small traders. This inclination likely arises from the potentially higher transportation costs and associated risks faced by large traders, which may result from transporting larger volumes of maize over longer distances. Moreover, we find that small traders are more concerned about improved electricity access compared to large traders. Interestingly, small traders, on average, spend more on electricity bills (4,670 Naira) than large traders (2,920 Naira), despite both groups storing maize for the same average duration (15 days). One plausible explanation could be that small traders' stalls or warehouses are more likely to be located off-market or in rural areas, where access to electricity would be limited and expensive. Large traders may also have better warehouse facilities, which could lead to more efficient electricity usage. As a result, small traders may place greater importance on improved electricity access to support their business operations effectively.

In contrast to preferences for conflict shock policies, traders' education level is not statistically significantly associated with their preferences for weather shock policies. This distinction may stem from traders' focus on hard infrastructure policies, such as improved road and market/warehouse infrastructure, in response to weather shocks (Table 4). While soft infrastructure measures, which can potentially be provided by the private sector, were prioritized in response to conflict shocks (Table 3), hard infrastructure typically requires public investments and government-led initiatives. Recognizing these as more effective and crucial in responding to weather shocks, traders, including the educated, may prioritize government interventions over private sector solutions. As a result, education may not play a key role in shaping traders' preferences for weather shock policies.

Sup-group Analyses by Trader Groups

Given the diverse policy preferences influenced by traders' characteristics, we categorized our sample into various subgroups to further explore the heterogeneity in policy preferences across trader groups. These subgroups were defined based on traders' gender, business scale, educational background, and geographic region, similar to the FML analyses. Using the estimated parameters obtained from the subgroup-correlated RPL models, we computed the shares of preferences for each subgroup, as presented in Tables 7 and 8. Full correlated RPL results are provided in Appendix B, Tables 12 through 19. Additionally, we provide the results from the analysis based on traders' prior experience of conflict shocks in Appendix B, Table 20. However, conducting subgroup analyses for traders' prior experience of weather shocks and engagement in other jobs was not feasible due to the small number of observations of those who experienced weather shocks or were involved in other jobs.

The preferences for conflict shock policies among subgroups (Table 7) largely align with the overall policy preferences of the full sample. *Conflict cash relief* remains the most favored policy options for all subgroups except the southern trader group, who prioritize *Improved road security* (26.3% SOP) over cash relief (21.6% SOP). This prioritization is consistent with the findings from the FML model, as southern traders typically travel longer distances to source maize from the northern region. Traders in the north ranked cash relief as their most preferred policy option (34.9% SOP), followed by market/warehouse security (17% SOP) and road security (15.5% SOP), which are soft infrastructure measures that were prioritized by the overall traders in response to conflict shocks.

While female traders' most favored policy option is cash relief (26.1% SOP), their preference is more evenly distributed to market/warehouse security (23.7% SOP) and road security (20.5% SOP) compared to male traders, who place significant importance on cash relief (34.4% SOP) and much less on road security (17.6% SOP) and market/warehouse security (15.9% SOP). This divergence may stem from female traders being often more vulnerable to conflict shocks, leading them to prioritize preventive security measures and place relatively less importance on ex-post cash assistance.

Large and small-scale traders generally show a similar pattern towards the policy options, with the most discerning observation relating to the share of preferences for *Conflict insurance*

(Table 7). While almost 7% of large traders are likely to identify insurance as their most preferred policy option, only 3.5% of small traders are likely to do so, reflecting the FML result that large traders have a higher share of preferences for insurance than small traders possibly due to their substantial business and higher stakes related to conflict shocks.

The subgroup analysis conducted among educated and uneducated traders reveals substantial disparities. Specifically, uneducated traders place a pronounced emphasis on cash relief (47.9% SOP), regarding it as more than three times as important as their second preferred option, road security (14.8% SOP). On the other hand, educated traders assign relatively less significance to cash relief (27.6% SOP). Their shares of preferences for alternative policy options, such as insurance, loans, and lighting – potentially market-oriented measures – are higher compared to those of their uneducated counterparts.

Additionally, Table 20 in Appendix B reports the estimated results by traders' past experience of conflict shocks. We find that both groups of traders, those who did and did not experience conflict shocks in the past, prioritize cash relief the most, followed by security measures on the road and in the market/warehouse area, albeit with slight differences. Traders who experienced conflict shocks previously tend to place relatively higher emphasis on road security (20.1% SOP) compared to market/warehouse security (12.0%), while those who did not experience conflicts in the past show more similar emphasis between road security (18.4% SOP) and market/warehouse security (17.3% SOP). This observation may suggest a potentially higher occurrence of conflicts on the road or that conflicts on the road may have more substantial impacts to traders compared to those occurring in the market/warehouse area.

Regarding weather shock policies (Table 8), the preferences of subgroups largely align with those of the full sample, favoring cash relief and hard infrastructure policy measures. While cash relief is the most preferred policy option overall, female traders deviate from this trend, predominantly favoring road infrastructure (36.2% SOP) over cash relief (24.3% SOP), whereas male traders exhibit a stronger preference for cash relief (33.7% SOP) over road infrastructure (28.5% SOP). This discrepancy potentially underscores the prioritization of preventive measures (i.e., dams, culverts, or drainage) by female traders, contrasting with the focus on ex-post cash relief, which could provide immediate financial assistance but may not offer the same level of broader risk mitigation.

Moreover, small traders, uneducated traders, and southern traders tend to assign significantly higher priority to cash relief compared to large traders, educated traders, and northern traders, respectively. The latter groups place a comparable emphasis on both cash relief and enhanced road infrastructure. In addition, while both northern and southern traders prioritize cash relief, southern traders place relatively greater importance on road infrastructure (11.3% SOP) compared to market/warehouse infrastructure (4.7% SOP); in constrast, northern traders allocate relatively less priority to road infrastructure (29.6% SOP) compared to market/warehouse infrastructure (19.1% SOP). This highlights the potentially higher emphasis on safety measures during travel by southern traders, possibly attributable to the longer transit distances they must cover compared to their northern counterparts.

6. Conclusion and Policy Implications

This study explores the preferences of Nigerian maize wholesale traders regarding policies aimed at mitigating the impacts of weather and conflict shocks. Violent conflicts and extreme weather events significantly disrupt various stages of agrifood value chains, including production, harvest, storage, and transportation, thereby affecting maize traders' procurement, transportation, storage, and sales of maize. Given the crucial role of maize traders in bridging upstream producers and downstream consumers, the disruptions and challenges faced by maize traders not only affect their activities but also have broader implications for the entire maize value chain in Nigeria. However, despite the potential to enhance the resilience of maize value chains, there has been a notable neglect in efforts to understand the needs of maize traders and develop policies that effectively address their challenges.

By implementing a BWS experiment in major maize-producing and consuming states in Nigeria, we evaluated nine distinct policy options to manage the challenges posed by conflict shocks and another eight policy options for addressing weather shocks, capturing maize traders' preferences for alternative policy options. The policy options for conflict shocks included financial measures (e.g., cash relief, insurance, and loans), as well as the provision of real-time safety information and training in technologies to minimize losses from conflicts. These, along with security services, were considered as soft infrastructure policy measures. Additionally, physical safety and electricity infrastructure were included as hard infrastructure policy measures. Weather shock policy options encompassed similar financial measures, alongside the provision of real-time weather information and training in technologies that can help prevent weather effects such as mold growth, all categorized as soft infrastructure policy measures. In addition, physical safety or flood-proof infrastructure, along with electricity infrastructure, were considered as hard infrastructure policy measures. The BWS approach allowed us to gain insights on how maize traders make trade-offs between these alternative policy options and understanding their most pressing needs.

Our results indicate that traders prioritize direct financial assistance (i.e., cash relief) when facing both conflict and weather shocks. However, our analysis also reveals distinct policy preferences among traders depending on the nature of the shocks. In the context of conflict shocks, which are caused by human activities, traders tend to prioritize soft infrastructure policy measures, such as enhanced security services on roads and within market/warehouse areas. This prioritization may reflect their need to address the security challenges inherent during violent conflicts. Conversely, when confronted with weather shocks, the priority shifts to hard infrastructure policy measures, such as physical flood-proof infrastructure on roads and within market/warehouse areas. This shift is likely influenced by the physical and logistical challenges posed by natural events and potentially underscores the adaptability of traders' policy preferences to the specific challenges they face.

We have also found that policy preferences vary across trader subgroups categorized by their gender, business scale, education, involvement in other income-generating jobs, and geographic region of operation. Interestingly, contrary to the expectation that male traders, often having greater resources and more extensive businesses than female traders, would prioritize preventive hard infrastructure against shocks to protect their substantial businesses, we observe that male traders predominantly prefer ex-post cash relief in response to both conflict and weather shocks. Instead, it is the female traders who prioritize physical infrastructure following conflict and weather shocks, likely due to their heightened vulnerability to these shocks. Particularly for weather shocks, the female trader group was the only subgroup that prioritized enhanced road infrastructure over cash relief. Another significant determinant for policy preferences is traders' geographical region. We consistently find that traders in the southern region more highly prioritize road security in response to conflict shocks than their northern counterparts, likely due to the longer distances typically covered by southern traders to source maize from the northern maize-producing region.

While some policy measures necessitate public investment and government-led initiatives, such as enhancing physical infrastructure or security services, there are also areas where government policies can foster a viable environment for the private sector to contribute. In particular, we find that educated traders express a preference for measures that can be provided by the market or private sector, such as insurance and loans, which may not necessarily be provided by the government. Additionally, given the privatization of Nigeria's energy sector, improved access to electricity may largely depend on the private sector as well. There is an opportunity for the government to create an enabling environment for private sector participation in these areas to effectively address the shocks.

The heterogeneity in preferences, influenced by trader characteristics and the nature of shocks, emphasizes the necessity for tailored, context-specific policy interventions to effectively address the multifaceted challenges encountered by maize traders, who serve as a vital link in the maize value chain. In this study, we were unable to account for traders' prior experiences with weather shocks due to the limited number of observations, which likely influences their perception on these shocks and policy preferences. Moreover, traders' involvement in other income generating activities is also likely to shape their policy preferences, as they may bring forth knowledge or experiences from those activities, particularly if involved in farming. However, these factors could not be incorporated in this study. Nevertheless, amidst growing concerns about the impact of various shocks on local and global agrifood value chains, this study lays the foundation for future research into a wide range of policy preferences and effective policy development to tackle the complex challenges.

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APPENDIX A. TABLES AND FIGURES

Table 1. Risk management instruments and policy options

Risk management instrument	Policy type	Policy options for conflict shocks *(Short name)*	Policy options for weather shocks *(Short name)*
Financial instruments	Soft – Financial service	Conflict cash relief *("Conflict cash relief")*	Weather cash relief *("Weather cash relief")*
		Conflict insurance *("Conflict insurance")*	Weather insurance *("Weather insurance")*
		Loans for investment in technology to prevent conflict losses (e.g., security camera) *("Loans for security")*	Loans for investment in technology to prevent weather losses (e.g., better storage facility) *("Loans for weather tech")*
Enterprise management practices	Soft – Information technology	Call center for real-time information on the safety of routes *("Real-time safety info")*	Call center for real-time information on flooded roads and alternative routes *("Real-time weather info")*
Technology development and adoption		Training in technologies to minimize conflict losses (e.g., strategies to diversify suppliers) *("Conflict training")*	Training in technologies to deal with weather effects (e.g., mold growth prevention) *("Weather training")*
Public policy and programs	Soft – Security service	More functional security on the roads *("Improved road security")*	-
		More functional security in the market/warehouse area *("Improved market/warehouse security")*	-
Infrastructure investment	Hard – Road infrastructure	-	More functional dams, culverts, or drainage on the roads *("Improved road infra")*
	Hard – Market/ warehouse safety infrastructure	More functional safety concrete barriers in the market/warehouse area *("Improved market/warehouse safety infra")*	More functional flood barriers, sandbags, or tarps in the market/warehouse area *("Improved market/warehouse flood-proof infra")*
	Hard – Energy	More functional electricity in the market/warehouse area (e.g., for reliable lighting) *("Improved market/warehouse lighting")*	More functional electricity in the market/warehouse area (e.g., for temperature-controlled warehouses) *("Improved market/warehouse electricity")*

Notes: Interviewers read the full policy options to the respondents. The short names in the parentheses are abbreviations that will be used throughout the rest of the paper.

Figure 1. Examples of BWS choice sets for conflict and weather shock policies

Each question is composed of four policy options that could be implemented to address disruptions in maize trading due to conflict or insecurity shocks. Conflict or insecurity shocks refer to Boko Haram conflicts, herder-farmer conflicts, armed robbery or banditry, and kidnapping. For each question we would like to know which policy option you think is the best or most preferred, and which is the worst or least preferred.

In your opinion, which of the following policy options is the best way to prevent or protect losses from conflict or insecurity shocks, and which policy option is the worst way to do so?		
Most Preferred	Policy	Least Preferred
O	More functional security on the roads	**O**
O	More functional electricity in the market/warehouse area (e.g., for reliable lighting)	**O**
O	Conflict insurance	**O**
O	More functional security in the market/warehouse area	**O**

Each question is composed of four policy options that could be implemented to address disruptions in maize trading due to weather shocks. Weather shocks refer to floods or droughts. For each question we would like to know which policy option you think is the best or most preferred, and which is the worst or least preferred.

In your opinion, which of the following policy options is the best way to prevent or protect losses from weather shocks, and which policy option is the worst way to do so?		
Most Preferred	Policy	Least Preferred
O	Weather insurance	**O**
O	Training in technologies to deal with weather effects (e.g., mold growth prevention)	**O**
O	Call center for real-time information on flooded roads and alternative routes	**O**
O	More functional dams, culverts, or drainage on the roads	**O**

Table 2. Summary statistics of maize traders' characteristics

Variable	Definition	Obs.	Mean	Std. Dev.
Maize trading	1 = Engaging in maize trading business as of May–Aug. 2023	300	0.97	0.17
Age	Age in years	291	47.36	10.27
Female	1 = Female, 0 = Male	291	0.20	0.40
Formally educated	1 = Completed formal education (primary, secondary, or post-secondary)	291	0.65	0.48
Large-scale	1 = Large (monthly sales ≥ 32 tons between Aug. 2020 and Feb. 2021), 0 = Small (monthly sales < 32 tons between Aug. 2020 and Feb. 2021)	291	0.55	0.50
Engaged in other job	1 = Engaged in other income-generating jobs between Aug. 2020 and Jul. 2021	300	0.11	0.31
South	1 = South, 0 = North	300	0.20	0.40
Years of trading	Years of trading experience	295	22.60	8.88
Conflict shock	1 = Experienced any Boko Haram conflict, herder-farmer conflict, armed robbery/banditry, or kidnapping between Aug. 2020 and Jul. 2021	291	0.15	0.36
Weather shock	1 = Experienced any flood or drought between Aug. 2020 and Jul. 2021	291	0.03	0.17

Table 3. Correlated RPL model results for conflict shock policies

	Conflict shock policies	Mean	Std. Dev.	Share of preferences (%)
Soft	*Conflict cash relief*	2.501***	0.753***	34.5
		(0.082)	(0.076)	(0.014)
	*Real-time safety info – **BASE***	0.000	-	2.8
				(0.002)
	Conflict training	0.336***	0.489***	4.0
		(0.065)	(0.060)	(0.002)
	Improved road security	1.828***	0.861***	17.6
		(0.073)	(0.067)	(0.008)
	Conflict insurance	0.474***	1.264***	4.6
		(0.071)	(0.075)	(0.003)
	Loans for security	0.254***	0.897***	3.7
		(0.071)	(0.069)	(0.002)
	Improved market/warehouse security	1.777***	0.640***	16.8
		(0.072)	(0.066)	(0.008)
Hard	*Improved market/warehouse safety infra*	1.310***	0.516***	10.5
		(0.071)	(0.064)	(0.005)
	Improved market/warehouse lighting	0.679***	0.918***	5.6
		(0.069)	(0.065)	(0.003)
	Sum of share of preferences			100%
	Number of traders	300		
	Number of observations (N)	2,700		
	Log likelihood function (LLF)	-5,228.107		
	Akaike Information Criterion (AIC) / N	3.905		
	Bayesian Information Criterion (BIC) / N	4.001		

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4. Correlated RPL model results for weather shock policies

	Weather shock policies	Mean	Std. Dev.	Share of preferences (%)
Soft	*Weather cash relief*	2.277***	0.711***	35.4
		(0.080)	(0.090)	(0.014)
	Loans for weather tech	0.340***	0.762***	5.1
		(0.065)	(0.079)	(0.003)
	Weather insurance	0.217***	1.263***	4.5
		(0.068)	(0.081)	(0.003)
	*Real-time weather info – **BASE***	0.000	-	3.6
				(0.002)
	Weather training	0.140**	0.493***	4.2
		(0.065)	(0.069)	(0.003)
Hard	*Improved road infra*	1.999***	1.592***	26.8
		(0.076)	(0.069)	(0.011)
	Improved market/warehouse flood-proof infra	1.482***	1.263***	16.0
		(0.072)	(0.065)	(0.007)
	Improved market/warehouse electricity	0.167**	0.560***	4.3
		(0.068)	(0.075)	(0.002)
	Sum of share of preferences			100%
	Number of traders	300		
	N	2,400		
	LLF	-4,684.102		
	AIC / N	3.933		
	BIC / N	4.017		

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5. Average marginal effects for the SOPs of conflict shock policies (FML)

	Soft infrastructure						Hard infrastructure	
VARIABLES	(1) *Conflict cash relief*	(2) *Conflict Insurance*	(3) *Loans for security*	(4) *Conflict training*	(5) *Improved road security*	(6) *Improved market/ warehouse security*	(7) *Improved market/ warehouse safety infra*	(8) *Improved market/ warehouse lighting*
1 = Female	-0.0702**	0.0698**	-0.0071	-0.0010	-0.0149	0.0156*	0.0146**	-0.0087
	(0.0284)	(0.0274)	(0.0055)	(0.0037)	(0.0133)	(0.0093)	(0.0068)	(0.0078)
1 = Large-scale	-0.0213	0.0257**	-0.0118**	-0.0043*	0.0103	0.0088	0.0025	-0.0093
	(0.0222)	(0.0104)	(0.0046)	(0.0026)	(0.0095)	(0.0074)	(0.0047)	(0.0060)
1 = Formally educated	-0.0277	0.0189**	0.0098**	0.0081***	-0.0204**	-0.0022	0.0028	0.0086*
	(0.0223)	(0.0095)	(0.0038)	(0.0024)	(0.0095)	(0.0077)	(0.0048)	(0.0045)
1 = Engaged in other job	-0.0257	0.0203	-0.0045	-0.0014	0.0045	0.0038	0.0091	-0.0076
	(0.0280)	(0.0144)	(0.0054)	(0.0039)	(0.0140)	(0.0096)	(0.0077)	(0.0073)
1 = South	0.0008	-0.041***	-0.0045	-0.0041	0.0475***	-0.0014	-0.0080	0.0151*
	(0.0321)	(0.0155)	(0.0069)	(0.0039)	(0.0176)	(0.0099)	(0.0065)	(0.0089)
Years of trading	-6.11e-06	-0.0003	-3.11e-05	2.08e-05	5.41e-05	0.0002	-4.06e-05	4.67e-05
	(0.0012)	(0.0005)	(0.0002)	(0.0002)	(0.0005)	(0.0004)	(0.0002)	(0.0002)
Observations	286	286	286	286	286	286	286	286

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Base policy is *Real-time safety info*. The FML model converged with a log pseudolikelihood of -535.164 and a Wald chi-squared value of 127.98 (Prob > chi-squared = 0.000).

Table 6. Average marginal effects for the SOPs of weather shock policies (FML)

VARIABLES	Soft infrastructure				Hard infrastructure		
	(1) *Weather cash relief*	(2) *Weather insurance*	(3) *Loans for weather tech*	(4) *Weather training*	(5) *Improved road infrastructure*	(6) *Improved market/warehouse flood-proof infra*	(7) *Improved market/warehouse electricity*
1 = Female	-0.0524**	0.0106	-0.0235**	-0.0162***	0.0927***	0.0190**	-0.0193***
	(0.0230)	(0.0070)	(0.0091)	(0.0048)	(0.0268)	(0.0074)	(0.0046)
1 = Large-scale	0.0027	0.0115**	-0.0200**	-0.0115***	0.0326*	0.0044	-0.0130***
	(0.0152)	(0.0048)	(0.0081)	(0.0042)	(0.0177)	(0.0058)	(0.0041)
1 = Formally educated	-0.0142	0.0025	0.0052	0.0026	-0.0004	0.0043	-0.0003
	(0.0158)	(0.0052)	(0.0081)	(0.0043)	(0.0179)	(0.0061)	(0.0047)
1 = Engaged in other job	0.0065	0.0070	-0.0181*	-0.0094*	0.0172	0.0062	-0.0058
	(0.0227)	(0.0080)	(0.0095)	(0.0052)	(0.0259)	(0.0086)	(0.0074)
1 = South	0.0699***	-0.0074	0.0307**	0.0170***	-0.112***	-0.0335***	0.0233***
	(0.0250)	(0.0061)	(0.0139)	(0.0062)	(0.0220)	(0.0084)	(0.0067)
Years of trading	0.0005	0.0001	-0.0003	-7.68e-05	-0.0002	-3.65e-05	-7.85e-05
	(0.0008)	(0.0003)	(0.0004)	(0.0002)	(0.0009)	(0.0003)	(0.0002)
Observations	286	286	286	286	286	286	286

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Base policy is *Real-time weather info*. The FML model converged with a log pseudolikelihood of -495.514 and a Wald chi-squared value of 104.60 (Prob > chi-squared = 0.000).

Table 7. SOPs by sub-groups for conflict shock policies (Correlated RPL)

	Conflict shock policies	Share of preferences (%)							
		Gender		Scale		Formal education		Region	
		Female	Male	Large	Small	Educated	Un-educated	North	South
Soft	*Conflict cash relief*	26.1 (0.027)	34.4 (0.015)	32.3 (0.017)	33.5 (0.021)	27.6 (0.014)	47.9 (0.031)	34.9 (0.015)	21.6 (0.030)
	*Real-time safety info – **BASE***	2.2 (0.003)	2.8 (0.002)	2.5 (0.002)	2.8 (0.003)	3.5 (0.002)	1.7 (0.002)	2.7 (0.002)	2.8 (0.004)
	Conflict training	2.6 (0.004)	4.3 (0.003)	4.0 (0.003)	4.3 (0.004)	5.4 (0.003)	2.5 (0.003)	4.2 (0.003)	2.6 (0.004)
	Improved road security	20.5 (0.024)	17.6 (0.009)	15.4 (0.010)	18.7 (0.013)	17.8 (0.009)	14.8 (0.014)	15.5 (0.008)	26.3 (0.028)
	Conflict insurance	6.9 (0.010)	4.1 (0.003)	6.9 (0.005)	3.5 (0.003)	5.6 (0.004)	2.6 (0.003)	4.6 (0.003)	4.3 (0.006)
	Loans for security	2.1 (0.003)	4.3 (0.003)	4.6 (0.004)	3.2 (0.003)	4.7 (0.003)	3.6 (0.004)	3.9 (0.003)	2.1 (0.003)
	Improved market/ warehouse security	23.7 (0.025)	15.9 (0.008)	17.3 (0.011)	17.6 (0.012)	17.4 (0.009)	12.1 (0.012)	17.0 (0.008)	18.7 (0.023)
Hard	*Improved market/ warehouse safety infra*	9.5 (0.011)	11.1 (0.006)	12.9 (0.008)	9.5 (0.007)	10.9 (0.006)	10.8 (0.011)	13.3 (0.007)	3.7 (0.005)
	Improved market/ warehouse lighting	6.4 (0.008)	5.5 (0.003)	4.1 (0.003)	6.7 (0.005)	7.1 (0.004)	3.9 (0.004)	3.9 (0.003)	18.0 (0.021)
Sum of share of preferences (%)		100	100	100	100	100	100	100	100
Number of observations		59	232	159	132	190	101	240	60

Notes: Standard errors in parentheses.

Table 8. SOPs by sub-groups for weather shock policies (Correlated RPL)

	Weather shock policies	Share of preferences (%)							
		Gender		Scale		Formal education		Region	
		Female	Male	Large	Small	Educated	Uneducated	North	South
Soft	*Weather cash relief*	24.3 (0.024)	33.7 (0.015)	32.8 (0.018)	36.0 (0.020)	28.9 (0.014)	46.8 (0.028)	32.6 (0.014)	69.6 (0.052)
	Loans for weather tech	4.7 (0.006)	5.4 (0.003)	4.4 (0.004)	6.3 (0.005)	8.2 (0.005)	2.7 (0.003)	4.3 (0.003)	2.2 (0.005)
	Weather insurance	5.6 (0.008)	3.4 (0.002)	5.7 (0.005)	3.6 (0.003)	5.0 (0.003)	3.2 (0.004)	4.7 (0.003)	2.3 (0.005)
	*Real-time weather info – **BASE***	3.9 (0.005)	3.5 (0.002)	3.3 (0.003)	4.5 (0.004)	4.4 (0.003)	2.6 (0.003)	3.2 (0.002)	2.1 (0.005)
	Weather training	4.0 (0.006)	3.8 (0.003)	3.7 (0.003)	5.1 (0.004)	5.7 (0.004)	2.3 (0.003)	3.5 (0.002)	2.4 (0.005)
Hard	*Improved road infra*	36.2 (0.034)	28.5 (0.014)	29.8 (0.017)	24.1 (0.016)	27.1 (0.014)	23.6 (0.020)	29.6 (0.013)	11.3 (0.021)
	Improved market/warehouse flood-proof infra	16.2 (0.017)	17.5 (0.010)	16.7 (0.011)	14.4 (0.010)	15.4 (0.009)	15.9 (0.015)	19.1 (0.010)	4.7 (0.010)
	Improved market/warehouse electricity	5.0 (0.007)	4.2 (0.003)	3.6 (0.003)	5.9 (0.005)	5.3 (0.004)	3.0 (0.004)	3.1 (0.002)	5.4 (0.011)
Sum of share of preferences (%)		100	100	100	100	100	100	100	100
Number of observations		59	232	159	132	190	101	240	60

Notes: Standard errors in parentheses.

APPENDIX B. SUPPLEMENTARY MATERIALS

Table 9. Best-worst scores of conflict and weather shock policies

		Best counts (B)	Worst counts (W)	BW score (B-W)
Conflict shock policies				
Soft	*Conflict cash relief*	752	66	686
	Real-time safety info	58	590	-532
	Conflict training	108	329	-221
	Improved road security	530	106	424
	Conflict insurance	196	442	-246
	Loans for security	121	548	-427
	Improved market/warehouse security	456	90	366
Hard	*Improved market/warehouse safety infra*	337	168	169
	Improved market/warehouse lighting	142	361	-219
	Number of choices made (9 choice sets for 300 traders)	2,700	2,700	
Weather shock policies				
Soft	*Weather cash relief*	688	88	600
	Loans for weather tech	228	362	-134
	Weather insurance	209	447	-238
	Real-time weather info	89	466	-377
	Weather training	88	374	-286
Hard	*Improved road infra*	599	111	488
	Improved market/warehouse flood-proof infra	392	130	262
	Improved market/warehouse electricity	107	422	-315
	Number of choices made (8 choice sets for 300 traders)	2,400	2,400	

Table 10. Proportion of traders supporting public provision of insurance and loans

	Formal education					
	Educated			Uneducated		
Public provision of:	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Insurance in response to conflict shocks	189	.87	.34	101	.98	.14
Insurance in response to weather shocks	189	.88	.32	101	.99	.10
Loans in response to conflict shocks	189	.79	.41	101	.89	.31
Loans in response to weather shocks	189	.77	.42	101	.84	.37

Table 11. Perception on public implementation of insurance and loans

VARIABLES	(1) *Conflict insurance*	(2) *Weather insurance*	(3) *Loans for security*	(4) *Loans for weather tech*
1 = Female	0.0509	0.0770	-0.0336	-0.102
	(0.0515)	(0.0476)	(0.0671)	(0.0718)
1 = Large-scale	-0.0307	-0.0453	-0.0951**	-0.101**
	(0.0367)	(0.0339)	(0.0478)	(0.0511)
1 = Formally educated	-0.117***	-0.114***	-0.0838*	-0.0638
	(0.0379)	(0.0350)	(0.0494)	(0.0529)
1 = Engaged in other job	-0.0266	-0.0104	-0.0665	-0.0506
	(0.0563)	(0.0520)	(0.0734)	(0.0785)
1 = South	-0.0152	-0.0259	-0.0234	0.0397
	(0.0522)	(0.0483)	(0.0681)	(0.0729)
Years of trading	0.000993	0.000580	0.00221	0.000455
	(0.00197)	(0.00182)	(0.00256)	(0.00274)
Constant	0.972***	0.996***	0.900***	0.898***
	(0.0606)	(0.0560)	(0.0791)	(0.0846)
Observations	285	285	285	285
R-squared	0.046	0.058	0.038	0.030

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. OLS regression was employed, with the dependent variables being a binary variable taking the value of 1 if the trader indicated that the government (at the local, state, or federal level) should be primarily responsible for providing insurance or loans, and 0 if they indicated that the private sector (wholesaler associations, formal financial institutions, credit-saving associations, or non-governmental organizations) should lead the effort.

Table 12. Correlated RPL results for conflict shock policies by gender

		Female traders			Male traders		
	Conflict shock policies	Mean	Std. Dev.	SOPs	Mean	Std. Dev.	SOPs
Soft	*Conflict cash relief*	2.481***	1.909***	26.1	2.520***	0.252***	34.4
		(0.194)	(0.227)	(0.027)	(0.091)	(0.093)	(0.015)
	*Real-time safety info – **BASE***	0.000	-	2.2	0.000	-	2.8
				(0.003)			(0.002)
	Conflict training	0.160	0.641***	2.6	0.435***	0.502***	4.3
		(0.157)	(0.145)	(0.004)	(0.075)	(0.064)	(0.003)
	Improved road security	2.240***	0.962***	20.5	1.850***	1.109***	17.6
		(0.188)	(0.160)	(0.024)	(0.084)	(0.080)	(0.009)
	Conflict insurance	1.145***	2.117***	6.9	0.403***	1.521***	4.1
		(0.191)	(0.151)	(0.010)	(0.083)	(0.066)	(0.003)
	Loans for security	-0.047	0.517***	2.1	0.437***	0.963***	4.3
		(0.176)	(0.177)	(0.003)	(0.081)	(0.067)	(0.003)
	Improved market/ warehouse security	2.384***	1.086***	23.7	1.746***	0.872***	15.9
		(0.194)	(0.210)	(0.025)	(0.083)	(0.075)	(0.008)
Hard	*Improved market/ warehouse safety infra*	1.467***	1.575***	9.5	1.385***	0.676***	11.1
		(0.182)	(0.232)	(0.011)	(0.081)	(0.078)	(0.006)
	Improved market/ warehouse lighting	1.076***	1.369***	6.4	0.683***	0.799***	5.5
		(0.174)	(0.212)	(0.008)	(0.079)	(0.075)	(0.003)
	Sum of share of preferences			100%			100%
	Number of traders	59			232		
	N	531			2,088		
	LLF	-935.544			-4,021.184		
	AIC / N	3.689			3.894		
	BIC / N	4.044			4.013		

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 13. Correlated RPL results for weather shock policies by gender

		Female traders			Male traders		
	Weather shock policies	Mean	Std. Dev.	SOPs	Mean	Std. Dev.	SOPs
Soft	*Weather cash relief*	1.822***	0.445**	24.3	2.268***	0.055	33.7
		(0.171)	(0.184)	(0.024)	(0.088)	(0.090)	(0.015)
	Loans for weather tech	0.192	1.600***	4.7	0.438***	0.637***	5.4
		(0.155)	(0.175)	(0.006)	(0.074)	(0.078)	(0.003)
	Weather insurance	0.362**	1.443***	5.6	-0.016	1.107***	3.4
		(0.162)	(0.145)	(0.008)	(0.075)	(0.067)	(0.002)
	*Real-time weather info – **BASE***	0.000	-	3.9	0.000	-	3.5
				(0.005)			(0.002)
	Weather training	0.026	1.238***	4.0	0.095	0.378***	3.8
		(0.157)	(0.168)	(0.006)	(0.074)	(0.064)	(0.003)
Hard	*Improved road infra*	2.223***	1.987***	36.2	2.102***	1.299***	28.5
		(0.196)	(0.158)	(0.034)	(0.090)	(0.074)	(0.014)
	Improved market/ warehouse flood-proof infra	1.420***	0.914***	16.2	1.614***	1.062***	17.5
		(0.166)	(0.128)	(0.017)	(0.085)	(0.068)	(0.010)
	Improved market/ warehouse electricity	0.246	1.563***	5.0	0.184**	0.514***	4.2
		(0.162)	(0.182)	(0.007)	(0.077)	(0.066)	(0.003)
	Sum of share of preferences			100%			100%
	Number of traders		59			232	
	N		472			1,856	
	LLF		-911.803			-3,628.564	
	AIC / N		4.012			3.948	
	BIC / N		4.320			4.052	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 14. Correlated RPL results for conflict shock policies by scale

		Large traders			Small traders		
	Conflict shock policies	Mean	Std. Dev.	SOPs	Mean	Std. Dev.	SOPs
Soft	*Conflict cash relief*	2.546***	0.604***	32.3	2.474***	1.231***	33.5
		(0.111)	(0.125)	(0.017)	(0.125)	(0.140)	(0.021)
	*Real-time safety info – **BASE***	0.000	-	2.5	0.000	-	2.8
				(0.002)			(0.003)
	Conflict training	0.453***	0.431***	4.0	0.431***	0.273***	4.3
		(0.093)	(0.078)	(0.003)	(0.098)	(0.090)	(0.004)
	Improved road security	1.807***	0.947***	15.4	1.893***	0.511***	18.7
		(0.104)	(0.073)	(0.010)	(0.111)	(0.086)	(0.013)
	Conflict insurance	0.998***	2.141***	6.9	0.227**	1.246***	3.5
		(0.105)	(0.105)	(0.005)	(0.108)	(0.089)	(0.003)
	Loans for security	0.586***	0.938***	4.6	0.135	0.739***	3.2
		(0.102)	(0.075)	(0.004)	(0.107)	(0.079)	(0.003)
	Improved market/ warehouse security	1.920***	0.867***	17.3	1.831***	0.863***	17.6
		(0.106)	(0.087)	(0.011)	(0.111)	(0.096)	(0.012)
Hard	*Improved market/ warehouse safety infra*	1.632***	0.671***	12.9	1.220***	0.736***	9.5
		(0.104)	(0.095)	(0.008)	(0.107)	(0.106)	(0.007)
	Improved market/ warehouse lighting	0.484***	0.646***	4.1	0.870***	0.490***	6.7
		(0.099)	(0.094)	(0.003)	(0.104)	(0.101)	(0.005)
	Sum of share of preferences			100%			100%
	Number of traders	159			132		
	N	1,431			1,188		
	LLF	-2,759.743			-2,293.015		
	AIC / N	3.919			3.934		
	BIC / N	4.080			4.123		

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 15. Correlated RPL results for weather shock policies by scale

		Large traders			Small traders		
	Weather shock policies	Mean	Std. Dev.	SOPs	Mean	Std. Dev.	SOPs
Soft	*Weather cash relief*	2.296***	0.613***	32.8	2.069***	0.843***	36.0
		(0.111)	(0.118)	(0.018)	(0.115)	(0.117)	(0.020)
	Loans for weather tech	0.278***	0.627***	4.4	0.330***	0.837***	6.3
		(0.089)	(0.102)	(0.004)	(0.097)	(0.097)	(0.005)
	Weather insurance	0.552***	1.460***	5.7	-0.229**	0.924***	3.6
		(0.095)	(0.091)	(0.005)	(0.099)	(0.089)	(0.003)
	*Real-time weather info – **BASE***	0.000	-	3.3	0.000	-	4.5
				(0.003)			(0.004)
	Weather training	0.103	0.267***	3.7	0.121	0.409***	5.1
		(0.090)	(0.100)	(0.003)	(0.099)	(0.093)	(0.004)
Hard	*Improved road infra*	2.201***	1.558***	29.8	1.668***	1.456***	24.1
		(0.108)	(0.105)	(0.017)	(0.111)	(0.087)	(0.016)
	Improved market/ warehouse flood-proof infra	1.623***	1.220***	16.7	1.152***	0.983***	14.4
		(0.102)	(0.100)	(0.011)	(0.103)	(0.082)	(0.010)
	Improved market/ warehouse electricity	0.074	0.593***	3.6	0.253**	0.352***	5.9
		(0.096)	(0.109)	(0.003)	(0.101)	(0.099)	(0.005)
	Sum of share of preferences			100%			100%
	Number of traders	159			132		
	N	1,272			1,056		
	LLF	-2,444.669			-2,093.846		
	AIC / N	3.899			4.032		
	BIC / N	4.041			4.196		

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 16. Correlated RPL results for conflict shock policies by region

		Northern traders			Southern traders		
	Conflict shock policies	Mean	Std. Dev.	SOPs	Mean	Std. Dev.	SOPs
Soft	*Conflict cash relief*	2.578***	0.053	34.9	2.046***	4.500***	21.6
		(0.090)	(0.093)	(0.015)	(0.202)	(0.392)	(0.030)
	*Real-time safety info – **BASE***	0.000	-	2.7	0.000	-	2.8
				(0.002)			(0.004)
	Conflict training	0.453***	0.364***	4.2	-0.087	0.465***	2.6
		(0.073)	(0.069)	(0.003)	(0.167)	(0.125)	(0.004)
	Improved road security	1.762***	0.740***	15.5	2.242***	1.182***	26.3
		(0.081)	(0.064)	(0.008)	(0.194)	(0.160)	(0.028)
	Conflict insurance	0.560***	1.477***	4.6	0.429**	1.701***	4.3
		(0.081)	(0.067)	(0.03)	(0.183)	(0.226)	(0.006)
	Loans for security	0.393***	0.842***	3.9	-0.271	1.194***	2.1
		(0.079)	(0.058)	(0.003)	(0.185)	(0.163)	(0.003)
	Improved market/ warehouse security	1.858***	0.808***	17.0	1.900***	0.784***	18.7
		(0.082)	(0.069)	(0.008)	(0.191)	(0.162)	(0.023)
Hard	*Improved market/ warehouse safety infra*	1.610***	0.659***	13.3	0.295*	0.106	3.7
		(0.082)	(0.079)	(0.007)	(0.176)	(0.170)	(0.005)
	Improved market /warehouse lighting	0.392***	0.712***	3.9	1.863***	0.400	18.0
		(0.078)	(0.068)	(0.003)	(0.191)	(0.249)	(0.021)
	Sum of share of preferences			100%			100%
	Number of traders	240			60		
	N	2,160			540		
	LLF	-4,105.354			-919.689		
	AIC / N	3.842			3.569		
	BIC / N	3.958			3.919		

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 17. Correlated RPL results for weather shock policies by region

		Northern traders			Southern traders		
	Weather shock policies	Mean	Std. Dev.	SOPs	Mean	Std. Dev.	SOPs
Soft	*Weather cash relief*	2.332***	0.016	32.6	3.516***	3.164***	69.6
		(0.090)	(0.095)	(0.014)	(0.291)	(0.316)	(0.052)
	Loans for weather tech	0.296***	0.869***	4.3	0.043	0.694***	2.2
		(0.075)	(0.081)	(0.003)	(0.153)	(0.163)	(0.005)
	Weather insurance	0.387***	1.191***	4.7	0.088	1.039***	2.3
		(0.077)	(0.068)	(0.003)	(0.157)	(0.161)	(0.005)
	*Real-time weather info – **BASE***	0.000	-	3.2	0.000	-	2.1
				(0.002)			(0.005)
	Weather training	0.092	0.525***	3.5	0.144	0.702***	2.4
		(0.075)	(0.070)	(0.002)	(0.162)	(0.146)	(0.005)
Hard	*Improved road infra*	2.235***	1.256***	29.6	1.700***	1.611***	11.3
		(0.090)	(0.076)	(0.013)	(0.181)	(0.144)	(0.021)
	Improved market/ warehouse flood-proof infra	1.797***	0.910***	19.1	0.828***	1.353***	4.7
		(0.086)	(0.074)	(0.010)	(0.164)	(0.132)	(0.010)
	Improved market/ warehouse electricity	-0.034	0.620***	3.1	0.963***	1.033***	5.4
		(0.079)	(0.077)	(0.002)	(0.171)	(0.143)	(0.011)
	Sum of share of preferences			100%			100%
	Number of traders	240			60		
	N	1,920			480		
	LLF	-3,639.036			-911.793		
	AIC / N	3.827			3.945		
	BIC / N	3.928			4.249		

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 18. Correlated RPL results for conflict shock policies by formal education

		Educated traders			Uneducated traders		
	Conflict shock policies	Mean	Std. Dev.	SOPs	Mean	Std. Dev.	SOPs
Soft	*Conflict cash relief*	2.059***	0.847***	27.6	3.330***	0.056	47.9
		(0.094)	(0.104)	(0.014)	(0.161)	(0.159)	(0.031)
	*Real-time safety info – **BASE***	0.000	-	3.5	0.000	-	1.7
				(0.002)			(0.002)
	Conflict training	0.418***	0.405***	5.4	0.378***	0.479***	2.5
		(0.081)	(0.062)	(0.003)	(0.121)	(0.112)	(0.003)
	Improved road security	1.621***	0.627***	17.8	2.154***	0.840***	14.8
		(0.088)	(0.073)	(0.009)	(0.141)	(0.108)	(0.014)
	Conflict insurance	0.463***	1.260***	5.6	0.430***	1.355***	2.6
		(0.088)	(0.082)	(0.004)	(0.134)	(0.138)	(0.003)
	Loans for security	0.285***	0.768***	4.7	0.752***	1.708***	3.6
		(0.087)	(0.062)	(0.003)	(0.138)	(0.104)	(0.004)
	Improved market/warehouse security	1.597***	0.645***	17.4	1.952***	1.086***	12.1
		(0.088)	(0.069)	(0.009)	(0.141)	(0.114)	(0.012)
Hard	*Improved market/ warehouse safety infra*	1.127***	0.668***	10.9	1.842***	0.560***	10.8
		(0.087)	(0.078)	(0.006)	(0.134)	(0.132)	(0.011)
	Improved market/ warehouse lighting	0.705***	0.758***	7.1	0.816***	0.476***	3.9
		(0.085)	(0.074)	(0.004)	(0.127)	(0.132)	(0.004)
	Sum of share of preferences			100%			100%
	Number of traders	190			101		
	N	1,710			909		
	LLF	-3,444.687			-1,622.942		
	AIC / N	4.080			3.668		
	BIC / N	4.220			3.901		

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 19. Correlated RPL results for weather shock policies by formal education

		Educated traders			Uneducated traders		
	Weather shock policies	Mean	Std. Dev.	SOPs	Mean	Std. Dev.	SOPs
Soft	*Weather cash relief*	1.877***	0.392***	28.9	2.873***	0.064	46.8
		(0.094)	(0.099)	(0.014)	(0.158)	(0.151)	(0.028)
	Loans for weather tech	0.617***	1.112***	8.2	0.006	1.078***	2.7
		(0.085)	(0.084)	(0.005)	(0.122)	(0.118)	(0.003)
	Weather insurance	0.128	1.257***	5.0	0.177	1.169***	3.2
		(0.085)	(0.075)	(0.003)	(0.122)	(0.103)	(0.004)
	*Real-time weather info - **BASE***	0.000	-	4.4	0.000	-	2.6
				(0.003)			(0.003)
	Weather training	0.245***	0.667***	5.7	-0.146	0.854***	2.3
		(0.083)	(0.079)	(0.004)	(0.125)	(0.112)	(0.003)
Hard	*Improved road infra*	1.814***	1.142***	27.1	2.187***	1.176***	23.6
		(0.093)	(0.074)	(0.014)	(0.144)	(0.103)	(0.020)
	Improved market/ warehouse flood-proof infra	1.245***	0.868***	15.4	1.796***	0.939***	15.9
		(0.087)	(0.070)	(0.009)	(0.137)	(0.099)	(0.015)
	Improved market/ warehouse electricity	0.178**	0.700***	5.2	0.139	0.840***	3.0
		(0.087)	(0.088)	(0.004)	(0.126)	(0.114)	(0.004)
	Sum of share of preferences			100%			100%
	Number of traders		190			101	
	N		1,520			808	
	LLF		-3,008.586			-1,478.678	
	AIC / N		4.005			3.747	
	BIC / N		4.127			3.950	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 20. Correlated RPL results for conflict shock policies by experience of conflict shocks

		Experienced			Did not experience		
	Conflict shock policies	Mean	Std. Dev.	SOPs	Mean	Std. Dev.	SOPs
Soft	*Conflict cash relief*	2.638***	0.419*	35.5	2.311***	0.131	27.5
		(0.221)	(0.230)	(0.184)	(0.085)	(0.093)	(0.048)
	*Real-time safety info – **BASE***	0.000	-	2.2	0.000	-	2.7
				(0.012)			(0.005)
	Conflict training	0.703***	0.633***	3.9	0.338***	0.436***	3.9
		(0.184)	(0.144)	(0.017)	(0.074)	(0.071)	(0.018)
	Improved road security	2.194***	1.911***	20.1	1.669***	0.772***	18.4
		(0.213)	(0.156)	(0.173)	(0.080)	(0.071)	(0.081)
	Conflict Insurance	0.069	2.179***	7.3	0.553***	1.865***	8.8
		(0.234)	(0.199)	(0.097)	(0.085)	(0.092)	(0.141)
	Loans for security	0.868***	1.102***	6.3	0.348***	1.005***	4.7
		(0.201)	(0.157)	(0.105)	(0.080)	(0.069)	(0.061)
	Improved market/ warehouse security	1.724***	1.418***	12.0	1.694***	0.582***	17.3
		(0.207)	(0.155)	(0.081)	(0.081)	(0.081)	(0.050)
Hard	*Improved market/ warehouse safety infra*	1.234***	0.365**	6.8	1.283***	0.529***	11.0
		(0.195)	(0.165)	(0.040)	(0.078)	(0.082)	(0.038)
	Improved market/ warehouse lighting	0.820***	1.699***	6.0	0.643***	0.494***	5.8
		(0.199)	(0.161)	(0.074)	(0.078)	(0.080)	(0.025)
	Sum of share of preferences			100%			100%
	Number of traders		45			246	
	N		405			2,214	
	LLF		-751.124			-4,322.961	
	AIC / N		3.927			3.945	
	BIC / N		4.362			4.058	

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.