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Weather Shocks and Urban Livelihood Strategies: The Gender Dimension of Household Vulnerability in the Kumi District Of Uganda

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ABSTRACT *The Teso sub-region of Uganda suffered numerous weather shocks in the past, with devastating food security consequences. Using household fixed effects and propensity score matching methods, we analyse the impact of exposure to drought, flood and severe incidence of pests and diseases on household consumption expenditure per adult equivalent for a random sample of households from Kumi Town Council. We find that weather shocks reduce consumption by 17 per cent and that the consumption decline is significantly larger among female-headed households. We also find a higher likelihood of non-farm employment, borrowing and receiving remittances in order to cope with the shocks.*

1. Introduction

As climate change remains a global challenge, extreme weather conditions like prolonged droughts and floods are becoming more prevalent and agricultural seasons are becoming increasingly unpredictable (Patricola & Cook, 2011). These shocks often reduce crop yields and food consumption, threatening food security especially among smallholder farming communities in developing countries (Dercon, Hoddinott, & Woldehanna, 2005; Fafchamps and Lund, 2003; Jack & Suri, 2014; Kurosaki, 2006; Nelson et al. 2009; Ringler, Zhu, Cai, Koo, & Wang, 2010). In urban areas, weather shocks often disrupt food flows from rural areas and result into reduced food security (Gaspar, Blohm, & Ruth, 2011).¹ The ability of households to insure against such vulnerabilities is limited by the inefficiency of insurance markets in developing countries (Townsend, 1995). In such a context, households strive to smooth their consumption by increasing members' participation in the labour market (Beegle, Dehejia, & Gatti, 2006; Ito & Kurosaki, 2009), selling livestock (Hoddinott, 2006), adjusting grain stocks (Kazianga & Udry, 2006), receiving remittances from family members and friends (Jack & Suri, 2014) and diversifying their income sources (Kochar, 1999; Porter, 2012). However, the devastating effect of shocks on food security are sometimes too strong to be fully offset by available strategies (Fafchamps, Udry, & Czukas, 1998) while other strategies are limited by the technological, environmental and economic constraints faced by these households (Fafchamps, 1999). It is also noteworthy that these climatic and environmental hazards affect urban inhabitants differently, depending on their assets and coping capabilities – which, in turn, are shaped by income, age, and gender, among other factors. It is therefore necessary to understand such differences when designing pro-poor adaptation policies aimed at protecting individual, household and community assets and capabilities. Analysis of vulnerabilities can help answer where and how society can best invest to

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reduce vulnerability. The objective of this study is to analyse the impact of weather shocks and assess the coping strategies used by urban residents to cope against these shocks while hinging on the gender dimension of these vulnerabilities at the household level.

Existing literature on vulnerability indicates that women in general are more vulnerable to both poverty and shocks (Klasen, Lechtenfeld, & Povel, 2014), especially because of their lack of access to productive resources. However, empirical evidence on the vulnerability of female-headed households in particular is largely missing in the literature. By virtue of their gender, female-headed households have less access to productive assets like land (Deere & León, 2003), lower education attainment (Duflo, 2012) and face more restrictive entry requirements into formal labour market opportunities as a result of economic and socio-cultural considerations in many developing countries (Contreras & Plaza, 2010). It is expected that these issues feed into vulnerability of female-headed households, an issue that we explore in the later sections of this study.

Although many studies have analysed the effect of and response strategies against weather shocks and other income shocks, there is little evidence on whether these strategies are effective enough to offset the negative effects of shocks. Besides, most existing works have analysed shock impacts in a rural context while effects among urban households remain less investigated. This is quite important because rural-urban disparities may imply differential impact of shocks and differences in the set of coping options available to rural and urban households. This study therefore makes a four-fold contribution to the existing literature: first, by investigating differences in the extent of vulnerability and coping ability by gender of household head; second, by analysing the effect of and coping strategies against shocks in an urban context; third, by explicitly evaluating the effectiveness of each strategy employed; and fourth, by disaggregating total consumption into its components to investigate potential reallocations among consumption categories in the event of weather shocks. The rest of the paper is organised as follows: [Section 2](#) gives a brief background on poverty and vulnerability to extreme weather events in the study area – Kumi district, Uganda and [Section 3](#) outlines the survey process and describes the data used in the analysis. The empirical strategy is elaborated in [Section 4](#) while [Section 5](#) presents the econometric results and [Section 6](#) concludes.

2. Poverty and vulnerability in the Teso sub-region

Located in the Eastern region of Uganda, the Teso sub-region comprises eight districts – Kumi, Ngora, Soroti, Serere, Amuria, Bukedea, Kaberamaido and Katakwi. The sub-region has a total land area of 13,027 square kilometres and is inhabited by 1,819,790 people based on the 2014 population and housing census, implying an average population density of 140 per square kilometre of land. Relative to other sub-regions, Teso has a high incidence of poverty; approximately 46 per cent of the inhabitants were categorised as ‘poor’ in 2010, compared to a national poverty rate of 25 per cent recorded in the same year. The main economic activity in the sub-region is farming, with predominant crops being cassava, sorghum, millet, sweet potatoes and ground nuts. Like in many other parts of the country, a vast majority of the residents are smallholder farmers relying directly on rain-fed agriculture, which is of concern because of the associated high vulnerability to extreme weather events like prolonged droughts, floods and changing and/or unpredictable seasons.

The sub-region is one of the most vulnerable areas in the country; it experienced five major droughts between 1990 and 2010 – 1998, 1999, 2002, 2005 and 2008. In one of the biggest floods that swept through Eastern and Horn of Africa in 2007, about 30 people in the sub-region died and an estimated 8500 acres of cropland was lost. As an immediate aftermath of the flood, many smallholder farmers experienced a bad harvest, which clearly manifested in the outbreak of acute famine in 2008 that further weakened food security in many villages across the sub-region.² This is often a combined result of crop loss in producing villages and disrupted food flow channels when roads are destroyed by floods.

3. Data and descriptive statistics

We collected household survey data between February and March 2015 from Kumi town, the administrative capital of Kumi district in the Teso sub-region of Eastern Uganda. Kumi district provides a suitable study area for this analysis because it is one of the areas that are most vulnerable to extreme weather events in the country, especially droughts. Twenty-five households were randomly sampled from each of the eight local councils 1's (LC1) that constitute Kumi Town Council.³ We thus constructed a quasi-panel of 200 urban households (400 household-year observations) through careful recalls of household consumption expenditures, incomes, household characteristics as well as exposure to various shocks – drought, flood and severe incidence of pests and diseases between 2009 and 2015.⁴ Consumption of food items was asked with weekly recalls while expenditure on school fees, medical care, semi-durable household items (hereafter referred to as basics) and contributions to social and religious functions (hereafter called contributions) were allowed annual recalls.

We first stratify our sample by whether or not a household reported having been affected by any of our shocks of interest – drought, flood and severe crop and/or animal pests and diseases – and provide summary statistics in Table 1. Households that reported experiencing any or a combination of these weather shocks have larger household sizes – one more member relative to unaffected households and the difference is statistically distinguishable from zero. The table also reveals that affected households are more likely to be female-headed although this difference is insignificant at conventional levels. There are also systematic differences in the age and education level of the household head; heads of households that self-reported exposure to weather shocks are more than three years older and completed one year less of schooling relative to those of unaffected households. The monthly consumption expenditure per adult equivalent among households not affected by weather shocks is 179,902 shillings (62 USD) which is approximately 1.5 times larger than that of self-reported shock victims (117,069 shillings or approximately 41 USD).⁵ Another significant difference between shock-affected and unaffected households is the pattern of remittance flows; the proportion of remittance recipients is twice as high among shock-affected households. This could partly reflect the possibility of soliciting remittances from family members and friends as an ex-post mechanism to cope with weather shocks.

Table 1. Summary statistics by exposure to weather shocks

VARIABLES	Affected		Unaffected		Affected – Unaffected
	Mean	SD	Mean	SD	
Distance to market (kms)	0.91	0.41	0.82	0.46	0.09
Household size	6.24	3.20	5.24	3.48	0.99***
1 if belongs to SACCO	0.36	0.48	0.27	0.45	0.08*
Age of household head	39.05	12.12	35.73	12.18	3.32**
1 if head is female	0.26	0.44	0.21	0.41	0.05
Head years of schooling	9.97	5.14	11.34	5.72	-1.36**
1 if head attended secondary school or higher	0.58	0.03	0.58	0.04	0.00
Monthly expenditure on food (UGX) ^a	39,020	44,336	37,337	55,531	1,682
Monthly expenditure on basics (UGX) ^a	37,947	52,394	66,631	88,068	-28,684***
Monthly expenditure on contributions ^a	13,395	19,130	26,716	80,373	-13,320**
Monthly expenditure (UGX) ^a	117,069	103,236	179,902	297,538	-62,833***
Value of assets ('000 UGX)	4,029	11,325	3,324	8,774	705
1 if owns mobile phone	0.76	0.43	0.74	0.44	0.02
1 if received remittance	0.42	0.49	0.24	0.43	0.17***
Number of Observations	262	-	138	-	-

Notes: Asterisks ***, ** and * respectively indicate that the mean difference between affected and unaffected households is significant at 1, 5 and 10 per cent levels of significance. ^a Measures of consumption expenditure are scaled by adult-equivalent units.

In Table 2, we provide summary statistics stratified by gender of the household head to crudely illustrate differential vulnerability to weather shocks and heterogeneity in key household characteristics between households headed by males and those headed by female counterparts. The first intriguing observation is the significant difference in the years of schooling, with female household heads lagging behind their male counterparts by over three years of schooling. Additionally, while 65 per cent of male-headed households attained at least a secondary school level of education, the proportion is only 39 per cent among female-headed households. These observations are rather expected given the renowned gender gap in education (Duflo, 2012). Nonetheless, the overall literacy level in this sample is notably higher than the 4.7 national mean years of schooling reported in 2012.⁶ Female household heads are also significantly older and spend more on household basics – education, health and non-durables like clothes – although this expenditure difference is marginally significant.

There are also some notable differences in asset possession and monthly adult-equivalent consumption with female-headed households reporting a lower value of household assets and spending less on food and social contributions – funerals, SACCOs, weddings and religious functions – albeit the difference being statistically insignificant. With respect to shock exposure, 65 and 70 per cent of male-headed and female-headed households respectively reported having been exposed to weather shocks in the past five years. Female-headed households are less likely to engage in the non-farm sector, especially salaried jobs, and thus earn significantly less per capita income than their male-headed counterparts. Additionally, households headed by females own significantly less livestock units, which could further curtail their ability to raise significant funds through livestock sales to offset the adverse effects of weather shocks. This could imply less coping options available to the female-headed households, resulting in costly coping mechanisms like missing meals and reallocating from other expenditure components like education.

Table 2. Summary statistics by gender of the household head

VARIABLES	Male-headed		Female-headed		Male – Female
	Mean	SD	Mean	SD	
Distance to market (kms)	0.86	0.44	0.94	0.38	-0.08
Household size	5.90	3.41	5.93	3.06	0.02
1 if belongs to SACCO	0.33	0.47	0.35	0.48	-0.03
Age of household head	36.87	11.28	41.17	14.20	-4.30**
Head years of schooling	11.35	4.99	7.74	5.51	3.61***
1 if head attended secondary school or higher	0.65	0.02	0.39	0.05	0.26***
1 if experienced drought	0.55	0.50	0.60	0.45	-0.04
1 if experienced flood	0.15	0.36	0.14	0.35	0.007
1 if experienced pests/diseases	0.42	0.49	0.44	0.50	-0.02
Monthly expenditure on food (UGX) ^a	39,872	51,466	34,518	35,653	-5,354
Monthly expenditure on basics (UGX) ^a	43,215	67,552	56,466	62,302	-13,250*
Monthly expenditure on contributions ^a	19,578	53,921	11,157	14,961	8,420
Monthly expenditure (UGX) ^a	138,281	207,048	129,958	111,078	8,323
Value of assets ('000 UGX)	4,292	11,530	2,276	6,447	2,016
1 if owns mobile phone	0.77	0.42	0.72	0.45	0.04
1 if received remittance	0.35	0.48	0.38	0.49	-0.02
1 if experienced weather shock	0.65	0.48	0.70	0.46	-0.05
Number of livestock	8.12	1.49	5.61	0.76	2.51
1 if any member in non-farm employment	0.43	0.04	0.17	0.05	0.27***
Annual household per capita income	830,442	147,230	248,560	42,928	581,882**
Number of Observations	302	-	98	-	-

Notes: Asterisks ***, ** and * respectively indicate that the mean difference between male-headed and female-headed households is significant at 1, 5 and 10 per cent levels of significance. ^a Measures of consumption expenditure are scaled by adult-equivalent units.

4. Empirical strategy

This study attempts to investigate four main empirical questions:

- 1) How does exposure to drought, flood and severe incidence of animal and crop pests and diseases affect household welfare measured by consumption expenditure?
- 2) Are there any heterogeneous impacts of and response strategies against shocks by gender of the household head?
- 3) Which coping strategies do affected households adopt to avert potential consumption loss when hit by a weather shock?
- 4) Do the coping strategies employed by the households effectively safeguard them from consumption declines that result from exposure to one or more weather shocks?

4.1. Weather shocks and household consumption expenditure

We presume a linear association between consumption expenditure and household-level covariates of the following specification.

$$Cons_{ijt} = \alpha + f_j + f_t + \beta_1 H_{ijt} + \beta_2 Shock_{ijt} + \varepsilon_{ijt} \quad (1)$$

Where $Cons_{ijt}$ is first estimated as aggregated real expenditure on all consumption categories – food, basics and social contributions. However, in order to investigate potential reallocation among these categories, especially when a household is hit by a weather shock, we also estimate separate regressions for expenditure on each of these consumption components. Scaling household consumption expenditure by adult equivalent units rather than per capita terms allows us to adjust for differences in expenditure needs due to demographic composition of households which would otherwise account for part of the observed consumption difference between affected and unaffected households. We then deflate all consumption categories using the consumer price index of 2009. Subscripts i, j and t indicate household, LC1 and year and $Shock_{ijt}$ is a binary variable taking one if a household was affected by at least one of the weather shocks – drought, flood and severe incidence of pests and diseases. The parameter β_2 is expected to have a negative sign to reflect the expected negative impact of shock exposure on household consumption. H_{ijt} is a vector of household characteristics – age, gender and years of schooling of household head, land and household asset endowments and household size – while f_j and f_t respectively capture LC1 and year-specific effects captured by their respective dummies.

4.2. Heterogeneous shock impacts and coping strategies by gender of household head

We next explore one critical aspect of potentially heterogeneous impacts of weather shock between male-headed and female-headed households using the following equation which is an extension of Equation (1).

$$Cons_{ijt} = \alpha + f_j + f_t + \beta_1 H_{ijt} + \beta_2 Shock_{ijt} + \lambda_1 Fehead_{ijt} + \lambda_2 Fehead_{ijt} X Shock_{ijt} + \varepsilon_{ijt} \quad (2)$$

Where $Fehead_{ijt}$ is a dummy variable taking the value one if the household head is female and zero otherwise. Its coefficient (λ_2) is presumed to have a negative sign, indicative of the higher consumption poverty of female-headed households relative to male-headed counterparts, as conceded in the literature (Klasen et al., 2014). The analysis of heterogeneous impacts by gender in Kumi district given that over 70 per cent of agricultural labour is provided by women yet only 30 per cent of women contribute towards decisions regarding the disposal of income from farming operations. The coefficient on the interaction term between the female head dummy and the shock dummy (parameter λ_2) captures potential heterogeneous impacts of shocks by gender of household headship. Our prediction

is that λ_2 will be negative, reflective of the relative vulnerability of female-headed households. In other words, the consumption decline due to shock exposure is expected to be larger among female-headed households than among their male-headed counterparts.

4.3. Coping strategies against weather shocks

We presume that a household responds to shock exposure by engaging in one or a set of available strategies to undo the potential negative impact of the shock, in which case we would observe an increased tendency of the household to engage in a particular coping strategy k . To explore the types of coping strategies which shock-affected households engage in, we adopt a Probit model to estimate the likelihood of a household engaging in a particular coping strategy conditional on shock exposure and other covariates.

$$Strategy_{ijt}^k = \theta_0 + f_j + f_t + \theta_1 H_{ijt} + \theta_2 Shock_{ijt} + v_{ijt} \quad (3)$$

Where $Strategy_{ijt}^k$ is a binary indicator taking one if the i -th household in LC1 j engaged in coping strategy k in year t . The coping strategies specifically investigated in this study include soliciting remittances from family members and friends, sending members to work off-farm and selling livestock and household assets.⁷ Most of these are ex-post mechanisms and compatible with the urban nature of our sample. Crop diversification and planting drought-resistant crops as ex-ante coping mechanisms are more compatible with rural settings and are thus excluded from this analysis. Other ex-ante coping strategies like diversifying income sources are also excluded because of data limitations. Our coefficient of interest θ_2 , which is presumed to be positive, captures the extent to which shock exposure induces the household to engage in a particular coping strategy.

4.4. Effectiveness of coping strategies

In the previous section, we assumed that a household responding to a shock by applying a particular coping strategy would be a positive signal of its ability to offset the potential negative impacts of the shock on consumption expenditure. However, it is quite possible that even after employing available coping mechanisms, shock-affected households may still experience significant declines in their household consumption (Fafchamps et al., 1998). We therefore estimate Equation (3) to assess the effectiveness of each of the respective coping strategies by slightly modifying Equation (1).

$$Cons_{ijt} = \alpha + f_j + f_t + \beta_1 H_{ijt} + \beta_2 Shock_{ijt} + \mu Strategy_{ijt}^k + \psi Strategy_{ijt}^k X Shock_{ijt} + \varepsilon_{ijt} \quad (4)$$

The additional term is an interaction between the shock dummy and dummies for each coping strategy k and its coefficient ψ captures the effectiveness of the coping mechanisms; a significantly positive coefficient would imply that the coping strategy in question is effective in offsetting the negative impact of the shock on consumption expenditure and, symmetrically, a significantly negative or insignificant coefficient would suggest that the coping strategy either exacerbates consumption declines or has no significant protective power to consumption against weather shocks.

5. Results and discussion

5.1. Shock impacts on household consumption per adult equivalent

We find a negative and significant association between self-reported exposure to weather shocks and real household consumption per adult equivalent. We first present the OLS estimates of this association in Table 3. Column 1 reveals a 15.1 per cent decline in real household consumption per adult equivalent associated with exposure to at least one of the weather shocks – drought, flood and severe animal/crop pests/diseases. Disaggregating consumption into food, household basics and social contributions in subsequent

Table 3. Weather shocks and household consumption per adult equivalent: OLS

VARIABLES	(1)	(2)	(3)	(4)
	Log(cons)	Log(food)	Log(basics)	Log(contribution)
1 if affected by any shock	-0.151** (0.0699)	0.0205 (0.136)	-0.385*** (0.128)	-0.408** (0.207)
Total dependency ratio	0.0390 (0.0341)	0.148** (0.0629)	0.0222 (0.0646)	0.0157 (0.0851)
Age of household head	0.00223 (0.0122)	-0.0269 (0.0312)	0.0196 (0.0278)	0.0826** (0.0381)
Age squared of household head	5.88e-05 (0.000136)	0.000318 (0.000343)	4.36e-05 (0.000319)	-0.000725* (0.000428)
1 if head is female	0.111* (0.0639)	-0.124 (0.139)	0.506*** (0.125)	-0.110 (0.182)
Head years of schooling	0.0216*** (0.00622)	0.0241** (0.0111)	0.0402*** (0.0120)	0.0476*** (0.0156)
Log(value of assets)	0.0367 (0.0328)	0.0339 (0.0440)	0.0829** (0.0363)	0.141** (0.0696)
1 if owns mobile phone	-0.102 (0.104)	-0.184 (0.179)	-0.0851 (0.188)	0.199 (0.289)
Household size	-0.0345*** (0.0100)	-0.0517*** (0.0189)	-0.0210 (0.0220)	-0.0390 (0.0277)
1 if worked for wage off-farm	0.0597 (0.0625)	-0.0405 (0.129)	0.0314 (0.118)	0.521*** (0.190)
year = 2015	0.511*** (0.0629)	2.744*** (0.132)	0.0333 (0.115)	0.371** (0.187)
Constant	10.52*** (0.441)	8.194*** (0.805)	7.342*** (0.709)	3.439*** (1.092)
Observations	376	376	376	376
R-squared	0.359	0.676	0.272	0.286

Notes: Robust standard errors are reported in parentheses. Asterisks ***, ** and * indicate statistical significance at 1, 5 and 10 per cent levels, respectively. Community times year dummies are controlled for in all specifications to control for location and time specific effects.

columns indicates that these shocks have no significant impact on food consumption but rather households seem to reallocate their expenditure from household basics and social contributions to supplement food consumption. In fact, exposure to weather shocks reduces expenditure on basics and social contributions by 38 and 40 percentage points, respectively. These results are corroborated by fixed effects estimates in [Table 4](#) with smaller coefficients after controlling for unobserved time-invariant household characteristics that could affect household consumption expenditure. We also find significantly lower consumption among female-headed households especially on food and social contributions. This could indicate their relative vulnerability to poverty and shocks as earlier found by Klasen et al. (2014) in the context of Thailand and Vietnam.

5.2. Heterogeneity of shock impacts by gender of household headship

We explore potential heterogeneities in shock impacts by gender of the household head and find that female-headed households are more severely affected by shock exposure and the difference is significant at 5 per cent. We present fixed effects estimates of Equation 2 for both total and disaggregated consumption and present the results in [Table 5](#). The negative and statistically significant coefficient on the interaction term between the female headship dummy and the shock exposure dummy indicates that, conditional on shock exposure, the resultant consumption decline is larger among female-headed households relative to male-headed counterparts. This is consistent with Dercon et al. (2005) who found that the drought-induced consumption decline in 15 Ethiopian villages is significantly more pronounced among female-headed households.

Table 4. Weather shocks and household consumption per adult equivalent: FE

VARIABLES	(1)	(2)	(3)	(4)
	Log(Consumption)	Log(Food)	Log(Basics)	Log(Contribution)
1 if affected by any shock	-0.132* (0.0743)	0.00362 (0.211)	-0.185** (0.0882)	-0.206 (0.205)
1 if head is female	-0.163 (0.139)	-1.005*** (0.336)	-0.264 (0.191)	-0.432* (0.231)
Age of household head	0.0312 (0.0230)	-0.0218 (0.0600)	0.0398 (0.0255)	0.159*** (0.0467)
Age squared of household head	-0.000352 (0.000415)	0.000766 (0.00110)	-0.000588 (0.000495)	-0.00248*** (0.000893)
Head years of schooling	-0.00575 (0.0391)	-0.00328 (0.101)	-0.0351 (0.0337)	0.00286 (0.0793)
Log(value of assets)	-0.0112 (0.0421)	0.00738 (0.0704)	-0.0241 (0.0270)	-0.0339 (0.0617)
1 if owns mobile phone	-0.0431 (0.114)	-0.257 (0.319)	-0.00737 (0.165)	0.194 (0.265)
Household size	-0.00333 (0.0159)	-0.00715 (0.0435)	0.00705 (0.0216)	-0.0286 (0.0395)
1 if worked for wage off-farm	-0.0562 (0.0841)	-0.0808 (0.201)	-0.0550 (0.102)	0.180 (0.221)
year = 2015	0.581*** (0.107)	2.644*** (0.267)	0.288** (0.123)	0.893*** (0.247)
Constant	11.11*** (0.822)	8.540*** (1.805)	9.886*** (0.654)	6.181*** (1.410)
Observations	376	376	376	376
R-squared	0.487	0.798	0.097	0.256
Number of households	188	188	188	188

Notes: Robust standard errors are reported in parentheses. Asterisks ***, ** and * indicate statistical significance at 1, 5 and 10 per cent levels, respectively. Community times year dummies are controlled for in all specifications to control for location and time specific effects.

As noted earlier, the likelihood of exposure to shocks does not significantly differ by gender of the household head, implying that the observed differential impact of shocks would be indicative of the relative inability of female-headed households to cope with the shocks. As a partial confirmation of this premise, female-headed households are less likely to engage in the non-farm sector, especially salaried jobs, and own significantly less livestock than those headed by males. This could imply less coping options available to the female-headed household, resulting in costly coping mechanisms like missing meals. In fact, female-headed households have significantly lower years of schooling and are less likely to have members working off-farm than their male counterparts. Column 3 further reveals that generally female-headed households spend significantly more on basics including education and health, a finding consistent with Klasen et al. (2014).

5.3. Shock exposure and livelihood coping strategies

We then investigate whether shock exposure induces the affected households to increase their engagement in ex-post risk-coping strategies. Since the outcome variables are binary indicators of whether or not a household engages in a particular strategy, we estimate Probit regressions and present their marginal effects in Table 6. Results reveal a positive and significant relationship between shock exposure on one hand and the likelihood of employment, seeking credit and receiving remittances on the other hand. Columns 1 and 2 indicate that shock exposure is associated with a positive likelihood of selling livestock albeit statistically insignificant coefficients. This finding contrasts with some previous studies which found significant increases in livestock sales during and after shock exposure (Hoddinott, 2006). The difference owes to the relatively urban nature of our sample whose main source of livelihood is non-farm income with minimal livestock ownership. In fact, results in Column 3 support this conjecture; exposure to weather

Table 5. Heterogeneity of shock impacts by gender of household headship

VARIABLES	(1)	(2)	(3)	(4)
	Log(Consumption)	Log(Food)	Log(Basics)	Log(Contribution)
1 if affected by weather shock	-0.0590** (0.0300)	-0.0737** (0.036)	-0.316** (0.146)	-0.285 (0.244)
1 if head is female	0.276* (0.142)	-0.486* (0.293)	0.751*** (0.279)	0.0740 (0.341)
Weather Shock X Female Head	-0.186** (0.087)	0.586* (0.319)	-0.263** (0.125)	-0.180* (0.101)
Head years of schooling	0.0236*** (0.00648)	0.0247** (0.0118)	0.0429*** (0.0119)	0.0562*** (0.0165)
Household size	-0.0351*** (0.0109)	-0.0493** (0.0216)	-0.0178 (0.0225)	-0.0472* (0.0286)
Age of household head	0.00370 (0.0122)	-0.0261 (0.0327)	0.0186 (0.0295)	0.0870* (0.0451)
1 if belongs to SACCO	0.177*** (0.0673)	0.123 (0.131)	0.270** (0.117)	0.970*** (0.180)
Age squared of household head	3.55e-05 (0.000135)	0.000280 (0.000359)	4.03e-05 (0.000339)	-0.000795 (0.000504)
Log(value of assets)	0.0304 (0.0312)	0.0313 (0.0433)	0.0761** (0.0341)	0.135** (0.0618)
1 if owns mobile phone	-0.139 (0.104)	-0.219 (0.182)	-0.160 (0.197)	0.0608 (0.277)
year = 2015	0.952*** (0.193)	3.366*** (0.487)	0.279 (0.347)	0.649 (0.424)
Constant	10.28*** (0.388)	8.136*** (0.895)	7.238*** (0.700)	3.151*** (1.073)
Observations	376	376	376	376
R-squared	0.384	0.678	0.300	0.348

Notes: Robust standard errors are reported in parentheses. Asterisks ***, ** and * indicate statistical significance at 1, 5 and 10 per cent levels, respectively. Community times year dummies are controlled for in all specifications to control for location and time specific effects.

shocks increases the household's probability of having a member working in the non-farm sector by 21 percentage points. Households with a high dependency ratio are more likely to sell household assets when hit by weather shocks, perhaps due to their relative lack of access to alternative strategies. Columns 4 and 5 reveal that the probability of borrowing (from formal and informal sources) and receiving remittances from family members and friends increases by 14 percentage points following shock exposure. For remittances, this finding corroborates findings from earlier studies that remittance receipt is a crucial source of informal insurance for poor rural households in Uganda (Munyegera & Matsumoto, 2015, 2016) and Kenya (Jack & Suri, 2014) without access to formal financial services like credit and insurance. Membership to a savings and credit association (SACCO) increases borrowing probability, consistent with the main functions of such groups – rotational saving and borrowing.

All coping strategies are augmented by asset-wealth with the exception of asset sales, further confirming that relatively poor households with no access to alternative coping strategies resort to selling household assets to survive shock impacts. The table also shows that an additional year of schooling by the household head increases the probability of having a member working off-farm and receiving remittances by 14 and 19 percentage points, respectively. This implies that these households make more investments in education and in turn it is easier for their members to find jobs in the non-farm sector both within Kumi town and other urban centres, ultimately sending financial help in the form of remittances.

Table 6. Shocks and coping strategies: probit marginal effects

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Sell Livestock	Sell Assets	Work Off-farm	Receive Credit	Receive Remittance
1 if affected by any shock	0.0786 (0.0547)	0.00552 (0.0522)	0.213*** (0.0637)	0.142** (0.0703)	0.143** (0.0669)
Total dependency ratio	0.0274 (0.0284)	0.0521* (0.0282)	0.0119 (0.0348)	-0.0522 (0.0326)	0.0196 (0.0333)
Household size	0.0225** (0.00915)	-0.00385 (0.00780)	-0.00286 (0.0102)	0.0102 (0.0108)	-0.00380 (0.00967)
1 if belongs to SACCO	0.0792 (0.0558)	0.000329 (0.0499)	0.0777 (0.0616)	0.200*** (0.0615)	0.0455 (0.0603)
Age of household head	0.000130 (0.0126)	0.0140 (0.0115)	0.0172 (0.0140)	0.0499*** (0.0166)	-0.00795 (0.0125)
Age squared of household head	-8.12e-05 (0.000153)	-0.000125 (0.000132)	-0.000216 (0.000159)	-0.000575*** (0.000193)	0.000145 (0.000145)
1 if head is female	-0.0496 (0.0592)	0.112* (0.0648)	0.108 (0.0700)	0.0588 (0.0714)	0.0645 (0.0688)
Head years of schooling	-0.00112 (0.00523)	0.00533 (0.00397)	0.0138** (0.00617)	0.00418 (0.00572)	0.0188*** (0.00596)
Log(value of assets)	0.0215* (0.0122)	0.00297 (0.00755)	0.0395*** (0.0125)	0.0503*** (0.0163)	0.0308*** (0.0106)
1 if owns mobile phone	0.0557 (0.0725)	-0.188** (0.0818)	0.116 (0.0866)	0.00622 (0.0804)	0.0745 (0.0774)
Observations	345	345	345	345	345

Notes: Robust standard errors are reported in parentheses. Asterisks ***, ** and * indicate statistical significance at 1, 5 and 10 per cent levels, respectively. Community times year dummies are controlled for in all specifications to control for location and time specific effects.

5.4. Effectiveness of coping strategies against weather shocks

In the previous sub-section, we illustrated that households increase their engagement in potentially risk-coping strategies. However, it is often the case that these strategies may not generate sufficient resources to offset the devastating impacts of shocks on consumption. We assess the effectiveness of each coping strategy using interaction terms between the shock exposure dummy and dummies for each of the respective strategies. Fixed Effects results in [Table 7](#) indicate that households that receive remittances are able to offset shock impacts, indicated by the positive and significant interaction term between the shock and remittance receipt dummies for total and food consumption expenditure in Columns 1 and 2, respectively. This is consistent with [Jack and Suri \(2014\)](#) who found that Kenyan households that use M-PESA – Safaricom’s mobile money platform – are able to offset the negative effect of weather and illness shock by receiving remittances from their family members and friends. However, although the coefficient is positive in the case of expenditure on basics, it is statistically indistinguishable from zero, implying that remittances perhaps are allocated to food consumption during crises.

[Table 8](#) presents similar analysis for asset sale. The negative coefficient on the asset sale dummy points to the possibility that asset-poor households are generally associated with lower consumption per adult equivalent. However, the positive and significant coefficient on the interaction term between shock exposure and asset sale dummies shows that conditional upon shock exposure, selling household assets provides temporary insurance against consumption decline. Nonetheless, asset depletion as a coping mechanism poses a risk of exposing poor households to medium- to long-term poverty which may manifest in further consumption declines. The coefficient is larger in the case of food consumption, possibly indicating that asset sales are made to temporarily supplement food intake but this strategy may not necessarily be used to safeguard other components of consumption.

Table 7. Effectiveness of coping strategies: remittance receipt

VARIABLES	(1)	(2)	(3)	(4)
	Log(Consumption)	Log(Food)	Log(Basics)	Log(Contribution)
1 if affected by any shock	-0.166* (0.0889)	-0.00745 (0.186)	-0.439*** (0.159)	-0.279 (0.242)
1 if received remittance	-0.0319 (0.155)	-0.0688 (0.290)	0.0635 (0.0435)	0.188 (0.404)
Weather Shock X Remittance	0.150** (0.073)	0.216** (0.110)	0.122 (0.292)	-0.162 (0.449)
1 if head is female	0.150** (0.0693)	-0.0780 (0.146)	0.566*** (0.128)	-0.0601 (0.184)
Head years of schooling	0.0227*** (0.00674)	0.0232* (0.0127)	0.0406*** (0.0121)	0.0549*** (0.0165)
Household size	-0.0342*** (0.0110)	-0.0513** (0.0211)	-0.0157 (0.0226)	-0.0473* (0.0283)
Age of household head	0.00559 (0.0121)	-0.0272 (0.0316)	0.0218 (0.0298)	0.0887** (0.0448)
1 if belongs to SACCO	0.165** (0.0659)	0.142 (0.131)	0.255** (0.117)	0.964*** (0.179)
Age squared of household head	6.97e-06 (0.000135)	0.000296 (0.000350)	-7.39e-06 (0.000342)	-0.000817 (0.000500)
Log(value of assets)	0.0306 (0.0306)	0.0257 (0.0431)	0.0756** (0.0339)	0.135** (0.0620)
1 if owns mobile phone	-0.144 (0.101)	-0.259 (0.181)	-0.160 (0.196)	0.0769 (0.276)
year = 2015	0.914*** (0.189)	3.379*** (0.504)	0.218 (0.348)	0.628 (0.425)
Constant	10.33*** (0.394)	8.154*** (0.889)	7.280*** (0.712)	3.119*** (1.086)
Observations	345	345	345	345
R-squared	0.387	0.674	0.303	0.348

Notes: Robust standard errors are reported in parentheses. Asterisks ***, ** and * indicate statistical significance at 1, 5 and 10 per cent levels, respectively. Community times year dummies are controlled for in all specifications to control for location and time specific effects.

Finally, [Table 9](#) presents the results for the rest of the coping strategies – credit access, livestock sale and participation in both on-farm and off-farm paid employment. There is no evidence that households that engage in each of these coping strategies suffer lower consumption declines due to weather shocks. The finding is not surprising in the case of livestock sales because of the urban nature of our sample households. In the case of farm and nonfarm employment, the results point to the possibility that wages are too low to offset the strong impacts of weather shocks. Moreover, farm labour demand in nearby villages reduces and wages are likely to decline due to reduced productivity during shock times. We find similar results for the disaggregated consumption measures and we do not report these results to save space.

5.5. Robustness checks

5.5.1. Observed heterogeneity. The OLS and fixed effects results presented so far assume no systematic differences in household characteristics between households affected by shocks and those that are unaffected. Although the fixed effects estimates control for unobserved time-invariant household heterogeneity, observed and time-variant unobserved heterogeneity could confound our results. In fact, [Table 1](#) indicates that households affected and unaffected by weather shocks are systematically different along key characteristics like household size and age and schooling years of the household head and these differences could be responsible for the consumption difference between these groups

Table 8. Effectiveness of coping strategies: asset sale

VARIABLES	(1)	(2)	(3)	(4)
	Log(Consumption)	Log(Food)	Log(Basics)	Log(Contribution)
1 if affected by any shock	-0.154** (0.0764)	-0.0773 (0.149)	-0.460*** (0.139)	-0.403* (0.224)
1 if sold assets	-0.325* (0.185)	-0.973*** (0.343)	-0.375 (0.371)	-0.563 (0.465)
Weather Shock X Asset Sale	0.380* (0.197)	1.226*** (0.388)	0.603 (0.395)	0.579 (0.497)
1 if head is female	0.154** (0.0688)	-0.0652 (0.141)	0.571*** (0.127)	-0.0363 (0.183)
Head years of schooling	0.0249*** (0.00647)	0.0279** (0.0120)	0.0444*** (0.0118)	0.0584*** (0.0165)
Household size	-0.0346*** (0.0110)	-0.0517** (0.0209)	-0.0160 (0.0227)	-0.0471* (0.0284)
Age of household head	0.00312 (0.0123)	-0.0334 (0.0334)	0.0166 (0.0285)	0.0863* (0.0441)
1 if belongs to SACCO	0.164** (0.0649)	0.130 (0.128)	0.252** (0.114)	0.954*** (0.178)
Age squared of household head	3.95e-05 (0.000135)	0.000371 (0.000368)	5.64e-05 (0.000327)	-0.000787 (0.000491)
Log(value of assets)	0.0321 (0.0303)	0.0270 (0.0425)	0.0776** (0.0333)	0.137** (0.0603)
1 if owns mobile phone	-0.135 (0.102)	-0.240 (0.181)	-0.135 (0.200)	0.0551 (0.279)
year = 2015	0.965*** (0.187)	3.499*** (0.494)	0.315 (0.344)	0.663 (0.416)
Constant	10.33*** (0.386)	8.222*** (0.903)	7.303*** (0.683)	3.227*** (1.051)
Observations	326	332	333	328
R-squared	0.390	0.685	0.305	0.351

Notes: Robust standard errors are reported in parentheses. Asterisks ***, ** and * indicate statistical significance at 1, 5 and 10 per cent levels, respectively. Community times year dummies are controlled for in all specifications to control for location and time specific effects.

of households. Similarly, such differences could as well imply differential ability to engage in anti-shock coping strategies even in the absence of weather shocks. To ameliorate this challenge, we perform propensity score matching to establish comparable counterpart households between the affected and unaffected categories along observed characteristics (Rosenbaum and Rubin, 1985).

The average treatment effect (ATE) presented in Tables 10 and 11 therefore respectively compare consumption expenditure and the likelihood of engaging in a particular coping strategy between comparable affected and unaffected households. The negative impact of weather shocks presented in previously presented OLS and fixed effects methods is confirmed by PSM estimates in Table 11; shock exposure reduces household consumption expenditure per adult equivalent by 17 per cent. By disaggregating consumption, we find a 22 per cent decline in expenditure on household basics and a negative but statistically insignificant coefficient for social contributions. Analysing individual shocks reveals that droughts and floods significantly reduce expenditure on basics and social contributions and that animal/crop pests/diseases have no significant impact on any of the consumption categories. Finally, Table 11 confirms the findings of Table 6; a positive and significant impact of shock exposure on the likelihood of non-farm employment, borrowing and remittance receipt and a positive but insignificant impact on livestock and household asset sales. Finally, Table 12 reports results from covariate balance tests to assess the comparability of covariates before and after matching. P-values for the equality of means covariates like distance to the market, SACCO membership dependency ratio,

Table 9. Effectiveness of other coping strategies: credit, off-farm labour and farm labour

VARIABLES	(1)	(2)	(3)	(4)
	Credit	Off-farm Labor	Farm Labor	Livestock Sale
1 if affected by any shock	-0.117 (0.103)	-0.203* (0.105)	-0.108 (0.0821)	-0.182** (0.0826)
1 if received credit	0.0829 (0.120)			
Weather shock X credit	-0.0144 (0.141)			
1 if worked for wage off-farm		-0.0274 (0.128)		
Weather shock X off-farm labour		0.141 (0.141)		
1 if worked for wage on-farm			-0.0797 (0.197)	
Weather shock X on-farm labour			-0.0357 (0.199)	
1 if sold livestock				-0.105 (0.144)
Weather shock X livestock sale				0.217 (0.157)
Head years of schooling	0.0226*** (0.00636)	0.0223*** (0.00635)	0.0215*** (0.00616)	0.0224*** (0.00628)
Household size	-0.0344*** (0.0102)	-0.0339*** (0.0101)	-0.0337*** (0.0102)	-0.0357*** (0.0102)
Age of household head	8.02e-05 (0.0125)	0.00160 (0.0124)	0.00230 (0.0125)	0.00234 (0.0122)
1 if head is female	0.126* (0.0657)	0.126* (0.0655)	0.120* (0.0665)	0.140** (0.0664)
Log(value of assets)	0.0347 (0.0317)	0.0363 (0.0309)	0.0342 (0.0334)	0.0372 (0.0312)
1 if owns mobile phone	-0.102 (0.105) (0.432)	-0.111 (0.106) (0.421)	-0.126 (0.104) (0.434)	-0.104 (0.105) (0.402)
Observations	335	335	335	335
R-squared	0.374	0.376	0.376	0.377

Notes: Robust standard errors are reported in parentheses. Asterisks ***, ** and * indicate statistical significance at 1, 5 and 10 per cent levels, respectively. Community times year dummies are controlled for in all specifications to control for location and time specific effects.

age and years of schooling of the household head are smaller than 0.05 before matching but larger than 0.1 after matching, indicating that covariates were unbalanced before matching but became balanced after matching. Failure to reject the hypothesis of joint equality of means after matching – indicated by a p-value larger than 0.05 – shows that covariates for households affected and unaffected by weather shocks are drawn from comparable distributions (Caliendo & Kopeinig, 2008). Additionally, a mean absolute bias of 3.3 per cent is far smaller than the 5 per cent recommended to yield reliable estimates (Rosenbaum and Rubin, 1985).

5.5.2. Sensitivity to hidden bias. Although propensity score matching removes potential confounding bias resulting from observed covariates, any unmeasured covariate that is simultaneously correlated with both the treatment and outcome could still confound the estimates of the average treatment effect (Rosenbaum, 2015). We perform sensitivity tests for our treatment effects estimates for the effect of general shock exposure on aggregate consumption expenditure and selected coping strategies for which the shock effect is significant. The assumption of the test is that, taking into account hidden bias, the treatment effect has

Table 10. Weather shocks and household consumption per adult equivalent: PSM

VARIABLES	(1)	(2)	(3)	(4)
	Log(Consumption)	Log(Food)	Log(Basics)	Log(Contribution)
ATE (weather shock)	-0.173*** (0.0612)	0.150 (0.125)	-0.227** (0.103)	-0.148 (0.225)
ATE (drought)	-0.0499 (0.0786)	0.140 (0.151)	-0.221* (0.128)	-0.417* (0.220)
ATE (flood)	-0.00744 (0.0493)	0.0805 (0.150)	-0.308* (0.165)	-0.240** (0.1080)
ATE (pests/diseases)	-0.0532 (0.0642)	-0.111 (0.134)	-0.0886 (0.126)	0.0736 (0.203)
Observations	342	342	342	342

Notes: Robust standard errors are reported in parentheses. Asterisks ***, ** and * indicate statistical significance at 1, 5 and 10 per cent levels, respectively.

Table 11. Shocks and coping strategies: propensity score matching results

VARIABLES	(1)	(3)	(5)	(6)	(7)
	Sell Livestock	Sell Assets	Work Off-farm	Receive Credit	Receive Remittance
ATE (weather shock)	0.0261 (0.0610)	0.00290 (0.0402)	0.125* (0.0733)	0.116* (0.0621)	0.171** (0.0865)
ATE (drought)	0.0551 (0.0641)	0.0696 (0.0467)	0.183*** (0.0595)	0.183** (0.0825)	0.0377 (0.0625)
ATE (flood)	0.110 (0.0693)	0.0580 (0.0712)	0.270*** (0.0757)	0.110 (0.0921)	0.322*** (0.0960)
ATE (pests/diseases)	0.0145 (0.0596)	-0.0232 (0.0436)	0.0580 (0.0573)	0.0551 (0.0604)	0.0116 (0.0603)
Observations	345	345	345	345	345

Notes: Robust standard errors are reported in parentheses. Asterisks ***, ** and * indicate statistical significance at 1, 5 and 10 per cent levels, respectively.

no effect and that all subjects would have the same response under an alternative treatment. Rosenbaum bounds are reported for different values of gamma; $\Gamma = 1$ reflects a fully randomised study with no confounding hidden bias while gamma values less than two expose the estimates to hidden bias (Rosenbaum, 2015). In Column 2 of Table 13, the maximum P-value for the estimated shock effect is 0.0480 which becomes insignificant beyond gamma values of three. This implies that the estimated negative impact of shock exposure on household consumption is insensitive to hidden bias that would triple the odds of shock exposure for the affected households. Similarly, for the coping strategies, although potential hidden bias is not fully ruled out, gamma values larger than two indicate that its magnitude needs to more than double the odds of shock exposure for it to alter the conclusions of this study; a significantly positive effect of shock exposure on the probability of seeking non-farm work, credit and remittances. Overall, our results are insensitive to both observed heterogeneity (as reflected by PSM results presented earlier) and unobserved confounding (as indicated by sensitivity analysis results in Table 13 and Section 5.52).

6. Conclusion

Urban households are potentially susceptible to food insecurity resulting from extreme weather events. Besides the direct impact of droughts, floods and severe incidence of animal and crop pests and diseases on

Table 12. Covariate balance check before and after propensity score matching

Variables	Mean before			Mean after			% Bias
	Shock = 1	Shock = 0	P-value	Shock = 1	Shock = 0	P-value	Reduction
Dependency ratio	1.0326	1.3944	0.062	1.0326	0.82387	0.168	73.3
Head years of schooling	9.97	11.34	0.041	11.347	12.405	0.137	35.3
Age of household head	39.05	35.73	0.037	39.438	39.884	0.801	28.4
Household size	6.24	5.24	0.009	5.7273	5.5868	0.709	26.1
1 if female head	0.26	0.21	0.366	0.2562	0.22314	0.549	980.0
Log (asset value)	14.283	13.989	0.309	14.283	14.456	0.357	41.1
Distance in km to market	0.91694	1.043	0.044	0.91694	0.81481	0.138	23.4
1 if belongs to SACCO	0.36	0.27	0.067	0.34711	0.38889	0.597	176.9
1 if owns mobile phone	0.76	0.74	0.812	0.75	0.75	1.000	100.0
Pseudo R ²	-	-	0.088	-	-	0.0043	-
Mean Bias	-	-	11.8	-	-	3.3	-
P-value (Joint Mean Equality)	-	-	0.040	-	-	0.154	-

Notes: Balance check before and after PSM for observations for which $0.1 < e(X) < 0.9$. Pseudo R² indicates how well covariates explain treatment probability; a small value after matching indicates goodness of the matching technique (Sianesi, 2004). A standardised absolute mean bias less than 5 after matching indicates effective matching (Rosenbaum and Rubin, 1985). A non-significant p-value for the joint mean equality test after matching is indicative of no significant differences between treatment and control groups after matching (Caliengin & Kopeinig, 2008).

Table 13. Sensitivity analysis for PSM results for consumption and coping strategies

Gamma	Log(Consumption)		Work Off-farm		Receive Credit		Receive Remittance	
	P-Value (min) (1)	P-Value (max) (2)	P-Value (min) (3)	P-Value (max) (4)	P-Value (min) (5)	P-Value (max) (6)	P-Value (min) (7)	P-Value (max) (8)
Γ = 1	0.0006	0.0006	0.0387	0.0387	0.0504	0.0504	0.0257	0.0257
Γ = 1.5	0.0029	0.0088	0.02476	0.0436	0.0165	0.0587	0.0108	0.0321
Γ = 2	0.0012	0.0060	0.00024	0.0552	0.0050	0.0602	0.00396	0.0401
Γ = 2.5	0.00039	0.0118	0.000016	0.0685	0.0015	0.0651	0.00697	0.0462
Γ = 3	0.000079	0.0480	1.1e-06	0.2960	0.0004	0.0772	2.0e-06	0.1082
Γ = 3.5	3.9e-08	0.1319	7.8e-08	0.4055	0.00014	0.3527	1.0e-07	0.2452
Γ = 4	1.2e-09	0.2902	5.5e-09	0.5001	4.6e-06	0.4546	5.0e-09	0.4629
Γ = 4.5	3.6e-11	0.4622	3.9e-10	0.5800	1.5e-06	0.5417	2.5e-10	0.6587
Γ = 5	2.7e-12	0.6622	2.9e-11	0.6151	4.6e-07	0.5800	1.3e-11	0.8183

Notes: Gamma indicates log odds of differential assignment due to unobserved factors. P-Value (min) and P-Value (max) respectively indicate the lower and upper P-value bounds. Sensitivity analysis is reported for the effect of general shock exposure on overall consumption but results for the association between shock categories and disaggregated consumption expenditure are not any different: estimates of drought and flood exposure on household basics and social contribution are insensitive to hidden biases well above two. For off-farm work, the estimates are insensitive to biases above three for categories of shock exposure – drought and flood. These results are not reported to save space.

crop harvest in surrounding rural areas, events like floods often lead to a breakdown of critical road infrastructure and disrupt the rural-urban food flow. The ultimate reduction in food security coupled with increased food prices often curtail the ability of urban households to access sufficient food. The case for female-headed households is even worse as they often have less access to coping resources and opportunities like land and paid non-farm labour. However, empirical analysis on these dynamics is lacking in the existing literature as most of the available studies focus on rural areas where the shock impact is direct –

through crop loss and crop failure while others aggregate households and ignore the role of gender of headship. This study therefore contributes to the existing literature by analysing the impact of weather shocks on consumption expenditure per adult equivalent among urban households, investigating the gender dynamics of vulnerability to weather shocks, assessing the effectiveness of coping strategies against the shocks and aggregating consumption to assess potential reallocation among sub-components in the face of shocks.

We find that self-reported exposure to weather shocks is associated with a negative and significant impact on household consumption expenditure per adult equivalent. Female-headed households are particularly vulnerable to more severe impacts of these shocks, owing in part to their lack of access to productive resources and opportunities including land, credit and off-farm employment. By disaggregating consumption, we illustrate that households reallocate expenditure from health, education, household semi-durables and contribution towards social, cultural and religious functions to augment food intake when hit by weather shocks. We also find that shock exposure is associated with a higher likelihood of participation in the non-farm sector, borrowing and receiving remittances as coping strategies against weather shocks. However, we intriguingly find that most of the coping strategies employed by shock-affected households do not effectively raise sufficient resources to safeguard the household against consumption decline with the exception of remittance receipt. These findings carry important policy implications: first, they point to the need for support policies to increase household resilience against shocks, partly through livelihood diversification. Secondly, they indicate the need to strengthen critical infrastructure to maintain a steady rural-urban food flow and alleviate any disruptions to the food supply chain during periods of floods as this would ensure sustained food security, help avoid unnecessary food price hikes and sustain food consumption especially among the relatively poor urban households. Finally, the results suggest that livelihood support strategies need to give special treatment to vulnerable households, particularly female-headed households because of their relative vulnerability and lower coping capacity. Policies to increase female education and skills, simplify labour market restrictions, and providing relevant weather forecasts to female farmers would potentially increase the resilience of female-headed households.

Further research will focus on improving some key data limitations encountered in this study. First, the sample size is relatively small and could not allow for detailed analysis of the dynamics of vulnerability of female-headed households. Secondly, in addition to expanding the sample, a panel dataset will be constituted to allow for a comprehensive analysis of urban vulnerability dynamics, particularly for female-headed households. This study relied on retrospective data, presuming that the potential confounding effect of recall bias is neutralised by its randomness among shock-affected and unaffected households. Nonetheless, analysis using panel data in future will be superior to the quasi-panel analysis conducted in this study.

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Notes

1. The World Food Summit of 1996 defined food security as existing ‘when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life’. Available at <http://www.who.int/trade/glossary/story028/en/>
2. Famine is defined as the sudden, sharp reduction in food supply resulting in widespread hunger (Eckholm & Brown, 1977). Other scholars define famine as the sudden collapse in the level of food consumption of large numbers of people (Scrimshaw, 1987) or a set of conditions that occurs when large numbers of people in a region cannot obtain sufficient food, resulting in widespread, acute malnutrition (Cuny & Hill, 1999).
3. An LC1 is the smallest administrative unit in the Uganda’s administrative hierarchy.
4. Household consumption expenditure includes expenditures on food, education, medication, semi-durable items like clothes, shoes and other household effects, contributions made towards social and religious functions and ceremonies.
5. The official exchange rate from The Bank of Uganda around the survey month of February was 2890 average. https://www.bou.or.ug/bou/collateral/interbank_forms/2015/Feb/Major_27Feb15.html
6. <http://hdr.undp.org/sites/default/files/Country-Profiles/UGA.pdf>
7. These are the most commonly cited coping strategies in the literature.

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