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CONTENTS

Chapter 3.

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OFF-FARM EMPLOYMENT RESPONSE TO IDIOSYNCRATIC SHOCKS TO CROP INCOME IN KILOMBERO VALLEY, TANZANIA

ABSTRACT

This paper investigates the mechanism in which off-farm employment offsets the effect of crop income shocks. Using data collected from paddy farming households in Kilombero Valley, Tanzania, we examine the interaction between seasonal farm and off-employment activities and how this interaction enables households to address crop income shock. A set of participatory rural appraisal approaches supported by economic estimation is used. Results from focus group discussions and seasonal calendars show that, availability of some off-farm incomes such as those related to farm wage do not covary with farm income, a feature that is critical for *ex post* shock strategies as it enables households to smooth income during the farming season. Evidence from econometric estimation showed that engagement in non-farm self-employment, which is largely available during the farming off-season, plays an essential risk management role and cushions against crop-based income shocks. These findings imply that insurability of off-farm employment depends not only on the type of off-farm activities, but is also shaped by seasonality. Therefore, given

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the prevailing condition of imperfection in credit and crops insurance market in rural areas, formulation of policies that enhance growth and diversification of income sources out of farming is of utmost importance in addressing crop related susceptibility.

Key words: Off-farm employment, Off-farm income, paddy price, seasonality, Kilombero valley.

1. Introduction

Rural households in Tanzania, like in most other developing countries, are exposed to a broad range of shocks resulting from climate and market related factors. Crop production failure mainly due to unfavourable weather and seasonal crop price variation (as a result of imperfect output markets) are two important variables that contribute to households shocks[1]. These shocks lead to variation in crop income. Nonetheless, formal mechanisms to deal with these shocks are poorly developed. One strategy, for example, would be through credit institution or crop insurance but this is poorly developed. Alternatively, governments may intervene through output price regulation or loan facilitation to reduce household exposure to output market related income shocks[2], though this is not affordable for most poor countries Tanzania included. As a consequence, rural households devise a number of informal strategies to reduce and cope with shocks. Informal strategies that households engage in include *ex ante* self-insurance via savings, mutual insurance system combined with *ex post* dissaving, selling

of assets, reducing consumption or engaging in off-farm employment[3]. When households fail to capitalise on these strategies and are unable to cope with shocks, they can find themselves in what Carter and Barret[4] call poverty traps, a situation in which households find it hard to escape chronic poverty and are pulled into destitution. Apparently, this leads to income poverty.

There is a handful of literature[5] on the role of off-farm employment on poverty and vulnerability in Tanzania. Nonetheless, little has been done on the interaction between off-farm employment/income and income shocks brought by seasonal crop output market fluctuations among rural farming households. A closely related attempt by Dercon[6] that attributed crop income risk and shocks to off-farm activities focused largely on cattle dominated livelihoods, whose shock behaviour response may be different from crop growers. These crop growers are more likely to be affected by the shocks related to the seasonal market price, an idiosyncratic shock type which is the main focus of this paper.

This paper draws a case from paddy farming households in Kilombero Valley to enrich literature on shock management. The

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[1] S. Dercon, J. Hoddinott, T. Woldehanna, *Shocks and Consumption in 15 Ethiopian Villages, 1999–2004*, „Journal of African Economies", 14(2005), no. 4, pp. 559–585; OECD, *Managing Risk in Agriculture: Policy Assessment and Design*, Paris 2011, http://dx.doi.org/10.1787/9789264116146-en.

[2] C. Kwon, P. Orazem, D. Otto, *Off-farmLabor Supply Responses to Permanent and Transitory Farm Income*, „Agricultural Economics", 34(2006), pp. 59–67.

[3] J. Faschamps, A. Quisumbing, *Social roles, Human Capital, and the Intra – households Division of labour: Evidence from Pakistan*, „Oxford Economic Papers", 55(2003), pp. 36–80; S. Dercon, J. Hoddinott, T. Woldehanna, *Shocks and Consumption...*, op. cit.

[4] M.R. Carter and C.B. Barrett, *The Economics of Poverty Traps and Persistent Poverty: An Asset – Based Approach*, „Journal of Development Studies", 42(2006), no. 2, 178–199.

[5] P. Lanjouw, J. Quizon, R. Sparrow, *Non-agricultural earnings in peri-urban areas of Tanzania: evidence from household survey data*, „Food Policy", 26(2001), pp. 385–403; F. Ellis, N. Mdoe, *Livelihoods and Rural Poverty Reduction in Tanzania*, „World Development", 31(2003), no. 8, pp. 1367–1384; I. Katega, P. Lifuliro, *Rural Non-farm Activities and Poverty Alleviation in Tanzania. Research Report 14/7*, Dar es Salaam 2014.

[6] S. Dercon, *Wealth, Risk and Activity Choice: Cattle in Western Tanzania*, „Journal of Development Economics", 55(1998), pp. 1–42.

purpose is first, to identify main sources of crop related shocks and the processes of the intra-annual seasonality of paddy sell price, farm income and income needs and how these are construed with availability of off-farm income. And second, to estimate the effect of off-farm employment on crop income shocks management.

1.2. Theoretical background

Generally, off-farm employment and income fall within a broad range of different income generating activities which are grouped into three broad functional categories. These are: (i) farm wage labour, (ii) non-farm wage employment and (iii) non-farm self-employment. Category one consists of income generated from casual labour on other people's farms or plantations. Category two refers to wage earnings from different employment activities including salaried work whereas category three consists of income generated from self-employment activities, i.e. brick making, brewing and charcoal burning and selling, and other trading activities. This categorization is adopted from Ruben and Van den Berg[7]. In this study, three different forms of off-farm employment and income sources are explored and linked with processes of seasonality in grain (paddy) price/sale fluctuation and resultant shocks.

Other concepts that need some clarity are seasonality and shocks. Seasonality[8] refers to any regular pattern or variation that correlates with season. The patterns of concern in the current analysis are: farm activities, off-farm activities, paddy sale price and household income needs. The central focus is to treat all patterns as a system with seasonal interaction between its elements (patterns). A shock is defined based on Dercon [et al.][9] to mean adverse events that are costly to individuals and households in terms of loss of income, assets or reduction in consumption. Generally, households' response to seasonal fluctuation of output (paddy) market has a consequence and brings adverse income loss and threatens consumption. Price (paddy market) fluctuation is considered to be variability in price offered to farmers for their paddy sales within one year period. Thus, in essence, the shock described is both idiosyncratic as it is specific to individual households and transitory as it results from the seasonal effect of crop income availability. Off-farm income is considered as one of the informal strategies to counteract the effect of such shocks. To analyse the interaction between shock and off-farm employment, the risk management theory is evoked as shocks result from inability to offset risk.

Based on the risk management theoretical insight, it is expected that households may invoke off-farm strategies in an attempt to reduce or cope with price shock, as a result of seasonal price fluctuations. Therefore, under a risky environment, households may engage in off-farm activities as an *ex ante*[10] risk reducing measure strategy[11]

[7] R. Ruben, M. Van den Berg, *Nonfarm employment and Poverty alleviation of Rural farm Households in Honduras*, „Word Development", 29(2001), no. 3, pp. 549–560.

[8] Seasonality can also be interpreted as a shock. For example, Devereux, (1999) considers seasonality as a 'regular' shock because it is predictable. The author differentiates it with unpredictable shocks such as drought and floods which are random shocks. Household responses to address the two are thus different.

[9] S. Dercon, J. Hoddinott, T. Woldehanna, *Shocks and Consumption...*, op. cit.

[10] *Exante* refers to the period before a shock whereas *expost* means the period after a full blown shock

[11] J. Lanjouw, P. Lanjouw, *The Rural Non-farm Sector: Issues and Evidence from Developing Countries*, „Agriculture Economics", 26(2001), no. 4, pp. 1–23; E. Rose, *Ex Ante and Ex Post Labor Supply Response to Risk in a Low-Income Area*, „Journal of Development Economics", 64(2001), no. 2, pp. 371–88; D. Cervantes-Godoy, S. Kimura, J. Antón, *Smallholder Risk Management in Developing Countries*, „OECD Food. Agriculture and Fisheries Papers", no. 61, 2013, http://doi.org/10.1787/5k452k28wljl-en.

or ex post risk coping strategy[12]. For example, as an *ex ante* strategy, households may avoid selling their produce at a low price (the period immediately after harvest) by having off-farm income sources during the low price season and hence less exposed to the potential crop income shock. Similarly, engagement in off-farm employment, such as farm wage employment after full blown shocks entails an *ex post* strategy in response to income loss. The income loss here refers to less profit from the sale conducted during or immediately after the harvest (post-harvest season). This is a legitimate concern in the context of Kilombero Valley since households incur costly production of paddy, but mostly earn little profit from paddy sales[13].

Considering off-farm as a shock coping strategy, Kochar[14] found that farm wage has an important *ex post* shock role among rural farming households in India. The author noted that males increased their time working off-farm for a wage (farm labour) responding to unreliable variations in income from their produced crops. This is particularly relevant when households do not have income during the farming season as they may have less crop stock to sell during this high price season. Hence, seasonal variability of different off-farm employments is expected to respond to seasonal variation in income.

In attempt to describe off-farm employment role, we extend the argument put forth by Ruben and Van de Berg[15] in recognizing the

[12] A. Kochar, *Smoothing Consumption by Smoothing Income: Hours of Work Responses to Idiosyncratic Agricultural Shocks in Rural India*, „Review of Economics and Statistics", 81(1999), pp. 50–61; C. Porter, *Shocks, Consumption and Income Diversification in Rural Ethiopia*, „Journal of Development Studies", 48(2012), no. 9, pp. 1209–1222; R. Dimova, S. Gangopadhyay, K. Michaelowa, A. Weber, *Off-Farm Labor Supply and Correlated Shocks: New Theoretical Insights and Evidence from Malawi*, „Economic Development and Cultural Change", 63(2015), no. 2, pp. 361–391.

[13] F. Kato, *Development of a Major Rice Cultivation area in Kilombero Valley, Tanzania*, „African Study Monography. Supplement", 36(2007), pp. 3–18.

[14] A. Kochar, *Smoothing Consumption by Smoothing Income...*, op. cit.

[15] R. Ruben, M. Van den Berg, *Nonfarm employment and Poverty...*, op. cit.

heterogeneity role of off-farm employment and the apparent need to distinguish different categories of off-farm employment: that is those related to farm (wage) labour employment on one hand and those related to wages outside the agricultural sector and non-farm self-employment activities. Theoretically, this distinction matters as these activities and income may have seasonal variability. Hence, off-farm employment response to a particular kind of shock also depends on its seasonal availability. Consequently, this may result in different implications as far as ex *ante* risk management and *ex post* coping strategies of off-farm employment are concerned. Thus, based on this brief theoretical review, it is hypothesised that off-farm employment has an insurability role by preventing households' exposure to shocks. This role, though, is shaped by the aspect of seasonality.

Although seasonality does not feature in risk management theory, it is highly related to crop income shocks[16]. This being the case, it is assumed that the ability of off-farm employment to provide a buffer against shocks is also determined by the aspect of seasonality. This is largely because of seasonal variation of crop income which is an important feature in the study area. Seasonality is not treated as a shock *per se* but rather as a precursor to shock events.

2. Study area and methodology

2.1. Study area

The study was conducted in the Kilombero Valley which is a swath of fertile lowland spreading across Kilombero and Ulanga Districts in Morogoro Region. Historically, the valley is dominated

[16] S. Devereux, *Making less Last Longer: Informal Safety Nets in Malawi, IDS Discussion Paper 373*, Brighton 1999, http://www.ids.ac.uk/files/dp373.pdf.

by subsistence paddy farming, although maize, sugarcane, bananas and sesame are also produced in small quantities. The 1999–2005 paddy production data show that the valley produces more than 40% of Morogoro Region's rice[17].

Paddy farming households in Kilombero Valley face a number of challenges including unreliable market and low output prices[18], leading to low surplus income from produced crops. This apparently increases vulnerability and susceptibility of paddy farming households' earning and consequently leads to seasonal income shocks. Kilombero provides an interesting case considering further that timing of the study coincided with the 2012/13 cropping season that experienced a considerable fall in rice (major output) price in the study area. This price fall was mostly severe around three post-harvest months[19] (June, July and August). Thus, the need for carrying out this investigation on seasonality of the price and crop income shock was imperative.

2.2. Data collection

Two sets of data were collected. These are quantitative households' level survey data and qualitative data gathered from focus group discussion (FGD) and in-depth interviews. Data collection was carried out between February 2014 and May 2014. Prior to data collection, a preliminary survey was conducted in August

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[17] Agricultural Council of Tanzania (ACT), *Report on Output Market Support. Centre for Sustainable Development Initiative (CSDI)*, 2007, www.tap.or.tz.

[18] F. Kato, *Development of a Major Rice Cultivation area...*, op. cit.; Ministry of Agriculture, Food Security and Cooperative (MAFC), *Tanzania Bread busket Transformation project. Annex A, District profile*, 2011, www.agriculture.go.tz/.../TBBT%20Project_Annex%20A_District.

[19] Because the main harvesting period for paddy in the study area is June, the post-harvest season is considered to be between June and August. The other dominant crop grown by few households is maize which is rarely used as a tradable crop and may have two harvesting season depending on availability of rain.

2013 to gather data on community characteristics via interviews with village and district leaders in Kilombero and Ulanga Districts.

Quantitative data: a structured questionnaire was used in gathering quantitative data. The tool was administered to the heads of the household. The purpose of the survey was to examine types of shocks and attributes that determine crop income shock exposure including off-farm employment engagement. Information was thus gathered on the households' socio-economic profile, types of off-farm employment as well as types of shocks most experienced by the same in the year prior to the survey.

Qualitative data: to have a better understanding of the processes and pattern of shocks, qualitative data were also collected: At community level, focus group discussion was held in each village. Each FGD contained 10 participants. Apart from being a useful source of qualitative data, the FGDs, which preceded the household survey, provided information that assisted refinement of the questionnaire, based on the context and key attributes of the study villages. In addition, a seasonal calendar was also used to gather community level data. The seasonal calendar was useful in identification and categorizing livelihood tasks by season[20]. This method was employed in order to highlight the distribution of different farm and off-farm activities during the year. The same participants for the FGDs took part in describing the seasonal calendar, whereby participants described activities and trends for the 12 months calendar, based largely on specific seasons, rather than months in which they undertook certain activities. In-depth interviews with selected 20 households heads were also employed to compliment community level data gathered though the FGDs.

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[20] *Power, Process and Participation*, eds. R. Slocum, L. Wichhart, D. Rocheleau, B. Thomas-Slayter, London 1995.

2.3. Sampling

Five villages with more dominance of paddy cultivation and which represent the socio-economic diversity of the study area were purposively selected. These villages were Malinyi, Mngeta, Lupilo, Mwaya and Lumemo. Malinyi, Mngeta and Lupilo villages were regarded as remote with poor road accessibility. In these three villages, roads are often damaged to the extent that they are impassable during the rainy season which is mostly associated with flooding in Kilombero. The two villages of Lumemo and Mwaya were regarded as accessible, land constrained and poorly endowed with agriculture resources. The contrasting differences between these villages were expected to have a differential impact on their exposure and response to shocks. In sampling households the target was to have a sampling intensity of 5% for each village. The total sample used was thus 309 which according to Gray[21], is a sufficient sample size for statistical analysis for a population with a low degree of heterogeneity. Kilombero Valley as the study area is considered more homogeneous in terms of households' occupations and other socio-economic characteristics. The focus was on paddy farmers i.e. those who had at least grown paddy in 2012/13 and 2013/14. Generally, available village registers were adopted as the sampling frame.

2.4. Data analysis approach

Qualitative data collected from the FGDs and in-depth interviews were organized in meaningful themes and presented in narratives. The use of narratives is ideal in capturing the lived experience of participants[22]. Since the overall aim was to explain processes that revolve around farm/off-farm seasonality and resultant shocks,

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[21] D. Gray, *Doing research in the real world*, 2nd edition, Los Angeles 2014.
[22] Ibidem.

an approach that captures assessment of temporal sequences of households' livelihoods was useful. We analyzed this temporal aspect using community level data from the seasonal calendar.

Because of the binary nature of the dependent variables a probit model was appropriate to examine the association between off-farm employment and income shock. The dependent variable was constructed based on whether a household made a low price paddy sale or otherwise. It was assumed that selling greater proportions of 2012/13 season crops immediately after harvest indicated potential income loss and shock exposure during the preceding season (2013/14), since the interest was on such transitory and idiosyncratic shock. Thus, households which sold more than 75% of the harvest before the start of the proper 2013/14 farming season (December 2013) were considered as shock affected, and those which did not were unaffected. Therefore, the outcome variable took the value '1' and '0' for shock affected (exposed) and unaffected (not exposed) households respectively.

The probit model specified in the analysis is represented by the following equation:

$$\text{Log}\,[p/(1-p)] = \beta_0 + \beta_1 \times_1 + \beta_2 \times_2 + \beta_3 \times_3 + u_i$$

Where:

Log $[p/(1-p)]$ = Natural logarithm of the odds of probability of being exposed to income shock. For the dependent variable '1' represents shock affected and '0' otherwise (unaffected)

β_0 = constant

β = estimated parameter

X_1 = a vector off-farm employment categories

X_2 = a vector of individual and household characteristics, including ownership of assets

X_3 = a vector for the location of farm households in different study villages

u_i = error term

Explanatory variables: The main explanatory variables are farm wage employment, non-farm self-employment and non-farm wage employment. These variables were measured as dummies. That is '1' if households participate in the relevant employment category and '0' otherwise. It is expected that households engagement in any of these off-farm categories to be associated with less exposure to shock, as income generated from these activities can provide a buffer against potential income loss.

To control for individual characteristics, households' heads education was included. This was a dummy variable for secondary education. The variable was 1 if a household head had secondary education and 0 otherwise. Education has been shown to influence the extent by which households can buffer economic shocks in rural Africa[23], as it enhances income. Similarly, age was specified in the model expecting that a higher age is associated with more farming experience and thus greater ability to control shocks.

Households in at least three villages in the study area usually own larger tracts of land than what they are actually able to cultivate. In addition, such households may make substantial amount by renting out extra farm land to land-constrained farmers. Thus, large land ownership was hypothesized to be associated with less exposure to shocks and two variables, farmland owned (ha) and farmland under cultivation (ha) were adopted. To capture for a household's ability to preserve harvested crop (paddy), a variable for possession of good storage facility was included. Households with crop storage facilities may be less prone to sell their harvest early when prices are low. As done

elsewhere in literature[24], the variable access to credit is specified as this provides a buffer and assists households to smooth consumption. Access to credit reduces the urge for post-harvest low price sale, and hence susceptibility to crop income shocks. A dummy variable, advanced crop sale, was also included. This variable was equal to '1' if the household had borrowed money during the pre-harvest 2012/13 season and '0' otherwise. This loan is usually repaid later with harvested crops of an equivalent value.

Finally, to account for village differentials in infrastructure endowment, a dummy variable of household location in Lumemo or Mwaya was included. Compared to the other three villages, these villages (Lumemo and Mwaya) have access to an all-weather road. This access ensures better functioning markets and profitability in selling harvested crops, leading to reduced exposure to income shocks.

3. Results

3.1. Off-farm employment distributions among households

All households were categorized into different main income generating activities. Percent distribution of these major employment categories is shown in Table 1. The results in Table 1 show that close to three-quarters (71.2%) of households had a household head or a spouse engaged in off-farm employment. This engagement is slightly similar to the 69.5% reported by Katega and Lifuliro[25] in a semi-arid area of rural Tanzania.

[23] Z. Yilma, A. Mebratie, R. Sparrow, D. Abebaw, M. Dekker, G. Alemu, A. Bedi, *Coping with shocks in rural Ethiopia*, „Journal of Development Studies", 50(2014), no. 7, pp. 1009–1024.

[24] A. Islam, P. Maitra, *Health Shocks and Consumption Smoothing in Rural Households: Does Microcredits have a Role to Play?*, „Journal of Development Economics", 97(2012), pp. 232–243.

[25] I. Katega, P. Lifuliro, *Rural Non-farm Activities...*, op. cit.

Table 1. Distribution of the main employment categories (n=309)

Employment Categories	Frequency	Percent
Households without off-farm employment	89	28.8
Households engaging in off-farm employment	220	71.2
Households with non-farm self-employment	128	58.3
Households with farm labour employment	52	23.5
Household with non-farm wage employment	40	18.2

Farm wage which employs 23% of the sampled respondents is dominated by 'piece work' on other people's farms and seasonal farm wages in plantations. Three main plantations were identified in the study area. These are Kilombero sugar plantation which is close to Mwaya, Kilombero Plantation Limited (KPL), which deals with rice cultivation in Mngeta, and Kilombero teak plantation which is a tree plantation located near Lupilo village. All of the farms are owned by multinational companies. On the other hand non-farm wage is dominated by unskilled workers as there were few opportunities for skilled employment except in a few government institutions such as schools. The largest off-farm employment category constituted largely households employed in low investment enterprises which had both low entry barriers and earnings. Due to numerous entry barriers to the well paid employment opportunities. Participation in low paying marginal activities is a salient feature of rural labour force and is observed elsewhere in sub Saharan Africa as noted in Fabusoro [et al.][26] study in rural Nigeria.

3.2. Main causes of shock exposure

Households were asked to mention the main shock events that led to severe income loss which they might have encountered in the previous 12 months. More than three quarters (89.4%) of the households reported to have been affected by one event or another. The proportions of households reporting a particular shock is presented in Table 2. With the liberalized market structure for agricultural products in Tanzania, market price was a cause of great concern to paddy farming households in the Kilombero Valley. This was a concern to about a third (34%) of the households. A similar concern has been reported elsewhere in Africa. For example, Salimona and Falusi[27] reported households in rural Nigeria affected by market failure and price fluctuation to be 54% and 46.6% respectively. A plausible explanation for this high percent of market related shock reported in the study area is that, during the year (2013/14) in which household survey for this study was conducted the price of paddy had greatly plummeted. The price for a100 kg bag of paddy during cropping season was 70 000 Tshs in 2011/12 whereas in 2013/2014 the price was 40 000 Tshs. To explain the cause for this, respondents from the five FGDs complained that there was too much of imported rice in the market that led to the decline in their output's value. To emphasise on this, one participant in FGD claimed:

> "...last season was the year of loss for all paddy farmers, the price was predominantly low even during months in which we normally get a good price. That is why some people in the village have not been able to grow paddy this season as they had little money obtained from paddy sales from last season. Hence lack of money for this year's farm preparation" (A male FGD participant aged 37 in Mwaya, 2 April 2014).

The most critical concern is how paddy price varies over seasons, which is explained in sub-sections 3.4 and 3.5. Since price

[26] E. Fabusoro, A. Omotayo, S. Apantaku, P. Okuneye, *Forms and determinants of rural livelihoods diversification in Ogun State, Nigeria*, „Journal of Sustainable Agriculture", 34(2010), no. 4, pp. 417–438.

[27] K.K. Salimonu, A.O. Falusi, *Sources of Risk and Management Strategies among Food Crop Farmers in Osun State, Nigeria*, „African Journal of Food Agriculture and Development", 9(2009), no. 7, pp. 1591–1605.

related shock is one of the main adverse events that may have considerable implication to households' income, in the above mentioned subsections, further empirical analysis dwells on this particular shock type.

On the other hand, crop destruction due to infestation by pests and infection by diseases was a significant shock reported by more than a quarter (28%) (see Table 2) of the households as their main shock event during the 2012/13 season. This is consistent with the findings by Salimona and Falusi[28] who reported pest and diseases to be among major risks related to shocks in rural Nigeria. Relatively few households, less than a fifth (17.5%), reported to be affected by weather related shock events i.e. drought and floods.

Table 2. Events that cause crop shocks among households (n=279)

Shock type	Frequency	Percent
Crop failure due to pests,	80	28.6
Crop failure due to flood	49	17.5
Illness/death of household member	31	11.1
Low price for paddy	96	34.4
Others (i.e. crop theft, land conflicts)	24	8.6

The last category 'other' includes idiosyncratic shocks related to crime or conflict with other farmers or agro-pastoralists. This category also includes some households whose shock of concern was weighing determination unit of their produce by the buyers. From the field observations, it was revealed that some buyers used a 30 kg size tin instead of the conventional 20 kg size tin to weigh paddy. Generally, farmers are on the receiving end and have less power to control this measurement as they are in a desperate need for cash after harvest.

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[28] Ibidem.

3.3. Socio-economic characteristics of households and shock exposure

Socio-economic characteristics determine the likelihood of being a victim of income shock resulting from selling harvested crop products at a low price. Table 3 shows statistics of the socio-economic characteristics differentiated by whether households are affected or not affected by the crop income shock. Few variables including those which show significant differences are of interest and deserve attention. One of these significant variables is total household income. For those households unaffected by shock, their total household income is higher than affected households. The difference between the two was significant (p=0.05) as shown in Table 3. This is probably because they were able to fetch a good price for their crops, which potentially enhanced their total income.

Table 3. Summary statistics of selected socio-economic characteristics

Variable name	All Households (n=309)	unaffected (n=198)	Shock affected (n=111)	t-test statistics
	Mean (S.D)	Mean (S.D)	Mean (S.D)	
Working adult (persons)	2.7 (1.6)	2.7 (1.9)	2.6 (1.4)	1.19
Landholding under ownership	1.5 (1.4)	1.6 (1.6)	1.4 (1.1)	1.38
Land holding under cultivation	1.0 (1.1)	1.1 (1.0)	1.1 (1.3)	–0.53
Education (years of schooling of the head of household head)	6.7 (3.0)	6.9 (3.1)	6.4 (2.8)	1.68*
Total household income (Tshs)	1 137 046 (1 439 017)	1 376 427 (2 275 815)	882 709.6 (985 072)	2.17**
Farm income (Tshs)	425 220.2 (608 238)	532 346 (592 301.4)	333 314.7 (624 173)	0.86
Other crop cultivated	52.1	39	65.1	NA
Head with secondary education	22.5	29.3	15.2	NA
Storage facility	24.1	24.2	24.3	NA
Access to credit (%)	30.5	35.8	25.2	NA
Advanced crop sale (%)	21.9	25.2	18.6	NA

Note: a) ** and * denote statistical significance at 5 and 10 percent level respectively; the null hypothesis is that the means for unaffected households are equal to those of affected households b) Incomes and landholding are calculated per adult equivalent. c) 'NA' indicates that the variables were not suitable for t-test statistics. * n = 220

The other variable which differentiates between the two groups is education level of the households head. Shock affected households' heads were relatively poorer educated than unaffected ones. This suggests an inverse relationship between education and exposure to shocks which are further tested in section 3.6. on crop diversification. Table 3 also shows that shock affected households were comparably more diverse in terms of other crops grown than the unaffected households. About 65% of the affected households reported growing other crops such as maize, banana, and cassava in addition to paddy and only 39% of unaffected households did the same.

With regards to a few selected assets, households on average owned 1.51ha of farmland and cultivated 1.04 ha. The cultivated land is about three-quarters of the farmland owned. It seems households are not able to invest on the whole land (farm) they own, and this may predispose them to shock as cultivating small areas could also lead to low crop income. On the other hand, shock affected households were more predisposed to advance crop sale. These households borrow money using yet to be harvested crops as collateral. This behaviour, which is practised by more than a fifth (21.3%) of the sampled households in Kilombero valley, is usually damaging as the lender usually buys paddy at a relatively low price as the terms do not favour the desperate households who need cash during the cash shortage pre-harvest season.

3.4. Shocks, seasonality and off-farm employment

This section draws on the data from the focus group discussions (FGDs), in-depth interviews and seasonal calendar to show the seasonality in the price of the paddy (the main food and cash crop), households' cash needs and off-season employment. Whereas, Table 4 provides the annual distribution of different households' activities and related consumption and income needs, Fig. 1 used

price data[29] which were validated by rice traders in Malinyi and Lumemo villages to discern the specific variation of paddy price across seasons.

With respect to off-farm employment, Table 4 shows two marked trends among off-farm activities: whereas activities related to non-farm wage employment are less seasonal compared to farm wage and non-farm self-employment, and are evenly distributed across the year, farm wage was nonetheless mostly seasonal as it goes parallel with the farming season. It is further shown that non-farm self-employment which encompasses business activities flourish more during the post-harvest season between June and November/December. This is because most households obtain cash from selling harvested paddy which could be used as a start-up capital.

Farming is dominated largely by a single season of paddy production. Farming activities can loosely be spread into two seasons: these are the farm season proper which is between December and June, and the off-farm season between August and October. As shown in Table 4 the main activities during the farming season are planting (January), weeding (February and March) and harvesting (May-June). Farm preparations during December and January are usually done by tractors or animal traction, and thus less human labour requirements.

The second column in Table 4 shows a marked variability of paddy price across seasons. These data are complemented with more quantitative results in Fig. 1. Generally, combining Table 4 and Fig.1 one sees that the paddy price was highest during the farming season, specifically from March to May and lowest during post-harvest season as expected. This finding is consistent with results

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[29] Visiting the study area during post-harvest season (August 2013) and pre-harvest season (February – April 2014) enabled the researcher to further validate the price trend of paddy in different seasons.

of another study conducted in the Kilombero Valley by Musamba [et al.][30] in which the price of paddy during April and May was found to be three times higher than the price in July – August.

**Table 4.** Intra-annual seasonality of different livelihood aspects

Month	Paddy sale price	Cash needs	Farm activities	Availability of off-farm employment
December – January	High:	High: farm input needs i.e. tilling school fees	Planting season	Some non-farm self-employment dominates
February – April	Highest, but most households face shortage of supply	Moderate: farm input needs for herbicides, labour	Weeding season, but largely February and March	Period of most farm casual waged activities, i.e. those related to weeding
May – June	Lowest, start of harvesting season, sales often at farm gate price	High: it is a festival season i.e. marriage, Second term school fees: capital for business start up	Harvesting season	Period for most farm casual wage activities in paddy harvesting, i.e. cutting, transportation
July – September	Low, plenty of supply	Low: few festivals around this time with little cash demanding farm tasks	Post-harvest, virtually no farm activities	Vibrant non farm self-employment activities, i.e. petty trade
October – November	Higher compared to June, July and August	Low: a few households start farm preparation	Households may start farm preparation	Some non farm self employment dominates

Overall, prices of paddy in 2013/14 season were lowest relative to the preceding four years prior to the survey as noted during the FGDs conducted in all the villages. For example, the average price during post-harvest months July and August was 80 000 TShs in 2011/12 where as for the same period in the 2013/14 season the average price was 40 000 TShs as reported in Mngeta and Malinyi

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[30] E. Musamba, Y. Ngaga, E. Boon, A. Richard, R. Giliba, A. Sirima, L. Chirenje, *The Economics of Water in Paddy and Non-paddy Crop Production around the Kilombero valley Ramsar site, Tanzania: Productivity, Costs, Returns and Implication to Poverty Reduction*, „Journal of Agricultural Science", 2(2011), no. 1, pp. 17–27.

villages. More attention is paid to this trend as it has implications on households shock exposure.

Figure 1: Seasonal (intra-annual) variation of paddy price in 2013/2014
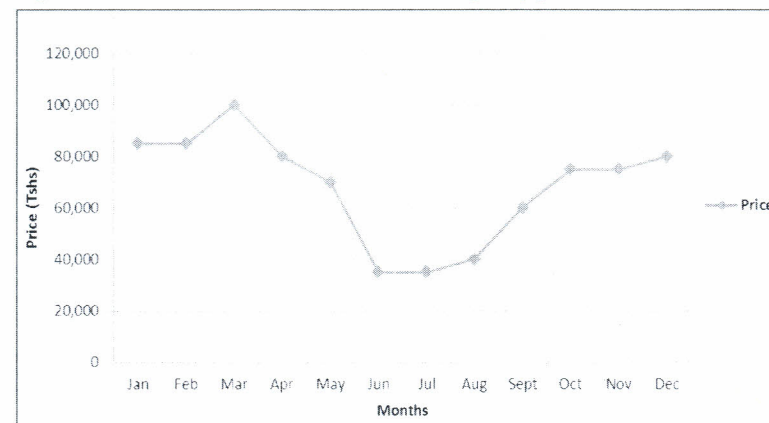
Notes: Price in the Y-axis is in Tanzanian shillings per one bag of paddy. Paddy in the study area is stored and measured in a 100–120kg bag of unhusked rice.

The other seasonal trend depicted in Table 4 is that of households cash needs which is high during December and January. This is the start of the proper[31] agricultural season in which cash to hire tractors for farm preparation is critically needed. Similarly, prior to paddy harvest (June – July), there is a high demand for cash for paying school fees, and some post-harvest festival activities and ceremonies e.g. wedding. Thus, most households begin to sell paddy[32] in large

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[31] The typical paddy farming season may start as early as September when a few well-off households may start tilling theirfields. But in most cases the majority of farmers would start farm preparation around December, the time during which even the cost of hiring a tractor for tilling is relatively higher compared to earlier months.

[32] Paddy sale price nonetheless varies across villages depending on village location in relation to the main urban centre (Ifakara town). However, during

quantities around June in order to satisfy their cash needs around this time. Survey data show that by January 2014 more than three-quarters of households had already sold about three-quarters of their paddy stock. Generally, sales made shortly after harvest are usually regarded as distress sales because of the low sell price as shown in Fig. 1. One interviewee in an in-depth interview in Lupilo village complained that; 'one bag of paddy was sold at a price that would not even enable one to hire a tractor for 1 hectare farm preparation during the start of the next farming season'.

The results on seasonality presented in Table 4 and Figure 1 are relevant in the discussion of households' exposure to transitory income shocks. Seasonality patterns shape and determine the *ex ante* and *ex post* strategies responses that households adopt. These responses are presented in the subsequent sections.

3.5. Off-farm employment responses to households shocks

So far the pertinent question is how different forms of off-farm employment and income thereof play a role in reducing income shock. To address this question, narratives from the FGDs and in-depth interviews are used. The FGD conducted in Mngeta was particularly relevant to explain cases of farm wage as a considerable number of households were engaged in farm wage employment in this village. This is because of the presence of a rice plantation (KPL) close to the village that provided seasonal waged labour employment. This type of off-farm employment is an important part of livelihood strategies as far as income shock

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harvesting season (June and April) the cost for a bag of paddywas between 30 000 – 40 000 Tanzanian shillings. The peak price was recorded in February 2014 in which the price ranged between 50 000 – 70 000 Tshs. These average estimates of the price were confirmed by key informants. The value of 1 USD was equivalent to 1,635 Tanzania shillings during months of the survey period. Tanzania shillings (Tsh) is the currency unit for Tanzania.

is concerned. One participant elaborated this scenario in the FGD held in Mngeta as:

> "A lot of people engage in casual labour at KPL during masika[33] not because the wages are high, but rather as a result of shortage of food due to selling a large proportion of their harvest during the post-harvest season. Thus, the little wage they get supports their basic consumption till the next harvesting season..."

Generally, households with farm wage employment have to divide most of the intense period of farming season (February – March) switching between their own farm work and plantation. This has an implication on food production as they have less time for own farm labour as pointed out by one participant in the quotation below:

> "...For some of us, paddy fields are located far from the village, so we always have low harvest because we do not have time to attend our farms. We need to do weeding in our farms and at the same time we have to work in the plantation".

Discussions with a key informant, a sub-village (hamlet) leader, in Mngeta revealed that the daily wage of 3 800 Tshs (2.3US$) from the plantation work during the income shortage season was barely enough for basic necessities. This daily wage was not even sufficient to hire labour to work in their paddy farms to replace the labour used in plantation work.

Off-farm employment may as well be a preventive mechanism against shocks. In this sense non-farm self-employment income enables households to reduce exposure to risk as income gained from these activities can prevent shortfall during a season of short-age. This was pointed out in another FGD held in Malinyi in which a male participant said:

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[33] *Masika isakiswahili* word *that* literally meansa long rainy season. The term is also used as a metaphor to imply time of acute income shortage associated with farming season in which there are few income generating opportunities.

"Having other off-farm income gaining activities is important in this village because you cannot rely on selling paddy. The price is very low now (August 2013) compared to the cost we incurred in farming. In this village off-farm income helps people to have alternative sources of income which enables them not to sell their paddy immediately after the harvest until February and March when its price is high. The harvest also needs to satisfy your food needs till the next season, as people in this village depend on paddy for food and cash..."

The key result in this sub-section is that poor households which are motivated by seasonal income shortfall rely on supplying off-farm labour during paddy farming season. This, thus, partially corroborates Samal and Pandey[34] claim made among rice farming community in India that marginal farmers rely on rice wages whereas big farmers cope with shortfalls of consumption by engaging in non-farm self-employment activities. In addition, the result is also consistent with an Indonesian study on income shock[35].

3.6. The role of off-farm employment on households' income shocks exposure

While discussion in section 3.4 described the processes under which households cope with income shock, depending on their off-farm income endowments, it did not provide the quantitative estimate on the extent to which having off-farm employment determines a household's exposure to shocks. As described earlier, exposure to shock is proxied by a household's decision to sell their

output during the low price season. Results of probit estimates are presented in Table 6. The overall model is significant ($P \leq 0.01$), suggesting that the variables specified are jointly significant in explaining households exposure to shocks.

Table 5. The Role of off-farm employment on reducing exposure to shocks-Probit model results

	Coefficient	Standard Error	Z	P>|z|
Household head's Education	–0.371	0.196	–1.89	0.059*
Household head's age	–0.010	0.005	–1.95	0.052*
Access to credit	–0.264	0.167	–1.58	0.114
Other crops cultivated	–0.502	0.163	–3.07	0.002**
Advanced crop sale	0.346	0.188	1.84	0.066*
Farm holding owned	–0.047	0.022	–2.13	0.033**
Farm holding cultivated	0.050	0.027	1.85	0.064
No. of working adult	–0.049	0.052	–0.94	0.345
Farm wage	–0.318	0.229	–1.39	0.165
Non–farm self–employment	–0.482	0.193	–2.50	0.012**
Non–farm wage	–0.296	0.253	–1.17	0.243
Households in Mwaya/Lumemo	–0.332	0.160	–2.07	0.038**
Storage facility	0.123	0.191	0.65	0.518
LRchi(13)	37.04			
Prob>chi2	0.0004			

Note: * = Significant at 10% (p=0.1); ** = Significant at 5% (p=0.05)

On our explanatory variables of interest, only non-farm self-employment income was negative and significant ($p \leq 0.05$). This implies that engagement in non-farm self-employment was associated with an increased probability of selling their crop during the peak price season. Thus, households with this status are more likely to make profit and avoid exposure to income shocks during the next paddy planting season (other things remaining constant).

[34] P. Samal, S. Pandey, *Climatic Risks, Rice Production Losses and RiskCoping Strategies: A Case Study of a Rain-fed Village in Coastal Orissa*, „Agricultural Economics Research Review", 18(2005), pp. 61–72.

[35] G. Berloffa, F. Modena, *Income Shocks, Coping Strategies, and Consumption Smoothing: An Application to Indonesian Data*, „Journal of Asian Economics", 24(2013), pp. 158–171.

Such households are likely to be able to manage price seasonality shock and their consumption needs. This result is consistent with Kijima [et al.][36] who found out that households in Uganda responded to agricultural shocks by expanding self-employment business thereby increasing their household income. A study conducted by Porter[37] in Ethiopia showed similar results.

Possession of secondary education by household head was negative and significantly ($P \leq 0.059$) associated with exposure to shocks, suggesting that household heads without secondary education compared to those with that level of education are more likely to fetch good price during high price season and avoid being affected by income shocks. Education increases awareness and skills in different production decisions including those related to the selling of farm produce. Similarly, an inverse relationship was found between farm area owned and the probability of being exposed to shock, with farm size holding being significant ($P \leq 0.05$) as shown in Table 5. This implies that those with large farms are unlikely to sell their crop at low prices and thus, avoid income loss. The plausible reason for this is that ability to cultivate large farms may be associated with more income as households may rent extra land and earn income, which can buffer against potential shock.

The results in Table 5 further show that advanced crop sale was positive and significantly ($P \leq 0.1$) associated with the likelihood of being exposed to shocks. This means that households, which accepted cash in advance for the unharvested paddy, were more likely to fall victim of income shortfalls. This was particularly common for poor households, in which households borrow money during the farming season and repay that money with harvested paddy on

[36] Y. Kijima, T. Matsumoto, T. Yamanoa, *Nonfarm Employment, Agricultural Shocks, and Poverty Dynamics: Evidence from Rural Uganda*, „Agricultural Economics supplement", 35(2006), pp. 459–467.

[37] C. Porter, *Shocks, Consumption and Income Diversification…*, op. cit.

terms set by the borrowers. The last variable which significantly determines exposure to income shock is village location. This variable was negative and significant ($P \leq 0.05$), indicating that residing in Mwaya or Lumemo was associated with decreasing the likelihood of being exposed to income shock. This may plausibly be associated with vibrant off-farm businesses that may provide enough income that satisfies household needs during the period of low price season.

4. Discussion

The findings have revealed a high rate of engagement in off-farm employment. The higher rate of engagement may be attributed to the study area having a high agricultural potential. It has been reported by Loening [et al.][38] and Mathenge [et al.][39] that off-farm activities prosper in favourable agro-climatic regions. This is plausibly explained as results of production linkages between farm and off-farm employment; that is output of one set of activities (i.e. farm) can be invested in another set (off-farm). More engagement in off-farm employment insures households against different types of shocks.

Shocks identified can be categorized into two broad types which are covariates shocks and idiosyncratic shocks. Notably, floods and draught are covariates shocks as they affect large groups of the population. These kinds of shock are though not the main focus of the analysis on this study. The majority of households had more

[38] J. Loening, B. Rijkers, M. Söderbom, *Nonfarm Microenterprise Performance and the Investment Climate: Evidence from Rural Ethiopia*, Policy Research Working Paper 4577. The World Bank Africa Region, Agriculture and Rural Development Unit & Development Research Group, 2008, www.microfinancegateway.org/library/rural-non-farm-sector-characteristics-importance-policies.

[39] M. Mathenge, M. Smale, D. Tchirley, *Off-farm employment and Input Intensification among Small holder Maize Farmers in Kenya*, „Journal of Agricultural Economics", 66(2015), no. 2, pp. 519–530.

concern with income loss resulting from low price for their paddy which caused income shortfalls during the farming season. Selling paddy at a low price by itself may strictly not be a shock. However, income shortage resulting from the low price and which occurs during the farming season in the study area could be treated as a shock. In such a case these types of shock that are seasonal and affecting certain segments of the population can be regarded as transitory and idiosyncratic. This seasonal nature of the shocks has a different implication on the insurance role of off-farm employment.

Our findings have shown that most of off-farm employment activities are largely seasonal. Their availability is closely related to seasonal variation of farm activities. For example, activities related to non-farm self-employment including those related to trading were dominant during the off-farm season. This may be due to two reasons. First, during the post-harvest season most households have enough cash obtained by selling the harvested paddy, and thus their purchasing power for off-farm goods and services is high. Second, most of those who engage in petty trade get their capital by selling paddy around the harvesting time (June-August). This is a typical farm-off-farm backward linkages as described by Haggblade [et al.][40] in which earnings from farm activities are invested in off-farm business ventures. When asked on the source of their capital, 76% of those who were engaged in non-farm self-employment mentioned income from their own paddy sales as their main source, implying production farm/non-farm linkages.

With respect to the role of off-farm employment in reducing or buffering against exposure to shocks, we suggest two important propositions. First, seasonal variation in availability of farm income and off-farm employment matters. Households with some forms of non-farm self-employment income during the post-harvest or off-farm season are strategically able to avoid selling their paddy immediately after the harvesting season. By doing so, they compromise their farm income. Generally, the highest net gain (profit) is obtained by selling at the start of the farming season or pre-harvest season (when the price is high). In this case they covary their main (two) income sources in an attempt to reduce *ex ante* their exposure to income and consumption shortfall. Further empirical evidence from estimation results (Table 5) shows that it is engagement in non-farm self-employment that reduces households' exposure to shocks, whereas farm wage and non-farm wage are statistically less relevant as *ex ante* mechanisms.

Second, farm wage employment income is inherently meant to vary with farm income, and this variation has a different implication to that of non-farm self-employment income. Because of the risky environment, households are by necessity compelled to engage in farm wage during the start of the farming season. This makes sense considering that the start of farming season corresponds to the time of most difficulty to meet household needs. Thus, different from non-farm self-income, the evidence from Kilombero Valley confirms that farm wage income is essentially an *ex post* coping strategy as it serves to smooth contemporaneous consumption and income during the farming and pre-harvest seasons. One should observe that this farm wage role may not be a unique case applicable to Kilombero Valley only; farm wage labour supply and demand have been responding well to destitution and/or transitory negative shocks in rural Malawi[41] and in rural India[42] as well.

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[40] S. Haggblade, P. Hazell, T. Reardon, *Introduction*, in: *Transforming the Rural Nonfarm Economy: Opportunities and Threats in the Developing World*, eds. S. Haggblade, P. Hazell and T. Reardon, Baltimore 2007, pp. 3–25.

[41] R. Dimova, S. Gangopadhyay, K. Michaelowa, A. Weber, *Off-Farm Labor Supply and Correlated Shocks...*, op. cit.

[42] A. Kochar, *Smoothing Consumption by Smoothing Income...*, op. cit.

At this point our findings and the resultant discussion adds to the theoretical perspective of risk management posited earlier by Cervantes-Godoy [et al.][43] and Kwon [et al.][44], whereby it is argued that the *ex post/ex ante* role of off-farm employment is structured and intricately featured within seasonality of these activities, their incomes and type of households shock events. This being the case, analysis of risk management role of off-farm employment must not only disaggregate off-farm employment activities but also their linkage with farm activities construed within the aspect of seasonality.

The distinction between *ex ante* and *ex post* shock reducing management roles is also relevant for policy interventions. For example, for farm wage and a few non-farm self-employment activities conducted during farming season, the goal is to smooth income *ex post*. In this case, activities to be encouraged should be low return and low risk, whereas for non-farm self-employment during the post-harvest season creation of employment should focus on high return activities as the goal is to mitigate farming seasonal income shock (*ex ante* measure). Thus, it is imperative to consider seasonal availability of different off-farm employment so as to accurately examine the robustness of off-farm income/employment as a coping or a risk management strategy.

5. Conclusions and recommendations

This paper has investigated the role of off-farm employment and income in responding to households' income shocks and how these responses are shaped by seasonality. Two main conclusions can be drawn. First, some off-farm activities and income sources have a seasonal variability which largely counters the farm season. Similarly, harvested crop (paddy) market price which affects crop income in Kilombero valley has a seasonal variation, and this seasonality is translated into shocks during the farming season for households that cannot take advantage of the price variations. Second, households employ different off-farm strategies in an attempt to counteract or manage the effect of income shock during the peak of farming (cultivating) season. For example, farm wage income enables households to cope with this shock by smoothing their income and consumptions. However, engagement in farm wage at the peak of the cultivating season compromises farm productivity for households with shortage of labour supply. Consequently, this leads to more vulnerability during the harvesting period which traps households into a cycle of income risk, uncertainties and shocks.

On the other hand, income from non-farm self-employment activities during the post-harvest season enables households to manage risks and prevent exposure to shocks during the farming season. The mechanism by which these risks and shocks are managed is through taking advantage and profitably exploiting crop price seasonal variability. Similarly, econometric evidence has confirmed that controlling for the set of individual, locational and household characteristics, off-farm employment increases the probability of selling paddy at a high price during the peak price season. This significantly reduces exposure to transitory income shocks.

From a risk management point of view, one broad insight can be made based on the specific scenario of Kilombero Valley; off-farm employment/income as a risk strategy does not only respond to the seasonal onset of shocks but is also shaped by these shock

[43] D. Cervantes-Godoy, S. Kimura, J. Antón, *Smallholder Risk Management...*, op. cit.

[44] C. Kwon, P. Orazem, D. Otto, *Off-farm Labor Supply Responses to Permanent and Transitory Farm Income...*, op. cit.

events. This seasonality indeed determines its *ex post* and *ex ante* role when it comes to households that highly depend on cultivation of one seasonal crop (paddy) that they largely depend on for their income as is the case in the study area.

In terms of the policy relevance of our findings, first and foremost, it is hard to prevent intra-annual seasonal change in price of agricultural commodities such as paddy, which is the main cause of income shock at least in the study area. Generally, to some extent the market price is determined by structural forces related to global food prices. However, the state institutions such as local district councils (local government authorities) can play a role of facilitating growth of entrepreneurial off-farm activities, particularly during the off-farm season. Income from such activities may not only enable households to offset the adverse effects of the seasonal variations of consumption but could also enhance households' ability to manage and cope with the seasonal income shortfalls. This might in turn have a positive implication on reduction of income poverty. It is thus recommended that more opportunities for off-farm employment should be made available in rural areas such as Kilombero Valley.

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