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Akira Murata and Suguru Miyazaki

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JICA Research Institute
10-5 Ichigaya Honmura-cho
Shinjuku-ku
Tokyo 162-8433 JAPAN
TEL: +81-3-3269-3374
FAX: +81-3-3269-2054

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Akira Murata* and Suguru Miyazaki†

Abstract

This study investigated the factors affecting the choice of coping strategies by rural Filipino farm households in the face of both covariate (or systemic) and idiosyncratic shocks. The study, conducted by the Japan International Cooperation Agency Research Institute (JICA-RI) in 2010, surveyed farm households in villages from three provinces in the Philippines. Using a multivariate probit model, the effects of shock attributes (i.e. coverage, intensity, and frequency), as well as both household and village characteristics were analyzed. The study found that in general, rural farm households rely mainly on the strategy of dissaving/selling assets regardless of shock attributes. However, in the face of idiosyncratic shocks, there is a greater probability that these households would count on borrowing/transfer as a coping option, while in the case of more frequent covariate shocks, they are more likely to reallocate labor. The findings from this study suggest the importance of the following factors in mitigating vulnerability and enhancing resilience: helping the farmers diversify sources of income and redistributing land ownership, improving agricultural infrastructure, and developing social insurance and social networks. For that purpose, there is a need for continuous agrarian reform including support for improvements in the agricultural infrastructure as well as for the further development of social protection.

Keywords: Risk, vulnerability, coping strategies, covariate and idiosyncratic shocks, Philippines

* Corresponding author, Research Fellow, JICA Research Institute (Murata.Akira@jica.go.jp)
† Japan International Cooperation Agency

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1. Introduction

Risk and its connection to poverty are crucial to an understanding of poverty reduction among households in developing countries. Household welfare is determined not only by income and assets, but also by its level of vulnerability to negative shocks over time. Past studies have defined "household vulnerability"[1] as the ability of a household to protect its consumption from income fluctuations caused by various shocks, both idiosyncratic and/or covariate (or systemic) (see Townsend 1994; Udry 1995; Glewwe and Hall 1998; Jalan and Ravallion 1998; Dercon and Krishman 2000; Morduch 2003). These shocks influence one or more livelihood source at a time and generate large variations in household income over time (Dercon 2002; Fafchamps and Lund 2003).

An increase in vulnerability tends to push households into even poorer situations and thus tends to perpetuate poverty in a cyclical fashion (Jalan and Ravallion 2000). Households in developing countries are more exposed and vulnerable to a variety of shocks[2] due to a lack of ex-ante risk management instruments such as a robust and developed infrastructure system which can contribute to disaster prevention, and the inadequacy of ex-post risk coping mechanisms such as the access to credit, social safety net supports, and insurance (Alderman and Paxson 1992; Akter 2012; Cole et al. 2012).

Farm households cope with the multiple sources of risk before or after the occurrence of a negative event by using a variety of risk management strategies. These strategies can be mainly grouped into three categories: (1) prevention strategies which reduce the probability of the occurrence of income risks (e.g. education and training), (2) mitigation strategies which decrease the potential impact of income risks (e.g. portfolio diversification, insurance, and

1. The category "household vulnerability" has three components: (1) exogenous characteristics of the risks a household faces (e.g. distribution of rainfall); (2) the extent to which a household engages in ex-ante risk management; and (3) the extent to which a household can engage in ex-post risk coping (Di Gregorio et al. 2012).
2. Shocks are categorized by their types such as natural, health-related, social, economic, political, and environmental shocks (see World Bank 2000: 136).

family arrangements of marriage), and (3) coping strategies which relieve the impact of the risks once they occur (e.g. dissaving, borrowing, reliance on public or private transfers, enhancing labor supply, and migration) (Holzmann and Jørgensen 2001). Prevention and mitigation strategies focus on income smoothing, while coping strategies focus on consumption smoothing (OECD 2009). Amongst these risk management strategies, this paper focuses on ex-post risk coping strategies, which are classified into the third category mentioned above. In this study we will examine factors which influence a choice of coping strategies by taking into account shock attributes (i.e. coverage, intensity, and frequency) as well as both household and village characteristics.

There are a considerable number of studies which have analyzed coping strategies amongst rural farm households in developing societies (see Jha et al. 2012; Jha, Nagarajan, and Pradhan 2012 on rural India; Helgeson et al. 2012 on rural Uganda; Miura et al. 2012 on rural Zambia; Porter 2012 on rural Ethiopia; Wainwright and Newman 2011 on rural Vietnam). However, little attention has been paid to the effects of agricultural infrastructure on the choice of coping strategies, despite its importance for the livelihood of farm household. In order to fill in this gap in knowledge, this paper will analyze the survey data (including the information on agricultural infrastructure) taken at rural farm households in the Philippines, a Southeast Asian country frequently and heavily hit by natural disasters, especially typhoons (see Israel and Briones 2012; GOP 2009).

The following sections of this paper are structured as follows. Section 2 briefly describes the farm household survey used for the paper. Section 3 summarizes risks faced by the farm households in the surveyed areas and their risk coping strategies. Our methodology and estimation results will be discussed in Section 4 and Section 5, respectively. The paper analyzes the choice of the strategies by using a multivariate probit model. This model was chosen because the households apply multiple coping strategies to weather the shocks. The last section will summarize our findings and provide some policy implications.

2. Data

The data used in this study came from the Filipino farm household survey conducted by the Japan International Cooperation Agency Research Institute (JICA-RI) in 2010. The survey areas cover three provinces in the Philippines: La Union in the Ilocos Region, Iloilo in the Western Visayas Region, and Compostela Valley in the Davao Region of Mindanao. Some of the villages located in these three provinces have benefited from the JICA-funded Agrarian Reform Infrastructure Support Project (ARISP), through which physical and economic infrastructure facilities such as irrigation, post-harvest facilities, and farm-to-market roads and bridges have been constructed.[3]

This survey is composed of three kinds of questionnaires: (a) The *Household Questionnaire,* (b) The *Agriculture Questionnaire,* and (c) The *Key Informant Questionnaire*. The questionnaires cover a wide variety of survey modules such as income, expenditures, employment, education, health, remittances, assets, and negative shocks that households have experienced.

The procedure of the survey sampling is as follows. First, using an existing list of households belonging to each barangay,[4] the survey team prepared a list of all household heads. Second, using the above household head list, all households in the barangay were classified into five categories[5] in terms of the size of their landholding. Third, for proportional sampling, the

3. In the Philippines, the aim of agrarian reform is not land distribution alone. In order to complement the practice of distributing land to landless farmers, the Philippine government has recognized the need for the following support services: (1) developing agrarian reform communities (ARCs); (2) building physical and economic infrastructure facilities such as irrigation systems, post-harvest facilities, and farm-to-market roads and bridges; (3) putting up credit facilities to finance various agricultural and livelihoods projects in the ARCs; (4) disseminating information about agrarian reform to the public; (5) networking with and linking to peoples' organizations, NGOs, and other concerned sectors; (6) mobilizing foreign resources for the complex process of support service delivery, including the construction of infrastructure facilities, institutional building, and cooperative development (for more details, see Reyes 2002).

4. A barangay is the smallest administrative division in the Philippines.

5. Five categories are as follows: Category A is landless households involved in agricultural activity; Category B is households with a landholding below two ha; Category C is households with landholdings between two and five ha; Category D is households with landholdings of five or more ha; and Category E is landless household not involved in any agriculture activity.

appropriate sample sizes of each subpopulation for this study were estimated based on the total number of households in each classification from the second procedure. Finally, sample households to be visited were randomly selected to meet the statistically required numbers, which were computed based on the third procedure. Sample households are nearly equally distributed in the three target provinces.[6]

3. Nature of the shocks and shock management strategies

Shocks against the incomes of farm households can be categorized according to their coverage, intensity/frequency, and sequence (Morduch 1999). This paper first mentions their coverage and groups the shocks into two types: covariate (or systemic) and idiosyncratic.

Covariate shocks are those affecting many communities or regions, or even the whole country. They are typically caused by natural disasters such as floods, typhoon and droughts as well as other external shocks like epidemics, inflation, or financial crisis (Holzmann and Jørgensen 1999; World Bank 2000; Azam and Imai 2012; Kuriakose et al. 2012; Jha et al. 2012; Jha, Nagarajan, and Pradhan 2012). These disasters can potentially cause high income volatility for farm households. The *Key Informant Questionnaire* of the said farm household survey asked the households to list all the disasters that had occurred within the barangay during the period of 2002-2010. Table 1 shows the shares of various kinds of disasters reported at the barangay level. Typhoons and floods are the major causes of covariate shocks revealed in the study. The former frequently occurred in La Union and Iloilo provinces, whereas the frequency of flooding was greater in the Compostela Valley province.

6. The actual number of samples entered into the datasets is 1,069. In three target provinces, there were at least 320 sample households. These households were chosen so that the survey included more than 100 households for each agrarian community category (i.e. ARC with ARISP, ARC without ARISP, and non-ARC).

Table 1. Share of covariate shocks (%), 2002-2010

Types of shock	Total	La Union	Iloilo	Compostela Valley
Flood	22.1	9.6	17.4	61.5
Landslide	5.7	1.4	8.7	15.4
Drought	6.6	5.5	17.4	0
Fire	6.6	0	17.4	15.4
Typhoon	45.9	64.4	39.1	0
Total number of disasters reported at barangay level	122	73	23	26

Source: 2010 JICA-RI farm household survey

Idiosyncratic shocks are household-specific shocks such as crop failure, [7] illness/injury/death of a family member, or the unemployment and underemployment of a bread winner. These shocks are fairly common in developing countries where difficult living conditions limit the access to medical care and safe drinking water, and consequently result in poor hygiene. Additionally, there are limited opportunities for diversifying income sources, and a lack of formal insurance and social safety nets (Holzmann and Jørgensen 1999; World Bank 2000; Azam and Imai 2012; Kuriakose et al. 2012; Jha et al. 2012; Jha, Nagarajan, and Pradhan 2012). With regard to idiosyncratic shocks, the *Household Questionnaire* asked each farm household to list all the negative shocks they had experienced since 2002. Our survey revealed that illness/injury/death of a family member is a primary cause of idiosyncratic shocks for households in all areas surveyed. Crop failure is the second major cause of negative shocks they faced (see Table 2).

7. Crop failure may be the result of both an idiosyncratic and a covariate shock. Here, using the *Household Questionnaire* explained above, we found that individual farm households even within the same province differently experienced crop failure because of different vulnerabilities, for example location vulnerability. Crop failures experienced by individual households were categorized as idiosyncratic shocks. On the other hand, shocks that might cause crop failures (e.g. drought, flood, and typhoon), influencing the entire community, were regarded as covariate, as indicated in the *Key Informant Questionnaire*, shown in the previous section.

Table 2. Share of idiosyncratic shocks (%), 2002-2010

Types of shock	Total	La Union	Iloilo	Compostela Valley
Crop failure	33.3	38.4	32.6	17.0
Job loss	2.5	3.7	0	1.1
Theft (cash, crops, property)	2.1	1.7	3.5	2.3
Destruction of property or agricultural assets	8.3	13.1	0	0
Illness/injury/death of a family member	53.7	43.1	64.0	79.5
Total number of negative shocks reported at the household level	471	297	86	88

Source: 2010 JICA-RI farm household survey

Besides the coverage of the shocks, this paper also deals with their intensity and frequency. Some farm households experience more frequent and normal risks such as bad weather, which in turn affects agricultural production and causes fluctuations in input prices or output demand. Other households experience risks with less frequency but with higher intensity as in the case of natural disasters, war, conflict, climate-change, infectious diseases, or economic and political crises.[8]

Facing negative shocks, households take ex-post risk coping actions to smooth consumption over time as well as within or across households (Alderman and Paxson 1992). Consumption smoothing over time can be achieved mainly through dissaving, borrowing, or selling of assets, while consumption smoothing within or across the households is achieved through risk sharing, such as income transfers from relatives or neighbors, or labor reallocation within a household. These household risk coping strategies can be sorted into three categories: household/community-based, market-based, and public sector-based (see Table 3).

8. According to time-series data on the frequency of disasters, the average occurrence of natural and technological disasters has been increasing, while economic crisis and war have occurred in more stable, settled patterns (Sawada 2011). As for the sequence of the shocks, different types of shocks might come one after another. For example, a disaster may be followed by sickness, injury, and/or the death of a family member. Highly correlated frequencies of different types of shocks will make it more difficult for households to cope with them, due to the inevitably more severe economic situations they will face and their limited or complete lack of effective coping strategies.

Table 3. Major forms of coping strategies in agricultural risk management[9]

Household/community-based	**Market-based**	**Public sector-based**
-Dissaving -Selling real assets -Mutual aid (borrowing/transfer from neighbors, relatives and friends) -Labor reallocation	-Selling financial assets -Credit (borrowing from banks and other financial institutions)	-Disaster relief -Social assistance (calamity relief, food-for-work, etc.) -Subsidies -Agricultural support programs -Rescheduling loans

Source: Constructed by authors based on Holzmann and Jørgensen 1999, 2001; Holzmann 2003; Singla and Sagar 2012.

Table 4 demonstrates how these three kinds of strategies are distributed among the farm households surveyed by the JICA-RI. Overall, the most frequently adopted strategy was dissaving/selling assets followed by the borrowing/transfer strategy. Within the former strategy, households can sell either real or financial assets, which means that their strategies can be either household/community-based or market-based. Similarly, they can borrow either from neighbors/relatives/friends (i.e. household/community-based) or from financial institutions (i.e. market-based). What is conspicuous is the lack of public sector-based strategies, which implies that the assistance from the public sector is not regarded as a major coping measure by farm households in the three provinces.

9. Several previous studies included reduced consumption as a household coping strategy in the face of shocks. In this study, however, coping strategies are meant to avoid consumption fluctuations. A decrease in consumption is a consequence of the shock and therefore not considered as a coping mechanism per se.

Table 4. Coping strategies amongst rural Filipino farm households, by location

Forms of coping strategies	Location			Total
	La Union	Iloilo	Compostela Valley	
Dissaving/Selling Assets	145	25	35	205
	(39.4)	(30.1)	(36.8)	(37.5)
Borrowing/Transfer	66	19	49	134
	(17.9)	(22.9)	(51.6)	(24.5)
Labor Reallocation	61	11	5	77
	(16.6)	(13.3)	(5.3)	(14.1)
Not Coping	96	28	6	130
	(26.1)	(33.7)	(6.3)	(23.8)
Total	368	83	95	546
	(100)	(100)	(100)	(100)

Source: 2010 JICA-RI farm household survey
Note: Figures in the parentheses indicate the percentage of households out of the total.

The survey found that the strategies employed amongst the farm households differed from one province to another. In La Union and Iloilo, dissaving/selling assets seems to be the major coping strategy, while more than half of the affected households in Compostela Valley relied on borrowing/transfer. However, the selection of coping strategies is influenced not only by the locations where a negative shock occurs but also by the nature of the shock and by the characteristics of each household. In the sections below, we will analyze household decisions on coping strategies, taking into account the effects of both household and location characteristics, as well as attributes of the shocks that the farm households experience.

4. Methodology

As mentioned earlier, the multivariate probit model is used in this analysis to examine households' responses to various types of the shocks. The model allows us to understand what determines household choices of more than one coping strategy in the face of negative shocks. The model can be given as follows:

$$Y_{iM}{}^{*} = \beta'_{M} X_{iM} + \varepsilon_{M} \quad (Y = 1 \text{ if } Y^{*}_{iM} > 0, \text{ and } 0 \text{ otherwise}) \tag{1}$$

where $Y_{iM}{}^{*}$ indicates a coping strategy M taken by a household i. We assume that the latent decision variable for a coping strategy would be a function of household characteristics X and an error term ε. X_i is a vector of all the variables corresponding to the household i including the intercept term. β is a vector of the unknown parameter we estimate. The error term ε has a multivariate normal distribution, each with a zero mean and variance-covariance matrix involving values of one on the principal diagonal and correlations $p_{mn} = p_{nm}$ as off-diagonal elements as follows (see Green 2007; Cappellari and Jenkins 2003):

$$\varepsilon_{M} = \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_M \end{pmatrix} \sim N_M \begin{bmatrix} 0 & 1 & p_{12} & \cdots & p_{1M} \\ 0 & p_{21} & 1 & \cdots & p_{2M} \\ 0, & \vdots & \vdots & \ddots & \vdots \\ 0 & p_{M1} & p_{M2} & \cdots & 1 \end{bmatrix} \tag{2}$$

Since a household's decision on coping strategies relies not only on household characteristics, but also on the nature of risks the affected household faces and on location characteristics, a vector of shock variables and a vector of village characteristics are also included as explanatory variables. We classify household coping strategies into three categories (i.e. M=3): (i) dissaving/selling assets, (ii) borrowing/transfer, and (iii) reallocating labor.[10] In order to examine coping strategies of rural Filipino households facing either covariate or idiosyncratic shocks, or both, we use the empirical model which can be expressed as follows:

$$coping_{iM} = \alpha_{iM} + \beta_{1M} \cdot cov\_shock_{jM} + \beta_{2M} \cdot idio\_shock_{iM} + \beta_{3M} \cdot HH_{iM} + \beta_{4M} \cdot village_{jM} + \varepsilon_{M} \tag{3}$$

where cov_shock_j indicates the frequency and intensity of covariate shocks (i.e. drought, floods, epidemic or typhoons) affecting a household living in a village j, while $idio\_shock_i$ shows the frequency and intensity of idiosyncratic shocks (i.e. illness/injury/death of household members

10. As mentioned in the footnote for Table 3, in this study reduced consumption is not considered to be a household coping mechanism per se. The fact that some households did reduce their consumption suggests that they were not fully protected against the detrimental effects of the shocks they experienced. Thus, this modality was excluded in the multivariate probit estimation model.

or crop failure) which a household i has experienced. HH_i is a vector of the household characteristics for the i th household, and $village_j$ is a vector of the location characteristics of the j th village. The α and β are unknown parameters we estimate.

The average intensity of covariate shocks was measured by the share of affected people out of the total village population. This measurement is at the village level. The intensity of idiosyncratic shocks was captured as the average total loss of each household, which includes the total decrease in household income, total expenses, and the value of lost items.

In this study, in order to control the effects of household characteristics on decisions regarding coping strategies, we added the following variables in terms of household characteristics: household head characteristics (age, gender, marital status, education level), sources of income (livestock income share, non-agricultural income share, income from government support programs, migrant share), size of land ownership, social vulnerability of household (such as share of dependent family members, participation in community activities, and insurance coverage).

To account for village characteristics, the model examined the physical/technical vulnerability and credit access of a village. The former includes variables that indicate a lack of irrigation and/or warehouses, the poor quality of farm-to-market roads, and the distance between the two. The latter indicates the access to financial intermediation institutions such as informal money lending, microfinance, and cooperatives located within the village. Despite its importance, there has been little discussion about the effect of agricultural infrastructure on the choice of household coping strategies in past studies. Our household survey data provide all of the information related to the household characteristics, as well as the village characteristics, including agriculture infrastructure within the village.

The definition of the variables used in the analysis and the summary statistics are shown in Table 5. In examining household coping strategies, the model only uses rural farm households affected by either covariate shocks or idiosyncratic shocks. The other households were excluded from the analysis.[11]

11. 210 sample farm households out of the original 1,069 are used for the analysis.

Table 5. Variable definition and summary statistics used for the analysis

	Description	Mean	Std. Dev.	Min	Max	Obs.
Household coping strategy						
dissaving/selling asset	=1 if a household used its own saving or assets for risk coping purpose; =0 otherwise	0.348	0.477	0	1	210
borrowing/transfer	=1 if a household borrowed money, received remittances, or asked for support from relatives, friends, or religious groups for risk coping purpose; =0 otherwise	0.257	0.438	0	1	210
labor reallocation	=1 if any family member engaged in the labor market or worked more for risk coping purpose; =0 otherwise	0.148	0.356	0	1	210
Shock Variables						
Shock Frequency						
covariate shock frequency	number of covariate shocks a household experienced (e.g. drougth, floods, epidemic, or typhoons)	1.657	1.546	0	4	210
idiosyncratic shock frequency	number of idiosyncratic shocks a household experienced (e.g. illness/ injury/ death of household members or crop failure)	1.129	0.551	0	1	210
Shock Intensity						
covariate shock intensity	average share of total affected village population per covariate shock	0.222	0.364	0	1	174
idiosyncratic shock intensity	logarithm of average total loss caused by idiosyncratic shocks	9.345	2.801	0	14	210
Household Characteristics						
Household Head						
head age	age of household head (years)	50.63	12.92	22	84	209
head female	=1 if a household is headed by female; =0 if male	0.096	0.295	0	1	209
head married	=1 if a head is married; =0 otherwise	0.900	0.301	0	1	209
head education	education of household head (years)	8.268	3.509	0	16	209
Income Diversification						
livestock/poultry income share	share of livestock/poultry income share out of total agricultural employment (%)	0.152	0.283	0	1	209
non-agricultural income share	non agricultural income share of total household income (%)	0.305	0.372	0	1	209
income from government support programs	logartithm of income from government support programs (e.g. social pension (SSS), Government Service Insurance Systems (GSIS), Pag-Ibig, 4Ps (Patawid Pamilyang Pilipino Program, Kalahi-CIDSS)	0.544	2.077	0	10.5	210
migrant share	share of migrants out of total family members (%)	0.056	0.124	0	0.67	210
Land Ownership						
land ownership	logarithm of size of land ownership (ha)	0.490	0.633	0	3.09	201
Social Vulnerability						
dependent family share	share of family members aged 0-14 years old and those aged 65 and over	0.325	0.227	0	1	210
community activity ratio	ratio of family members participating in community activities out of total family members	0.311	0.342	0	2	210
insurance coverage	=1 if covered by any insurance policy; =0 if not covered	0.386	0.488	0	1	210
Village Characteristics						
Physical/ Technical Vunlerability						
irrigation	=1 if village has irrigation; =0 if no irrigation	0.271	0.446	0	1	181
warehouse	=1 if village has warehouse; =0 if no warehouse	0.219	0.415	0	1	210
farm-to-market road surface	=1 if village has no paved farm-to-market road; =0 if paved	0.329	0.471	0	1	210
farm-to-market road distance	logarithm of distance from village to capital market (km)	3.644	0.821	1.25	4.69	181
Access to credit within the village						
microfinance	number of microfinance institutions within the village	0.696	1.131	0	5	181
cooperative	number of cooperatives within the village	0.514	0.904	0	8	181
informal money lender	number of informal money lenders within the village	2.210	2.658	0	20	181

Note: The variable community activity ratio can exceed one because the total of the number of community groups joined by family members can be greater than a family size.

5. Determinants of farm household's risk coping strategies

Table 6 provides the results obtained from a multivariate probit estimation. In addition to the coverage, frequency, and intensity of shocks which rural Filipino farm households experienced, household and village characteristics are taken into account in the examination of the extent to which selected explanatory variables influence the decision of the rural Filipino households on their coping strategies: dissaving/selling assets, borrowing/transfer, and reallocation of labor. Our estimation results indicate that household characteristics affect the choice of all three strategies, while shock variables and village characteristics are related only to the selection of the borrowing/transfer and labor reallocation strategies. Shock variables and village characteristics must not be correlated with the dissaving/selling assets strategy because, as shown in Table 4, dissaving/selling assets is the major coping strategy amongst rural Filipino households. Whatever shocks they face and wherever they live, they mostly use their own savings and/or assets to overcome a crisis.

5.1 Nature of shocks and coping strategies

The coverage, intensity, and frequency of a shock event is only partially associated with the nature of coping strategies that farm households choose. For instance, our estimation results show that households are more likely to rely on reallocation of labor when they face frequent covariate shocks. Our interpretation is that, in the case of frequent broad-scale disasters, agriculture cannot be a stable income source and consequently that these households shift the labor allocation of their family members. On the other hand, as the average intensity of the covariate shocks gets greater, the households are less likely to reallocate their labor as a coping option. This is probably because severe damages to a broad area extending beyond the boundary of a village or a region might devastate the employment opportunities within the whole area. In such a case, it would be difficult for family members to find appropriate jobs. Furthermore, in the face of covariate shocks, the affected households seem not to rely on borrowing from their

Table 6. Multivariate probit coefficient estimates

	Dissaving/ Selling Assets	Borrowing/ Transfer	Labor Reallocation
Shock Variables			
Shock Frequency			
covariate shock frequency (number)	0.1374	-0.0805	0.3718***
	(0.1203)	(0.1493)	(0.1305)
idiosyncratic shock frequency (number)	0.0746	0.1483	0.1311
	(0.1804)	(0.1888)	(0.2346)
Shock Intensity			
covariate shock intensity (average per shock)	0.2614	-0.0977	-1.2189**
	(0.5234)	(0.5010)	(0.5647)
idiosyncratic shock intensity (average per shock)	0.0269	0.1565**	0.0211
	(0.0482)	(0.0694)	(0.0616)
Household Characteristics			
Household Head			
head age	-0.0091	0.1311**	0.1428
	(0.0619)	(0.0665)	(0.1162)
head age squared	0.0001	-0.0017**	-0.0011
	(0.0006)	(0.0007)	(0.0012)
head female (=1 if female;=0 if male)	-0.7910*	-0.0171	1.5677**
	(0.4095)	(0.3438)	(0.6107)
head married (=1 if married;=0 if otherwise)	0.2064	-1.3666***	1.9276**
	(0.4774)	(0.4111)	(0.9621)
head education (years)	0.0464	-0.0450	0.0213
	(0.0314)	(0.0315)	(0.0435)
Income Diversification			
livestock/poultry income share (%)	1.1108**	0.9072*	-0.7440
	(0.4394)	(0.4811)	(0.4935)
non-agricultural income share (%)	-0.0432	-0.2927	0.3060
	(0.3554)	(0.4019)	(0.4452)
income from government support programs (peso in log)	0.0448	-0.0138	0.0812
	(0.0424)	(0.0580)	(0.0683)
migrant share (%)	0.3585	0.6798	-2.6207*
	(0.8405)	(0.7609)	(1.5804)
Land Ownership			
land ownership (ha in log)	0.3383**	-0.1718	0.0654
	(0.1708)	(0.2082)	(0.3172)
Social Vulnerability			
dependent family share (%)	-0.0549	-0.8087	0.0319
	(0.3339)	(0.5182)	(0.5771)
community activity ratio	-0.5226**	0.0693	0.1620
	(0.2585)	(0.2618)	(0.4832)
insurance coverage (=1 if covered;=0 if not covered)	0.5685**	0.0295	-0.0213
	(0.2776)	(0.2061)	(0.2927)
Village Characteristics			
Physical/ Technical Vunlerability			
irrigation (=1 if with irrigation;=0 if no irrigation)	-0.2431	0.3515	-0.7588**
	(0.3525)	(0.4243)	(0.3714)
warehouse (=1 if with warehouse;=0 if no warehouse)	-0.3362	-0.6884*	0.0961
	(0.4479)	(0.3690)	(0.5521)
farm-to-market road surface (=1 if not paved;=0 if paved)	0.3456	0.0443	-0.7546
	(0.2738)	(0.3160)	(0.4707)
farm-to-market road distance (km in log)	-0.0418	-0.5073**	-0.0419
	(0.1462)	(0.1992)	(0.2536)
Access to credit within the village			
microfinance (number)	-0.1864	0.0944	0.1342**
	(0.1248)	(0.0710)	(0.0617)
cooperative (number)	0.2429	-0.0449	-0.2341
	(0.1683)	(0.1637)	(0.1835)
informal money lender (number)	-0.0484	-0.0454	-0.1299
	(0.0368)	(0.0392)	(0.0821)
constant	-1.0651	-0.6617	-7.9353**
	(2.3007)	(2.2565)	(3.3318)
Number of observation		168	

Notes: (a) Almost all insured farm households purchased health/life insurance, while few had crop insurance. (b) * p<0.10, ** p<0.05, *** p<0.01 (c) Likelihood ratio test of rho21=rho31=rho32=0: chi2(3)=38.0517: prob > chi2=0.0000

neighbors and relatives as the other residents within the village are also likely to be victims of the shocks.[12]

As the frequency and intensity of idiosyncratic shocks increase, affected houses are slightly more likely to opt for labor reallocation, although the result is not statistically significant. Rather, rural Filipino households tend to rely on external sources of financing when they face an intense idiosyncratic shock. This result is statistically significant and consistent with the findings by Jha, Nagarajan, and Pradhan (2012) in rural India.

5.2 Household characteristics and coping strategies

Amongst the various household characteristics, characteristics of the household head and the share of income from livestock/poultry production affect the selection of coping strategies the most. It was found that female-headed households are less likely to select the dissaving/selling assets strategy, and are instead more likely to cope with the negative shocks by taking additional jobs. This result may be explained by the point made by the World Bank, FAO, and IFAD (2009), which argues that female-headed households are asset-poor and consequently need to reallocate their labor to survive. This suggests that increasing the number of women-headed households around the world would elevate the importance of improving women's employment opportunities as a means for reducing poverty. According to World Development Indicators, the percentage share of households with a female head increased from 14 percent in 1993 to 18.7 percent in 2006 in the Philippines. This indicates the expanding role of women in generating household income. For example, Torres (1994) argues that the earnings of a female head from informal sector activities greatly contribute to sustaining poor Filipino families under severe economic conditions.

12. Jha, Nagarajan, and Pradhan (2012) also show that in the face of covariate shocks, rural farm households in India are less likely to rely on transfer as a coping strategy because covariate shock affects not only the immediate households but also the other residents within the village.

Additionally, when the household head is married, he/she tends to rely less on borrowing/transfer but more on making family members take outside jobs. If the household already engages in livestock or poultry production, it responds to any shock not by reallocating family labor but by dissaving/selling assets or by borrowing/transfer. Table 6 also indicates statistically significant correlations between the nature of the coping strategies and several additional household characteristics such as the share of the family members who work as migrant labor outside, land ownership, participation in community activities, and insurance coverage.

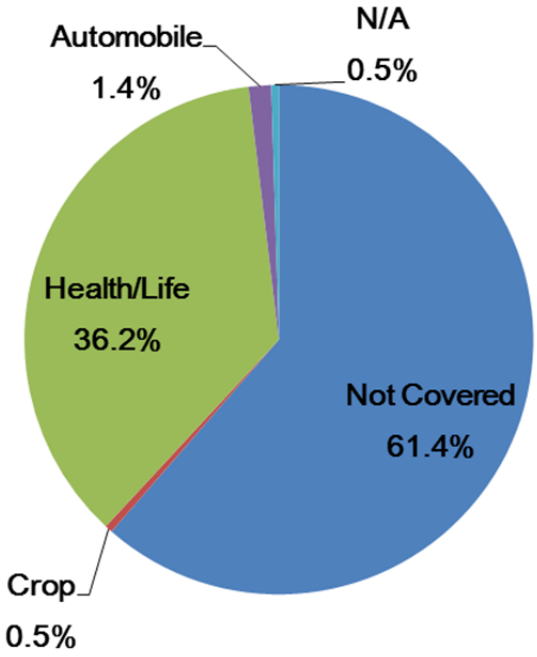
When a family has already sent out their members as migrant workers, it is less likely to further employ labor reallocation as a strategy. On the other hand, the share of migrants in a family positively influences the choice of borrowing/transfer but, against our expectations, this result is statistically insignificant. In fact, only a few respondents chose overseas remittances as a significant coping strategy. Based on the focus group discussions conducted in the surveyed villages, we learned that migrants sent by rural Filipino farm households are struggling for their own life, and cannot immediately assist the affected farm households.

A farm household which owns a larger parcel of land chooses the dissaving/selling assets strategy, probably because they can afford to do so. However, the estimation results show that families with stronger community participation, which expectedly offers informal social assistance to the families, rely less on this strategy.

Contrary to our expectation, however, the coverage by formal social insurance does not reduce the reliance on the dissaving/selling assets strategy. One possible reason for this is the insufficiency of insurance coverage. The findings from our study revealed that most of the households affected by the negative shocks were not covered by any insurance policies. Even amongst those covered, there was little use of crop insurance (Figure 1), which could be due to the scarcity, expense, and mistrust of crop insurance. According to the farm and household survey conducted among corn farmers in Isabela province located in the Cagayan Valley Region

in Luzon,[13] crop insurance was unavailable in these farming communities. All smallholder corn farmers were up to their necks in debt as local usurers and loan sharks have been profiting from them through high-interest loans (see Reyes et al. 2009). Insufficient financial support from the government for subsidizing the cost of insurance could make insurance coverage unattractive, and could eventually lead to the downfall of the agricultural insurance program in the Philippines (see Reyes and Domingo 2009). During the focus group discussions we conducted in the surveyed villages, several farmers also expressed a sense of mistrust of crop insurance because of insurance claims that went unpaid despite the evidence of the damage by typhoons.

Figure 1. Insurance coverage amongst the affected farm households



Source: 2010 JICA-RI farm household survey
Note: In the survey, 210 sample farm households were affected by negative shocks.

13. The survey called "Bridging the Gap Between Seasonal Climate Forecasts and Decision Makers in Agriculture" was funded by the Australian Centre for International Agricultural Research (ACIAR), and jointly implemented in the Philippines by the Philippine Institute for Development Studies (PIDS), Philippine Atmospheric and Geophysical and Astronomical Services Administration (PAGASA), and Leyte State University (LSU).

5.3 Village characteristics and coping strategies[14]

Village characteristics are correlated with the adoption of the borrowing/transfer and labor reallocation strategies. When agricultural infrastructure is inadequate, farm households cannot rely only on agriculture earnings in the face of negative shocks. Our estimation results reveal that in order to cope with disastrous events, households located in villages without irrigation or warehouses have a significantly higher probability of using the coping strategies of labor reallocation and borrowing/transfer, respectively. These results can be explained by the fact that without irrigation, the farm households depend on rain-fed farming and have no choice but to work outside the home after natural disasters. Without a warehouse, households must sell all agricultural crops to middleperson and are left without stocks to sell. Therefore, in the face of negative shocks, they need to work outside or borrow.

On the other hand, households located in villages with better road access to the market are more likely to choose the borrowing/transfer strategy, probably because they have a greater chance of obtaining credits from financial institutions. However, when households have better access to microfinance institutions within their own villages, they choose labor reallocation rather than other coping strategies. A possible explanation for this might be that some microfinance institutions such as credit unions/cooperatives and non-governmental organizations in the countryside have attempted to introduce mutual assistance programs such as informal micro-insurance schemes, and consequently the affected do not need to rely on the borrowing/transfer or dissaving/selling assets strategies. Under these programs, members are required to contribute a fixed amount on a regular basis to a common fund, which will serve as an informal social security system to assist them in times of contingencies such as death, sickness, accident, disability, and natural calamity (see Gonzalez and Manasan 2002; Llanto et al. 2007). Also, there are support programs through cooperatives/NGOs to cover the costs of

14. For this section, we would like to extend our special thanks to Yukihiro Kawahara, Team Leader of DAR-ARISP, who suggested possible explanations for the effects of agricultural infrastructure on coping strategies, as well as to Yojiro Sekiguchi, Operations Management Expert of ARISP-CPMO, for his suggestions for understanding the relationships between microfinance institutions and coping strategies.

important households' social events such as weddings, graduations, and birthdays, among others, which relieve them from having to sell assets, borrow informally, refinance loans, or even default. Another possible explanation is that rural farm households financed by microfinance institutions have already established their own business and are more likely to choose labor reallocation to cover the cost of negative shocks.

Further research is required to examine how and to what extent the development of agricultural infrastructure and the access to credit would affect farm households' coping decisions.

6. Conclusion

This study attempted to examine factors influencing the choice of coping strategies by rural Filipino farm households in the face of both covariate (or systemic) and idiosyncratic shocks. It has used the multivariate probit model and analyzed the survey data collected by the Japan International Cooperation Agency Research Institute (JICA-RI) in 2010.

Although the nature of the shocks (i.e. coverage, frequency, intensity) is somewhat correlated to the nature of the coping strategies chosen by the Filipino households in the survey areas, the main variables which affect the adoption of the strategies are the characteristics of each household. Regardless of the types and the frequency of negative shocks they experienced, the rural farm households most frequently rely on dissaving or selling of their assets. However, when the household head is female, the probability of choosing this strategy is significantly lower, likely because there are insufficient savings or assets. Instead, the female-headed household is more likely to reallocate family labor to cope with the negative shocks. However, households which own larger tracts of lands or earn incomes from livestock/poultry production can use the dissaving/selling assets strategy, though reliance on dissaving and asset disposal becomes lower when they can rely on cooperation in the community.

Against our expectations, the performance of migrant labor by family members does not help the rural farm households facing a sudden crisis. Their tendency to rely on borrowing/transfer (from family members working outside) does not increase significantly while their reliance on further labor reallocation is limited.

On the other hand, the availability of rural infrastructures such as irrigation, warehouses, and paved roads is associated with the adoption of the borrowing/transfer or labor reallocation strategies, but not with a choice of dissaving/selling assets as a coping option. Without irrigation, households are more likely to reallocate labor to work outside, while a lack of warehouses leaves them without a stock of cultivated crops to sell and therefore forces them to borrow money. However, the relationship between the nature of infrastructures and coping strategies is still not clear and necessitates further exploration.

The results of this study indicate several courses of future action which are expected to mitigate the vulnerability of rural farm households and to enhance their resilience against negative shocks. First, agrarian reform matters because it redistributes land ownership and contributes to diversifying income sources of rural households, by potentially increasing their incomes. Consequently, it improves the probability that rural farm households hedge against risks by dissaving and/or selling their assets. Second, improving agricultural infrastructure helps farm households reduce their vulnerability and makes them more resilient to natural disasters. Third, promoting cooperation at the community level is important in the Philippines for reducing the necessity of dissaving and selling family assets in the face of a sudden crisis.

Taken together, these findings indicate the importance of the agrarian reform accompanied by supports for the improvement of agricultural infrastructure. They also indicate the need for the development of community-level social protection which mitigates the vulnerability of rural farm households and enhances their resilience.

Several caveats need to be noted here. First, regarding the small size of our sample, caution is necessary, as the multivariate probit estimation is a large-sample method. Following

Cappellari and Jenkins (2003), this research used a relatively large sample for the sake of replications, which increased the accuracy of estimation results but at the cost of a lengthening run time. Second, as this research used a small sample of the rural farm households affected by either covariate shocks or idiosyncratic shocks, it needed to stick to these aggregated shock variables. When a greater sample size becomes available in the future, it will be possible to estimate results by taking into consideration each disaggregated shock. Third, more definitive evidence can be provided if the existing farm household datasets are expanded into panel datasets in the future.

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Abstract (in Japanese)

要約

発展途上国の農民が災害・病気などの様々なショックに直面した際の対処行動（coping strategy）は、どの様な要因で決定されるのか。本研究は、JICA 研究所が 2010 年に実施したフィリピン 3 州（ラウニオン州、イロイロ州、コンポステラ・バレー州）での農村家計調査を元に、その決定要因を実証的に分析したものである。調査地域のフィリピン農村家計では、貯蓄の切り崩しや資産の売却による対応が優先的に行われていた。他方で、洪水・台風などの広範に被害をもたらすショックを受けた際には、就労時間を増やすことで対処し、世帯主の病気など個別の家計に発生した被害に対しては、借金や親戚など他の家計からの支援によって対処する場合が多いことが明らかになった。さらに、農家の収入源の多様化、土地の再分配、農業インフラの改善、社会保障ネットワークの強化などが、フィリピン農村家計のリスク耐性を高める効果があると確認された。これらから、政策面では被害を受けた家計への政府による救済プログラムの充実と併せて、農業インフラの改善を含む農地改革の更なる推進の必要性を示唆する結果となった。