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VULNERABILITY TO POVERTY IN MALAYSIA: WHAT LONGITUDINAL DATA CAN TELL US?

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ABSTRACT

In developing countries, many household are exposed to high risk, uncertainties and crises, which not only causes of poverty, but also a path to micro-economic downturn. Studies have shown that households who have the fewest instruments to deal with these risks are considered poor. In some cases, they are seen as the most vulnerable. In Malaysia, both poverty and a wide variety of risks are widespread among household member, especially in the rural areas. The present research aims to examine rural households' vulnerability to poverty using longitudinal data set of three waves. The present study developed and designed (an alternative to panel data) modules in cross-sectional surveys with recall questions that can be used to tract a households' history and its evolution along various welfare dimensions. The study aims, in general, to analyse the link between exposure to risks and vulnerability to poverty of rural households in Kelantan and Terengganu. Data was collected from a three-round panel survey undertaken at 6 month interval to allow measurement of seasonal variation in behaviour and outcome and to balance both cross-sectional and time series requirements of panel data. 460 respondents were interviewed in the first round, but only 301 questionnaires in the last round were valid for data analysis. The findings illustrated that fighting future poverty is not only to incorporate monetary measure but also non -monetary measure need to be merged. The lack of access to assets and resources and the exposure to threats have made the process of recovering from poverty unsuccessful. Assets are regarded as the core element of vulnerability reduction. Both covariate and idiosyncratic risks are central causes behind a household future vulnerability. The effect of these threats is determined by its nature and level of severity, as well as by the type of strategies to respond to the threats.

Key words: *Vulnerability, Poverty, Longitudinal data, Malaysia.*

INTRODUCTION

Many households suffered high risks, uncertainties and crises that have led to poverty and micro-economic downturn across the developing countries. Studies have shown households that have the fewest risk coping and managing instrument are considered poor. At times, they are seen as the most vulnerable group, because risks (such as market risks, environmental risks, political risks, social risks, and health risks) make them more fearful; discourage them from engaging in more income generating activities, while undermining their economic performance.

Studies argue that it is unsatisfactory to measure people's welfare based only on their income, consumption or expenditures at the expense of threats and risks that limited productive abilities of many (Jha *et al.*, 2010). As people vulnerability enhances under-development, so also it significantly drives them to chronic poverty. Majority of the rural population live in areas that are prone to various types of risks and threats, which have continually caused substantial losses to their welfare. This is due to damages to their assets, increased coping cost and weak process of wealth creation, when the threats occur.

Rural people are poor, because they are prone to high level of risks and uncertainties, while they are unable to cope with and manage risks due to the absence of well-developed financial institutions and social security (Morduch, 1994). Lack of adequate formal mechanisms, such as credit, market and insurance limit the ability of rural dwellers to invest in risk-coping technologies that are associated to satisfactory outcomes (Baez, 2006).

Poverty, including numerous risks spread across households, especially in the rural areas. These households apply diverse tools and strategies to overcome threats and uncertainties as well as to manage the onset and consequences of risks in Malaysia. Household responses depend on their accessibilities to various types of assets, such as land, irrigation, employment, markets, other risk-coping mechanisms, including informal financial transactions, migration and reducing expenditure. Studies have shown that farming activities are seriously being affected by changes in climate in Malaysia (Alam *et al.,* 2011a; Alam *et al.,* 2011b; Alam *et al.,* 2012a). Farmers are exposed to various risks that in turn affect their productivity and livelihood in Malaysia. Excessive rains, floods and droughts are parts of the calamities resulted to reduction in yield in rubber; oil palm and cacao plantations (Al-Amin *et al.,*Ghani, 2011).

Begum *et al.* (2011) reveal that there are excessive rain fall and temperature increase in Terengganu, Kelantan, Perlis, Kedah and Perak, where many become vulnerable to climate change that result in hardcore poverty. The figures indicate that the most vulnerable to climate change are the poor and hardcore poor with large households. Alam et al. (2012a) expressed that climate change has influenced on the social and economic condition of farmers, as it lowers farm productivity and damages crop. This causes a decline in income and increases both cost of production and cost of coping. Their results indicate that the most possible vulnerable states in terms of exposure to risks and poverty are Terengganu (15.4 percent), Kelantan (10.6 percent), Kedah (7 percent), Perlis (6.3 percent) and Perak (4.9 percent).

Idiosyncratic risks have had serious effects on rural household welfare in the affected states, although, there are no official data on these types of risks in Malaysia. Yet, a growing body of empirical evidence suggests that idiosyncratic risks may be as important or indeed dominant covariate risks in rural Asia (Udry, 1990; Townsend, 1995; Deaton, 1997; Morduch, 2002; Dercon, 2005). The rising degree of vulnerability to poverty among rural households due to idiosyncratic and covariate risks is disturbing. Leaving this uncheck, means more families will not only be vulnerable to poverty, but also many households will be less economically productive. This situation poses great dangers to Malaysians and the governments. This study aims to examine rural households' vulnerability to poverty using longitudinal data set of three waves. The study aims, in general, to analyze the link between exposure to risks and vulnerability to poverty of rural households in Kelantan and Terengganu.

RESEARCH METHOD

Data collection

Data was collected from a three-round panel survey undertaken at 6 month interval to allow measurement of seasonal variation in behavior and outcome and to balance both cross-sectional and time series requirements of panel data. 460 respondents were interviewed in the first round, but only 301 questionnaires in the last round were valid for data analysis.

Vulnerability to poverty

This study employed Chaudhuri (2003) and Chaudhuri *et al.* (2002) method of vulnerability definition namely Vulnerability as Expected Poverty (VEP). Vulnerability as the expected poverty is defined as the probability of non-poor farmers to fall into poverty in the future or if currently poor, will remain in poverty or fall deeper into poverty in future. Therefore, the vulnerability of household i at time *t* can be written as:

$$VEP_t^i = \Pr\left(I_{t+1}^i \leq PLI\right) \quad \text{.....(1)}$$

Where I_{t+1}^i is the per capita income of household at t+1 time and PLI is the poverty line income.

It is assumed that household's per capita income is a function, in general, of household capacities (Assets), idiosyncratic and covariate risks that it experiences, its abilities to cope with, and manage against, these risks and institutional supports. By assuming that per capita income is log-normally distributed, therefore household i's per capita income can be expressed as follows:

$$\mathrm{Ln}I_{t+1}^i = X_{ijt}\beta_{ijt} + \theta_{ijt} \quad \text{.....(2)}$$

While

$$X_{ijt} = (A_{ijt}\,\alpha_f + CR_{ijt}\,\beta_k + IR_{ijt}\,\gamma_l + RMS_{ijt}\,\delta_m + CS_{ijt}\,\partial_n + IS_{ijt}\,\tau_o) \quad \text{..... (3)}$$

Where $\mathrm{Ln}\, I^{i}_{t+1}$ is the future normal log of per capita income, θ_{ijt} represents the unobserved permanent earning determinant as well as the transitory component of earnings (Bourguignon, Goh, & Kim, 2004). represents farmer capacities (Assets) of household i in cohort j at time t, CS_{ijt} represents farmer coping strategies and RMS_{ijt} represents farmer risk management strategies. represents the covariate risks that farmers are exposed to and IR_{ijt} represents the idiosyncratic risks that farmers are exposed to. Next, IS_{ijt} represents the institutional supports are the vectors of parameters.

Accordingly, we assume that the residual term follows an autoregressive process AR(1) (Bourguignon *et al*., 2004):

$$\theta_{ijt} = \rho\theta_{ijt-1} + \varepsilon_{ijt} \quad \text{.....(4)}$$

Where ε_{ijt} is the innovation in earnings and is supposed to have a variance σ^{2}_{sijt}

As the repeated cross-sectional data are available for periods t=1, 2, and 3; and the sample is representative of the whole population in each period, therefore, the sample of individuals belonging to each cohort j is observed in each period. It is thus possible to follow cohort j over time (Bourguignon *et al.*, 2004). If observations are well-specified and done in adequate time; which is technically three cross-sections data allowing the estimated equation 3.2; (Bourguignon *et al.*, 2004), then the estimated $\hat{\rho}_i$ and $\hat{\sigma}^{2}_{sijt}$ will have the expected signs and magnitude, that is, $1>\hat{\rho}_i>0$ and $1>\hat{\sigma}^{2}_{sijt}>0$ for all t.

Some assumptions are necessary for estimating the future per capita income. The first assumption is that the innovation term is distributed as normal as with mean 0 and variance $\hat{\sigma}^{2}_{sijt}$, so that earnings are distributed as a lognormal variable, conditional on individual X_{ijt}. The second assumption is that some predictions of future individual $\hat{X}_{ijt+1}$ characteristics might have to be assumed stationary. The same applies to future earning coefficients $\hat{\beta}_{jit+1}$ and the variance of the innovation $\hat{\sigma}_{sijt+1}$. In both cases, the simplest assumption is that the parameters are stationary (Bourguignon *et al.*, 2004).

Under preceding assumptions, and denoting θ_{ijt}, the estimated residual of the earning equation 3.2 in period t, the probability of earning less than a poverty threshold PLI at time t+1, conditional on characteristics of period t is given by:

With ϕ is the cumulative log-normal distribution function

$$VEP^{i}_{t} = \begin{cases} \phi\left(\dfrac{\mathrm{Ln}\ PLI - \hat{X}_{ijt+1} - \hat{\rho}\hat{\theta}_{ijt}}{\hat{\sigma}^{2}_{\varepsilon ijt+1}}\right) & \text{if} \quad I^{i}_{t+1} \le PLI \\ 0 & \text{if} \quad I_{t+1} > PLI \end{cases} \quad \text{.....(5)}$$

The household with its VEP greater than, or equal to, 0.5 is considered to not put an end to his or her poverty, therefore he or she is vulnerable to poverty (Chaudhuri *et al.*, 2002). In Malaysia a household is considered poor if his income is less than his own PLI, that is, he lacks the resources to meet the basic needs of his family members. A household is considered poor if his per capita income is less than the PLI (which it is RM194 per month per capita) (10^{th} Malaysian Plan, P.397).

Farmer capacity

Farmer capacity is measured as the total set of assets that farmers own or have access to. An asset is identified as a stock of financial, human, natural, physical or social resources that can be acquired, developed, improved and transferred across generations. It generates flows or consumption, as well as additional stock (Moser, 2006). Human capital is measured as the household health situation which determines his capacity to work. Social capital implies the membership of citizens associations and relationships of trust that facilitate co-operation. Natural capital implies the resources that farmers can acquire from nature such as land, soil and water. Physical capital denotes the basic infrastructure and tools that farmers have such as roads, sources of tilling, housing, livestock, food storage and valuable things. Meanwhile, financial capital is referred as savings at home or in the bank that the household owes or acquires. Farmers were asked to indicate their assets (human, social, physical, natural and financial) from a given list.

Exposure to risks

This study defines risks as uncertain events that can damage farmer wellbeing. The uncertain event can be natural, health-related social, economic and environmental. Furthermore, the present study measures risks

firstly according to its nature, ranging from risks affecting individuals (i.e. idiosyncratic) to those affecting communities, regions or nations (i.e. covariate); secondly according to frequency (i.e. idiosyncratic risks such as illness might occur frequently, whereas covariate one such as floods are much less frequent); and lastly according to the severity (i.e. whether the risk affects the farmers wellbeing in a severe manner). For example, farmers were asked to indicate from a given list the various covariate and idiosyncratic risks that they had experienced within the last 6 months and also indicate the severity (based on the 3-point likert-type (1) weak, (2) medium and (3) high) and frequency (how many time they experienced the risks within the last 6 months) of these risks.

RESULTS

Vulnerability as expected poverty (VEP) distribution Tables 1 and 2 illustrate the distribution of poverty and vulnerability for the respondents. Both 0.5 and 0.25 thresholds are taken in the analyses in order to figure effectively how vulnerability is tailored to the farmers. Using the threshold of 0.25, the results indicated that among the community studied, 59.47 percent of farmers were vulnerable to poverty, while only 30.23 percent were vulnerable to poverty when using threshold of 0.5. Table 1 (Using 0.25 threshold) depicted that 50.48 percent of the non-poor may remain non-poor in the future, while 49.52 percent of non-poor today are likely to fall below the poverty line in the future (Transient poverty). At the same time 35.35 percent of farmers who were currently poor are likely to escape poverty in future, meanwhile 65.65 percent of the farmers who were currently poor are likely to remain poor in future (Chronic poverty).

Table 2 (Using 0.5 threshold) depicts that 76.70 percent of the non-poor may remain non-poor in the future, while 23.30 percent of non-poor today are likely to fall below the poverty line in future (Transient poverty). At the same time 66.16 percent of farmers who were poor are likely to escape poverty in future, meanwhile 33.84 percent of the farmers who are currently poor are likely to remain poor in future (Chronic poverty).

Table 3 illustrates the distribution of vulnerability based on household socio-demographic variables (age, gender, region and education). The results depicted that vulnerability is largely associated with age between 31 and 60 years old, and who have large household. Vulnerability as expected poverty (VEP) for the male farmers as the head of household was 57.81 percent based on threshold 0.25. This amount decreased to 29.24 percent if threshold 0.5 is taken. Farmers aged 31-45 and 46-60 were more vulnerable among other groups. Vulnerability of farmers between 31-45 years old was 19.93 percent based on threshold 0.25 and decreased to 9.30 percent, if threshold 0.5 is used. Meanwhile, 32.56 percent of farmers who were between 46 and 60 years old were vulnerable based on threshold 0.25 and this amount decreases to 17.28 if threshold 0.5 is taken. 6.31 percent of farmers are more than 60 years old are vulnerable to poverty based on threshold 0.25 and this amount decreases to 3.65 percent if threshold 0.5 is used.

Data showed that there were no significant differences among farmers based on their educational level. Table 1 also illustrate that 19.27 percent, 14.95 percent, 10.30 percent and 14.95 percent of farmers who have no formal education, primary, lower certificate education and Malaysian certificate of education, respectively were likely to fall into the poverty trap in future based on threshold 0.25. If threshold 0.5 is taken then the probability of being poor is equal to 10.96 percent, 7.31 percent 5.98 percent and 5.98 percent, respectively.

The farmers who live in Pasir Putih and Besut were found to be more vulnerable compared to those who live in Setiu. About 21.26 percent and 19.93 percent of farmers who were located in Pasir Putih and Besut districts are likely to become poor in the future based on the 0.25 threshold and 11.63 percent and 9.63 percent of them are vulnerable to poverty if the 0.5 threshold is taken. Meanwhile, only 18.27 percent of farmers who live in Setiu are likely be impoverished in the future based on the 0.25 threshold. This amount decreases to 8.97 percent if the 0.5 threshold is taken. This is because the incidence of poverty in these three districts varies from one to another. It was found that the poor people have little chance in escaping future poverty (or vulnerability). These results were in line with previous study findings (Moser, 1998).

Farmers who have large families were more vulnerable compared to those who have smaller families' members under their care. About 37.87 percent of farmers who have family sizes between 5 and 7 were vulnerable to poverty based on the 0.25 threshold, 11.96 percent and 5.98 percent who have family sizes between 8 and 9 are likely to remain poor or fall into poverty in the future based on the 0.25 and 0.5 threshold respectively, while only 9.63 percent of farmers who have family size between 2 to 4 are vulnerable to poverty based on the 0.25 threshold. This amount decreases to 4.32 percent if the 0.5 threshold is used.

Table 1: Cross-distribution between poverty and vulnerability (VEP≥0.25)

	Non-vulnerable to poverty	Vulnerable to poverty	Overall
Overall	40.53%	59.47%	100%
Poor	35.35%	65.65%	34.20%
Non-poor	50.48%	49.52%	65.80%

Table 2: Cross-Distribution between Poverty and Vulnerability (VEP≥0.50)

	Non-vulnerable to poverty	Vulnerable to poverty	Overall
Overall	69.77%	30.23%	100%
Poor	66.16%	33.84%	34.20%
Non-poor	76.70%	23.30%	65.80%

Table 3. Vulnerability as expected poverty (VEP) distribution within different socio-demographic variables

		VEP ≥ 0.25		VEP ≥ 0.50	
		Freq	%	Freq	%
Region	Besut	60	19.93	29	9.63
	Setiu	55	18.27	27	8.97
	Pasir Putih	64	21.26	35	11.63
Age	20-30	2	0.66	0	0.00
	31-45	60	19.93	28	9.30
	46-60	98	32.56	52	17.28
	More than 61	19	6.31	11	3.65
Gender	Male	174	57.81	88	29.24
	Female	5	1.66	3	1.00
Household size	2 to 4	29	9.63	13	4.32
	5 to 7	114	37.87	60	19.93
	8 to 9	36	11.96	18	5.98
Educational Level	No formal education	58	19.27	33	10.96
	STD 5/6	45	14.95	22	7.31
	PMR/LCE	31	10.30	18	5.98
	SPM/MCE	45	14.95	18	5.98

Effect of farmer assets on vulnerability

The results of Table 4 reveal that the regression model was significant (F=2.12, p=0.0036). The coefficient determination (R^2) equals 0.694. This means that 69.4 percent of farmer vulnerability was explained by the selected predictors. The results of Table 4 indicated that human capital was crucial for reducing people vulnerability to poverty. The results revealed too, that most of the selected variables of the human capital model significantly affected farmer vulnerability. The number of time farmer has experienced illness that did not limited his activities (t=2.430, 0.015), points to the fact that illness had limited the farmers activities (t=5.360, 0.000) and number of times farmers were required treatments from hospitals (t=2.270, 0.023) depicted that variables were statistically significant at 5 percent level of significance. If farmers experience another sickness that did not limit their activities, then their probability of being poor will increase by 0.032 point. At the same time, if sickness limits farmer activities once more, then the probability of being poor in future increases by 0.286.

The results also show that for every additional time that the farmers required hospitals treatments this leads to the increase of their probability of being poor in future by 0.96. Distance to get healthcare was found to be insignificant (t=0.270, p=0.789) as healthcare centers were located not far away from farmers' residences.

Compared to human capital, all social capital variables were insignificantly affecting farmer vulnerability. The number of friends or relatives of the farmers (t=-1.100, p=0.270), the number of times farmers were helped by friends and relatives, (t=-0.320, p=0.701) membership in association (t=1.630, p=0.103) and the number of time associations helped the farmers (t=-0.040, p=0.971) are statistically insignificant at 5 percent level of significance.

Table 4: Effect of farmer assets on vulnerability

		Coef.	Std. Err.	t	P>t
	Constant	0.765**	0.379	2.020	0.044
Human Capital	Number of times households experienced ill-ness that did not limit his activities (1st stage health condition)	0.032**	0.013	2.430	0.015
	Number of times households experienced ill-ness that limited his activities(2nd stage health condition)	0.252***	0.047	5.360	0.000
	Number of times household required hospital treatment (3rd stage health conditions)	0.962**	0.042	2.270	0.023
	Distance to get healthcare (Km)	0.058	0.218	0.270	0.789
Social Capital	Number of friends household have	-0.221	0.200	-1.100	0.270
	Number of times friends helped the household	-0.197	0.063	-0.320	0.701
	Membership in association (1= have member-ship, 0= do not have membership)	0.036	0.022	1.630	0.103
	Number of times associations helped the household	-0.004	0.109	-0.040	0.971
Natural Capital	Land managed (acre)	-0.094**	0.040	-2.370	0.018
	Use of fertilizers (Kg/acre)	-0.001	0.004	-0.160	0.874
	Source of fertilizers (1= if farmer is subsi-dized, 0= if farmer is not subsidized)	-0.341**	0.140	-2.440	0.015
	Source of water (1= if farmers has proper irri-gation system, 0= if farmers do not have proper irrigation system)	-0.071	0.138	-0.520	0.605
Physical Capital	Source of tilling (1= if farmer has tractors, 0= if farmer do not have tractors)	-0.387***	0.134	-2.880	0.004
	Problems with households accommodation (1= farmers has problem in accommodation, 0= otherwise)	0.001	0.149	0.010	0.993
	The amount of production sold (RM1000)	-0.620***	0.114	-5.430	0.000
	Number of Head of cows	-0.288***	0.057	-5.052	0.000
	Number of Head Sheep and goats	-0.100***	0.027	-3.703	0.000
	Number of Head Hens and ducks	0.020	0.012	1.610	0.108
	Food storage and valuable things (RM1000)	-0.100**	0.049	-2.010	0.045
Financial Capital	Saving at home or in bank (RM1000)	-0.339**	0.135	-2.510	0.012
	R-squared = 0.694	F-Statistic = 2.12		Prob > F = 0.0036	

Of four variables of natural capital, only two show significant impact on farmer vulnerability. While land managed (t=-2.370, p=0.018) and source of fertilizers (t=-2.440, p=0.015) were statistically significant at 5 percent level of significance, the use of fertilizers (t=-0.160, p=0874) and source of water (t=-0.520, p=0.605) were found to be not statistically significant at 5 percent level of significance. Data revealed further that an additional increase of 1 acre of land managed leads to the decrease of farmer vulnerability by 0.094 point. Access to and owning physical assets were found to be an essential variable towards reducing farmer vulnerability. Results of Table 4 illustrate that the source of tilling or mechanization (t=-2.880, p=0.004), the amount of production sold (t=-5.430, p=0.000), food storage and valuable things (t=-0.100, p=0.045), head of cows (t=-5.052, p=0.000) and head of sheep and goats (t=-3.703, p0.000) were statistically significant at 1 percent level of significance. By contrast, problems with farmer accommodation (t=0.010, p=0.993) and head of hens and ducks (t=1.610, p=0.108) were found to be statistically insignificant at 5 percent level of significance. It is found that (table 4) if farmers use mechanization in their farming activities, then their vulnerability can be reduced up to 0.320.

The amount of production sold can also play a part in decreasing farmer vulnerability by 0.620. Owning one more additional head of cow or "sheep and goats" can lead to the decrease of farmer vulnerability by 0.288 and 0.100. An additional RM1000 of food storage and valuable things can decrease the probability of being poor in future by 0.100. Financial capital (savings at home or in the banks) was found to be statistically significant at 5 percent level of significance (t=2.510, p=0.012). The results show that having an additional RM1000 savings at home or in the bank can lead to the decreased farmer vulnerability by 0.339.

Effect of risks on farmer vulnerability

Table 5 summaries the results of the impact of risks on farmer vulnerability. Risks were measured as the number of time farmers had experienced these risks with 6 months. The results of table 5 revealed that the regression model is significant (F=3.29, p=0.0001). The R^2 value was 0.725, which means that 72.5 percent of farmer vulnerability is explained by the selected predictors. Floods (t=0.451, p=0.000), pest diseases (t=3.86, p=0.000) and harvest failure (t=3.200, p=0.001) are statistically significant at 1 percent level of significance. Financial difficulties (t= 1.91, p=0.050) and illness (t=2.36, p=0.019) were also found to be statistically significant but only at 5 percent level of significance.

Table 5: Effect of risks on farmer vulnerability

		Coef.	Std. Err.	t	P>t
	Constant	0.874***	0.127	6.89	0.000
Covariate Risks	Floods	0.451***	0.143	3.16	0.002
	Droughts	-0.088	0.343	-0.26	0.797
	Strong winds	-0.014	0.176	-0.08	0.939
	Pest diseases	0.376***	0.097	3.86	0.000
	Heavy rains	-0.008	0.13	-0.06	0.949
	Increase food prices	0.275	0.191	1.44	0.149
Idiosyncratic Risks	Financial Difficulties	0.389**	0.204	1.91	0.050
	Illness / Injury	0.1949**	0.082	2.36	0.019
	Harvest failure	0.200***	0.062	3.20	0.001
	Loss job or reduce salary	0.049	0.216	0.23	0.820
	R-squared = 0.725	F-Statistic = 3.29		Prob > F = 0.0001	

The results further revealed that an additional problem to farmers who experienced floods, pest diseases, financial difficulties, illness and harvest failure would lead to the increased probability of being poor in future by 0.569, 0.456, 0.389, 0.194 and 0.221 point respectively. Other risks such as droughts (t=-0.26, p=0.797), strong winds (t=-0.08, p=0.939), heavy rains (t=-0.06, p=0.949), increase of food prices (t=1.44, p=0.149) and loss of job and salary (t=0.23, p=0.820) have been found to be statistically insignificant even at 10 percent level of significance.

Effect of severity of risks on farmer vulnerability

One way ANOVA was used to test the effect of the severity of risks on farmer vulnerability. The severity of risk was measured based on four point likert-types. They were not experienced, low severity, medium severity and high severity. Results from the Levene's statistical test for homogeneity of variances show that the assumptions have not been violated. The results indicated that out of 10 risks, there were 5 statistically significant variables at 5 percent level namely floods, pest diseases, financial difficulties, illness and harvest failure. The F- ratios of floods, pest diseases and harvest failure were equal to 10.66, 5.624 and 6.513 with probabilities of 0.000, 0.001 and 0.000 respectively, which indicated that they are statistically significant at 1 percent level of significance. Therefore, there was a significant difference in the severity of impact of floods, pest diseases and harvest failure on farmer vulnerability. Also, data indicated that the

F-ratio of financial difficulties (F= 2.822, p=0.038) and illness (F=3.577, p=0.014) were statistically significant at 5 percent level of significance. This signifies the existence of statistical differences in the severity of impact of financial difficulties and illness on farmer vulnerability. In this case, it is appropriate to conduct the Tukey HSD test to determine where the significance lies.

According to the results of Table 7, there was a significant difference of the means between farmers who did not experience floods and those who experienced floods categorized as having medium severity. The results indicated that farmers who have not experienced floods have less mean value of vulnerability by 0.509 and 0.574 from those who have experienced floods of medium and high severity, respectively. In case of pest diseases, data revealed that farmers who have not experienced pest diseases have lesser mean of vulnerability by 0.486 from those who have experienced pest diseases of high severity only.

Also, the results depicted the existence of a significant difference of the mean of vulnerability between farmers who do not experience financial difficulties and those who have experienced it at most, of high severity. The results further indicated that farmers who have not experienced financial difficulties have lesser mean of vulnerability 0.487 from those who have experienced financial difficulties of high severity only. Meanwhile, farmers who have not experienced any illness have lesser a mean of vulnerability by

Table 6: Effect of severity of risks on farmer vulnerability (ANOVA)

		Sum of squares	df	Mean square	F	Sig.
Floods	Between groups	2.361	3	.787	10.606	.000
	Within groups	66.693	297	.074		
	Total	69.054	300			
Droughts	Between groups	.154	3	.051	.670	.571
	Within groups	68.900	297	.077		
	Total	69.054	300			
Strong winds	Between groups	.553	3	.184	2.420	.165
	Within groups	68.501	297	.076		
	Total	69.054	300			
Pest diseases	Between groups	1.272	3	.424	5.624	.001
	Within groups	67.782	297	.075		
	Total	69.054	300			
Heavy rains	Between groups	.271	3	.090	1.182	.316
	Within groups	68.783	297	.077		
	Total	69.054	300			
Increase of food prices	Between groups	.112	3	.037	.488	.690
	Within groups	68.942	297	.077		
	Total	69.054	300			
Financial difficulties	Between Groups	.644	3	.215	2.822	.038
	Within Groups	68.410	297	.076		
	Total	69.054	300			
Illness/ Injury	Between Groups	.815	3	.272	3.577	.014
	Within Groups	68.239	297	.076		
	Total	69.054	300			
Harvest failure	Between Groups	1.469	3	.490	6.513	.000
	Within Groups	67.585	297	.075		
	Total	69.054	300			
Loss of jobs or reduce salary	Between Groups	.586	3	.195	2.565	.153
	Within Groups	68.468	297	.076		
	Total	69.054	300			

Table 7: Effect of severity of risks on farmer vulnerability (Tukey HSD)

				Mean difference	Std. error	Sig.
Covariate risks	Flood	Not experienced	Low S	0.443	0.419	0.716
			Medium S	-0.509***	0.144	0.000
			High S	-0.574***	0.144	0.000
	Pest diseases	Not experienced	Low S	-0.179	0.176	0.738
			Medium S	-0.015	0.140	1.000
			High S	-0.486***	0.153	0.008
	Financial difficulties	Not experienced	Low S	0.0460	0.421	0.694
			Medium S	-0.519	0.274	0.231
			High S	-0.487***	0.137	0.002
Idiosyncratic risks	Illness/ injury and accident	Not experienced	Low S	0.301	0.435	0.900
			Medium S	-0.387***	0.167	0.006
			High S	-0.497**	0.265	0.039
	Harvest failure	Not experienced	Low S	-0.262	0.125	0.158
			Medium S	-0.408**	0.162	0.050
			High S	-0.945***	0.300	0.009

0.387 and 0.497 from those who have experienced illness of medium and high severity respectively. For harvest failure, the results indicated that farmers who have not experienced harvest failure have lesser mean of vulnerability by 0.408 and 0.975 from those who have experienced harvest failure of medium and high severity respectively.

DISCUSSION

Human capital

Human capital variable is measured as the farmer health predisposition. Most items of human capital variables are noted to be of significance in contributing towards the heads of household vulnerability to poverty (Number of time heads of household are unwell, the number of times the factor of illness has limited household activities and the number of times heads of household are in need of the hospital). These results have all been anticipated (Wei, 2001; Glick & Sahn, 1998; Strauss, 1986). Differences in farmer health also help to explain the variance that persists in agricultural production efficiency (Loureiro, 2009).

There are three varying stages of the effect of health on farmer vulnerability to poverty. For the first stage, if farmers have to endure any form of illness, and yet the severity of illness does not get to the point where it restricts farmer activities, then farmer vulnerability to poverty is slightly on the increase (table 4). This happens because low severity of illness did not reduce farmer number of working hours but rather, to some extent; it may affect the farmer's performance. In the second stage, the impact becomes significant when farmers experience illness that has limited their activities (table 4). The reduction of farmer working hours decrease farmers revenues generated from both in-farm and off-farm activities. Revenues continue to drop based on the number of days that farmers are unable to work. Also farmers were unable to engage in various activities and programs assigned by institutions. As for the last stage, which is more critical, the poor situation has to remain immediately after farmers were required to undergo hospital treatments (table 4). In this case, and with the fact that heads of household were unable to work for some longer time, farmers are normally obliged to spend extra money for their medical attention. Overall, the presence of unproductive heads of household has led to the increase of the vulnerability to poverty by 0.252 while this number increases to 0.962 if productive heads of the house require treatment from the hospital (Table 4).

Social capital

Social capital does not seem to be in favour to enhance farmer livelihood. These results are unexpected (Table 4). The social capital theory argues that person social capital such as networks allows people to access job markets easily and helps them to use the information that they obtained frequently from their networking to find jobs and others resources. Studies have confirmed that social capital plays a significant role in reducing poverty (Narayan & Pritchett, 1999; Maluccio *et al.*, 1999; Ruben and Strien., 2001; Schwarze and Zeller, 2005; Mathbor, 2007; Ghazali, 2003; Islam *et al.*, 2011). Others, however, contradict the above hypotheses (Van Ha *et al.*, 2004; Walusimbi and Nkonya, 2004). Their membership in various associations also does not contribute to the reduction of vulnerability to poverty within farmers. This can be explained by two main reasons. First, farmers lack access or there is the absence of these types of associations in the areas studied. Secondly, these memberships bring little or even no benefit for farmers, but costs them fees, time and energy (Van Ha *et al.*, 2004).

Heads of household were also less helped by their friends and relatives. Most of farmers reported that they had friends who were not helped-not even once. Because most of the farmers live in communities prone to several uncertainties, and relatively scores of people in these areas are poor, then there is only little chance for them to be helped. Although some farmers managed to receive some kind of assistance from their relatives and friends, such assistance was rendered insignificant and this did not encourage the poor family to move forward. Table 4 shows the existence of no significant impact of "number of times farmers were helped by friends and relative" on farmer vulnerability. The unproductive effect of social capital on farmer livelihood does not mean that social capital should not receive any priority in policy interventions directed towards the enhancement of rural communities. In Perlis, Jamalludin *et al.*, (2012) found that Perlis is not a gazetted granny area and farmers are apparently less organized. They conclude that even those who belong to associations were not sufficiently helped and assisted by these associations. The government needs to create a better environment that can enhance local association capacities to help citizens cope with, and manage against, uncertainties. In Asia, the heads of household are heavily reliant on social capital (neighbours, friends, and members of local associations) when they are exposed to uncertainties (Deolalikar *et al.*, 2002). According to Ghazali (2003) Malaysian women in Penang actively participated in the informal rotating credit scheme (*kut/kutu)*. Their participation have enabled them to make a considerable savings which were later used when they need to purchase household items, electrical appliances, jewelleries, meet their children's school needs and refurbish their houses for the preparation of a marriage or to make the down payment for

other major purchases. Also Moser (2006) indicated that access to social capital in Indio Guayas in Ecuador helps the heads of household to accumulate their physical capital such as building houses and acquiring lands. Establishing small and medium credit associations and even informal financial institutions (that should be pro-poor in nature) will accelerate the process of development in these communities, and therefore prepare these communities to cope with, and manage against, even the most severe risks.

Natural capital

The variables of the natural capital model have shown a significant impact on heads of household poverty-driven vulnerability. Farmers who had access to land were more secure than those who lacked access to it. These results did not support the Inverse Relationship (IR) theory that claims that smallholders produced more per unit of land than large-scale farmers. Small farms might be more productive than big farms (Heltberg, 1998), only when there is the availability of other resources that could enhance farm productivity such as mechanization, fertilizers and irrigation, as well as effective decisions and strategies in order.

Farmers who receive subsidies also positively affected the household wellbeing (Table 4). Farmers who can have the access to fertilizers are usually found to be less vulnerable to poverty. These results are similar to Kaizzi *et al.* (2012); Mahajan *et al.* (2012). This could happen only if the adverse impact of climatic change is minimized or removed as well as productivity increased. In support of this, the government fertilizer subsidy alone was not sufficient and will not guarantee a sustainable and progressive paddy and agricultural sector in Malaysia (Alam *et al*., 2010a).

The quantity of fertilizers used (the use of fertilizers kg/acre) has no significant effect on farmer vulnerability. It has been observed that farmers mostly use a considerable amount of fertilizers in their farming activities. This is due to the fact that the quality of land in the communities studied is not very fertile. These results did not support Jamalludin *et al*. (2012) findings. The authors have found that the excessive use of fertilizer is positively related to higher probability of being vulnerable within paddy farmers in Perlis, Malaysia. They argue that:

> *"Continuous cultivation of land makes it less productive and in the case of paddy land it does make the land more acidic. Use of more fertilizer and other chemicals is therefore required to revitalise the land. However, over application of fertilizer is also a bad agricultural practice as production will definitely decrease. In either case, the increase use of fertilizer means higher production cost to the farmers"* (p, 521).

The reasons why the present study results do not support Jamalludin *et al*. (2012) findings could be due to the fact that the present uses longitudinal data analysis while Jamalludin *et al* (2012) uses a cross-sectional data analysis. To calculate the VEP from cross-sectional data some strong assumptions are required while calculating the VEP from longitudinal data would give a robust and adequate estimation.

Using much fertilizer may cause severe consequences on farmer health condition. Antle *et al.* (1998) have found that fertilizers and pesticides deteriorate farmer health condition which in turn causes a significant decline in farm productivity and production. The reason for the usage of much fertilizer not affecting farmer vulnerability to poverty can be explained by two facts. Firstly, the cost of purchasing fertilizers is relatively low as most farmers used subsidized fertilizers from the government. Secondly, farmers were very aware of the health hazards that can emerge out of those fertilizers; therefore, they have adopted some very significant ways and strategies t0 protect their health.

It is worthy to indicate that the use of much fertilizer may lead to high yield hence reducing farmer probability of being poor in future, but equally importantly, it also might deteriorate the environment (Vasileiou, 2010; Bokusheva *et al.,* 2012). This issue needed to be examined by policy makers, practitioners and even farmers themselves. Strategies, both pro-farm growth and pro-environment, should be well-implemented.

Having access to an appropriate irrigation system seems to have insignificant effect in the reduction of the household vulnerability (Table 4). Many studies confirm that investment in irrigation is a fundamental element in enhancing farm productivity, therefore eradicating poverty. Hussain and Hanjra (2003); Hussain and Hanjra (2004); García-Ponce *et al.* (2013); Connor *et al.*, (2008); Nagaz *et al.,* (2012); and Khan and Shah (2012) have found strong linkages between irrigation, agricultural productivity and poverty reduction. Others realize the existence of insignificant relationship between irrigation and the farm income (Jehangir *et al.,* 2002).

The results of the present study are not in support of the hypothesis that signifies that irrigation reduces the farmer vulnerability to poverty. This could be explained by the fact that getting access to irrigation can lead farmers to implement less risk management strategies in their farming activities. Access to irrigation also leads farmers to feel safer. As a result, they were involved in limited activities that could prevent them from any unexpected events. Consequently, adopting fewer risks management and coping strategies may easily make them more vulnerable to income diversification. Access to resources might not bring farmers to poverty unless these resources were used adequately and effectively. Access to irrigation might not reduce farmer vulnerability to poverty unless certain conditions and environment that guarantee the effectiveness of the usage of water resources are achieved efficiently

Physical capital

Access and own physical assets are found to be essential variables that could keep farmers away from being vulnerable to poverty (table 4). Using mechanical tractors in farm activities can enhance farm productivity and then increase production. Marketable surplus leads to higher income generation thereby reducing the probability of being vulnerable to poverty (Omolehin *et al*., 2007). These results are similar to those by Shah *et al.* (2006) who indicate that adopting improved production technology increases more than thrice the provincial mean of wheat yield in Pakistan, therefore increasing the farm revenues. Farmers who have more cows, sheep and goats, hens and ducks; and who have stored foods and other valuable things (that can be transformed to liquidity) are also found to be less vulnerable. These findings are similar to Bokosi (2007) results who stated that a unit that increases the per capita value of livestock owned, reduces the probability of the farmers being poor in Malawi by 3 percent between the period of 1998-2002. Also Owuor *et al.* (2007) discovered that livestock assets significantly contribute to the reduction of the probability of being chronically poor. The quality of livestock is important in increasing farmers' capacities. If farmers own animals that are old, sick or are in a bad shape, then the real value of the herd is negligible (Alary *et al.*, 2011).

> "*It is not livestock itself that is the major contributor to these higher incomes. The contribution of livestock is not direct but influences interactions with other activities or placements. Livestock is both a tool for seasonal work and security at any time in the majority of mixed and integrated livestock cropping systems and, in pastoral systems, appears to represent mainly short and medium-term insurance"* (Alary *et al.,* 2011, p.1646)

It is likely that heads of household who own fewer productive assets such as livestock are likely to be poor, as they have low productivity and production. However, it is likely that those who have fewer assets would want to work much harder to compensate for their disadvantaged position. This may also lead to them adopting some inappropriate strategies for income generation. Farmers who do not possess assets (such as cows, sheep and goats, hens and ducks and food storage and other valuable things) may engage in multiple jobs. Engaging in multiple off-farm activities results in reducing the number of hours in farm activities, thus decreasing farm productivity. Low productivity in turn leads to fewer revenues, and then it increases farmer probability of being poor in future. Having problems in accommodation seems an insignificant factor that harms the household livelihoods. Consequently, owning productive assets rather than non-productive assets, as primary source of income, significantly increases farm productivity and production, which in turn increases the probability that farmers may end up being impoverished in the future.

Financial capital

Literature has proven that access to financial resources is the most efficient tool that significantly leads to poverty alleviation (Jehangir *et al.*, 2002; Owuor *et al.*, 2007). These results are plausible. The findings indicate that saving at home or at the bank also reduces the likelihood of being poor by 0.399 (Table 4). It is important to indicate that the first round of the present data set was analysed using Pearson correlation test (Abdelhak *et al.,* 2012) and the results show that financial capital is negatively correlated with farmer monthly income. The authors have also found that the more savings the households had the lesser monthly income that they had earned. Nonetheless, the correlation between farmer saving and their

monthly income is moderate (r=-0.387, p=0.000). The present study has shown that saving is an effective tool that secures farmers from the trap of poverty.

This contradiction can be explained by the fact that having some savings at home or in the bank (and not investing it in order to improve the production capacities and therefore enhancing their land productivity) do not bring any return to farmers. But when exposed to uncertainties, farmers tend to use these savings to cope with unexpected events. In that way farmers can secure themselves from being unable to manage against these risks. In order to eradicate poverty, heads of household should implement productive strategies and get involved in other programs and activities that might increase their production and therefore this leads to the generation of more income. At the same time farmers should invest some of their savings in productive assets that could enhance their production capacities as well as the fact that they should manage saving a certain amount of their financial resources as a source that might protect them from any unexpected or seriously disastrous events.

The impact of risks on heads of household vulnerability to poverty

The findings indicate that both covariate and idiosyncratic risks were present in the communities being studied. These results were expected and they confirmed the existence of direct and indirect negative links between risks and people's poverty (Siwar *et al.,* 2009b; Kapoor and Ojha, 2006; Cheng and Tao, 2010; Hertel *et al.,* 2010; Somi *et al.,* 2009; Gunter and Harttgen, 2009). Risks and uncertainties have direct negative impact on the household asset accumulation (Giesbert and Schindler, 2012) which causes poor farmers to fall even harder towards chronic poverty while pushing the non-poor farmers into transit poverty. Floods and pest diseases (Covariate risks); financial difficulties, harvest failure, illness and injury (Idiosyncratic risks) were the most threats that exacerbate farmer vulnerability. Their effects remain in different degrees based on their severities. The people vulnerabilities significantly increased when they were exposed to the floods which were moderately severe, while these vulnerabilities only significantly increased when they experienced high severity of other risks pertinent to pest diseases, illness, financial difficulties and harvest failure (Table 5 and 6). Floods cause severe damages on farmer dwellings, which were mostly stilt houses for the majority of the farmers. Floods and pest diseases seriously affected farmer production capacities and inflicted acute damages on crops and livestock (sheep, goats and cows, hens and ducks) as well as indirectly reducing farmer's savings. The extent of this impact is determined based on the level of severity of these risks. Exposure to medium severity of floods and pest diseases sufficiently weakened farmer capacities, thus making farmers more vulnerable to poorer living status.

Illness and injury can affect farmer livelihood directly and indirectly. Directly, it decreases farmer working hours and declines farmer productivity and production capacities in both in-farm and off-farm activities. Indirectly, it increases the cost borne for medications and the fees to admit healthcare centres, as well as increasing the opportunity cost that occurred as farmers were jobless during their period of being ill. Notwithstanding, moderate level of severity of illness was not significant to lead people to poverty as the data reveal that only high severity of illness increased farmer vulnerability to such a disadvantaged position (Table 5 and 6). This can be explained by the fact that when farmers experienced low severity of illness, they just needed to use some of their savings to cope with the situation, and resumed their daily activities when they have recovered. However, if the illness was severe, then maybe it would take months to recover. This will lead to a massive decline in their revenues and borrowing from third parties to guarantee their families subsistence would be in plan.

It seems that in a short time, harvest failure increases farmer monthly income (Abdelhak *et al.,* 2012). Farmers who experienced harvest failure were engaged in off-farm activities by collecting and selling natural resources, doing multiple jobs and also selling their productive and non-productive assets such as livestock. However, these strategies are effective only in a very short period (Abdelhak *et al.,* 2012). The data also revealed that vulnerability to poverty significantly increased when farmers experienced harvest failure (Table 4). Exposing to only medium severity of harvest failure had caused a significant decline (severe damage) in the amount of agricultural production sold, number of animals such as sheep, goats and cows, food storage and valuable things, and savings.

Household vulnerability to poverty was also exacerbated when they face financial difficulties (Table 7). Some household would sell some of their livestock (sheep, goats and cows), rent out or sell their properties and spend some of their savings when they experienced low severity of financial difficulties which led to

significant decline in these assets. However, only severe financial difficulties were found to be significant in increasing farmer vulnerability to poverty (Table 7). This can be explained by the fact that severe financial difficulties had led farmers to sell almost everything they owned.

Even though the results indicate that risks such as strong winds, loss of jobs and reduced salary in some situations were to some extent significant in decreasing some of the farmer assets, these risks were found to be not significant in increasing farmer vulnerability to poverty (Table 5 and 6). One of the reasons was that the household capacities are weakened only if they were exposed to high severity of strong winds, loss of job and reduced salary. Another reason is that these risks affected few of the farmer assets only temporarily such as the reduced number of hens and ducks and food storage and valuable things. These assets can be replenished soon after, as compared to other assets such as land, sheep and goats, cows and saving that necessitate a lot of efforts and time to re-accumulate.

Under-developed in the communities that were chosen for this study. Both covariate and idiosyncratic risks are central causes behind a household future vulnerability. The effect of these threats is determined by its nature and level of severity, as well as by the type of strategies to respond to the threats.

Drought, another environmental degradation can have a negative impact on land productivity, which in many cases made farmers particularly to be more vulnerable to other risks such as decreased farm revenues (Benson and Clay, 1998). However, in the case of the communities studied, drought is not a significant factor that exacerbates farmer vulnerability to poverty (Table 5). This is due to the fact that the majority of farmers rely on the irrigation system for their farming activities. Alam *et al.* (2011c) indicated that the problem of low rainfall was avoidable through proper irrigation system. The Malaysian government has invested in irrigation projects since the eighties. These efforts have resulted in the transforming of the agricultural sector in Malaysia into an efficient and competitive sector (Ghazalli, 1998). Meanwhile, there is no significant relationship between the exposure to heavy rain that prevents farmers from doing their daily activities and their assets. Previous work by Abdelhak *et al.* (2012) shows that heavy rain is a useful resource for farmers in Kelantan and Terengganu as they use the water made available during the period of drought. However, the heavy rainfall is not significant to boost farmers' capacities and reduce farmer vulnerability (Table 5). This is due to the fact that the government has developed and designed efficient irrigation systems that protect farmers from any shortage of water supply during the dry period. Opposing results have been found by Alam *et al*. (2011c) which indicated that the uncertain changes of rainfall patterns in Malaysia have made the paddy production cycle challenging and ineffective, as the exposure to heavy rain after irrigation may lead to harvest failure.

Although the risks of increased food prices serve as one of the threats that farmers have reported, the impact of this risk is insignificant (Table 4). The increase of food prices did not cause any decline to the farmer assets (CPI for food increase by 23.6 percent in 2010 based on 2005 prices)[2]. The reasons for these are firstly, as only few farmers reported that they had had experienced this threat, the impact of increased food prices is marginal, and therefore it is statistically insignificant. The second reason could be due to the fact that farmers depend on their own crops production most of the time to sustain the food required for their families. Farmers also mainly rely on rice production for marketization. At the same time they produce varieties of vegetables and fruits for their daily diet. The results have further indicated that farmers also do not gain much from the increased food prices. Theoretically, higher food prices benefit farmers by boosting their revenues from selling the surplus produced (Ivanic and Martin, 2008). As rice prices are subsidized by the government, the prices are almost stable over time. Farmers do not receive any revenues from the higher prices of the other commodities as most of them tend to produce them for their families consumption. Another reason can be due to the fact that small farmers cannot quickly take advantage of better market opportunities or increase their production due to the lack of access to financial resources and inputs (Benson *et al.,* 2008).

CONCLUSION

Decades ago, scholars, policymakers and practitioners have dealt with poverty as a static phenomenon. Most of the anti-poverty policies, strategies and programs were designed as ex-post programs. Malaysia is one the countries that succeeded in bringing down the national poverty prevalence to a low level of about 5 percent. Yet, some pockets of poverty are acknowledged to still remain, especially in the rural areas. Kelantan and Terengganu are two states experiencing a relatively higher level of poverty incidence in Peninsular

Malaysia. The poverty eradication measures become more complex and hard to be achieved when the Malaysian government still rests on its ex-post anti-poverty policies. A transformation from the ex-post into ex-ante policy for poverty eradication could notably serve to understand why, and how, people move in and out of poverty, therefore framing the appropriate programs and policies to overcome poverty issue more effectively.

The findings have suggested that combating future poverty is not only to incorporate monetary measure but also the non-monetary measure where in actual fact, a good way to do this is by integrating both measures. Many factors are inter-correlated and inter-connected to each other for shaping the process that makes a household vulnerable. The lack of access to assets and resources and the exposure to threats have made the process of recovering from poverty unsuccessful. Assets are regarded as the core element of vulnerability reduction. This can only be achieved only if a sustainable environment is created. In many cases, access to assets is responsible for disturbing farmer effectiveness and performance level. Human, natural, physical and financial capitals have shown a positive sign for terminating future poverty, but in many cases the results show that access to these resources creates a negative and unproductive behaviour at the managerial level. Social capital is found to be an ineffective tool for vulnerability to poverty reduction because social capital is still under-developed in the communities that were chosen for this study. Both covariate and idiosyncratic risks are central causes behind a household future vulnerability. The effect of these threats is determined by its nature and level of severity, as well as by the type of strategies to respond to the threats.

REFERENCES

Abdelhak, S., S. Jamalludin, and M. Saidatulakmal. 2012. Poverty among rural communities in Kelantan and Terengganu: the role of institutions, farmers' risk management and coping strategies. Journal of Applied Sciences 12: 125-135.

Alam, M., Siwar, C., Molla, R., Toriman, M., And Talib, B. (2010a). Socioeconomic impacts of climatic change on paddy cultivation: an empirical investigation in Malaysia. Journal of Knowledge Globalization,3 (2): 71-84.

Alam, M., C. Siwar, R. Molla, M. Toriman, and B. Talib. 2011a. Climate change and vulnerability of paddy cultivation in North-West Selangor, Malaysia: a survey of farmers' assessment. Voice of Academia, 6(1): 45-56.

Alam, M.M., T. Mohd Ekhwan, C. Siwar, and B. Talib. 2011b. Paddy farmers' adaptation practices to climatic vulnerabilities in Malaysia. Mitigation and Adaptation for Global Change, 16(7): 1-12.

Alam, M., M.E. Toriman, C. Siwar, and B. Talib. 2011c. Rainfall variation and changing pattern of agricultural cycle. American Journal of Environmental Sciences, 7(1): 82-89.

Alam, MM., C. Siwar, B. Talib, M. Mokhtar, and M.E. Toriman. 2012a. Climate change adaptation policy in Malaysia: issues for agricultural sector. African Journal of Agricultural Research 7(9): 1368-1373

Al-Amin, A.Q., W. Leal, J.M. de la Trinxeria, A,.H. Jaafar, and Z.A. Ghani. 2011. Assessing the impacts of climate change in the Malaysian agriculture sector and its influences in investment decision. Middle-East Journal of Scientific Research 7(2): 225-234.

Alary, V., C. Corniaux, and D. Gautier. 2011. Livestock's contribution to poverty alleviation: how to measure it? World Development 39(9): 1638-1648.

Antle, J. M., D.C. Cole, and C.C. Crissman. 1998. Further evidence on pesticides, productivity and farmer health: potato production in Ecuador. Agricultural Economics 18(2): 199-207.

Baez, J.E. 2006. Income vulnerability, risk coping behavior and consumption smoothing mechanisms in developing countries. Desarrollo y sociedad58. 37-83. Retrieved from http://economia.uniandes. edu.co/revistadys/58/918cIncome.pdf

Begum, R., C. Siwar, R. Abidin, and J.J. Pereira. 2011. Vulnerability of climate change and hardcore poverty in Malaysia. Journal of Environmental Science and Technology 4(2): 112-117.

Benson, C., and E.J. Clay. 1998. The impact of drought on sub-Saharan African economies: a preliminary examination. World Bank Publications. No: 401/

Benson, T., N. Minot, J. Pender, M. Robles, and J. Von Braun. 2008. Global food crises monitoring and assessing impact to inform policy responses. International Food Policy Research Institute, Washington, D.C. IFPRI Issue Brief 55. Retrieved from http://www.ifpri.org/sites/default/files/publications/ib55_0.pdf

Bokosi, F. K. 2007. Households' poverty dynamics in Malawi: a bivariate Probit analysis. Journal of Applied Sciences, 7(2): 258-262.

Bokusheva, R., S.C. Kumbhakar, and B. Lehmann. 2012. The effect of environmental regulations on Swiss farm productivity. International Journal of Production Economics 136: 93-101.

Bourguignon, F., C. Goh, and D.I. Kim. 2004. Estimating individual vulnerability to poverty with pseudo-panel data. World Bank Policy Research Working Paper No. 3375. Retrieved from wds.World bank.org/servlet/WDSContentServer/WDSP/IB/2004/09/08/000009486_20040908120056/ Rendered/ PDF/wps3375panel.pdf

Chaudhuri, S. 2003. Assessing vulnerability to poverty: concepts, empirical methods and illustrative examples, Working Paper, Columbia University.

Chaudhuri, S., J. Jalan, and A. Suryahadi. 2002. Assessing household vulnerability to poverty from cross-sectional data: a methodology and estimates from Indonesia. Discussion Paper No. 0102-52. Columbia University

Cheng, J. and J. Tao. 2010. Fuzzy comprehensive evaluation of drought vulnerability based on the analytic hierarchy process: an empirical study from Xiaogan City in Hubei Province. Agriculture and Agricultural Science Procedia 1:126-135.

Connor, D., J. Comas., H.G. Macpherson, and L. Mateos. 2008. Impact of small-holder irrigation on the agricultural production, food supply and economic prosperity of a representative village beside the Senegal River, Mauritania. Agricultural Systems 96(1): 1-15.

Deaton, A. 1997. The analysis of household surveys: a micro-econometric approach to development policy. Baltimore, Johns Hopkins University Press. Retrieved from http://graduateeconomist.files.wordpress.com/ 2012/07/published-1997-the-analysis-of-household-surveys-by-angus-deaton.pdf

Deolalikar, A. B., M. Castro-Guevara, L.L. Lim,, and P.F. Quising. 2002. Poverty reduction and the role of institutions in developing Asia: Citeseer. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/ download ?doi=10.1.1.200.1933Andrep=rep1&type=pdf

Dercon, S. 2005. Risk, poverty and vulnerability in Africa. Journal of African Economies 14(4): 483-488.

García-Ponce, E., H. Gómez-Macpherson,, O. Diallo, M. Djibril, C. Baba, O. Porcel, and D.J. 2013. Contribution of sorghum to productivity of small-holder irrigation schemes: On-farm research in the Senegal River Valley, Mauritania. Agricultural Systems 115: 72-82.

Ghazalli, M. 1998. Modernisation of irrigation and drainage management for agricultural production. Department of Irrigation and Drainage Malaysia, 10. Retrieved http://eng.upm.edu.my/~kbp/smart% 20farming99/ keynote/magmid.doc

Ghazali, S. 2003. Kut (informal rotating credit) in the livelihood strategies of urban households in Penang, Malaysia. Area, 35(2): 183-194.

Giesbert, L. and K. Schindler. (2012). Assets, shocks, and poverty traps in rural Mozambique. World Development. 40(8): 1609-2012

Glick, P. and D.E. Sahn. 1998. Health and productivity in a heterogeneous urban labour market. Applied Economics 30(2): 203-216.

Gunther, I. and K. Harttgen. 2009. Estimating household vulnerability to idiosyncratic and covariate risks: a novel method applied in Madagascar. World Development 37(7): 1222–1234

Heltberg, R. 1998. Rural market imperfections and the farm size-productivity relationship: evidence from Pakistan. World Development 26(10): 1807-1826.

Hertel, T. W., M.B. Burke, and D.B Lobell. 2010. The poverty implications of climate-induced crop yield changes by 2030. Global Environmental Change 20(4): 577-585.

Hussain, I. and M.A. Hanjra (2003). Does irrigation water matter for rural poverty alleviation? evidence from South and South-east Asia. Water Policy 5: 429-442.

Hussain, I. and M.A. Hanjra. 2004. Irrigation and poverty alleviation: review of the empirical evidence. Irrigation and Drainage 53: 1-15.

Islam, G. M. N., T.S. Yew, N. M. R.. Abdullah, and K.K. Viswanathan. 2011. Social capital, community based management, and fishers' livelihood in Bangladesh. Ocean and Coastal Management 54(2): 173-180.

Ivanic, M. and W. Martin. 2008. Implications of higher global food prices for poverty in low-income countries. World Bank Policy Research Working Paper Series, No. 4594. Retrieved from https:// open knowledge.worldbank.org/ bitstream/handle/10986/6723/wps4594.pdf?sequence=1)//GP

Jamalludin, S., A. Azlinda, M. Saidatulakmal, and A. Senadjki. 2012. Vulnerability a new dimension in poverty: an empirical analysis. Humanities and Social Sciences Review 01(02): 517–525.

Jehangir, W. A., M. Ashfaq, A. Ali, and N. Sarwar. 2002. Use of credit for poverty reduction by small farmers, Pakistan. Journal of applied sciences 2(7): 777-780.

Jha, R., T. Dang,, and Y. Tashrifov. 2010. Economic vulnerability and poverty in Tajikistan. Economic change and restructuring 43: 95–112.

Kaizzi, K. C., J. Byalebeka, O. Semalulu, I.N. Alou, W. Zimwanguyizza, A. Nansamba, and Hyuha (2012). Optimizing smallholder returns to fertilizer use: Bean, soybean and groundnut. Field Crops Research 127: 109-119.

Kapoor, S. and R.K. Ojha. 2006. Vulnerability in rural areas: potential demand for micro-finance. International Journal of Rural Management 2(1): 67-83.

Khan, H. and M. Shah. 2012. Irrigation, farm productivity and poverty reduction in kpk: understanding direct and indirect impacts and linkages. Procedia Economics and Finance 2: 292-298.

Loureiro, M. L. 2009. Farmers' health and agricultural productivity. Agricultural Economics, 40(4): 381-388.

Mahajan, G., B. Chauhan, J. Timsina, P. Singh, and K. Singh. 2012. Crop performance and water-and nitrogen-use efficiencies in dry-seeded rice in response to irrigation and fertilizer amounts in Northwest India. Field Crops Research 134: 59-70.

Maluccio, J., L. Haddad, and J. May. 1999. Social capital and income generation in South Africa, 1993-1998. Food Consumption and Nutrition Division Discussion Paper No. 71.Washington, DC: International Food Policy Research Institute. Retrieved from http://www.cid.harvard.edu/archive/events/cidneudc/ papers/ maluccio.pdf

Mathbor, G.M. 2007. Enhancement of community preparedness for natural disasters: The role of social work in building social capital for sustainable disaster relief and management. International Social Work 50(3): 357–369.

Morduch, J. 1994. Poverty and vulnerability. American Economic Review 84(2): 221-225.

Morduch, J. 2002. Consumption smoothing across space: testing theories of risk-sharing in the ICRISAT study region of South India. Discussion Paper No. 2002/55. Retrieved from http://www.wider.unu.edu/stc/ repec/pdfs/rp2002/dp2002-55.pdf

Moser, C.O.N. 1998. The asset vulnerability framework: reassessing urban poverty reduction strategies. World Development 26(1): 1-19.

Moser, C.O.N. 2006. Asset-based Approaches to Poverty Reduction in a Globalized Context: An introduction to asset accumulation policy and summary of workshop findings. Global Economy and Development. The Brookings Institution. Working paper 01. Retrieved from http://www.brookings.edu/~/media/research/files/papers/2006/11/sustainabledevelopment%20moser/200611moser

Nagaz, K., M.M. Masmoudi, and N.B. Mechlia. 2012. Impacts of irrigation regimes with saline water on carrot productivity and soil salinity. Journal of the Saudi Society of Agricultural Sciences 11(1): 19-27.

Narayan, D. and L. Pritchett. 1999. Cents and sociability: Household income and social capital in rural Tanzania. Economic Development and Cultural Change 47(4): 871-897.

Omalehin, R.A., T.O. Ogunfiditini, and O.B. Adeniji. 2007. Factors influencing adoption of chemical pest control in cowpea production among rural farmers in Makarfi Local Government Area of Kaduna State Nigeria. International Journal of Agricultural Research 2(11): 920-928.

Owuor, G., M. Ngigi, A.S. Ouma, and E.A. Birachi. 2007. Determinants of rural poverty in Africa: the case of small holder farmers in Kenya. Journal of Applied Sciences 7(17): 2539-2543.

Ruben, R. and D. Strien. 2001). Social capital and household income in Nicaragua: the economic role of rural organization and farmers' networks. Paper presented at the 74th European Association of Agricultural Economists (EAAE) Seminar, Wye College, UK.

Schwarze, S. and M. Zeller. 2005. Income diversification of rural households in Central Sulawesi, Indonesia. Quarterly Journal of International Agriculture 44(1): 61-73.

Shah, N.H., Inamulla, G. Hassan, and F.U. Khan. 2006. Role of intensive management of wheat in poverty alleviation of NWFP Pakistan. Asian Journal of Plant Sciences 5(2): 190-192.

Siwar, C., M.M. Alam, M.W. Murad, and A.Q. Al-Amin. 2009b. A review of the linkages between climate change, agricultural sustainability and poverty in Malaysia. International Review of Business Research Papers 5(6): 309-321.

Somi, M.F., J.R.G. Butler, F. Vahid, J.D. Njau, and S. Abdulla. 2009. Household responses to health risks: a study from rural Tanzania raises some methodological issues. Journal of International Development 21: 200-211

Strauss, J. 1986. Does better nutrition raise farm productivity? The Journal of Political Economy 94(2): 297 -320.

Townsend, R. 1995. Consumption insurance: an evaluation of risk-bearing systems in low-income economies. Journal of Economic Perspectives 9(3): 83-102.

Udry, C. 1990. Credit markets in northern Nigeria: credit as insurance in a rural economy. World Bank Economic Review 4(3): 251-269.

Van Ha, N., S. Kant, and V. Maclaren. 2004. The contribution of social capital to household welfare in a paper-recycling craft village in Vietnam. Journal of Environment And Development 13(4): 371-399.

Vasileiou, K. Z. 2010. Exploring the role of fertilizer application on the sustainability of Greek potato farms: A DEA application. Agricultural Economics Review 11(1): 17-32.

Walusimbi, R. and E. Nkonya. 2004. Community and household-level income And asset status baseline survey report. Southwestern Uganda sustainable natural resources management (SUNAREM) project. Retrieved from http://ussp.ifpri.info/files/2011/09/community-and-household-income-and-assets.pdf

Wei, L. 2001. The effect of human resource development on household income in selected poor areas of rural China. Journal of Labor and Management in Development 2(2): 1-23.