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**‘The Impact of Rice and Maize Price Volatility on Farm Households’ Income and  
Consumption in Northern Vietnam’**

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**Introduction and Research Objectives**

World food prices have been characterized by massive fluctuations over the past three years. Price levels through 2007 and early 2008 increased dramatically by 128% only to be followed by a sharp decline of -56% in 2008 and 2009 (FAO, 2009). A parallel pattern was visible in the development of agricultural input prices of crude petroleum (+69% / -115%) and fertilizers (+254% / -197%) from 2007 to 2009 (FAOSTAT, 2009). Rural households in low income countries are affected by volatile agricultural commodity prices through their impact on consumption expenditures and income. The net impact of changing consumer and producer prices on household welfare depends on whether a household is a net buyer or net seller of an agricultural commodity and on the applied input intensity (FAO, 2008). Furthermore, income variability as such is shown to have a negative impact on both efficiency of agricultural production and poverty reduction as households in low income countries have limited possibilities to insure themselves against risks and low initial daily consumption levels as many households are already located around minimum consumption thresholds (MORDUCH, 1995; HOLDEN and BINSWANGER, 1998; ZIMMERMAN and CARTER, 2003). Therefore, the 2008 food price hikes caused major public concern about food security in low income countries, but also created hopes of higher agricultural incomes for rural households (AKSOY and IZIK-DIKMELIK, 2008). Therefore, the objective of this study is to investigate both the extent of net income shocks related to volatile food crop prices as well as households’ response to income and consumption risk through a household level study in Yen Chau district in north-western Vietnam covering the period from 2006 to 2008. In particular, the paper analyzes (1) the extent to which rural households’ net income was affected by rice and maize price fluctuations, (2) the ability of households to insure consumption against maize income shock, and (3) the coping and adaptation strategies households employ to smooth consumption.

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## Description of the Research Area

The research was conducted in the mountainous Yen Chau district in north-western Vietnam, which is among the poorest districts in the country (poverty rate 16.7% in 2007/08) (ZELLER et al., unpublished). Agricultural production is dominated by two major crops, paddy cultivation as the major staple in the lowlands and intensive production of maize as the primary cash crop in the uplands, taking up 11% and 71% of total farmed area respectively. Rice is characterized by a very low degree of commercialization and accounts for approximately 8.5% of total consumption expenditures on average, but 49% of households do not achieve self-sufficiency.

Maize production accounts for an average of 65% of total household cash income and is characterized by high levels of commercialization and input use (KEIL et al., 2008).

## Methodology

For *data collection* structured interviews were conducted in a random sample of 300 households representative of Yen Chau district between March 2007 and July 2009. For household selection a two-stage cluster sampling procedure was followed. In the first stage of the sampling procedure 20 villages were randomly selected using the Probability Proportionate to Size (PPS) method; in the second stage 15 households were randomly selected in each village. This sampling procedure results in a self-weighting sample (CARLETTO, 1999).

In a first step *the static impact of rising rice and maize prices on household net income* was analyzed, based on an extension of the Net Benefit Ratio (DEATON, 1989; MINOT and GOLETTI, 2000). Equation (1) expresses the short term effect on household welfare before producers or consumer respond to price changes by adjusting their production decisions or consumption patterns.

$$\frac{\Delta w_i}{x_{0i}} = \frac{\Delta p_a^p}{p_{0a}^p} PR_{ia} - \frac{\Delta p_a^c}{p_{0a}^c} CR_{ia} \quad (1)$$

where  $\Delta w_i$  = the change in real income for household  $i$  of a price change of commodity  $a$   
 $x_{0i}$  = income (consumption expenditure) of household  $i$ , in period  $0$   
 $\Delta p_a^p/p_{0a}$  = change in producer price (index: p); change in consumer price (index: c)  
 $PR_{ia}$  = the value of production of commodity  $a$  as proportion of  $x_{i0}$  for household  $i$   
 $CR_{ia}$  = the value of consumption of commodity  $a$  as proportion of  $x_{0i}$  for household  $i$

In a second step *households' resilience to the maize income decline in 2008* was analyzed using an OLS regression model which employs an asset based approach to social risk management linking households' capital endowment with the stability of their consumption expenditures (SIEGEL and ALWANG, 1999). The structural equation of the model can be written as follows:

$$R = f(D, A, I) \quad (2)$$

where  $R$  = Resilience (measured as change in consumption expenditures in the maize post harvest season (Jan-Apr) in 2009 compared to 2008)  
 $D$  = Income shock (measured as the decrease in total household income due to the decline in maize income)  
 $A$  = Asset base of a household (e.g. total cropping area, labor capacity)  
 $I$  = Idiosyncratic shocks (e.g. sickness, crop failure)

## Results and Discussion

Consumer prices for rice increased 19.6% in 2007 and 16.9% in 2008 while producer prices increased 14.6% in 2007 and 12.5% in 2008.<sup>2</sup> The consequences of the price increase on net income were moderate, amounting on average to -3.5% for net buyers and +0.8% for net sellers. However, the welfare loss for net buyers showed wide variation among households, ranging from -32.0% to +3.8% of net income, reflecting the large differences in rice consumption expenditures in total household income (NBR) between households, and hence different levels of vulnerability to the rice price increase (Table 1). From a food security point of view the lower absolute bound of NBR (-69.0%) and respective net income decrease (-32.0%) is of particular interest, since it is the poorer households with the highest proportion of expenditures on food (Engel's Law).

In the same period, maize producer prices increased by an extraordinary 50.4% in 2007 and then decreased moderately by 4.6% in 2008.<sup>3</sup> Nonetheless, household level differences in maize price variability in 2008 relative to 2007 were considerable (in the range of -37.8 to +64.7%) indicating village and household level factors that influence price formation beyond general price tendencies.<sup>4</sup> Large price differences occur due to quality differences, differences in time of sale (data not shown here) and location (i.e. distance from main paved road, see KEIL et al., 2008). Causes underlying maize price disparities are important to understand since maize price variability translates closely into household income changes due to the dominance of maize in cash income (Table 1)<sup>5</sup>. The combined rice and maize price effect on household income in 2008 was moderate (-7.4%, on the average), but showed large variations with both clearly net winning and net losing households (Table 1).

**Table 1: Static impact of rice and maize price changes on net income**

	N (% of all hhs)	NBR 2007 [%]			Price change 2008 [%]			Net income change 2008 [%]		
		Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Rice Net buyer	125 (44.6)	-21.9	-69.0	-1.0	16.9	-34.2	73.1	-3.5	-32.0	3.8
Rice Net seller	16 (5.7)	14.7	2.0	40.0	12.5	-10.0	54.0	0.8	-7.0	8.4
Maize Net seller	253 (90.3)	101.7	5.1	312.7	-4.6	-37.8	64.7	-6.5	-49.8	42.5
Rice+Maize All HH	280 (100)	82.9	-46.0	290.5				-7.4	-64.0	42.5

To assess the full impact of price changes on 2006-2008 net income it is also crucial to take into account input use and input costs. While overall input prices showed a modest increase in 2007 (-3.5% for seeds, and 7.9% for fertilizers), they increased greatly in 2008 both for seeds (25.2%) and fertilizers (63.0%) (Table 2). Thus, the strong increase in maize income (59.9%) in 2007

<sup>2</sup> Test: Friedman's Anova followed by Wilcoxon-signed-rank test corrected for familywise  $\alpha$ -error.

Consumer prices: N=119, significance level: P <0.01, Producer prices: N=11; significance level: P<0.01 (2007), not significant (2008)

<sup>3</sup> P<0.01: One-way repeated-measures ANOVA corrected for familywise  $\alpha$ -error, N=249.

<sup>4</sup> Absolute price ranges for maize were similar for 2007 (1500-4500 VND kg<sup>-1</sup>) and for 2008 (1470-4000 VND kg<sup>-1</sup>).

<sup>5</sup> The mean NBR of 102% for maize results from measurement. Total household income was measured in the form of total household expenditures, while maize income was measured directly (gross margin). According to KEIL et al. (2008) maize income constitutes 65% of total household cash income (figures for 2007, same sample households).

relative to 2006 can be mostly ascribed to the massive increase in maize prices that year, while the large decline (25%) in maize income in 2008 relative to 2007 was mainly attributable to considerably higher input costs rather than to the decrease of output prices in 2008, given that input levels for maize are very high in the research area (i.e. 907.6 kg ha<sup>-1</sup> of fertilizers in 2008) (Table 2). Hence, maize income fluctuations in the period 2006 to 2008 were substantial.

**Table 2: Maize production and maize income development 2006 – 2008**

	Production <sup>1</sup>					Income <sup>2</sup>	
	Seed <sup>3</sup>		Fertilizer <sup>3</sup>		Yield <sup>3</sup>	Gross margin <sup>3,4</sup>	Change
	Kg ha <sup>-1</sup>	'000 VND <sup>5</sup> kg <sup>-1</sup>	Kg ha <sup>-1</sup>	'000 VND kg <sup>-1</sup>	Kg ha <sup>-1</sup>	'000 VND ha <sup>-1</sup>	(hh-level) %
2006	20.3 <sup>a</sup>	22.8	659.7 <sup>a</sup>	2.8	6,099.7 <sup>a</sup>	10,842.5 <sup>a</sup>	
2007	21.4 <sup>b</sup>	24.6	741.5 <sup>b</sup>	2.7	6,784.9 <sup>b</sup>	15,885.6 <sup>b</sup>	+ 59.9
2008	22.4 <sup>b</sup>	30.8	907.6 <sup>c</sup>	4.4	7,232.5 <sup>c</sup>	11,371.9 <sup>a</sup>	- 24.6

<sup>1</sup> Amount of seed and fertilizer used, and yield based on plot level data (N=206), seed and fertilizer prices based on district level data

<sup>2</sup> Based on household level data (N=221), 2006 uses area information [ha] from 2007

<sup>3</sup> a,b,c P < 0.05; Friedman's ANOVA followed by individual Wilcoxon signed-rank tests / One-way-repeated measures ANOVA, corrected for familywise  $\alpha$ -error

<sup>4</sup> Deflated by the Consumer Price Index (GSO, 2009)

<sup>5</sup> Vietnamese Dong. 1 US\$ = 18,857 VND (November 2009)

Nevertheless, few of the households affected by maize income decline in 2008 (10.2%) applied specific post-shock measures to deal with maize income depression (e.g. taking a loan, sale of assets or temporary wage employment). Instead, most households affected by maize income decrease either did nothing (88%) or postponed the purchase of a larger, durable consumption or investment good (14.7%). The most likely explanation is that households experienced an above average income situation in 2007 rather than an income shock in 2008, which is also confirmed by the results from the regression analysis (see below). However, households did respond to differences in maize prices by adjusting the time of maize sale. Since maize prices showed an increasing trend over the harvest season (mid of August to end of December) in 2006 and 2007 households gradually moved their time of sale from October (when most households sold in 2006) to November (when most households sold in 2008). Consequently, the time between onset of harvest and time of maize sale also increased from 3.4 weeks in 2006 to 5.8 weeks in 2008.<sup>6</sup>

Assessing households' resilience to maize income decline, the regression results show that the 2008 maize income depression did not translate into decreased consumption expenditures compared to the previous year (Table 3). On the contrary, despite decreasing household income (-21%) consumption expenditures increased by 20% in the post-harvest season (Jan-Apr) 2009 relative to 2008.<sup>7</sup> The tendency of consumption expenditure development can be viewed as plausible, since the absolute level of maize income in 2008 equaled the absolute level of maize income in 2006 (Table 2). Hence, the post-harvest season in 2009 could reflect a normal year with

<sup>6</sup> P < 0.05; Friedman's ANOVA followed by individual Wilcoxon signed-rank tests corrected for familywise  $\alpha$ -error, (N= 245)

<sup>7</sup> Income and expenditures are deflated by the Consumer Price Index (GSO, 2009)

normal consumption levels. Furthermore, increased maize income in 2007 might not have translated into higher regular consumption expenditures in the post-harvest season 2008 (such as food, clothing and health) as elicited in this study<sup>8</sup>, but rather increased extraordinary expenditures such as durable consumption or investment goods (e.g. television sets, livestock or motorbikes) and savings. This reasoning conforms to the most important (and almost exclusive) coping strategy cited by households, namely the ‘postponement of purchases of assets’. The magnitude of the consumption expenditure increase in 2009 should be interpreted with caution as it could be attributable to perception bias caused by high inflation rates experienced in 2008 (i.e. 23%, GSO 2009) and by difficulties in getting precise expenditure data based on recall<sup>9</sup>.

**Table 3: OLS Regression results**

	Variable	Mean	Coefficient
Dependent	% Change consumption expenditures Jan-Apr 2009 / 2008	20.02	
Hazard proxies	% Change total household income 2008 / 2007	-21.14	0.06
	Dummy, 1= non maize selling household	0.08	40.70*
Individual shocks	Positive / negative income shocks ( mill VND)	-0.53	0.68
	Nb weddings	0.26	9.66*
	Nb deaths (dependent member)	0.06	59.89**
	Nb deaths (working member)	0.02	-18.67**
	Days sick (dependent member)	2.92	-0.39**
	Days sick (working member)	2.90	0.38
	Dummy, 1= crop failure	0.41	19.28**
Asset based proxies	Minutes to Yen Chau on motorbike	43.79	0.15
	Nb alternative marketing partners maize	3.36	1.51
	Total cultivated land per capita ('000 m <sup>2</sup> )	3.48	-3.70**
	Labor capacity	0.18	42.60
	Nb organizations per adult	1.50	7.14
Constant			-12.64
Diagnostics	N = 287 F(14,272) = 2.27 *** R2 = 0.18 ***, (**), [*] P < 0.01, (0.5), [0.1]		

Following this explanation, the asset base of a household consequently did not impact on the stabilization of consumption expenditures. Only for households owning a large amount of land was the relationship with consumption expenditures negative (-4 percentage points) which can be attributed to the fact that households with more land also have a larger share of maize income in total household income.<sup>10</sup> The impact of maize share in household income was therefore not completely neutral, which is also confirmed by the positive regression coefficient for the non-maize selling households (e.g. households with other agricultural-based activities like pig

<sup>8</sup> The full set of expenditure categories asked include: food categories (rice, other cereal products, animal products, oils, condiments, snacks and alcohol), clothing, health, education, utilities and housing, social and family events, and fuels. The design of the expenditure module was based on the Living Standards Measurement Surveys (LSMS).

<sup>9</sup> Data on consumption expenditures for Jan-Apr 2008 were asked by recall in May/June 2009, relative to expenditures in Jan-Apr 2009 and by category as mentioned in footnote 8

<sup>10</sup> Spearman coefficient 0.27; P<0.01

production, with off-farm employment such as government jobs, trading etc.). Non-maize selling households did comparatively better by increasing consumption expenditures an additional 41 percentage points as compared to their maize selling counterparts.

Another significant effect on household consumption expenditures was exercised by individual shocks. Expensive social events increased consumption expenditures (i.e. weddings by 10 percentage points and funerals by 60 percentage points), while the death of a working member decreased consumption expenditures by 19 percentage points, probably due to the decrease of available working power for income generation. Crop failure increased consumption expenditures by 19 percentage points. This effect can be attributed to rice crop failure, since it forces households to purchase rice on the market during the hungry season (Jan-Apr) which exactly matches the base period of our expenditure data.

## Conclusions

Although in this instance households were found to be resilient to the maize income depression, the high degree of specialization on maize production has to be viewed as a relatively risky strategy given the high levels of input requirements coupled with fluctuating input and output prices. Therefore, policies should focus on mitigating the effects of price fluctuations such as strengthening formal rural finance institutions to reduce farmers' dependency on expensive informal in-kind input credit, to support consumption loans if needed and to further support the establishment and improvement of maize storage facilities as well as enhancing maize market integration to improve maize prices for farmers. In the longer run policies should also foster income diversification to reduce households' dependency on maize income and to improve the ecological sustainability of the farming system which suffers from severe soil erosion.

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