Multiple Shocks and Vulnerability of Chinese Rural Households

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Rural households are exposed to high degree of vulnerability. This paper examines how Chinese rural households are exposed to shocks, what ex-post coping strategies are employed, and how shocks affect households' welfare, using survey on a variety of shocks and household consumption from the China Rural Social Protection Survey. In addition, we explore the impacts of shocks under multiple shocks. We found that households who experienced only health shocks have higher medical expenditures than those who experienced both agricultural and health shocks, suggesting that insurance schemes in rural China are not functioning enough. Experiencing multiple shocks simultaneously is not a rare incident in rural China. This paper address the need for adequate insurance schemes in these areas of China.

Key Words: Vulnerability, Risk Coping Strategies
JEL classification: O12

1. Introduction

Rural households in China, as those in other developing countries are exposed to a variety of shocks, and their economic behaviors under shocks have been one of the important themes in development economics.[1] One strand of this literature is a test of full risk sharing which examines temporal or geographical correlates of consumption and income (Townsend, 1994). Testing risk sharing needs consumption and income measures, but detailed information on shocks is not required for the test. The other strand of literature focuses on a certain type of shock and examines changes in income, consumption, or savings due to shocks. Particular interest has been put on agricultural shocks using weather or rainfall data (Paxson, 1992; Dercon, 2004; Kazianga and Udry, 2006; Alderman, 2006) and on health shocks (Shultz and Tansel, 2002; Gertler and Gruber, 2002; De Weerdt and Dercon, 2006). However, except for Dercon, Hoddinott and Woldehanna (2005), relatively small weight has been put on understanding the relative impacts of various types of shocks on household welfare. Particularly, agricultural shocks and health shocks are different in frequency, magnitude of impacts and on the types of consumption the shocks affect. Dercon, Hoddinott and Woldehanna (2005) provides quantitative evidence on impacts of various types of self-reported shocks including agricultural and health shocks on consumption in rural Ethiopian villages where they found drought and illness shocks have negative impacts on per capita consumption. Using survey of rural Chinese households in four provinces, we investigate impacts of agricultural and health shocks on different kinds of consumption, and also examines whether the effect of shocks is additive when households are hit by both agricultural and health shocks simultaneously. We find there is an association between health-related shocks and non-medical consumption: food consumption is

[1] Morduch (1995) provides extensive survey on income and consumption smoothing under a variety of shocks

negatively associated with health shocks in the province of Zhejiang. Durable consumption is also negatively related with health shocks in three of four provinces. Impacts of agricultural shocks on various consumption measures was not found, but there is a difference in medical expenditure between those who had only health shocks and those who experienced both agricultural and health shocks, indicating those who were hit by the combination of health and agricultural shocks are not insured enough to spend in the necessary medical expenditure. Being hit by the two types of shocks is not rare in rural China: 6 to 7 percent of households in Guangxi or Gansu provinces report they are hit by both agricultural and health-related shocks within one year. These findings suggest the need to increase coverage of insurance schemes against both agricultural and especially health shocks in rural China.

The rest of this paper is organized as follows. We describe the data and background in section 2. Empirical strategies and estimation results on welfare impacts of agricultural and health-related shocks are discussed in section 3. Concluding remarks are provided in the final section.

2. Background and the China Rural Social Protection Survey

2.1. China Rural Social Protection Survey

The China Rural Social Protection Survey was conducted in 2004 as a part of World Bank project. The survey collected rural households' welfare measures such as types of consumption and household characteristics in four provinces of China: Zhejiang, Fujian, Guangxi and Gansu. The sample consists of 6400 households in 120 villages (60 townships and 12 counties). The selected provinces are geographically and economically different. Zhejiang province, one of the most economically advanced provinces located in

Eastern coast of China. Fujian province is next to Zhejiang province and is also a relatively wealthy province. Guangxi is a relatively poor autonomous region (27th out of 31 administrative divisions in terms of GDP per capita in 2006) which is located across the border of Vietnam. Gansu province is the poorest of the four surveyed provinces (30th out of 31 administrative divisions) located in the northern part of China.

Descriptive statistics shown in Table 1 indicates the relative economic development of four provinces. Households in Zhejiang province have about 70 percent higher total expenditure per capita than those in the rest of the provinces. There are also wide differences in food expenditure per capita across provinces. However, medical expenditure per capita is not as different as total expenditure: it ranges between 610 RMB in Zhejiang and 412 RMB in Guangxi. In addition to various consumption measures, a wealth level index is constructed from the various housing characteristics such as water and toilet access and conditions of wall and roofs, which are less likely to change due to shocks.

The survey questionnaires also contain information on the various types of shocks which occurred in 2004 such as perceptions on the severity of the impacts on income and households' shock coping strategies. Household members are asked if they have experienced shocks in the year of 2004.[2] If the household have experienced any of shocks, then the magnitude of the impacts on income and their coping strategies against shock were documented.[3] Table 2 summarizes the frequency of various types of shocks by magnitude of impacts, indicating that not only the socio economics characteristics but also frequencies of shocks vary across provinces significantly. Very few agricultural

[2] A list of shocks are as follows: household member got married, gave birth to a child or adopted a child, household working member died, household dependents died, crop failure, livestock died, household member got unemployed, household property was lost, such as burglary, household working member had a major illness, and household dependents had a major illness.

[3] Households are asked to indicate whether the shock had no influence in their income, slightly decreased income, or significantly decreased income.

shocks are observed in Zhejiang or Fujian provinces whereas 67 percent of households in Guangxi and 26 percent of households in Gansu provinces experienced agricultural shocks. One third of households in Guangxi and one fifth of households in Gansu report crop failure significantly decreased their income. Even though the difference in occurrence of health-related shocks is not as stark as that of agricultural shocks, households in Fujian and Gansu provinces report higher incidence of health-related shocks than those in Zhejiang and Fujian provinces. 6 percent and 9 percent of households in Guangxi and Gansu provinces report the illness of working members decreased their income significantly. Panel B of Table 2 reports the frequency of multiple shocks among households. About a half of households in Guangxi and 40 percent of households in Gansu who experienced health-related shock were also hit by agricultural shocks as well. The ratio is higher when less severe shock is included. Since there is almost no agricultural shock and very low likelihood of death in household members in Zhejiang and Fujian, these two provinces do not exhibit multiple shocks. Based on these facts, we restrict to households in Guangxi and Gansu provinces for analyzing multiple shocks.

Table 3 presents the fraction of villages where at least one household reported each shock across provinces, showing geographic concentration of agricultural shocks. Given the high frequency of crop failure in Guangxi, there is at least one household who experienced a shock in all villages, but there is some evidence of geographic concentration of shocks in Gansu: 18 percent of households report crop failure but there are 30 percent of villages where no household experiences this shock. Health-related shock seems to be more uniformly distributed across villages than agricultural shocks. These facts provide rationale for village-level fixed effects in empirical analysis.

Table 4 presents correlations among shocks and wealth index. In Guangxi, where 67 percent of all households reported at least the occurrence of crop failure and a little

less than half of those said the shock severely decreased income, agricultural shocks at any level are not correlated with wealth level, but severe shocks are negatively and significantly correlated with wealth level. This result reflects ability to mitigate the impact of agricultural shocks through coping strategies such as crop diversification (Binswanger and Rosenzweig, 1993; Kurosaki and Fafchamps, 2002) or they may be able to increase labor supply to smooth income (Kochar, 1999).

Turning to correlation among shocks, we observe a positive correlation between agricultural shocks and illness of household working members in Guangxi and Gansu.[4] To examine the correlation, we estimate a linear probability model of reporting shocks on household characteristics. For reporting illness or death of household members, we also add agricultural shocks to the RHS variables in Guangxi and Gansu provinces. Specifically, we estimate the following simultaneous equations:

$$D_{iv}^{a} = \alpha^{a} + \beta^{a} X_{iv} + \eta_{v}^{a} + u_{iv} \quad (1)$$

$$D_{iv}^{h} = \alpha^{h} + \nu^{h} D_{iv}^{a} + \beta^{h} X_{iv} + \varsigma_{v}^{h} + \varepsilon_{iv} \quad (2)$$

where D_{iv}^{a} and D_{iv}^{h} are dummy variables for reporting agricultural shock and health-related shocks for household i in village v respectively. X_{iv} is a vector of household characteristics which affect the likelihood of reporting shocks: household head's age, gender, ethnicity, educational attainment, migration history, and marital status, household size, share of household members working on own agricultural business, own non-agricultural business, and working for others, distance to the nearest hospital, and wealth index. η_{v}^{j} and ς_{v}^{h} are village-level unobservable characteristics, and u_{iv} and ε_{iv} are household unobservable error terms. There is a problem of reverse causation in

[4] It could be because crop loss results in lower health investments and hence more likelihood of reporting health, or could be because illness could affect productivity of household members as argued by Strauss (1986). In this study, we treat agricultural shocks as exogenous shocks.

interpreting the coefficients of wealth level. Households report shocks which occurred in 2004 whereas the wealth index is constructed from housing characteristics as of interview date. Households might move to a different house or sell furniture to mitigate shocks, and changes the wealth index. However, as we describe later in this section, selling furniture or household property is not common coping strategy among rural households, and migration is not frequent in the sampled households, indicating the wealth level does not change after the shock. [5] We estimate two equations by seemingly unrelated regressions proposed by Zellner (1962). For Zhejiang and Fujian provinces, equation (1) is not estimated and a dummy of reporting agricultural shocks is excluded from equation (2). Results are shown in Table 5. Agricultural shocks are positively correlated with the likelihood of reporting illness of household working member in Guangxi and Gansu provinces. We observe high overlap between agricultural shocks and health shocks in Guangxi and Gansu. Contribution of wealth level to reporting agricultural shock is different across severity in Guangxi province. As wealth level increases by one standard deviation, the likelihood of reporting severe agricultural shocks decreases by 6.7 percents and reporting any level of agricultural shock is not sensitive to wealth level.[6]

2.2.Medical Insurance in Rural China

After the market oriented reforms in the early 1980s, the old and village-based rural medical insurance scheme, cooperative medical system (CMS), has collapsed, and

[5] Even though we do not have a measure of migration in the last year, households are asked if they have moved since 1995. Even for this long duration, 0.2 to 0.3 percent of household migrated in Zhejiang and Fujian, and about 1 percent of household moved in Guangxi and Gansu.
[6] Testing the null hypothesis that coefficients of wealth index for reporting agricultural shocks between these levels of severity yields, F-statistic of 5.37 (P-value = 0.0205).

coverage of medical insurance has decreased.[7] Empirical research have found that high medical expenditures are causing impoverishment in rural area. There have been a number of new county-based rural insurance schemes called New Cooperative Medical Scheme (NCMS) which the government aims at covering all rural counties by 2008. At the time of survey, the enrollment was not completed, with provincial differences in enrollment rates: Zhejiang (94.2 percent) and Gansu (89.9 percents) exhibit high enrollment rates whereas in Fujian (0.3 percent) and Guangxi (0.8 percent). Even for those who joined NCMS, limited coverage and high copayments restrict households' access to medical care.[8] Under these environments with incomplete medical insurance, households either have to resort to informal insurance mechanisms or squeezing non-medical consumption when they were exposed to health shocks.

2.3. Description of Shock Coping Strategies

The survey provides an opportunity to explore what kinds of ex-post shock coping strategies are adopted for each type of shock. For each shock households reported, they are asked five questions regarding income smoothing strategies: household member increased workload, worked for other households, found another local job, went out for work, and children were put to work. As for consumption smoothing, households are asked if they used up savings, ate stored grain, sold livestock, sold production tools, sold furniture, or sold other household property. Households are also asked if any household member went to live with their relatives or friends, anyone offered help in cultivating

[7] Liu et al (2003) reports that by 1998, insurance coverage for rural households was only 9.5 % of total expenditure, hence out of pocket payments constituted the majority of medical expenditure. Wang et al. (2005) notes 87 percent of farmers had to pay medical expenses in full amounts based on the 1998 China National Health Survey.

[8] There is the medical financial assistance program (MFA) which provides monetary supports to poor households. However, only 37 households from the sample succeeded in their application and 22 of these received positive amounts. About half of recipients report that their family members got sick in the past 6 months but did not seek medical treatment because of financial problems.

land or other production for free, if anyone took care of children or patients for free, if the household borrowed money, food or other items from anyone.[9] These questions are considered as consumption smoothing strategies via social networks. Table 6 shows evidence of reporting income smoothing by increasing workload: half of those who report the death or illness of household members increase their workload, while about a third of households increase their workload under crop failure. Consumption smoothing is more frequently reported than income smoothing strategies. As shown in Panel C, borrowing money from relatives without interest is the most widespread source of financial help. Friends are also an important source of financial help although borrowing from banks is slightly more frequent. This implies that there is a high degree of informal risk sharing without interest, and that the formal banking sector is not the only source of credit for those hit by shocks. We also observe household do not sell-off production tools (except for livestock) or household properties under shocks. That is, the housing characteristics do not vary much before and after the shocks. This is important to note because we constructed a wealth index from the households' housing characteristics and property to account for households' persistent income level. A large fraction of households report that they reduced food consumption under various types of shocks, indicating the shocks were not fully insured. However, as we show later, there is an association between food consumption and shocks in only Zhejiang province.

3. Impacts of Different Shocks on Various Types of Consumption

The previous section shows that there is heterogeneity in exposure to health and agricultural shocks among rural households in China. It also shows that households employ various ex-post shock coping strategies. In this section, we examine association between households' welfare and the exposure to shocks after the shock coping strategies

[9] They were asked who offered help from the list of relatives, friends, villagers, or others.

are adopted. We analyze correlation between different types of consumption and single shock, controlling for household characteristics. Then we estimate the association between consumption and multiple.

3.1. Single Shocks

Consider following estimation equation:

$$\ln C_{iv} = \alpha + \sum_j \nu^j D_{iv}^j + \beta X_{iv} + \eta_v + \varepsilon_{iv} \quad (3)$$

where $\ln C_{iv}$ is natural log of consumption per capita. We consider total consumption, food consumption, consumption of durable goods, and medical expenditure. Medical expenditure is defined as out of pocket payments, or total medical expenditure minus medical financial assistance and reimbursements from health insurance. Included household characteristics are household head's gender, age, ethnicity, educational attainment and marital status, household size, and wealth index. In this analysis, it is important to note that our estimation strategy relies on the assumption that households' characteristics including wealth levels capture counterfactual consumption levels.

Table 7 presents estimation results. First, agricultural shocks do not seem to be associated with any consumption measure in Guangxi and Gansu provinces. This finding is consistent with empirical research that reports failure to reject the permanent income hypothesis or full risk sharing under agricultural shocks. Medical expenditure is strongly correlated with illness of household members for all provinces, indicating health insurance schemes and financial assistance are not enough to cover the cost of health shocks. This positive relation contributes to the association between total consumption and health shocks. Even with the possibility of income losses when a working member is sick, households hit by a health shock increase overall expenditure, indicating that they must employ some types of coping strategies. Another question is whether households

squeeze different types of consumption to compensate the change in medical expenditure. Food consumption per capita is negatively correlated with illness of household working members only in Zhejiang province. The magnitude of the decrease is sizeable: the shock is associated with a 38 percent reduction in food consumption. A possible explanation for this result is that households in the other three provinces are relatively near subsistence levels so that they cannot reduce food consumption substantially whereas those in Zhejiang province have enough buffer to reduce food consumption. We also note that households reduce a sizeable portion of durable purchases because of health shocks. Those who reported illness of household working members in Zhejiang and Fujian provinces consume durables by 70 to 80 percent less. Those in Guangxi and Gansu provinces seem to consume a lower amount of durables even though the magnitudes are overall lower and not statistically significant.

As a robustness check, we explore differences in means of per capita consumption using the matching methods based on propensity scores proposed by Rosenbaum and Rubin (1983). We first construct propensity scores from the estimation equations (1) and (2) under the logit model, then we construct counterfactual consumption from the smoothed weights of the propensity scores. We compare these results to OLS results where we regress the level of consumption per capita instead of natural logs. The results are presented in Table 8, which is consistent with the previous OLS results. Also, the coefficients of shocks in the OLS regressions and estimates of Average Treatment for Treated are similar in magnitude as well as in statistical significance, providing more confidence in the previous regression results.

3.2. Multiple Shocks

Estimating associations between various shocks and types of consumption reveals that households with health shocks change their expenditure in non-medical items such

as food or durables whereas agricultural shocks do not seem to be associated with any measure of consumption. Our next exploration is how the exposure to multiple shocks is associated to consumption. We estimate the equation (3), except that we now categorize the dummy variables of reporting shocks as follows: no shocks (0), agricultural shocks only (1), death of household members only (2)[10], illness of household members only (3), agricultural shocks and death of household members (4), agricultural shocks and illness of household members (5), death and illness of household members (6), all shocks (7). Since we do not observe agricultural shocks in Zhejiang and Fujian provinces, we restrict this analysis to the samples in Guangxi and Gansu provinces. As shown in Table 2, the frequency of reporting multiple shocks is sizeable for shocks (1), (3), and (5), so we focus on consumption of these households, which is shown in Table 9. Reporting no shock is set as base. Again, experiencing agricultural shocks is not associated with changes in consumption. However, the positive association with medical expenditure is higher for households reporting only illness of household members compared to those who report an agricultural shock and illness (although the F-test of equality of coefficients between only health shock and both health and agricultural shocks cannot be rejected in both provinces, p-value = 0.14 in Guangxi and 0.13 in Gansu). This indicates that agricultural shocks are not insured enough to allow households to cover their health expenditures. This finding should be taken seriously given the fact that a similar fraction of households report both shocks and only illness of household members in Guangxi (3.3 percent and 3.2 percent). In Gansu, 6.4 percent of households report both shocks and 4.1 percent of households report illness of household members. Consumption of durables is negatively associated with shocks in a few cases: reporting only illness or death of household members in Gansu, and reporting agricultural shocks and death of

[10] We combine the death of a working member and dependents to have more variation in covariates. Similar treatment is done for illness of household members.

household members and reporting all shocks in Guangxi.

4. Concluding Remarks

Chinese rural households are exposed to various types of shocks, just like other rural households in developing countries. In two of the four provinces where the China Rural Social Protection Survey was conducted, sizeable fraction of households reported they experienced crop failure or loss of livestock. Health shocks are less frequent but relatively evenly distributed across provinces. This survey and other empirical literature find health insurance scheme does not fully insure medical expenditures, indicating households have to employ income or consumption smoothing strategies. The possible losses of labor income together with the increase in medical expenditure may have impacts on non-medical consumption. This paper examines who are more likely to be exposed to shocks, what ex-post coping strategies are adopted, and how much of the welfare impact of these shocks remains after these coping strategies are taken. Especially, the rich information on experiencing shocks from this survey allows us to examine if there are differences between households who experience single shock and those who reported multiple shocks.

An increase in medical expenditure from health shocks forces households to reduce their non-medical expenditure: consumption of durables is negatively associated with health shocks in the two relatively richer provinces; food consumption has a similar tendency for the households in the richest province. The positive association between medical expenditure and health shocks is higher for those who do not report agricultural shocks than for those who reported them, indicating that agricultural shocks are not insured well enough to cover the cost of medical expenditure. Experiencing both health and agricultural shocks is not a rare incident in rural China. These findings document the need for well-functioning health insurance schemes, especially areas where

households are vulnerable to multiple shocks.

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Table 1: Descriptive Statistics of Sampled Households

	Zhejiang		Fujian		Guangxi		Gansu		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Hh size	3.69	1.31	4.11	1.59	4.52	1.67	4.60	1.40	4.26	1.55
Hh head's age	53	12	52	14	48	12	46	12	49	13
Hh head is male	95%	22%	94%	23%	91%	28%	97%	17%	94%	23%
Migration since 1995	1%	18%	1%	19%	2%	19%	3%	29%	2%	22%
Electricity access	100%	6%	99%	9%	99%	8%	100%	4%	100%	7%
Wealth index	0.94	0.65	0.31	0.83	-0.09	0.69	-0.91	0.67	0.00	0.97
Total expenditure	17,262	32,881	11,342	11,919	9,488	9,784	9,564	10,523	11,657	18,361
Total expenditure per capita	4,922	10,635	3,111	5,018	2,163	1,920	2,193	2,334	3,001	5,873
Hh food consumption per capita	2,123	1,621	1,432	1,285	1,031	790	888	671	1,327	1,215
Hh nonfood daily consumption per capita	1,248	3,468	629	1,664	460	1,127	424	1,047	663	2,011
Medical expenditure per capita	610	2,148	525	4,170	412	995	538	1,777	517	2,497
Education per capita	234	489	114	303	87	263	165	358	147	362
Purchasing durable goods per capita	417	9,600	144	582	70	222	60	233	161	4,519
Utilities per capita	233	223	235	535	82	164	84	186	152	317

Source: Author's calculations from data defined in Section 2.

Table 2: Fraction of Households Experiencing the Shocks

Panel A: Frequency of Shocks

	All shocks					Less severe or no impact					Severe shocks				
Shocks	Zhejiang	Fujian	Guangxi	Gansu	Total	Zhejiang	Fujian	Guangxi	Gansu	Total	Zhejiang	Fujian	Guangxi	Gansu	Total
Hh working member died	1.1%	0.5%	0.8%	1.0%	0.8%	1.1%	0.4%	0.8%	1.0%	0.8%	0.6%	0.3%	0.7%	0.5%	0.5%
Hh dependants died	0.3%	0.6%	1.5%	1.2%	0.9%	0.2%	0.5%	1.3%	1.1%	0.8%	0.0%	0.3%	1.0%	0.7%	0.5%
Crop failure	0.9%	1.4%	67.2%	26.2%	25.9%	0.9%	1.1%	63.3%	25.0%	24.4%	0.0%	0.4%	28.2%	18.2%	12.7%
Livestock died	0.2%	0.2%	23.5%	3.0%	7.3%	0.2%	0.2%	17.9%	2.6%	5.6%	0.0%	0.1%	5.6%	1.1%	1.8%
Hh working member had a major ill	4.1%	3.1%	7.7%	12.0%	7.0%	3.2%	2.5%	7.3%	11.1%	6.3%	1.2%	1.3%	5.8%	8.6%	4.5%
Hh dependants had a major ill	0.7%	0.5%	2.8%	4.3%	2.2%	0.6%	0.3%	2.6%	4.1%	2.0%	0.2%	0.1%	1.3%	2.9%	1.2%
Observation	1277	1335	1537	1528	5677	1277	1335	1537	1528	5677	1277	1335	1537	1528	5677

Panel B: Frequency of Multiple Shocks

	All shocks					Less severe or no impact					Severe shocks				
	Zhejiang	Fujian	Guangxi	Gansu	Total	Zhejiang	Fujian	Guangxi	Gansu	Total	Zhejiang	Fujian	Guangxi	Gansu	Total
(0) no shock	92.8%	93.8%	26.2%	62.9%	66.8%	94.0%	95.1%	31.2%	64.9%	69.3%	98.1%	97.6%	65.1%	74.5%	82.6%
(1) crop failure or livestock died	0.9%	1.6%	62.0%	20.1%	22.9%	0.9%	1.3%	57.8%	19.2%	21.4%	0.0%	0.5%	26.6%	13.9%	11.1%
(2) death of hh member	1.3%	1.0%	0.7%	1.2%	1.1%	1.2%	0.8%	0.6%	1.1%	0.9%	0.6%	0.6%	0.9%	0.7%	0.7%
(3) illness of hh member	4.8%	3.6%	2.4%	8.9%	5.0%	3.7%	2.8%	2.4%	8.5%	4.5%	1.4%	1.4%	3.3%	6.4%	3.3%
(4) combination of (1) and (2)	0.2%	0.0%	1.1%	0.7%	0.5%	0.2%	0.0%	1.1%	0.7%	0.5%	0.0%	0.0%	0.5%	0.3%	0.2%
(5) combination of (1) and (3)	0.0%	0.0%	7.2%	5.9%	3.5%	0.0%	0.0%	6.6%	5.4%	3.3%	0.0%	0.0%	3.2%	4.1%	2.0%
(6) combination of (2) and (3)	0.0%	0.0%	0.1%	0.2%	0.1%	0.0%	0.0%	0.1%	0.2%	0.1%	0.0%	0.0%	0.1%	0.2%	0.1%
(7) combination of (1), (2), and (3)	0.0%	0.0%	0.3%	0.1%	0.1%	0.0%	0.0%	0.2%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%

Source: Author's calculations from data defined in Section 2.

Table 3: Fraction of Villages where Hh Experienced the Shocks

Panel A: Frequency of Shocks

	All shocks					Less severe or no impact					Severe shocks				
Variable	Zhejiang	Fujian	Guangxi	Gansu	Total	Zhejiang	Fujian	Guangxi	Gansu	Total	Zhejiang	Fujian	Guangxi	Gansu	Total
Hh working member died	37%	27%	33%	53%	38%	37%	23%	30%	53%	36%	17%	20%	27%	37%	25%
Hh dependants died	13%	27%	50%	40%	33%	10%	23%	43%	37%	28%	0%	10%	37%	23%	18%
Crop failure	27%	33%	100%	93%	63%	27%	30%	100%	90%	62%	0%	17%	100%	70%	47%
Livestock died	7%	10%	100%	53%	43%	7%	10%	100%	50%	42%	0%	7%	83%	33%	31%
Hh working member had a major ill	87%	77%	97%	100%	90%	77%	70%	97%	100%	86%	50%	50%	93%	100%	73%
Hh dependants had a major ill	27%	17%	77%	90%	53%	23%	13%	77%	87%	50%	7%	3%	53%	83%	37%

Panel B: Frequency of Multiple Shocks

	All shocks					Less severe or no impact					Severe shocks				
	Zhejiang	Fujian	Guangxi	Gansu	Total	Zhejiang	Fujian	Guangxi	Gansu	Total	Zhejiang	Fujian	Guangxi	Gansu	Total
(1) crop failure or livestock died	30%	40%	100%	90%	65%	30%	37%	100%	87%	63%	0%	20%	100%	67%	47%
(2) death of hh member	43%	47%	30%	50%	43%	40%	40%	23%	47%	38%	17%	30%	37%	37%	30%
(3) illness of hh member	87%	80%	77%	93%	84%	80%	77%	77%	93%	82%	57%	53%	83%	93%	72%
(4) combination of (1) and (2)	7%	0%	47%	20%	18%	7%	0%	43%	20%	18%	0%	0%	20%	10%	8%
(5) combination of (1) and (3)	0%	0%	93%	63%	39%	0%	0%	93%	50%	36%	0%	0%	87%	47%	33%
(6) combination of (2) and (3)	0%	3%	7%	7%	4%	0%	3%	7%	7%	4%	0%	0%	7%	7%	3%
(7) combination of (1), (2), and (3)	0%	0%	13%	7%	5%	0%	0%	10%	7%	4%	0%	0%	7%	3%	3%

Source: Author's calculations from data defined in Section 2.

Table 4: Correlation among Income, Wealth Level and Shocks

	All shocks					Less severe or no impact					Severe shocks				
	Wealth index	Agrcultural shock	Death of hh working member	Illness of hh working member	Death of hh dependents	Wealth index	Agrcultural shock	Death of hh working member	Illness of hh working member	Death of hh dependents	Wealth index	Agrcultural shock	Death of hh working member	Illness of hh working member	Death of hh dependents
Zhejiang															
Agrcultural shock	-0.03					-0.03					.				
	0.35					0.35					0.00				
Death of hh working	-0.03	-0.01				-0.03	-0.01				-0.07	.			
member	0.25	0.70				0.25	0.70				0.01	0.00			
Illness of hh working	-0.12	-0.02	-0.02			-0.13	-0.02	-0.02			-0.12	.	-0.01		
member	0.00	0.44	0.43			0.00	0.49	0.48			0.00	0.00	0.75		
Death of hh	-0.02	0.27	-0.01	-0.01		-0.02	0.32	-0.01	-0.01		.	.	.	.	
dependents	0.43	0.00	0.83	0.67		0.43	0.00	0.86	0.74		0.00	0.00	0.00	0.00	
Illness of hh	0.00	-0.01	-0.01	-0.02	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.01	.	0.00	0.00	.
dependents	0.90	0.76	0.75	0.52	0.87	0.86	0.79	0.78	0.62	0.90	0.81	0.00	0.92	0.87	0.00
Fujian															
Agrcultural shock	-0.05					-0.04					-0.03				
	0.08					0.11					0.25				
Death of hh working	0.00	-0.01				-0.01	-0.01				0.00	-0.01			
member	0.89	0.72				0.82	0.77				1.00	0.85			
Illness of hh working	-0.10	-0.03	-0.02			-0.08	-0.02	-0.01			-0.09	-0.01	-0.01		
member	0.00	0.34	0.56			0.00	0.43	0.62			0.00	0.68	0.72		
Death of hh	0.00	-0.01	-0.01	0.03		0.02	-0.01	-0.01	0.04		0.00	0.00	0.00	-0.01	
dependents	0.87	0.72	0.83	0.23		0.59	0.77	0.85	0.11		0.95	0.89	0.91	0.80	
Illness of hh	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	0.00	0.01	0.00	0.00	0.00	0.00
dependents	0.81	0.76	0.85	0.61	0.85	0.84	0.82	0.89	0.71	0.89	0.64	0.94	0.95	0.89	0.96
Guangxi															
Agrcultural shock	0.01					-0.02					-0.10				
	0.83					0.34					0.00				
Death of hh working	-0.03	-0.01				-0.03	0.01				-0.03	0.05			
member	0.31	0.73				0.20	0.68				0.19	0.07			
Illness of hh working	-0.04	0.05	0.02			-0.04	0.07	0.03			-0.04	0.13	0.04		
member	0.12	0.07	0.36			0.15	0.01	0.26			0.10	0.00	0.08		
Death of hh	0.02	-0.02	0.05	0.01		0.02	-0.01	-0.01	0.02		0.02	-0.02	-0.01	0.03	
dependents	0.41	0.33	0.07	0.82		0.55	0.82	0.70	0.54		0.48	0.48	0.75	0.18	
Illness of hh	0.00	0.02	-0.02	0.06	0.05	0.01	0.02	-0.01	0.07	0.02	-0.02	0.02	-0.01	0.07	-0.01
dependents	0.99	0.46	0.53	0.03	0.06	0.80	0.47	0.56	0.01	0.41	0.47	0.42	0.70	0.01	0.66
Gansu															
Agrcultural shock	-0.41					-0.40					-0.41				
	0.00					0.00					0.00				
Death of hh working	-0.07	-0.02				-0.07	-0.02				-0.03	-0.03			
member	0.01	0.34				0.01	0.41				0.20	0.30			
Illness of hh working	-0.12	0.11	-0.03			-0.13	0.11	-0.03			-0.12	0.15	-0.03		
member	0.00	0.00	0.23			0.00	0.00	0.27			0.00	0.00	0.24		
Death of hh	-0.06	0.05	0.04	-0.01		-0.06	0.06	0.04	0.00		-0.05	0.04	0.08	0.03	
dependents	0.01	0.05	0.15	0.73		0.03	0.01	0.11	0.95		0.05	0.13	0.00	0.32	
Illness of hh	-0.02	-0.02	-0.03	0.13	0.00	-0.02	-0.01	-0.03	0.11	0.01	-0.03	0.05	-0.02	0.13	0.03
dependents	0.50	0.41	0.28	0.00	0.94	0.46	0.66	0.30	0.00	0.79	0.18	0.06	0.51	0.00	0.28

Source: Author's calculations from data defined in Section 2.

Table 5: Determinants of Reporting Shocks

	Zhejiang			Fujian			Guangxi			Gansu		
						Agricultural Shocks						
Magnitude of shocks	All	Less Severe	Severe	All	Less Severe	Severe	All	Less Severe	Severe	All	Less Severe	Severe
Wealth index							-0.017	-0.034	-0.066	-0.076	-0.081	-0.072
							(0.86)	(1.62)	(3.37)**	(3.74)**	(4.09)**	(4.32)**
Observations							1453	1453	1453	1375	1375	1375
R-squared							0.15	0.15	0.15	0.51	0.49	0.48
						Death of hh working member						
Magnitude of shocks	All	Less Severe	Severe	All	Less Severe	Severe	All	Less Severe	Severe	All	Less Severe	Severe
Wealth index	-0.004	-0.004	-0.010	0.002	0.002	0.002	-0.009	-0.009	-0.008	-0.012	-0.012	-0.007
	(0.71)	(0.71)	(2.05)*	(0.57)	(0.82)	(0.60)	(2.13)*	(2.18)*	(2.04)*	(1.83)+	(1.84)+	(1.39)
Agricultural Shocks							-0.004	-0.003	0.009	-0.007	-0.006	-0.004
							(0.57)	(0.40)	(1.54)	(0.71)	(0.70)	(1.82)+
Observations	1194	1194	1194	1228	1228	1228	1453	1453	1453	1375	1375	1375
R-squared	0.11	0.11	0.17	0.07	0.07	0.08	0.05	0.05	0.05	0.07	0.07	0.05
						Illness of hh working member						
Magnitude of shocks	All	Less Severe	Severe	All	Less Severe	Severe	All	Less Severe	Severe	All	Less Severe	Severe
Wealth index	-0.039	-0.038	-0.024	-0.026	-0.023	-0.013	-0.026	-0.026	-0.019	-0.009	-0.015	-0.023
	(3.13)**	(3.31)**	(2.90)**	(2.49)*	(2.58)*	(2.03)*	(2.22)*	(2.26)*	(1.77)+	(0.48)	(0.84)	(1.56)
Agricultural Shocks							0.020	0.035	0.066	0.056	0.050	0.065
							(1.30)	(2.46)*	(3.82)**	(1.83)+	(1.70)+	(2.04)*
Observations	1194	1194	1194	1228	1228	1228	1453	1453	1453	1375	1375	1375
R-squared	0.07	0.06	0.05	0.07	0.07	0.06	0.06	0.06	0.08	0.09	0.09	0.10
						Death of hh dependent						
Magnitude of shocks	All	Less Severe	Severe	All	Less Severe	Severe	All	Less Severe	Severe	All	Less Severe	Severe
Wealth index	-0.002	-0.002		-0.000	0.001	-0.001	0.003	0.002	0.001	-0.006	-0.007	-0.006
	(0.73)	(0.73)		(0.10)	(0.24)	(0.29)	(0.58)	(0.40)	(0.27)	(1.75)+	(1.87)+	(1.96)+
Agricultural Shocks							-0.006	-0.000	-0.003	0.001	0.012	0.009
							(0.72)	(0.02)	(0.50)	(0.10)	(1.19)	(0.94)
Observations	1194	1194		1228	1228	1228	1453	1453	1453	1375	1375	1375
R-squared	0.03	0.03		0.04	0.04	0.04	0.11	0.06	0.03	0.07	0.08	0.06
						Illness of hh dependent						
Magnitude of shocks	All	Less Severe	Severe	All	Less Severe	Severe	All	Less Severe	Severe	All	Less Severe	Severe
Wealth index	-0.004	-0.002	-0.002	0.001	-0.001	0.002	-0.006	-0.005	-0.007	-0.017	-0.015	-0.010
	(0.83)	(0.42)	(1.36)	(0.38)	(0.33)	(1.00)	(0.95)	(0.78)	(1.92)+	(1.52)	(1.34)	(1.00)
Agricultural Shocks							0.002	0.002	-0.003	-0.007	0.002	0.038
							(0.14)	(0.17)	(0.38)	(0.51)	(0.16)	(2.13)*
Observations	1194	1194	1194	1228	1228	1228	1453	1453	1453	1413	1413	1413
R-squared	0.04	0.03	0.03	0.06	0.03	0.04	0.05	0.03	0.03	0.02	0.03	0.03

Source: Author's calculations from data defined in Section 2.

Table 6: Descriptive Statistics on Consumption and Income Smoothing Strategies

Panel A: Consumption and Income Smoothing Strategies

		household working member died	household dependants died	crop failure	livestocks died	household working member had a major ill	hh dependants had a major ill
Income smoothing by working more	hh member increased workload	54%	41%	32%	16%	47%	51%
	hh member worked for other hh	18%	11%	6%	2%	14%	14%
	hh member find another job	7%	6%	7%	6%	7%	11%
	hh member went out for work	14%	30%	22%	15%	30%	33%
	children were made to work	12%	0%	3%	1%	5%	4%
	At lease one means of income smoothing	62%	55%	50%	31%	62%	67%
Consumption smoothing within hh	Use saving	50%	24%	7%	4%	41%	46%
	Eat stored grain	25%	25%	19%	8%	27%	28%
	Sell off livestock	15%	9%	8%	3%	14%	14%
	Sell off production tools	5%	2%	2%	1%	6%	2%
	Sell of furnitures	1%	0%	1%	0%	1%	3%
	Sell off other hh property	4%	0%	2%	1%	4%	4%
Consumption smoothing using network	hh member live in other hh	2%	7%	3%	2%	9%	7%
	other hh help production for free	20%	13%	7%	4%	17%	13%
	other hh help taking care of children	9%	5%	4%	2%	12%	10%
	borrow food or other things from other hh	19%	18%	21%	10%	23%	19%
	borrow money from other hh or bank	69%	62%	44%	24%	70%	67%
At lease one means of consumption smoothing		89%	78%	59%	33%	88%	88%
Subjective experience of cosumption smoothing	Children's schooling discontinued	2%	3%	1%	1%	4%	0%
	Eat cheap food	63%	51%	45%	43%	59%	58%
	Reduce hh food consumption to lowest level	38%	31%	25%	14%	37%	41%
	At least one of (2) and (3)	72%	51%	50%	44%	66%	65%

Panel B: Composition of lenders

	Relatives without interest	93%	89%	66%	68%	79%	86%
	Relatives with interest	0%	0%	1%	2%	5%	0%
	Friends witout interest	27%	38%	29%	34%	37%	30%
	Friends with interest	3%	0%	1%	1%	4%	1%
	Credit coope	0%	0%	1%	1%	0%	0%
	Bank	34%	35%	50%	41%	48%	45%
	Other wituout interest	0%	0%	2%	4%	2%	2%
	Other with interest	0%	0%	2%	4%	2%	0%

Source: Author's calculations from data defined in Section 2.

Table 7: Association between consumption per capita and shocks

	Zhejiang				Fujian			
	Total consumption	Food consumption	Purchasing durable	Medical expenditure	Total consumption	Food consumption	Purchasing durable	Medical expenditure
crop failure or livestock loss	0.000	0.000	0.000	0.000	-0.082	0.012	-0.461	-1.219
	(.)	(.)	(.)	(.)	(0.22)	(0.02)	(1.58)	(0.89)
death of hh working member	0.797	-0.172	-0.138	0.776	0.345	-0.011	-1.856	0.776
	(2.85)**	(0.51)	(0.16)	(0.65)	(1.84)+	(0.07)	(3.77)**	(0.69)
ill of hh working member	0.542	-0.374	-0.826	5.191	0.641	-0.027	-0.696	4.662
	(3.15)**	(2.65)**	(2.01)*	(11.83)**	(3.72)**	(0.22)	(2.07)*	(6.71)**
death of hh dependent memb	0.000	0.000	0.000	0.000	1.134	0.363	0.961	1.046
	(.)	(.)	(.)	(.)	(6.06)**	(1.12)	(0.85)	(0.60)
ill of hh dependent member	0.054	0.023	-1.678	4.241	-0.231	-0.618	-1.069	5.440
	(0.27)	(0.15)	(2.51)*	(8.46)**	(1.94)+	(5.22)**	(2.79)**	(9.91)**
Constant	8.853	7.990	1.168	3.086	7.538	7.043	0.482	1.819
	(39.53)**	(36.90)**	(1.55)	(3.00)**	(34.62)**	(28.29)**	(0.74)	(2.31)*
Observations	1226	1226	1226	1226	1413	1413	1413	1413
R-squared	0.23	0.18	0.11	0.13	0.25	0.21	0.09	0.23

	Guangxi				Gansu			
	Total consumption	Food consumption	Purchasing durable	Medical expenditure	Total consumption	Food consumption	Purchasing durable	Medical expenditure
crop failure or livestock loss	0.027	0.035	-0.117	0.158	0.044	0.058	0.118	-0.073
	(0.71)	(0.86)	(0.89)	(1.21)	(0.69)	(0.99)	(0.70)	(0.28)
death of hh working member	0.885	0.276	0.001	-0.180	0.185	-0.508	-0.421	0.462
	(3.55)**	(1.87)+	(0.00)	(0.22)	(0.93)	(1.70)+	(2.18)*	(0.63)
ill of hh working member	0.531	0.059	-0.141	2.128	0.397	-0.022	-0.205	2.422
	(7.32)**	(0.89)	(0.57)	(11.14)**	(5.49)**	(0.41)	(1.32)	(11.64)**
death of hh dependent memb	0.428	0.092	-0.731	0.039	0.616	0.134	0.892	1.876
	(3.27)**	(0.87)	(1.60)	(0.08)	(2.73)**	(0.71)	(0.84)	(3.09)**
ill of hh dependent member	0.440	0.016	-0.115	2.318	0.259	0.106	-0.078	2.214
	(3.54)**	(0.09)	(0.29)	(5.84)**	(2.26)*	(1.03)	(0.28)	(8.43)**
Constant	7.402	6.451	0.256	2.601	7.386	6.952	0.612	1.732
	(35.22)**	(24.06)**	(0.43)	(4.00)**	(32.28)**	(26.60)**	(0.93)	(2.17)*
Observations	1485	1485	1485	1485	1396	1396	1396	1396
R-squared	0.21	0.18	0.08	0.19	0.26	0.22	0.10	0.23

Source: Author's calculations from data defined in Section 2.
Dependent variables are in log (X + 1)

Included independent variables are: household head's gender, age, ethnicity, educational attainment (dummy for each level) and marital status, household size, and wealth index constructed from the characteristics of houses.

Table 8: Comparison between OLS and Difference in Means from Propensity Score Matching

	Guangxi					
	Total consumption		Food consumption		Medical expenditure	
	OLS	ATT	OLS	ATT	OLS	ATT
agricultural shock	59.109	112.35907	-0.473	-44.31298	-13.291	69.535366
	(0.55)	(0.93)	(0.01)	(0.97)	(0.26)	(1.22)
illness of hhold working member	1,473.447	1562.4989	36.681	80.672759	1,193.595	1159.9475
	(4.10)	(4.19)	(0.47)	(0.67)	(6.07)	(6.67)
illness of hhold dependent member	1,013.867	1225.0026	21.403	12.553756	1,100.828	1296.1068
	(2.12)	(2.2)	(0.17)	(0.09)	(2.35)	(2.7)
	Gansu					
	Total consumption		Food consumption		Medical expenditure	
	OLS	ATT	OLS	ATT	OLS	ATT
agricultural shock	-300.146	-666.7593	-16.809	-14.24654	-367.878	-666.4682
	(1.16)	(1.94)	(0.20)	(0.16)	(1.60)	(2.24)
illness of hhold working member	1,623.162	2017.5231	-45.111	-67.1783	1,706.421	2111.5721
	(3.24)	(3.96)	(0.91)	(1.28)	(3.46)	(4.26)
illness of hhold dependent member	565.519	1531.5521	112.146	6.557889	673.303	1597.2541
	(1.55)	(2.81)	(1.06)	(0.07)	(1.84)	(3.00)

Source: Author's calculations from data defined in Section 2.

Table 10: Association between Consumption per Capita and Shocks (Multiple Shocks)

	Guangxi				Gansu			
	Total conumption	Food consumption	Purchasing durable	Medical expenditure	Total conumption	Food consumption	Purchasing durable	Medical expenditure
(1) crop failure or livestock die	0.044	0.044	-0.099	0.220	0.030	0.039	0.094	-0.041
	(1.09)	(1.02)	(0.72)	(1.58)	(0.45)	(0.62)	(0.55)	(0.15)
(2) death of hh member	0.717	0.267	-0.632	-0.415	0.413	-0.322	-0.419	0.611
	(3.58)**	(2.55)*	(1.49)	(0.72)	(1.88)+	(1.16)	(2.24)*	(0.95)
(3) illness of hh member	0.583	0.032	-0.092	2.713	0.451	-0.043	-0.408	2.942
	(7.31)**	(0.33)	(0.28)	(13.25)**	(5.11)**	(0.73)	(2.45)*	(13.27)**
(4) shocks (1) and (2).	0.403	-0.004	-0.971	0.441	0.698	0.126	2.321	2.131
	(2.00)*	(0.02)	(5.02)**	(0.43)	(3.06)**	(0.39)	(1.28)	(2.04)*
(5) shocks (1) and (3)	0.588	0.106	-0.450	2.269	0.373	0.095	0.159	2.322
	(5.20)**	(1.18)	(1.57)	(9.00)**	(3.80)**	(0.99)	(0.56)	(7.00)**
(6) shocks (2) and (3)	0.596	-0.007	2.304	1.257	0.318	0.025	-0.694	3.647
	(2.49)*	(0.04)	(0.98)	(1.35)	(1.43)	(0.15)	(1.45)	(7.90)**
(7) shocks (1), (2) and (3)	1.255	-0.017	-0.945	3.666	0.000	0.000	0.000	0.000
	(4.32)**	(0.09)	(3.28)**	(4.31)**	(.)	(.)	(.)	(.)
Constant	7.379	6.447	0.397	2.557	7.378	6.927	0.594	1.398
	(34.30)**	(23.70)**	(0.65)	(3.93)**	(32.62)**	(26.68)**	(0.90)	(1.77)+
Observations	1467	1467	1467	1467	1396	1396	1396	1396
R-squared	0.21	0.18	0.08	0.19	0.26	0.22	0.10	0.24

Source: Author's calculations from data defined in Section 2.

Robust t statistics in parentheses

+ significant at 10%; * significant at 5%; ** significant at 1%

Dependent variables are in log (X + 1)

Included independent variables are: household head's gender, age, ethnicity, educational attainment (dummy for each level) and marital status, household size, and wealth index constructed from the characteristics of houses.