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Are the poor less well insured? Evidence on vulnerability to income risk in rural China

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Abstract

We test how well consumption is insured against income risk in a panel of sampled households in rural China. The risk insurance models are estimated by Generalized Method of Moments treating income and household size as endogenous. Partial insurance is indicated for all wealth groups, although the hypothesis of perfect insurance is universally rejected. The rejection of full insurance is strongest for the poorest wealth decile, with 40% of an income shock being passed onto current consumption. By contrast, consumption by the richest third of households is protected from almost 90% of an income shock. The extent of insurance in a given wealth stratum varies little between poor and non-poor areas.

JEL classification: D91; O16; Q12

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1. Introduction

The literature on risk and insurance in poor rural economies has established three stylized facts: (i) income risk is pervasive; (ii) household behavior is geared in part to protecting consumptions from such risk; and (iii) the mechanisms of

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doing so are both private and social, the latter comprising various informal risk-sharing arrangements amongst two or more households. [1] Drawing on an even larger literature, and ample casual observations, there is a fourth stylized fact of relevance: households are not all equally poor within poor rural economies.

Motivated by these stylized facts, this paper asks: Do existing arrangements for consumption insurance within poor rural economies work better for some wealth groups than others? Various arguments can be made on a priori grounds, though pointing in different directions. Poorer households are likely to be more averse to risk, and hence more keen to insure against it. Yet they are also more likely to be rationed in access to credit and insurance, to the extent that the likelihood of poor households defaulting on agreements made for repayment or reciprocation will be deemed more than for the non-poor. While the poorest may have the highest notional demand for insurance, it is an open question whether it will be adequately supplied.

That question is of interest for a number of reasons. Governments and nongovernmental organizations have implemented various programs to reduce the riskiness of rural incomes; examples include seasonal public works, credit schemes, buffer stocks, and crop insurance schemes. [2] The stated aim of such schemes is often to provide insurance for the poor. The premise is that poor households and communities are unable to insure themselves adequately without such schemes. Is that right? And are the non-poor in these settings any better insured than the poor? If not, then the non-poor may be just as likely as the poor to take advantage of such programs (which may dilute targeting, although with possible gains to the poor through broader political support for the program). A better understanding of these aspects of indigenous self-insurance and risk-sharing arrangements should help inform public action.

The answer may also hold insights into longer-term development issues. It is well recognized that risk-market failures discourage productive but risky investments, with potential implications for distributional dynamics as well as aggregate growth. [3] In particular, if it is the case that the poor bear the brunt of persistent credit and risk-market failures, the poor will be less likely to participate in growth. We will expect to see less growth, and worsening distribution in a growing economy. Thus wealth effects on exposure to uninsured risk can have important

[1] Reviews of the theory and evidence on these points can be found in Alderman and Paxson (1992), Deaton (1992), Fafchamps (1992), Townsend (1994, 1995a), Morduch (1995), and Besley (1995).

[2] For an overview of the policies and programs which aim to provide a rural safety net in poor countries, see section 6 of Lipton and Ravallion (1995).

[3] For an exposition of this argument, see Eswaran and Kotwal (1989). On the implications for growth and distribution, see Aghion and Bolton (1992) and Bénabou (1996), and references therein. For evidence (for India) that uninsured risk influences poor people's investment decisions, see Rosenzweig and Binswanger (1993), Rosenzweig and Wolpin (1993), Morduch (1993) and Chaudhuri (1995).

implications for the rate of poverty reduction. We do not directly address this issue here, but only note it as one possible implication of our results.

We investigate the extent of consumption insurance in post-reform rural China, using a household-level panel data set from four contiguous southern provinces spanning the period, 1985–1990. The study area mirrors the sizeable disparities in levels of living currently found in rural China; three of the four provinces (Guangxi, Yunnan and Guizhou) make up one of the poorest regions in the country, while the fourth is the prosperous coastal province of Guangdong. [4] Under the 1978 reforms, China's commune system of production was discontinued, and decision-making authority was transferred back to farm-households. While both institutional and non-institutional credit to the new farm-household sector appears to have expanded since the reforms, it is widely believed that rural credit markets still remain highly imperfect. [5] Even by the standards of poor rural economies, credit markets appear to be under-developed in rural China. Formal financial institutions seem uncommonly reticent to lend to poor people, particularly in remote rural areas, and there is little sign of the village money lenders that one finds throughout South Asia.

In previous work, we found that a large share of the poverty observed at any one date in this part of China is transient, in that it would not exist without variability in consumptions (Jalan and Ravallion, 1998a,b). Risk-market failures may hold the key to understanding that finding. Risk-market failures for the poor might also hold a clue to another observation about Chinese economic development since the mid-1980s, namely that economic growth appears to have been accompanied by rising inequality within rural areas (Ravallion and Chen, 1998).

Section 2 summarizes the theoretical results which motivate our tests for insurance. Section 3 describes our data, and Section 4 our empirical model and estimation techniques. Section 5 presents our main results, while Section 6 checks their robustness to alternative instruments, to different components of consumption, and to different wealth stratifications. Our conclusions are in Section 7.

2. Conditions for efficient risk-sharing

Assume for the moment that income risk is the only kind of risk facing a particular coinsurance group. Then perfect risk-sharing within the group will result in members' individual consumptions being protected from idiosyncratic risk. Consumptions may still vary, but only through the group's joint exposure to any

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[4] Official data indicate that Guangdong's average income in 1989 was more than twice Guizhou's (Chen and Ravallion, 1996).

[5] There is evidence that a significant proportion of households in this setting are credit-constrained; see Feder et al. (1993).

aggregate risk. The Pareto-optimal allocation of consumption within the group maximizes a weighted sum of the lifetime expected utilities of the group's members, subject to the group's aggregate resource constraint (Wilson, 1968; Townsend, 1994). Under regular assumptions (separability of consumption and leisure, additive preferences over time and across states, common rates of time preference), one can readily show that a necessary condition for perfect risk-sharing for each individual i in the group, and at all dates t is:

$$\omega_i u'(c_{it}) = \lambda_t \tag{1}$$

$u(\cdot)$ is the common (differentiable) within-period utility function, c_{it} is consumption of person i at date t, ω_i is an individual-specific Pareto weight which remains unchanged over time, and λ_t is a measure of the aggregate resource constraint that the group faces in period t.

This suggests a simple test of the benchmark hypothesis of perfect insurance for any given parameterization of the utility function. Suppose that preferences can be represented by an exponential utility function:

$$u(c_{it}) = (-1/\sigma)\exp(-\sigma c_{it}) \tag{2}$$

where σ is the Arrow–Pratt measure of absolute risk aversion. Eq. (1) becomes:

$$c_{it} = (\log \omega_i - \log \lambda_t)/\sigma \tag{3}$$

which, on aggregating over individuals and substituting, implies that:

$$c_{it} = \bar{c}_t + \left(\log \omega_i - \sum_j \log \omega_j/N\right)\Big/\sigma \tag{4}$$

where $\bar{c}_t$ is mean consumption at date t in a group comprising N individuals. Thus, the deviations of individual consumption around the group mean are constant over time. The key prediction is the following: if there is perfect insurance against income risk, then controlling for aggregate consumption, individual consumption should not be affected by idiosyncratic income shocks. An analogous derivation with a power (iso-elastic) utility function would have yielded equations similar to Eqs. (3) and (4) in the log of consumption (Townsend, 1994). Other parameterizations are also possible, though many do not yield test equations which are linear in parameters.

Now, suppose that members of a coinsurance group face multiple sources of risk. If none of the risk variables affect the per-period marginal utility function, then the above analysis is unchanged. (Stochastic rationing of certain consumption goods in a village economy would be an example of a non-income risk that affects household consumption without affecting the utility function.) On the other hand, there may be risks which affect the marginal utility of consumption. For example, illness in any period may increase the household's marginal utility from consumption in that period. A specific form of utility function that would incorporate such a risk is:

$$u(c_{it},\theta_{it}) = (-1/\sigma)\exp[-\sigma(c_{it}+\theta_{it})] \tag{5}$$

where θ_{it} is an unobserved shock which can have both a group-wide common component, and a member specific component. (In this specification, a lower θ_{it} corresponds to a greater level of ill health in household i in period t.) The basic message of Eq. (1) remains valid in this case: With perfect risk-sharing in each period, the weighted marginal utilities of consumption would be equated across all members of the coinsurance group. However, in such a situation, perfect risk-sharing does not imply that individual consumption should co-move perfectly over time with aggregate group consumption. Idiosyncratic variation in consumption will remain.

3. Data and descriptive statistics

We shall test for insurance against income risk in villages of rural China. The village is a natural coinsurance group, given that repeated interaction in close proximity must surely help overcome the classic problems of moral hazard and adverse selection. [6] The household panel was constructed from China's Rural Household Surveys (RHS) conducted by the State Statistical Bureau (SSB) since 1984. [7] The original panel consists of 6651 households observed over the period 1985–1990 (after which the sample was rotated). In our analysis, we use observations from only those villages which have at least six (or more) households. We need to restrict our sample this way in order to do the tests for insurance (discussed later). Most villages have around 10 sampled households.

The RHS is a good quality budget and income survey, notable in the care that goes into reducing both sampling and non-sampling errors (Chen and Ravallion, 1996). Sampled households maintain a daily record on all transactions, as well as log books on production. Local interviewing assistants (resident in the sampled village, or another village nearby) visit each sampled household at roughly two weekly intervals. Inconsistencies found at the local SSB office are checked with the respondents. The sample frame of the RHS is all registered agricultural households except those who have moved to urban areas (large towns and cities). [8]

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[6] There are other possible coinsurance groups, such as based on ethnicity; see Grimard (1997). There are distinct ethnic groups in southern China, but these are not identified in our data.

[7] Further details on this survey, and the way it has been processed for this study, can be found in Chen and Ravallion (1996).

[8] Under the household registration system in China, all rural households are registered as 'agricultural households' for administrative purposes, even if they depend mainly or solely on non-farm incomes.

Table 1
Descriptive statistics by wealth groups

Variable	1985	1986	1987	1988	1989	1990
Richest decile (213 households)						
Consumption per capita[a]	605.67 (763.34)	658.83 (640.71)	688.28 (688.44)	672.92 (606.82)	735.88 (733.87)	757.83 (719.90)
Income per capita[a]	912.26 (1135.87)	1124.35 (1423.37)	1190.52 (1234.22)	1166.46 (1283.54)	1143.70 (1336.10)	1133.90 (1255.73)
Correlation between changes in income and changes in consumption[b]	–	0.59 (0.0001)	0.39 (0.0001)	0.40 (0.0001)	0.17 (0.0122)	0.26 (0.0002)
70–90th percentile (219 households)						
Consumption per capita[a]	365.33 (260.33)	383.61 (282.71)	386.45 (320.03)	413.41 (369.97)	388.37 (355.29)	398.67 (431.50)
Income per capita[a]	478.97 (414.43)	526.88 (466.77)	572.91 (490.63)	575.85 (495.61)	583.75 (547.41)	578.29 (595.82)
Correlation between changes in income and changes in consumption[b]	–	0.42 (0.0001)	0.36 (0.0001)	0.33 (0.0001)	0.24 (0.0001)	0.35 (0.0001)
40–70th percentile (320 households)						
Consumption per capita[a]	321.89 (223.52)	317.87 (214.03)	328.21 (233.23)	319.17 (230.37)	310.39 (263.15)	306.90 (278.85)
Income per capita[a]	380.22 (322.67)	383.63 (310.77)	419.08 (353.35)	417.38 (322.17)	400.20 (342.45)	393.25 (335.38)
Correlation between changes in income and changes in consumption[b]	–	0.35 (0.0001)	0.41 (0.0001)	0.37 (0.0001)	0.32 (0.0001)	0.31 (0.0001)

10–40th percentile (512 households)						
Consumption per capita[a]	264.08 (190.20)	273.92 (214.78)	284.58 (301.50)	273.84 (212.28)	273.56 (238.84)	260.89 (210.86)
Income per capita[a]	305.68 (253.84)	324.28 (280.80)	341.70 (326.03)	329.90 (290.22)	328.42 (318.443)	313.25 (289.04)
Correlation between changes in income and changes in consumption[b]	–	0.44 (0.0001)	0.62 (0.0001)	0.60 (0.0001)	0.49 (0.0001)	0.50 (0.0001)
Poorest decile (149 households)						
Consumption per capita[a]	208.54 (188.54)	217.50 (205.40)	210.71 (152.21)	222.45 (188.06)	203.20 (193.97)	201.94 (165.50)
Income per capita[a]	226.57 (227.69)	245.73 (223.90)	245.62 (209.61)	240.75 (225.97)	227.90 (213.28)	231.90 (214.37)
Correlation between changes in income and changes in consumption[b]	–	0.59 (0.0001)	0.65 (0.0001)	0.49 (0.0001)	0.51 (0.0001)	0.58 (0.0001)

[a] Figures in parentheses are standard deviations.
[b] Figures in parentheses are the *p*-values.

Our measure of consumption expenditure based on the RHS includes cash spending, and the imputed values of in-kind spending, on food, clothing, housing, fuel, culture and recreation, books, newspapers and magazines, medicines and non-commodity expenditures like transportation and communication, repairs, etc. [9] The income variable includes both cash and imputed values for in-kind income from various sources (household production which includes farming, forestry, animal husbandry, handicrafts, etc.) as well as income received as a gift from non-rural relatives (although this accounts for less than 1% of income on average). Our income variable does not include borrowings from (or loans to) informal and/or formal sources.

To test for systematic inter-household differences in the extent of insurance, we stratify our sample by average household wealth per capita. Household wealth comprises of physical wealth only (fixed productive assets, cash, deposits, housing, grain stock, and durables). Land is excluded because the land market is virtually non-existent, making valuation difficult. Land is allocated in large part by administrative means and is unlikely to be used as collateral in this setting. Our wealth variable appears to be the best indicator in the data set of how credit constrained a household is likely to be. Households are grouped into five categories by wealth per person: poorest decile; poorest 10%–40%, 40%–70%, 70%–90%, and top decile.

It can also be argued that living in a generally poor area will make defection from informal coinsurance more likely (following Coate and Ravallion, 1993). We also group households by whether or not they live in a county which was officially declared 'poor', [10] and by province. We interact these geographic stratifications with household wealth.

Table 1 gives descriptive statistics on household consumption and income for each wealth group. [11] As is to be expected, the per capita average consumption and income are lowest for households in the bottom decile of the wealth distribution, and highest for those in the top decile. We also report the (unconditional) correlation between the change in consumption and change in income. The

[9] Certain problems have been corrected in the raw data. Grain consumption from own production has been valued at market rather than administrative prices, current year housing expenditure has been replaced with 5% of the recorded dwelling value, and 10% of the estimated current value of the durable goods has been used to compute current spending on durable goods; see Chen and Ravallion (1996).

[10] The central government introduced an anti-poverty program in 1986 which declared that 272 counties were national poor counties and targeted substantial aid to them. At the province level, a number of additional counties were identified as provincial poor on relative poverty criteria. In our original panel sample, we have 21 national poor and 23 provincial poor counties. These areas are significantly poorer than other counties on a wide range of objective criteria (Jalan and Ravallion, 1998b).

[11] The number of households in the different deciles of the wealth distributions differ because (as mentioned earlier) we need to restrict our sample in a way such that there are at least six households in each village for estimation purposes.

correlation coefficients are highest for the bottom decile (0.56), with the next poorest group close behind (0.53). But even for the other wealth groups the correlation coefficients are significant. For the top decile, the average correlation coefficient is 0.36. [12]

These correlations suggest that consumption and income co-move for each of the five wealth groups. However, to test whether or not there is sharing of idiosyncratic income risk within a village, we need to control for aggregate village shocks. We do that in Section 4.

4. Econometric model

We use the panel to estimate the following regressions for changes in consumption per person, c^w_{ivt} of the ith household at date t for wealth group w:

$$\Delta c^w_{ivt} = \sum_{jk} \delta^w_{jk} D^{jk}_{ivt} + \beta^w \Delta y^w_{ivt} + \gamma^w \Delta n^w_{ivt} + \Delta \varepsilon^w_{ivt} \qquad (6)$$

where D^{jk}_{ivt} is a village–time dummy variable equal to one when $j = v$ and $k = t$ and zero otherwise, y^w_{ivt} is income per capita, n^w_{ivt} is the household size, [13] and ε^w_{ivt} is an unobserved independently and identically distributed random variable. We also estimate a log-linear version of Eq. (6). The results are similar and not reported in the paper but are available from the authors on request. [14] In this specification, aggregate income risk is captured by the (interacted) village–time dummies while idiosyncratic income risk is captured by changes in income (which is treated as endogenous). If there is perfect income insurance within the village then changes in household income will have no effect on consumption after controlling for common village–time effects, i.e., $\beta^w = 0$ for all w.

Similar specifications have been used in the literature (Cochrane, 1991; Ravallion and Chaudhuri, 1997; Grimard, 1997). An alternative specification entails regressing the deviation from village-mean consumption on income changes, or regressing changes in household consumption on changes in village-mean consumption as well as household income (Townsend, 1994). However, this will give biased estimates of the excess sensitivity parameter against the alternative of risk-market failure whenever there is a common village-level component in household-level income changes (Ravallion and Chaudhuri, 1997). Our specifica-

[12] We observe similar patterns for the other stratifications. These are not reported in the paper but are available from the authors on request.

[13] Townsend (1994) and Lanjouw and Ravallion (1995) note that there could be some economies of scale in the household's production function. Presence of such economies of scale require that we include additional demographic variables like household size as regressors.

[14] We also estimate a log-linear version of Eq. (6). The results are similar and not reported in the paper but are available from the authors on request.

tion is robust to that problem. Further, given that we are testing for perfect sharing of income risk, our specification is also robust to the existence of other unobserved risks as long as: (a) they can be completely captured in the last term ($\Delta\varepsilon^{w}_{ivt}$) in Eq. (6), and (b) are uncorrelated with income changes. [15]

It is of interest to also test the restricted form of Eq. (6) in which we do not control for village-level income effects, giving:

$$\Delta c^{w}_{ivt} = \beta^{w*}\Delta y^{w}_{ivt} + \gamma^{w*}\Delta n^{w}_{ivt} + \Delta\varepsilon^{w*}_{ivt} \tag{7}$$

If consumptions are fully insured for both idiosyncratic and covariate shocks then $\beta^{w*}=0$. Notice that if lagged values are used as instruments then estimating Eq. (7) is equivalent to testing the martingale property of consumption, as implied by the permanent income hypothesis.

In estimating Eqs. (6) and (7), we treat both income and household size as endogenous. Households may be using some income component, or household size, for consumption smoothing. For example, one response to a crop failure may be to look for non-farm work (though this can be even more uncertain than crop income in poor rural areas). Or the response may be to send one of more members of the family to live temporarily in a relative's house. There is also likely to be measurement error in incomes.

Lagged levels of income and household-size are used as instruments. One might also use non-crop income components as instruments for income. However, current non-farm income sources might be used by households to protect their consumptions in face of crop income shocks. Later we test the robustness of our results using alternative instruments.

To estimate Eqs. (6) and (7), we use Generalized Method of Moments (GMM). The GMM estimator is the most efficient one within the class of instrumental variable estimators. Arellano and Bond (1991) provide a GMM estimator for panel data models, which can be readily adapted to our case.

The coefficient estimates of the parameter vector $\boldsymbol{\nu} = (\delta_{jk},\beta,\gamma)$ are given by:

$$\boldsymbol{\nu} = (\mathbf{q}'\mathbf{w}\mathbf{a}_n\mathbf{w}'\mathbf{q})^{-1}(\mathbf{q}'\mathbf{w}\mathbf{a}_n\mathbf{w}'\Delta\boldsymbol{c}) \tag{8}$$

where $\mathbf{q} = [\mathbf{D}^{jk},\Delta y,\Delta n]'$ is the $(NT\times m)$ matrix of the m regressors, in which $\mathbf{D}^{jk}$ is the matrix of the time-interacted village dummies, $\mathbf{w}$ is the $(NT\times k)$ matrix of k instrumental variables, while $\mathbf{a}_n$ is the $(k\times k)$ weighting matrix, and $\Delta\boldsymbol{c}$ is a $(NT\times 1)$ vector of the first differences of log consumption. The optimal choice of $\mathbf{a}_n$ ('optimal' in the sense of giving the most efficient estimator asymptotically) is proportional to the inverse of the asymptotic covariance matrix (Hansen, 1982). [16]

[15] Consider the utility specification in Eq. (5). If that is the true model, then our econometric specification and our test are valid as long as $\Delta\theta_{it}$ and Δy_{it} are not correlated.

[16] In the just identified case where the number of instruments arising from the moment conditions are exactly equal to the number of parameters to be estimated, the parameter estimates do not depend on the weighting matrix and hence the choice of the matrix is redundant.

If all the available moment conditions are used, the relevant instrument matrix for individual i is given by:

$$\mathbf{w}_i = \begin{bmatrix} [z_{i1}] & & 0 & \bar{\mathbf{s}}_i \\ & [z_{i1}, z_{i2}] & & \bar{\mathbf{s}}_i \\ & & \cdots\cdots\cdots & \bar{\mathbf{s}}_i \\ 0 & & [z_{i1}, z_{i2}, \ldots z_{iT-1}] & \bar{\mathbf{s}}_i \end{bmatrix}$$

where $z_{ip} = [y_{ip} : n_{ip}]$, and y_{ip} and n_{ip} ($p = 1, 2, \ldots, T-1$) are the instruments used for the two endogenous variables Δy_{ivt} and Δn_{ivt}, respectively, and $\bar{\mathbf{s}}_i$ is the matrix of the strictly exogenous variables. (In almost all our estimations reported in Section 5, the only exogenous variables are the time interacted village dummies). Thus even if we use only one moment condition to instrument the change in current income and use the lagged level of household-size to predict the change in household-size variable, the total number of instruments used in the model is T. [17] Thus with $T = 6$ as is in our case, we use six instruments to predict two variables leaving us with four over-identifying conditions.

To ensure that the instruments are valid, we check whether the model passes the over-identifying restrictions (χ^2) test of Sargan (1958) as suggested by Arellano and Bond (1991). The test-statistic is given by:

$$\Delta \boldsymbol{\varepsilon}' \mathbf{w} \left[\sum_{i=1}^{N} \mathbf{w}_i' (\Delta \boldsymbol{\varepsilon})(\Delta \boldsymbol{\varepsilon})' \mathbf{w}_i \right]^{-1} \mathbf{w}' \Delta \boldsymbol{\varepsilon} \sim \chi^2_{k-m-1} \tag{9}$$

where k is the number of columns in the instrument matrix, m is the number of parameters in the model, and $\Delta \boldsymbol{\varepsilon}$ are the estimated residuals from the model. If the test rejects the null hypothesis of the instruments being optimal, then the estimates of the model should be interpreted cautiously because this may indicate that either the model is misspecified and/or that some of the instruments are invalid. [18]

Heteroscedasticity-robust standard errors are computed using the estimated residuals to correct for any general kind of heteroscedasticity. For further details on the estimation procedure, see Arellano and Bond (1991). [19]

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[17] This combination of instruments is typically what has been used in the following section. However, details on what instruments are used for which variables are given at the bottom of each of the tables.

[18] In GMM panel data models, lagged values used as instruments are bound to be strongly correlated with the endogenous variable; the greater concern in these models is whether the instruments are correlated with the error term, as would arise if the underlying innovation error is serially correlated.

[19] Estimation of the village-interacted time dummy variables used as a proxy for village mean income requires at least six households per village in the sample. With fewer than six households, the weighting matrix in the GMM estimation is near-singular. In such cases, we cannot correct for any general kind of heteroscedasticity that might be present in the data.

5. Results

We first estimate the regression coefficient on income changes without controlling for village-level covariate risk as in Eq. (7). We then control for aggregate risk by adding (interacted) village–time dummies, as in Eq. (6). We estimate the regression for each of the five wealth groups (Table 2); for households in the different provinces categorized by wealth groups (Table 3); and for households grouped on the basis of wealth holdings and whether or not they belong to a declared poor (national or provincial) county (Table 4).

The null hypothesis of perfect insurance against income risk is rejected for all wealth groups, including the richest. This holds with or without the controls for covariate (village-level) shocks, though the village-interacted time dummies were jointly significant for all wealth groups. In all the cases, the null hypothesis of the over-identification restrictions test (i.e., that the instruments used are valid) was accepted. Change in household size has a negative impact on the change in consumption in all the cases.

Our results indicate that the full insurance model is not the correct specification for our sample. Some other model is determining the evolution of consumption. The underlying model may be different from that implied by Eq. (6) and may well yield different marginal propensities to consume out of current income than those we report in Tables 2–4. Nonetheless, without specifying that model, it is still of descriptive interest to examine the marginal propensities to consume derived from the test equation, for they reveal a striking pattern, which may help inform the development of a better model in future work.

In particular, we find that the effect of idiosyncratic income shocks on consumption varies across the different wealth groups. In each of Tables 2–4, the lower the wealth, the more closely consumption tracks income. For example, in Table 2, the marginal propensity to consume (mpc) out of idiosyncratic income is 0.42 for the households in the bottom wealth decile, but is only 0.12 for the households in the top decile. Again in Table 3, for each of the provinces, the mpc out of idiosyncratic income is the largest for households in the bottom 25% of the wealth distribution. In addition, the mpc for the poorest strata is the largest for Guizhou, the poorest of the four provinces. In Table 4, we report the results when we stratify the sample into four wealth groups and also whether the household belongs to a poor county or not. Analogous to the previous results, in both poor and non-poor areas, household consumption co-moves with household income more closely for the poorest wealth group (bottom 15% of the distribution). However, if we compare the mpc coefficients across poor and non-poor areas for the poorest strata, they are not significantly different from each other.

In summary, our tests suggest that rural households in this setting are not fully insured against idiosyncratic income risk. The rejection of the full insurance model is strongest for the poorest households in terms of wealth. We find no evidence that the poor are less well insured when they live in generally poor areas ceteris

Table 2
Consumption changes regressed on income changes, stratified by wealth

Wealth group	Number of households	Categorized by household wealth per capita			
		Income coefficient		Household-size coefficient	
		Without village–time dummies	With village–time dummies	Without village–time dummies	With village–time dummies
Richest decile	213	0.12 (1.71)	0.12 (4.61)	−50.72 (−1.72)	−35.79 (−1.38)
70–90th percentile	219	0.11 (2.75)	0.13 (4.01)	−32.51 (−2.23)	−26.48 (−2.32)
40–70th percentile	320	0.16 (6.01)	0.18 (6.88)	−31.43 (−4.25)	−24.64 (−4.78)
10–40th percentile	512	0.30 (10.01)	0.24 (7.22)	−17.51 (−5.00)	−17.03 (−5.94)
Poorest decile	149	0.42 (8.47)	0.41 (7.05)	−7.53 (−1.38)	−14.13 (−3.55)

Figures in parentheses are the *t*-values of the estimated coefficients. In each case, change in household size is also included as an additional regressor. Both changes in income and household size are treated as endogenous. While change in income is instrumented out using one moment condition (five instruments), household-size is instrumented out using its lagged level value (one instrument). In each case, a Sargan over-identification test is constructed. The null of optimal instruments used is not rejected in any of the specifications. The village interacted time dummies are jointly significant in each of the specifications.

Table 3
Consumption changes regressed on income changes, stratified by wealth and province

Wealth group	Guangdong			Guangxi			Guizhou			Yunnan		
	No. of households	Without village–time dummies	With village–time dummies	No. of households	Without village–time dummies	With village–time dummies	No. of households	Without village–time dummies	With village–time dummies	No. of households	Without village–time dummies	With village–time dummies
Richest 25%	456	0.17 (7.86)	0.11 (6.36)	74	0.11 (2.41)	0.06 (1.78)	Small sample			157	0.08 (1.68)	0.13 (2.95)
Middle 50%	339	0.26 (7.78)	0.16 (4.85)	647	0.14 (7.40)	0.09 (5.45)	376	0.22 (5.97)	0.25 (7.49)	269	0.20 (6.29)	0.23 (7.90)
Poorest 25%	Small sample			122	0.12 (2.31)	0.11 (2.72)	320	0.37 (11.31)	0.33 (9.65)	208	0.27 (4.79)	0.29 (6.78)

Figures in parentheses are *t*-values of the estimated coefficients. In each case, change in household size is also included as an additional regressor. Changes in income and household size are treated as endogenous. While change in income is instrumented out using one moment condition (five instruments), household-size is instrumented out using its lagged level value (one instrument). In each case, a Sargan over-identification test is constructed. In each the null is not rejected. The village interacted time dummies are jointly significant for all the specifications.

Table 4
Consumption changes regressed on income changes, stratified by wealth and poor/non-poor areas

Wealth group	No. of households		Without village–time dummies		With village–time dummies	
	Poor areas	Others	Poor areas	Others	Poor areas	Others
Richest 25%	71	651	−0.08 (−1.14)	0.17 (4.12)	−0.01 (−0.12)	0.12 (6.63)
40–75th percentile	168	435	0.12 (4.06)	0.16 (6.16)	0.13 (5.19)	0.22 (9.08)
15–40th percentile	136	102	0.34 (6.43)	0.25 (4.68)	0.28 (6.53)	0.25 (3.29)
Poorest 15%	186	96	0.33 (6.89)	0.34 (6.15)	0.30 (5.68)	0.38 (6.27)

Figures in parentheses are *t*-values of the estimated coefficients. In each case, change in household size is also included as an additional regressor. Changes in income and household size are treated as endogenous. While change in income is instrumented out using one moment condition (five instruments), household-size is instrumented out using its lagged level value (one instrument). Sargan over-identification tests are constructed for all the specifications. In each the null is not rejected. The village interacted time dummies are jointly significant for all the specifications.

paribus. However, for all households, including the poorest stratum, the magnitude of the income coefficient suggests partial insurance against idiosyncratic income risk.

6. Robustness

How robust are our results to the choice of a different set of instruments, or to a different wealth criteria to stratify the data? In our first check, we assume income and household-size to be both exogenous and re-estimate the first-differenced model using OLS with robust standard errors. Next we assume that only household-size is endogenous assuming income to be still exogenous. Comparing these two results (Table 5) we see that there is no statistical difference between the case where household-size is treated as exogenous and the case where it is treated as endogenous. This would suggest that household size is a weakly exogenous variable in our model. Next, comparing the model where household-size and income are assumed to be endogenous to one where they are taken to be exogenous, we find that the coefficient estimate for the change in income variable is consistently higher for the latter (exogenous) case. However, even in this case, the poor seem to be the least well insured against idiosyncratic income shocks. The monotonic relationship between wealth group and the marginal propensity to consume out of idiosyncratic income observed in Tables 2–4 is also evident here.

Next we use moment conditions constructed from lagged non-farm income (in place of lagged total income) to predict the change in income variable. Comparing these results to those reported in the earlier section, we see that for at least the top

Table 5
Does the choice of instruments for income matter? Consumption changes regressed on income changes, stratified by wealth

Wealth group	Income coefficient			
	Income, household-size treated as exogenous	Income treated as exogenous	Lagged non-farm income used as instrument for income (one moment condition), lagged household-size used as instrument for household-size	Lagged income used as instrument for income (one moment condition), lagged household size used as instrument for household-size
Richest decile	0.17 (3.26)	0.17 (4.42)	0.14 (5.56)	0.12 (4.61)
70–90th percentile	0.21 (7.63)	0.21 (7.57)	0.16 (3.91)	0.13 (4.01)
40–70th percentile	0.23 (8.09)	0.22 (7.92)	0.22 (7.27)	0.18 (6.88)
10–40th percentile	0.41 (3.85)	0.34 (3.93)	0.27 (6.74)	0.24 (7.22)
Poorest decile	0.44 (10.03)	0.43 (10.34)	0.32 (5.54)	0.41 (7.05)

Figures in parentheses are *t*-values of the estimated coefficients. In each case, change in household size is also included as an additional regressor. Sargan over-identification tests are constructed for all the specifications. In each the null is not rejected. The village interacted time dummies are jointly significant for all the specifications.

Table 6
Food consumption changes regressed on income changes, stratified by wealth

Wealth group	Income coefficient	
	Lagged income (one moment condition) used to instrument income	Lagged non-farm income (one moment condition) used to instrument income
Richest decile	0.08 (4.64)	0.05 (3.32)
70–90th percentile	0.09 (4.67)	0.10 (4.16)
40–70th percentile	0.12 (6.19)	0.16 (6.71)
10–40th percentile	0.18 (9.18)	0.18 (7.13)
Poorest decile	0.31 (6.88)	0.20 (4.14)

Figures in parentheses are *t*-values of the estimated coefficients. In each case, change in household size is also included as an additional regressor. Changes in income and household size are treated as endogenous. Sargan over-identification tests are constructed for all the specifications. In each the null is not rejected. The village interacted time dummies are jointly significant for all the specifications.

Table 7
Alternative wealth stratifications

Wealth group	Categorized by total household wealth		Categorized by initial (1985) household wealth per capita	
	No. of households	Income coefficient	No. of households	Income coefficient
Richest decile	203	0.12 (4.12)	192	0.13 (4.67)
70–90th percentile	179	0.14 (4.08)	191	0.04 (1.23)
40–70th percentile	322	0.15 (5.09)	260	0.05 (1.18)
10–40th percentile	459	0.25 (6.36)	459	0.27 (8.41)
Poorest decile	116	0.45 (8.39)	157	0.28 (5.75)

Figures in parentheses are the *t*-values of the estimated coefficients. In each case, change in household size is also included as an additional regressor. Changes in income and household size are treated as endogenous. Instruments used are similar to those in the earlier tables. In each case, a Sargan over-identification test is constructed. The null of optimal instruments used is not rejected in any of the specifications. The village interacted time dummies are jointly significant in each of the specifications.

four wealth groups there does not appear to be a significant change across the two models (Table 5). It is only for the bottom decile that using non-farm income as an instrument reduces the coefficient on the change in income variable significantly. But it is reassuring that even for this instrument set, the pattern that the poor are the least well insured against idiosyncratic income shocks is still observed.

Next we test to what extent the household's food consumption is protected from idiosyncratic income shocks across the different wealth groups. The results are given in Table 6.[20] Food consumption is better protected from idiosyncratic income risk than is total consumption. But, as with total consumption, food consumption by the poorest households is the least well protected.

Lastly, we test the robustness of our results to different wealth stratifications. In Table 7, we report two such alternative groupings—stratification on the basis of total household wealth holdings (averaged over the 6 years) and wealth groups on the basis of initial (1985) household wealth per capita. We find the same pattern as in the previous models: consumption is least well insured for the bottom decile and the best protected for the top decile. However, in the case of the subsamples based on initial wealth per capita, for two groups—households in the 70–90th, and those in the 40–70th groups, the income coefficient is not significant. Given the conclusive rejection of perfect risk insurance in all other cases, we would interpret the results for these two groups as anomalous, rather than evidence in favor of perfect risk sharing.

7. Conclusions

We have tested for systematic wealth effects on the extent of consumption insurance against income-risk in a six-year panel of rural households in post-reform southern China. Motivated by the theory of risk-sharing, our tests entailed estimating the effects of income changes on consumption (with current income treated as endogenous), after controlling for aggregate shocks through interacted village–time dummies. We also tested for insurance against covariate risk at village level. To test for wealth effects, we stratified our sample on the basis of household wealth per capita, and whether or not the household resides in a poor area.

The full insurance model is convincingly rejected on these data. The lower a household's wealth, the stronger is the rejection, in that the marginal propensity to consume out of current income implied by the test equation is higher for less wealthy households. This conclusion is robust to changes in the set of instruments,

[20] Food consumption is defined as expenditure on staple and non-staple food grains, other foodstuffs, and meals consumed outside the place of residence. The variable includes consumption from own production.

and to changes in the wealth measure. It holds for both total consumption and food consumption, although the latter is better protected. There is little sign, however, that living in a poor area enhances exposure to risk at a given level of individual wealth.

We interpret these results as indicating that, while there are clearly arrangements for consumption insurance in these villages of southern China, they work considerably less well for the asset poor. These results strengthen the case, on both equity and efficiency grounds, for public action to provide better insurance in underdeveloped rural economies; the specific form that such action should take in given circumstances is still, however, an open question. Our results also suggest that, unless credit and insurance options for poor people can be improved, one should not be surprised to see persistent inequality, and an inequitable growth process, in this setting.

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