# Are the Poor More Vulnerable to Income Shocks? An Analysis of Consumption Insurance in Rural India*

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**November 2001**

## Abstract

This paper examines the extent of consumption insurance against income risk by households in rural India. We estimate the effects of income changes on consumption after controlling for aggregate shocks through changes in village level consumption and household size. We also test whether there is a systematic wealth effect on the extent of consumption insurance against idiosyncratic income shocks by classifying the households on the basis of landholding, which is the primary source of wealth for rural households in India. The null hypothesis of full insurance is rejected both for the population as a whole and for the different land classes. Our estimation results also show that consumption tracks income more closely for the poorer households – the estimated marginal propensity to consume out of idiosyncratic changes in income is significantly higher for the poorer households compared to the richer households. The results are robust to alternative estimation methodologies and alternative methods of sample stratification.

JEL Classification: O12, O16, C33

Key Words: Consumption Smoothing, Risk, Insurance, Rural India

* Very preliminary version.

## 1. Introduction

The literature on risk and insurance in poor rural economies argues that income risks are pervasive in these economies. That leads us to the question of how well (if at all) are households in rural economies able to insure consumption against such shocks to income? In the recent past this question has led to a large volume of literature that examines the success or otherwise of households in insuring consumption and identifying the different mechanisms that could potentially be used to enable households to insure against the different kinds of income shocks. The literature has concluded that indeed households take actions aimed at protecting consumption, by drawing on both private and social risk sharing arrangements. Townsend (1994) lists five potential risk-bearing institutions: (1) Spatial diversification of land holdings, (2) Storage of grains from one year to the next, (3) Purchases and sales of assets such as bullocks and land, (4) Credit from formal and informal sources and (5) Gifts and Transfers within the family networks.[1] However it is also agreed that not all households are equally able to insure consumption against income shocks and differentiated access to markets, particularly financial markets result in differential ability of households to insure against income shocks.

If risks are idiosyncratic in nature, then households will pool together to share all risks. Further if risks are fully pooled then there is complete risk sharing among households and changes in household consumption will track changes in the community average consumption and nothing else. In particular, changes in factors specific to the

[1] See Alderman and Paxson (1992), Deaton (1997), Fafchamps (1992), Grimard (1997), Morduch (1995) and Townsend (1994, 1995a) for a review of the theories and empirical evidence using different data sets. Morduch (1995) categories the different mechanism into two categories: exante income smoothing and expost consumption smoothing.

household like changes in household income will not have a statistically significant impact on changes in household consumption. In such a case we say that consumption is fully insured. As a consequence the estimated marginal propensity to consume out of idiosyncratic changes in income should not be statistically different from zero. Consider a regression of a change in household consumption on a change in community average consumption and a change in household income. If consumption is fully insured then the coefficient estimate of community average consumption should be one and the coefficient estimate of household income should be zero. The actual amount of risk sharing that actually takes place can now be compared to this benchmark of complete risk sharing. Note however that the community average consumption, which is a measure of aggregate risk (common to all households in the community), will continue to fluctuate.

In addition to the general question of risk sharing by rural households, this paper also examines whether the arrangements for consumption insurance in rural economies work better for some households (belonging to specific wealth groups) compared to others. On the one hand poorer households are likely to be more risk averse and hence they are more likely to undertake specific measures to reduce the variability of their income and hence directly reduce the variability of consumption. On the other hand poorer households are more likely to be rationed in the availability of credit and insurance, so they are less likely to be able to insure consumption once the income shock has occurred. Therefore a-priori we cannot say whether poor households are more vulnerable or not. Our estimation results show that the poorer households are actually more vulnerable.

Different versions of this empirical specification have been tested using household level data from both developed and developing countries. Mace (1991) in her study on risk sharing in the US economy finds that the evidence is conditional on the preference specification. Results are mostly consistent with consumption insurance for the exponential utility specification but not for the power utility specification. Townsend (1995) finds overwhelming rejection of the null hypothesis for different regions in Thailand. He finds that consumption in one *ampoe* (region or state) tracks income in that region. Deaton (1992) obtains a similar conclusion using data from Côte d'Ivoire. He finds that the marginal propensities to consume out of current income are always positive and significant. Jalan and Ravallion (1999) using data from rural China find that that while full insurance is always rejected, there is evidence of partial insurance for certain wealth groups and the rejection of full insurance is the strongest for the poorest wealth decile. Results from rural India are somewhat varied. Townsend (1994) in his study of risk and insurance in three ICRISAT villages finds that full consumption insurance is a fairly good benchmark.[2] Maitra (1998) on the other hand using data from rural Punjab finds no evidence in favour of consumption insurance against idiosyncratic income shocks. This paper uses a household level panel data set from rural India to examine the extent of consumption insurance. India is characterised by extreme regional variations in income and as such is a very interesting country to examine. This is the first paper that examines consumption insurance using data from all parts of India, without focussing on specific regions as the Semi-Arid tropics (Townsend, 1994) or rural Punjab (Maitra, 1998).

[2] Data collected by the International Crop Research Institute for the Semi Arid Tropics (ICRISAT). This data is referred to as the ICRISAT data and the villages included in this survey the ICRISAT villages.

The issue of consumption insurance has important policy implications. In many developing countries, governments and policy makers have implemented programs (like food for work programs, credit schemes, buffer stocks and crop insurance schemes) aimed at reducing the riskiness of income and provide insurance for the poor. The basic premise is that left to themselves (and in the absence of such government programs) poor households will be unable to insure themselves against income shocks. Given that these programs are expensive it is important to examine whether this argument is correct or not because it is an important issue from the point of view of designing efficient policies.

The rest of the paper is organised as follows. Section 2 describes the data set used and also presents selected descriptive statistics on the relative volatility of income and expenditure and the co-movement of these variables. Section 3 describes the theoretical model that motivates the test for insurance that is used in this paper. Section 4 describes the empirical specification used. Section 5 presents the basic results, Section 6 the sensitivity of the results to alternative estimation techniques and also to alternative methods of sample stratification. Finally Section 7 concludes.

## 2. Data and Descriptive Statistics

This paper tests for insurance against income shocks in rural India. For this purpose we use a panel data set from rural India obtained from a survey conducted by the National Council of Applied Economic Research (NCAER) in three rounds for the years 1968-69, 1969-70 and 1970-71 – the Additional Rural Income Survey (ARIS). The data set will henceforth be referred to as the ARIS-NCAER data. The main purpose of the

survey was to measure the changes in income levels and income distribution and the consequent changes in the patterns of consumption, investment and savings of households in rural areas. The final data set we use in this paper consists of 4118 households residing in 257 villages. Detailed information was collected on the demographic composition of the household including household size and composition, the number of earners in the household, income by source, expenditure on different accounts, savings and asset holdings by type. More details about the survey can be obtained from NCAER (1975).

The measure of consumption that is used in this paper includes expenditure on food, non-food items (including toiletry), fuel and lighting, clothing, education, medical items, services and entertainment. The measure of income used includes income earned from crop profits, livestock, agricultural wages, regular salaries earned and income from self-employment.

To test for systematic inter-household differences in the extent of consumption smoothing, the sample is stratified on the basis of landownership. This method of stratification is used because in rural India landholding is the primary indicator of wealth because of the collateral value associated with land. This pattern of sample stratification is also a good indicator of how credit constrained a household is likely to be. The households are grouped into 4 categories depending on the amount of land owned: the landless (907 households), the small landowners owning between 1.0 and 2.5 hectares (1699 households), the medium landowners owning between 2.6 and 6.5 hectares (980 households) and finally the large landowners owning in excess of 6.5

hectares (532 households). We examine the sensitivity of the estimates to alternative sample stratification in Section 6.

Table 1 presents the summary statistics (sample size, mean and standard deviation) for income and consumption for each of the three years, for the full sample and also for the sample stratified on the basis of landownership. We also present the Coefficient of Variation (CV) of both Total Income and Total Consumption Expenditure for each of the three years. The Coefficient of Variation is a unit free measure of volatility. Notice that income is much more volatile compared to consumption, irrespective of the landholding of the household. Also presented are the correlation between the change in income and change in consumption expenditure. Generally consumption tracks income more closely for the poorer households (i.e., the correlation between change in total income and change in total consumption expenditure is higher) but the correlation is always statistically significant.

The descriptive statistics presented show that while the volatility of consumption expenditure is generally less than the volatility of income (indicating some amount of consumption smoothing), income and consumption generally co-move, irrespective of the wealth group. However to test whether there is sharing of idiosyncratic risk within a village, we need to control for aggregate village level shock. We do that next.

## 3. Conditions for Risk Sharing – Theory

Let us assume that income risk is the only form of risk faced by a particular community. Complete risk sharing in this framework will result in each household in the community being protected from idiosyncratic risk. Consumption will still vary but that is only

because of the risk common to all households (aggregate community level risk). The test for full insurance is therefore a test of the validity of Pareto Optimality for the economy under consideration.[3] The problem for the social planner is to

$$\text{Max} \sum_{i=1}^{I}\sum_{t=0}^{T}\sum_{s=0}^{S}\mu_{is}\,\pi_s\rho^t U(c_{its};\theta_{its}) \qquad (1)$$

subject to the full income constraint

$$\sum_{i=1}^{I} c_{its} = \sum_{i=1}^{I} y_{its} \forall (t,s) \qquad (2)$$

where $\pi_s$ is the probability of state $s, s=1,\ldots,S$; $c_{its}$ is household consumption and $y_{its}$ is household income; $\mu_{is}$ is the time invariant Pareto Weight associated with household $i, i=1,\ldots,I$ in state s and I is the number of households; $\rho$ is the rate of time preference assumed to be the same for all households, $\theta_{its}$ incorporates factors that change tastes. The Langrangian associated with this problem is:

$$L = \sum_t \rho^t \left[\sum_i \mu_{is} \sum_s \pi_s U(c_{its};\theta_{its}) + \lambda_{ts}\left\{\sum_i (y_{its} - c_{its})\right\}\right] \qquad (3)$$

Different specifications of the utility function $(U(c_{its};\theta_{its}))$ will give different empirical specifications. Let us consider an exponential utility function with the specific functional form for U given by

$$U(c_{its};\theta_{its}) = -\frac{1}{\alpha}\exp\{-\alpha(c_{its} - \theta_{its})\} \qquad (4)$$

Using this specific functional form for U, the first order conditions (after manipulations and disregarding the notation for the state) can be written as

[3] The test described below closely follows Mace (1991). Cochrane (1991) and Townsend (1994) present similar tests.

$$\Delta c_{it} = \Delta c_t^a + \left(\Delta\theta_{it} - \Delta\theta_t^a\right), c_t^a = \frac{1}{I}\sum_i c_{it}, \theta_t^a = \frac{1}{I}\sum_i \theta_{it} \qquad (5)$$

Under the assumption of full consumption insurance, change in individual consumption $\Delta c_{it}$ depends only on change in aggregate consumption $\Delta c_t^a$.

On the other hand if the specific form of the utility function is

$$U(c_{its};\theta_{its}) = \frac{c_{its}^{1-\alpha}}{1-\alpha}\exp(\theta_{its}) \qquad (6)$$

the first order conditions (again after manipulations and disregarding the notation for the state) can be written as:

$$\Delta\log(c_{it}) = \Delta c_t^a + \left(\Delta\theta_{it} - \Delta\theta_t^a\right), c_t^{*a} = \frac{1}{I}\sum_i \log(c_{it}), \theta_t^a = \frac{1}{I}\sum_i \theta_{it} \qquad (7)$$

Once again however under the assumption of full insurance, change in household consumption depends only on change in community average consumption.

To examine how Pareto Optimal allocation is attained in a decentralised economy, we assume the existence of a complete set of Arrow Debreu securities. The existence of such securities allows me to decentralise the economy and examine whether full insurance can be attained through market mechanisms in such an economy. This enables us to test for consumption insurance for subsets of the population. In particular we test for consumption insurance for households classified by land holding. It can easily be shown that if there exists a complete set of Arrow Debreu securities, then the equilibrium consumption allocation will be identical to that obtained under a social planner's problem.

Let us now turn to the empirical specification.

## 4. Empirical Framework

Let $c_{ivt}^{w}$ denote the per capita consumption of household i in village v in year t and belonging to the wealth group w $(i = 1,\ldots,I; v = 1,\ldots,V; t = 0,\ldots,T; w = 1,\ldots,W)$. Under the assumption of complete risk pooling (full insurance), the change in household consumption from year t to year $t+1$ depends only on the corresponding change in the aggregate village level consumption. The empirical specification follows immediately. Regress the change in the consumption of the $i^{th}$ household on the change in the village level average consumption and other explanatory variables like the change in household consumption. All variables with the exception of changes in average village level consumption are predicted to enter insignificantly. If the utility function is given by (4), we can write the empirical specification as

$$\Delta c_{ivt}^{w} = \beta_0^{w} + \beta_1^{w}\Delta c_{vt}^{aw} + \beta_2^{w}\Delta y_{ivt}^{w} + \beta_3^{w}\Delta n_{ivt}^{w} + \varepsilon_{ivt}^{w} \qquad (8)$$

Here $\Delta y_{ivt}^{w}$ is the change in household i's per capita income and $\Delta n_{ivt}^{w}$ is the change in the household size. The error term $\varepsilon_{ivt}^{w}$ includes both preference shocks $(\theta_{it})$ and measurement error and is distributed identically and independently. The null hypothesis of full risk sharing predicts that $\beta_1^{w} = 1, \beta_2^{w} = 0$.

If on the other hand the utility function is given by (5), the empirical specification can be written as

$$\Delta\log\left(c_{ivt}^{w}\right) = \beta_0^{w} + \beta_1^{w}\Delta c_{vt}^{*aw} + \beta_2^{w}\Delta\log\left(y_{ivt}^{w}\right) + \beta_3^{w}\Delta\log\left(n_{ivt}^{w}\right) + \varepsilon_{ivt}^{w} \qquad (9)$$

Once again the null hypothesis of full risk sharing predicts that $\beta_1^{w} = 1, \beta_2^{w} = 0$.

## 5. Results

Table 2 presents the coefficient estimates for the regression of the change in the level of consumption on the change in the level of income and the change in the community average level of consumption (estimates of equation (7)). In this and in all subsequent regressions we control for the change in household size. The coefficient of the change in household size $\left(\beta_3^w\right)$ is always negative and statistically significant. Results are presented for all households (full sample) and the sample stratified on the basis of landholding. The joint test presented in the Table refers to the test for full insurance $\beta_1^w = 1, \beta_2^w = 0$. Note that $\beta_2^w$ is the estimated marginal propensity to consume out of total income. Two alternative specifications are considered. In the first we consider household income to be exogenous. The estimates are computed using OLS. We then account for the possibility that household income might actually be endogenous in that households might be using some component of income for the purposes of consumption smoothing – for example one response to crop failure might be to look for additional non-farm work. Lagged levels of income, savings and the number of earners in the household are used as instruments to compute the instrumental variable (IV) estimates.

The following results are worth noting. First, the estimated marginal propensities to consume are generally the higher when income is assumed to be exogenous (OLS estimates) compared to the case where income is assumed to be endogenous (IV estimates). Second the estimated marginal propensities to consume are always significantly greater than zero and this is true for all households and separately for households belonging to the different land classes. Third, the null hypothesis of full insurance (that changes in household consumption is related to changes in community

level average consumption and not to changes in household income) is always rejected. Fourth, the estimated marginal propensities to consume out of idiosyncratic changes in income are higher for the landless households and the small landowners compared to the medium and large landowners. These results therefore imply that the poorest households are the most vulnerable to idiosyncratic income shocks as consumption generally tracks income more closely for the poorer households (landless households and small landowners).

Table 3 presents the estimated coefficients corresponding to equation (9) – growth rates in consumption regressed on growth rates of income and growth rates in community average consumption. Here the estimated coefficients of $\beta_2^w$ may be interpreted as the elasticity of consumption with respect to change in income. Once again two sets of estimates are presented. The results are similar to those presented in Table 2. As before the OLS estimates are higher compared to the IV estimates, and once again irrespective of the estimation methodology used, the null hypothesis of full insurance is always rejected. We again find that the poorest households are the most vulnerable to income shocks as consumption generally tracks income more closely for the poorer households.

India is characterised by significant regional variations – certain parts of the country are poorer than others and therefore it is likely that institutions vary significantly across these very different regions. To examine whether there are any regional variations in the extent of consumption insurance we stratify households on the basis of the region of residence: East (comprising of the states of Assam, Bihar, Orissa and West Bengal), West (comprising of the states of Gujarat, Maharashtra and

Rajastan), North (comprising of the states of Haryana, Himachal Pradesh, Jammu and Kashmir, Haryana, Punjab and Uttar Pradesh) and South (comprising of the states of Andhra Pradesh, Karnataka, Kerala and Tamil Nadu). The results are presented in Tables 4. Note that we only present the coefficient estimates for the linear version and the coefficient estimates for the log-linear version are not presented but are available on request. The following results are worth noting. First, the OLS estimates of the estimated marginal propensities to consume out of idiosyncratic changes in income are almost always higher compared to the corresponding IV estimates. This implies that endogenising income consistently reduces the estimated marginal propensities to consume out of changes in income. Third, in general consumption tracks income more closely for the poorer households (the landless and the small landowners) compared to the richer households (the medium and large landowners). For example, the OLS estimates show that the estimated marginal propensity to consume out of income is as high as 0.596 for the landless households residing in the East compared to 0.071 for the large landowners in the same region. Fourth, the null hypothesis of full insurance $\left(\beta_1^w = 1, \beta_2^w = 0\right)$ is generally rejected. They are always rejected for the poorer households and in the few cases where consumption is insured against idiosyncratic income shocks (i.e., household consumption changes in response to changes in the community average consumption and not in response to changes in household income), the households belong to the medium or large landowning category.

## 6. Robustness

How sensitive are our results to the estimation methodology used and the sample stratification used. We consider several tests to ensure that the results are robust to alternative estimation methodologies used and alternative sample stratification used.

Ravallion and Chaudhuri (1997) and Jalan and Ravallion (1999) criticise the estimation methodology used above arguing that this test gives biases 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. They instead use the following specification:

$$\Delta c_{ivt}^{w} = \sum_{jk} \beta_{1jk}^{w} D_{ivt}^{jk} + \beta_{2}^{w} \Delta y_{ivt}^{w} + \beta_{3}^{w} \Delta n_{ivt}^{w} + \varepsilon_{ivt}^{w} \qquad (10)$$

where $D_{ivt}^{jk}$ is a village-time dummy variable such that

$$D_{ivt}^{jk} = \begin{cases} 1, \text{if } j = v \text{ and } k = t \\ 0, \text{otherwise} \end{cases}$$

The rest of the variables are the same as in equation (8). Notice that we again control for changes in household size. In this specification aggregate income risk is captured by the interacted village-time dummies and idiosyncratic income risk is captured by changes in income, which may be endogenous. If there is perfect income insurance within the village, then changes in household income will have no effect on consumption, after controlling for the village-time effects, i.e., $\beta_{2}^{w} = 0$. We also consider a restricted version of equation (10) where we do not control for the village-time effects

$$\Delta c_{ivt}^{w} = \beta_{2}^{*w} \Delta y_{ivt}^{w} + \beta_{3}^{*w} \Delta n_{ivt}^{w} + \varepsilon_{ivt}^{*w} \qquad (11)$$

Once again if consumption is fully insured against both idiosyncratic and covariate shocks, then $\beta_2^{*w} = 0$.

The estimated coefficients are presented in Table 5. Once again two alternative versions of equation (10) and (11) are estimated: in the first income is assumed to be exogenous and in the second, income is assumed to be endogenous, with lagged savings, lagged income and lagged number of earners used as instruments. We also estimated log-linear versions of these two equations and the results are available on request. The results are similar to those obtained earlier. The estimated marginal propensities to consume out of idiosyncratic changes in income is always rejected and consumption tracks income closely for the poorer households. It might be noted that the estimated marginal propensities are generally lower compared to those presented in Table 2.

The second specification test that we consider is yet another test of the sensitivity of the results to the estimation methodology used. The estimation methodology used thus far did not take into account the panel structure of the data. We next re-estimate equation (8) taking into account the panel structure of the data by including household level fixed effects that corrects for the potential omitted variable bias caused by the unobserved household fixed effects. To account for the potential endogeneity of income, we also consider the fixed effects IV regression. The results are presented in Table 6. The results are quite similar to those presented in Table 2. To re-iterate, once again the null hypothesis of full insurance $\left(\beta_1^w = 1, \beta_2^w = 0\right)$ is always rejected and we again find that consumption tracks income more closely in the poorer households. The estimated marginal propensities to consume out of idiosyncratic

income changes are always significantly greater than zero. Also notice that the estimated coefficients for $\beta_2^w$ are lower when income is assumed to be endogenous.

In our estimation thus far, we have stratified the sample on the basis of landownership arguing that in rural India landownership is the primary indicator of wealth because of the collateral value associated with land. How sensitive are the estimates to this particular form of stratification used? We next consider an alternative method of stratification using the highest level of education attained by any member of the household. Households are stratified into one of the following four categories: No education (EDUC = 1), the most educated member of the household has some primary schooling or is literate without any formal education (EDUC = 2), the most educated member of the household has more than primary but less than matriculation (EDUC = 3) and the most educated member of the household has more than high school education (EDUC = 4). Total household income increases with the educational attainment of the most educated member of the household.[4] Once again two sets of estimates are presented – OLS estimates when income is exogenous and the IV estimates when income is assumed to be endogenous. The estimated coefficients are presented in Table 7. Once again the null hypothesis of full insurance $\left(\beta_1^w = 1, \beta_2^w = 0\right)$ is rejected. Further the null hypothesis that the estimated marginal propensities to consume out of income are zero $\left(\beta_2^w = 0\right)$ are also rejected. Consumption tracks income for the poorer households when income is assumed to be exogenous. The results are somewhat different when income is assumed to be endogenous – in particular we find that when

[4] For example, the average household income in 1970-71 for the households in each of the four categories were as follows: Rs 2375.38, Rs 3373.45, Rs 5096.95 and Rs 6898.66.

income is assumed to be endogenous, the estimated marginal propensity to consume is the lowest for the poorest households (no member of the household has any education – EDUC = 0).

## 7. Conclusion

This paper examines the extent of consumption insurance against income risk by households in rural India. Motivated by the theory of risk sharing we estimate the effects of income changes on consumption after controlling for aggregate shocks through changes in village level consumption and household size. We also test whether there is a systematic wealth effect on the extent of consumption insurance against idiosyncratic income shocks by classifying the households on the basis of landholding, which is the primary source of wealth for rural households in India.

Consumption regressions using the ARIS-NCAER data show that the null hypothesis of full insurance is rejected both for the population as a whole and for the different land classes. Our estimation results also show that consumption tracks income more closely for the poorer households – the estimated marginal propensity to consume out of idiosyncratic changes in income is significantly higher for the poorer households compared to the richer households. The results are robust to alternative estimation methodologies and alternative methods of sample stratification.

The implications of the results are quite significant. Governments and non-governmental organisations have implemented various programs designed specifically to reduce the riskiness of rural incomes and the stated aim of such programs is often to provide a safety net to the rural poor. It appears however that the programs are not being

targeted adequately – the poorest continue to be the most vulnerable. The results in this paper strengthen the case for improved public insurance programs, targeted at the most vulnerable, in underdeveloped rural economies. What specific form the program should take is left open to debate.

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**Table 1:**
**Selected Descriptive Statistics**

| | | 1968 – 69 | | 1969 – 70 | | 1970 – 71 | |
|---|---|---|---|---|---|---|---|
| | **Sample Size** | **Mean** | **Std. Dev.** | **Mean** | **Std. Dev.** | **Mean** | **Std. Dev.** |
| **All Households** | | | | | | | |
| Total Income | 4118 | 3840.516 | 4239.807 | 3975.463 | 3762.848 | 4208.211 | 4095.707 |
| Total Expenditure | 4118 | 3002.369 | 2576.365 | 3118.308 | 2418.402 | 3186.873 | 2458.127 |
| CV (Total Income) | | 110.397 | | 94.6518 | | 97.3266 | |
| CV (Total Expenditure) | | 85.8111 | | 77.5549 | | 77.1329 | |
| Correlation* | | | | 0.3883 (0.0000) | | 0.5149 (0.0000) | |
| **Landless Households** | | | | | | | |
| Total Income | 907 | 2178.840 | 2421.497 | 2116.427 | 1802.195 | 2256.591 | 2404.215 |
| Total Expenditure | 907 | 1851.308 | 1917.734 | 1922.929 | 1451.966 | 1954.802 | 1607.362 |
| CV (Total Income) | | 111.137 | | 85.1527 | | 106.542 | |
| CV (Total Expenditure) | | 103.588 | | 75.508 | | 82.2263 | |
| Correlation* | | | | 0.6035 (0.0000) | | 0.5271 (0.0000) | |
| **Small Landowners** | | | | | | | |
| Total Income | 1699 | 2895.491 | 2565.156 | 2920.519 | 2236.783 | 2990.534 | 2195.875 |
| Total Expenditure | 1699 | 2453.692 | 1865.769 | 2521.446 | 1697.379 | 2564.243 | 1637.806 |
| CV (Total Income) | | | 88.5914 | | 76.5885 | | 73.4275 |
| CV (Total Expenditure) | | | 76.0393 | | 67.3177 | | 63.8709 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Correlation* | | | | 0.4765 (0.0000) | | 0.6711 (0.0000) | |
| **Medium Landowners** | | | | | | | |
| Total Income | 980 | 4986.281 | 4244.981 | 5212.728 | 3382.835 | 5468.707 | 3507.855 |
| Total Expenditure | 980 | 3865.374 | 2719.264 | 3999.813 | 2409.040 | 4079.836 | 2347.032 |
| CV (Total Income) | | 85.1332 | | 64.8957 | | 64.1441 | |
| CV (Total Expenditure) | | 70.3493 | | 60.2288 | | 57.5276 | |
| Correlation* | | | | 0.3858 (0.0000) | | 0.4978 (0.0000) | |
| **Large Landowners** | | | | | | | |
| Total Income | 532 | 7580.904 | 7147.765 | 8234.820 | 6055.951 | 9102.318 | 6626.628 |
| Total Expenditure | 532 | 5127.310 | 3361.450 | 5438.615 | 3380.523 | 5630.923 | 3523.768 |
| CV (Total Income) | | 94.2864 | | 73.5408 | | 72.8015 | |
| CV (Total Expenditure) | | 65.5597 | | 62.1578 | | 62.5789 | |
| Correlation* | | | | 0.3143 (0.0000) | | 0.4734 (0.0000) | |

**Notes:**
CV = (SD/Mean)*100
*: Correlation between change in Total Income and change in Total Expenditure
Figures in Parenthesis indicate p-values

**Table 2:**
**Consumption Changes Regressed on Income Changes (Levels)**

| | **Income Exogenous** | | | **Income Endogenous** | | |
|---|---|---|---|---|---|---|
| | $\Delta c_{vt}^{aw}$ | $\Delta y_{ivt}^{w}$ | **Joint Test[a]** | $\Delta c_{vt}^{aw}$ | $\Delta y_{ivt}^{w}$ | **Joint Test[a]** |
| All Households | 0.860*** (0.016) | 0.179*** (0.006) | 477.34*** | 0.876*** (0.017) | 0.162*** (0.012) | 50.68*** |
| Landless Households | 0.850*** (0.039) | 0.322*** (0.021) | 115.53*** | 0.853*** (0.041) | 0.315*** (0.033) | 46.84*** |
| Small Landowners | 0.767*** (0.028) | 0.311*** (0.010) | 461.81*** | 0.861*** (0.033) | 0.167*** (0.027) | 19.08*** |
| Medium Landowners | 0.880*** (0.029) | 0.119*** (0.009) | 83.35*** | 0.892*** (0.031) | 0.104*** (0.015) | 25.46*** |
| Large Landowners | 0.898*** (0.036) | 0.126*** (0.013) | 51.19*** | 0.904*** (0.040) | 0.118*** (0.029) | 8.17*** |

**Notes:**
Figures in Parenthesis are Standard Errors
***: Significant at 1%
Joint Test[a]: $\beta_1^w = 1, \beta_2^w = 0 \sim F$

**Table 3:**
**Consumption Changes Regressed on Income Changes (Growth Rates)**

| | **Income Exogenous** | | | **Income Endogenous** | | |
|---|---|---|---|---|---|---|
| | $\Delta c_{vt}^{*aw}$ | $\Delta \log(y_{ivt}^{w})$ | **Joint Test[a]** | $\Delta c_{vt}^{*aw}$ | $\Delta \log(y_{ivt}^{w})$ | **Joint Test[a]** |
| All Households | 0.805*** (0.013) | 0.247*** (0.006) | 891.60*** | 0.842*** (0.014) | 0.188*** (0.010) | 182.27*** |
| Landless Households | 0.722*** (0.027) | 0.391*** (0.014) | 410.49*** | 0.794*** (0.030) | 0.276*** (0.023) | 75.72*** |
| Small Landowners | 0.791*** (0.022) | 0.278*** (0.010) | 405.92*** | 0.844*** (0.023) | 0.172*** (0.016) | 64.27*** |
| Medium Landowners | 0.868*** (0.023) | 0.157*** (0.011) | 105.43*** | 0.896*** (0.025) | 0.115*** (0.018) | 20.70*** |
| Large Landowners | 0.842*** (0.034) | 0.188*** (0.014) | 89.40*** | 0.845*** (0.036) | 0.184*** (0.020) | 40.28*** |

**Notes:**
Figures in Parenthesis are Standard Errors
***: Significant at 1%
Joint Test[a]: $\beta_1^w = 1, \beta_2^w = 0 \sim F$

**Table 4:**
**Consumption Changes Regressed on Income Changes, by Region (Levels)**

| | **Income Exogenous** | | **Income Endogenous** | |
|---|---|---|---|---|
| | $\Delta\log(y^{w}_{ivt})$ | **Joint Test[a]** | $\Delta\log(y^{w}_{ivt})$ | **Joint Test[a]** |
| **All Households** | | | | |
| East | 0.258*** | 177.21*** | 0.163*** | 16.04*** |
| | (0.014) | | (0.030) | |
| West | 0.213*** | 82.72*** | 0.211*** | 22.24*** |
| | (0.017) | | (0.032) | |
| North | 0.177*** | 176.99*** | 0.163*** | 23.63*** |
| | (0.009) | | (0.024) | |
| South | 0.140*** | 127.77*** | 0.122*** | 29.91*** |
| | (0.009) | | (0.016) | |
| **Landless Households** | | | | |
| East | 0.596*** | 192.28*** | 0.264*** | 5.99*** |
| | (0.030) | | (0.082) | |
| West | 0.418*** | 24.15*** | 0.499*** | 19.86*** |
| | (0.060) | | (0.079) | |
| North | 0.259*** | 42.31*** | 0.194*** | 7.71*** |
| | (0.028) | | (0.050) | |
| South | 0.175*** | 65.98*** | 0.143*** | 19.18*** |
| | (0.015) | | (0.024) | |
| **Small Landowners** | | | | |
| East | 0.352*** | 110.84*** | 0.268*** | 17.32*** |
| | (0.024) | | (0.046) | |
| West | 0.228*** | 46.39*** | 0.133*** | 4.50** |
| | (0.024) | | (0.046) | |
| North | 0.303*** | 189.43*** | 0.125*** | 5.40*** |
| | (0.016) | | (0.039) | |
| South | 0.349*** | 115.22*** | 0.162*** | 2.19 |
| | (0.023) | | (0.079) | |
| **Medium Landowners** | | | | |
| East | 0.216*** | 31.58*** | 0.117 | 1.43 |
| | (0.027) | | (0.075) | |
| West | 0.202*** | 55.53*** | 0.173*** | 13.14*** |
| | (0.019) | | (0.034) | |
| North | 0.112*** | 14.76*** | 0.085** | 2.60* |
| | (0.021) | | (0.037) | |
| South | 0.091*** | 20.75*** | 0.084*** | 9.97*** |
| | (0.014) | | (0.084) | |
| **Large** | | | | |

| | | | | |
|---|---|---|---|---|
| **Landowners** | | | | |
| East | 0.071*** | 3.61** | 0.113*** | 5.00*** |
| | (0.027) | | (0.036) | |
| West | 0.103*** | 12.58*** | 0.021 | 0.22 |
| | (0.021) | | (0.043) | |
| North | 0.150*** | 29.02*** | 0.168*** | 6.40*** |
| | (0.020) | | (0.047) | |
| South | 0.199*** | 5.50*** | 0.166* | 1.94 |
| | (0.036) | | (0.084) | |

**Notes:**
Figures in Parenthesis are Standard Errors
***: Significant at 1%
**: Significant at 5%
*: Significant at 10%
Joint Test[a]: $\beta_1^w = 1, \beta_2^w = 0 \sim F$
Regressions Control for Community Average Consumption

**Table 5:**
**Consumption Changes Regressed on Income Changes with and without Village Level Dummies**

| | Income Exogenous | | Income Endogenous | |
|---|---|---|---|---|
| | **Including Village Level Dummies** | **Without Village Level Dummies** | **Including Village Level Dummies** | **Without Village Level Dummies** |
| All Households | 0.258*** | 0.254*** | 0.235*** | 0.238*** |
| | (0.007) | (0.007) | (0.014) | (0.014) |
| Landless | 0.366*** | 0.425*** | 0.364*** | 0.451*** |
| Households | (0.026) | (0.023) | (0.036) | (0.035) |
| Small | 0.388*** | 0.380*** | 0.178*** | 0.228*** |
| Landowners | (0.012) | (0.011) | (0.031) | (0.029) |
| Medium | 0.183*** | 0.190*** | 0.166*** | 0.162*** |
| Landowners | (0.013) | (0.011) | (0.019) | (0.017) |
| Large | 0.207*** | 0.196*** | 0.237*** | 0.166*** |
| Landowners | (0.018) | (0.015) | (0.042) | (0.036) |

**Notes:**
Figures in Parenthesis are Standard Errors
***: Significant at 1%

**Table 6:**
**Consumption Changes Regressed on Income Changes (Levels) – Fixed Effects**

| | Income Exogenous | | | Income Endogenous | | |
|---|---|---|---|---|---|---|
| | $\Delta c_{vt}^{aw}$ | $\Delta y_{ivt}^{w}$ | **Joint Test[a]** | $\Delta c_{vt}^{aw}$ | $\Delta y_{ivt}^{w}$ | **Joint Test[b]** |
| All | 0.870*** | 0.177*** | 200.78*** | 0.894*** | 0.139*** | 181.82*** |
| Households | (0.024) | (0.009) | | (0.024) | (0.010) | |
| Landless | 0.866*** | 0.319*** | 44.20*** | 0.886*** | 0.267*** | 50.46*** |
| Households | (0.057) | (0.034) | | (0.058) | (0.038) | |
| Small | 0.771*** | 0.309*** | 218.48*** | 0.812*** | 0.244*** | 193.03*** |
| Landowners | (0.043) | (0.015) | | (0.044) | (0.018) | |
| Medium | 0.908*** | 0.099*** | 27.61*** | 0.933*** | 0.066*** | 18.52*** |
| Landowners | (0.040) | (0.013) | | (0.041) | (0.015) | |
| Large | 0.8653*** | 0.137*** | 27.50*** | 0.865*** | 0.137*** | 39.40*** |
| Landowners | (0.055) | (0.019) | | (0.055) | (0.022) | |

**Notes:**
Figures in Parenthesis are Standard Errors
***: Significant at 1%
*: Significant at 10%
[#]: Number of Groups = 4118
Joint Test[a]: $\beta_1^w = 1, \beta_2^w = 0 \sim F$
Joint Test[b]: $\beta_1^w = 1, \beta_2^w = 0 \sim \chi^2$

**Table 7:**
**Consumption Changes Regressed on Income Changes (Levels) – Stratified by the Highest Level of Education Attained by any Member of the Household**

| | **Income Exogenous** | | **Income Endogenous** | |
|---|---|---|---|---|
| | $\Delta y^{w}_{ivt}$ | **Joint Test[a]** | $\Delta y^{w}_{ivt}$ | **Joint Test[a]** |
| All Households | 0.169*** | 575.60*** | 0.141*** | 90.92*** |
| | (0.005) | | (0.010) | |
| Illiterate | 0.208*** | 261.07*** | 0.078*** | 5.69*** |
| | (0.009) | | (0.023) | |
| Some Primary Schooling | 0.188*** | 201.73*** | 0.118*** | 11.09*** |
| | (0.009) | | (0.026) | |
| Middle Schooling | 0.189*** | 145.78*** | 0.182*** | 29.35*** |
| | (0.011) | | (0.024) | |
| Post Secondary | 0.132*** | 75.19*** | 0.145*** | 33.07*** |
| | (0.011) | | (0.018) | |

**Notes:**
Figures in Parenthesis are Standard Errors
***: Significant at 1%
*: Significant at 10%
Joint Test[a]: $\beta_1^w = 1, \beta_2^w = 0 \sim F$
Regressions Control for Community Average Consumption