Indian Economic Review, Vol. XLVII, No. 2, 2012, pp. 265-283

Consumption Smoothing and Insurance Against the Income Risks: A Case of India

PARMOD KUMAR[1]
ADRTC, Institute for Social and Economic Change, Bangalore

AND

SUDHIR KUMAR SINGH
Word Bank, Washington DC, United States

ABSTRACT

This paper examines the incidence of consumption smoothing or risk sharing among the above and below poverty households in India. The results suggest partial risk sharing activities between households either within the same village or within their same ethnic groups. The results of insurance through same ethnic groups are more robust than that of village insurance. The results of insurance along the same caste line were found across the board whereas results for village insurance appeared in few cases. The implications of these results are quite significant. The findings of the paper indicate that various welfare programmes launched by the government to provide safety nets to the poor are not being targeted adequately as the poorest of the poor households remain the most vulnerable. The findings strengthen the case for improved targeting and making some provision for the public insurance for the households who lie at the bottom in the income bracket.

Keywords: Consumption smoothing; Risk sharing; Insurance; Above poverty; Below poverty; Antyodaya; Public distribution system

JEL Classification: D81; D91; I38

1. INTRODUCTION

Household income is subject to various fluctuations. Such fluctuations are much higher among the poor households in rural areas in the developing economies because earning sources of rural poor are not regular. In addition to fluctuations in their earnings subject to availability of employment during a particular period, they are also vulnerable to natural calamities like, flood, drought and crop damage caused by weed, insects, etc. Therefore, in the event of income failure how they are able to sustain their consumption poses a paramount question. In the absence of any kind of public immunity the households are left to their social underpinnings to manage their consumption. There is a wide literature available that indicates the existence of some sort of insurance among the poor,

1 Corresponding Author: ADRTC, Institute for Social and Economic Change (ISEC), Nagarbhavi P.O., Bangalore – 560072.

Acknowledgement: The author would like to thank the anonymous referees for their useful comments and suggestions.

either through their social networking or through their management of income or assets in the long run. How well are households in rural economies able to insure consumption against shocks to income? In the recent past, this question has led to a substantial literature examining the success of households in insuring consumption and identifying different mechanisms that could potentially enable households to do so. The literature on risk and insurance in poor rural economies has established three stylized facts – (i) income risk is pervasive; (ii) household behaviour is geared in part to protecting consumption from such risk; and (iii) the mechanism of doing so are both private and social, the latter comprising various informal risk sharing arrangements amongst two or more households (Jalan and Ravallion, 1999).

The studies including Mace (1991), Alderman and Paxson (1992), Deaton (1992), Fafchamps (1992), Grimard (1997), Morduch (1995), Townsend (1994, 1995), Maitra (1998, 2001), Zhang and Ogaki (2000), Krueger and Perri (2002), Chetty and Looney (2006), Asdrubli and Kim (2008) and Chiappori et al. (2011) led to the question of how well households in rural economies are able to insure consumption against such shocks to income? They concluded that households take action aimed at protecting consumption by drawing on both private and social risk sharing arrangements. Townsend (1994) lists five potential risk bearing mechanisms as (i) Spatial diversification of land holdings; (ii) Storage of grains from one year to the next; (iii) Purchases and sales of assets such as bullocks and land; (iv) Credit from formal and informal sources; and (v) Gifts and transfers within the family networks. However, not all households are equally able to insure consumption against income shocks and differences in access to market, particularly financial market, result in varying ability of households to insure against income shocks.

The implications of consumption insurance are quite significant for policy matters related to welfare programmes aimed at providing social security network to the poor. In India, Public Distribution System (PDS) is a prominent welfare programme aimed at providing cheaper food to the lower income strata of the population. The purpose of making PDS system targeted was implicitly to reduce the risk of income shocks being transformed into consumption shocks in the case of poor. In other words, aim of such welfare-oriented programmes was to provide a safety net to the poor households. This paper makes an attempt to evaluate how successful has been the policy of targeted PDS in mitigating such risks and providing safety net to the vulnerable sections of society, namely the below poverty line households (BPL) and Antyodaya Anna Yojana (AAY) households, the latter being the poorest of the poor households.

The paper is divided into five sections. The second section presents the theoretical framework of the model on consumption smoothing through insurance. The third section presents some facts about the observed distribution pattern of households' income and consumption in our selected states. Section four presents the results of the model estimated to measure the risk insurance among the selected households using our penal data generated though six rounds of household survey. The last section presents the major conclusions of the study.

2. THE THEORETICAL FRAMEWORK OF RISK INSURANCE

The theoretical framework of risk sharing stems from the fact that households try to mitigate risk by their combined actions. If the risks are idiosyncratic i.e. they are household specific in nature, then households will pool together to share all risks. 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 other words, if households pool their risks together, then their consumption will be determined in a combined way rather than being an individual phenomenon. In those circumstances, changes in factors specific to the household like changes in household income will not have a statistically significant impact on changes in household consumption. The estimated marginal propensity to consume of a particular household out of changes in its own income should be equal to zero while response of changes in community consumption on individual consumption should be equal to one. If that happens, such occurrences indicate that the household consumption is fully insured against any risk. The amount of risk sharing that actually takes place, could be compared with this benchmark of complete risk sharing.

This paper examines whether the incidence of consumption smoothing (risk sharing) works better among the rich (Above Poverty Line) households who have better means of getting insured or does it work more effectively among the poor (Below Poverty Line and Antyodaya) households. The poor households are likely to be more vulnerable to various kinds of income risks and therefore they should undertake such measures to reduce the much higher chances of variability in consumption. However, although poor being more vulnerable should be more likely to undertake such risk aversion measures but they will also be constrained by their limited availability of credit and insurance coverage. Therefore, it is very difficult to predict a-priori whether the consumption smoothing through risk insurance would be more among the poor or rich households.

Formal financial and insurance markets for the prevalent risks particularly in rural areas in developing economies are often deficient. There could be various reasons for that like high transaction costs, lack of information about the income pattern of rural households, lack of institutions for proper enforcement, collateral, etc. In the given circumstances, households are left with the only option of informal risk sharing among the family ties and relatives, their community members within or outside the village (among same ethnic groups) or among people having the same income brackets, etc. There are evidences that informal risk-sharing schemes exist and perform very well in some developing countries[2]. Because of proximity of geographical locations and because of close transactions among group members, these informal ties work very well as the monitoring and enforcement costs are next to nil in their cases. However, these informal arrangements are still subject

2 For a review of issues related to the performance of traditional system of social security and insurance in developing countries, refer to Platteau (1991).

to aggregate risks. The amount of such risk would be higher among those community members where the whole community members are engaged in seasonal activities like in agriculture. The cropping pattern in developing countries is not diversified sufficiently. If all the cultivating members in a village are growing the same crop, their income will co-vary putting them in a combine risk. The local covariant risk can be reduced either by diversifying the cropping pattern or by extending the informal arrangements outside the village. The third option could be pooling with relatives or persons with close ties that are not subject to same risks.

Therefore, the central question in the discussion of insurance among households is the identification of the appropriate group within which the informal risk sharing takes place. These groups may differ according to countries and societies. In relatively homogeneous societies, geographic proximity may be the determinant of the formation of the insurance group. In a number of studies, village is assumed to form such a homogeneous group. However, in societies that are more diverse, either along ethnic groups or castes, the village may not be the appropriate unit of risk-sharing. In one of the examples, Morduch (1990) examined the possibility that rural households in the ICRISAT dataset from India insure consumption with members of their own castes within their village. In another study from Cote d' Ivoire, Grimard (1997) examined whether households take part in spatially diversified risk sharing arrangements with members of their own ethnic group. In both these studies, evidences were found for risk sharing but the hypothesis of complete risk sharing was however rejected.

In yet another study on India, Townsend (1994) used an optimal consumption allocation framework to derive a test for complete insurance among households in villages in rural India. Although he rejected the incidence of complete insurance, his results did suggest that an individual household's consumption was partly insured with the other households in the village. In addition to above studies, there are many more especially in the developing countries that analyzed risk sharing, taking village as the unit of risk sharing[3]. Udry (1994) and Townsend (1994) pointed out that the village arrangements were vulnerable to aggregate village shocks and that research was needed to examine how these households dealt with such an aggregate risk. Rosenzweig (1988) argues that households in informal risk sharing schemes were aware of the covariant nature of the risks and they would attempt to diversify spatially to reduce such risks. Rosenzweig and Stark (1989) took an example from the practice in rural India of sending daughters as brides to families residing in other villages that helps to mitigate the effects of income risks by establishing ties to households in locations that are subject to uncorelated income shocks. Following the example of Townsend and other studies, in this paper we use village as unit for exploring risk insurance among our selected households. However, Morduch observed that caste played very important role forming uniform group in India as members preferred

3 See Townsend (1995) for a survey of the studies of consumption insurance in developing countries.

to transact within their own caste group. In our survey data, we have another uniform group based on economic criterion in terms of ration card holding[4]. The people issued with similar ration cards belonged to one uniform group from both social as well as economic point of view. From the economic view point, e.g., the APL households belonged to the higher income bracket while AAY households belonged to the lowest income bracket. From social view point, they mostly belonged to the same caste group. The demographic characteristics of household data (Table 1) indicates that majority of Antyodaya (AAY) households belonged to the Scheduled Caste and Scheduled Tribe groups, while the below poverty (BPL) households mostly belonged to Scheduled Caste, Scheduled Tribe and Other Backward Caste. The above poverty line (APL) households had more number of Forward Caste households. Therefore, in our analysis, we evaluate risk-sharing theory from this point of view as well.

3. THE ECONOMETRIC MODEL

A fairly general specification of the risk-sharing test may be developed by proposing a risk-sharing group and assuming that within each group, consumption is efficiently allocated in each period over the life time of the household. Let us assume that each household i, of a risk sharing group g, has a constant absolute risk aversion utility function in terms of its consumption at time t, c_{igt} and household preferences x_{igt} : $U(c_{igt}) = - \exp [- A (c_{igt} - x_{igt})]$. One can then develop a test for the hypothesis of perfect insurance by directly using the first order condition of the group's optimization problem to solve for consumption:

$$C_{igt} = \left(\frac{1}{A}\right) ln\, A + \left(\frac{1}{A}\right) ln\, (\omega_{ig}) - \left(\frac{1}{A}\right) ln\, (\lambda_{gt}) + x_{igt} \qquad ...(1)$$

where ω_{ig} is the welfare weight which group g uses in choosing the optimal sets of consumption for households of the group, λ_{gt} is the Lagrange multiplier on the group resource constraint. Equation (1) states that if household i, perfectly insures with other households of group g, its consumption should be partly determined by the aggregate resources of the group. Except in so far as it enters the aggregate resource constraint, household i's income does not affect household i's consumption. Including an individual household's earning term y_{igt}, in equation (1) and making this a testable proposition by including an error term u_{igt}. This error term may contain measurement errors as well as household-specific shocks, which are non-observable:

4 All households in India are categorized into Above Poverty Line (APL) or Below Poverty Line (BPL). Among the BPL households, the bottom 25 percent are further categorized into Antyodaya Anna Yojana (AAY) households. All below poverty households are provided with concessional food through the Public Distribution System (PDS). The AAY households get food at a much cheaper rate as compared to other BPL households.

$$C_{igt} = \left(\frac{1}{A}\right) ln\, A + \left(\frac{1}{A}\right) ln\, (\omega_{ig}) - \left(\frac{1}{A}\right) ln\, (\lambda_{gt}) + x_{igt} + by_{ig} + u_{igt} \qquad ...(2)$$

Estimating equation (2) is problematic because it contains terms especially weights and preferences that are not observed. However, if one has information on the household for two consecutive periods, one can assume that household specific characteristics stay the same every period. Alternatively, they may be assumed to change, but are orthogonal to individual income and group resource constraints. In both cases, the effect of individual household preferences can be removed by working out first difference of equation (2).

$$\Delta C_{jt} = \Delta C_{ta} + (\Delta b_{jt} - \Delta b_{ta}) \qquad ...(3)$$

where

$$\Delta C_{jt} = C_{jt} - C_{jt-1}$$

$$\Delta C_{ta} = \frac{1}{j} \sum \Delta C_{jt}$$

$$\Delta b_{ta} = \frac{1}{j} \sum \Delta b_{jt}$$

Equation (3) presents a nontrivial approach for testing the full insurance implications: regress the changes in individual consumption onto the changes in aggregate consumption and other right hand side variables such as changes in individual income, family size and earning members in a family. All variables other than the aggregate consumption variable are predicted to enter insignificantly. This reflects the key feature of risk sharing: individual consumption responds to aggregate risk but not to idiosyncratic risk. Formally the empirical specification is

$$\Delta C_t^j = \beta_o + \beta_1 \Delta Y_t^j + \beta_2 \Delta C_t^a + u_t^j \qquad (4)$$

where ΔY_t^i is the change in individual j's income and ΔC_t^a is change in village combined consumption. The error term includes the time varying component of both individual and aggregate preference shocks and might also include measurement errors from the consumption and income data. The predictions of the risk-sharing model are $\beta_1 = 0$ and $\beta_2 = 1$. The model also predicts a zero coefficient for other right hand side variables. The hypothesis of complete risk sharing is tested in this paper using equation (4) [5].

5 The theoretical framework could also be explained using a constant relative risk aversion (CRRA) utility function. Equation (3) and (5) would then be expressed in terms of change in logarithms instead of changes in levels.

4. DATA BASE

The paper is based on a large primary survey of six selected states in India, namely Delhi, Jharkhand, Kerala, Madhya Pradesh, Maharashtra and Uttrakhand[6]. From each selected state, five districts in the geographical regions of North, South, East, West and Central were selected for drawing the sample. A total number of 200 households were surveyed for detailed information from each selected district. In this fashion, a total number of 6000 households (30*200) were surveyed for a consecutive six months' period. The proportion of BPL and APL households was done in the ratio of 80 and 20. Thereby, 4800 selected households belonged to BPL and rest 1200 were that of APL. Out of the selected BPL households, the proportion of BPL and AAY was in the ratio of 77 and 23 (as that was the ratio of total existing number of BPL and AAY card holders in the country). Keeping into account the proportion of rural and urban population in the country, an approximate ratio of 80/20 was adopted for drawing sample from rural and urban areas. The distribution of sample in APL, BPL and AAY for the rural and urban was done following the same criterion mentioned above. Information was collected on monthly basis and the data collection process was carried out for a period of 6 months. The survey was carried out consecutively for six months beginning from January 2007. The collected data represents these six months period for the monthly data and the calendar year 2006 for the annual data.

5. THE DISTRIBUTION OF INCOME AND CONSUMPTION

Before presenting the results of the model, a brief outline of the sample selected and the distribution of observed income and consumption for the selected households is discussed in this section. The demographic profile of households indicates their socio-economic characteristics. Comparing the caste characteristics across AAY, BPL and APL households, higher number of Forward Caste (FC) households were found in the case of APL category as compared to AAY and BPL (Table 1). On the age factor, around half to two-third members of all households in all the cases were in the working age while rest of them were either children below working age or they were senior citizens. It is apparent from the statistics that household size varied from 4 to 6 in different states with an average around 4.5 to 5 members per family. Household size was generally higher for the above poverty households because of common property/agriculture/business. In the case of below poverty, especially Antyodaya families, household size was lower because of their nuclear families owing to their adhoc earnings. Out of the average five members in a family, around one to two members were earning members.

6 This paper is drawn from a larger study completed by the author namely Evaluation of the Public Distribution System in India undertaken for the National Council of Applied Economic Research, New Delhi with financial support from the Department of Food and Public Distribution, Government of India. For details see Kumar (2010).

TABLE 1
THE DEMOGRAPHIC PROFILE OF THE SELECTED HOUSEHOLDS

					Age group			Caste			
		No. of HH	House hold size	Avg. no. of earners	<16	16-60	>60	SC	ST	OBC	FC
Delhi	AAY	200	4.40	1.39	32.15	61.85	5.99	44.33	6.19	26.80	22.68
	BPL	597	4.79	1.47	27.08	69.76	3.16	40.48	3.60	28.64	27.28
	APL	203	5.27	1.59	29.17	66.04	4.79	27.23	0.50	25.74	46.53
Jhar-	AAY	200	4.99	2.16	34.32	60.53	5.15	26.13	35.68	33.67	4.52
khand	BPL	641	5.19	2.12	38.34	56.57	5.08	18.86	41.52	36.45	3.17
	APL	159	5.75	2.13	37.29	56.41	6.29	10.69	28.3	52.20	8.81
Kerala	AAY	201	5.11	2.03	21.76	65.55	12.69	33.85	8.21	52.82	5.13
	BPL	601	4.96	1.92	22.36	66.97	10.67	37.67	1.39	51.74	9.20
	APL	198	4.75	1.65	26.46	66.41	7.13	26.98	1.59	58.20	13.23
Madhya	AAY	195	4.76	2.04	43.11	50.67	6.22	28.5	61.14	9.33	1.04
Pradesh	BPL	611	5.17	2.14	43.28	51.77	4.95	28.95	44.59	23.13	3.33
	APL	194	5.35	2.02	34.80	59.66	5.54	23.56	28.80	37.17	10.47
Maha-	AAY	193	4.09	1.88	30.54	60.70	8.76	20.42	35.08	30.89	13.61
rashtra	BPL	604	5.06	2.24	28.92	64.48	6.60	25.55	32.15	32.66	9.64
	APL	203	4.88	1.93	27.07	65.81	7.13	17.33	25.25	39.60	17.82
Uttra-	AAY	205	4.30	1.48	39.72	51.68	8.59	55.72	7.96	16.92	19.40
khand	BPL	592	5.23	1.62	42.99	52.32	4.68	56.09	12.18	11.32	20.41
	APL	203	4.77	1.63	33.69	59.53	6.78	35.20	16.84	12.24	35.72

Note: SC = Scheduled Caste; ST = Scheduled Tribe; OBC = Other Backward Caste; FC = Forward Caste

The household consumption comprises of expenditure on food and non-food items, excluding the durables. Similarly, household income includes all income earned from agriculture, livestock, agriculture and non agricultural wages, salaries, earnings from business and self-employment and all other transfer earnings. Table 2 presents average income and food & non food consumption expenditure for the selected AAY, BPL and APL households. In the table, income is decomposed into regular income and casual income.

TABLE 2
INCOME AND CONSUMPTION BREAK-UP OF THE SELECTED HOUSEHOLDS
(Rs. PER CAPITA PER MONTH)

	AAY		BPL		APL	
Income break-up						
	Income	Share (%)	Income	Share (%)	Income	Share (%)
			Delhi			
Regular Income	382	71.1	435	66.2	1022	80.9
Casual Income	156	28.9	223	33.8	242	19.1
Total	537	100.0	658	100.0	1263	100.0
			Jharkhand			
Regular Income	55	21.0	71	24.7	304	74.7
Casual Income	206	79.0	216	75.3	103	25.3
Total	260	100.0	287	100.0	406	100.0
			Kerala			
Regular Income	213	30.1	193	24.4	676	61.1
Casual Income	496	69.9	599	75.6	431	38.9
Total	710	100.0	792	100.0	1107	100.0
			Madhya Pradesh			
Regular Income	48	21.9	81	31.0	358	68.3
Casual Income	172	78.1	180	69.0	166	31.7
Total	221	100.0	260	100.0	524	100.0
			Maharashtra			
Regular Income	141	34.0	211	44.5	982	86.5
Casual Income	274	66.0	264	55.5	154	13.5
Total	415	100.0	475	100.0	1136	100.0
			Uttrakhand			
Regular Income	113	33.3	154	35.0	721	78.3
Casual Income	225	66.7	285	65.0	200	21.7
Total	338	100.0	439	100.0	921	100.0

TABLE 2 Continued...

	AAY		BPL		APL	
Consumption break-up						
	Consumption	Share (%)	Consumption	Share (%)	Consumption	Share (%)
			Delhi			
Food consumption	229	59.0	262	60.3	338	55.6
Non food consumption	159	41.0	173	39.7	269	44.4
Total consumption	388	100.0	434	100.0	607	100.0
			Jharkhand			
Food consumption	165	69.3	190	70.9	235	68.4
Non food consumption	73	30.7	78	29.1	109	31.6
Total consumption	237	100.0	268	100.0	344	100.0
			Kerala			
Food consumption	185	55.8	204	55.7	284	51.9
Non food consumption	147	44.2	163	44.3	262	48.1
Total consumption	332	100.0	367	100.0	546	100.0
			Madhya Pradesh			
Food consumption	148	68.3	180	68.2	251	59.0
Non food consumption	68	31.7	84	31.8	175	41.0
Total consumption	216	100.0	264	100.0	425	100.0
			Maharashtra			
Food consumption	193	66.2	217	67.6	312	59.2
Non food consumption	99	33.8	104	32.4	215	40.8
Total consumption	291	100.0	321	100.0	527	100.0
			Uttrakhand			
Food consumption	204	63.2	222	64.6	308	61.7
Non food consumption	118	36.8	121	35.4	191	38.3
Total consumption	322	100.0	343	100.0	499	100.0

The regular income comprises of income sources that have comparatively lesser degree of uncertainty like income from agriculture, livestock, earnings from self-employment in business etc., and salary & pension. The casual income comprises of

earnings from casual sources that have much higher uncertainty like casual wages from agriculture and non-agriculture, income from transfer payments, income from sale of assets, income from common property resources etc. The statistics in the table reveal that the proportion of casual income was significantly higher among the below poverty households (AAY and BPL) as compared to above poverty households (APL) in all the six selected states without any exception. As APL households were dependent on salary, self-business or agriculture, they had assured regular earnings. Whereas, BPL and AAY households were more vulnerable as they did not have any regular means of employment and in most of the cases they were not employed for the whole month. Average above poverty households earned around twice as much as that of BPL households and more than two and a half times higher compared to the poorest of the poor households. In the case of consumption, above poverty households spent around 1.5 times that of BPL households and 1.7 times that of poorest of the poor households. The proportion of food to non food expenditure was in the ratio of 60/40 to 70/30 in different states.

Table 3 presents variability and concentration in per capita income and consumption among the selected households. The variation in consumption across the households was less than that of income. The coefficient of variation (CV) in per capita consumption averaged around 0.4 for the below poverty (AAY and BPL) households and 0.5 for the above poverty households. In comparison, CV for per capita income averaged around 0.5 to 0.6 for the below poverty households and 0.9 for the above poverty households. Variation was highest in Maharashtra and lowest in Jharkhand. Analyzing concentration in consumption and income across the categories, consumption appeared to be more symmetric compared to income. This was true in all the states without any exception. The value of Gini coefficient for income was higher than that of consumption in all the categories. As in the case of CV, difference between the Gini of income and consumption was highest among above poverty households in all the selected states. The average value of Gini coefficient was 0.20 and 0.26 for consumption and income, respectively for below poverty households, while corresponding averages for above poverty households were 0.23 and 0.37. This indicates that the range between the lowest and the highest income and consumption was much higher among the above poverty households than that of below poverty households. Between the BPL and AAY, no major differences in the distribution of income and consumption were observed as value of Gini coefficient did not vary much for income as well as consumption between these two categories. Comparing the six states, Gini coefficient for both income and consumption was comparatively higher in Maharahstra and Uttrakhand, while its magnitude was lowest in Jharkhand. The value of Gini coefficient for income varied from 0.45 in Maharashtra for the APL category to 0.22 in Jharkhand for the AAY households. In consumption, the range of Gini coefficient for consumption lied between 0.28 for APL in Madhya Pradesh to 0.15 for BPL in Maharashtra.

TABLE 3
CO-MOVEMENT OF INCOME AND CONSUMPTION VARIABLES

State	AAY		BPL		APL	
Coefficient of variation across household						
	Per capita Consumption	Per capita income	Per capita Consumption	Per capita income	Per capita Consumption	Per capita income
Delhi	0.40	0.47	0.34	0.53	0.37	0.83
Jharkhand	0.35	0.41	0.42	0.50	0.36	0.61
Kerla	0.35	0.52	0.38	0.58	0.69	1.09
Madhya Pradesh	0.48	0.47	0.45	0.50	0.89	0.90
Maharashtra	0.40	0.58	0.28	0.50	0.48	1.11
Uttarakhand	0.45	0.61	0.39	0.75	0.45	0.76
Concentration ratio - Gini coefficient						
	Per capita Consumption	Per capita income	Per capita Consumption	Per capita income	Per capita Consumption	Per capita income
Delhi	0.19	0.25	0.16	0.26	0.18	0.33
Jharkhand	0.18	0.22	0.17	0.24	0.19	0.31
Kerla	0.18	0.26	0.20	0.29	0.26	0.37
Madhya Pradesh	0.23	0.24	0.21	0.24	0.28	0.38
Maharashtra	0.20	0.29	0.15	0.23	0.22	0.45
Uttarakhand	0.21	0.30	0.18	0.29	0.24	0.38
Correlation coefficient (Δ Individual Consumption with)						
	Δ Individual income	Δ village consumption	Δ Individual income	Δ village consumption	Δ Individual income	Δ village consumption
Delhi	0.06	0.38	0.08	0.52	0.06	0.44
Jharkhand	0.06	0.34	0.11	0.46	0.00	0.43
Kerla	0.08	0.47	0.07	0.44	0.19	0.30
Madhya Pradesh	0.01	0.27	0.01	0.17	0.10	0.07
Maharashtra	0.14	0.46	0.09	0.34	0.14	0.46
Uttarakhand	0.18	0.39	0.08	0.46	0.08	0.35

The above results indicate that individual consumption does not perfectly co-move with that of income, although diversion between the two was more among above poverty households as compared to below poverty and poorest of the poor households. The last section of Table 3 presents correlation between change in individual consumption (over time) and change in individual income as well as that of village consumption. It is seen from the results that village consumption tracks individual consumption far better than individual income. The coefficient of correlation between change in individual consumption and change in individual income averaged around 0.1. On the other hand, value of coefficient between change in individual consumption and that of village consumption averaged around 0.4 among all categories of households. Thus, these results indicate that consumption variations were more symmetric and less variant as compared to income. In other words, when income observed fluctuations due to some internal or external shocks, consumption did not fluctuate to the same magnitude. This latter phenomenon is compatible with the hypothesis of consumption smoothing due to the presence of some formal or informal insurance among the households. This hypothesis is supported by the results of correlation between the individual consumption with that of village consumption.

6. RESULTS OF THE MODEL

The primary survey data collected over a period of six months for six thousand households in 6 states have been used for empirical estimation of this theoretical framework. In each state, data was collected from five districts, selecting five villages in each district[7]. From each state, a total number of one thousand households were surveyed for a period of six months. However, the model is estimated by regressing change in consumption on change in income and thereby loosing one month information in the process of generating data for the first difference of income and consumption. By pooling the time series and cross section - panel data, we have a total number of 5000 observations at the aggregate for each state and around 1000 observations in the case of AAY and APL households each, and around 3000 observations for the BPL households in each state for the first difference.

Equation (4) is estimated using OLS on first difference data. We estimate the regression of change in the level of consumption on the change in the level of income and change

7 In our selection, we followed four villages and one city/town from each district. Therefore, our data consists of 120 villages and 30 towns/cities. However, our sample selection consisted of 80 percent below poverty households including that of the AAY households. The selected sample from the city or town also belonged to the slum area of the city or existing villages within the big cities. For example, the sample selected from Delhi state belonged to rural areas only, for example, Palam village, Jahangirpuri, Narela, Nazafgarh village. For this reason, in the present exercise we do not differentiate between the sample selected from the village and town as underneath earning and consumption pattern as well as functioning of the PDS was same. Therefore we proceed with assuming there are a total number of 150 villages surveyed for this exercise.

in village consumption for the state and for each welfare group of AAY, BPL and APL households. Subsequently, we test the hypothesis that risk sharing is taking place within caste or community (ethnic groups, i.e., Scheduled Caste; Scheduled Tribe; Other Backward Caste and General Caste) rather than within the village. To test the hypothesis of risk sharing within ethnic or caste groups, instead of rounding up consumption across the village, we round it up for the four sub castes within each village to form combine ethnic consumption. In another specification, we test that insurance unit rather than being based on ethnic, caste and creed grounds is actually based on economic grounds. Similar to ethnic grouping, for the economic categorization within a village, we clubbed village consumption based on economic categories of AAY, BPL and APL card holding by the households. In addition, we used household size and number of earners as additional control variables to see the effect of family size and earning units per family on the household consumption.

TABLE 4
REGRESSION RESULTS-ORDINARY LEAST SQUARE
(DEPENDENT VARIABLE = ΔC)

	ΔY	ΔVC	R^{-2}	F* ΔY=0, ΔVC =1	ΔY	ΔBC	R^{-2}	F* ΔY=0, ΔBC =1	ΔY	ΔEC	R^{-2}	F* ΔY=0, ΔEC =1
						Delhi						
Aggre-gate	0.01* (3.3)	0.65* (29.2)	0.152	133.7*	0.01* (3.2)	0.80* (39.2)	0.242	54.0*	0.01* (3.7)	0.78* (33.4)	0.190	53.4*
AAY	0.02* (2.6)	0.41* (11.1)	0.115	132.5*	0.00 (1.0)	0.75* (16.9)	0.227	16.1*	0.01** (2.3)	0.57* (13.5)	0.160	57.9*
BPL	0.012* (4.8)	0.63* (26.6)	0.199	131.6*	0.01* (4.01)	0.91* (33.9)	0.284	13.7*	0.01* (4.82)	0.72* (28.9)	0.227	72.3*
APL	-0.00 (-0.61)	0.95* (12.8)	0.143	0.41	0.00 (0.55)	0.71* (15.3)	0.190	20.00*	0.00 (0.12)	1.01* (14.7)	0.179	0.40
						Jharkhand						
Aggre-gate	0.01* (3.08)	0.75* (28.3)	0.140	47.89*	0.02* (3.67)	0.84* (43.1)	0.272	42.41*	0.01** (2.48)	0.76* (31.0)	0.164	48.94*
AAY	0.01 (0.59)	0.60* (10.7)	0.104	26.43*	0.00 (0.34)	0.66* (12.7)	0.141	22.75*	0.00 (0.42)	0.51* (10.1)	0.095	46.12*
BPL	0.31* (5.51)	0.69* (24.4)	0.166	73.66*	0.02* (3.96)	0.89* (32.3)	0.252	14.28*	0.028* (5.08)	0.73* (25.9)	0.182	56.47*
APL	-0.00 (-0.25)	1.15* (12.0)	0.151	1.29	0.013 (1.31)	0.84* (21.4)	0.364	9.06*	-0.01 (-0.63)	1.05* (14.2)	0.202	0.44

TABLE 4 Continued...

	ΔY	ΔVC	R^{-2}	F* ΔY=0, ΔVC =1	ΔY	ΔBC	R^{-2}	F* ΔY=0, ΔBC =1	ΔY	ΔEC	R^{-2}	F* ΔY=0, ΔEC =1
Kerala												
Aggre-gate	0.02* (8.4)	0.80* (23.9)	0.115	53.02*	0.02* (9.56)	0.74* (30.5)	0.168	105.4*	0.02* (9.23)	0.76* (29.3)	0.160	85.12*
AAY	0.01* (2.8)	0.87* (13.0)	0.150	5.75*	0.02* (4.58)	0.77* (17.7)	0.243	26.6*	0.02* (3.17)	0.80* (14.0)	0.171	11.4*
BPL	0.02* (4.5)	0.77* (19.5)	0.116	27.61*	0.02* (5.88)	0.88* (26.8)	0.197	26.1*	0.02* (5.24)	0.79* (25.2)	0.181	39.3*
APL	0.03* (5.4)	0.82* (8.4)	0.095	16.0*	0.03* (5.5)	0.51* (8.7)	0.100	47.51*	0.03* (5.7)	0.68* (9.9)	0.123	26.7*
Madhya Pradesh												
Aggre-gate	0.05* (3.68)	0.49* (8.00)	0.015	39.4*	0.05* (3.63)	0.22* (5.77)	0.009	204.4*	0.05* (3.72)	0.24* (5.5)	0.001	159.6*
AAY	-0.01 (-0.43)	0.35* (8.4)	0.064	124.7*	0.01 (0.24)	0.21* (2.76)	0.004	53.3*	0.004 (0.15)	0.11* (3.38)	0.008	404.7*
BPL	0.004 (0.26)	0.55* (9.1)	0.025	27.1*	0.01 (0.43)	0.62* (11.6)	0.041	24.5*	0.01 (0.37)	0.30* (7.5)	0.017	147.8*
APL	0.07** (2.48)	0.49** (1.96)	0.006	5.02*	0.07** (2.46)	0.05 (0.61)	0.003	64.3*	0.07** (2.46)	0.15 (0.76)	0.003	12.3*
Maharashtra												
Aggre-gate	0.02* (8.0)	0.83* (26.5)	0.136	45.3*	0.02* (7.2)	0.78* (35.7)	0.215	73.7*	0.03* (9.2)	0.55* (20.8)	0.097	180.6*
AAY	0.05* (4.9)	0.68* (14.6)	0.205	32.8*	0.04* (4.62)	0.79* (20.6)	0.326	23.1*	0.06* (5.08)	0.22* (6.8)	0.076	304.6*
BPL	0.02* (4.9)	0.61* (19.2)	0.117	85.4*	0.02* (4.14)	0.81* (20.9)	0.133	20.1*	0.02* (4.76)	0.50* (17.1)	0.095	154.5
APL	0.02* (3.55)	1.65* (14.8)	0.192	25.4*	0.02* (3.73)	0.76* (17.9)	0.256	21.3*	0.03* (4.83)	1.28* (12.9)	0.164	16.9*
Uttrakhand												
Aggre-gate	0.01* (5.14)	0.65* (26.2)	0.127	106.2*	0.01* (5.41)	0.73* (30.9)	0.167	79.3*	0.01* (5.02)	0.72* (26.8)	0.134	65.2*
AAY	0.05* (6.2)	0.46* (11.6)	0.157	100.8*	0.04* (5.35)	0.63* (12.0)	0.165	34.6*	0.05* (5.25)	0.63* (14.4)	0.206	44.6*
BPL	0.01* (3.53)	0.62* (24.2)	0.172	116.9*	0.004* (3.19)	0.88* (28.6)	0.224	12.7*	0.01* (3.61)	0.72* (25.8)	0.193	53.0*
APL	0.02* (2.91)	0.95* (10.7)	0.106	4.34**	0.02* (3.30)	0.64* (12.3)	0.135	28.8*	0.02* (2.74)	0.76* (8.6)	0.073	7.2*

Note:(i) Figures in parentheses are respective, t values.
(ii) *, **, *** indicate significant at one, five and ten percent, respectively.

Table 4 presents the results of regressions. The table presents the coefficients of individual income and village consumption in column two and three, respectively. In column seven, coefficient of beneficiary consumption (based on economic grouping; BC) and in column eleven coefficient of ethnic consumption (based on caste grouping; EC) is presented. The value of F-ratio is reported in the subsequent columns for testing the joint occurrence of $\beta_1=0$ and $\beta_2=1$, which tests the hypothesis of complete risk sharing. The values of coefficients of household size and earners are not reported in the text although included as autonomous variables. The model is run in the first difference, thus differencing out the fixed effect and thereby random model in the panel data assumes automatically that there is no correlation between the error terms and controls variables. This suggests that our estimates of the coefficients are consistent.

The results of the regressions were mixed for different states and categories. The value of income coefficient was close to zero and the value of the village/ethnic/beneficiary consumption close to unit in most of the cases. These results are consistent with the implications of risk sharing. In explaining the change in household consumption, the change in aggregate consumption entered with a coefficient one, while change in household income had a zero coefficient. The value of the't' statistic presented in the parenthesis points out that the household income was significant in most of the states and categories. The coefficient of household income was insignificant for the APL category in Delhi and Jharkhand and AAY category in Jharkhand and Madhya Pradesh. Significant value of household income in all the other cases indicates that the changes in household consumption were idiosyncratic. The coefficients of village/ethnic/beneficiary consumption, however, were highly significant in all the states and categories without any exception supporting the hypothesis of risk sharing. On the basis of the F-test, the full risk sharing implications could not be accepted for any of the state or any category of households. The hypothesis was rejected mostly at one percent significance level. Thus, on one hand, individual consumption was found co-moving along with the aggregate village consumption supporting the hypothesis of risk sharing. On the other hand, coefficient of individual income was found highly significant indicating individual consumption was a function of individual income, thereby leaving the households vulnerable in the face of fluctuating income due to natural calamities and other idiosyncratic factors.

Comparing among different categories, the value of coefficient of individual income was generally same across different categories. However, the value of group consumption across village or beneficiary or ethnicity varied across different household categories. The value of the coefficient was higher for APL households compared to BPL/AAY households in all the states except Kerala and Madhya Pradesh. The higher values of combined consumption for APL households indicate that economically better off household were better insured compared to lower income strata households belonging to BPL and AAY categories. The reason for well off households being better insured is simply their better

hold on the resources in the form of ownership of land, business etc., and their better connectivity with the financial resources. This was indicated by statistics shown in Table 2 which shows their higher share in regular income compared to the households in the BPL and AAY category.

Our results also enable us to find out the modus operandi of informal group insurance at village or sub village categories. It is seen from the results that the coefficient of group consumption for village, beneficiary and ethnic groups was significant in all the states. However, the value of R^{-2} was highest in case of economic grouping (i.e., beneficiary consumption DBC) followed by ethnic grouping (DEC) and village grouping (DVC). These results support the earlier literature by Morduch (1991) who found that food consumption appeared to be well insured for some castes, suggesting that the right model may be one where neighbours insure each other against dire events but are left to cope individually in the face of minor shocks. Our results suggest that rather than insurance being at the village level, it was more convincing among the sub groups either based on economic stratification or based on ethnic or caste grounds. We also estimated a model, grouping consumption across various ethnic and economic groups at the broader state level rather than within a village under these sub categories. The results were not significant as R^{-2} was significantly small compared to the results presented above. Therefore these results are not reported here. Finally we also estimated our equations only for food instead of taking total expenditure (food + non food). The results of food were not significantly different from that of total expenditure presented above and therefore they are not reported here. The above results also indicated that risk sharing was better among different caste or economic groups within the village rather than across the state as a whole. Finally, the signs of coefficients of household size and number of earners in the family were not unique, indicating that additional members in the family and additional earners increased household consumption in some cases but acted negatively in other cases. Only in few cases, the coefficients were found significant.

7. CONCLUSIONS AND POLICY IMPLICATIONS

The findings of this paper suggest that selected households were not fully insured against idiosyncratic income risks. The full insurance model was rejected for all the states and all the category of households, except one or two cases, where income coefficient was not found significant. The full insurance was earlier refuted by Townsend (1994), Urdy (1994), Morduch (1990) and Deaton (1992). The results suggest partial risk sharing activities between households either within the same village or within their same ethnic group. The results of insurance through same ethnic groups were more robust than the results for the village insurance. These results are also valid from the socio-economic view-point. It is well known fact that Indian society is strongly divided on caste and creed

lines. People in a particular caste group prefer to transact within their own ethnic group and these facts lend support to our above findings that risk sharing groups have a closer knit on ethnic or caste basis. The results of insurance along the same caste line were found across the board whereas results for village insurance appeared in few cases, while it was rejected in other cases.

The implications of these results are quite significant. Government of India is running various schemes/programmes including the Targeted Public Distribution System designed specifically to provide food at a cheaper rate to the below poverty households. The prime objective of such programmes is to mitigate vulnerability in access to food for such people who are highly exposed to fluctuating income because of irregular nature of their employment. The stated aim of such programmes is often to provide a safety net to people who are below the poverty line. Our results support the fact that such programmes are not being targeted adequately as the poorest of the poor (the AAY) households remain the most vulnerable. The findings of the paper strengthen the case for improved targeting and making some provision for public insurance, for the poorest of the poor.

REFERENCES

Alderman, H. and Paxson, C. (1992), Do the Poor Insure?, A Synthesis of the Literature on Risk and Consumption in Developing Countries, Policy Research Working Paper No.108, *The World Bank*, Washington, D.C.

Asdrubli, P. and Soyoung, K. (2008), Incomplete Intertemporal Consumption Smoothing and Incomplete Risk Sharing, *Journal of Money, Credit and Banking,* Vol. 40, 1521–31.

Chetty, Raj and Loony, Adam (2006), Consumption Smoothing and the Welfare Consequences of Social Insurance in Developing Economies, *Journal of Public Economics,* Vol. 90, 2351-2356.

Chiappori, P.-A., Samphantharak, K., Schulhofer-Wohl, S. and Townsend, R. M., (2011), Heterogeneity and Risk Sharing in Village Economies, Working Paper Number 16696, *National Bureau of Economic Research*, Cambridge.

Deaton, A. (1992), Saving and Income Smoothing in Cote d'Ivoire, Mimeo, Princeton University.

Fafchamps, M. (1992), Solidarity Networks in Pre Industrial Societies: Rational Peasants With a Moral Economy, *Economic Development and Cultural Change,* Vol. 41, 147-76.

Grimard, F. (1997), Household Consumption Smoothing Through Ethnic Ties: Evidence from Cote d'Ivoire, *Journal of Development Economics*, Vol. 41, 391-422.

Krueger, D. and Perri, F. (2002), Does Income Inequality Lead to Consumption Inequality? Evidence and Theory, *NBER* Working Paper 9292.

Jalan, J. and Ravalllion, M. (1999), Are the Poor Less Well Insured? Evidence on Vulnerability to Income Risk in Rural China, *Journal of Development Economics,* Vol. 58, 61-81.

Kumar, P. (2010), *Targeted Public Distribution System: Performance and Inefficiencies*, Academic Foundation, New Delhi.

Mace, B.J. (1991), Full Insurance in the Presence of Aggregate Uncertainty, *Journal of Political Economy,* Vol. 99, 928-56.

Maitra, P. (1998), Consumption Smoothing in Rural Punjab in the Green Revolution Years, *Indian Economic Review,* Vol. 33, 185-96.

Maitra, P. (2003), Are the Poor More Vulnerable to Income Shocks? An Analysis of Consumption Insurance in Rural India, in Raghbendra Jha (ed.), *Indian Economic Reforms,* Palgrave, Macmillan, New York.

Morduch, J. (1990), Consumption Smoothing Across Space: Testing for Village Level Responses to Risk, Unpublished Manuscript, Harvard University

Morduch, J. (1995), Income Smoothing and Consumption Smoothing, *Journal of Economic Perspectives*, Vol. 9, 103-14.

Platteau, J.P. (1991), Traditional System of Social Security and Hunger insurance: Some Lessons from the Evidence Pertaining to Third World Village Societies, in Ahmad, E., Dreze, J., Sen, A.K. (eds), *Social Security in Developing Countries,* Oxford University Press, Oxford.

Rosenzweig, M.R. (1988), Risk, Implicit Contracts and the Family in Rural Areas of Low-Income Countries, *The Economic Journal,* Vol. 98, 1148-1170.

Rosenzweig, M.R. and Stark, O. (1989), Consumption Smoothing, Migration and Marriage: Evidence from Rural India, *Journal of Political Economy*, Vol. 97, 905-27.

Townsend, R.M. (1994), Risk and Insurance in Village India, *Econometrica,* Vol. 62, 539-91.

Townsend, R.M. (1995), Consumption Insurance: An Evaluation of Risk Bearing Systems in Low Income Countries, *Journal of Economic Perspectives,* Vol. 9, 83-102.

Urdy, C. (1994), Risk, Insurance and Default in a Rural Credit Market: An Empirical Investigation in Northern Nigeria, Unpublished Manuscript, Northwestern University.

Zhang, Q. and Ogaki, M. (2000), Risk Sharing in Village India: The Role of Decreasing Relative Risk Aversion, Ohio State University, Department of Economics, Working Paper No. 00-02.