Attitudes towards Risk of Forest Dependent Communities Evidence from Andhra Pradesh

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Abstract

This study is an attempt to generate empirical evidence on attitude towards risk of forest dependent communities (FDCs). The FDCs covered in the study include two different geographical regions from the Indian state of Andhra Pradesh – Rayalaseema (a relatively dry forest region with low income) and the coastal region (relatively fertile forest and with higher income). Attitude towards risk was measured as the revealed degree of risk aversion (as a constant relative risk aversion coefficient) from the multiple price list methodology. With these measures, on average, members of FDCs from Rayalaseema were found to be more risk averse as compared to their counterparts from the coastal region. Using interval regression, the study also looked at the role of income and socioeconomic variables on their risk behaviors. For members of FDCs from Rayalaseema, income was not found to be a contributor towards risk aversion. Including socioeconomic variables in the regression showed that on average being men, married and a shared decision-maker within family contributed positively to risk aversion, and membership to managing committee and having adult children in the family negatively so. Degree of risk aversion for members of FDCs in the coastal region, however, did show a role for income, albeit weak statistically. In particular, members from the low and high income groups were found to be risk seeking and those from the middle income groups risk averse, with family size and education contributing positively to risk aversion and proximity to urban centers negatively so.

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1 Introduction

Forest dependent communities (FDCs) in India are among the more disadvantaged sections of society with relatively poor access to economic opportunities, health care, nutrition and education (Kumar, 2002). Isolated from mainstream society socially, culturally and geographically, the FDCs dwell in and around forest fringes in small hamlets without the comforts and amenities of modern life and depend on forest produce for their livelihood.

Policy changes at the National level and connected financial aid during the past twenty years have enabled forest dwellers to participate more actively in forest management and undertake community projects involving investment decisions. This has increased the interactions between FDCs and the Government officials and provided the FDCs with a first-hand exposure to financial management. FDCs have also been often required to assess, as a community, the relative costs and benefits in the short, medium and long run of undertaking specific forestry investments and evaluate connected trade-offs.

The fact that Indian FDCs are now more actively involved in decision making on investments involving tradeoffs between present and future costs and benefits makes studying their risk attitudes of interest. However, research in this area has been lacking. This study is an attempt to document evidence on the risk attitudes of FDCs using data from the forest communities of Andhra Pradesh in India.

The plan of the paper is as follows. The next section provides a very brief overview of the FDCs in the Indian context. Section 3 reviews the literature and discusses the motivation for the research. Section 4 provides details on the research design and section 5 describes the methodology. Section 6 discusses the results and section 7 concludes.

2 Context: Forest Dependent Communities in India

Approximately 200 million of the Indian population consists of forest dwellers and forest dwelling scheduled tribes (both categories are referred to as forest dependent communities in this study) who are dependent on forest resources for their livelihood. Fifty four million of these forest dwellers belong to the tribal communities which have ethnic origins. The forest cover in India is 78.29

million hectares (ha) which covers 23.81% of the total geographic area (Ministry of Environment and Forests, Government of India, 2011).

Since the FDCs reside and earn their livelihood in forests that are Government-controlled, their welfare is vested with the State Forest Department. Beginning with an attitude of hostility and indifference towards the FDCs in the nineteenth century, Governments gradually viewed them as partners in the management of forests and enlisted their active participation through the joint forest management program since 1990.

The National Forest Policy, 1988 accorded priority to the needs of the FDCs over national interests. This policy resulted in the Government of India Circular on JFM in 1990 which envisaged involvement of FDCs, with emphasis on the participation of women, customary title holders and forest dwellers with ethnic origin in rehabilitating degraded forest areas. Essentially, JFM sought to establish a cooperative partnership between the FDCs and the State forest departments for rehabilitating degraded forest areas. For more details on the structure and financial management at JFM and its present status please see Sundar and Virmani (2013).

3 Literature Review

This section briefly discusses the literature on risk attitudes of small scale farmers, rural households and fishing communities who are similar to the FDCs.

People from all walks of life often are required to make decisions whose outcomes can be known only in the uncertain future. This uncertainty is captured by the term “risk”. Thus, risk applies to situations where every possible outcome of an event and the probability of its occurrence can be ascertained (Pindyck & Rubinfeld, 2005).

A risk averse person prefers a sure income than an uncertain, risky income with the same expected value. A risk neutral person is indifferent and thus expresses no choice between a sure, certain income and an uncertain, risky income with the same expected value while a risk lover would prefer a risky, uncertain and variable income to a certain, sure income with the same expected value (Pindyck & Rubinfeld, 2005).

3.1 Rural farmers

Binswanger (1974) reports that majority of farmers are risk averse and risk aversion leads to under investment. The study also finds a negative association between risk aversion and land holding size with women exhibiting higher risk aversion than household heads. Further evidence that peasant farmers are generally risk averse was reported by Moscardi and de Janvry (1977) from studies on poor peasants in Mexico and Dillon and Scandizzo (1978) based on studies of small farm owners and share croppers in Brazil.

Access to credit reduces risk aversion of poor farmers which supports the theoretical prediction of Roumasset (1976) and empirical findings of Binswanger (1980). Education was found to reduce risk aversion of a farmer and encouraged her to adopt innovations (risky venture) yielding higher returns which may be emulated by other less-educated farmers leading to positive externalities (Knight, Weir &, Woldehanna, 2010).

3.2 Rural households

Studies have found that majority of the rural households in developing countries like Ethipoia (Yesuf & Blackstone, 2009), India (Gini, Townsend, & Vickery, 2008) and Nigeria (Udry, 1994) are risk averse.

Familiarity with risk and information on its management equips households and people to handle risks in an informed manner and thus reduce risk aversion. Gine, Townsend and Vickery (2008) find evidence for the above hypothesis from a study of rural households in Andhra Pradesh that availability of credit to purchase insurance is a constraint and familiarity of rural households with insurance products encourage higher take up rates. Besides economic factors like credit availability and lower premium prices, noneconomic factors like trust in the insurance product increases take up rates (Gine et al., 2012). Yesuf and Bluffstone (2009) find evidence from Ethiopia that as households accumulate more wealth, their risk aversion decreases which points to path dependence in wealth accumulation as well as poverty. Hill (2009) reports similar path dependency effects amongst coffee-producing farmers in Uganda.

In their efforts to manage risks, poor farmers and rural households have evolved informal social mechanisms in the absence of formal credit and insurance markets.

Rosenzweig (1986) finds evidence among rural Indian households that family ties through kinship enabled income transfers amongst households to reduce exposure to income risks. Udry (1994) and Udry (1995) too find evidence from studies on rural Nigerian households that in the absence of formal insurance markets, households resort to informal credit transactions to share risks arising from income shocks and smoothen their consumption across time.

Informal gifts and loans is a risk sharing strategy, but it happens between rural people who have good interpersonal relations (Fafchamps & Lund, 2003). In addition, labor pooling, fostering children from other families, using extended kinship networks to escape drought or famine, providing information on job opportunities and using trade credit in family businesses are other mechanisms used by rural households to reduce their exposure to risks and combat adverse income and health shocks (Fafchamps, 2011).

The informal mechanisms evolved by poor farmers and rural households for risk sharing through their networks of friends, relations and kin as described above is thus an important risk management strategy. D'Souza (2000) defines social capital as an investment in networks of family, relations and friends which provide safety nets during adverse shocks.

3.3 Fishing communities

Bokstael and Opaluch (1983) show that New England commercial fishermen respond positively to increase in their returns but negatively to variability in the returns implying that fishermen are risk averse as do Mistian and Strand (2000). However, recent research studies indicate a risk seeking attitude among fishermen (Eggert & Lokina, 2007; Eggert & Tveteras, 2004; Nguyen, 2009).

In the Indian context, Jensen (2007) draws attention to the efforts made by the Government and the private sector in their attempt to reduce the price risks faced by the fishing communities in Kerala. Jensen finds evidence that the introduction of mobile phones in Kerala during 1997 has made information readily available to the market which has resulted in reduction of price variation across fish markets from 60-70% to less than 15%, reduction of price differentials to zero from 50-60%, increase in fishing profits by 8% and decrease in consumer price by 4% resulting in overall increase in welfare.

3.4 Risk attitudes in other socioeconomic contexts

Ball, Eckel and Heracleous (2010) find evidence that taller and attractive persons, though predicted by fellow participants to be risk-seeking, are risk averse while stronger persons are risk seeking as compared to their weaker counterparts.

Spivey (2010) finds evidence that risk averse people marry sooner rather than wait for the uncertain arrival of the perfect spouse as they see greater benefits in pooling risks. Spivey also reports that the risk averse male settles for a woman with less desirable qualities while the risk seeker tends to marry a more intelligent and more physically attractive woman.

Studies using field games involving college students broadly find that women are more risk averse than men (Eckel & Grossman, 2002; Eckel & Grossman, 2008; Schubert et al., 1999). However, Schubert et al. also finds evidence that women are risk averse only in the gains domain but are risk seeking in the loss domain.

Analyzing Ethiopian fishing communities, Brick, Visser and Burns (2012) find that risk aversion showed ambiguous relation to wealth which corroborates Binswanger (1980). However, Bardsley and Harris (1987) find evidence from studies on rural farmers in Australia that risk aversion decreases with wealth and increases with income.

Miyata (2003) and Gong and Yang (2012) find evidence that individuals who live with their parents and in-laws are more risk seeking than individuals from nuclear families. Similarly, both studies report that people with education are more risk seeking.

The above overview implies a strong perception that the risk aversion coefficient truly reflects the risk behavior of people. However, Eckel and Grossman (2006) doubt the existence of risk attitude as a measurable trait in people which is governed only by wealth or income through an assumed utility function.

3.5 Anthropological perspectives

Henrich and McElreath (2001) find evidence that the Mapuche and the Sangu ethnic peoples are risk seekers while the town-influenced Huinca and University undergraduates were risk averse. An

explanation offered is that the Mapuche and Sangu emulate the problem solving methods, decision-making rules and strategies of more successful and prestigious people in their communities implying that risk behavior is culturally transmitted.

Niger ethnic forest groups have been found to be risk seeking due to their collectivist cultures (Ehmke, Lusk, & Tyner, 2010). An explanation offered is that in collectivist cultures, individuals are more likely to accept financial and other forms of risks due to assured help from friends and relatives during adverse shocks. The researchers further argued that collectivism and poverty may also be linked as persons struggling due to poverty tend to become more dependent on families, relations and friends to secure their livelihoods.

In north-eastern India, the Khasi ethnic women have been found to be more risk seeking than the Khasi men (Gneezy, Leonard, & List, 2008). The scholars suggested that the risk seeking behavior of Khasi women may be due to their matrilineal social structure which accords a higher importance to women than men in lineage and inheritance.

Pre-occupied with the desire to meet the requirements of present consumption, forest communities have evolved risk sharing mechanisms to cope with the dangers and risks inherent in their daily lives. The main risk revolves around the availability of sufficient food given the harsh environment they live in which is addressed by sharing vessels, meat and food during festivals (Davies & Bennett, 1996).

Little, Aboud, and Lenachuru (2009) show that the spread of education among pastoral communities in Kenya has increased the knowledge levels and income earning opportunities of the individuals of these communities to cope with risks like theft of livestock and famine in an informed manner. On the contrary, more availability of urban jobs results in the breakdown of family ties and would remove the cushion available to an individual in the form of advice of family elders, physical resources and expertise which would make her more risk averse (Miyata, 2003).

Women were found to be more risk averse than men in the patriarchal Masaai ethnic group of Tanzania (Gneezy, Leonard, & List, 2008), Ethiopian fishing communities (Brick, Visser, & Burns, 2012) and Chinese matrilineal and patriarchal societies (Gong &Yang, 2012).

In an investigation of risk sensitivities of two herding communities in the Andes mountains, Kuznar (2001) offers yet another perspective on the wealth effects of risk attitude by reporting that herders with middle wealth levels are risk averse, while herders with high and low levels of wealth are risk seeking.

3.6 Motivation for research

As discussed above, evidence from Africa and South America suggests that forest dwellers are risk seeking by nature. Studies have identified wealth effects (Kuznar, 2001), emulation of successful individuals within the communities (Henrich & McElreath, 2002), collectivism and sharing culture (Ehmke, Lusk & Tyner, 2010) as possible determinants of the risk behavior of forest communities.

The lone Indian study shows that Khasi women in north-eastern India to be more risk seeking than the Khasi men (Gneezy, Leonard, & List, 2008) as explained above. There appears to be very few studies which shed light on the risk attitudes of Indian FDCs and their determinants.

FDCs in India too belong to low income groups (Kumar, 2002) and live in sharing and collectivist cultures (Morris, 1982). Income levels of Indian FDCs have increased due to State interventions like JFM (Baheranwala, 2011; Cooper, 2009; Klooster, 2000; Singh, 2004).

4 Research Design

4.1 Study area

This study looks at the FDCs of the Indian state of Andhra Pradesh. The forests of Andhra Pradesh, covering roughly 23% of the state's geographic area, is spread over 6.38 million ha and accounts for approximately 9% of India's total forest cover. Rich in biodiversity, the forests harbor tribes like the Gonds, Chenchus, Savara and the Yanadi.

The Government of Andhra Pradesh adopted JFM as a tool to rejuvenate the degraded forests in 1992. Since its adoption, 7718 JFM committees, called Vana Samrakshana Samithis (VSS), involving approximately 1.539 million people are functional and managing 1.52 million ha (23.8% of total forest area in the State) of forests.[1] In 2002, the State re-christened JFM as community

[1] In Andhra Pradesh, the FDC is thus referred to as Vana Samrakshana Samithi in the regional Telugu language.

forest management (CFM) indicating its commitment to encourage deeper community participation in forest management (Andhra Pradesh Forest Department, 2011).

The Forest department of the Government of Andhra Pradesh (APFD) creates suitable jobs in the forest areas assigned to the VSSs in these two regions. Members of VSS who work in these jobs receive daily wages from the APFD at rates fixed by the District Collector. After 5-7 years of such working, these plantations begin to yield fruit, seeds and timber. The members of VSS sell the produce from these plantations through the APFD after 5-7 years following some procedures prescribed by the Government. The revenues realized from these sales (termed as "VSS income" in this study) are credited to the respective VSS bank accounts.[2]

The managing committees of the respective VSSs then decide to distribute this money amongst the VSS members or may choose to invest in a community hall, latrines, temple, *pucca* roads and similar other goods and services of a public nature.

4.2 Sample description

The study sample was spread over four VSSs (Sri Venkateshwarapuram, Mangapuram, Goplalpuram and Gadanki) in Chittoor district, one VSS (Indiranagar) in Kadapa district (both districts from the Rayalaseema region) and four VSSs (Chedimala, Peddavaram, Apparaothota and Kasumuru) in Nellore district from the coastal region of Andhra Pradesh. The nine VSSs were thus geographically dispersed across the districts of Kadapa, Chittoor and Nellore over an area span of approximately 175 sq. kms. The field work for data collection was done during the months of May and June 2013. 149 members of VSS participated in the study. 75 members of VSS were from the Rayalaseema region while 74 members of VSS were from the coastal region of Andhra Pradesh.

In general, the forests allotted to the VSSs from the Rayalaseema region were degraded to a large extent and hence, community forest plantations were not fully successful. The revenue accrued in the joint bank account of these VSSs from community forestry projects under the JFM/CFM program is perhaps an indicator of the economic status of the members of the VSS.

The last column of Table 1 reports the details of the revenues accrued to these VSSs from the assigned forests under the JFM/CFM program and deposited in the joint bank account as on

[2] Retrieved January 10, 2013 from Working plan of Chittoor (East) Wildlife Division, Office of Divisional Forest Officer, Chittoor (East), Government of Andhra Pradesh.

31/05/2013. The five VSSs from Rayalaseema region selected for the study have less than Rs. 10000 each as revenues from community forestry. S. V. Puram and Mangapuram VSSs are situated 6 and 13 kms. from Tirupati town in Chittoor district. Gopalapuram VSS, situated 29 kms. from Tirupati, is running an eco-tourism unit since 2010. Gadanki VSS is situated 47 kms. away from Tirupati. Indiranagar VSS is situated 16 kms. away from Kodur town in Kadapa district.

The forests assigned to the VSSs from the coastal region in Nellore district, in general, contained fertile soil which was amenable for raising community plantations. As shown in the last column of

Table 1

Descriptive Statistics for the Study Sample, by VSS and Region

VSS	Age (Years)	Female (%)	Education (Years)	House hold size	Land (Acres)	Individual Monthly Inc. (Rs.)	Household Monthly Inc. (Rs.)	Household Assets (Rs.)	Occupation (%)	No. of Families / Population	VSS Revenue in Bank (Rs.)[c]
S. V. Puram $n = 11$	31.45 (12.57)	63.63	4.09 (4.85)	3.91 (1.38)	0.0 (0.0)	3236.36 (2173.14)	4872.73 (2322.97)	1627.27 (958.22)	72.72	26 / 172	1000
Mangapuram $n = 13$	31.31 (6.83)	46.15	7.31 (3.71)	6.23 (1.59)	0.0 (0.0)	4423.07 (5392.30)	6807.69 (4701.67)	3246.15 (3559.63)	76.92	32 / 187	1000
Gopalapuram $n = 18$	30.94 (10.38)	77.78	3.5 (3.79)	4.11 (0.9)	0.21 (0.54)	2250.0 (1833.11)	3583.33 (1751.05)	19100.0 (33405.95)	72.22	36 / 244	7300
Gadanki $n = 22$	34.00 (13.37)	59.09	8.86 (3.1)	4.86 (1.32)	0.27 (0.55)	1272.73 (1629.25)	2840.91 (1112.12)	26965.91 (29423.05)	45.45	52 / 306	2553
Indiranagar $n = 11$	39.91 (13.03)	36.36	1.09 (1.97)	5.00 (1.55)	1.05 (1.68)	3500.0 (2012.46)	3863.64 (1761.97)	48390.91 (75274.26)	100	40 / 209	1580
Rayalaseema[a] *n1 = 75*	*33.29 (11.69)*	*58.67*	*5.47 (4.48)*	*4.8 (3.78)*	*0.28 (0.81)*	*2668.0 (2956.22)*	*4154.67 (2776.17)*	*20392.67 (38777.58)*	*69.33*	*186 / 1118*	*2687*
Chedimala $n = 14$	48.57 (9.79)	0.0	0.86 (1.75)	3.71 (1.20)	0.11 (0.29)	2357.14 (1833.75)	3035.71 (1875.6)	71150.0 (188298.85)	92.85	72 / 498	657,967
Peddavaram $n = 27$	33.63 (13)	55.56	1.89 (2.76)	3.89 (1.58)	0.31 (0.87)	3074.07 (1650.78)	4314.81 (1856.11)	19370.37 (45102.61)	100	105 / 578	1279,613
Apparaothota $n = 21$	33.86 (13.20)	57.14	3.14 (3.95)	3.76 (1.14)	0.83 (0.65)	2976.19 (2619.52)	3595.24 (2390.71)	45490.48 (32514.47)	95.23	77 / 512	324902
Kasumuru $n = 12$	32.25 (14.89)	58.33	3.92 (3.94)	3.67 (1.07)	0.0 (0.0)	3125.0 (2659.5)	6250.0 (1768.15)	1250.0 (655.74)	100	63 / 257	770,271
Coastal Region[b] *n2 = 74*	*36.30 (13.94)*	*45.95*	*2.38 (3.31)*	*3.78 (1.30)*	*0.37 (0.71)*	*2918.92 (2143.02)*	*4182.43 (2225.09)*	*33640.54 (88805.4)*	*97.30*	*317 / 1845*	*758,188*
Full Sample *N* = 149	**34.79 (12.9)**	**52.35**	**3.93 (4.22)**	**4.30 (1.49)**	**0.33 (0.76)**	**2792.62 (2578.90)**	**4168.46 (2509.15)**	**26972.15 (68453.89)**	**83.22**	**503 / 2963**	**-**

Note. [a]*Rayalaseema* comprises S. V. Puram, Mangapuram, Gopalapuram, Gadanki and Indiranagar VSSs; [b] *Coastal Region* comprises Chedimala, Peddavaram, Apparaothota and Kasumuru VSSs; [c] This information was obtained from the District / Division Forest Offices Chittoor (East), Rajampet, Tirupati and Nellore; Standard deviations in parentheses.

Table 1, all the four VSSs from the coastal region selected for the study have, on an average, more than Rs. 750000 as revenues from community forestry works. Besides forestry works under public programs, the members of these VSS have also benefitted from jobs available in the nearby towns like Nellore (20 kms. from Chedimala VSS and 29 kms. from Kasumuru VSS) and Kavali (15 kms. from Apparaothota VSS and 23 kms. from Peddavaram VSS).

Table 2

Details of the Multiple Price List Methodology for Elicitation of Risk

Task No.	Lottery A (Rs.)	Lottery B (Rs.)	EV^A	EV^B	Implied CRRA Range	Risk Behavior
1.	180	0.5 of 200; 0.5 of 0	180	100	$r < -1.41$	Highly Risk Loving
2.	150	0.5 of 200; 0.5 of 0	150	100	$-1.41 < r < -0.36$	Very Risk Loving
3.	120	0.5 of 200; 0.5 of 0	120	100	$-0.36 < r < 0$	Risk Loving
4.	100	0.5 of 200; 0.5 of 0	100	100	$0 < r < 0.24$	Risk Neutral
5.	80	0.5 of 200; 0.5 of 0	80	100	$0.24 < r < 0.42$	Risk Averse
6.	60	0.5 of 200; 0.5 of 0	60	100	$0.42 < r < 0.69$	Very Risk Averse
7.	20	0.5 of 200; 0.5 of 0	20	100	$r > 0.69$	Highly Risk Averse

Note. EV^A = Expected value of Lottery A; EV^B = Expected value of Lottery B; CRRA = Constant relative risk aversion.

In what follows, VSSs from the Rayalaseema region are denoted as VSS-R and the VSSs from the coastal region as VSS-C.

The contrasting regions to which the two VSS belong offers a way to compare attitudes towards risk of two similar FDCs but belonging to different income levels. This offers a natural set-up to control for income effects, if any.

5 Methodology

To elicit risk attitudes of the members of VSS, this study uses the multiple price list methodology of Bricks, Visser and Burns (2012) which is derived from Eckel and Grossman (2008). Before commencement of the procedure, each participant was provided with detailed instructions in Telugu on what they were expected to do. Instructions and procedures were explained in vernacular Telugu. In addition, mock versions of the procedure were played out with the participants with different payoffs to increase their familiarity with the game before the actual procedure was conducted.

Table 2 describes the seven tasks (task 1 – 7) that was presented to the VSS participants. For each binary choice lottery game, a participant chooses either Lottery A or Lottery B shown in columns 2 and 3. To keep the procedures simple, only fixed probabilities of 50% and 100% are used. For example in task 1, the participant has a 100% chance of receiving Rs. 180 if she chooses Lottery A. If she chooses Lottery B, she stands a 50% chance of receiving Rs. 200 and 50% chance of receiving nothing.

The payoff for Lottery A declines from Rs. 180 in task 1 to Rs. 20 in task 7, while the payoff for Lottery B remains constant. A risk-seeking person would choose Lottery B in task 1 while a risk-averse person would choose Lottery A in task 7. A risk-neutral person would be expected to change from Lottery A to Lottery B when the expected values of both the choices is roughly the same and hence in this game, she would choose Lottery A in tasks 1,2 and 3 and Lottery B thereafter. The participants were presented with only columns 1, 2 and 3.

Following the discussion in Bricks, Visser and Burns (2012), a constant relative risk aversion (CRRA) utility function defined over the lottery gambles is assumed. The CRRA utility function is of the form $U(x) = \frac{x^{1-r}}{1-r}$, where x = lottery prize and r = risk coefficient. The 6th column shows the bounds of r, which is calculated based on the choices expressed by the participants in tasks 1-7. The last column shows the corresponding risk behavior.

For example, a participant who chooses Lottery A (safe, certain payment) for tasks 1-5 before switching over to Lottery B (risky payment) for tasks 6 and 7 would have a CRRA range of 0.24 - 0.42. Negative CRRA values denote risk seeking attitude, a CRRA of 0 indicates risk neutrality and positive CRRA values indicate risk aversion.

After the conclusion of the multiple price list procedure as outlined above, one of the tasks 1-7 is selected at random and real money is paid out in accordance with the participants' expressed choices for the randomly selected task. The payment of real money for a randomly selected task ensures that the participants exercise their choices carefully and rewards active participation.

Some of the VSS participants might make inconsistent choices like switching back and forth between Lottery A and Lottery B in the course of the multiple price list procedure. Such behaviors might be due to improper understanding and comprehension of the procedures (Bricks, Visser & Burns, 2012) and are hence, excluded from analysis.

In addition, going by the literature review earlier, for each participant, data on demographic and economic variables like land owned, age, sex, married status, number of children, whether household head or not, family size, years of education, whether managing committee member or not and monthly income are collected for use as socio-economic covariates.

6 Results and Discussion

6.1 Summary statistics

Before describing the results, given the nature of the study it is useful to take a look at some descriptive statistics which is given in Table 1.The members of VSS who participated in the study were primarily middle-aged individuals with almost equal participation from both the sexes. On average, the members of VSS participating in the study were 35 years old. Approximately, 52% of the study sample were women, though this varied between VSSs significantly.

The participants were from households with an average size of four members. The average household income is Rs. 4168 per month. These income measures vary between the VSSs in the study sample.

Educational attainment of the members of VSS in the study sample was low. The members of VSS, on average, had just about 4 years of education. Approximately 43% of the sample in the study did not attend school and had zero years of schooling.

Also, 34% of the sample had attained some level of primary education (between one and seven years of schooling) and 14% had completed primary education. Of the 23% of the study sample who reported that they have obtained some high school education, only 9% completed high school education (passed the tenth standard) and are attending a pre-university college and about 6% completed the pre-university education (passed the twelfth standard). No member of VSS in the study sample had education beyond the pre-university level (twelfth standard) nor attended a degree college.

The members of VSS are reliant on forestry works under the state-funded JFM / CFM program for their livelihood. Overall, approximately 83% of the study sample depended on the jobs under the

JFM / CFM program though there was considerable variation amongst the VSSs ranging from 45% (Gadanki VSS) to 100% (Peddavaram, Kasumuru and Indiranagar VSSs). The remaining 17% of the sample comprised of wives who were home makers, the aged and infirm who could not undertake jobs in the forests and those dependent on poultry and livestock activities. The members of VSSs from the coastal region, on average, were more dependent on forestry jobs under the JFM / CFM program than the members of VSSs from the Rayalaseema region.

The average land-holding size was 0.33 acres per VSS household. Land is an important household asset class for the VSS household along with bovines, livestock and poultry. The average value of these assets per VSS household is Rs. 26,972 in the study sample which varies considerably between VSSs as there is significant variation of values of land depending on their fertility and proximity to *pucca* roads.

6.2 Econometric estimation

In the present study, 107 members of VSS switched only once in the multiple price list method implying that 72% of the study sample made consistent choices confirming to economic logic. The inferred CRRA bounds from these 107 members of VSS only have been used in the econometrics and the remaining 42 members of VSS made inconsistent choices and hence, are excluded from analysis.

Dependent and independent variables. The interval regression model is employed in the present study for eliciting estimates of CRRA coefficients of the members of VSS. The dependent variable in this econometric model is the CRRA interval that each member of VSS implicitly chooses when she switches from option A to option B.

Please see section 3 for a detailed literature review highlighting the various determinants of risk attitudes which provides a theoretical justification for including some of the above socioeconomic controls. Table 3 provides details of the independent variables used in the estimation.

Table 3

Description of Independent Variables used in the Econometric Estimation of Risk Attitudes

Variable	Description	Remarks
rorc	Whether the VSS is from Rayalaseema (= 0) or Coastal Andhra Pradesh (= 1) region; Reference category is Rayalaseema	Binary variable

age	Age of the VSS member in years	Numerical variable
sex	Sex of the VSS member; male = 0, female = 1; Reference category is male	Binary variable
occup	Occupation of the VSS member; non-forestry related = 0, forestry related = 1; Reference category is non-forestry related	Binary variable
marital	Married status of the VSS member; unmarried = 0,married = 1; Reference category is unmarried	Binary variable
cbelow5	Number of children of the member of VSS less than five years of age	Numerical variable
cbelow18	Number of children of the member of VSS between five and eighteen years of age	Numerical variable
cabove18	Number of children of the member of VSS above eighteen years of age	Numerical variable
ctotal	Total number of children of the VSS member	Numerical variable
fsize	Size of the family or household of the VSS member	Numerical variable
hhead	Whether the VSS member is the head of the family or household (=1) or not (=0) or shares responsibility in household decision-making with spouse or other family elders (=2); Reference category is not being head of household	Nominal variable
educ	Number of years of education attained by the VSS member	Numerical variable
mc	Whether VSS member is a managing committee member (=1) or not (=0); Reference category is not being a member of the managing committee	Binary variable
totincT	Average household monthly income of the VSS member over the past 3-4 months in Rupees (Thousands). This data was obtained from the members of VSS during the interviews and cross checked with records maintained by the APFD and the concerned VSS.	Numerical variable
totassetsT	Total value of assets held by the household of the VSS member in Rupees (Thousands). This includes the approximate market / exchange value of land owned, appliances like television and mixer, cattle, livestock and poultry.	Numerical variable
caste	Whether the VSS member belongs to Scheduled tribe (=1), Scheduled caste (=2), Other backward caste (=3) or others (=4); Reference category is Scheduled tribe; The Scheduled tribes and Scheduled castes are economically disadvantaged and have suffered discrimination and subjugation based on caste. The members of VSS predominantly belong to the Scheduled tribe category.	Nominal variable
dist	Distance in kms. between the VSS habitation or hamlet and the nearest urban centre which has schools, post office, bank and groceries / fruit / vegetable market.	Numerical variable

Information on VSS household incomes is important. In this study, the monthly income of the household to which the member of VSS belongs (*totincT*) is taken as the average of the monthly earnings of the members of the household during the last 3-4 months. This data was obtained from the members of VSS during the interviews and cross checked with records available with the APFD and the VSS.

The Model. The interval regression model has been employed by Dohmen, Falk, Huffman and Sunde (2007), Harrison and Rutstrom (2008) and Wik et al., (2004) among others to estimate risk coefficients.

The dependent variable is the CRRA interval which is not continuous but grouped into several ranges. The dependent variable here has a quantitative meaning. In the study, what is observed is whether the CRRA coefficient falls into one of these intervals and not the CRRA coefficient itself. In such cases, Wooldridge (2002) notes that there is a data-coding issue due to which the beta coefficients cannot be consistently estimated if ordinary least squares estimation is used. Wooldridge concludes that interval regression may be used in such cases.

The interval regression model is specified as follows:

$$y_i^* = \beta_0 + x_i\beta + \varepsilon_i \ ;$$

y_i^* is the latent dependent variable that measures the CRRA coefficient that characterizes the risk behavior of member i of the VSS which is never observed with $i = 1,2,\dots,N$ and N being the sample size in the study, x_i is a $1 \times K$ vector containing the individual, household and institutional socioeconomic variables of member i of the VSS and ε_i is the error term pertaining to member i of VSS. Only the interval where the CRRA coefficient falls is observed. A function $y_i = t(y_i^*)$ that links the latent variable y_i^* to the observed interval of CRRA coefficient y_i is assumed which is defined as follows:

$$\begin{aligned} y_i \equiv t(y_i^*) & \\ = 1 \text{ if } & \quad y_i^* \leq c_1 \\ = 2 \text{ if } c_1 < & \ y_i^* \leq c_2 \\ = 3 \text{ if } c_2 < & \ y_i^* \leq c_3 \\ = 4 \text{ if } c_3 < & \ y_i^* \leq c_4 \\ = 5 \text{ if } c_4 < & \ y_i^* \leq c_5 \\ = 6 \text{ if } c_5 < & \ y_i^* \leq c_6 \\ = 7 \text{ if } c_6 < & \ y_i^* \end{aligned}$$

The interval regression specification estimates beta coefficients using Maximum Likelihood methods in an unbiased manner under some assumptions of distribution of the error term ε_i: $\varepsilon_i \sim N\ (0, \sigma_\varepsilon^2)$ (D'Exelle, Campenhout & Lecoutere, 2011; Wik et al., 2004).

6.3 Difference between VSS-C and VSS-R

The success rate of the community forestry plantations is relatively high for VSS-C than for VSS-R. Thus, it is inferred that VSS-C earn relatively higher revenues from community forestry than VSS-R due to differentials in natural resource endowments. Records from the district forest offices in the two regions also show that VSSs from coastal region, in general, have more community-owned assets created from surplus VSS incomes in comparison to the VSSs in Rayalaseema. [3]

It is thus inferred that members of VSS-C, receiving higher revenues from community forestry projects than VSS-R though not on a yearly basis, may be earning higher incomes and enjoy a relatively higher standard of living due to better rural infrastructure, improved access to towns via *pucca* roads and improved awareness of hygiene and health. On the other hand, members of VSS-R, receiving low revenues from community forestry projects, may be earning lower incomes and living in relatively poorer conditions.

This inference is supported from some evidence in the literature. Reviewing some of the successful VSSs in Kadapa distict, Reddy et al. (2004) reports that average annual household income for the Sugali thanda VSS in the district rose from Rs. 3700 to Rs. 4800 over a period of four years obtained from selling timber and wages. Prasad (2011) similarly reports that Nanayala VSS, one of the success stories in Chittoor district, earned monthly incomes ranging from 1500-2500 by selling soap nut products harvested in forest areas.

On the other hand, Gundlamamidi VSS in Vishakhapatnam coastal district constructed a temple and a community hall where a school is run for their children from the revenues earned from community forest plantations. The offerings and donations to the temple from many visitors in the State and neighboring Odisha district may be a good source of income for this VSS. In a similar manner, Kondamamillipudi VSS in the same district earned Rs. 500000 by harvesting bamboo which was redistributed to the families. Each family earned Rs. 22500 during the harvesting season (Andhra Pradesh Forest Department, 2006). Kasumur VSS in Nellore coastal district spent some of its VSS income to provide electrification to its residents.[4]

[3] Retrieved January 12, 2013 from Working plans of Chittoor (East) Wildlife Division, Rajampet, Guntur and Nellore in the Offices of Divisional Forest Officer, Chittoor (East), Rajampet, Guntur and Nellore, Government of Andhra Pradesh.
[4] Retrieved May 14, 2013 from Records of Office of Divisional Forest Officer, SPSR Nellore, Government of Andhra Pradesh.

These studies point to the fact that members of VSSs in the coastal district generally may earn higher VSS incomes compared to those in the Rayalaseema region.

The above inference is further supported by the fact that the average monthly household incomes of districts from Rayalaseema region is lower than the average monthly household incomes of districts from the coastal region. For example, the average monthly household incomes of Ananthapur, Chittoor and Kadapa districts in the Rayalaseema region is Rs. 15810, Rs. 14762 and Rs. 14455 while the average monthly household incomes from Krishna, Prakasam and Nellore districts in the coastal region is Rs. 20460, Rs. 18842, and Rs. 19751(Centre for Monitoring Indian Economy, 2010).

In this study, it is expected that these income differentials between the members of VSS-R and VSS-C could possibly impact their risk attitudes. Hence, the average member from VSS-R who earns lower income would be expected to be risk averse as she cannot afford to lose what little is earned as wages.

Models 1 and 2 of Table 4 reports the results present results of implied CRRA interval of the 107 members of the VSS from the interval regression described earlier.

Table 4

Interval Regression Results to Show Effects of Regional Variable (rorc) *on Risk Attitudes of Members of VSS in the Study*

Dependent Variable = [*rlow, rhigh*] which represents the lower and upper bounds of the constant relative risk aversion (CRRA) coefficient of the members of the VSS in the study				
	Model 1		**Model 2**	
Independent Variables	**β (se)**	***p* value**	**β (se)**	***p* value**
Intercept	-0.311 (0.769)	0.686	0.494*** (0.126)	0.000
rorc1 (ref. = Rayalaseema)	-0.618*** (0.220)	0.005	-0.688*** (0.173)	0.000
age	-0.004 (0.013)	0.752		
sex1 (ref. = male)	0.057 (0.223)	0.796		
occup1(ref. = non-forestry)	0.185 (0.311)	0.550		
marital1(ref. = not married)	0.198 (0.364)	0.587		
cbelow5(number of children below 5 years)	- 0.072 (0.172)	0.677		
cbelow18(number of children between 5-18 years)	-0.212* (0.118)	0.073		
cabove18(number of children above 18 years)	-0.170 (0.127)	0.178		
fsize	0.083 (0.067)	0.216		
hhead1(being a household head; ref. = not being a household head)	0.146 (0.239)	0.543		
hhead2 (equal decision-making in household)	-0.442 (0.369)	0.232		
educ (number of years of education)	0.022 (0.026)	0.402		
mc1(ref. = not a member of managing committee)	0.015 (0.290)	0.957		
totcat2[a]	0.389** (0.198)	0.050		
totcat3	-0.021 (0.311)	0.945		
totassetsT (Total assets owned by VSS household)	0.001 (0.001)	0.230		
caste2 (Scheduled caste; ref. = Scheduled tribe))	- 0.004 (0.216)	0.98		
caste3(Other backward caste)	- 0.117 (0.371)	0.752		
dist	0.012	0.752		

	(0.371)	
N	107	107
Scale	0.795	0.887
Log likelihood (Model)	-251.9	-263.5
Log likelihood (Intercept)	-270.8	-270.8
χ^2(df)	37.79 (20); p value = 0.009	14.75 (1); p value = 0.0001

Note. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
[a] The members of VSS are classified into three categories based on their household or family's total monthly income: *totcat1* $= \leq 4000$ (reference category); *totcat2* $= > 4000$ and ≤ 8000; *totcat3* $= > 8000$;

For purposes of estimation, the lower bound of the first CRRA interval is set to -2 and the upper bound of the last interval at 1 similar to the methodology used in Bauer and Chytilova (2009). The regional characteristic is captured by the dummy variable *rorc* (whether the VSS is from Rayalaseema or the coastal region of Andhra Pradesh) which is the variable of interest.

Model 1 shows that *ceteris paribus*, a member of VSS from the coastal region, on average, has a CRRA coefficient that is 0.62 less than the member of VSS from the Rayalaseema region. The result is statistically and economically significant. This implies that, on average, the members of VSS from Rayalaseema are more risk averse than the members of VSS from the coastal region.

The overall model is significant at the 1% level. The chi-square distribution for intercept only and the full model is significant at 1% level, χ^2 (20, $N = 107$) = 37.79, $p = 0.009$. The statistic Scale = 0.795 is equivalent to the standard error of the estimation of the model in ordinary least squares regression. This statistic, when compared to the standard deviations of *rlow* ($sd = 1.042$, $N = 107$) and *rhigh* ($sd = 0.912$, $N = 107$) shows substantial reduction.

Model 2 of Table 4 reports the results when the implied CRRA interval of the members of VSS is regressed against *rorc* without any controls. The average CRRA coefficient of members of VSS from Rayalaseema region of Andhra Pradesh (*rorc* $= 0$) is 0.49, which indicates that these VSS members are very risk averse (result significant at the 1% level). The average CRRA coefficient of members of VSS from the coastal region of Andhra Pradesh (*rorc* $= 1$) is (0.49 – 0.69 =) – 0.20, which indicates that these VSS members are risk seeking (result significant at the 1% level).

The overall model is significant at the 1% level. The chi-square distribution for intercept only and the full model is significant at 1% level, χ^2 (1, $N = 107$) = 14.75, $p = 0.0001$. The statistic Scale = 0.887 is equivalent to the standard error of the estimation of the model in ordinary least squares

regression. This statistic, when compared to the standard deviations of *rlow* ($sd = 1.042$, $N = 107$) and *rhigh* ($sd = 0.912$, $N = 107$) shows reduction.

Other significant effects – *(a) Having children.* Model 1 of Table 4 shows that members of VSS with children aged between 5 and 18 years of age are less risk averse. An increase in one child aged between 5 and 18 years of age is predicted to decrease the CRRA coefficient of a member of VSS by 0.21 (result significant at the 10% level). In the VSS context, a growing child may lessen the responsibilities of its parents as children are often sent to the forest for collecting food and fodder, thus supplementing the labor of the household. In addition, most girl children are married off at the onset of their puberty.

(b) Risk behavior of middle status member of VSS. The middle status member of VSS (*totcat2*) has a CRRA coefficient that is 0.39 higher than the member of VSS who is poor, the reference category (result significant at the 5% level). However, the analysis of deviance results shows that the overall effect of the income variable (*totcat*) is not statistically significant (the two degree of freedom test for *totcat* show a p value of 0.14).

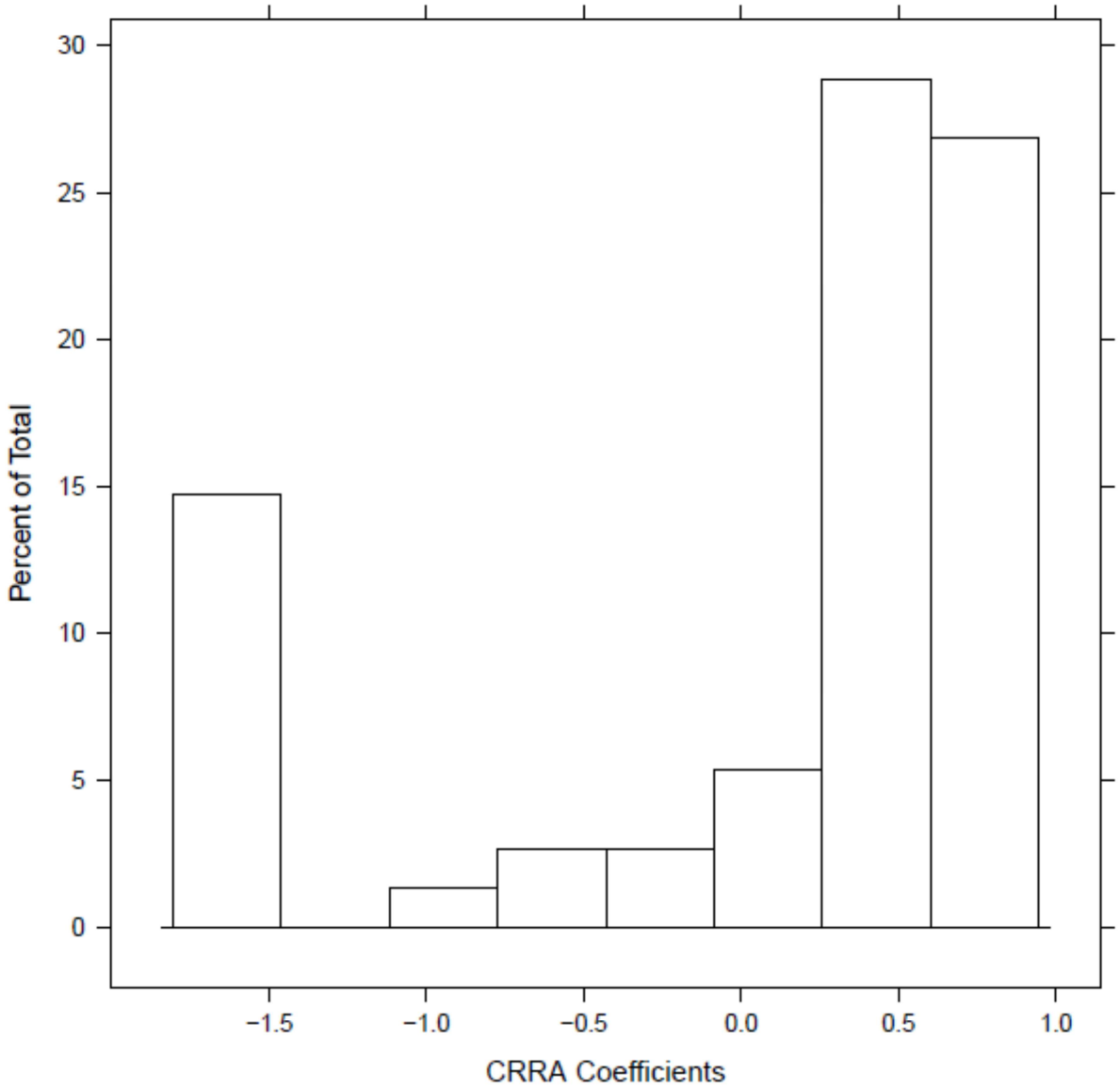
The middle status member of VSS is predicted to be more risk averse than the poor member of VSS as the middle status VSS member stand to lose too much in taking risks. The poor member of VSS has less to lose and being desperate, may be willing to take risky decisions to improve her lot (Kuznar, 2001).

Risk behavior for the whole sample. The average CRRA coefficient of the sample of members of VSS from Rayalaseema and coastal regions who participated in the study is 0.13. This shows that members of VSS from Rayalaseema and the coastal regions of Andhra Pradesh in the present study sample have low levels of risk aversion bordering on risk neutrality as defined in Table 2.

Figure 1 provides the details of the distribution of the midpoints of the risk coefficient intervals of the members of VSS. Close to 20% of the sample are risk seeking by nature while nearly 60% of the sample is risk averse.

Figure 1

Distribution of risk attitudes of the VSS members in the study



Robustness checks. For robustness checks, the arithmetic means of CRRA interval data (*rmid*) is used as a dependent variable in an ordinary least squares (OLS) regression on the various socioeconomic controls. The present study follows the framework used in Bauer and Chytilova (2009) which uses the means of interval-censored data in OLS regressions to test the robustness of their findings from interval regression. The estimates obtained from the OLS are similar to the results obtained from interval regression (available on request).

To summarize, on an average, the members of VSS-C in the sample are risk seeking while the members of VSS-R are risk averse.

Since members of VSSs from Rayalaseema region were assumed to earn relatively lower incomes than those from the coastal region due to differential natural resource endowments, it was expected that members of VSSs from Rayalaseema, on average, would be risk averse while members of VSS from the coastal region, on average, would be risk seeking . The study thus expected to find statistically significant effects of income on risk behavior of members of VSS.

However, *post facto* data in Table 1 shows that the average monthly household income of members of VSS from Rayalaseema (Mean $= 4155$, $sd = 2776$) and the coastal region (Mean $= 4182$, $sd = 2225$) are not significantly different. Some possible reasons for the observed homogeneity in incomes between the two regions could be due to measurement error or an overall lack of variation in household incomes of the lower incomes group which is a recurring economic phenomenon.

This *post-hoc* finding is contrary to the prediction made in this section where it was expected that members of VSS in the coastal region may be earning higher incomes than those from Rayalaseema. This variance between the prediction and the field data on household incomes impacts the results of econometric estimation.

It may also be noted that the VSS income has not been used as an independent variable in the regression model. The reasons for not including the VSS incomes to capture the regional variation are as follows: There is an inherent uncertainty in how the VSS income (of the VSSs in the study sample) is utilized as on date of reporting this research. The VSSs may decide to distribute this income amongst its members or they may decide to utilize it for creating a public good or service. Further, the VSS income is not a monthly or even a yearly income. As explained in section 4, the VSS income may accrue to a VSS after several years and not in the year earned.

The monthly household income variable did not have a statistically significant effect on the risk attitudes in the regression model (the analysis of deviance results showed a p-value of 0.18 for the household income variable).

6.4 Within-VSS Comparison

The study also aims to look at the effects of incomes of VSS members on their risk attitudes within the Rayalaseema and the coastal region separately.

Income differentials are expected to exist within the VSSs in both the Rayalaseema and the coastal region. Able bodied individuals would be able to work more days per month and hence earn more wage income in comparison to less healthy individuals. Women members in general may prefer to work less in view of additional responsibilities and health concerns.

In this study, it is expected that a member of VSS with higher incomes would show a risk seeking attitude since she can afford to take risks and may even find risk taking attractive as an easy means of attaining the next highest economic status. The middle status member of VSS is predicted to be more risk averse than the poor member of VSS as the middle status VSS member stand to lose too much in taking risks. The poor member of VSS has less to lose and being desperate, may be willing to take risky decisions to improve her lot. These predictions in the present study find support in Kuznar (2001).

6.4.1 Evidence from VSS-R

Classification of members of VSS into income groups. The household's average monthly income of the member of VSS participating in the study (*totincT*) is used to classify the member of VSS into low income, middle income and high income group which corresponds to the poor, middle status and rich members of VSS.

In view of the dependence of the majority of members of VSS on daily wage forestry jobs offered by the Government, the classification of members of VSS is based on the average number of working adults per household, wage rate fixed by the District Collectors of Kadapa, Chittoor and Nellore districts (Rs. 137) and the fact that the average member of VSS works for 15-20 days per month. On this basis, a member of VSS from a household earning less than or equal to Rs. 4000 is treated as belonging to the low income group. A member of VSS from a household whose earnings are greater than Rs. 4000 but less than or equal to Rs. 8000 is treated as belonging to the middle income group. Members of VSS from households earning greater than Rs. 8000 are treated as belonging to the high income group.

The nominal variable *totcat* is defined to represent the three income categories of the members of the VSS and included in the model. The base group is *totcat1* which is the low income (poor) group. The nominal variables *totcat2* and *totcat3* represent the middle income (middle status) and the high income (rich) group.

Results of regression. Model 1 of Table 5 reports the results. The sample size considered for analysis here is 50 who switched only once in the multiple price list procedure. The remaining 25 responses have been excluded as these members of VSS made inconsistent choices in the multiple price list methodology.

Table 5

Interval Regression Results to Show Effects of Total Household Income (totcat) *on the Risk Attitudes of Members of VSS-R*

Dependent Variable = [*rlow, rhigh*] which represents the lower and upper bounds of the constant relative risk aversion (CRRA) coefficient of the members of the VSS from Rayalaseema				
Independent Variables	**Model 1**		**Model 2**	
	***β* (se)**	***p* value**	***β* (se)**	***p* value**
Intercept	- 0.571 (0.657)	0.385	0.438*** (0.117)	0.0001
age	0.031** (0.012)	0.013		
sex1 (ref. = male)	- 0.634** (0.281)	0.024		
occup1(ref. = non-forestry)	0.226 (0.203)	0.266		
marital1(ref. = not married)	1.404*** (0.432)	0.001		
cbelow5(number of children below 5 years)	- 0.208 (0.156)	0.184		
cbelow18(number of children between 5-18 years)	-0.227* (0.116)	0.051		
cabove18(number of children above 18 years)	-0.628*** (0.132)	0.000		
fsize	0.016 (0.068)	0.812		
hhead1(being a household head; ref. = not being a household head)	- 0.133 (0.232)	0.566		
hhead2 (equal decision-making in household)	1.239** (0.579)	0.032		
educ (number of years of education)	0.011 (0.022)	0.588		
mc1(ref. = not a member of	- 0.581**	0.012		

managing committee)	(0.232)			
totcat2[a]	-0.046 (0.209)	0.826	0.163 (0.192)	0.396
totcat3	- 0.806** (0.347)	0.020	0.076 (0.333)	0.821
totassetsT (Total assets owned by VSS household)	- 0.003* (0.002)	0.094		
caste2 (Scheduled caste; ref. = Scheduled tribe))	- 0.206 (0.182)	0.259		
caste3(Other backward caste)	-0.569 (0.410)	0.166		
dist	- 0.001 (0.006)	0.799		
N	50		50	
Scale	0.422		0.621	
Log likelihood (Model)	- 90.4		- 108.8	
Log likelihood (Intercept)	- 109.1		- 109.1	
χ^2(df)	37.41 (19); p value = 0.0071		0.72 (2); p value = 0.7	

Note. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
[a] The members of VSS are classified into three categories based on their household or family's total monthly income: *totcat1* $= \leq 4000$ (reference category); *totcat2* $= > 4000$ and ≤ 8000; *totcat3* $= > 8000$;

The variable of interest is *totcat2* and *totcat3*. *Ceteris paribus*, the members of VSS with middle status (*totcat2*) have a CRRA that is 0.05 lower ($p = 0.83$) than the poor members of VSS (*totcat1*), the reference category implying that members of VSS with middle status are less risk averse than their poor counterparts. The result is not statistically significant.

The rich members of VSS (*totcat3*), on the other hand, have a CRRA that is 0.81 lesser ($p = 0.02$) than the poor members of VSS indicating that the rich members of VSS have low levels of risk aversion in comparison to the poor. The result is statistically significant.

However, the analysis of deviance results shows that the overall effect of the income variable (*totcat*) is not statistically significant (the two degree of freedom test for *totcat* show a p value of 0.19).

Overall, the results imply that the members of VSS belonging to poor status have highest levels of risk aversion among the three income groups and members of VSS who are rich are the least risk averse.

Model 2 of Table 5 reports the results without controls. The results show that on average, the CRRA coefficient of the poor members of VSS is 0.44 indicating risk aversion (result significant at the 5% level). The CRRA coefficient of the middle status members of VSS (*totcat2)* is 0.16 more than those of the poor members implying that this group is more risk averse than the poor members. The CRRA coefficient of the rich members of VSS (*totcat3)* is 0.08 more than those of the poor members implying that this group is also more risk averse than the poor members. However, *totcat2* and *totcat3* are not significant at the 5% level. In addition, the overall model is not statistically significant ($p = 0.70$).

Other significant effects – *(a) Age effects.* Model 1 of Table 5 shows that all else being equal, aged members of VSS are found to be more risk averse. An increase of one year in age of a VSS member is associated with an increase of her CRRA by 0.03 which is a quantitatively small effect. The positive association between age and risk aversion has also been reported amongst the fishing communities in Ethiopia by Bricks, Visser and Burns (2012). In the VSS context, aged persons, by virtue of their experiences gained in life, may tend to be cautious which might contribute to their risk aversion.

(b) Gender. Women are estimated to have a CRRA that is 0.63 lesser than men implying that women are less risk averse than men. That women are more risk seeking than men has also been reported by Gneezy, Leonard and List (2008) in the context of the Khasi matrilineal tribal societies of north eastern India. In the context of primitive forest societies, it is possible that equality of roles for men and women in foraging, tending, hunting, collection of materials for food and shelter may foster a risk seeking behavior amongst women.

(c) Marital status. Married members of VSS from Rayalaseema are likely to have a CRRA that is 1.4 higher than the unmarried members. The result is economically significant. Adult members of VSS who are married have higher responsibilities in taking care of their families that may induce risk aversion.

(d) Having children. A member of VSS with one more progeny aged 18 years of age and above is likely to have a CRRA that is 0.63 lesser on average. The effect is also economically significant. As sons and daughters approach adulthood, they are married off and sent to work. On marriage, sons usher in the resources of their wives into the VSS household. Wives also contribute to household work and income. Daughters, on marriage, move into their husband's heath. Sometimes, as is

characteristic in some VSS communities, married daughters stay with their parents. The adult member of VSS, with fewer responsibilities now that her sons and daughters are settled in their lives, may tend to be risk seeking.

(e) Household decision making. Members of VSS who share decision-making responsibilities with their spouses on household matters are found to have a CRRA that is 1.24 higher, and therefore more risk averse than those members of VSS who are not decision-makers in their households. This is a practically large effect. It is possible that consulting and sharing responsibilities for household decision making instills caution and prudence which may induce risk aversion.

(f) Institution effects. Members of managing committee are found to have a CRRA that is 0.58 less than those members of VSS who are not a part of the managing committee implying that the managing committee members are less risk averse. It is possible that members of managing committee may tend to be risk seeking by virtue of their higher social visibility and greater success in life relative to non-members.

Model 1 of Table 5 also indicates that the overall model is significant at the 1% level. The chi-square distribution for intercept only and the full model is significant at 1% level, χ^2 (19, $N = 50$) $= 37.41$, $p = 0.007$. The statistic Scale $= 0.422$ is equivalent to the standard error of the estimation of the model in ordinary least squares regression. This statistic, when compared to the standard deviations of *rlow* ($sd = 0.73$, $N = 50$) and *rhigh* ($sd = 0.62$, $N = 50$) shows substantial reduction.

Robustness check - I. Since the methodology involves testing for change of sign of the CRRA coefficients as average total household monthly incomes of members of VSS increase, it is also possible to do so by regressing the CRRA interval data of members of VSS on their raw monthly household incomes and its squared term (with and without controls). This strategy removes the need for classifying the members of VSS into poor, middle status and the rich groups. The results are similar to those from the interval regression model (available on request).

Robustness check - II. As another robustness check, the arithmetic means of CRRA intervals of members of VSS from Rayalaseema is regressed on the income variable (*totcat*) with and without socioeconomic controls using the OLS method. The results indicate similar conclusions as was drawn from the interval regression model.

Income levels of members of VSS from Rayalaseema have no statistically significant effect on their risk attitudes. Taken together, the results indicate that as far as members of VSS from Rayalaseema in the present study are concerned, social factors like age, gender, married status, the intensity of social responsibilities, household decision making patterns and membership in the managing committee of an adult VSS member govern their risk propensities rather than their income levels.

6.4.2 Evidence from VSS-C

The criteria for categorization of members of VSS from coastal region into poor, middle status and rich groups based on the average household monthly income is same as for VSS-R

Results of regression. Models 1 and 2 of Table 6 reports the results. The sample size considered for analysis here is 57 who switched only once in the multiple price list procedure. The remaining 17 responses have been excluded as these members of VSS made inconsistent choices.

Table 6

Interval Regression Results to Show Effects of Total Household Income (totcat) *on the Risk Behaviors of Members of VSS-C*

Dependent Variable = [*rlow, rhigh*] which represents the lower and upper bounds of the constant relative risk aversion (CRRA) coefficient of the members of the VSS from coastal regions of Andhra Pradesh				
	Model 1		**Model 2**	
Independent Variables	***β* (se)**	***p* value**	***β* (se)**	***p* value**
Intercept	- 4.789*** (1.631)	0.003	-0.426*** (0.179)	0.017
age	0.002 (0.021)	0.916		
sex1 (ref. = male)	- 0.071 (0.293)	0.807		
occup1(ref. = non-forestry)	1.668 (1.053)	0.113		
marital1(ref. = not married)	0.192 (0.486)	0.692		
cbelow5(number of children below 5 years)	- 0.473 (0.336)	0.159		
cbelow18(number of children between 5-18 years)	-0.381** (0.187)	0.042		
cabove18(number of children above 18 years)	-0.139 (0.193)	0.474		
fsize	0.281***	0.003		

	(0.096)			
hhead1(being a household head; ref. = not being a household head)	0.547 (0.339)	0.107		
hhead2 (equal decision-making in household)	0.126 (0.475)	0.790		
educ (number of years of education)	0.112** (0.046)	0.014		
mc1(ref. = not a member of managing committee)	1.11 (0.805)	0.167		
totcat2[a]	0.093 (0.308)	0.764	0.646** (0.300)	0.032
totcat3	- 0.252 (0.420)	0.549	0.225 (0.456)	0.621
totassetsT (Total assets owned by VSS household)	0.0004 (0.001)	0.793		
caste2 (Scheduled caste; ref. = Scheduled tribe))	- 0.248 (0.383)	0.517		
caste3(Other backward caste)	-0.133 (0.468)	0.78		
dist	0.072*** (0.03)	0.018		
N	57		57	
Scale	0.766		1.02	
Log likelihood (Model)	- 129.6		- 145.6	
Log likelihood (Intercept)	- 147.9		- 147.9	
χ^2(df)	36.61 (19); p value = 0.009		4.45 (2); p value = 0.11	

Note. Standard errors are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
[a] The members of VSS are classified into three categories based on their household or family's total monthly income: *totcat1*= ≤ 4000 (reference category); *totcat2* = > 4000 and ≤ 8000; *totcat3* = > 8000;

The variable of interest is *totcat2* and *totcat3*. Model 1 shows that *ceteris paribus*, the members of VSS with middle status (*totcat2*) have a CRRA that is 0.09 higher ($p = 0.76$) than the poor members of VSS (*totcat1*), the reference category implying that members of VSS with middle status are more risk averse than their poor counterparts. The rich members of VSS (*totcat3*), on the other hand, have a CRRA that is 0.25 lesser ($p = 0.55$) than the poor members of VSS indicating that the rich members of VSS have low levels of risk aversion in comparison to the poor. The results are not statistically significant at the 5% level.

Further, the analysis of deviance results show that the overall effect of the income variable (*totcat*) is not statistically significant (the two degree of freedom test for *totcat* show a p value of 0.28).

Model 2 reports the results of the interval regression when the implied CRRA interval of the members of VSS, the dependent variable, is regressed against *totcat* without any controls.

The intercept and *totcat2* are significant at the 5% level. This implies that the poor members of VSS have a CRRA of -0.43 (the intercept) on average indicating risk seeking behavior. The middle status members of VSS have a CRRA of $(-0.43 + 0.65=)$ 0.22 indicating risk aversion. The coefficient on *totcat3* indicates that the rich members of VSS have a CRRA of of $(-0.43 + 0.23=) -0.20$, implying that the rich members of VSS, on average, are risk seeking but this result is not statistically significant at the 5% level. The overall income variable is not statistically significant ($p = 0.11$).

Other significant effects – *(a) Having children.* Model 1 of Table 6 further shows that, *ceteris paribus*, a member of VSS from coastal regions with one more progeny aged between 5 and 18 years of age is estimated to have a CRRA that is 0.38 lesser on average implying that such individuals are more risk seeking. This may be due to the fact that children of adult members of VSS from coastal regions are married off or sent to work even before they attain the age of 18 years.

(b) Household size. Ceteris paribus, members of VSS from the coastal region who are from larger households are found to be less risk seeking. For every one member increase in the household size, the member of VSS from that household is found to have a CRRA that is 0.28 higher than the norm. Larger VSS families may have more members to feed and clothe and hence its members may be induced to be more careful in expending their resources.

(c) Education. Risk aversion is found to be positively associated with educational attainment. All things being equal, an increase in one year of educational attainment by a member of VSS is estimated to increase her CRRA coefficient by 0.11. Higher educational attainment may have helped the members of VSS understand risk better (Miyata, 2003). Such an understanding might encourage prudence and caution. Bricks, Visser and Burns (2012) and Tanaka, Camerer and Nguyen (2010) find that educated participants are more risk averse in their study sample.

(d) Proximity to town. Members of VSS that are farther away from the urban center or town are found to be more risk averse. For every one kilometer increase in distance between the VSS and the

nearest urban center or town, *ceteris paribus*, members from that VSS are estimated to have a CRRA of 0.07 more.

It is expected that members of VSS that are further away from urban center or town would be more risk seeking in comparison to members of VSS that are situated nearer to urban centers or towns as the former are less affected by market forces. Individuals from urban centers or towns and influenced by town cultures and market forces tend to be risk averse decision makers (Ehmke, Lusk & Tyner, 2010; Henrich & McElreath, 2001).

The opposite result emanating from the present study in the case of VSS from coastal region may be explained as follows: The average CRRA coefficient for a member of VSS from the coastal region was estimated as -0.20, implying a general risk seeking behavior for this population sub group. It is possible that the members of VSS which are situated nearer to urban centers may be more influenced by the pleasures and vices of urban centers which may induce a higher risk seeking behavior. Hence, members of VSS situated nearer to urban centers may be more risk seeking than members of VSS that are situated further away from urban centers or towns.

Model 1 of Table 6 also indicates that the overall model is significant at the 1% level. The chi-square distribution for intercept only and the full model is significant at 1% level, χ^2 (19, $N = 57$) $= 36.61$, $p = 0.009$. The statistic Scale $= 0.766$ is equivalent to the standard error of the estimation of the model in ordinary least squares regression. This statistic, when compared to the standard deviations of *rlow* ($sd = 1.16$, $N = 57$) and *rhigh* ($sd = 1.00$, $N = 57$) shows reduction.

Model 2 is not statistically significant at the 5% level. The chi-square distribution for intercept only and the full model is not significant at the 5% level, χ^2 (2, $N = 57$) $= 4.45$, $p = 0.11$. The statistic Scale $= 1.02$ is equivalent to the standard error of the estimation of the model in ordinary least squares regression. This statistic, when compared to the standard deviations of *rlow* ($sd = 1.16$, $N = 57$) and *rhigh* ($sd = 1.00$, $N = 57$) shows no reduction.

Robustness check - I. As in the case of VSS-R, it is possible to understand within VSS-C behavior by regressing the CRRA interval data of members of VSS on their raw total monthly household incomes and its squared term (with and without controls). The results are similar to the conclusion drawn from the interval regression model (available on request).

Robustness check - II. As another robustness check, the arithmetic means of CRRA intervals of members of VSS from the coastal regions is regressed on the income variable (*totcat*) with and without socioeconomic controls using the OLS method. The results suggest similar conclusions as was drawn from the interval regression model.

The above regression results show that income levels of members of VSS from the coastal regions have some, but not strong, statistically significant effect on their risk behaviors.

The members of VSS from the coastal region, on average, are moderate risk seekers as per the definition in the study. Taken together, the results indicate that household size, the intensity of social responsibilities of an adult VSS member, educational attainment and proximity of the VSS habitation to urban centers and towns appear to be the drivers of risk behaviors of VSS members and to a lesser extent, their income levels.

7 Conclusion

The average CRRA coefficient of the sample of members of VSS from Rayalaseema and coastal regions who participated in the study is 0.13 indicating low levels of risk aversion bordering on risk neutrality (as defined in Table 2) while *a priori,* it was expected that the members of VSS would be risk seeking. This estimate is low when compared to estimates obtained on nearly comparable population groups from other developing countries using similar estimation methods.

Cook et al. (2013) report an average CRRA coefficient of 0.53 for a sample of the urban poor from the Indian city of Kolkata. Holt and Laury (2002) report a range of 0.28-0.54 for a sample of University undergraduates from Georgia, Florida and Miami. Binswanger (1981) report the average measure of risk aversion as 0.33 for low payoffs and 0.54 for higher payoffs for a sample of small-scale farmers from villages in central India. Bricks, Visser and Burns (2012) found an average CRRA coefficient of 0.39 for the fishing communities in Ethiopia.

The members of VSS from the coastal regions in the study sample are risk seeking while the members of VSS from the Rayalaseema region are risk averse. The monthly household income variable did not have a statistically significant effect on the risk attitudes. Members of VSS with children between 5 and 18 years of age were found to be less risk averse. This suggests that the

intensity of social responsibilities also could be a possible driver of risk propensities in the study sample.

Income levels of members of VSS from Rayalaseema have no statistically significant effect on their risk attitudes. Aged members of VSS from this region are found to be more risk averse. Women are found to be less risk averse than men. Married members of VSS from Rayalaseema are found to be more risk averse than the unmarried members. Members of VSS with children aged 18 years of age and above are found to be less risk averse. Members of VSS who share decision-making responsibilities with their spouses on household matters are more risk averse than who are not decision-makers in their households. Members of managing committee members are found to be less risk averse.

Income levels of members of VSS from the coastal regions have some, but not strong, statistically significant effect on their risk behaviors. Members of VSS with children between 5 and 18 years of age are found to be more risk seeking. Members of VSS from larger households are found to be less risk seeking. Risk aversion is found to be positively associated with educational attainment. Members of VSS that are farther away from the urban center or town are found to be more risk averse.

As against econometric estimation of risk attitudes based on individual's real life and actual behavior which have ecological validity (Antle, 1983; Moscardi & de Janvry, 1977), elicitation through methods like multiple list method casts doubts and concerns as to whether the results obtained would apply to real behavior (Frederick et al., 2002). This limited ecological validity is an important limitation.

Deaton (2003) describes some adjustments that needs to be made while computing household incomes such as costs of children and the aged relative to adults and the public goods character of some consumption items like housing rent, television, refrigerator, lighting and cooking fuel leading to economies of scale. These adjustments relate to both the urban and rural contexts.

Adjustments for consumption of children, the aged and gender in the VSS context have not been made in this study. Such and further refinements in computing household incomes may be taken up in future research.

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