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## "Impatience" of Forest Dependent Communities Evidence from Andhra Pradesh

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### Abstract

This study is an attempt to generate empirical evidence on the time discount rate or “impatience” 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). “Impatience” was measured as the revealed individual time discount rate from the choice task methodology. With this measure, on average, members of FDCs from Rayalaseema were found to be more “impatient” 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 impatience. Incomes of members of FDCs both from Rayalaseema and the coastal region did not contribute to their “impatience”. For members of FDCs from Rayalaseema, on average, proximity to urban centers was found to contribute positively to “impatience” and membership to “other backward caste” (relative to “scheduled caste” and “scheduled tribe”) negatively so. For members of FDCs from the coastal region, family size and being a shared decision maker within the family contributed negatively to impatience.

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## 1 Introduction

A forest dweller is a person who resides in, and depends on the forests for her livelihood. In 2006, the Government of India enacted the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 which not only defines forest dwellers but also distinguishes between “forest dwelling scheduled tribes” and “other forest dwellers” for purposes of assigning ownership rights over forest lands to FDCs.

According to this Act, forest dwelling scheduled tribes are people belonging to the scheduled tribes category who reside in and depend on forests for their livelihood activities. The “other forest dwellers” are people who have resided in forests for at least three generations (a generation comprises 25 years) prior to 13/12/2005 and who depend on forests for their livelihood activities (Ministry of Law and Justice, Government of India, 2007).

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 Government of India Circular on Joint Forest Management (JFM) in 1990 envisaged higher 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. The partnership takes the form of a standard JFM agreement where the FDC agrees to protect the forests they inhabit from fire, grazing

and illicit timber removals in return for which the community receives some rights over forest produce (like fuel, fodder, timber, and other forest products) and a share of penalty levied on forest offences.<sup>1</sup> For more details on structure, financial management and the present status of JFM see Sundar and Virmani (2013a).

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 time discount rate, or “impatience”, of interest. However, research in this area has been lacking. This paper addresses the above gap and attempts to study the impatience levels of FDCs using data from the forest communities of Andhra Pradesh in India.

The plan of the paper is as follows. The next section reviews the literature and discusses the motivation for the research. Section 3 provides details on the research design and section 4 describes the methodology. Section 5 discusses the results and section 6 concludes.

## 2 Literature Review

Conceptions of time as perceived by traditional societies like FDCs differ from the way contemporary societies regard time. For example, Mbiti (1968) notes the fundamental difference in the African conception of time thus: For the modern society, time is a scarce commodity that can be precisely measured and which arrives in a linear fashion. For the traditional forest dweller, time is not scarce and is linked to unpredictable nature which jumps into existence when special events (like rain, child birth and marriage) occur in the course of her life (as cited in D’Exelle et al., p.567).

Further, modern society emphasizes the efficient use of time which is regarded as a valuable resource, while the traditional African society does not express concern over time availability. In this study, it is assumed that this traditional African concept of time would be broadly applicable to forest communities in other parts of the world including India.

Bazon and Smetters (1999) defines the internal rate of time preference or the individual time discount rate as the rate that is required for a person to defer her present consumption to a future time period. In terms of utility and its gratification, the individual time discount rate measures the

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<sup>1</sup> Retrieved from <http://www.aponline.gov.in/apportal/departments/departments.asp?dep=06&org=60&category=about> on 29/01/13

preference of a person for immediate utility or gratification over future utility which is delayed and uncertain to some extent.

Following Kirby et al., (2002), a time discount rate of zero implies that the person is indifferent between waiting for the reward in the future and enjoying the reward immediately in the present. A high time discount rate indicates impatience, a higher inclination for present gratification and a lack of future orientation while a low time discount rate implies patience, a future orientation and an ability to delay gratification. The time discount rate is defined mathematically as the logarithm of the marginal rate of substitution of present consumption over future consumption (Godoy et al., 2004).

Bazellon and Smetters (1999) also define the external rate of time preference or the external time discount rate as the rate at which current generations of people discount the utility of future generations. The present study is concerned with the internal rate of time preference or the individual time discount rate.

It may be useful to note that in general, an individual's time discount rate for consumption is such that the utility obtained from present consumption is valued more than the utility obtainable from consumption in the future (D'Souza, 2008).

### ***3.1 Different perspectives***

Adam Smith (1723-90 AD) argues that inter temporal choices determine the prosperity of a nation. John Rae's *Sociological Theory of Capital* (1834) gave a firm theoretical underpinning to the notion of inter temporal choice. Rae argues that besides labor and capital, the psychological desire to acquire wealth differed across nations which explained why some nations were rich and some poor (as cited in Frederick, Loewenstein, & O'Donoghue, 2002, pp. 351-353).

Fisher (1930) stressed on the psychological determinants of time preferences and predicted poor people to have high impatience.

The discounted utility model posited that the inter temporal preferences of a person can be represented by a single discount rate (Samuelson, 1937) which can be applied to all forms of consumption like leisure, rice, apple and vacations. When people are asked to choose between

consumption options at different points in time, the model discounts the utility of each future option to the present and selects the option with the highest discounted utility.

Empirical research from subsequent studies shows that observed discount rates were not constant as predicted by the discounted utility model but declined with time and gains and small amounts are discounted more than losses and large amounts (Frederick et al., 2002).

Rogers (1994) offers an evolutionary perspective by arguing that time discount rates may be genetically determined through the forces of natural selection and cites the following reasons to explain why people tended to prefer present consumption: loss of reproductive vigor and a fear that delayed rewards would benefit only children and not self. Rogers predicted that young people, who seem to live too much in the present forgetting the existence of future, would be highly impatient compared to the aged.

### **3.2 Determinants**

(a) *Wealth*. Becker and Mulligan (1997) develop a model which hypothesized that wealth, and perhaps income, should decrease individual time discount rates and hence, increase patience because the rich people can afford to invest in more future-oriented human and material capital like education, stocks and bonds.

Research studies have found evidence that poor people have higher discount rates in relation to rich people (Harrison et al., 2002; Hausman, 1979; Kurz, Spiegelman, & West, 1973 as cited in Lawrance, 1991, p. 55 ; Lawrance, 199; Pender, 1996; Andersen et al., 2004).

(b) *Incomes*. Fisher (1930) predicts that people with lower incomes would be impatient due to the pressing need for providing for current consumption. The poor person suffering from poverty has to supply for her present necessities to maintain the continuity in life and also to cope with the future needs and consumption. In this daily struggle for providing for present consumption, Fisher argues that the poor person becomes oblivious to future needs.

The evidence from the literature linking incomes and time discount rates of individuals is mixed. In a study of graduate and undergraduate students from the business school at the University of South Carolina, Collier and Williams (1999) reports a positive and significant correlation between income

and impatience and attributed this finding to the irregular income flows and expectations of future incomes that is characteristic of students.

In their study of the time preferences of forest dependent communities in Sinharaja Man and Biosphere Reserve in Sri Lanka, Gunatilake, Wickramasinghe, and Abeygunawardhena (2009) report that poor individuals from these forest communities had high time discount rates. Kirby et al. (2002) reports no association between wealth and time discount rates and an inverse relationship between income and time discount rates in a study of Tsimane Amerindians, a simple foraging and horticultural community in Bolivia.

Godoy et al. (2004) found that both cash income earnings and wealth had no statistically significant effect on the time discount rates of the same subjects (Tsimane Amerindians). Godoy et al. attributes this finding to the prevalence of a sharing culture and reciprocity amongst the Tsimane Amerindians. Sharing and reciprocity possibly weakens the role of material resources like wealth and income in shaping the patience levels of these individuals.

Harrison, Lau and Williams (2002) report that high income individuals had a significantly lower time discount rate in their study of Danish individuals randomly drawn from various walks of life as does Hausman (1979) and Green et al. (1996).

(c) *Education*. Education, which helps people to visualize future with some clarity, has been found to have a negative association with impatience levels of people (Harrison, Lau & Williams, 2002; Kirby et al., 2002).

D'Exelle, Campenhout and Lecoutere (2012) use data from Tanzania and conclude that urban people are more impatient than rural people. An explanation offered to explain this counter intuitive finding is that modernization, conveyed through education, makes urban people assign higher weight to time and present consumption, leading to higher discount rates whereas in the traditional African concept of time as perceived by rural people, there are no time preferences resulting in lower discount rates.

(d) *Age*. Aging shortens the time horizon and hence aged people are predicted to be more impatient and prefer immediate consumption (Harrison et al., 2002; Read & Read, 2004).

(e) *Occupation*. Nguyen (2009) finds fishing communities to be more patient relative to people from other occupations. An explanation offered is that fishermen are constantly working under regulations which require fishermen to give up earning profits through fishing today to earn higher profits in the future.

(f) *Gender effects*. From studies in rural villages in south India, Bauer and Chytilova (2009) find evidence that women with 3-4 children, in general, make more patient choices than women without children and men. The study explains the finding by observing that having more children in the family increases a mother's need for more savings and investments to take care of the children's education and health which finds support in the findings of Ray and Wang (2001).

In addition to recognizing the importance of psychological factors in analyzing time discount rates of people as stressed in Frederick et al., (2002), it needs to be noted that in the real world, a person might display a variety of attitudes towards the future. She could be a high profile investment banker earning millions to secure a good future but may not exercise which may indicate a low concern for the future health of her heart. The example illustrates intra-person heterogeneity in utility discounting which needs to be addressed (Frederick et al., 2002).

While the above findings on impatience pertain to forest communities outside India, very few studies talk about the impatience of Indian FDCs and their determinants. This study attempts to fill this gap.

### **3 Research Design**

#### **3.1 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.<sup>2</sup> In 2002, the State re-christened JFM as community forest management (CFM) indicating its commitment to encourage deeper community participation in forest management (Andhra Pradesh Forest Department, 2011).

### 3.2 Sample description

The sub-section below is essentially taken from Sundar and Virmani (2013b), and is essential to add context to the econometrics later.

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 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

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<sup>2</sup> In Andhra Pradesh, the FDC is thus referred to as Vana Samrakshana Samithi in the regional Telugu language.

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 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.) <sup>c</sup>
S. V. Puram <i>n</i> = 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 <i>n</i> = 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 <i>n</i> = 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 <i>n</i> = 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 <i>n</i> = 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
<i>Royalaseema</i> <sup>a</sup> <i>n</i> <sub>1</sub> = 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 <i>n</i> = 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 <i>n</i> = 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 <i>n</i> = 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 <i>n</i> = 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
<i>Coastal Region</i> <sup>b</sup> <i>n</i> <sub>2</sub> = 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
<b>Full Sample N = 149</b>	<b>34.79 (12.9)</b>	<b>52.35</b>	<b>3.93 (4.22)</b>	<b>4.30 (1.49)</b>	<b>0.33 (0.76)</b>	<b>2792.62 (2578.90)</b>	<b>4168.46 (2509.15)</b>	<b>26972.15 (68453.89)</b>	<b>83.22</b>	<b>503 / 2963</b>	<b>-</b>

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

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 VSSs belong offer a way to compare time discount rate of two similar FDCs but belonging to different income levels. This offers a natural set-up to control for income effects, if any.

#### 4 Methodology

To elicit time discount rates of the members from the VSS, this study uses the choice task methodology used in Kirby et al. (2002) for Tsimane Amerindian forest dwellers in Bolivia. Before commencement of the procedure, instructions and procedures were explained in vernacular Telugu to the VSS participants.

The question used to elicit the individual time discount rate (IDR) of a participant is simple: Do you prefer Rs. 100 today or Rs. (100 + x) tomorrow, where x is greater than 0? If the person prefers Rs. 100 today, one infers that her IDR is greater than x% per day. If the person prefers Rs. (100 + x) tomorrow, the inference is that her IDR is less than or equal to x% per day (Harrison, Lau, & Williams, 2002).

Following Godoy et al. (2004) and Kirby et al. (2002), the study uses hyperbolic discounting to estimate IDR. The formula used to capture IDR is given by  $PV = \frac{A}{1+k*D}$  where  $PV$  = Present Value of Amount  $A$ ,  $k$  = IDR = hyperbolic discount rate and  $D$  = delay in days. The future loses value as  $D$  increases because of the higher risks associated with future rewards and the inability of people to accurately estimate future costs and benefits (Godoy et al., 2004; Laibson, 1997).

Table 2 describes the eight payoff alternatives (1 – 8) that shall be presented to the participants. For each of the eight payoff alternatives, the participant chooses either Option A or Option B shown in columns 2 and 3. Thus, Option A provides payment 7 days from now and Option B provides payment 37 days from now implying that the revealed time discount rate applies over a time horizon of 30 days.

**Table 2***Details of Choice Task Methodology for Elicitation of Individual Time Discount Rate*

<b>Payoff Alternative</b>	<b>Payment Option A in Rs. (pays amount 7 days from now)</b>	<b>Payment Option B in Rs. (pays amount 37 days from now)</b>	<b>Implied IDR (%per day)</b>
1	300	305	0.055
2	300	310	0.111
3	300	325	0.27
4	300	350	0.55
5	300	400	1.11
6	300	450	1.67
7	300	500	2.2
8	300	600	3.3

*Note.* IDR = Individual Time Discount Rate

The implied IDR shown in column 4 implies an annual rate of interest in the range of approximately 19.8% (for payoff alternative 1) to 1188% (for payoff alternative 8). Gunatilake, Wickramasinghe and Abeygunawardhena (2009) use the existing market rate of interest for bank loans (= 18.5%) as a benchmark. The average elicited discount rate from the forest dwellers was greater than 18.5% in their study and hence, the researchers interpreted that the forest dwellers displayed impatience.

The present study employs a similar principle. Local enquiries and one of the author's knowledge reveals that FDCs in the study area borrow and lend petty amounts on a simple basis of borrowing Rs.100 today and repaying Rs.105 the next month which implies an annual interest rate of roughly 60%. The payoff alternatives and the IDR in Table 2 have been constructed around this principle and the range of 19.8% - 1188% is wide enough to capture a wide range of patience and impatience levels.

Payments to the VSS participants would be made through the forest office to increase credibility and render the transaction costs same for collecting both present and future incomes. To reward active participation, one of the eight payment alternatives would be randomly selected for payment and would be paid in accordance with the option expressed for the randomly selected payment alternative.

As shown in Table 2, Option A pays Rs. 300 seven days from now for all the eight alternatives. Option B pays Rs. (300+x) after 37 days, where x ranges from Rs. 5 to Rs. 300. The table also

shows the implied IDR in column 4 calculated using hyperbolic discounting with  $k$  ranging from daily hyperbolic discounted return of 0.055% to 3.3% on the principal of Rs. 300.

If the VSS participant chooses the payment option A for payoff alternatives 1 and 2, and then switches to option B for payoff alternatives 3-8, it is inferred that her IDR is between 0.111 and 0.27% per day. Following Godoy et al. (2004) and Kirby et al. (2002), the geometric mean of (0.111, 0.27), which is 0.172, is used to represent the point estimate of IDR.

For those participants who exhibit multiple switching, a wider time discount rate interval is used following the principle of adopting the most conservative time discount rate intervals following Coller and Williams (1999). As an example, for a member of VSS who chose the payment option B in the 2<sup>nd</sup> row, switched back to payment option A for the 4<sup>th</sup> and subsequent rows, the most conservative estimate of her time discount rate is considered as her “true” response, which in this case is taken as greater than 3.3% per day.

## 5 Results and Discussion

### 5.1 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.

## **5.2 Econometric estimation**

Six out of the 149 members of VSS switched more than once in the choice task procedure for whom it was possible to construct a wider time discount rate interval following Coller and Williams (1999). The observations for 17 other members of VSS were removed from the analysis as they recorded inconsistent choices like making choices in the reverse direction and alternating between choices on every other row. Thus, the number of valid responses in the study is 132 which have been used in econometric estimation.

The members of the VSS borrow and lend petty amounts on a simple basis of borrowing Rs. 100 today and repaying the above amount with interest (*Vaddi* in vernacular Telugu) in the next month. During the interviews in the nine VSS, it was ascertained that the interest ranged from Rs.2 – Rs.5 per month depending on the volume and frequency of borrowing besides the relationship between

the borrower and lender implying an interest rate between 24% - 60% per annum approximately. The geometric mean of this band (~ 38% per annum) is treated as the cut off for classifying the individual time discount rates of members of VSS into high and low.

**Dependent and independent variables.** The interval regression model is employed in the present study for eliciting estimates of IDR of the members of VSS following Bauer and Chytilova (2009), D'Exelle, Campenhout and Lecoutere (2011) and Harrison, Lau and Williams (2002) among others. The dependent variable is the IDR interval that each member of VSS implicitly chooses when she switches from option A to option B in Table 2.

Please see section 2 for a detailed literature review highlighting the various determinants of impatience which provides a theoretical justification for including some of the 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 Impatience*

Variable	Description	Remarks
<i>rorc</i>	Whether the VSS is from Rayalaseema (= 0) or Coastal Andhra Pradesh (= 1) region; Reference category is Rayalaseema	Binary variable
<i>age</i>	Age of the VSS member in years	Numerical variable
<i>sex</i>	Sex of the VSS member; male = 0, female = 1; Reference category is male	Binary variable
<i>occup</i>	Occupation of the VSS member; non-forestry related = 0, forestry related = 1; Reference category is non-forestry related	Binary variable
<i>marital</i>	Married status of the VSS member; unmarried = 0, married = 1; Reference category is unmarried	Binary variable
<i>cbelow5</i>	Number of children of the member of VSS less than five years of age	Numerical variable
<i>cbelow18</i>	Number of children of the member of VSS between five and eighteen years of age	Numerical variable
<i>cabove18</i>	Number of children of the member of VSS above eighteen years of age	Numerical variable
<i>ctotal</i>	Total number of children of the VSS member	Numerical variable
<i>fsize</i>	Size of the family or household of the VSS member	Numerical variable
<i>hhead</i>	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
<i>educ</i>	Number of years of education attained by the VSS member	Numerical variable
<i>mc</i>	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
<i>totincT</i>	Average household monthly income of the VSS member over the	Numerical variable



	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.	
<i>totassetsT</i>	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
<i>caste</i>	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
<i>dist</i>	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

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 Forest department of the Government of Andhra Pradesh (APFD) and the VSS.

**The Model.** The dependent variable is the IDR interval which is not continuous but grouped into several ranges and has a quantitative meaning. In the study, what is observed is whether the IDR falls into one of these intervals and not the IDR 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 IDR that characterizes the impatience 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  $\varepsilon_i$  is the error term pertaining to member  $i$  of VSS. A function  $y_i = t(y_i^*)$  that links the latent variable  $y_i^*$  to the observed interval of IDR  $y_i$  is assumed which is defined as follows:

$$y_i \equiv t(y_i^*)$$

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

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

### 5.3 Difference between VSS-C and VSS-R

As pointed out in Sundar and Virmani (2013b), the success rate of the community forestry plantations is relatively high for VSSs from the coastal region as compared to Rayalaseema and in general incomes of members of VSS-C is higher compared to those belonging to VSS-R.

As discussed in section 2, studies from Africa and South America have identified shorter life expectancy (Godoy et al., 2004; Kirby et al., 2002) and decreased need for future needs due to collectivist living (Ehmke, Lusk, & Tyner, 2010) as important determinants of impatience levels of forest communities.

These factors may be important determinants of impatience in the context of Indian FDCs. In this study, it is expected that the income differentials between the members of VSS-R and VSS-C could possibly impact their impatience. Thus, the average member of VSS-R, earning a low income relative to her counterpart in VSS-C, may be expected to assign importance to present consumption over future consumption, exhibit a lesser future orientation and consequently a higher impatience to acquire income as early as possible.

On the other hand, the average member of VSS-C, who may be earning higher income as compared to the average member of VSS-R, can be expected to possess a future orientation and hence, plan for her future needs.

This hypothesis finds support in the literature also. For example, studies have found evidence that people with low incomes have higher discount rates in relation to people with higher incomes (Harrison et al., 2002; Hausman, 1979; Kurz, Spiegelman, & West, 1973; Lawrance, 1991) which is in alignment with the theoretical prediction of Fisher (1930).

Models 1 and 2 of Table 4 reports the results of implied IDR from the interval regression described earlier.

**Table 4**

*Interval Regression Results Showing Effects of Regional Variable (rorc) on Individual Time Discount Rates of Members of VSS*

<b>Dependent Variable = [tdr<sub>low</sub>, tdr<sub>high</sub>] which represents the lower and upper bounds of the individual time discount rates of the members of the VSS in the study</b>				
<b>Independent Variables</b>	<b>Model 1</b>		<b>Model 2</b>	
	<b><math>\beta</math> (se)</b>	<b>p value</b>	<b><math>\beta</math> (se)</b>	<b>p value</b>
<i>Intercept</i>	3.059 <sup>***</sup> (0.996)	0.002	2.553 <sup>***</sup> (0.188)	0.000
<i>rorc1</i> (ref. = Rayalaseema)	- 0.676 <sup>**</sup> (0.30)	0.024	-0.597 <sup>**</sup> (0.1565)	0.02
<i>age</i>	0.005 (0.016)	0.743		
<i>sex1</i> (ref. = male)	- 0.675 <sup>**</sup> (0.312)	0.031		
<i>occup1</i> (ref. = non-forestry)	0.452 (0.398)	0.257		
<i>marital1</i> ( ref. = not married)	0.541 (0.544)	0.32		
<i>cbelow5</i> (number of children below 5 years)	0.481 <sup>**</sup> (0.238)	0.043		
<i>cbelow18</i> (number of children between 5-18 years)	0.309 <sup>*</sup> (0.161)	0.056		
<i>cabove18</i> (number of children above 18 years)	0.159 (0.162)	0.328		
<i>fsize</i>	- 0.165 <sup>*</sup> (0.0941)	0.079		
<i>hhead1</i> (being a household head; ref. = not being a household head)	0.424 (0.331)	0.199		
<i>hhead2</i> (equal decision-making in household)	-1.618 <sup>***</sup> (0.481)	0.0007		
<i>educ</i> (number of years of education)	0.009 (0.038)	0.814		
<i>mc1</i> (ref. = not a member of managing committee)	0.672 (0.419)	0.872		
<i>totcat2</i> <sup>a</sup>	0.021	0.938		

	(0.273)		
<i>totcat3</i>	- 0.48 (0.483)	0.32	
<i>totassetsT</i> (Total assets owned by VSS household)	- 0.0001 (0.001)	0.951	
<i>caste2</i> (Scheduled caste; ref. = Scheduled tribe))	- 0.026 (0.309)	0.933	
<i>caste3</i> (Other backward caste)	-1.034 <sup>*</sup> (0.537)	0.054	
<i>dist</i>	- 0.029 <sup>**</sup> (0.012)	0.015	
<i>N</i>	132	132	
Scale	1.24	1.45	
Log likelihood (Model)	- 313.6	- 333.7	
Log likelihood (Intercept)	- 336.4	- 336.4	
$\chi^2$ (df)	45.57 (20); <i>p</i> value = 0.0009	5.29 (1); <i>p</i> value = 0.021	

Note. Standard errors are reported in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

<sup>a</sup> 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  $\leq 8000$ ; *totcat3* =  $> 8000$ ;

For purposes of estimation, the lower bound of the first IDR interval is set to 0.01 and the upper bound of the last interval at 4 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, is found to have a time discount rate that is 0.68 percentage points per day less than the member of VSS from the Rayalaseema region (result significant at the 5% level) which is economically significant too. This implies that, on average, the members of VSS from Rayalaseema have a higher time discount rate and hence, are more impatient than the members of VSS from the coastal region.

**Other significant results** – (a) *Gender*. Women members of VSS, in general, have a time discount rate that is 0.67 percentage points lower than men indicating that women are more patient than men. This result finds support in Bauer and Chytilova (2009). However, Kirby et al. (2004) reported the gender effect in the opposite direction.

(b) *Having children*. *Ceteris paribus*, a member of VSS with one more child below five years of age is estimated to have a time discount rate that is 0.48 percentage points higher which is economically

significant too. With more members to feed and take care in the present, members of VSS with more children aged below five years may prefer immediate consumption to future savings.

(c) *Sharing of household responsibilities.* Members of VSS who share responsibility for decisions in households with their spouses are estimated to have a lower time discount rate and hence, be more patient and future oriented. The coefficient on *hhead2* indicates that a member of VSS who shares responsibility for decisions on household matters with her spouse has a time discount rate that is 1.62 percentage points lower than a member of VSS who is not the head of the household.

(d) *Distance between the VSS and urban center or town.* *Ceteris paribus*, for every one kilometer increase in the distance between a VSS habitation and the nearest urban center or town, a member of that VSS is found to have a discount rate that is 0.03 percentage points lower on average. From the professional experience of one of the authors of this study and also during interviews, it was learnt that members of VSS visit the nearby towns regularly to spend their incomes in pleasures and vices of town.

If proximity of VSS to urban centers or towns is assumed to increase exposure of members of VSS to an urban or town culture, these results indicate that the more the member of VSS is exposed to an urban or town culture, the more impatient she becomes which finds support in D'Exelle, Campenhout and Lecoutere (2012).

The overall model is significant at the 1% level. The chi-square distribution for intercept only and the full model is significant at the 1% level,  $\chi^2(20, N = 132) = 45.57, p = 0.0009$ . The statistic  $\text{Scale} = 1.24$  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 *tdrlow* ( $sd = 1.448, N = 132$ ) and *tdrhigh* ( $sd = 1.576, N = 132$ ) shows substantial reduction.

Model 2 reports the results of the interval regression when the time discount rate intervals of the members of VSS are regressed against *rorc* without any covariates. The intercept, which represents the average time discount rate of members of VSS from Rayalaseema region (*rorc* = 0) is 2.553 percentage points per day (result significant at the 1% level) which implies 919 percentage points per annum approximately. The average time discount rate of members of VSS from the coastal region (*rorc* = 1) is  $(2.553 - 0.597 = )1.956$  percentage points per day (significant at the 5% level) implying 704 percentage points per annum approximately.

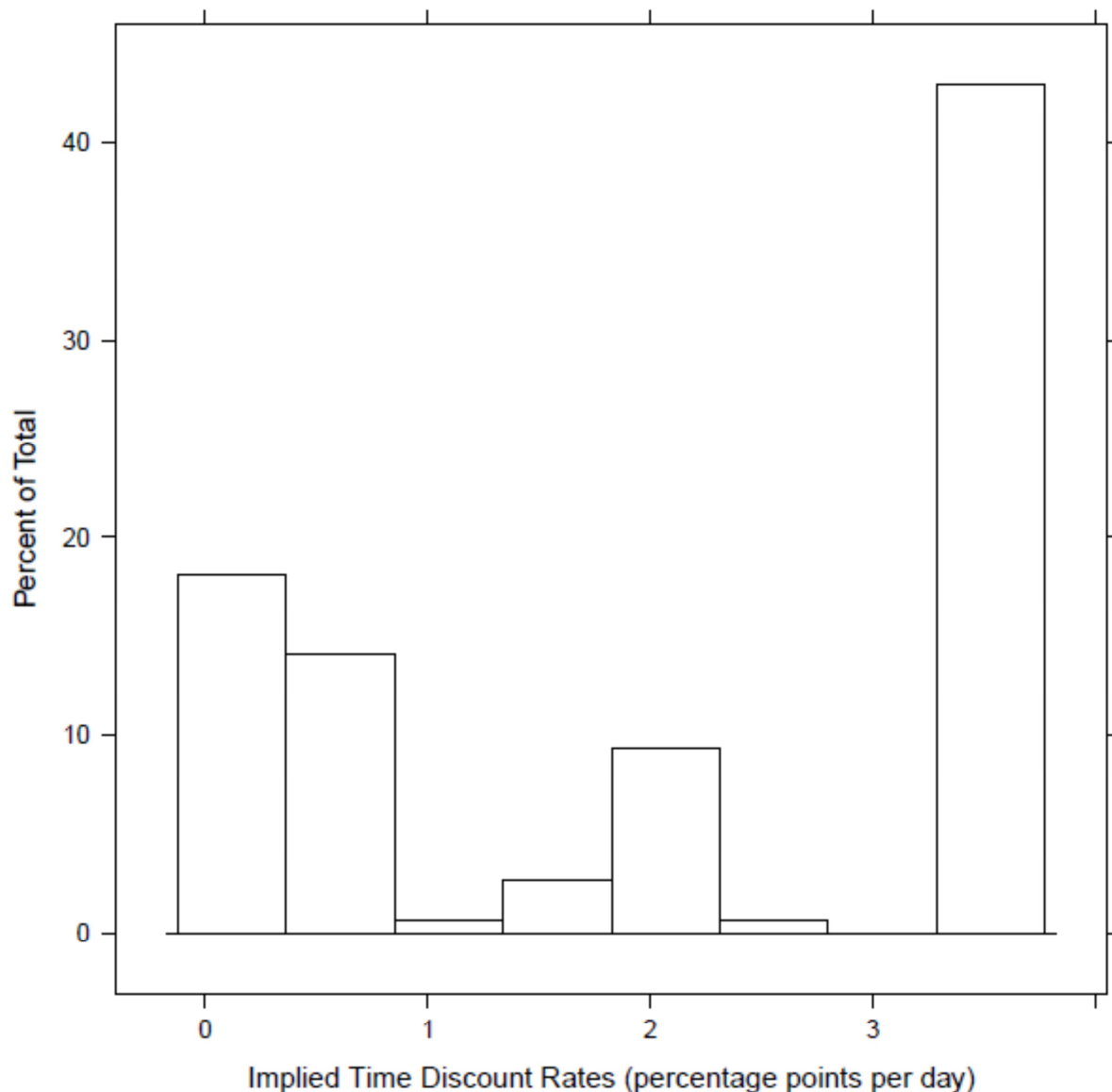
These results indicate that the members of VSS from the Rayalaseema regions have higher time discount rates, and hence are more impatient than the members of VSS from the coastal region. Further, members of VSS from both regions, as a whole, can be characterized as highly impatient as per the definition in this study.

Model 2 is significant at the 5% level. The chi-square distribution for intercept only and the full model is significant at 5% level,  $\chi^2(1, N = 132) = 5.29, p = 0.021$ . The statistic Scale = 1.45 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 *tdrlow* ( $sd = 1.448, N = 132$ ) and *tdrhigh* ( $sd = 1.576, N = 132$ ) does not show reduction.

The average individual time discount rate of the sample of members of VSS from Rayalaseema and coastal region who participated in the study is 2.235 percentage points per day implying ~ 805 percentage points per annum ( $p = 0.000$ ) which indicates high impatience levels. Figure 1 shows that approximately 40% of the study sample was highly impatient (between 3 – 3.5 percentage points per day) while close to 18% of the sample had low levels of impatience.

**Figure 1**

Distribution of impatience of the VSS members in the study



**Robustness check.** The geometric mean of the individual time discount rate interval data is regressed on the regional variable (*rorc*) with and without socioeconomic controls using ordinary least squares (OLS) as in Bauer and Chytilova (2009). 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 from the Rayalaseema region in the study are more impatient than those from the coastal region. The monthly household income variable did not have a statistically significant effect on impatience (the analysis of deviance results showed a p-value of 0.74 for the household income variable). The study did find evidence that the members of

VSS from Rayalaseema were more impatient than those from the coastal region but the drivers of impatience of VSS members appeared to be social factors like gender, presence of young children less than 5 years in the family, shared decision-making on household matters and proximity to towns rather than their income levels.

It may be noted that the average household income in VSSs from Rayalaseema is Rs. 4155 per month while those from VSSs in the coastal region is Rs. 4182 per month which indicates that the average household incomes are almost the same in the VSSs from the two regions. 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 has an impact on the results from econometric regression.

#### **5.4 Within VSS Comparison**

The study also looks at the effects of incomes of VSS members on their impatience 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.

##### **5.4.1 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.** Models 1 and 2 of Table 5 reports the results. The sample size considered for analysis here is 62. The remaining 13 responses have been excluded as these members of VSS made inconsistent choices in the choice task methodology.

**Table 5**

*Interval Regression Results to Show Effects of Total Household Income (totcat) on the Individual Time Discount Rates of Members of VSS-R*

<b>Dependent Variable = [tdrlow, tdrhigh]</b> which represents the lower and upper bounds of the individual time discount rates of the members of the VSS from Rayalaseema in the study				
<b>Independent Variables</b>	<b>Model 1</b>		<b>Model 2</b>	
	<b><math>\beta</math> (se)</b>	<b>p value</b>	<b><math>\beta</math> (se)</b>	<b>p value</b>
<i>Intercept</i>	3.153*** (1.211)	0.009	2.438*** (0.212)	0.000
<i>age</i>	0.016 (0.021)	0.457		
<i>sex1</i> (ref. = male)	0.051 (0.426)	0.904		
<i>occup1</i> (ref. = non-forestry)	0.365 (0.376)	0.331		
<i>marital1</i> ( ref. = not married)	- 1.103 (0.788)	0.162		
<i>cbelow5</i> (number of children below 5 years)	0.450* (0.260)	0.083		
<i>cbelow18</i> (number of children between 5-18 years)	0.053 (0.220)	0.807		
<i>cabove18</i> (number of children above 18 years)	0.056 (0.238)	0.813		
<i>fsize</i>	- 0.075	0.543		

	(0.124)			
<i>hhead1</i> (being a household head; ref. = not being a household head)	0.66* (0.400)	0.099		
<i>hhead2</i> (equal decision-making in household)	-1.560* (0.858)	0.069		
<i>educ</i> (number of years of education)	- 0.015 (0.045)	0.742		
<i>mcl</i> (ref. = not a member of managing committee)	- 0.122 (0.421)	0.772		
<i>totcat2</i> <sup>a</sup>	- 0.140 (0.340)	0.680	0.269 (0.366)	0.46
<i>totcat3</i>	- 0.402 (0.676)	0.552	0.502 (0.684)	0.46
<i>totassetsT</i> (Total assets owned by VSS household)	0.004 (0.003)	0.276		
<i>caste2</i> (Scheduled caste; ref. = Scheduled tribe))	- 0.658** (0.306)	0.031		
<i>caste3</i> (Other backward caste)	- 2.249*** (0.642)	0.0004		
<i>dist</i>	- 0.027** (0.012)	0.031		
<i>N</i>	62		62	
Scale	0.893		1.29	
Log likelihood (Model)	- 108.5		- 130	
Log likelihood (Intercept)	- 130.5		- 130.5	
$\chi^2$ (df)	43.96 (19); <i>p</i> value = 0.0009		0.91 (2); <i>p</i> value = 0.63	

Note. Standard errors are reported in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

<sup>a</sup> 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  $\leq 8000$ ; *totcat3* =  $> 8000$ ;

The variable of interest is *totcat2* and *totcat3*. Model shows that *ceteris paribus*, the members of VSS with middle status (*totcat2*) have a time discount rate that is 0.14 percentage points lower ( $p = 0.68$ ) than the poor members of VSS (*totcat1*), the reference or the base category implying that members of VSS with middle status are more patient than their poor counterparts.

The rich members of VSS (*totcat3*) have a time discount rate that is 0.40 percentage points lesser ( $p = 0.55$ ) than the poor members of VSS indicating that the rich members of VSS are more patient in comparison to the poor.

**Other significant effects – (a) Caste group effects.** All things being the same, members of VSS belonging to the Scheduled castes and other backward castes categories are found to have a time

discount rate that is lower by 0.65 and 2.25 percentage points respectively as compared to the members of VSS belonging to the Scheduled tribes, the reference category.

Thus, members of VSS belonging to Scheduled castes and other backward castes are less impatient than those belonging to Scheduled tribes. Close to 80% of the sample of members of VSS from Rayalaseema region belong to the Scheduled tribes category who are the most disadvantaged population group in Indian society in important socioeconomic indicators like literacy, nutrition, health and employment opportunities (Kumar, 2002).

(b) *Distance between the VSS and urban center or town.* The members of VSS from Rayalaseema region that are situated farther away from urban centers or towns are found to be more patient. The urban centers or towns considered for the Rayalaseema region are Chittoor, Kodur and Tirupati.

*Ceteris paribus*, for every one kilometer increase in the distance between a VSS habitation and the nearest urban center or town, a member of that VSS is estimated to have a discount rate that is 0.026 percentage points lower on average. Thus, the more the member of VSS is exposed to an urban or town culture, the more impatient she becomes which finds support in D'Exelle, Campenhout and Lecoutere (2012).

Model 1 also indicates that the overall model is highly significant at the 1% level. The chi-square distribution for the intercept only and the full model is significant at the 1% level,  $\chi^2(19, N = 62) = 43.96, p = 0.0009$ . The statistic  $\text{Scale} = 0.893$  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 *tdr<sub>low</sub>* ( $sd = 1.371, N = 62$ ) and *tdr<sub>high</sub>* ( $sd = 1.331, N = 62$ ) shows substantial reduction.

Model 2 reports the results of the interval regression when the time discount rate interval data of the members of VSS from Rayalaseema, the dependent variable, is regressed against *totcat* without any controls.

The intercept, denoting the impatience levels of the poor members, indicates that their time discount rate is 2.44 percentage points per day. The members of VSS with middle status (*totcat2*) are estimated to have a time discount rate that is 0.27 percentage points higher ( $p = 0.46$ ) than the poor

members of VSS, the reference category implying that members of VSS with middle status are more impatient than their poor counterparts.

The rich members of VSS (*totcat3*) have a time discount rate that is 0.50 percentage points higher ( $p = 0.46$ ) than the poor members of VSS indicating that the rich members of VSS are more impatient in comparison to the poor.

Thus, the results suggest that the rich members of VSS are the most impatient and the poor members least impatient. The overall model is not statistically significant ( $p = 0.63$ ) indicating that the income variable itself is overall insignificant.

**Robustness check.** The geometric mean of the elicited IDR of members of VSS from Rayalaseema is regressed on the categorical income variable *totcat* with and without socioeconomic indicators using OLS. The results indicate similar conclusions as was drawn from the interval regression model (available on request).

Income levels of members of VSS from Rayalaseema have no statistically significant effect on their impatience. As far as members of VSS from Rayalaseema in the study are concerned, factors like membership in caste groups (other backward castes, scheduled castes) and proximity to towns appear to be the main determinants of their impatience rather than their income levels.

#### 5.4.2 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 the 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 70. The remaining 4 responses have been excluded as these members of VSS made inconsistent choices in the choice task methodology.

Table 6

Interval Regression Results to Show Effects of Total Household Income (totcat) on the Individual Time Discount Rates of Members of VSS-C

<b>Dependent Variable = [tdr<sub>low</sub>, tdr<sub>high</sub>] which represents the lower and upper bounds of the individual time discount rates of the members of the VSS from the coastal regions in the study</b>				
<b>Independent Variables</b>	<b>Model 1</b>		<b>Model 2</b>	
	<b><math>\beta</math> (se)</b>	<b>p value</b>	<b><math>\beta</math> (se)</b>	<b>p value</b>
<i>Intercept</i>	3.18 (2.038)	0.118	2.061*** (0.241)	0.000
<i>age</i>	- 0.0029 (0.023)	0.898		
<i>sex1</i> (ref. = male)	- 0.565 (0.434)	0.194		
<i>occup1</i> (ref. = non-forestry)	0.155 (1.102)	0.888		
<i>marital1</i> ( ref. = not married)	1.08 (0.772)	0.162		
<i>cbelow5</i> (number of children below 5 years)	0.206 (0.510)	0.686		
<i>cbelow18</i> (number of children between 5-18 years)	0.374 (0.236)	0.113		
<i>cabove18</i> (number of children above 18 years)	0.183 (0.228)	0.422		
<i>fsize</i>	- 0.343** (0.147)	0.019		
<i>hhead1</i> (being a household head; ref. = not being a household head)	- 1.16** (0.498)	0.019		
<i>hhead2</i> (equal decision-making in household)	-1.79*** (0.675)	0.008		
<i>educ</i> (number of years of education)	0.009 (0.073)	0.893		
<i>mc1</i> (ref. = not a member of managing committee)	0.017 (0.940)	0.985		
<i>totcat2</i> <sup>a</sup>	0.394 (0.489)	0.421	- 0.253 (0.421)	0.547
<i>totcat3</i>	- 0.201 (0.678)	0.767	- 0.318 (0.686)	0.643
<i>totassetsT</i> (Total assets owned by VSS household)	0.00001 (0.002)	0.996		
<i>caste2</i> (Scheduled caste; ref. = Scheduled tribe))	1.37** (0.637)	0.031		
<i>caste3</i> (Other backward caste)	0.043 (0.768)	0.955		
<i>dist</i>	- 0.035 (0.045)	0.43		
<i>N</i>		70		70

Scale	1.3	1.57
Log likelihood (Model)	- 189.2	- 201.8
Log likelihood (Intercept)	- 202.1	- 202.1
$\chi^2$ (df)	25.79 (19); $p$ value = 0.14	0.48 (2); $p$ value = 0.79

Note. Standard errors are reported in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

<sup>a</sup> 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  $\leq 8000$ ;  $totcat3 = > 8000$ ;

Model 1 is jointly not significant at the 5% level ( $p = 0.14$ ). The overall insignificance of the model notwithstanding, it may be informative to examine the direction of coefficients on the variables of interest ( $totcat2$  and  $totcat3$ ).

Model 1 shows that *ceteris paribus*, the members of VSS with middle status ( $totcat2$ ) have a time discount rate that is 0.39 percentage points higher ( $p = 0.42$ ) than the poor members of VSS ( $totcat1$ ), the reference category implying that members of VSS with middle status are more impatient than their poor counterparts (result is not significant at the 5% level).

The rich members of VSS ( $totcat3$ ) have a time discount rate that is 0.20 percentage points lower ( $p = 0.77$ ) than the poor members of VSS indicating that the rich members of VSS are less impatient in comparison to the poor.

**Other significant effects.** (a) *Family size.* Members of VSS from larger households are less impatient. For every increase in one adult member in the VSS household, a member of VSS from that household is found to have a time discount rate that is lower by 0.34 percentage points implying that presence of more adult members in the household encourages a future orientation.

(b) *Household decision making patterns.* Members of VSS from the coastal regions and who are household heads are found to be more patient than members of VSS who are not household heads which is the reference group. The head of household is estimated to have a time discount rate of 1.16 percentage points lower on average than a member of VSS who is not the head of the household.

Members of VSS who share responsibility for decisions in households with their spouses are estimated to have an even lower time discount rate. The member of VSS who shares responsibility

for decisions on household matters with her spouse is found to have a time discount rate that is 1.79 percentage points lower than a member of VSS who is not the head of the household.

(c) *Caste group effects.* All things being the same, members of VSS from the coastal regions and belonging to the Scheduled castes are estimated to have a time discount rate that is higher by 1.37 percentage points as compared to the members of VSS belonging to the Scheduled tribes, the reference category. It may be noted that members of VSS from the Rayalaseema region and belonging to the Scheduled castes showed the opposite effect. While members of VSS belonging to the Scheduled castes comprised only 14.8% of the sample in Rayalaseema region, this group comprised 50.66% of the sample in the coastal region indicating their stronger presence here.

Model 1 is not jointly significant at the 5% level. The chi-square distribution for the intercept only and the full model is not significant even at the 10% level,  $\chi^2(19, N = 70) = 25.79, p = 0.14$ . The statistic Scale = 1.3 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 *tdr<sub>low</sub>* ( $sd = 1.488, N = 70$ ) and *tdr<sub>high</sub>* ( $sd = 1.711, N = 70$ ) shows reduction.

Model 2 reports the results of the interval regression when the time discount rate interval data of the members of VSS from the coastal region, the dependent variable, is regressed against *totcat* without any controls.

The overall model, here too, is not statistically significant ( $p = 0.79$ ). The intercept, denoting the impatience levels of the poor members, indicates that their time discount rate is 2.06 percentage points per day. The members of VSS with middle status (*totcat2*) are estimated to have a time discount rate that is 0.25 percentage points lower ( $p = 0.55$ ) than the poor members of VSS, the reference category implying that members of VSS with middle status are less impatient than their poor counterparts.

The rich members of VSS (*totcat3*) have a time discount rate that is 0.32 percentage points lower ( $p = 0.65$ ) than the poor members of VSS indicating that the rich members of VSS are also less impatient in comparison to the poor.

The results suggest that the middle status and the rich members of VSS are less impatient than the poor members.

**Robustness check.** The geometric mean of the elicited IDR of members of VSS from the coastal region is regressed on the categorical income variable *totcat* with and without socioeconomic indicators using OLS. The results indicate similar conclusions as was drawn from the interval regression model (available on request).

Income levels of members of VSS from the coastal region have no statistically significant effect on their impatience. There is some evidence, though statistically weak, that social factors like household size, decision making patterns within the household and membership in caste groups (Scheduled castes) contribute to the impatience levels of members of VSS from the coastal region rather than their income levels.

## 7 Conclusion

The average individual time discount rate of the sample of members of VSS from Rayalaseema and coastal region who participated in the study is 2.235 percentage points per day implying ~ 805 percentage points per annum ( $p = 0.000$ ) which indicates high impatience levels.

*A priori*, it was expected that the average individual time discount rates of members of VSS would be high (greater than 39 percentage points per annum as defined in the study) as evidence from South America, Africa and Sri Lanka suggest that forest communities, in general, are highly impatient.

This study attempts to provide a comparison of time discount rates of population groups similar to VSS from different cultures and countries. Godoy et al. (2004) reported an average daily discount rate of 14.3% - 17.2% for the Tsimane, a foraging community in the Bolivian Amazon forests of South America which implies high levels of impatience amongst these communities ranging from 5148 - 6198 percentage points per annum approximately. Bauer and Chytilova (2009) reported the mean three-month current discount rate of individuals from rural villages in Karnataka as 24.4 percentage points implying an annual rate of 97.6 percentage points. D'Exelle, Campenhout and Lecoutere (2012) estimated the mean monthly time discount rates of urban individuals as 16.9 percentage points (implying a discount rate of 203 percentage points per annum approximately) and rural individuals as 12.5 percentage points (implying a discount rate of 150 percentage points per annum approximately).



Coller and Williams (1999) reported low levels of impatience (17.5 – 20 percentage points per annum) among the undergraduates and graduates of South Carolina University in USA while Harrison, Lau and Williams (2002) too reported low impatience rates in the range of 28-30 percentage points per annum among Danish individuals drawn from municipalities.

Members of VSS from the Rayalaseema region in the study sample are found to be more impatient than the members of VSS from the coastal region.

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, following Fisher (1930), it was expected that members of VSSs from Rayalaseema, on average, would be more impatient than their counterparts from the coastal region. The study thus expected to find a negative and statistically significant effect of income on the impatience of members of VSS in the econometric estimation.

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 income group which is a recurring economic phenomenon.

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 earlier, 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 impatience in the regression model (the analysis of deviance results showed a p-value of 0.74 for the household income variable). Women are found to be more patient and possess a stronger future orientation than men. Members of VSS with more children below five years of age are found to be more

impatient. Members of VSS who share responsibility for decisions in households with their spouses are estimated to be more patient and future oriented. The members of VSS that are situated farther away from urban centers or towns are found to be more patient.

Income levels of members of VSS from Rayalaseema have no statistically significant effect on their individual time discount rates. Members of VSS belonging to Scheduled Castes and Other Backward Castes are less impatient and have a better future orientation than members of VSS belonging to Scheduled Tribes. Members of VSS that are situated farther away from towns in this region are found to be more patient.

Income levels of members of VSS from the coastal region have no statistically significant effect on their individual time discount rates.

There is some, but not strong, evidence that social factors like household size, decision making patterns within the household and membership in caste groups contribute to their impatience. Members of VSS from larger households are found to be less impatient. Members of VSS from the coastal regions and who are household heads and those who share responsibility for decisions in households with their spouses are found to be more patient than members of VSS who are not household heads (reference group). Members of VSS belonging to the Scheduled castes are more impatient as compared to those belonging to the Scheduled tribes, the reference category.

Note that as against eliciting time discount rates from field studies which reflect actual economic behavior of individuals and hence applicable to real life, elicitation from choice task method may have limited ecological validity. The findings of the study are subject to this 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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