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Willingness to Pay for Annual Health Care Services in Small Ruminants: The Case of South India

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Abstract: A study was undertaken in southern peninsular State of India, the Tamil Nadu State, to assess the farmers Willingness To Pay' (WTP) for annual health care services in small ruminants. The districts of the State were categorized as Livestock Developed (LD) and Livestock Under Developed (LUD) based on initial base line developed. Contingent Valuation (CV) approach was used to study the farmers maximum WTP value for two types of health care services: (a) providing animal health care services at government veterinary centres, (b) extending animal health care services at farmers door steps. A Payment Card (PC) format was used to assess the farmers' maximum WTP for ensuring health care services to sheep and goat. The Maximum Likelihood technique was used on interval midpoints. The study revealed that the farmers were willing to pay a maximum of INR 56.34 and INR 61.61 for availing health services to their sheep and goat, respectively, by in-centre services, while they were ready to offer INR 87.49 and INR 95.27 for the animal health services delivered at doorsteps. The mean maximum WTP value was found to be more for goats than sheep, postulated both in-centre and home services. Of the factors incorporated in the in-centre service model for sheep, age of respondent, livelihood share of livestock, number of sheep and VLU owned and distance from nearest public veterinary centre were found to significantly influence the WTP values. Unlike sheep, age of respondent, VLU possession, distance of the public veterinary centre and district versatility had a significant role in determining WTP values for goats. WTP values in sheep for home service were found to be significantly predisposed by all the significant factors of in-centre services model, except number of sheep owned. Similarly, in goat, the age of respondent turned to be insignificant in home services model. The results indicated that the people were willing to pay more for getting their small ruminants adequately protected from diseases and treated at once with quality services.

Key words: Willingness To Pay, WTP, payment card, contingent valuation, interval regression, small ruminants, animal health care

INTRODUCTION

Livestock has been an integral part of the Indian rural economy and an indispensable tool of income and employment generation to millions of poor households across the country, besides being a major source of protein and supplementary nutrition, drought power, fertilizer, fuel and a store of wealth. Recent globalization and economic liberalization policies present enormous opportunities for our country to boost rural incomes and accelerate the pace of poverty alleviation through promoting livestock services. Yet, successful capitalization of these opportunities requires a policy regime that could facilitate growth in productivity at the farm level (Ahuja *et al.*, 2003).

Availability of and accessibility to better quality livestock services could play a pivotal role in increasing

the productivity of livestock sector. Recognising the importance of livestock to the rural poor and inability to avail the fully paid livestock services, the Government of India and the Governments in the States have been extending these services at a huge subsidy with their vast veterinary institutional network built-up in the past five decades through many special livestock sector promotion schemes to augment livestock production and productivity.

Although the public sector is believed to be the appropriate means of supplying livestock services, the governments could not perform with the efficiency it should have in practice. Some now even argue that it could be better to privatise these public services (Leonard, 1993). The advocacy for privatization has, however, been tempered by the recognition that in many situations livestock services require some form of public

management. The availability and quality of these livestock services are therefore unlikely to improve, unless public sector performance is strengthened (Holden *et al.*, 1996). Growing fiscal pressures exacerbated by huge subsidy and less than adequate cost recovery for the services had left the governments to bring down their priorities and budget allotments towards improving the quality of public provision of livestock services. Policy initiatives aimed at increased cost recovery, which could alleviate these financial difficulties, however, are often deferred by the policy makers due to political reasons on the assumption that the farmers would not be willing to pay for these services. It is in the light of this background, a study was undertaken in southern peninsular State of India, Tamil Nadu, to assess the farmers Willingness To Pay' (WTP) for contract annual health care services in small ruminants (sheep and goat). These small ruminants are livelihood source for many livestock farmers, who raise them solely or along with other large ruminants as an integral component of crop agriculture. This study basically addresses two questions, viz., 1) How much the farmers are willing to pay for receiving total annual health care for their small ruminants? and 2) What factors determine their WTP level.

MATERIALS AND METHODS

The districts of Tamil Nadu State were categorized as Livestock Developed (LD) and Livestock Under Developed (LUD) based on initial base line data gathered using the value of livestock output, rural human population and common property resources available for livestock farming. Four districts, two each from livestock developed (Coimbatore and Villupuram districts) and 'Under Developed' (Thanjavur and Sivagangai districts) areas were selected randomly. From the districts so selected, a total number of 320 farmers (80 from each district) were chosen by adopting multistage random sampling technique. Information on socio-economic status of the selected farmers, livestock possession, accessibility of veterinary services, costs incurred, true maximum WTP for total annual health care services for sheep and goats, etc. were collected by personal interview through the structured and pilot-tested interview schedule.

Contingent Valuation (CV) approach was used to study the farmers maximum WTP for two types of animal health care services: (a) providing animal health care services at government veterinary centres (in-centre), (b) extending animal health care services at farmers' door steps (at farm gate). The farmers were posed with two scenarios for eliciting their WTP as narrated below:

Scene 1: There is an offer to provide annual health care for your animals by providing services at the government veterinary centre. This offer will include all expenses on medicines, service fee, etc. What is the maximum amount of money you would be willing to pay for this offer? (in Indian Rupee: INR)

Scene 2: There is an offer to provide annual health care for your animals by providing services at your farm gate. This offer will include all expenses on transport medicines, service fee, etc. What is the maximum amount of money you would be willing to pay for this offer?

A payment card depicting charges ranging from INR 25 to INR 1500, with an equal interval of INR 25 were shown to them to encircle the amount that they were willing to pay for the offers described above. The payment card WTP data pertain to total annual animal health care were analyzed as interval data on the assumption that the respondent's true maximum WTP is at least as high as the amount chosen on the payment card, but less than the next highest amount listed on the card. As interpreted by Morey *et al.* (1997), this analysis presumed that a farmer would not choose any amount that exceeds his true maximum WTP and therefore circles the highest amount mentioned on the card that is less than or equal to his maximum WTP.

The WTP values estimated in this study were for hypothetically providing total annual animal health care for sheep and goat either at the veterinary centre or at farmer's doorstep. The WTP was assumed to be a function of a respondent's attributes and a random component that caused the WTP value to vary across respondents, even if they possessed same attributes. Hence Cameron and Huppert (1989) suggested that there could be some bias and that its sign would be indeterminate in OLS, while the Maximum Likelihood Interval technique could be unambiguously more reliable if used on interval midpoints. Kolmogorov-Smirnov test also confirmed the normal distribution in random component assumed in the payment card estimation model study. Therefore, the interval model maximizes the likelihood of an individual's WTP that lies between the amount chosen on the payment card, WTP_M and the next larger amount, WTP_L . The probability that WTP_i lies between WTP_{M_i} and WTP_{L_i} is given by Morey *et al.* (1997) as below:

$$= \Phi\left(\frac{WTP_{L_i} - E(WTP_i)}{\sigma_i}\right) - \Phi\left(\frac{WTP_{M_i} - E(WTP_i)}{\sigma_i}\right)$$

$$\text{Prob}(WTP_{M_i} \leq WTP_i \leq WTP_{L_i}) = \text{Prob}(WTP_i < WTP_{L_i}) - \text{Prob}(WTP_i > WTP_{M_i})$$

where Φ is the standard normal cumulative density function. Then the expectation of the individual's WTP, $E(WTP_i)$, is:

$$\begin{aligned} (WTP_i) &= E(WTP_i) + \xi_i \\ &= \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 \\ &\quad + \beta_9 X_9 + \beta_{10} X_{10} + e_i \end{aligned}$$

Where:

- X_1 : Sex of respondent (1 – if male; 0 – otherwise)
- X_2 : Age of respondent (Years in numbers)
- X_3 : Mean household education (0 – illiterate; 1 – primary; 2 – secondary; 3 – collegiate)
- X_4 : Annual household income (in INR'000)
- X_5 : Livelihood share of livestock (as proportion of income from livestock to total income)
- X_6 : No. of sheep/goat owned by respondent
- X_7 : Veterinary livestock units (VLU) owned by respondent (where, 1 VLU = 1 cow or 1 buffalo or 1 bullock or 2 young cattle or buffaloes or 5 sheep or 5 goats)
- X_8 : Mutton/Chevon price (INR per kg.)
- X_9 : Distance from the government veterinary centre (in terms of travel time in minutes)
- X_{10} : District versatility (1 – if LD; 0 – otherwise)

e_i is distributed normally with mean zero and standard deviation σ_i .

Estimation of interval model of WTP: STATA 9.0 SE was used to find the values of the parameters that maximized the log of the likelihood function:

$$\text{LogL} = \sum \log \left\{ \Phi \left(\frac{WTP_{L_i} - E(WTP_i)}{\sigma_i} \right) - \Phi \left(\frac{WTP_{M_i} - E(WTP_i)}{\sigma_i} \right) \right\}$$

RESULTS AND DISCUSSION

Modelling WTP values for annual health care services in sheep

In-centre services: The interval regression model fitted to explain the variation in the stated true maximum WTP values for annual health care services to sheep extended at the centre generated a log likelihood of -18.6385

(Table 1). Of the factors fitted to explain the WTP values for in-centre services, age of the respondent, livelihood share of livestock, number of sheep, veterinary livestock units owned and distance from the nearest public veterinary centre were found to be significantly influencing the stated WTP value. The results indicated that the age of respondent had a significant and negative effect on the stated WTP value, as the age advanced by one year, the stated WTP value was found to be decrease by INR 1.06. Livelihood share of livestock which was calculated as the proportion of income from the livestock to total annual income had a significant positive influence on the stated true maximum WTP value for extending in-centre annual health care services for sheep. The results showed that as the proportion of income from the livestock increased by one unit the willingness to pay value increased by INR 38.82. This in turn exhibited the importance attached to the livestock, especially to the sheep, by the farmers owning sheep. The analysis also indicated that the stated WTP value would increase by Re.0.65 for every addition of a sheep to the flock owned by the farmer. However, an increase in the veterinary livestock units owned by the farmer would significantly reduce the stated WTP value by INR 4.76. The above results clearly explained the importance of sheep to the farmers owning sheep alone. Because, large ruminants contribute more to a livestock unit than small ruminants, where one livestock unit means five sheep/goat or one cattle/buffalo. Notably, even when the farmer's locality was away from the public veterinary centre, the WTP value was found to increase for such offer. That is, an every additional minute travel time required to reach the centre would also increase the stated true WTP amount by INR 0.48. This was possible because, on most of the occasions, the sheep were brought to the centre by vehicles which, in turn, took only a minimal time to reach the centre.

It was observed that the explanatory variables, sex of the respondent, mean household education, annual household income, mutton price in local area and district versatility had not exerted any significant effect on the stated WTP values for annual health care services in sheep.

Farm gate services: The results of interval regression analysis indicated that the age of respondent, livelihood share of livestock, veterinary livestock units owned and distance from the nearest public veterinary centre had significantly predisposed the stated true maximum WTP values for farm gate annual health care services in sheep. However, the number of sheep owned, which was significant and positive in the in-centre services model turned to be insignificant in the farm gate services model.

Similar to the in-centre services model, the results of farm gate services model indicated that age of the respondent had a significant and negative effect on the stated WTP value, where one year advancement in the age of respondent was found to decrease the stated WTP value by INR 0.95. Moreover, the livelihood share of livestock which was calculated as the proportion of income from the livestock to total annual income had a significant positive influence on the stated true maximum WTP value for extending even for farm gate annual health care services for sheep. The results showed that as the proportion of income from the livestock increased by one unit, the WTP value increased by INR 39.63. This, in turn, exhibited the importance attached to the livestock especially to the sheep by the farmers owning sheep. However, an increase in the veterinary livestock units owned by the farmer would significantly reduce the stated WTP value by INR 5.30. Further, when the farmer's locality was away from the public veterinary centre, the WTP value was also found to increase significantly. That is, an every additional minute travel time required to reach the centre would also increase the stated true WTP amount by INR 1.13.

Modelling WTP values for annual health care services in goat

In-centre services: The interval regression model fitted to explain the variation in the stated true maximum WTP values for annual health care services to goats to be extended at the centre exhibited a good fit with log likelihood being -106.16 (Table 1). Of the factors fitted to explain the WTP values for in-centre services, age of the respondent, veterinary livestock units owned, distance from the nearest public veterinary centre and district versatility were found to be significant. The results indicated that as age of the respondent advances by a year, the stated WTP value would decrease by INR 0.48 for extending in-centre annual health care to goat. In contrast to the models fitted for sheep, the model fitted for goats exhibited a significant positive association of veterinary livestock units with the stated WTP value. As the veterinary livestock units owned by farmers increased by a unit, the WTP value would increase by INR 3.40. This could be due to the reason that the farmers own goat along with large ruminants. Further, the farmers, whose locality was away from the public veterinary centre, were willing to pay less than those who were placed nearer to the centre. That is, an every additional minute travel time required to reach the centre would decrease the stated true WTP amount by INR 0.61. Obviously, as this offer proposed in-centre services, the distance would be an

inhibiting factor to state a higher WTP value. However, the farmers of LD districts were willing to pay INR 13.94 more than the farmers in LUD districts.

The analysis revealed that the explanatory variables included in the fitted model, viz., sex of the respondent, mean household education, annual household income, livelihood share of livestock, number of goats and chevon price in local area had not exerted any significant effect on the stated WTP values for annual health care services in goats.

Farm gate services: The results of interval regression analysis pointed out that the number of goats and veterinary livestock units owned, distance from nearest public veterinary centres and district versatility had significantly determined the stated true maximum WTP values for farm gate annual health care services in goats. The age of respondent which was found to be significant in the in-centre services model had become insignificant in this model. However, the factor, number of goats owned had turned to be significant, influencing the stated WTP values for farm gate services.

The results of regression analysis exhibited that an addition of a goat to the flock would significantly reduce the stated WTP value by INR 1.77. However, as the veterinary livestock units owned by farmers increased by an unit, the stated WTP value would get boosted by INR 2.84. The results clearly exhibit that the poor, who depend mainly on goats, would be willing to pay less compared to others. Unlike in-centre services, the distance to the nearest public veterinary centre had a significant and positive influence on the stated WTP value for farm gate services. That is, a minute increase in the travel time required to reach the public veterinary centre would add INR 0.50 in the stated WTP value. Compared to the farmers in LUD districts, farmers of LD districts were willing to pay INR 13.80 more for getting annual health care services at farm gate for their goats.

Mean WTP values for annual health care services in sheep and goats:

The mean WTP values worked out through the interval regression models fitted are displayed in Table 2. Overall mean WTP value for annual health care services in sheep was INR 56.34 for in-centre services and INR 87.49 for home services. Surprisingly, the mean stated WTP values for both in-centre and at home services in LUD districts were larger (INR 60.99 and INR 89.31, respectively) as compared to LD districts (INR 52.73 and INR 86.07, respectively). The higher the amount in the LUD districts could be attributed to the underprivileged livestock farmers of this area.

Table 1: Factors determining WTP for annual health care services in sheep and goat (Results of interval regression)

Explanatory variables	Services at centre		Services at home	
	Sheep	Goat	Sheep	Goat
Sex of respondent	0.5483 (8.1757)	-1.5860 (4.3870)	4.0071 (11.7342)	1.9022 (4.1845)
Age of respondent	-1.0574** (0.2469)	-0.4812** (0.1735)	-0.9460** (0.3178)	-0.2881 (0.1643)
Mean household education	4.6998 (8.4720)	3.1376 (3.7518)	9.0862 (11.6783)	3.8373 (3.5741)
Annual household income (INR '000)	0.0006 (0.0235)	0.0251 (0.0563)	-0.0159 (0.0288)	0.0014 (0.0531)
Livelihood share of livestock	38.8246** (11.6192)	4.9132 (11.2989)	39.6263** (16.2813)	-9.7685 (10.7110)
No. of sheep owned	0.6534* (0.3026)	-0.8060 (0.9665)	0.5132 (0.3975)	-1.7682* (0.9163)
Veterinary livestock units owned	-4.7646** (1.3601)	3.4034** (1.2087)	-5.3020** (1.7657)	2.8355* (1.1454)
Distance from nearest public veterinary centre (travel time in min.)	0.4809** (0.1680)	-0.6110** (0.1277)	1.1322** (0.2313)	0.4957** (0.1208)
Mutton price in the area (INR /Kg.)	-0.2192 (0.5031)	-0.2939 (0.4551)	-0.6261 (0.6777)	-0.3091 (0.4348)
District versatility	-5.0738 (7.3138)	13.9443** (4.6.71)	2.8332 (10.1074)	13.8032** (4.3885)
Constant	108.4480 (64.1598)	115.8411* (60.1068)	154.6278 (86.9549)	116.6066* (57.4548)
/Insignia	2.0013** (0.2545)	2.6605** (0.0839)	2.4466 (0.1722)	2.5923** (0.0846)
Sigma	7.3989 (1.8832)	14.3028 (1.1997)	11.5485 (1.9892)	13.3605 (1.1297)
Number of observations	32	109	32	109
LR χ^2 (10)	35.03	60.25	31.77	51.02
Prob > χ^2	0.0001	0.0000	0.0004	0.0000
Log likelihood	-18.6385	-106.1642	-26.1744	-99.7237

*Significant ($P \leq 0.05$); ** Highly significant ($p \leq 0.01$). Figures in parentheses indicate standard errors

Table 2: Mean WTP values for annual health care for sheep and goat (INR)

District	In-centre services		At home services	
	Sheep	Goat	Sheep	Goat
LUD districts	60.99 (2.56)	51.53 (2.51)	89.31 (3.68)	87.42 (2.37)
LD districts	52.73 (2.42)	67.68 (1.94)	86.07 (3.24)	100.01 (1.85)
Overall	56.34 (1.77)	61.61 (1.54)	87.49 (2.43)	95.27 (1.46)

Figures in parentheses indicate standard errors

Overall mean WTP value for annual health care services in goat was INR 61.61 for in-centre services and INR 95.27 for farm gate services. The mean stated WTP values for both in-centre and at home services in LD districts (INR 67.68 and INR 100.01, respectively) were higher as compared to LUD districts (INR 51.53 and INR 87.42, respectively). The higher amount in the LD districts could be attributed to the increased livestock oriented activities in these areas.

CONCLUSION

The results of the study indicated that the small ruminant owners, although poor, are willing to pay substantially for ensuring adequate health cover to their sheep and goat. The socio-economic conditions of farmers and the regions play a significant role in the quantum that farmers would be prepared to pay. As the farmers are ready to pay for the timely and quality services, contract animal health care system' or 'partial cost recovery for the publicly provided livestock services would ensure sustainability of services provided by the State.

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